

GREEN INDUSTRIAL POLICY: FOSTERING INNOVATION AND DRIVING STRUCTURAL CHANGE TOWARD A GREEN ECONOMY

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Abstract: *Humanity is currently facing serious climate change challenges resulting from long-term reliance on unsustainable patterns of consumption and production, as well as the intensive use of land and energy resources. In addressing these challenges, there is a growing need to formulate an environmentally sustainable industrial policy capable of decoupling economic growth and improvements in quality of life from excessive resource depletion and waste generation. Achieving such a development model requires the accelerated development and deployment of new, advanced, and clean technologies, as green growth necessitates green technologies. Green industrial policy can be understood as a set of public measures and strategic state interventions aimed at transforming the structure of the economy toward environmentally sustainable sectors, technologies, and production processes. Its theoretical justification stems from the existence of market failures associated with climate change and the development of new technologies, including negative externalities, technological uncertainty, and coordination problems along value chains. The objective of this paper is to analyze the role of green industrial policy in overcoming market failures, with particular emphasis on its function in fostering innovation, reducing investment risks, and accelerating the diffusion of green technologies.*

Special attention is devoted to examining the instruments of green industrial policy, including subsidies, regulatory measures, and institutional support mechanisms, as well as their economic and developmental implications. The paper concludes that a properly designed industrial policy represents a key element of a successful green transition, enabling the simultaneous achievement of economic development and environmental protection goals.

Key words: *green industrial policy, green technologies, sustainable development.*

JEL classification: L52, Q56, O25

1. INTRODUCTION

In contemporary conditions, where automation and digital technologies are reshaping the structure of production, traditional industrialization no longer represents the dominant path of development. As an alternative, a new concept of globalization is being proposed, based on green industrial policy, strengthened cooperation between the public and private sectors, and greater strategic autonomy of states. Such an approach enables countries to rely on the development of domestic industries and labor-intensive services, while simultaneously

preserving democratic institutions and environmental sustainability (Rodrik, 2025).

The key challenges of the modern world—environmental protection, the stability of democratic systems, and the reduction of global poverty—are interconnected and require an integrated approach. The previous model of globalization, which relied on trade liberalization and cheap labor, has led to the weakening of the middle class, the rise of authoritarian tendencies, and limited economic progress in developing countries (Rodrik, 2025).

In the context of climate change and technological transformation, industrial policy is increasingly acquiring a “green” dimension. The green transition represents a global shift from systems based on fossil fuels toward renewable and sustainable alternatives. In a broader sense, the green transition encompasses not only changes in the energy sector but also the transformation of industrial structures, production processes, and consumption patterns, which requires significant institutional and technological changes (Altenburg & Assmann, 2017). This process involves the development of low-carbon technologies, improvements in energy efficiency, and the widespread adoption of renewable energy sources, with the aim of reducing greenhouse gas emissions and preserving natural resources (Kemp & Never, 2017). Contemporary literature emphasizes that a successful green transition requires an active role of the state and the use of industrial policy as an instrument for fostering innovation, accelerating technological progress, and addressing market failures that hinder the decarbonization process (Mazzucato, 2018; OECD, 2023). Green industrial policy is justified by a number of economic factors, including knowledge externalities, path dependence, infrastructural lock-in, and coordination failures, while simultaneously contributing to cost reductions through learning-by-doing and overcoming imperfections in capital markets.

The subject of this research focuses on the analysis of green industrial policy, with particular emphasis on its role in addressing market failures in the context of the green transition. Within this framework, the study examines various instruments of green industrial policy, including research and development subsidies, tax incentives, and direct support for innovation, which contribute to technological advancement and accelerate the transition toward a low-carbon economy. A specific aspect of the research involves assessing the economic and developmental implications of these policies, both at the level of individual economies and within the broader context of global transformations. In this

way, the subject of the research encompasses the interconnections between public policies, market mechanisms, and processes of technological transformation aimed at achieving sustainable development.

2. THEORETICAL FOUNDATIONS OF INDUSTRIAL POLICY

2.1. TRADITIONAL INDUSTRIAL POLICY

There is a large number of definitions of industrial policy. Traditionally, in the development literature, industrial policy has often been used interchangeably with the concept of “industrialization policy.” The formulation of industrial policy is based on the need to adapt the industrial structure to changes in human needs and contemporary technologies (Savić, 2017). The Japanese Ministry of International Trade and Industry (MITI) defined industrial policy as a vision of the future development of industry. For countries primarily concerned with declining industrial output, industrial policy can be viewed as a national strategy aimed at stimulating the development and growth of the manufacturing sector. However, for others, industrial policy implies a targeted sectoral approach that is not necessarily focused on the entire production system. Some authors associate industrial policy with a set of government policies aimed exclusively at the development of the manufacturing sector. In this regard, Soete (2007) defines industrial policy as “structural policies designed to strengthen the efficiency, scale and international competitiveness of domestic industrial sectors,” while acknowledging that this “typically contains an element of national champions, of self-reliance in bringing about growth and development” (Pop & Connon, 2020). Pack and Saggi (2006) define industrial policy as “any type of selective intervention or government policy that attempts to change the structure of production towards sectors that are expected to generate better outcomes for economic growth than would occur in the absence of such interventions, i.e., under market equilibrium conditions.” In this sense, industrial policy is closely related to growth strategies. Warwick provides a sufficiently broad definition that encompasses the various concepts most commonly associated with the term “industrial policy.” He defines it as “...any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity towards sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of any such intervention” (Warwick, 2013). In the context of dynamic changes driven by international trade, industrial

policy is often viewed as an instrument that goes beyond existing comparative advantages and contributes to the development of new, latent comparative advantages. Contemporary perspectives emphasize that industrial policy does not exclusively involve measures targeting industry and manufacturing, but can also extend to other sectors with high growth potential, such as agriculture or high value-added services, including software development. In this regard, Rodrik (2004) highlights that the primary objective of industrial policy is to promote specific economic activities and guide structural transformation within the economy. Accordingly, industrial policy can be defined as a set of government measures aimed at restructuring the economy and reallocating resources toward sectors identified as strategic or desirable for future development.

2.2. NEW INDUSTRIAL POLICY

Given the diversity of approaches to defining industrial policy, several key principles can be identified that shape its contemporary framework. First, industrial policy should be grounded in the broad national interest, achieved through consensus among key stakeholders, including the government, industry, and labor unions. Furthermore, its scope extends beyond narrowly defined state intervention in industry, encompassing a broader strategic framework for development. In addition, industrial policy must be aligned with national development priorities and long-term industrial strategies. At the same time, it should be designed with sufficient flexibility to allow for adaptation and adjustment in response to changes in the economic environment and the perspectives of relevant stakeholders. Although numerous arguments support the use of industrial policy, the most widely accepted justification is based on the existence of market failures, that is, situations in which competitive markets do not lead to socially optimal outcomes. In this context, economic development is not viewed as a spontaneous process, but rather as the result of active state and societal engagement in guiding structural transformation. A key element of this process is the reallocation of resources—primarily capital and labor—from less productive to more productive sectors. Such transformation enables overall productivity growth and income increases, which is particularly important for developing countries seeking to accelerate their economic progress.

In the contemporary context, the objectives of industrial policy have expanded significantly. In practice, industrial policy measures today aim to influence structural transformation in ways that contribute to reducing regional disparities, supporting labor-intensive industries and small

enterprises, and enhancing environmental sustainability (Altenburg & Assmann, 2017). Recent literature increasingly defines industrial policy according to its purpose, while leaving the scope of potential measures implicitly broad. For instance, Millot and Rawdanowicz define industrial policies as “government intervention in specific markets attempting to induce a desired change in an economy, motivated by social, economic and environmental objectives.” Criscuolo defines industrial policies as “interventions intended to improve structurally the performance of the domestic business sector” (OECD, 2024).

3. CONCEPT OF GREEN INDUSTRIAL POLICY

3.1. DEFINITION AND OBJECTIVES

Humanity is currently facing significant climate challenges resulting from prevailing lifestyles and unsustainable patterns of consumption and production. Recognizing the need to address these challenges, the development of an environmentally sustainable industrial policy is essential in order to decouple economic growth and human well-being from resource depletion and waste generation. This process also entails the development and implementation of new technologies that enable a more sustainable model of economic growth. Building on this approach, the concept of mission-oriented innovation policy has emerged, within which the state assumes a proactive role in defining socially relevant objectives—such as decarbonization or technological modernization—and mobilizing both public and private resources toward their achievement (Mazzucato, 2018; 2021). In this context, industrial policy becomes a tool for directing investments toward sectors that generate long-term developmental effects, including employment growth, technological advancement, and sustainable economic development. In doing so, it moves beyond a passive role of the state and establishes a framework of strategic, development-oriented intervention.

The industrial sector has significant potential to act as a key driver of change in the process of the green transition. This transition entails not only technological change, but also institutional and economic reforms, including the design of policies that encourage investment in green technologies. In this context, industrial policy is increasingly recognized as a crucial instrument for steering structural transformation toward a model of sustainable and inclusive growth. Empirical evidence indicates that support for industrial policy in OECD countries increased on average from 1.40% to 1.53% of gross domestic product (GDP)

between 2019 and 2022, including countries such as Canada, France, Germany, Israel, Sweden, and the United Kingdom. Within these support measures, the green transition stands out as one of the three most important areas of industrial policy, with the share of resources allocated to this domain rising from 0.23% to 0.27% of GDP over the same period (Maltais & Suljada, 2025). Middle-income countries, particularly the BRICS economies, also implement industrial policies, although these are less frequently oriented toward the green transition compared to high-income countries, where green energy policies are more prominent.

Green industrial policy can be defined as “any policy measure aimed at aligning the structure of a country's economy with the needs of sustainable development within established planetary boundaries” (Maltais & Suljada, 2025). It is primarily justified by the need to correct market failures, while its limitations include high fiscal costs, the risk of trade distortions, and potential institutional challenges. In contemporary literature, green industrial policy is often interpreted as a “second-best solution,” whereby states attempt to address environmental challenges while maintaining their competitiveness in the global market. Although the theoretically optimal solution to issues such as fossil fuel emissions would be the introduction of a global carbon tax, in practice, countries more frequently resort to indirect measures, such as subsidies for the development of green technologies and support for domestic industries.

The economic rationale for green industrial policy is multifaceted. It is primarily introduced to correct market failures, particularly negative environmental externalities and the underinvestment in green innovation, in order to accelerate the transition toward a sustainable economy. Public support for green industrial policy is economically justified when the benefits of avoided environmental damage exceed the associated costs. Additionally, such policies help to address structural barriers, including path dependence, infrastructural lock-in, network effects, and coordination failures. At the same time, carbon pricing policies tend to favor technologies that are closer to market readiness, whereas subsidies can stimulate the development of more advanced innovations. Furthermore, the adoption of new technologies is reinforced by learning-by-doing effects, which contribute to cost reductions and the wider diffusion of innovative solutions (Maltais, 2025).

Another significant motivation for the implementation of these policies is the creation of new employment opportunities. The expansion of renewable energy, energy efficiency, and green

infrastructure sectors generates demand for labor and contributes to the restructuring of labor markets. At the same time, green industrial policies enhance energy security by reducing dependence on fossil fuel imports and mitigating exposure to price volatility in international markets. These policies are primarily oriented toward strengthening national economies and the competitiveness of domestic firms; therefore, while they may produce certain positive international spillovers, they do not necessarily promote global cooperation nor always significantly contribute to the achievement of shared environmental objectives (Maltais & Suljada, 2025).

In addition, the implementation of such measures can have important implications for international trade and market access. For example, estimates suggest that the introduction of carbon costs on imports into the European Union, through the Carbon Border Adjustment Mechanism (CBAM), could lead to a reduction in exports from certain developing countries to the EU market in the range of 1.4% to 2.4% (UNCTAD, 2021).

3.2. POLICY INSTRUMENTS OF GREEN INDUSTRIAL POLICY

Instruments of green industrial policy encompass a range of measures through which the state promotes the development of environmentally sustainable technologies and low-carbon sectors. The most important financial instruments include subsidies for renewable energy, tax incentives for green investments, and public investments in research and development of clean technologies.

In addition, regulatory instruments—such as emission standards, energy efficiency requirements, and emissions trading systems—play a key role in steering the economy toward more sustainable production models. Increasing importance is also attributed to instruments of industrial coordination, including public–private partnerships and the development of strategic sectors, which enable an accelerated transition toward a green economy. In contemporary conditions, these instruments are often combined with carbon pricing policies, further encouraging the shift toward low-carbon technologies and enhancing the long-term competitiveness of the economy.

According to data from the New Industrial Policy Observatory (NIPO) database, contemporary industrial policy encompasses a variety of instruments, among which domestic subsidies are the most frequently used. In addition to these, significant roles are played by measures such as export and import barriers, export incentives, policies related to foreign direct investment,

localization requirements, and public procurement. However, the choice of instruments varies depending on the level of economic development. While advanced economies more frequently rely on export subsidies and localization policies, developing countries tend to depend more heavily on import barriers as a key instrument of industrial policy. These patterns confirm that the structure of industrial policy is shaped by the specific

development objectives and economic capacities of individual countries (Maltais, 2025).

Table 1 presents the structure of identified industrial policies in 2023, classified by country income groups and the policy instruments employed (Maltais, 2025).

Table 1. Active distortive measures by policy instrument and country grouping

Group of countries	Subsidy	Export barrier	Export subsidy	Foreign direct investment	Import barrier	Localization	Procurement	Other
EMDEs	312	72	31	22	196	54	11	26
Advanced economies	814	53	146	4	86	127	29	66
Total	1126	125	177	26	282	181	40	92

Source: Adapted from Maltais and Suljada (2025), based on Evenett et al. (2024).

The data presented in Table 1 indicate significant differences in the implementation of industrial policies depending on the level of economic development and the choice of policy instruments. Advanced economies predominantly employ more sophisticated instruments, such as research and development subsidies, tax incentives, and direct support for innovation, thereby fostering technological progress and accelerating the transition toward a low-carbon economy. In contrast, developing countries and emerging markets tend to rely more on traditional industrial policy instruments, including public investment, regulatory measures, and protection of domestic production, with the aim of building industrial capacity and enhancing competitiveness.

At the same time, the structure of the instruments employed reflects differing development priorities. While advanced economies strive to maintain technological leadership and accelerate innovation in green sectors, less developed economies focus on attracting investment, facilitating technology transfer, and integrating into global value chains. This differentiation in approaches reflects existing disparities in institutional capacity, fiscal space, and levels of technological development.

However, the analysis also suggests that these differences are gradually diminishing, as an increasing number of developing countries adopt instruments oriented toward innovation and the green transition. This trend points to a growing global convergence in approaches to industrial policy, driven by climate challenges and shifts in the structure of international competition. In this sense, Table 1 not only reflects the current state of industrial policy but also indicates the future directions of its development at the global level.

4. GLOBAL TRENDS AND POLICY PRACTICE

In contemporary literature on industrial policy, increasing attention is being devoted to new strategies adopted by advanced economies aimed at green and technological transformation of industry. In particular, the initiatives of the United States and the European Union stand out as prominent examples of modern industrial policy in the context of climate change and technological challenges.

The European Union has institutionalized this approach through the European Green Deal, introduced in 2019 as a comprehensive strategy for economic and environmental transformation, with the primary objective of achieving climate neutrality by 2050. Within this framework, industrial policy plays a central role, particularly in promoting the development of clean technologies and the decarbonization of production processes.

With the aim of strengthening the competitiveness of European industry in the context of the global race for green technologies, the European Commission presented the Green Deal Industrial Plan in 2023. This plan includes measures such as simplifying the regulatory framework, increasing financial support for green industries, developing relevant skills, and ensuring access to critical raw materials. As such, this initiative represents a key instrument of the European Union's industrial policy and forms part of broader efforts to accelerate the green transition while simultaneously reinforcing the industrial base and global competitiveness of the European economy.

The different strategies adopted by countries point to a wide range of public policy options that can

enhance national competitiveness through the integration of industrial and environmental policies. The transition to green industrialization leads to significant changes in the structure of global trade, generating increased demand for critical raw materials, renewable energy sources, and low-carbon energy carriers. Developing countries and emerging market economies (EMDEs), endowed with abundant natural resources, are in a favorable position to take advantage of these changes and improve their development prospects (UNCTAD, 2024). In this way, the green transition not only affects the structure of production but also redefines comparative advantages in the global economy.

At the same time, global efforts aimed at the decarbonization of industry enable the repositioning of EMDEs within energy-intensive value chains. A particularly notable trend is the relocation of certain production stages to countries with access to affordable and abundant renewable energy, as in the case of iron ore processing. Countries that combine high-quality mineral resources with favorable energy conditions have the greatest potential to attract such industrial activities. Consequently, green industrial policies and the process of decarbonization influence not only technological development but also the spatial redistribution of industry, creating new development opportunities as well as specific challenges for developing countries (OECD, 2024).

One of the key advantages of the transition to green industrial policies lies in the acceleration of innovation processes and the broader deployment of low-carbon technologies. In recent years, there has been a significant decline in the costs of technologies such as solar and wind power, as well as battery systems. As advanced economies continue to increase investments in the development and implementation of clean energy solutions, this trend is expected to persist, particularly in areas such as batteries, electric vehicles, and electrolyzers for hydrogen production (OECD, 2024).

In this context, green industrial policies play an important role not only in fostering technological progress but also in accelerating the diffusion of innovation, thereby enhancing its accessibility and application on a global scale. Consequently, such policies contribute to both economic and environmental benefits by reducing the costs of the transition and improving the efficiency of energy systems.

CONCLUSION

The growing interest in industrial policy is the result of multiple factors, among which its role as

a response to various economic crises is particularly prominent. In contemporary conditions, industrial policy is increasingly used as a mechanism for stabilization and economic recovery. Following the global financial crisis of 2008, advanced economies significantly intensified interventions in the industrial sector, while the scale of these measures further increased during the COVID-19 pandemic, with the aim of revitalizing economic growth. At the same time, industrial policy has also been employed to reduce regional disparities and strengthen domestic economies. Moreover, it has acquired a new dimension as a key instrument for facilitating the transition toward a green and digital economy.

Green industrial policies are becoming an increasingly important component of contemporary economic policy, and their implementation is driven by a combination of environmental, economic, and political factors. One of the primary motivations for their adoption is the need to mitigate climate change by reducing greenhouse gas emissions and promoting the transition to renewable energy sources. In this context, countries aim not only to meet international commitments, such as those outlined in the Paris Agreement, but also to reduce the long-term environmental and social costs associated with unsustainable development.

Beyond their environmental dimension, green industrial policies also have a strong economic component. The development and deployment of green technologies, including renewable energy sources, electric vehicles, and advanced energy storage systems, represent a rapidly growing global market. Through subsidies, tax incentives, and industrial strategies, governments seek to stimulate domestic production and innovation in these sectors in order to achieve a competitive advantage and reduce dependence on imports of key technologies. Economic literature highlights market failures as a central justification for green subsidies, as they help address knowledge externalities and encourage investment in green innovation.

Finally, the adoption of green industrial policies is also driven by political and social factors. The growing environmental awareness, pressure from the public and international institutions, as well as the need to maintain a country's global reputation, further motivate governments to take an active role in advancing the green transition. Nevertheless, despite their numerous advantages, these policies also face certain challenges, including high fiscal costs, the risk of inefficient resource allocation, and potential trade disputes.

Overall, green industrial policies represent an effort to reconcile environmental protection objectives with the imperatives of economic growth and long-term competitiveness, thereby becoming a key component of contemporary development strategies. For their effective implementation, it is essential that government support be precisely targeted, time-bound, and supported by robust monitoring and evaluation mechanisms. At the same time, in order to avoid uneven transition dynamics across regions and ensure the equitable achievement of climate goals, green industrial policy should be viewed as a coordinated global endeavor.

In this context, it is important to emphasize that green industrial policies cannot be based on a uniform approach across all countries. In developed economies, the focus should be on fostering innovation, developing advanced green technologies, and maintaining technological leadership. In contrast, developing countries should prioritize technology transfer, attracting investment, and strengthening production capacities, while least developed countries require stronger institutional support, international cooperation, and access to financing mechanisms. Therefore, an effective green industrial policy must be tailored to the level of economic development, institutional capacities, and technological readiness of each group of countries, in order to ensure a successful and inclusive green transition.

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