

GREEN INDUSTRIAL POLICY AND DEVELOPMENT: A PERSPECTIVE FROM THE GLOBAL SOUTH

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RESUMO EXECUTIVO

- The historical trajectory of industrial policy has been anchored in the idea that economic development results from structural change and industrialization, aiming to reproduce the productive paradigm of the Global North.
- However, this model consolidated a strong dependency between economic growth and the intensive use of natural resources, proving to be unsustainable in the face of planetary limits.
- The countries of the Global South now face the challenge of promoting a "compressed development," which combines industrialization, social inclusion, digitalization, and decarbonization within a reduced timeframe and under historical-structural conditions that limit structural transformation.
- Such constraints reinforce the need to reorient industrial policy based on the principles of Common But Differentiated Responsibilities and Respective Capabilities, based on Principle 7 of the Rio Declaration on Environment and Development, adapting it to ecological limits and global inequalities.
- In a context of reconfiguring industrial policies due to the emerging search for solutions related to the economy's energy transition, green industrial policy presents itself as a strategic instrument for productive and technological reorganization, capable of aligning competitiveness, inclusion, and environmental sustainability, in response to the exhaustion of conventional growth models based on the exploration of intensive resources.
- Regarding the main structuring axes of contemporary green industrial policy, the articulation of complementary approaches is noted, such as degrowth, economic-environmental decoupling, and the progressive elimination of unsustainable technologies (phase-out), which seek to redefine the relationship between growth and resource use.
- Additionally, there are strategies based on Green New Deals, which combine green investments and social justice; and green digitalization (or sustainable Industry 4.0), which integrates digital innovation and energy efficiency into low-carbon production strategies.
- The growing demand for critical minerals and the vulnerability of supply chains reinforce the centrality of policies based on natural resources, especially in countries of the Global South. Such policies reveal both opportunities for productive sophistication and the risk of reissuing extractivist and dependent patterns.
- Mission-oriented policies propose a new model of public coordination focused on systemic structural transformation, articulating innovation, investment, and social purpose.
- From this perspective, "Good Industrial Policy" represents a normative synthesis, conceiving green industrial policy under an "eco-humanist" approach, where economic prosperity, social justice, and ecological integrity are inseparable objectives.
- Mission-oriented policies propose a new model of public coordination focused on systemic structural transformation, articulating innovation, investment, and social purpose.

- From this perspective, "Good Industrial Policy" represents a normative synthesis, conceiving green industrial policy under an "eco-humanist" approach, where economic prosperity, social justice, and ecological integrity are inseparable objectives.
- However, the economies of the Global South face historical barriers to productive diversification and technological diffusion, inherited from their historical formation processes based on specialization in natural resources. This configuration perpetuates structural heterogeneity—marked by wide productivity asymmetries and intersectoral disarticulation—and limits the advancement of green industrialization strategies, as the more technologically intensive sectors remain incipient and dependent on external induction.
- The premature deindustrialization observed in these countries expresses the weakening of productive bases before the consolidation of a diversified and dynamic industrial core. Unlike advanced economies, where industrial decline is compatible with high levels of income and productivity, in the peripheries, it occurs at early stages, limiting the creation of skilled jobs and technological progress.
- This process, associated with a subordinate insertion in global value chains and fiscal and ecological constraints, reinforces the middle-income trap and reduces the capacity for formulating and implementing robust green industrial policies, especially in the face of growing pressures imposed by the global climate crisis.
- Beyond the marginal incorporation of measures seeking decarbonization in coexistence with development strategies based on normative and institutional orientations shaped by the

techno-economic paradigm of the first and second Industrial Revolutions, the most virtuous trajectory for the countries of the Global South should be oriented towards the construction of a new paradigm.

- Systemic dimension: action on international mechanisms of financialization, technological dependence, and unequal trade regulation. This implies strengthening development banks, regional credit mechanisms, and green funds, in addition to articulating fiscal and capital control policies that reduce the financial vulnerability of the Global South.
- Green Growth Dimension (economic-environmental decoupling): overcoming carbon lock-in and the linearity of consumption and production. This requires policies to incentivize clean technological innovation, differentiated taxation for polluting activities, strengthening of circular production chains, and promoting sustainable consumption patterns. The focus must be on the absolute decoupling between economic growth and the intensive use of natural resources.
- Dimension of coupling between structural heterogeneity and just growth: green industrial policies need to consider the social, regional, and productive heterogeneities typical of the Global South. It is necessary to combine incentives for technological diffusion and Research and Development (R&D) programs with mechanisms for productive and social inclusion. Public financing should prioritize sectors with high potential for creating green and formal jobs, reducing historical inequalities, and strengthening the political legitimacy of the ecological transition.

1.INTRODUCTION: THE LIMITS OF THE CONVENTIONAL FRAMEWORK OF INDUSTRIAL POLICY AND DEVELOPMENT

Historically, the understanding of the economic development process has always been associated with processes of structural change. Since seminal interpretations such as those of Hamilton (1791) and List (1841), both the economic literature and the debate among policy makers have sought to emphasize the relevance of building a solid material base as a fundamental element for the development of nations and the increase in the well-being of their populations.

From the second half of the 20th century, a growing questioning of the possibilities of convergence between developed nations and the countries then defined as Third World or underdeveloped was observed. Such a movement gained political strength after the Bandung Conference (1955), in the context of the search for political and economic emancipation of African countries in parallel with attempts to build autonomous development strategies by Latin American countries.

In common, such initiatives sought to build development policies that combined the search for national sovereignty, the self-determination of peoples, and enabled an external insertion that circumvented the tendency of deteriorating terms of trade in international commerce. In other words, in line with List's (1841) interpretations of the negative consequences of the hierarchical and asymmetric character of the international system on the development possibilities of the

then-Third World countries, the aim was to circumvent such restrictions by strengthening domestic industrial bases.

In this context, a set of interpretations and authors emerged in the post-World War II period that viewed industrialization as an essential instrument for overcoming underdevelopment. Classified as pioneers of Development Economics, numerous authors such as Celso Furtado, Albert Hirschman, Gunnar Myrdal, and Raul Prebisch played important roles as policy makers in international organizations and in national governments.

Despite different methodological approaches and some variations in policy suggestions, their interpretations were generally based on the logical circuit that overcoming underdevelopment would occur through a process of structural change marked by the reduction of the relative importance of primary sectors, with the displacement of surplus labor to urban and industrial sectors (Furtado, 1961).

Such a trajectory, in essence, was inspired by the logical circuit and the paradigm of productive development forged from the original Industrial Revolution, which emerged in England in the 18th century. It was based on the hypothesis, albeit implicit, that development meant the advancement of productive forces guided by technological progress, in the pursuit of increased accumulation in a capitalist dynamic.

As a result of this process, already in the techno-economic paradigm built from the Second Industrial Revolution, it was observed that the trajectories of accumulation and income growth in developed countries were characterized by a great coupling between these and the increase in the intensity of the use of the planet's natural resources.

In summary, in a secular movement, a paradigm crystallized in which development showed a great coincidence between the increase in the material standard of living of the populations of rich countries and the consumption of natural resources and energy, mainly based on the use of fossil fuels (Hauge and Hickel, 2025; Rodrik, 2014).

As a consequence of this process, it was possible to observe the construction of a framework of institutions and policies that sought to guide national development trajectories towards a catching-up movement to the productive and technological structures of the countries then classified as First World. It is in this movement that the import substitution industrialization policies of numerous countries in the Latin American periphery or the set of strategies that crystallized into what the literature calls the Asian Developmental State are situated.

However, since the early 1970s, seminal contributions such as the report "Limits to Growth" (Meadows et al, 1972), "The entropy law and the economic process" by Georgescu-Roegen (1971), and the "Myth of Economic Development" by Celso Furtado (1974), have warned of the unsustainability of such strategies. More profoundly, what these contributions suggest is the need for a critical reassessment of the concept of development as it was engendered from the Original Industrial Revolution.

With the growing questioning about the sustainability of planetary limits and the classic logical circuit of development (Rockström et al., 2009; Hauge and Hickel, 2025), the economic literature and policy makers are faced with a set of new challenges. This fact is even more pressing in the countries of the Global South. There are several reasons for this.

First, the exhaustion of development possibilities from the paradigm based on a coupling between intensive resource use and income growth, given the limits of planetary boundaries, has asymmetric impacts between the Global North and South (Hauge, 2023; Hauge and Hickel, 2025; Mazzucato et al, 2024). This is because historically the exhaustion of these boundaries is associated with the processes of excessive use of natural resources by developed countries, while in the countries of the Global South, problems associated with poverty, lack of minimum basic sanitation conditions, education, among other human rights that should be universal, are still very common.

Second, because at the same time that they are subjected to extreme climatic events resulting from the exhaustion of planetary boundaries, the countries of the Global South still lack the development of a productive structure that is capable of enabling long-term trajectories that combine increased productivity, generation of jobs with better working conditions and higher remuneration, and sophistication of exports in order to overcome their historical problems of external constraint (Kaldor, 1967; Thirlwall, 1979).

In short, as emphasized by Andreoni (2024), the countries of the Global South would be subjected to a condition of "compressed development," in which they should simultaneously pursue objectives that the Global North was able to achieve over a much longer time horizon. Thus, they should:

- industrialize with the aim of fostering processes of structural transformation marked by increased productivity and creative destruction;
- reconcile these processes with the confrontation of historical issues of social, regional, gender, and racial inequality;
- insert themselves competitively into the emerging techno-economic paradigm marked by digitalization and the advancement of what has been conventionally called Industry 4.0 and
- decarbonize their productive matrices, reorienting development from a model adapted to the limits of planetary boundaries.

In parallel with these conditioning factors, Andreoni (2024) and Lebdioui (2024) recall that the countries of the Global South are confronted with a set of restrictions derived from the intensification in recent decades of processes of premature deindustrialization. These, by making it impossible to build a virtuous cycle that combines innovative learning, technological progress, and growth in international competitiveness, could trigger the entrapment of these countries in what the literature calls the middle-income trap (Lee, 2013; Andreoni; Tregenna, 2020).

It is precisely in this context that the recent public and academic debate on Green Industrial Policy (GIP) highlights that it must assume a differentiated character between the Global North and the Global South. This suggestion is based on the normative orientation suggested by the logic of CBDR-RC - Common But Differentiated Responsibilities and Respective Capabilities based on Principle 7 of the Rio Declaration on environment and development (United Nations, 1992).

2. GREEN INDUSTRIAL POLICY IN FOCUS: SYNTHESIS OF CENTRAL INTERPRETATIONS

In recent years, a succession of crises and economic shocks has exposed structural vulnerabilities in the world economy and reconfigured debates around contemporary development. The financial crisis of 2008, the Covid-19 pandemic, the heightening of geopolitical tensions between the United States and China, as well as the escalation of armed conflicts between Russia/Ukraine and Israel/Palestine, simultaneously highlighted the fragility and centrality of global value chains, while questioning the institutional foundations that sustained the current phase of globalization (Aiginger; Kettels, 2024; Alami; Taggart; Chodor, 2025).

The record of more than 2,500 industrial policy measures in 2023 alone (Evenett et al., 2024) demonstrates the growing centrality of this instrument as an active development strategy on the global stage. Since the early 2010s, a greater appetite for state interventionism has been observed, which has repositioned industrial policy as a central element in the search for new forms of economic coordination and planning (Cherif; Hasanov, 2019; Aiginger; Rodrik, 2020; Juhász et al., 2023).

This movement is not restricted to the European Union, the United States, and China: developing countries have also been resorting to interventionist policies to accelerate productive transformation, compete for positions in strategic sectors, and strengthen their resilience in a context of "polycrisis," that is, of the simultaneity of multiple crises (Hauge, 2023).

Among these trends, the climate crisis is an important concern to be addressed by industrial policy strategies. The emergence of the "green imperative" imposes the need to redefine the bases of development, shifting the focus from mere quantitative growth to strategies capable of combining economic progress, social inclusion, and environmental integrity (Lee, 2025). More than adjusting productive practices, it is about rethinking the very foundations of industrialization, guiding them by principles of energy efficiency, green innovation, and sustainable use of resources, in order to enable long-term trajectories compatible with planetary limits (Tamasiga et al., 2025).

It is important to emphasize that the intensification of the formulation of national strategies for the green transition reveals not only a concern for planetary limits, but also inclinations guided by long-term market and geopolitical motivations (Hauge; Hickel, 2025). The insufficiency of private investment in key sectors for the transition, since they are not judged sufficiently profitable, leads states to assume an active role in inducing these transformations (Christophers, 2022), as a mitigator of financial risks (Gabor, 2021).

Thus, the notion of "Green Industrial Policy" emerges not only as a response to the climate urgency, but also as an instrument of interstate competition for competitiveness in strategic technological clusters that are not yet fully consolidated (Lebdoui, 2024).

Based on these dynamics, GIP has been consolidated both in national development strategies and in academic literature. Although there is no single definition, the existing interpretations are largely complementary. Hauge and Hickel (2025) point out that GIP should be understood in a simple and direct way, as a measure of government intervention with a view to supporting the green development agenda. To this end, Altenburg and Rodrik (2017) assert that GIP must ensure the acceleration of structural transformation based on low-carbon, resource-efficient, and high-productivity productions. Despite this, its effectiveness depends on the adaptation not only of manufacturing, but also of services, agricultural modernization, and the use of critical minerals for green infrastructure (Oqubay, 2025), since the importance of this process is also revealed in the expanded coordination of the continuous and incessant process of creative destruction in the economy. Additionally, GIPs should also present themselves as an attempt to face broad social challenges, ensuring that the green transformation incorporates inclusion, sustainability, and resilience.

The adoption of these measures aims to foster "green growth," that is, the compatibility of economic growth with environmental sustainability (Hickel; Kallis, 2020).

Green growth can thus be defined as a pattern of growth that is efficient in the use of natural resources, clean in minimizing environmental impacts, and resilient to climate change (World Bank, 2012), based on the basic premise that growth and environmental preservation are not incompatible objectives. As highlighted by Fouquet and Hippe (2019), although the conventional growth model is unsustainable in the long term, there is room for strategies that integrate economic prosperity and ecological responsibility, provided they are accompanied by profound structural transformations in the way wealth is produced, consumed, and distributed.

Although the notion of green growth has recently become popular, to the point of becoming a mainstream approach in the international debate (Hickel; Kallis, 2022), concerns about the limitations of traditional growth models have ancient roots. In "The entropy law and the economic process" Georgescu-Roegen (1971) had already warned of the dangers of portraying the economy as a timeless dynamic, detached from physical limits, when in fact it should be understood as an entropic process, in which the transformation of natural resources into goods and services involves irreversible losses of energy and matter, according to the laws of thermodynamics.

Following this same line, the report "Limits to Growth" (Meadows et al., 1972) showed that the exponential expansion of production and consumption on a finite planet inevitably leads to resource depletion and environmental degradation. In the same spirit, Daly (1972) defended the need for a "steady-state economy," in which material stability replaces the incessant pursuit of growth, so that societies can reconcile human well-being and ecological preservation.

Together, these authors established the intellectual foundations for rethinking the biophysical limits of growth, contrasting with the idea that the economy can expand indefinitely.

These pioneering interpretations founded the basis of a current stream of industrial policy based on the idea of post-growth, or degrowth, which argues that the discontinuous expansion of the national product, especially in developed economies, would be structurally incompatible with ecological sustainability (Hickel, 2021). This proposal starts, therefore, from an attempt to promote the planned "degrowth" of energy and resource use in specific sectors, in order to free up productive capacity for more socially necessary objectives, such as health, education, care, and green infrastructure (Kallis, 2025).

In this sense, green industrial policy can be understood as an instrument of structural reorganization capable of aligning energy efficiency, planned reduction of resource use, and social redistribution. This perspective distances itself from a mere update of traditional green productivism, as it recognizes that the energy transition, although necessary, tends to intensify the demand for materials and, therefore, needs to be conducted in a way that avoids the reproduction of new ecological pressures associated with resource extraction (Hauge; Hickel, 2025).

These elements make the transition more feasible in developed countries, given that they have more advanced and environmentally resilient productive and institutional structures, compatible with a progressive green growth agenda. In this context, strategies inspired by the so-called Green New Deals, conceived in the image of the

program implemented by Franklin D. Roosevelt in the 1930s, gain prominence.

These are comprehensive packages of public policies aimed at tackling the climate crisis and global warming, while seeking to generate jobs and reduce inequalities (Pollin, 2020). To this end, they articulate massive investments in new energy systems, financial reforms for the mobilization of public and private capital, greater regulations on emitting activities, in addition to redistributive measures that try to signal a just transition, in which costs and benefits are equitably shared by society (Kozul-Wright; Barrowclough; Fortunato, 2025).

Another central point of the debate around GIP is the search for decoupling, between the generation of growth and economic well-being and the intensive use of polluting or non-renewable resources, while advancing in structural change towards more productive and competitive activities. However, this process is crossed by significant uncertainties: regarding technological progress and the unpredictability of markets; institutional and political, which depend on clear long-term objectives; and ecological, since the response of ecosystems to anthropic pressures is complex and non-linear, difficult to anticipate (Altenburg; Rodrik, 2017).

Altenburg and Rodrik (2017) are optimistic in highlighting that achieving absolute decoupling depends not only on expressive gains in resource efficiency and diffusion of clean technologies, but also on the definition of clear phase-out strategies, that is, the progressive elimination of polluting technologies. In this sense, GIP must draw up roadmaps and create incentives to replace unsustainable matrices — such as those based on fossil fuels or combustion vehicles — with

low-carbon alternatives. This process is not impossible, as GIP offers ample space for experimentation, adaptation, and dissemination of sustainable technologies.

Although it is especially challenging for developing countries, as their sectoral composition is mainly marked by high levels of emission in low and medium technology-intensive sectors (Andreoni, 2024), the logic of decoupling is still relevant, precisely because it translates into opportunities for defining their own national strategies, given the absence of consolidated international technological leadership in this field (Altenburg; Rodrik, 2017).

Even if "absolute decoupling" is enabled by the diffusion of clean technologies and the phase-out of unsustainable matrices, on the other hand, the construction of low-carbon trajectories depends on the harnessing of emerging innovations. At this point, sustainable Industry 4.0, linked to the logic of green digitalization, acquires an important role in recent GIP strategies, by offering an alignment between productive transformations and the climate agenda (Andreoni, 2024; Alami; Chodor; Taggart, 2025). The use of digital technologies, such as artificial intelligence, big data, the Internet of Things, and cyber-physical systems, allows for significant gains in energy efficiency, traceability of value chains, and real-time monitoring of emissions, strengthening eco-efficiency and circular economy practices (Khan et al., 2025).

To this end, such political arrangements based on green digitalization seem to combine the connection between technological direction, environmental regulation, and incentives for sustainable innovation, in order to avoid the generation of other contradictions and ambivalences (Hauge, 2023). That is, although green digital innovations ensure eco-efficiency gains, they can also intensify unsustainable patterns of energy consumption, obsolescence, and productive specialization, mainly in primary sectors, as in the case of transition strategies based on the exploitation of scarce critical minerals, essential to meet the energy needs of the ongoing transitions.

The increase in international demand for crucial minerals, such as lithium, cobalt, copper, nickel, and rare earths, highlights the imminence of national policies aimed at a "resource nationalism" (Lebdioui; Riofrancos, 2025). Given the strategic value and vulnerability of the supply chain for these minerals, their exploitation becomes a central geopolitical point, especially in Global South economies such as those in Africa and Latin America, which seek to expand their participation in the generation and appropriation of value in the different spheres of the production chain, from extraction to refining and manufacturing. Although this situation translates into opportunities for economic and technological gains, its pursuit runs the risk of reproducing past extractivist models, marked by the drainage of resources, environmental damage, and the perpetuation of the productive specialization of these countries in segments of lower added value (Lebdioui; Riofrancos, 2025; Wani, Leape; Dobermann, 2025).

If, on the one hand, the different axes of GIPs highlight central dimensions of the climate transition in the productive field, on the other hand, they show the need for a more integrated logic of strategic coordination. In this context, mission-oriented policies (Mazzucato, 2021) emerge as proposals capable of articulating specific instruments and interventions in systemic public policies aimed at common and urgent goals. By defining the desired growth path, missions configure a form of economic planning oriented by the State and by collective action around broad social objectives – such as the energy transition, carbon neutrality, or urban sustainability. With this, they are transformed into vectors of coordination for inclusive investments, innovation, and productive transformation, decisively shaping industrial ecosystems (Mazzucato et al., 2020; Mazzucato, 2022).

In practice, missions mobilize a diverse set of instruments: innovative public procurement, targeted investment funds, subsidies, and tax incentives conditioned on socio-environmental goals. The distinctive feature is the emphasis on systemic and long-term interventions, which seek to build new markets rather than just correcting pre-existing failures. In this way, mission-oriented policy becomes a mechanism of "direction" from the establishment of purposes (Routes); of the structure and support capacity of the public machine (Organizations); of monitoring and dynamic efficiency (Evaluation), in addition to public-private incentives and investments based on conditionalities (Risks and Rewards) (Mazzucato et al., 2020; Mazzucato; Rodrik, 2023).

By recognizing GIP as an opportunity for structural renewal, some authors understand it holistically, anchored in humanist, structuralist, and class-conscious principles, from which the notion of "good industrial policy" emerges, aimed simultaneously at human and environmental flourishing (Estevez; Forero, 2025). In this perspective, the green transition is not restricted to the mitigation of greenhouse gases, but constitutes a systemic process of economic restructuring in response to interdependent ecological and social challenges. It is, therefore, an "eco-humanist" industrial policy, oriented towards the transformation of production and provision systems to more fully and equitably satisfy human needs, in line with planetary limits. Under this normative prism, an industrial policy can only be considered "good" if it is also green, because ensuring the habitability of the planet and the well-being of the working class is not just an environmental condition, but the very foundation of GIP (Estevez; Forero, 2025; Estevez; Riofrancos, 2025).

Table 1 brings together a summary of the main green industrial policy initiatives discussed in this section, as well as their main mechanisms of action, risks, and opportunities.

Table 1 - Synthesis of the main international green industrial policy initiatives

Initiatives	Central Focus	Main Mechanisms	Opportunities	Risks/Limits
<i>Degrowth</i>	Reduction of production and consumption in polluting sectors.	Planned deceleration, redistribution of work and income, reduction of superfluous consumption.	Direct reduction of emissions; questioning of unsustainable production patterns.	Political resistance; limited viability in developing countries, with still immature industrial stages.
Economic and environmental decoupling	Dissociation of growth based on emissions and use of polluting resources.	Clean technological innovation, energy efficiency, circular economy.	Possibility of maintaining growth with less environmental impact.	"Absolute decoupling" difficult to achieve, high uncertainty; requires the creation of national institutions and technologies, with limited replication.
<i>Phase-out</i>	Progressive elimination of polluting technologies.	Gradual prohibitions, divestments, technological substitution.	Clarity of the desired trajectory; incentive for innovation in low-carbon sectors.	Resistance from traditional sectors; social costs of the transition can be high.
<i>Green New Deal</i>	Large blocks of public investment in green infrastructure and jobs.	Integrated national plans, demand stimulus, energy transition.	Combination of social and climate justice; creation of green jobs.	High fiscal cost; risk of undue political interests and partial implementation.
Green digitalization (sustainable Industry 4.0)	Use of digital technologies aimed at environmental objectives.	Internet, artificial intelligence, big data, real-time monitoring, traceability.	Energy efficiency; circular economy; sectoral innovation.	High energy consumption of data centers; planned obsolescence; digital greenwashing.
Industrial policy based on natural resources	Strategic use of critical minerals, green resources, and rare earths.	Resource nationalism; local supply; energy access; regional cooperation.	Greater value capture in the Global South; possibility of production chain autonomy; geopolitical influence.	Risk of neo-extractivism; dependence on commodities; socio-environmental damage.
Mission-based industrial policy	Coordination around major social and environmental challenges.	Technological direction, public procurement, regulation, public-private cooperation.	Creation of new markets; systemic innovation; social legitimacy.	Requires strong state capacity; risk of fragmentation given very broad and comprehensive national missions.
Good industrial policy (climate and social justice)	Integration between ecological transition and social justice as a normative basis.	Holistic political vision; social equity, respect for planetary limits.	Development linked to human and environmental well-being and workers' rights.	High degree of coordination; limitations based on the capture of different political agendas.

Source: author's own elaboration

As evidenced, the emergence and relative importance of GLPs are essential in the context of intense economic and social transformations in the current phase of "compressed development" of global capitalism. However, countries in the Global South face a series of historical-structural constraints that hinder the effectiveness of a broad sustainable industrial development policy. The next section addresses some of these challenges.

3. PREMATURE DEINDUSTRIALIZATION AND STRUCTURAL HETEROGENEITY: CONSTRAINTS AND LIMITS FOR A GREEN INDUSTRIAL POLICY

Economic development, in its classic interpretation, is understood as a process of continuous elevation of per capita income associated with capital accumulation and the expansion of productivity, as economies advance in the construction of their material base and become capable of internalizing and appropriating the surplus generated by productive activities (Furtado, 1961).

There is broad recognition, both theoretical and historical, of the role of the manufacturing sector in enabling this dynamic, based on important central characteristics that this sector possesses, namely: it concentrates activities of higher added value and productivity (Kaldor, 1967), transmits the gains of technical progress via linkage effects with other sectors of the economy (Hirschman, 1958), contributes to mitigating external constraints on growth (Thirlwall, 1979), favors innovation and stimulates endogenous learning capabilities (Dosi, 1988), in addition to generating more qualified jobs with wages above the economy's average (Rodrik, 2016).

As highlighted by the development tradition, these characteristics gave industry the unique role of being the driving engine of economic growth. The energy that sustained and pushed this rotary motion, however, was anchored in a productive pattern intensive in the use of natural resources, negligent of the severe associated environmental costs. There is, therefore, a widespread perception that this canonical recipe for industrialization, previously seen as central to the advancement of income and productivity convergence, no longer holds and today faces an insurmountable limit: that of reconciling development with environmental sustainability.

In this sense, the notion that structural change should be guided by green economic growth — based on the efficient use of natural resources, the minimization of environmental impacts, and climate resilience (Hauge and Hickel, 2025), as discussed in section 2 — has been consolidating as a recurring reference in the literature and in the debate on industrialization in the 21st century. After all, as pointed out by Fouquet and Hippe (2019), the unsustainability of the conventional growth model opens up significant gaps for thinking about the way the economy produces, consumes, and distributes wealth.

It is needless to say that the efforts to achieve a sustainable productive transition are particularly more challenging for developing countries in the Global South. In these countries, the leap to the green paradigm occurs under the veil of immature and poorly diversified productive structures, strongly rooted in chains intensive in the exploitation of non-renewable resources (Kozul-Wright; Barrowclough; Fortunato, 2025). In this condition, capital accumulation based on activities with high environmental impact acts to cumulatively deepen ecological fragilities.

In this context, the productive structure inherited from the historical formation process of these economies carries elements that, under the condition of underdevelopment, limit diversification and hinder green structural transformation. As pointed out seminally by the structuralist analytical perspective (Prebisch, 1950), peripheral economies, in contrast to central ones, would be characterized by low levels of aggregate productivity, a marked specialization in commodity-based products, with limited advancement of technological progress. In addition, the presence of heterogeneous productive structures would indicate that a significant portion of the labor force was in subsistence activities, or even in low-productivity sectors (Prebisch, 1950; Fajnzylber, 1983; Alatorre et al., 2025).

Based on this framework, structural heterogeneity could be defined by the existence of significant asymmetries in labor productivity, both at the intra- and inter-sectoral levels, expressing the disarticulation and discontinuity between the modern, intermediate, and traditional segments of the economy (Pinto, 1952).

Thus, in addition to the internal productivity gaps, given the unequal sectoral levels and the concentration of the labor force in activities linked to informality and underemployment, there is the mismatch in relation to imitation, adaptation, and technological diffusion (Cepal, 2010), since the peripheral industrializing impulse consists of import substitution, dependent on external technological induction (Furtado, 1983).

The persistence of an institutional arrangement aimed at exploiting Ricardian advantages and financial rent-seeking tends to intensify the external constraint on the growth of these economies (Alatorre et al., 2025). In this context, the limited pattern of productive transformation results in low degrees of intersectoral complementarity and incipient vertical integration (Rodríguez, 2009). The result is a "truncated

industrialization": incomplete, disjointed, and lacking an endogenous core of technological dynamism (Fajnzylber, 1983), or even a national innovation system (Freeman, 1995; Lundvall, 2007).

In parallel, through stagnant processes of structural transformation in recent decades, in many cases the countries of the Global South are confronted with the intensification of the diagnosis of premature deindustrialization. Considering these elements, deindustrialization is understood as a sustained fall in both the share of industrial value added in Gross Domestic Product (GDP) and industrial employment in total employment in the economy (Tregenna, 2016).

Contrary to what is observed in developed countries, where the phenomenon is considered an expected byproduct of both industrial productivity growth and aggregate economic growth, as it begins at high levels of per capita income (Rowthorn, 1995), in undeveloped countries, the diagnosis is premature because it occurs at low levels of per capita income, even before the crystallization of a diverse industrial fabric, a diffuser of innovations, and knowledge-intensive (Rodrik, 2016).

Thus, an increase in the relative weight of the service sector in GDP is observed, a result of the absorption of an expressive portion of the labor force, frequently allocated in low-skilled occupations with incomes lower than the average of other economic segments (McMillan; Rodrik, 2011). In parallel, an increase in the income elasticity of demand for goods and products associated with services is also noted (Tregenna, 2016).

It is important to highlight that, since the 1990s, the relative share of industry in GDP, whether at the level of value added (Özçelik; Özmen, 2023), or industrial jobs (Felipe; Mehta; Rhee, 2018), has declined in parallel with very incipient per capita income levels, especially in economies of Latin America and Africa (Rodrik, 2016). On the other hand, a strong heterogeneity of deindustrialization at the sectoral level is identified, in which, the higher the technological intensity, the greater the evidence of declining or even stagnant patterns of contribution of the industrial sector to national development for the countries of the Global South (Tregenna; Andreoni, 2020).

Notably, premature deindustrialization is not a spontaneous phenomenon, but reflects the profound transformations in the techno-economic paradigm between the late 20th century and the 2000s. In this scenario, the unequal and not very resilient insertion of the economies of the Global South in Global Value Chains reduced the gains from trade and weakened industrial employment (Rodrik, 2018). This movement was reinforced by asymmetric processes of commercial and financial liberalization, conducted under the guidelines of the Washington Consensus (Özçelik; Özmen, 2023), which consolidated a regressive specialization based on the exploitation of primary resources. As a consequence, space was opened up for the contagion of the "Dutch disease," with additional impacts on industrial dynamism (Palma, 2019).

Consecutively to the effects of deindustrialization, an additional concern persists related to the effects of the middle-income trap, which refers to the different structural and institutional configurations that prevent industrial growth associated with the generation of dynamic capabilities and technological progress in middle-income

countries in the Global South. In turn, such entrapment contributes to premature deindustrialization by creating a vicious cycle of industrial stagnation, low economic growth, and other difficulties in sustaining structural changes compatible with convergence beyond a certain level of per capita income (Lee, 2013; Andreoni; Tregenna, 2020).

These processes deepen the inequalities between countries, since the economies of the Global South, marked by low productive diversification, limited technological capabilities, and reduced fiscal space, face severe restrictions in mobilizing resources both domestically and internationally (Kozul-Wright; Barrowclough; Fortunato, 2025). These limitations become even more serious in the face of the escalating impacts of the climate crisis, that is, a phenomenon that they did not produce, but from which they suffer disproportionately, with prospects of future aggravation (Baarsch et al., 2020).

Such a context moves in clear disagreement with Principle 7 of the Rio Declaration on environment and development (United Nations, 1992), according to the interpretation of the orientation regarding Common But Differentiated Responsibilities and Respective Capabilities, being:

States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command (United Nations, 1992, p.2, our emphasis).

Since the structures of the Global South are more heterogeneous, the transition of their productive bases under the green imperative proves to be especially complex. The erosion of the room for maneuver for autonomous development strategies, added to legal, financial, and institutional barriers, limits the adoption of policies capable of sustaining environmentally compatible industrial trajectories (Alami; Chodor; Taggart, 2025). In this scenario, the reconciliation between growth, productive diversification, and green transition remains conditioned by historical-structural constraints that restrict the construction of an endogenous development project.

4. GREEN INDUSTRIAL POLICY AND DEVELOPMENT IN THE GLOBAL SOUTH

Based on the understanding of the heterogeneous character derived from the different levels of development of the countries of the Global South and North and, in adherence to the principle of CBDR-RC - Common But Differentiated Responsibilities and Respective Capabilities based on Principle 7 of the Rio Declaration on environment and development (United Nations, 1992), this section seeks to deepen the discussions of GIPs conditioned on overcoming the structural heterogeneity characteristic of the countries of the Global South.

In adherence to this framework, Hauge (2023) suggests that Green Industrial Policy in the Global North should focus on a drastic reduction of emissions, decarbonization, productive reconversion, and even degrowth (see figure 1). In the Global South, these should concentrate on inclusive industrialization, with space for the continuity of growth, in parallel with the incorporation of clean technologies. According to the author,

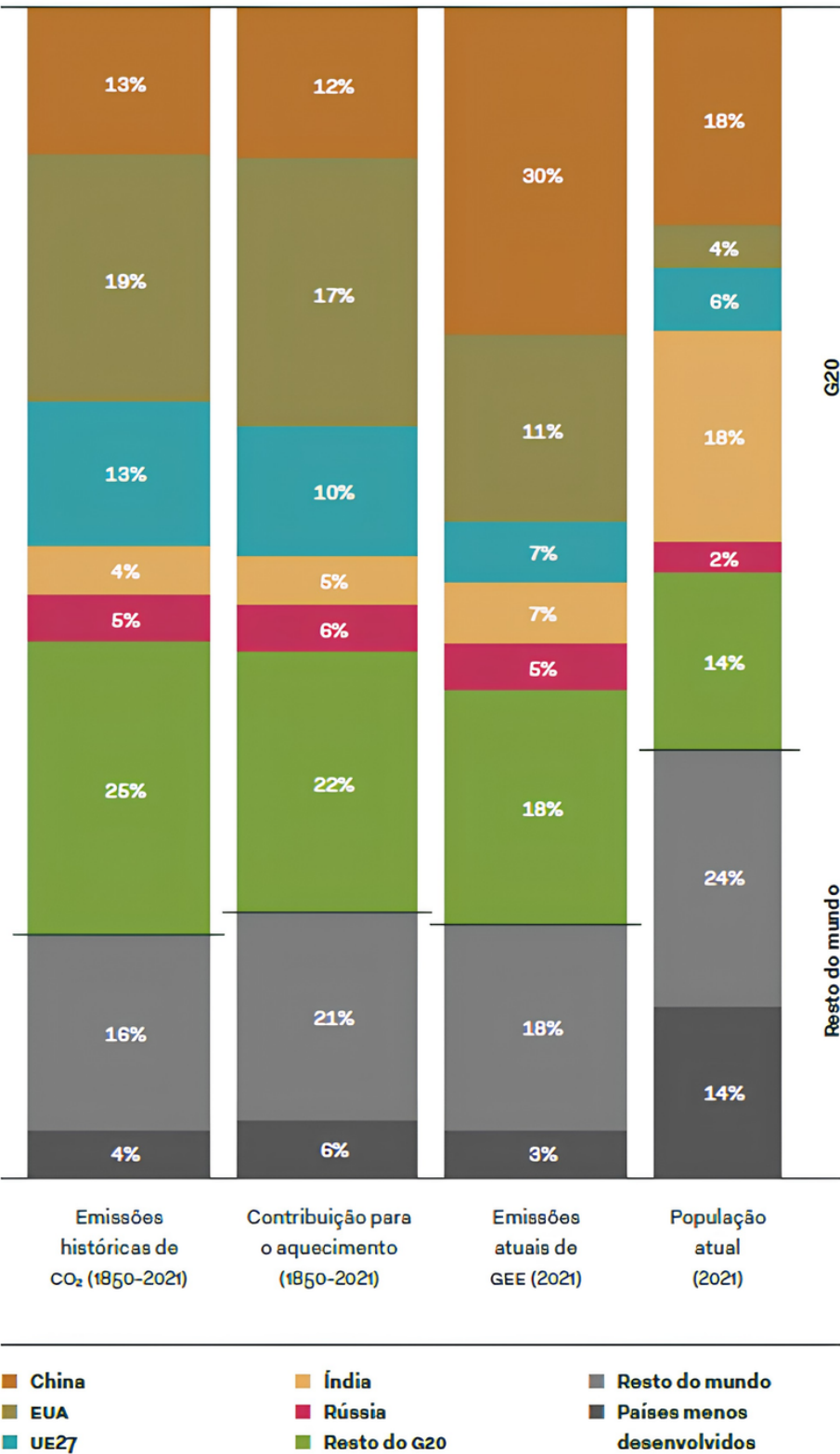
In the age of ecological breakdown, we need to more honestly discuss whether there are contradictions and trade-offs between industrialization and ecological sustainability. When thinking about policy implications, we need to explore the possibility of giving some countries more 'ecological policy space' than other countries, given how national responsibility for ecological breakdown is highly unequal across the world. (Hauge, 2023, p.1).

In the same vein, Mathews and Oqubay (2025) and Hauge and Hickel (2025) suggest that adopting strategies that seek decoupling between growth and resource utilization in the Global North would be insufficient to preserve the stability of planetary boundaries. That is, strategies that enable economic-environmental decoupling by enabling growth that is compatible with the reduction of resource use and compatible with the preservation of planetary boundaries (also understood as green growth, as presented in section 2).

Thus, it would be necessary for these countries to adopt a new development regime, in which there is a reorientation towards degrowth and the solution of social problems (through the construction of production around the public good) instead of essentially material accumulation.

Figure 1: Current and historical CO2 emissions:
G20 versus rest of the world

Source: Mazzucato et al, 2024



From the understanding of the asymmetry between countries of the Global North and South, the need to reconfigure the institutional and political restrictions on the formulation of development and industrial policies also derives, mainly for middle and low-income countries.

Thus, Hauge and Hickel (2025) suggest that the Global South should have a broader ecological policy space, in order to have greater freedom to increase resource uses to continue promoting the growth of their economies. The construction of this greater space for the autonomy of public policies in the countries of the Global South would be based on two vectors: historical recognition of the unequal responsibility of the North, with regard to the depletion of planetary boundaries and the need for financial compensation and reparations to the Global South in order to enable an ecological and socially just transition.

However, Kozul-Wright, Barrowclough and Fortunato (2025) highlight that the search for a just transition to a low-carbon economy, especially for the countries of the Global South, runs into a set of restrictions imposed by the international political-institutional arrangement and the logic of capitalist accumulation.

The first of these would stem from the negatives of financialization in the search for the transition to a low-carbon economy. This is because in the prevalence of a logic of accumulation oriented towards the short-term, in search of the extraction of value from intellectual monopolies (Rikap, 2021) in which the links between accumulation and productive investment are unstructured, a low relative availability of long-term financing for the green transition is observed.

As a way to circumvent such restrictions, the authors suggest GIPs such as: (i) strengthening public development banks with directed and long-term credit, (ii) fiscal-monetary coordination to finance the transition, (iii) establishment of capital controls to prevent speculative flight and (iv) seeking multilateral cooperation between the North and Global South (with the creation of green funds, reduction of the external debts of low-income countries, in exchange for the use of these resources for financing sustainable investments (“green debt swaps”, Mathews and Oqubay, 2025).

The second restriction derived from the international political-institutional-economic arrangement would be the dominance of Global Value Chains (GVCs) by multinational companies from the North. These, by controlling the stages of higher added value such as R&D, finance, and marketing, would restrict the access of Global South countries to assembly activities, production of low-value inputs, and invariably more polluting stages based on the use of cheap labor.

In order to overcome such restrictions, they advocate that GIPs should: (i) establish local content targets and technology transfer requirements, (ii) regulate the activities of multinationals, establishing rules for local reinvestment, (iii) prioritize the creation of regional green value chains (e.g., lithium in Latin America, bioenergy in Africa) and (iv) press for the creation of an international competition body to limit corporate power.

Finally, the third restriction to the formulation of GIPs that enable a socially just transition would derive from the framework of rules of organizations, especially the World Trade Organization (WTO), and international treaties such as TRIMs – Trade-Related Investment Measures, TRIPS – Trade-Related Aspects of Intellectual Property Rights and SCM – Agreement on Subsidies and Countervailing Measures. Together, these rules would substantially restrict the ability of Global South countries to carry out development policies with the aim of especially fostering nascent industries such as those associated with the green transition.

In this sense, the authors suggest that GIPs should (i) make creative use of loopholes (green subsidies, sustainable public procurement) and that (ii) the Global North should commit to relaxing the restrictions cited in the previous treaties, especially for clean technologies, based on the principle of CBDR-RC. In parallel, they suggest the need to strengthen South-South cooperation for the creation of regional green R&D funds.

In this same line of interpretation, Andreoni (2024) and Lebdioui (2024) also highlight the removal of international restrictions as a *sine qua non* condition for a green and socially just transition. According to Lebdioui (2024, p.2): "Global decarbonization tends to widen economic disparities between countries, leaving—and perhaps even pushing—the poorest nations behind in the industrial geography of decarbonization." (author's own translation).

In addition to the asymmetry with regard to the previous development of productive forces, the capacity for innovative learning, and the institutional arrangement of the countries of the Global South (Pegels, 2014; Pegels and Altenburg, 2020), Lebdioui (2024) draws attention to the prevalence of a strategy of "kicking away the green ladder" on the part of rich countries. This strategy would be based on a new edition of protectionism, now disguised with a green character. The current most emblematic instrument in this sense would be the Carbon Border Adjustment Mechanism (CBAM) adopted by the EU, with the aim of imposing tariffs on imports of products that did not meet certain pre-established regulatory standards.

Not enough, the author also highlights as part of this strategy the exclusion of Global South countries from the use of green technologies protected by intellectual property regimes and the insufficiency of fund transfers from rich countries to middle and low-income ones to finance their green transitions.

Despite these restrictions, Altenburg and Rodrik (2017) highlight that Global South countries would face fewer lock-in effects in technologies intensive in the use of fossil fuels when compared to developed countries, given that their industrialization processes are heterogeneous and incomplete. Thus, these countries would tend to present some typical benefits of late comers as they would find less political and productive resistance to taking advantage of windows of opportunity created by the paradigm shift towards decarbonization (Lee, 2025; Lema and Perez, 2024).

Additionally, Altenburg and Rodrik (2017) also present elements that would justify, even in economic and rational terms, the overcoming by the countries of the Global South of the historical trade-off between growing and decarbonizing.

According to the authors, by postponing the adoption of GIPs, these countries could erode future growth bases by exhausting their own ecosystems, increase future costs to abandon/carry out the phasing out of highly polluting assets, in addition to being subject to restrictions in their participation in GVCs due to growing green protectionism.

In summary, from the international context presented, it is clear the need for countries of the Global South to understand that GIPs must occupy a central role in their development strategies (Mazzucato et al, 2024).

As suggested by Hauge and Hickel (2025), Kozul-Wright, Barrowclough and Fortunato (2025), and Andreoni (2024), beyond the marginal incorporation of measures that seek decarbonization in coexistence with development strategies based on normative and institutional orientations shaped by the techno-economic paradigm of the first and second Industrial Revolutions, the most virtuous trajectory of these countries should be oriented towards the construction of a new paradigm. For this, a set of policies is suggested in this policy paper that should be articulated in three dimensions (as shown in table 2): internationally systemic, with the aim of reorganizing the logic of accumulation and capitalist competition; that seek green growth/decoupling between growth and intensive use of resources and those based on the inherited productive structure and conditioned by structural heterogeneity.

Table 2. Green Industrial Policies for the Global South

Dimension of Green Industrial Policy	Structural Obstacle	Problem Diagnosis	Impacts on Green Industrialization	Necessary Green Industrial Policies
1. Systemic	Financialization	Predominance of short-termism and rent-seeking; corporate profits directed to shareholders, to the detriment of productive investment; capital flight in the Global South.	Limitation of long-term credit for renewable resources, infrastructure, and R&D; financial volatility that weakens green investments.	- Public development banks with directed and long-term credit. - Fiscal-monetary coordination for financing the transition. - Capital controls to prevent speculative flight. - Multilateral cooperation (Special Drawing Rights, green funds, debt-for-climate swaps).
1. Systemic	Global Value Chains (GVCs)	Multinationals from the North control high-value segments (R&D, design, marketing); Southern countries are restricted to assembly and low-value inputs.	Difficulty of green technological upgrading; dependence on expensive imports; risk of exclusion from chains due to environmental regulations (CBAM).	- Local content policies and technology transfer requirements. - Regulation of multinationals for local reinvestment. - Creation of regional green value chains (e.g., lithium in Latin America, bioenergy in Africa). - International competition body to limit corporate power.
1. Systemic	Trade and investment treaties	WTO rules (TRIMS, TRIPS, SCM) and bilateral treaties restrict subsidies, local content, and technology transfers; IP strengthens monopolies of the North.	High cost of clean technologies; blocking of classic industrial policy instruments; risk of dependent ecological specialization (supply of resources without innovation).	- Creative use of loopholes (green subsidies, sustainable public procurement). - Reform of TRIPS and flexibility of IP for clean technologies. - Revision of WTO rules based on the CBDR-RC principle. - Regional green R&D funds and South-South cooperation. - Global Green New Deal to ensure industrial policy space for the South.

Table 2. Green Industrial Policies for the Global South

Dimension of Green Industrial Policy	Structural Obstacle	Problem Diagnosis	Impacts on Green Industrialization	Necessary Green Industrial Policies
2. Green Growth/ Decoupling	Carbon lock-in	Predominance of productive structures and logic of accumulation based on the use of fossil fuels.	Static efficiency of the inherited structure reduces the competitiveness and attractiveness of green innovations.	Disincentive / punishment of polluting technologies Incentive for new renewable energy sources Incentive for electric mobility (individual and collective)
	Linearity of production and consumption	The capitalist paradigm born in the Industrial Revolutions understands development as the exploitation of natural resources	The way established production chains are organized is easier to manage and reduces the relative attractiveness of green chains, which are more complex.	Strengthening of circular production chains Incentive for urban mining and recycling Creation of traceability protocols for used materials.
	Intensive use of natural resources	Use of natural resources incompatible with the sustainability of planetary boundaries.	Difficulty of managing a major transformation that reformat consumption patterns.	Differentiated taxation according to the recyclability levels of the chains Promotion of the green chemistry industry Gradual prohibition of products and services that are highly intensive in the inefficient use of natural resources

Table 2. Green Industrial Policies for the Global South

Dimension of Green Industrial Policy	Structural Obstacle	Problem Diagnosis	Impacts on Green Industrialization	Necessary Green Industrial Policies
3. Coupling between reduction of structural heterogeneity and just growth	Low per capita income levels of Global South countries	Low access to material conditions adequate for the full exercise of citizenship.	Difficulty of building political legitimacy around GIP.	Relative incentive for consumer goods of the popular classes and relative disincentive for consumer goods typical of the middle and upper classes
	Highly heterogeneous productive structure	Structural heterogeneity contributes to low productivity, weak competitiveness, and an inability to generate employment under conditions of adequate remuneration.	Major constraints on the implementation of the green transition, owing to the inability to mobilize sufficient financial resources for investment.	Financing for the replacement of energy-inefficient machinery and equipment "Productive extension programs for Small and Medium Enterprises, with the aim of fostering learning in the use of green technologies" "Promotion of R&D for the development of local technological solutions in order to overcome problems typical of Global South countries (such as inefficiency in land use, agriculture, and deforestation, etc.)" Reduced taxes for Small and Medium Enterprises that use green technologies and generate green jobs
	Regional, social, racial, and gender heterogeneity	Impacts of the negative effects of low income and restricted citizenship are more intense in poor regions and minoritized segments of the population.	Resistance from elites and the upper middle class to reorienting consumption patterns to the detriment of an expansion of rights and citizenship in minoritized segments.	Taxation of luxury goods Progressive taxation Obligation to use green technologies in popular housing programs Disincentive for inefficient automobiles (SUVs, etc.) Subsidized financing for minoritized segments for the implementation of solar PV structures, purchase of efficient home appliances, etc. Subsidy for collective transport that adopts green technologies

Source: author's own elaboration

Based on the combination of these three dimensions, green industrial strategies should be at the center of national transition plans, with clear missions, public-private collaboration, and a focus on strengthening domestic capacity (Mazzucato et al, 2024). In summary, in this new paradigm, GIPs should be the axis of structural transformation with the aim of combining social justice and the subordination of production to a logic of providing public goods. This combination would be fundamental to guarantee their political legitimacy in societies historically characterized by structural heterogeneity in the social, productive, regional, racial, and gender dimensions.

In order to overcome these heterogeneities, GIPs, in turn, should be constituted taking into consideration the search to meet national needs, thus avoiding what Lebdioui (2024) calls green dependency. For this, however, local innovative and institutional learning would be necessary, in order to circumvent the trap of institutional mimicry that characterized the normative orientations typical of the Washington Consensus (Lebdioui, 2024).

It is only in this way that countries of the Global South could guide their green transition strategy and at the same time avoid a new reprimarization, now based on the supply of green inputs to the Global North – which would be typical of the re-edition of the ‘kicking away the ladder’ strategy, now in a dimension coated with ecological sustainability.

5. FINAL CONSIDERATIONS

The consolidation of green industrial policies in the Global South represents not only a climate mitigation strategy, but above all an opportunity to redefine historical elements that have marked the foundations of national development. The analysis proposed by this policy paper demonstrated that the marginal incorporation of decarbonization instruments, without a review of the inherited historical-structural foundations, tends to reproduce dependencies and limit the possibilities of structural transformation. In this sense, the green transition must be understood as a development project that combines sustainability, innovation, and social justice, and not as a mere adaptation to the trends of contemporary capitalism.

This study pointed out that, from three normative dimensions – systemic, green growth / economic-environmental decoupling, and coupling between the reduction of structural heterogeneity and just growth – the effectiveness of GIPs depends on the articulation between national capacities and international coordination mechanisms. The systemic dimension highlights the urgency of reconfiguring the logic of accumulation of capitalist competition, which demands the creation of financial institutions aimed at development, in addition to the expansion of the industrial policy space and the revision of international trade and investment rules. Such reforms are essential to broaden the room for maneuver of the countries of the South and prevent the ecological transition from deepening existing asymmetries.

In the dimension of green growth, overcoming carbon lock-in and the linearity of production and consumption requires active policies of technological innovation, environmental regulation, and incentives for the circular economy. Absolute decoupling between growth and intensive use of natural resources is a difficult goal to achieve, but indispensable for redefining the development trajectory on sustainable and competitive bases.

Finally, the dimension focused on structural heterogeneity and just growth highlights that the green transition will only achieve political legitimacy if it incorporates objectives of social inclusion and reduction of inequalities. Green industrial policies must be designed in a way that promotes productive diversification and the generation of green jobs, prioritizing historically marginalized segments and less developed regions.

In summary, green industrial policies must assume a central role in the development strategies of the Global South, guided by national transition missions and the construction of endogenous technological capabilities. The redefinition of the global techno-economic paradigm requires a political project capable of articulating innovation, productive sovereignty, distributive justice, and attention to social, gender, and racial heterogeneities — indispensable elements for green industrialization to effectively become a dynamizing instrument for a new cycle of development.

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