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## The role of the Chinese State in the transition process from the carbon automotive industry to the electric vehicle industry

### El papel del Estado chino en el proceso de transición de la industria automotriz de carbono a la industria del vehículo eléctrico

### A atuação do Estado chinês no processo de transição da indústria automotiva de carbono para a de veículos elétricos

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#### Abstract

The aim of this article is to describe and analyze the public policies that have been implemented by the Chinese State with the aim of promoting the transition of the carbon automotive industry to the electric vehicle industry. Based on bibliographic and documentary research, the study indicates that, through a very well articulated integration between industrial policy instruments and climate policies, China has been able to promote the green transition of its automotive industry with great success. Considering that the decarbonization of transport constitutes one of the greatest challenges of the contemporary world, the work is important insofar as it addresses a current issue of great relevance to the environment and society.

**Keywords:** Climate change; decarbonization; electromobility; China.

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#### Resumen

El objetivo de este artículo es describir y analizar las políticas públicas implementadas por el gobierno chino para promover la transición de la industria automotriz basada en carbono a la industria de vehículos eléctricos. Mediante investigación bibliográfica y documental, el estudio indica que, gracias a una integración bien articulada entre los instrumentos de política industrial y las políticas climáticas, China ha logrado impulsar la transición verde de su industria automotriz con gran éxito. Considerando que la descarbonización del transporte es uno de los mayores desafíos del mundo contemporáneo, este trabajo es importante ya que aborda un tema actual de gran relevancia para el medio ambiente y la sociedad.

**Palabras clave:** cambio climático; descarbonización; electromovilidad; China.

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## Resumo

O objetivo deste artigo é descrever e analisar as políticas públicas que vêm sendo implementadas pelo Estado chinês com a finalidade de promover a transição da indústria automotiva de carbono para a de veículos elétricos. Realizado por meio de pesquisa bibliográfica e documental, o estudo aponta que, a partir de uma integração muito bem articulada entre instrumentos de política industrial e de políticas climáticas, a China vem conseguindo promover com grande êxito a transição verde de sua indústria automotiva. Considerando que a descarbonização dos transportes constitui um dos maiores desafios do mundo contemporâneo, o trabalho se reveste de importância na medida em que aborda um tema atual e de grande relevância para o meio ambiente e para a sociedade.

**Palavras-chave:** mudanças climáticas; descarbonização; eletromobilidade; China.

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## Introduction

In recent decades, concern about climate change has been growing steadily. Since the World Commission on Environment and Development was established by the United Nations in the early 1980s, numerous conferences on the topic have been held in various countries, culminating in the creation of a global agenda focused on environmental issues.

Considering that one of the main objectives of this agenda is to promote the reduction of greenhouse gas emissions, especially CO<sub>2</sub>, sectors directly related to these emissions have begun to undergo a series of transformations. The need to meet targets set for the transportation sector, such as zero emissions for all passenger cars by 2050, has led major automobile manufacturers to advance the production of electric vehicles (Lutsey, 2015).

China, which began the green transition of its automotive industry in the early 2000s, has already built the largest electric vehicle ecosystem in the world and has remained the market leader since 2015 (LI et al., 2020). By formulating and implementing a series of public policies to encourage and protect the new segment,

known as industrial policies, which range from regulatory measures to financial stimulus instruments such as subsidies and tax exemptions, support for the construction of charging stations, and significant investments in R&D, the Chinese government has managed to continually increase both the production and consumption of electric vehicles in the country (Gomes, 2022).

In light of recent literature on green industrial policies and sustainable development, the objective of this article is to describe and analyze the actions taken by the Chinese government to stimulate electromobility in the country and foster the creation of a strong and internationally competitive domestic electric vehicle industry.

Conducted through bibliographical and documentary research, the study uses as a theoretical framework recent approaches in the literature on green industrial policies, highlighting the works of Altenburg and Rodrik (2017), Lema, Fu & Rabellotti (2021), and Mazzucato (2021). In addition to highlighting the essential role that the State has to play in finding solutions to the major challenges of the contemporary world, such as the need to mitigate the damages related to global warming, these authors argue that the technological leaps and new markets generated by the current energy transition process can be seen as major windows of opportunity for lagging countries to advance their industrialization and development processes on a more sustainable basis.

Considering that the decarbonization of transportation constitutes one of the greatest challenges of the contemporary world and that electromobility is already being treated as an irreversible global trend, this work is important as it addresses a current topic of great relevance to the environment, the economy, and society. Furthermore, considering that Brazil has also begun the green transition of its automotive industry, the study provides relevant data and information that can inform the development of local public policies aimed at promoting electromobility in the country.

The article is divided into three sections. The first highlights recent approaches in the literature on green industrial policies and sustainable development. The second describes the context and motivations that led China to accelerate the green transition of its automotive industry since the 2000s. The third presents the main policies that have been formulated and implemented by the Chinese government to promote the electrification of road transport in the country. Finally, the analyses and concluding remarks are presented.

### **Green industrial policies and sustainable development: recent approaches**

Industrial policy is a highly controversial topic. The idea that the state should help leverage industries considered strategic to promoting national development has been widely debated since the 18th century.

Those who advocate this type of intervention argue that the free market alone is not capable of promoting the diversification of countries' productive structures in a way that advances their industrialization and development processes. Therefore, proactive state action to foster certain sectors and activities, especially in the early stages of their formation, would be essential to guide national economies toward the desired structural transformation (Rodrik, 2004; Stiglitz, Lin & Monga, 2013; Chang & Andreoni, 2016).

Those who oppose it, in turn, argue that industrial policies should be avoided because they tend to generate a series of distortions. In addition to budgetary constraints on public administration and the risks related to corruption, which often arise when relations between the public and private sectors become closer, the government would be unable to identify which activities should receive state support because they are the most strategic and promising (Pack & Saggi, 2006).

Despite the debate surrounding the viability and effectiveness of industrial policies, the definition of the term does not raise significant disagreements. For Chang and Andreoni (2016), industrial policy is a public policy that deliberately favors certain industries over others in order to increase economic efficiency and

promote growth in capital and labor productivity. Similarly, Stiglitz, Lin, and Monga (2013) and Pack and Saggi (2006) define them as government policies aimed at transforming the productive structure of economies by redirecting human, material, and financial resources from low- and medium-productivity activities to high-productivity ones.

Thus, the concept of industrial policy is based on the premise that there is a direct relationship between the diversification of the productive structure and wealth generation; that is, countries become richer as they move from producing only primary goods to producing more complex and sophisticated industrialized goods.

Regarding the support and protection measures that can be used by governments to foster strategic industries, proponents of this type of policy emphasize that the State has at its disposal a series of instruments that can be used to stimulate both the supply and demand sides. Among the main ones are: granting loans at subsidized interest rates (especially through public banks); conducting government purchases; promoting exports; restricting imports of competing products; granting tax exemptions; and investing in R&D. The recommendation is that each country/region use the instruments most appropriate to its reality and objectives and adopt efficient mechanisms for monitoring, evaluating, and holding beneficiary companies accountable (Rodrik, 2004).

From a practical perspective, historical evidence indicates that, especially since the 19th century, virtually all countries, to a greater or lesser extent, have adopted (and continue to adopt) numerous industrial policies aimed at promoting the diversification of their economic activities. As a result, they have ceased to be essentially agrarian economies and have become industrialized countries, many of which are developed, such as the USA, France, South Korea, and Japan (Chang, 2004).

Although the original main purpose of industrial policy was to promote the industrialization of national economies, over time its objectives have broadened to

include more social and socio-environmental issues, such as improving the health and quality of life of the population, reducing greenhouse gas emissions, and promoting sustainable development (Stiglitz, Lin, and Monga, 2013). Within this context, new approaches have begun to emerge, giving rise to the concept of green industrial policies, which seek to combine social, economic, and environmental objectives.

According to Altenburg and Rodrik (2017, p. 27), green industrial policies are "government actions aimed at transforming countries' productive structures toward a low-carbon economy." The concept is based on the understanding that the processes of creating and disseminating environmentally sustainable technologies, necessary to promote the reconfiguration of the global economy within green frameworks, are unlikely to occur without government support. Therefore, it presupposes greater integration between industrial policies and climate policies.

Besides incorporating concerns about environmental issues, the new approaches also argue that the technological leaps and new markets generated by the current energy transition process can be seen as significant windows of opportunity for lagging countries to advance their industrialization and development processes on a more sustainable basis.

The pursuit of green technologies will create many opportunities for economic development, health benefits, increased efficiency, and improved living conditions. Governments must understand these synergies and be able to design green industrial policies that maximize profits and minimize costs (Altenburg & Rodrik, 2016, p. 25).

From this perspective, Lema, Fu, and Rabelotti (2021) systematized the concept of Green Windows of Opportunity, arguing that policies aimed at meeting environmental goals open new avenues for developing countries to modernize their productive capacities and narrow the gap between them and developed countries. In line with this thinking, Pérez (2004) emphasizes that with each technological

revolution, a new technoeconomic paradigm emerges, offering lagging countries the opportunity not only to catch up with developed countries but also to lead the new wave of development. The success or failure of those who embark on this process will depend, above all, on the timing of entry into the new paradigm, the level of local efforts toward technological autonomy, and the form of association with external capital.

Recognizing that governments have a vital role to play in the pursuit of sustainable and inclusive economic growth, Mazzucato (2021) developed the concept of Mission-Driven Industrial Policies. Within this vision, the state must be able to identify the major social or socio-environmental challenges of the contemporary world and seek innovative solutions for them through a well-articulated integration between the public and private sectors. According to the author, the aim is not to benefit specific companies or activities, but to leverage the productive sector with the aim of solving social or socio-environmental problems. In mission-driven industrial policies, the state takes the initiative, sets the direction, assumes the initial risks, and encourages the private sector to act jointly and collaboratively with the government.

Governments cannot execute these missions alone: they need to work in parallel with purpose-driven companies (...) To achieve this, it is necessary to create more symbiotic forms of partnership and collaboration across different sectors (...) In the energy sector, this involves reducing investments in fossil fuels and investing in the creation of public goods, such as infrastructure and green production systems (Mazzucato, 2021, p. 198-199).

To avoid the problems highlighted by critics of industrial policy, Evans (1995) suggests establishing a cohesive and autonomous bureaucracy capable of preventing the capture of the state by private interest groups and, at the same time, building alliances with businesses and civil society organizations to expand access to the information necessary for decision-making. In this sense, the author emphasizes the importance of the governance system and bureaucratic capabilities in the processes of policy formulation, implementation, and evaluation.

Thus, based on the aforementioned approaches, it can be noted that the contemporary debate on industrial policy recognizes that the future direction of socioeconomic development is deeply linked to addressing the major environmental challenges of the contemporary world.

### **Promoting the Electric Vehicle Industry in China: Context and Objectives**

Beginning in the 1990s, China began to make substantial progress in its industrialization and development processes thanks to the adoption of successive industrial policies focused on innovation, diversification of the local economy's productive structure, and the conquest of the global market. From a manufacturer of low-value-added goods intensive in low-skilled labor, the country quickly became a major producer and exporter of complex, high-tech goods, such as electronic devices, automobiles, and airplanes (Masiero & Coelho, 2014; Jigang, 2020).

The success of the implemented policies can be largely attributed to China's successful strategy of partnering with foreign capital and integrating into the global economy. By offering lower production costs and easier access to the broad local market, the government was able to attract foreign companies from various sectors, which established large production and export facilities in the country. However, around the mid-2000s, the strong presence of multinationals, especially in medium- and high-tech industries, began to be seen as a major obstacle to the advancement of domestic companies in higher-value-added segments. To reverse this situation and pursue technological autonomy and strengthen domestic capital, industrial policies focused on local innovation were expanded, and ambitious value-added and technological content targets for Chinese companies were established (Liu & Tsai, 2021).

In this context, the automotive sector, considered an important arena for technological innovation, began to receive even greater attention from the

government. Recognizing the global trend toward electrification of transportation, it placed electromobility at the center of the country's industrial and technological development plans, qualifying it for special support, protection, and public incentives. In 2010, the electric vehicle industry was declared one of China's seven strategic emerging industries (Tagscherer, 2012; Gomes, 2022).

The decision to invest in this new segment stemmed largely from the low acceptance of Chinese automotive brands in the global internal combustion engine (ICE) vehicle market. Concluding that it would be very difficult to compete with large foreign automakers that already dominated this market with their production scale, technological superiority, and internationally recognized brands, the government shifted focus and began investing in the segment closest to the technological frontier of the automotive sector in the 2000s: electric-powered vehicles, known in the country as New Energy Vehicles (Tagscherer & Frietsch, 2014; Altenburg; Schamp & Chaudhary, 2016).

Based on the premise that the creation of a dynamic and competitive electric vehicle (EV) industry would not occur spontaneously, based on the free operation of market forces, the Chinese government began formulating and implementing a series of policies to encourage and protect the new segment, focusing on its various stages of development. Using a diverse combination of regulatory measures and industrial policy instruments, such as subsidies and tax exemptions, support for the construction of charging stations, and significant investments in R&D, the government has successfully stimulated both the production and consumption of electric vehicles in the country and is already progressively advancing toward new markets (Consoni et al., 2018).

Beyond the pursuit of global leadership in a nascent industry in which its competitors have yet to establish significant competitive advantages, the promotion of electromobility in China also seeks to meet other important long-term and

interrelated objectives. These include reducing greenhouse gas emissions, reducing pollution in densely populated urban centers, promoting a major technological upgrade in the automotive sector, and reducing external dependence on oil (Liu & Kokko, 2013; Ipea, 2023).

## **Public policies to promote electromobility and the electric vehicle industry in China**

### ***Governance System and Public-Private Sector Coordination***

Public policies to promote electromobility and the EV industry in China are formulated and coordinated by the highest level of government, comprised of the State Council, the country's main administrative authority; the National Development and Reform Commission (NDRC), one of the most important central government agencies; and various agencies and ministries that work together and collaboratively. The most important are the Ministry of Industry and Information Technology (MIIT), primarily responsible for policy planning; the Ministry of Science and Technology (MOST), which leads major R&D programs for related technologies; and the Ministry of Finance (MOF), primarily responsible for vehicle purchase subsidies (Consoni et al., 2018).

While policy formulation is the responsibility of the highest level of the state planning structure, provincial and municipal governments enjoy considerable administrative autonomy and flexibility in implementing them, including the power to promote institutional innovations and adopt additional measures (China, 2015). In this sense, in addition to implementing the guidelines established by central authorities in a manner they deem most appropriate to local conditions, some governments also create their own policies to encourage electric mobility in their regions. According to a study by Gomes (2022), in cities where governments act more actively by establishing regulatory measures, granting additional subsidies, and/or supporting research at local universities, the EV market grows more rapidly.

In addition to state agencies and local authorities, other actors also play an important role in the development of the EV industry, such as universities, research

centers, state-owned companies, trade associations, and private corporations (China, 2020). Tsinghua University and the Beijing Institute of Technology, for example, have specialized electric vehicle research centers that develop important projects in partnership with various companies in the sector, such as component manufacturers, battery producers, and automobile manufacturers (Consoni et al., 2018).

Thus, regarding the governance system, policies are led by state entities and involve a range of public and private sector actors working in a coordinated manner to promote electric mobility in the country and continuously improve the global competitiveness of Chinese industry specializing in this new segment.

As advocated by Evans (1995), China has opted to establish a cohesive and autonomous bureaucracy capable of building successful alliances with business groups and civil society organizations to increase the chances of success in the processes of policy formulation, implementation, and evaluation.

#### Policy Planning and Implementation

China's most important development planning documents are the Five-Year Plans. Based on the premise that strategic emerging industries constitute fertile ground for technological innovation and industrial modernization, the plans prioritize these industries and seek to provide them with all the public support they need (China, 2016).

According to Consoni et al. (2018), it was from the 8th Five-Year Plan (1991-1995) that the guidelines, objectives, and strategies for promoting electric mobility in the country began to be established. Initially, the instruments used were defined as public subsidies for R&D and small-scale demonstration programs. Over time, the policies were expanded, and support measures began to encompass both research and innovation activities and the production, distribution, and commercialization of vehicles.

According to the guidelines defined in the five-year plans, the government must build strategic alliances with the private sector to stimulate collaborative

innovation in all EV-related technologies, especially the so-called "three vertical" technology systems (pure electric vehicles, hybrid vehicles, and fuel cell vehicles) and the "three horizontal" technology systems (energy batteries and management systems, smart technology, and drive motors and the network).

Furthermore, given that the construction of a broad and accessible charging infrastructure is a key aspect of the country's transportation electrification process, the documents emphasize that the installation of charging stations and points in strategic locations, such as urban public service areas, residential areas, and parking lots, must also receive government support (Altenburg; Schamp & Chaudhary, 2016; Ipea, 2023).

Another national plan that has been fostering the EV industry is Made in China 2025 (MIC25). Launched in 2015 to be implemented over ten years, its main objective is to direct Chinese manufacturing toward the production of high-tech goods in order to reduce external dependence. Seeing the global trend toward electrification of transportation as a significant opportunity for China to become a global automotive powerhouse, the document proposes the creation of a comprehensive and comprehensive industrial innovation system that enables the development of strong, independent local brands (China, 2015).

Based on the guidelines defined in the national plans, other, more specific plans and programs are formulated and implemented, such as the New Energy and Fuel-Efficient Vehicle Industrial Development Plans, considered the country's most important documents for the development of this new industry.

The first, developed for the 2012-2020 period, determined that China should prioritize battery-powered vehicles, or pure electric vehicles. However, it emphasized that it would also be necessary to follow the rest of the world in the development of hydrogen fuel cell vehicles and promote the industrialization of hybrid models in order to dominate all technological paths in this new segment (IPEA, 2023).

In addition to granting tax exemptions and purchase subsidies, as well as developing increasingly strict standards and regulations for the circulation of internal combustion vehicles, the plan adopted measures to support the entire vehicle industrial chain by providing resources for R&D activities, demonstration projects, the components industry, and charging infrastructure.

The second plan, which outlines the sector's guidelines and goals for the 2021-2035 period, focuses primarily on strengthening technological innovation capabilities, improving quality assurance systems, and expanding charging infrastructure. The document highlights the need to capitalize on the positive momentum experienced by China's EV segment—the world's leading producer, seller, and consumer since 2015—to further expand the new industry's global competitiveness. According to the established targets, the sales volume of new energy vehicles is expected to reach approximately 20% of total new car sales by 2025 (China, 2020).

In addition to these, several other specific plans and programs have been developed and implemented by the Chinese government in recent decades. Generally speaking, industrial policies to promote the new segment seek to help the national automotive industry overcome its greatest dilemma: "being big, but not strong." Therefore, their main focuses are the pursuit of technological self-sufficiency, improving the quality of domestically produced automobiles, and conquering the global market.

To achieve these goals, the government is willing to act on several fronts with support measures that address both the supply and demand sides. In general, policies are directed at three specific fields: Research and Development, production and consumption, and charging infrastructure.

### *Policies to Support R&D Activities*

The Chinese government began supporting R&D activities for EV-related technologies in the early 1990s, when a partnership between the Beijing Institute of Technology and a group of local automakers led to the development of the first prototypes that reached commercial production. From then on, policies to support basic and applied research intensified, and a series of programs began to be implemented under the leadership of the Ministry of Science and Technology (Tagscherer, 2012).

Throughout the 2000s, the State's High-Tech Development Plan, known as the 863 program, launched a series of projects aimed at developing new-energy vehicles, particularly electric vehicles. The 2006 863 Energy-Saving and New Energy Vehicles Project, for example, which received a US\$174 billion investment, sought to establish a technology roadmap and a set of definitions for the EV industry to strengthen the internal learning process regarding new technologies. The 863 Key Technology and System Integration Project for Electric Vehicles, launched in 2010, created an investment plan for the development of EV component integration and battery improvement (CONSONI et al., 2018).

Based on the realization that batteries, especially those with the most advanced technology, represent the most expensive component of electric vehicles, the 13th Five-Year Plan (2016-2020) highlighted the need for the country to build a comprehensive battery industrial chain, taking into account aspects such as safety, durability, and high energy density. To achieve this goal, China decided to promote R&D in battery technology by building a series of technological innovation centers for key materials and production equipment and investing in building technical and engineering capabilities across the entire industrial chain. As a result of the policies implemented, within a few years it surpassed the most advanced countries and became a global leader in the segment (Gomes, 2022; IPEA, 2023).

The Development Plan for Fuel-Efficient and New Energy Vehicles, announced in 2010 by the State Council, advocated the creation of a new national

testing base for new energy and fuel-efficient vehicles. The base would be composed of research institutes and public universities that would establish testing platforms and make information and data related to product development available to the entire industry. Similarly, the MIC25 plan established that the government should strive to establish approximately 40 industrial innovation centers by 2025 (Li, 2020).

In addition to these measures, it's worth noting that the government also provides tax exemptions to companies in the segment's production chain to invest in technological innovation. Thus, through a well-coordinated integration between the state and the market, the government has managed to establish important industrial alliances focused on the development of all technologies related to electrified vehicles.

### *Policies to Support Charging Infrastructure*

Considering that the expansion of electric mobility directly depends on the availability of charging stations and points, the Chinese government has also supported the construction of charging infrastructure. State involvement in this area is justified by the private sector's limited interest in providing the service, given that in the initial stages of transition from one industry to another, uncertainties and costs are very high, and demand is still low.

In 2009, when the government began implementing subsidy policies for the purchase of electrified vehicles, it found that most cities still lacked an adequate network of charging stations. To address this problem, it called on state-owned electricity companies to work with local governments to build an adequate and satisfactory charging network (Gong; Wang; Wang, 2012).

Because the initial phase of policy implementation focused on promoting public vehicle fleets, especially buses, the demand for charging points was lower and easier to meet. However, with the expansion of the market, especially in the private passenger vehicle segment, the challenges became greater. The demand for charging

stations increased, and the promotion of electromobility in the country became increasingly challenging (Gomes, 2022).

Therefore, local governments began to encourage the entry of private operators into the market by granting subsidies for the construction of new stations in strategic locations. As a result, the number of charging stations jumped from 57,791 units in 2015 to 5.2 million units in 2022. Furthermore, new guidelines began to determine that commercial and residential buildings must be equipped with charging stations and reserve a minimum percentage of parking spaces for electric vehicles (Gomes, 2022; Ipea, 2023).

### *Policies to Incentive Electric Vehicle Purchases*

Beginning in the late 2000s, when EVs began to be commercialized in the Chinese market, the government launched a series of demonstration projects in various cities to encourage consumers to opt for this mode of transportation. The first pilot program, called Ten Cities, Thousand Vehicles, initially targeted the public sector and provided purchase subsidies paid directly to automakers.

Responsibility for implementing the program, jointly announced by the MIIT, MOST, MOF, and NDRC, fell to local governments, which were also able to grant other incentives, such as additional subsidies up to 100% of the amount already granted by the central authority. The Shenzhen government, for example, subsidized the purchase of locally manufactured cars by offering discounts of up to 60% on locally manufactured vehicles. The initial goal was to introduce 1,000 vehicles per year for three years in each of the ten participating cities. However, the number of cities was gradually expanded, reaching a total of 25 by the end of the project (Tagscherer & Frietsch, 2014).

Subsequently, new programs were created that expanded the coverage of the subsidy policy. The Promotion and Continuous Application of New Energy Vehicles program, for example, launched in 2013, reached 39 regions and 88 pilot cities. In addition, the Four Ministries program (2013-2015) is worth noting. Through a

partnership between the MIIT, MOST, MOF, and NDRC, it provided subsidies of approximately US\$9,700 for the purchase of pure electric vehicles; US\$5,600 for hybrid electric vehicles (HPVs); and US\$80,500 for electric buses (Consoni et al., 2018). With the launch of the New Energy and Fuel-Efficient Vehicle Industrial Development Plan (2012-2020), tax exemptions and new subsidies were granted for the purchase of pure electric vehicles, with substantial differences between provinces (Altenburg; Schamp & Chaudhary, 2016).

The Chinese government's intention was to gradually reduce subsidies until they were completely eliminated at the end of 2020. However, due to the drop in sales caused by the pandemic, a new policy was introduced extending the subsidies until 2022. According to IPEA (2023), from 2009 to 2022, China granted more than US\$29 billion in subsidies and tax incentives to companies in the sector to improve their vehicles and make them more affordable for consumers, a policy that proved crucial to the sector's growth over the years.

Another instrument used by the government is public procurement contracts, which aim to help manufacturing companies, especially domestic ones, remain in business during their first years of operation. Government purchases are made through municipal public transportation companies, prioritizing segments in which the government can best manage demand, such as public buses, taxis, and vehicles used by public authorities and agencies (Gong; Wang, Wang, 2013).

It is also worth noting that various regulatory measures have also been established by local governments to encourage electromobility in their regions. Among the main measures are: exemption from registration fees for electric vehicles, preferential parking rules in public spaces, establishment of prohibited areas for internal combustion vehicles, exemption from toll payments, and authorization to participate in the rotation system in urban centers (Consoni et al., 2018; LI et al., 2020; Gomes, 2022).

#### Final Considerations

The study presented here showed that, as advocated by Mazzucatto (2021), the Chinese government has been able to promote a well-articulated integration between the public and private sectors with the aim of seeking innovative solutions to a major socio-environmental challenge facing the contemporary world: the need to promote the green transition of the automotive industry as a way to reduce greenhouse gas emissions and mitigate the damage related to global warming. Understanding that the free action of market forces would not be able to promote the decarbonization of road transport in the country, the Chinese government took the initiative and began formulating and implementing a series of public policies specifically aimed at this end. Furthermore, in line with recent approaches to green industrial policies and sustainable development developed by authors such as Altenburg and Rodrik (2017), Lema, Fu & Rabellotti (2021), and Pérez (2004), China has identified the global trend toward electrification of transportation as a significant window of opportunity to advance its industrialization and development process on a more sustainable basis. In addition to the country's pursuit of decarbonizing transportation, the policies being adopted in this area also focus on achieving technological self-sufficiency, strengthening and modernizing the domestic automotive industry, and conquering the global market.

Regarding the governance system, the Chinese government, in line with Evans's (1995) recommendations, has opted to establish a cohesive and autonomous bureaucracy that has built successful alliances with business groups and civil society organizations, expanding the possibilities for success in the processes of policy formulation, implementation, monitoring, and evaluation.

As a result of the actions implemented, China has already managed to build the largest electric vehicle ecosystem in the world and has maintained its market leadership since 2015. In addition to leading large companies in the traditional

automotive industry, such as SAIC and BAIC, to advance the transition to electric vehicle production, government actions have enabled the emergence of new automakers specializing exclusively in this type of transportation, such as BYD, NiO, and Xpeng. By focusing on the development of all key EV-related technologies, the country has also led other segments of the production chain and has already created the largest manufacturers of batteries for electric vehicles in the world, notably CATL, a global leader in the segment.

The Chinese experience discussed in this study constitutes an emblematic example of the recent expansion of industrial policies worldwide and their integration with climate policies. Given the above, it can be concluded that China has successfully promoted the green transition of its automotive industry and has served as a benchmark for several other countries.

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