CHINESE INVOLVEMENT IN THE LITHIUM TRIANGLE: DETERMINANTS AND IMPLICATIONS

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ABSTRACT: This article examines the investments and activities of Chinese companies and entities in the so-called "Lithium Triangle." It aims to describe these involvements, identify the main determinants and motivations behind this presence, and discuss some implications. The "Lithium Triangle" encompasses a vast region that includes Bolivia, Chile, and Argentina, known for their rich lithium reserves, a vital mineral for the production of batteries used in electric vehicles, energy storage systems, and other green technologies. This article will analyze the main Chinese investments in the lithium sector in the region, including mine acquisitions, stakes in local companies, and cooperation agreements with South American governments. The determinants of these investments will be discussed, such as the need for supply security, control over emerging production chains, and the global expansion strategy of Chinese companies. Furthermore, some implications of this process will be presented, including its geopolitical reverberations and the challenges and opportunities for the involved South American countries.

KEYWORDS: Chinese investments, Lithium Triangle, Lithium, Determinants, Motivations, Implications.

Introduction

Among the various debates associated with China-Latin America relations, Chinese presence in the so-called "lithium triangle" is undoubtedly one of the most relevant and of great interest. Around this presence, perceptions, concerns, and uncertainties converge and express comprehensive and extremely important discussions, including geoeconomic and geopolitical disputes over strategic minerals, dominance in core technologies for energy transition, and opportunities and limits for development in the Global South.

Lithium constitutes the essential raw material for the production of batteries used in electronic devices, electric vehicles (EV), and energy storage solutions. The importance of this commodity has grown significantly in recent years, driven by the growth of the EV industry. Over the past decade the demand for the mineral has increased exponentially, and this scenario is expected to continue, driven by the revolution symbolized by the electrification of transportation.

Latin America holds more than half of the identified lithium on the planet, with the majority situated in South America and particularly in the lithium triangle, a region encompassing parts of Bolivia, Argentina, and Chile (Barbon, 2023). Despite that immense

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potential, their production is still below its potential, partly due to a lack of production and technological capacity for extraction and refining activities (Lewkowicz, 2022).

If it depends on the interest of technological powers and foreign investors, the landscape is likely to change rapidly. Alongside countries like the United States, Germany, and Japan, China plays a central role in the race for the "white gold". Its presence in the lithium triangle is largely a reflection of its leadership in the battery and electric vehicle production chain: currently, China is responsible for approximately 60% of global battery production and roughly half of hybrid and electric vehicles (White, 2023; Climatescope, 2022).

In this context, Chinese investments in lithium projects in Latin America, particularly within the lithium triangle region, are driven by economic and strategic interests. These interests encompass several objectives, including ensuring a reliable supply of strategic minerals, domaining emerging and pivotal production chains for the energy transition, supporting the global competitiveness of Chinese companies in the electric vehicle market, and advancing China's role as an exporter of technological standards.

The article seeks to analyze Chinese investments and activities in the lithium triangle region from the perspective of International Political Economy, with the aim of identifying the determinants and motivations behind China's presence. Consequently, the following section initiates a discussion concerning the factors influencing Chinese investments in South America and the growing significance of lithium in these relations. Subsequently, we aim to contextualize the increasing importance of lithium and the potential it holds within the lithium triangle region, as well as outline the primary investments and financial contributions made by Chinese entities in lithium projects in Argentina, Bolivia, and Chile. Ultimately, our objective is to present the implications of this process, which include geopolitical ramifications and the challenges and opportunities faced by South American countries and its development path**.**

1.China's International Development Strategy and its implications for South America

China's economic and financial internationalization in the 21st century has given rise to a wide range of debates regarding its motivations, determinants, and implications (Santos and Milan, 2014; Beeson, 2018). The Asian country has experienced rapid growth since the late decades of the twentieth century, becoming the world's leading exporter and gradually establishing itself as a source of foreign direct investments (FDI) and development financing. Additionally, China has emerged as a hub of technological innovation across various sectors. It is undeniable that China has increasingly integrated itself into the dynamics of the global economy and significantly expanded its global presence over the past few decades, with direct implications for the international economic landscape and notably for Latin America.

According to Carol Wise (2020), the fundamental reason behind China's "internationalized development strategy" lies in its resource constraints. The most pressing restrictions are related to the urgent needs of feeding the world's largest population and acquiring essential resources to sustain the growth of the world's second-largest economy. Resource-rich countries in South America play a central role in this strategy: while supplying commodities such as copper, iron, oil, beef, and soy, they also constitute markets for Chinese exports of manufactured goods (Wise, 2020).

Chinese demand for agricultural, mineral, and energy commodities, coupled with the abundance of these resources in specific South American countries, has shaped a strong and complementary trade relations. This relationship is characterized by the concentration of export

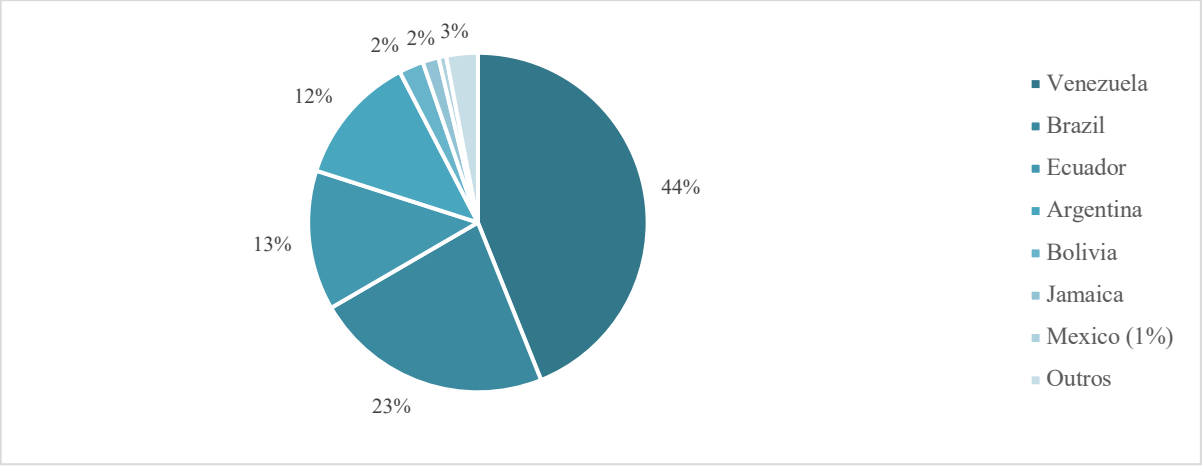
items in certain commodities and their compartmentalization among a few countries (Pecequilo, 2013; Vadell, 2013; Medeiros and Cintra, 2015). Currently, China stands out as the primary trading partner for most South American countries, such as Brazil, Peru, and Chile, which are major exporters of the primary commodities imported by the Asian country (Ray, Albright, and Wang, 2021).

In Brazil, three products account for approximately three-quarters of the export basket: soybeans, iron, and oil, totaling $66.5 billion out of the $89.4 billion exported to China in 2022[1] (Brazil, 2023). About 70% of Chilean exports to China revolve around copper and refined copper sales, while copper represents nearly 60% of Peru's exports to China. In Argentina, soybeans and beef account for approximately 70% of the country's exports to China, a similar scenario to that identified in Uruguay, which is currently negotiating a Free Trade Agreement (FTA) with China. Alongside Brazil, other South American countries like Colombia, Venezuela, and Ecuador rely on petroleum as a significant export product to China (Ungaretti et al., 2022).

Chinese banks have entered into loan-for-oil agreements with governments in the region over the past decade. This financing arrangement involves using oil exports as collateral for funding operations, typically tied to infrastructure development projects. It serves as a risk mitigation mechanism and guarantees for China a steady supply of oil (Brautigam and Gallagher, 2014). According to Jenkins (2019), there is a positive correlation between Chinese institutional loans and oil exports to the Asian country.

Venezuela received $60 billion in loans, accounting for nearly half of the $136 billion disbursed by the China Development Bank (CDB) and the China Export-Import Bank (Chexim) to Latin America since the year 2000 (Figure 1). Ecuador is the third-largest recipient of Chinese financing in the region, with approximately $18 billion in loans, including four loans secured by oil (Salgado, 2019). Petrobras, the Brazilian state-owned oil company, received $25 billion from Chinese banks between 2007 and 2018, with $17 billion tied to oil supply agreements (Hiratuka and Deos, 2019).

Figure 1 – Financiamentos do CDB e do Chexim na América Latina, 2005-2022.



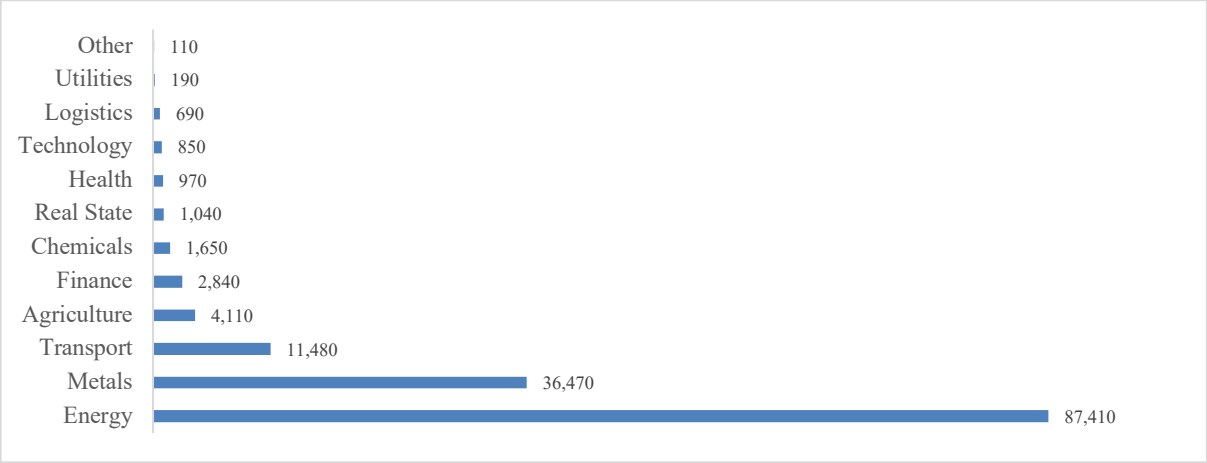
Fonte: Ray e Myers (2023).

[1] Data retrieved from Comex Stat: http://comexstat.mdic.gov.br/pt/comex-vis.

Converging to fundamental principles characterizing China's strategy of internationalized development, heavily grounded in resource-seeking investments, State-Owned Enterprises (SOE) have acquired assets in the oil and mining sectors and initiated new extractive projects in the region. This is done as a means to ensure a steady supply of energy resources and raw materials (Rodrigues and Hendler, 2018; Wise, 2020). In other words, the need to secure energy resources and other raw materials to support Chinese growth explains the adoption of incentives to coordinate and promote the international expansion of firms in the oil and mining sectors, encompassing both downstream and upstream activities (Jenkins, 2019).

Data from the China Global Investment Tracker (CGIT) further emphasize that the primary focus of Chinese investments remains closely tied to the acquisition of natural resources assets (Figure 2).

Figure 2 – Chinese FDI in South America, 2005-2023, per sector (In US$ million).



Source: China Global Investment Tracker. Available at: https://www.aei.org/china-global-investment-tracker/.

Chinese companies invested approximately $148 billion among different sectors in South America between 2005 and 2023, with a notable focus on the energy and metals, respectively accounting for 59% and 25% of the total. More specifically, the oil and gas make up about one-fifth of the total Chinese FDI in South America, while copper and iron combined represent about 16% of the total (Table 1).

Table 1 – Chinese FDI in South America, per subsector, 2005-2023. (In US$ million).

Sector	Value (in US$ million)	Share
Energy	**87.410**	**59,14%**
Other	40.850	27,64%
Oil	30.710	20,78%
Hydro	8.960	6,06%
Gas	2.860	1,93%
Alternative	4.030	2,73%
Metals	**36.470**	**24,67%**
Copper	15.450	10,45%
Other	12.580	8,51%

Steel	8.340	5,64%
Aluminum	100	0,07%
Other sector	**23.930**	**16,19%**
Total	**147.810**	**100,00%**

Source: China Global Investment Tracker. Available at: https://www.aei.org/china-global-investment-tracker/.

Apart from resource-seeking, the challenges within the Chinese growth model, notably the excess production capacity in heavy industries and a saturated domestic construction sector following the post-financial crisis period, drove many Chinese business groups, particularly state-owned enterprises, to invest overseas. Their primary goal was to expand their presence in global markets and boost exports of goods and services, revealing market-seeking motivations (Cai, 2017; Barbosa, 2021). In this context, Chinese companies progressively recognized opportunities in South America to broaden their global presence and tap into foreign markets (Ungaretti et al., 2021).

The electricity sector gained significant prominence from the mid-2010s onwards and started attracting substantial investments from companies like the State Grid Corporation of China (SGCC) and China Three Gorges (CTG), leaders in electricity generation and transmissions in China, respectively. These companies were responsible for substantial acquisitions in power generation, transmission, and distribution assets not only in Brazil but also in other markets in the region, such as Chile and Peru.

Between 2017 and 2021, the electricity sector accounted for nearly 70% of Chinese acquisitions in Latin America (Albright, Ray, and Liu, 2022). In aggregate terms, the electric sector received 37% of Chinese acquisitions in Latin America between 2000 and 2020, followed by the oil and gas and mining sectors, which respectively represented 28% and 16% of the total (ECLAC, 2021).

Another significant determinant, linked to China's development rebalancing, and particularly its transition to innovation-intensive sectors, pertains to the goal of Chinese companies to test native technologies in foreign markets (efficiency-seeking). In that sense, promote investments abroad allows chinese companies to enhance efficiency, demonstrate leadership, and refine standards and systems (Barbosa, 2021; Schutte and Debone, 2017).

In Brazil, the State Grid participated in the construction of two transmission lines for the Belo Monte hydroelectric power plant, the second biggest in the country. As a result, these projects enabled the transportation of energy produced by the hydroelectric plant, located in the northern region of the country, to consumer centers in the Southeast region. These transmission lines, spanning over two thousand kilometers each, introduced the ultra-high voltage[2] (UHV) transmission technology to foreign markets, which allows for the transmission of energy over intercontinental distances with minimal losses and reduced environmental impact (Proença and Kupfer, 2018). This move served the company's interest in projecting its leadership in the electricity transmission sector (Schutte and Debone, 2017).

[2] According to Silveira (2018), UHV technology is suitable for transmitting energy over distances exceeding one thousand kilometers without a loss of voltage level. It can be controlled remotely and automatically to make adjustments to the integrated system, and it is feasible to connect it to lower voltage alternating current lines, most common to solar and wind energy plants.

It's worth noting that China stands as the primary investor in energy transition and positions itself as an innovation hub in various domains related to low-carbon technologies. In 2022, China accounted for approximately half of the $1.1 trillion in global investments in energy transition (BloombergNEF, 2023), solidifying its leadership in the production of photovoltaic panels, wind turbines, electric vehicles, and other green technologies.

China's leadership in energy technologies has been reflected in increasing investments in wind and solar energy in Latin America. Chinese investments in alternative energy sources tripled between 2019 and 2022, growing from $1.9 billion to around $6 billion. During the same period, solar and wind energy capacity controlled by chinese entities in Latin America have near quadrupled and doubled, respectively[3] (Amaral et al., 2023).

The use of Chinese technologies, such as photovoltaic panels and wind turbines, has spread among countries in the region due to their increased competitiveness. They have become the preferred choice even for project developers of other nationalities (Ugarteche and León, 2022). In recent years, there have also been announcements of investment projects in battery and electric vehicles factories, such as BYD and Great Wall Motors in Brazil and Chery in Argentina (Cariello, 2023).

Thus, a new and emerging dimension in the Sino-South American relationship unfolds, focusing on investment projects in the battery and electric vehicle chain, renewable energy, and growing commercial exchanges in commodities crucial for the energy transition, such as lithium, nickel, cobalt, among others (Ray, Albright, and Liu, 2023; Roy, 2023). This is primarily because the countries in the region are holders of these critical minerals for the production of renewable and low-carbon energy technologies.

2.The lithium triangle and the chinese presence: determinants and implications

The significance of lithium has seen a substantial increase in recent years due to its extensive use in rechargeable lithium batteries in the growing markets of electric vehicles, portable electronic devices, as well as the gradual adoption in electric tools and energy storage applications. Therefore, lithium is a key component of low-carbon technologies essential for the energy transition. Between 2010 and 2021, lithium consumption surged by 283% (Buthada, 2022), with roughly 80% of its utilization directed towards battery production in 2022 (United States Geological Survey, 2023).

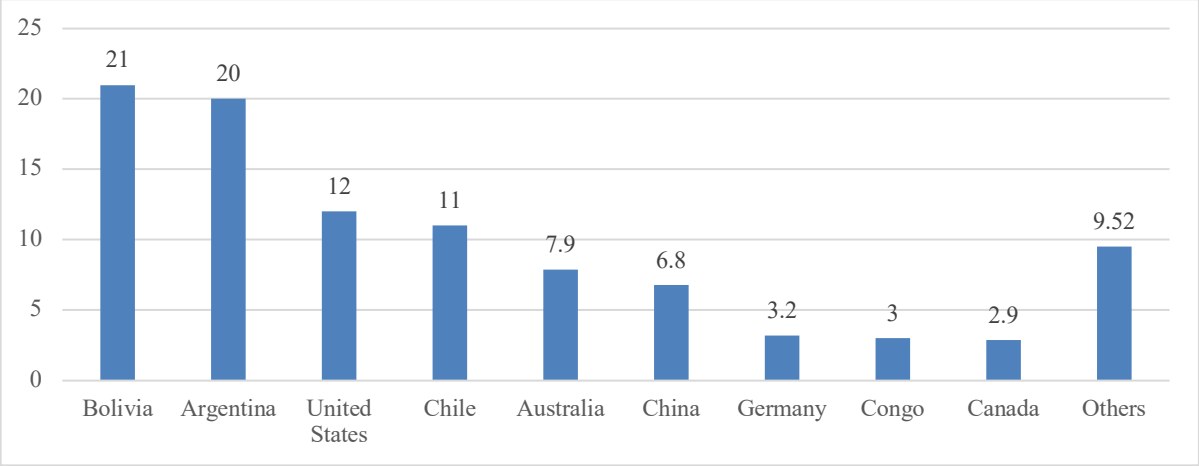
In the production process of electronics, 3 grams of lithium carbonate are needed for the production of cell phones, 20 grams for tablets, and 30 grams for laptops. However, the demand for electric vehicles is much higher, reaching an average of 50 kilograms for cars and 200 kilograms for buses. With the race to reduce the use of fossil fuels and the higher consumption of lithium-ion batteries in the automotive sector, it is estimated that the demand for lithium will grow exponentially in the coming years, possibly reaching 1.8 million metric tons by 2030, which is six times higher than the amount recorded in 2020 (Cariello, 2021; Álvarez, 2022).

Latin America holds around half of the world's identified lithium reserves, with the majority concentrated in the already mentioned “lithium triangle” characterized by the highest relative lithium concentrations globally (Vásquez, 2023). These reserves are primarily derived

[3] The wind power controlled by Chinese firms in Latin America increased from 1.6 GW to 3.2 GW between 2019 and 2022, while the solar nearly quadrupled during the same period, rising from 363 MW to approximately 1.4 GW (Amaral *et al*, 2023).

from deposits situated in Argentina, Chile, and Bolivia, particularly in the Uyuni, Puna, and Atacama salt flats, where lithium is obtained through evaporation processes (Barbon, 2023).

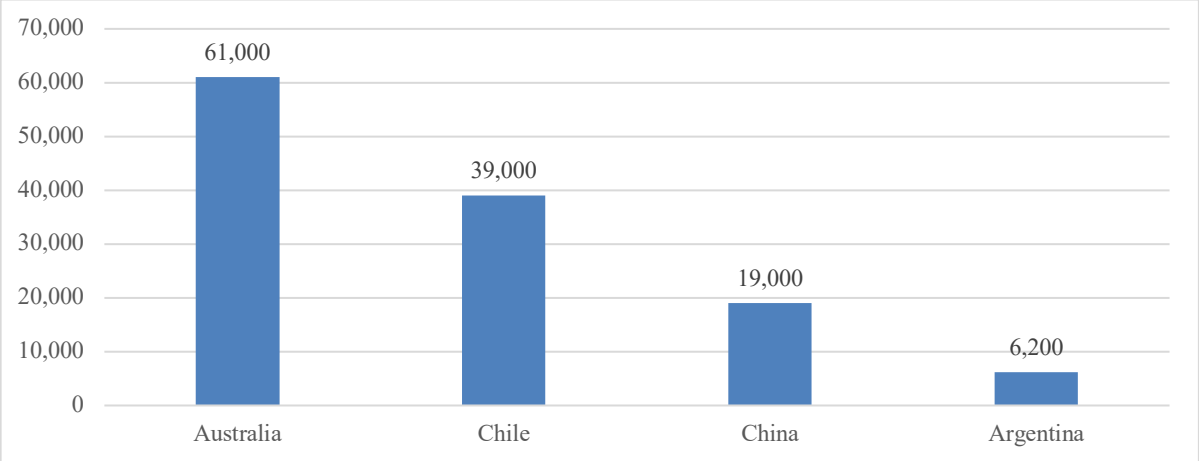
Figure 1 – Lithium resources per country, 2022. (In millions metric tonnes).



Source: United States Geological Survey (USGS), Lithium, 2023. Available at: https://pubs.usgs.gov/periodicals/mcs2023/mcs2023-lithium.pdf

Although the salt flats in these three countries account for near half of global lithium resources, their production still falls short of their potential. This is partly due to a lack of production and technological capacity for extraction and refining activities (Lewkowicz, 2022). Currently, Australia is the leading producer with a 46% global market share in 2021, followed by Chile with 32% (Figure 2). Argentina represents only 8% of global production, while Bolivia has yet to achieve industrial-scale production (Álvarez, 2022).

Figure 2 – Lithium Production per country, 2022. (In thousand metric tonnes).



Source: United States Geological Survey (USGS), Lithium, 2023. Available at: https://pubs.usgs.gov/periodicals/mcs2023/mcs2023-lithium.pdf

If the interests of technological powers and foreign investors have their way, the landscape is poised to change rapidly. Alongside the United States, the European Union, and other countries, China plays a central role in the “race” for the "white gold," given its current

position as the largest producer of batteries for electric vehicles and provider of lithium compounds (Lu and Fabbro, 2023; Yan, 2023).

China dominates the value chain of battery components and cells, leading in the processing of strategic minerals. In 2022, China accounted for the largest share of key battery component processing, including 65% of global lithium, 74% of cobalt, almost all of graphite, and 42% of copper (Economist Intelligence Unit, 2023). This prominence is driven by the rapid development of the battery and electric vehicle industry. Currently, China accounts for approximately 60% of global electric vehicle battery production (White, 2023), and more than half of the global electric vehicle fleet[4] and over 60% of public charging connectors are in China (Climatescope, 2022; IEA, 2023).

As a result of Chinese demand for strategic minerals, there has been a rapid expansion of Chinese company investments in electric vehicle supply chain projects in recent years. Between 2016 and 2022, the value of investments announced by China in these sectors increased more than 40 times, soaring from $605 million to $23 billion (Kratz et al., 2023). These investments encompass mining ventures in countries such as Congo, Indonesia, and Chile, as well as projects in battery and electric vehicle production plants (Cariello, 2023).

It is within this context that Chinese investments in lithium projects are situated. These investments are essential for China to meet its growing demand and maintain its global leadership in battery and electric vehicle production. Similar to the solar panel value chain, where China's participation in all production stages exceeds 80% (IEA, 2022), Beijing has a keen interest in ensuring the orderly supply of strategic minerals for the production of technologies that will play a central role in global decarbonization pathways. In the case of lithium, dominance and control over activities ranging from exploration and extraction to battery and electric vehicle production are crucial for various reasons.

First, it ensures a stable supply of lithium to meet the estimated growth in demand throughout this decade. Second, it contributes to sustaining the competitiveness of companies in the electric vehicle and other carbon storage technologies. Third, it propels Chinese leadership in high-value-added segments, aligning with the strategic objectives of the Chinese government to drive its development model through technological innovation. Fourth, it solidifies China as a hub for innovation and its role as an exporter of technological standards. Lastly, it provides control over supply chains of strategic minerals crucial for the production of technologies that are increasingly at the core of technological and productive competition with the United States, enhancing China's geo-economic and geopolitical influence.

The manifestation of these interests in South America has been quite evident in recent years, and its geopolitical repercussions have been equally apparent. Compared to the other countries in the lithium triangle, Argentina has offered attractive conditions for foreign investors, including low royalty rates, which have contributed to the country becoming a preferred destination for investments by Australian, Chinese, North American, and British companies.

According to calculations by Sanderson (2023), Chinese companies are the leading investors in greenfield lithium projects in Argentina, a deal type that necessarily involves

[4] Meanwhile, sales of electric vehicles in the Chinese market are growing rapidly. Over the past three years, the annual number of electric vehicles sold in the country has risen from 1.3 million to 6.8 million, making 2022 the eighth consecutive year in which China was the leading market for electric vehicles (Yang, 2023).

investments creating new installations and consequently increasing production capacity. (Ching, 2021). Companies such as Ganfeng Lithium and Zijin Mining have already invested over $2.7 billion in recent years. Fernández and Cesarin (2023) also note that, although the United States, Japan, and Australia are involved in exploration and commercialization units in Argentina, Chinese companies are the most active in seeking projects in different provinces like Catamarca, La Rioja, Salta, and Jujuy. By 2030, at least 26% of the country's lithium production will originate from projects involving Chinese participation (Sanderson, 2023).

Numerous examples of these investments abound. In 2022, Zijin Mining acquired the Canadian company Neo Lithium for $737 million, which held the rights to the Tres Quebradas project in the Argentine province of Catamarca (Ray, Albright, and Liu, 2023). The company will invest $380 million to build a lithium carbonate plant and initially produce 20,000 tons of lithium carbonate per year (Reuters, 2022). Meanwhile, Tsingshan, the world's largest producer of stainless steel, announced a $375 million investment to build a lithium plant in Argentina, alongside the French company Eramet (Sanderson, 2023).

Other projects include Ganfeng Lithium's $962 million investment to acquire the company Lithea, which owns assets in the Pozuelos and Pastos Grandes salt lakes, both in the province of Salta (Lu and Fabbro, 2023). The same Ganfeng holds the Mariana lithium project located in the Llullaillaco salt flat, also in the province of Salta. In the province of Jujuy, the Chinese company holds a 51% stake in the Caucharí-Olaroz lithium project in a joint venture with Lithium Americas (Sanderson, 2023). Other Chinese companies are present in the Argentine market, such as Tibet Summit Resources, which will invest $1.7 billion in the Salar Arizano and Salar de Diablillos projects to produce between 50,000 and 100,000 tons of lithium between both projects (Pelcastre, 2023; Sigal, 2023).

China is also willing to participate in the Argentine government's plans to promote lithium industrialization. In addition to investments in new lithium production facilities, the recent announcement about Chinese participation in the manufacturing and production of lithium batteries in Santiago del Estero stands out. This project is composed of a consortium formed by the Chinese companies Contemporary Amperex Technology Company Co. Ltd (CATL), Tianqi Lithium, and Gotion High Tech (Nicholls, 2023). It is expected that the production resulting from this investment will supply the future electric vehicle factory to be built by Chery, which recently announced its interest in investing $400 million to realize the project (Attwood, Gilbert, and Durao, 2023).

In Chile, the Chinese company Tianqi Lithium acquired a 26% stake in one of the world's largest lithium producers, Sociedad Química y Minera (SQM) (Vásquez, 2023a). The approximately $4 billion acquisition represented more than half of China's FDI flows to Latin America in 2018 and was the largest investment by a Chinese company in Chile (Centro de Estudios China-Mexico, 2023). The purchase secured the supply of 80,000 tons of lithium for the Chinese company BYD over a period of seven years (Nichols, 2023). Currently, Chile is the leading producer of high-quality lithium from brines and the second-largest producer after Australia, which produces lithium from rock deposits (Vásquez, 2023b). China was the destination of 72% of Chilean lithium exports in 2021, followed by South Korea and Japan with 15% and 7%, respectively (Bnamericas, 2023).

There are expectations that Chinese capital will finance the creation of a lithium industrial park in Antofagasta, with investments expected to exceed $2 billion. The companies

participating in the project will be Tsingshan Holding Group, Rupia Energy, Battero Tech, and FoxESS (Nichols, 2023). However, uncertainties associated with the prospects for future lithium projects could be a barrier to the announcement and development of new extraction projects. According to Vásquez (2023), the lithium industry in Chile is at a crucial moment, with debates about the role of the State and the need to protect the environment and local communities.

Known as the Saudi Arabia of lithium due to its vast identified lithium resources, Bolivia is seeking to engage with foreign companies to develop its production potential. As mentioned, the South American country does not yet produce lithium on a commercial scale (Vásquez, 2023a). In January 2023, the government of Luis Arce signed a $1 billion agreement with a consortium of Chinese firms to develop the lithium reserves in the Uyuni and Oruro salt flats. The consortium includes the Chinese battery producer CATL and the mining company CMOC (Ray, Albright, and Liu, 2023). The partnership will give the consortium the capacity to produce 25,000 tons of lithium carbonate per year through two production units (Bouchard, 2023).

In June 2023, the Chinese company CATL officially confirmed that it will make additional investments of $400 million to build the two planned production units. In the initial phase, the consortium will be responsible for building infrastructure improvements and establishing the necessary conditions to start operations (Bouchard, 2023). Total investments could reach $9.9 billion over the course of this decade, considering the Bolivian government's goals of promoting processing units and adding value to the mineral (Cambero, 2023).

China's involvement in projects and activities related to lithium production represents a new and increasingly relevant dimension of the relationship between China and South American countries. China's strategy of internationalized development and the incorporation of South America into this process stemmed from its role as a supplier of raw materials and a market for the global expansion of Chinese companies and the export of goods, services, and technologies (Wise, 2020). The development of low-carbon technologies resulting from the imperative of energy transition and climate change mitigation adds perspectives linked to the development of new production and trade networks, while also implying repercussions in different spheres.

From a geopolitical perspective, the deepening of China's presence in South America and its expression in lithium investments occurs in a systemic context marked by the intensification of the competition between China and the United States. According to Pautasso et al (2020), productive and technological competition manifests as an intermediate dimension of the strategic competition between Beijing and Washington. Trade disputes represent the most superficial level, illustrating the resurgence of U.S. protectionism and the country's attempt to increase its bargaining power with China to reduce trade deficits. At a deeper level, there is a competition for the leadership of the international system, which is influenced and reflected in technological competition in various specific technological segments, including semiconductor production, 5G infrastructure networks, and energy technologies.

Therefore, control over the supply chain of strategic minerals and domain of new technologies are key components of the Sino-American competition, accentuating the global race for lithium batteries (Moores, 2021). Due to external shocks in recent years, symbolized by the Covid-19 crisis and the Russia-Ukraine war, there has been an increased recognition in Washington about the need to diversify energy and raw material suppliers. This has motivated

actions to reduce China's dominance and restrain its rapid scientific and technological development (Vazquez, 2023a).

In other words, the security of supply chains for batteries and the minerals needed for their production has become a priority for the United States. The country seeks to facilitate the development of clean energy, revitalize its industrial competitiveness, and reduce dependence on a supply chain dominated by China (Nakano and Huang, 2023). The Inflation Reduction Act (IRA), which became law in August 2022 (White House, 2023), is a $369 billion initiative by the U.S. government aimed at reducing the country's dependence on critical minerals in the lithium value chain (Vásquez, 2023a).

The IRA offers incentives in the form of tax credits for the production of domestic batteries, contingent upon a specific percentage of minerals being extracted and processed either domestically or in countries that have free-trade agreements with the United States, such as Chile. Furthermore, it establishes ambitious goals for the extraction of critical minerals in North America and discourages the involvement of Chinese companies in strategic supply chains, particularly in the manufacturing of electric vehicles (Vásquez, 2023; Senderson, 2023).

In this context, Latin America, a region traditionally subordinate to Washington's influence, reinforces its position as a geo-economic and geopolitical space in dispute (Pecequilo, 2013). Meanwhile, lithium emerges as one of the primary assets in the productive and technological competition between China and United States. In March 2023, several months after the Sino-Bolivian agreement on lithium projects, U.S. Southern Command General Laura Richardson, during a Congressional hearing, expressed concerns that China was exploiting the region's resources, potentially undermining conditions for private investment: "They don't invest, they extract... the ground game they have with lithium is very advanced and very aggressive" (Ramos, 2023).

In this context of opportunities and disputes, South American and Latin American countries find themselves grappling with dilemmas that have permeated the region's history. Historically, Latin America has been inserted into the international division of labor in a subordinate and dependent manner. It is worth noting that underdevelopment and dependency have been central to academic and intellectual debates in the region. These debates consistently revolved around designing strategies to promote industrial projects, overcome the primary-exporting condition, and actively integrate the region's economies into the international stage (Ocampo, 2013).

With the global surge in demand for lithium and the availability of this mineral in the region, questions arise about the actions and policies to be implemented to benefit economic and sustainable development. On one hand, there are concerns that the region may become a "lithium quarry", with all the socio-environmental implications associated with lithium extraction. Meanwhile, countries in the global North ensure the supply of resources necessary for their own decarbonization and energy transition, perpetuating a relationship of "neo-dependency," "neocolonialism," or "green colonialism" (Fornillo and Lampis, 2023; Barbon, 2023). On the other hand, analysts emphasize that lithium is abundant worldwide and subject to economic cycles, with opportune moments for investment. In other words, there is a need to attract capital to materialize future projects (Álvarez, 2022).

It falls upon the countries in the region, particularly those that are major producers of commodities crucial for the 21st-century energy transition, to evaluate the partnerships

currently being forged and to outline strategies that align with their own development needs. For future research agendas, it is crucial to investigate the policies and strategies adopted by countries in the region to promote economic development and ensure the sustainable exploitation of lithium resources. Additionally, it is essential to explore the impacts, challenges, and opportunities stemming from the integration of their economies into emerging supply chains associated with global trajectories of energy transition and decarbonization.

3.Final considerations

As observed, China employs an internationalized development strategy that incorporates South America as a crucial region for resource supply, a market for the export of goods, services, and technologies, and an opportunity space for profitable investments (Wise, 2020). The Asian country has already become the primary trading partner for several South American countries and has deepened its political and economic ties with the region. This is evidenced by the significant volumes of FDI, bilateral loans, and financing for infrastructure projects. The region is also an integral part of China's international cooperation initiatives, particularly the Belt and Road Initiative and the Asian Infrastructure Investment Bank (Ungaretti et al., 2022).

In recent years, the relationship between China and South American countries has begun to incorporate new dimensions associated with the energy transition and the gradual decarbonization of global energy systems. This implies the construction of new trade and investment networks in strategic minerals, electric vehicles, and renewable energies (Albright, Ray, & Liu, 2023). In particular, the potential to develop lithium resources in South America has attracted the interest of Chinese companies and entities, which currently dominate the value chain associated with battery and electric vehicle production.

There are several Chinese interests tied to investment projects in the lithium triangle. As observed, there is the Chinese intention to diversify its sources of mineral imports, boost the competitiveness of its companies, and increase its influence over lithium value chains, thereby supporting its leadership in emerging segments and its role as an exporter of technological standards. Additionally, this prominence leverages Chinese influence in increasingly strategic production chains, reflecting its ongoing technological disputes with the United States and its allies.

China's presence in the lithium triangle reveals perceptions, concerns, and uncertainties that are associate with comprehensive discussions and warrant future research and in-depth analysis. Firstly, it manifests geoeconomic and geopolitical disputes over strategic resources, particularly for key commodities to the energy transition. Secondly, it constitutes an increasingly important dimension of the Sino-American competition for the dominance of green technologies and their supply chains. Finally, it reveals dilemmas and possibilities for the development of Latin America, with a focus on the sustainability of lithium projects and the region's integration into value chains linked to global decarbonization.

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SUSTAINABLE URBAN MOBILITY POLICIES: A COMPARATIVE ANALYSIS OF CHALLENGES AND INCENTIVES FOR ELECTRICITY-POWERED TRANSPORTATION IN BRAZIL AND CHINA

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ABSTRACT: Energy transition is present in all public policies today, especially in the context of the Paris Agreement and 2030 Agenda, catalyzed by the high population concentration and the need to mitigate climate change. An alternative to this reduction is the electrification of urban transport, in which China is a pioneer and has been serving as an example for Brazil. The question raised in the article is which effective public policies have been adopted by Brazil and China for the electrification of their transport sector and how Brazil could learn with the Chinese regulatory experience. To answer this question, it will discuss the commitments assumed by both countries for the urban transport electrification (centered in buses) aiming at environmental sustainability. Firstly, it will analyze the urban mobility policies adopted at the federal and municipal level, focused in two of the biggest cities of the world: São Paulo and Shenzhen. The aim is to explore the context of the rise of sustainable urban mobility involving buses, and what are the legal measures adopted in the countries; secondly, it will be examined the impacts of electric transport on the energy system and its challenges; and, finally, the lessons learned by Brazil based on the Chinese experience will be addressed. The methodology will involve the analysis of doctrine, official documents, and systematization of the Brazilian and Chinese legislation.

KEYWORDS: Sustainability – Transports – Electric Bus – Brazil and China - Internal Legal Laws - International Convention

Introduction

Nowadays, many countries have been concerned about environmental pollution and the development of energy transition, especially in the urban scenario. They have perceived some mechanisms for achieving sustainable urban mobility and reducing pollutants, in line with international commitments and national regulations. Electric vehicles (EVs) and the electrification of fleets are considered a mechanism for this. EVs are those that use electric motors for propulsion and the electricity can be obtained in different ways: 1. connected directly to the external source of electricity, through plugs or using overhead cables; 2. using the electromagnetic induction system; 3. from the reaction of hydrogen and oxygen with water in a fuel cell; or 4. through mechanical braking energy (regenerative braking) when braking the vehicle[1].

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The electrification of vehicles is already a reality in the city of Shenzhen, the fourth largest city in China, with 12 million inhabitants. The city was the most advanced in terms of EV and public buses (100%), taxis (nearly 100%), and logistic vehicles (24%) in 2018[2]. China's massive investment in education, with an emphasis on technical education, has made this country increasingly stand out in the production of high-tech goods, notably in sectors such as energy and transport[3].

This movement is in accordance with China's commitments with the Paris Agreement to cut CO2 emissions per unit of GDP by more than 65% from 2005 levels, increase the share of non-fossil energy to around 25% and raise forest stock volumes by 6bn cubic meters from 2005 levels, as well as bringing the installed capacity of wind and solar to more than 1,200 GW. In 2020, China added a fourth target in the basket: to achieve net-zero emissions before 2060[4].

However, China's reality was not always like this. China's development model promoted a significant increase in greenhouse gasses (GHG) emissions due to the strong participation of fossil sources in its energy matrix (mainly mineral coal). Because of the difficulties raised for the country's energy security and the increase in dependence on oil, China was obliged to reflect about alternatives. Thus, this landscape combined with the commitments to reduce GHG emissions oriented the country to adopt various measures to promote renewable sources.

Brazil is also very concerned about sustainability and the goal of reducing pollutants. The government has committed to reducing GHGs in line to the Paris Agreement. The country is committed to reduce GHG emissions by 37% in 2025, with a subsequent indicative reduction contribution of 43% in 2030, in relation to the emission levels estimated for 2005.[5] It also promised reach an estimated share of 45% of renewable energies in the composition of the energy matrix in 2030[6] and adopted the 2029 Decennial Energy Plan (PDE), an energy planning instrument that aims to optimize the expansion of energy supply in a sustainable manner.

The cities of Shenzhen in China and, in Brazil, São Paulo, have almost equivalent populations and similar demands for transportation. The difference is that Shenzhen has 100% of electric fleets, and São Paulo has committed to widen its electric fleet, which is still insufficient to follow the sustainable and populational demands.

In this sense, this article aims to understand the reality of electrified buses in both cities. The research is divided into four stages: (i) the analysis of the historical context and

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commitments adopted on sustainable urban mobility; (ii) the exam of the policies and legal incentives at federal and municipal levels for the implementation of electric buses in São Paulo and Shenzhen; (iii) the understanding of the impact of electric vehicles on the Brazilian energy system and its challenges; and, finally, (iv) the analysis of Brazil's lessons from the Chinese experience. In the end, the goal is to understand the reality of electric bus transportation in the two cities and their internal practices towards increasing their fleets.

1.HISTORICAL CONTEXT IN THE INTERNATIONAL COMMITMENTS ON SUSTAINABLE URBAN MOBILITY

According to Amaro Olimpio Pereira Junior, on the one hand, China has a vast mastery over the best practices in the exploitation of fossil fuels. It intends to make large investments in the next decade for the expansion of its hydroelectric matrix, to reduce its dependence on these fonts. On the other hand, Brazil, a country with extensive experience in exploiting its water potential for energy generation, has large reserves of mineral coal that are still little explored or obsolete technologies are used, with little efficiency and a high level of pollution[7].

The United Nations Conference on Environment and Development (Rio-92), also known as Eco-92, was the United Nations (UN) event that marked the awakening of global awareness for improving air quality in cities, by reducing GHG emissions and replacing fossil fuels with alternative energies[8]. Since then, International Organizations have been encouraging goals to reduce the emission of polluting gasses, the growth of ecological movements, investments in renewable sources and technologies to collaborate with sustainability. ECO-92 resulted in the international treaty of the United Nations Framework Convention on Climate Change (UNFCCC). The Convention has the ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that will prevent any dangerous anthropogenic disturbance of the climate system [9].

The United Nations Environment Programme (UNEP) is an example of the leading global environmental authority in raising awareness about green development and finance, sustainable consumption, low-carbon development, as well as environmental laws and circularity. The Climate and Clean Air Coalition is the only global effort uniting governments, civil society and the private sector, committed to improving air quality and protecting the climate in the coming decades by reducing short-lived climate pollutants in all sectors. For the coalition, reducing man-made methane emissions and supporting the electrified vehicle fleet is one of the quickest and most cost-effective strategies to reduce the rate of warming and contribute to global efforts to limit the temperature increase to 1.5°C.

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Another relevant international treaty was the Kyoto Protocol (KP) [10], the first that addressed the emission of GHGs that has already been overtaken by the Paris Agreement[11]. This agreement is an international treaty on climate change, adopted in 2015. China's current climate commitment under the Paris Agreement can be summarized as "double carbon" objectives, that is, reaching the peak of carbon dioxide emissions (CO2) before 2030 and "make every effort to peak sooner", and achieve carbon neutrality before 2060 (meaning net zero emissions of all greenhouse gasses) [12].

Among the 196 countries that signed the Paris Agreement in 2015, the main signatories are the G-20 countries, which account for most of the world's carbon dioxide emissions. These include China, the countries from the European Union, India, the United States, and Brazil. The agreement establishes that all signatory countries must collaborate with climate innovation, clean sources, allied to technology, with protection of the ecosystem, to reduce gas emissions, allied to their economies and industries. It also recognizes that sustainable lifestyles and sustainable patterns of consumption and production play an important role in addressing climate change.

In Article 5.2 of the Paris Agreement, parties are encouraged to take measures to implement and support the reduction of emissions resulting from forest degradation, and the increase of forest carbon stocks for integral and sustainable management. In addition, art. 6.4 (b) highlights the need to mitigate greenhouse gas emissions while promoting sustainable development, as well as encouraging and facilitating participation in the mitigation of greenhouse gas emissions by public and private entities. Article 7.7 (e) strengthens the resilience of socio-economic and ecological systems, namely through economic diversification and the sustainable management of natural resources.

With increasingly intense urbanization, there is concern that the increase in the fleet and population growth will undermine the goals of reducing gas emissions. However, beyond energy from renewable sources, the electrification of vehicle fleets appears as a great tool to help the main purpose of environmental sustainability.

To understand how Brazil and China have achieved environmental sustainability through policies to promote the electrification of bus fleets or public transport, it is necessary to understand the international commitments they have made, to measure the degrees of institutional and effective progress.

To achieve the goals established in international instruments, Brazil has committed to promoting new standards of clean technologies, expanding energy efficiency measures and low-carbon infrastructure, in addition to reaching an estimated share of 45% of renewable energies in the energy matrix by 2030, increasing from 28% to 33% the share of renewable energy sources other than hydropower [13]. Another Brazilian objective is to reduce, already in 2025, 37%

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of its emissions in relation to 2005 levels and reach neutrality of emissions in 2060[14]. The National Environmental Policy (PNMA), Law 6,938/81[15] and the Efficient Propulsion Systems Project (PROMOB-e)[16], which aims to support Brazil in establishing the conditions for the dissemination of electric mobility, contributing to the formulation and implementation of public policies aimed at the electrified automotive sector are also instruments for Brazil to achieve these goals and the stipulated goals.

The National Environment Council (CONAMA)[17], advisory and deliberative body of the National Environment System-SISNAMA, provides, in Conama Resolution No. 401[18], the regulations for manufacturers, importers and the maximum limits for lead, cadmium and mercury and the and standards for the environmentally sound management of portable cells and batteries, lead-acid batteries, automotive and industrial, and cells and batteries in electrochemical systems.

China is very concerned about the issue, with decarbonization at its core to deal with the climate change emergency. To this end, it has made international commitments to climate change and has also taken part in initiatives to electrify vehicles. The Copenhagen Accord formulated by Brazil, China, India, South Africa, and the United States in 2009 was produced in negotiations by a group of 26 countries, and was a declaration that recognized the need to establish strong measures to hold the increase in global temperature to within 2 °C. The agreement was neither decisive nor legally binding, but it was an important milestone in China's commitment to CO2 emission reduction public targets.[19]

According to 2019 data from the National Energy Agency (IEA), China is the largest battery electric bus market in the world with 460,000 units (99% of the world market). The city of Shenzhen stands out with 16,000 battery electric buses, the largest electric fleet in the world[20]. In 2017, Shenzhen became the world's first metropolis with an all-electric urban fleet. The city currently has the largest electric bus fleet on the planet, consisting of 16,359 thousand e-buses,

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[14] DOS SANTOS, Guilherme Ramos et al. THE IMPACT OF ELECTROMOBILITY: ELECTRIC VEHICLES, THE ENVIRONMENT AND THE ENERGY INFRASTRUCTURE IN BRAZIL. South American Development Society Journal , v. 7, no. 21, 2021, p. 247.

[15] BRAZIL, Law No. 6938, of August 31, 1981 . Provides for the National Environmental Policy, its purposes and mechanisms for its formulation and application, and makes other provisions. Brasília, DF: Official Gazette of the Union, 1981. Available at: < https://www.planalto.gov.br/ccivil_03/leis/l6938.htm >. Accessed on August 13, 2023.

[16] NATIONAL ELECTRIC MOBILITY PLATFORM. PROMOB-e, 2017-2021, Electric Mobility for Brazil. Available at:< https://www.pnme.org.br/biblioteca/promob-e-2017-2021-portugues/ >. Accessed on August 16, 2023.

[17] Institute for the Environment and Renewable Natural Resources . Batteries. Available at:< https://www.gov.br/ibama/pt-br/assuntos/emissoes-e-residuos/residuos/pilhas-e-baterias >. Accessed on August 18, 2023.

[18] CONAMA RESOLUTION No. 401, of November 4, 2008 Published in DOU No. 215, of November 5, 2008, Section 1, pages 108-109. Establishes the maximum limits of lead, cadmium and mercury for cells and batteries sold in the national territory and the criteria and standards for their environmentally adequate management, and other measures. Available at:< http://conama.mma.gov.br/?option=com_sisconama&task=arquivo.download&id=570 >. Accessed on August 20, 2023.

[19] COP15 / MOP5 - Copenhagen, Denmark (December 2009). March 2020. Available at:<https://cetesb.sp.gov.br/proclima/conferencia-das-partes-cop/cop-15-mop-5-copenhague-dinamarca-dezembro-de-2009/>. Accessed on August 20, 2023.

[20] BERMUDEZ, Tatiana; CONSONI, Flávia L. op. *quote,* p.8.

surpassing the electric bus fleet of major cities such as New York, Los Angeles, New Jersey, Chicago, and Toronto, together [21].

The countries' energy transition and the development of sustainable technologies, especially urban mobility in Brazil and China, are still at different levels. However, countries have encouraged the implementation of public transport powered by electricity, especially buses and trolleybuses.

2.THE LEGAL STANDARDS AND INCENTIVE POLICIES IN BOTH COUNTRIES FOR THE IMPLEMENTATION OF THE MEANS OF TRANSPORT POWERED BY ELECTRIC ENERGY

Legislation has a fundamental role in enabling the implementation of electrified means of transport, providing commitments, and establishing incentives. Incentive policies include the widespread installation of charging stations, licensing fee exemptions, subsidies and general government incentives for the installation of electric buses [22]. In this sense, it will be addressed the federal legislation of Brazil and the municipal legislation in São Paulo regarding the decarbonization commitments and those related to fostering the electrification of bus fleets.

2.1BRAZIL AND SÃO PAULO

A. BRAZILIAN FEDERAL LEGISLATION

The electric fleet may encompass conventional electric buses as trolleybuses. The difference is that the electric trolleybus contains two rods that connect with cables arranged over the path of the vehicle, which runs on wheels and does not need rails [23]. The first trolleybus system[24] in Brazil was inaugurated in São Paulo in 1949. The type of technology implemented in trolleybuses is similar to the electromotor system developed by Dr. Ernst Werner Von Siemens and presented to the public in 1882 in Berlin [25].

As in this study we will focus on the electric buses, it is important to highlight that nowadays, the Federal government, represented by the Ministry of Regional Development (MDR), is discussing different criteria for the implementation of electric buses as part of the Urban Public Transport Fleet Renewal Program (Refrota)[26], and municipalities are also streamlining their public policies to this end.

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[21] BRITO ANTUNES, Verônica Nascimento; DOS SANTOS SILVA, Jacilene; DO CARMO HERMIDA, Camila, op. *quote,* p. 250.

[22] DELGADO, Fernanda; COSTA, José Evaldo Geraldo. FEBRARO, Julia. DA SILVA, Tatiana Bruce., op. *quote,* p. 40.

[23] ESTADÃO. Sustainable mobility: do trolleybuses still have a place in cities? Available at: < https://summitmobilidade.estadao.com.br/sustentabilidade/mobilidade-sustentavel-o-trolebus-ainda-tem-espaco-nas-cidades/#:~:text=Em%20compara%C3%A7%C3%A3o%20a%20%C3%B4bus%20conventional,with%20gases%20nem%20polutes%C3%A7%C3%A3o%20sonora .> Accessed on August 20, 2023 .

[24] Breathe São Paulo. The Trolleybuses. Available at: http://www.respirasaopaulo.com.br/Trolebus%20-%20Problemas%20e%20solucoes.htm . Accessed on August 22, 2023.

[25] SILVA, Maria Annalyanne Pereira da. Main trends and challenges in the implementation of electric vehicles in the road freight transport sector. 2022, p.28.

[26] MINISTRY OF INTEGRATION AND REGIONAL DEVELOPMENT. REFROTA program. August 7, 2020. Available at: < https://www.gov.br/mdr/pt-br/assuntos/mobilidade-e-servicos-urbanos/programa-refrota >. Accessed on August 20, 2023.

In a legal perspective, this goal relates to the Brazilian Constitution not only from an urbanistic point of view, but also environmental. The Brazilian Federal Constitution of 1988[27] raised the concern of the ecologically balanced environment to provide quality of life to the Brazilian people. This provides for the need to control the production, sale and use of techniques, methods and substances that pose a risk to life, quality of life and the environment.

Although the stimulus to other "modern" sources of renewable energy is still incipient in Brazil compared to the world average, it is important to bear in mind some Brazilian legislative initiatives. The first instrument adopted in Brazil to facilitate the use and expansion of the supply of electricity with incentives for alternative sources was the Alternative Sources Incentive Program (Proinfa), instituted by Brazil through Law No. 10,438/2002, which, although ambitious [28] did not fully achieve its objectives[29].

Then, Law No. 12,187/2009[30] was created in the scope of the National Policy on Climate Change, making the reduction of GHG emissions mandatory. Few years ago, the Senate approved Bill No. 6539/2019 that modified Law No. 12,187/2009 to include the commitments assumed by Brazil in the Paris Agreement[31].

Focused on the topic of urban environmental sustainability and transports, Law No. 12,587/2012[32] established the principles, guidelines, and objectives of the National Urban Mobility Policy (PNMU), aiming to guide the actions of both the Federal Government and the States and Municipalities to foster urban mobility. Among the guidelines set out in the PNMU is the use of renewable and less polluting energies in mobility systems stands out[33]. The adoption of electric buses in public transportation fits precisely in this guideline.

In this sense, it is important to point out that the new Brazilian industrial policy for the automotive sector, called Route 2030 is also in line with the past policies that combine urban transportation and sustainability. This policy aims to support technological development, competitiveness, innovation, vehicle safety, environmental protection, energy efficiency and improvement in the quality of Brazilian automobiles. The second phase of the Route 2030 is still under discussion and proposes actions for electromobility. Among these are: attracting investments to the country, including the assembly of hybrid and electric vehicles and their components; creation of a working group focused on hybrid and electric vehicles with a view to preparing a new National Plan for the Development of Electromobility in Brazil [34]. According to Margarete Gandini, director of the Department of Development of High-Medium Technological Complexity Industry at the Ministry of Development, Industry, and Commerce

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[27] BRAZIL. Constitution of the Federative Republic of Brazil. Brasília, DF: Federal Senate. Available at:< https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm >. Accessed on: August 13, 2023.

[28] Law No. 10.438, of April 26, 2002. Available at: <https://www.planalto.gov.br/ccivil_03/leis/2002/l10438.htm >. Accessed on August 22, 2022.

[29] PEREIRA JUNIOR, Amaro Olimpio, op. *quote,* p . 120.

[30] Law No. 12.187, of December 29, 2009. Available at:< https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm >. Accessed on August 22, 2023.

[31] Bill No. 6539, of 2019. Amends Law No. 12,187, of December 29, 2009, which institutes the National Policy on Climate Change - PNMC, to update it in the context of the Paris Agreement and the new challenges related to it to climate change. Available at: <https://www12.senado.leg.br/radio/1/noticia/2021/11/03/aprovado-projeto-que-atualiza-a-politica-nacional-sobre-mudanca-do-clima > . Accessed on August 1, 2023.

[32] Law No. 12.587, of January 3, 2012. Available at:<https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12587.htm>. Accessed on August 22, 2023.

[33] PASCOAL, ET; FURTADO, AE; FERREIRA FILHO, Valter Silva, op. *quote,* p.2.

[34] PASCOAL, ET; FURTADO, AE; FERREIRA FILHO, Valter Silva, op. *quote,* p.9.

(MDIC), the production of electrified vehicles will be intensified with the new automotive policy rules and the resumption of working groups to relaunch the National Electromobility Plan[35].

The public policies involved also encompass public financing to meet the targets imposed by mandatory rules. BNDES Finem Mobilidade Urbana is a program created to foster the financing of electric buses. It allows financing from R$ 20 million for investment projects of public interest focused on urban mobility. Among them, financing for the acquisition of buses and trucks that are hybrid, electric, or powered by clean fuels [36]. The initiative supports undertakings that reduce energy consumption in buildings, production processes, power plants, electrical networks, public lighting, and/or increase the efficiency of the national energy system[37].

Recently, the Federal Government's new Growth Acceleration Program (PAC) for Development and Sustainability intends to invest R$ 48.8 billion from 2023 to 2026 in sustainable urban mobility. The program will induce innovations in management, regulation, and technologies for urban transport, such as the use of renewable energies to reduce CO2 emissions. The Program Urban Mobility portfolio includes public and private investments and Public-Private Partnerships (PPPs).[38]

B. MUNICIPAL LEGISLATION OF SÃO PAULO

In this context, the concern with the reduction of GHG has become central to the municipality of São Paulo, the biggest city of Brazil and the most important financial center of the country. The preliminary environmental policy that incorporated low emission in SP was the one which established trolleybuses in São Paulo, that is, Law 14.933/2009 - the Climate Change Policy for the Municipality of São Paulo. Article 5 of the Law sets a target of reducing the municipality's anthropogenic emissions of the greenhouse gases listed as a priority in the Kyoto Protocol of 30%. Article 6, II, a, encouraged the provision of public transport with an emphasis on a bus system with lower polluting potential and no greenhouse gas emissions with emphasis on the rail network, subway, trolleybuses, and other means of transport[39]. In recent years, the electric fleet in the State of São Paulo was still mostly represented by trolleybuses. The trolleybuses are present in three corridors, in the city of São Paulo, while the hybrid buses are the second fleet in volume, and then electric buses.

The same legal measure determined that the operators of the Urban Passenger Transport System of São Paulo must promote the progressive reduction of fossil carbon dioxide (CO2)

[35] EPBR. Novo Rota 2030 pretende intensificar produção nacional de veículos elétricos. Available at: <https://epbr.com.br/novo-rota-2030-pretende-intensificar-producao-nacional-de-veiculos-eletricos/>. Accessed on September 20th, 2023.

[36] PASCOAL, ET; FURTADO, AE; FERREIRA FILHO, Valter Silva, op. *quote,* p. 8.

[37] BNDES Finem - Environment - Energy Efficiency . Available at:< https://www.bndes.gov.br/wps/portal/site/home/financiamento/produto/bndes-finem-eficiencia-energetica >. Accessed on August 1, 2023.

[38] BRAZILIAN FEDERAL GOVERNMENT. Efficient and Sustainable Transportation. Growth Acceleration Program (PAC). 2023. Available at:<https://www.gov.br/casacivil/novopac/cidades-sustentaveis-e-resilientes/mobilidade-urbana-sustentavel>. Accessed on August 1, 2023.

[39] Law No. 14,933 of June 5, 2009. Institutes the Climate Change Policy in the City of São Paulo. Available at:< http://legislacao.prefeitura.sp.gov.br/leis/lei-14933-de-05-de-junho-de-2009 >. Accessed on August 20, 2023.

emissions, and toxic pollutants emitted in the operation of their respective fleets, through the gradual use of cleaner and more sustainable fuels and technologies [40].

More contemporary, Municipal Law No. 16,802/2018[41] specified annual schedules with the targets for cutting pollutants that will be required by bus concessionaires over 20 years. The Law deals with the use of less polluting energy sources and less greenhouse gas generators in the urban public transport fleet of the Municipality of São Paulo. The trend is that most of the current fleet of diesel buses (14,400 units) will be replaced by electric and hybrid buses or powered by other renewable energy technologies [42].

In September 2019, the transport authority of São Paulo (SPTrans), the public transport operator in the city, published a tender for the operation of around 14,000 urban buses. The grants set ambitious targets to reduce greenhouse gas emissions from 2028 to 2038. The bidding process is in line with the city of São Paulo's goals. Also in 2019, a pilot project by SPTrans incorporated 15 electric buses with the battery manufactured by the Chinese automaker BYD, which represents the largest fleet of this type in Brazil [43].

In the most recent policy of the city, under the government of Mayor João Doria (2017-2018), large investments in urban transport infrastructure were announced for the construction of Bus Rapid Transit (BRT) and Bus Rapid Service (BRS) São Paulo. Although considered low-cost when compared to the subway, these projects show little significant improvements both from the point of view of urban mobility and the reduction of atmospheric pollution[44].

It is estimated that 11,008 electric buses will start running in Brazil by 2030. An investment of around US$ 3.6 billion, with São Paulo, Rio de Janeiro, and Salvador accounting for 84% of the market[45]. Most public transport service contracts are for a period of more than 15 years, through public tenders. To make the installation of electric buses viable, the new tenders and contracts need to provide for business models that support the implementation of new technologies in the public transport system, by including financial and technological incentives and guarantees[46].

Despite the legal measures created by the municipality of São Paulo to thrive the electrification of the fleet and achieve GHG reduction for the next years, there are some barriers to the adoption of electric buses such as lack of operational knowledge, technical limitations, inflexible procurement practices, non-scalable financing, institutional limitations, and stagnant

[40] BERMUDEZ, Tatiana; CONSONI, Flávia L. op. *quote,* p.8.
[41] Law No 16.802 of July 27, 2018. Available at: <https://www.al.sp.gov.br/repositorio/legislacao/lei/2018/lei-16802-27.07.2018.html>. Accessed on August 1, 2023.
[42] PASCOAL, ET; FURTADO, AE; FERREIRA FILHO, Valter Silva, op. *quote,* p.9.
[43]Inter-American Development Bank (IDB) and Ministry of Regional Development (MDR). Transition to Zero Emission Urban Mobility Brasília: Editora IABS, 2021, p. 48. Available at:< https://www.gov.br/mdr/pt-br/assuntos/mobilidade-e-servicos-urbanos/CRTransioZeroEmissosemconsideraes.pdf >. Accessed on August 20, 2023.
[44] PEREIRA JR, Amaro Olimpio, op. *quote,* p. 121.
[45] CABRINI, Ju. By 2030, Brazil will have more than 11,000 electric buses. Estadão, February, 2023. Available at:<https://mobilidade.estadao.com.br/inovacao/onibus-eletrico/>. Accessed on September 19, 2023.
[46] GUIDE TO ELECTROMOBILITY Guidelines for structuring projects in public transportation. Ministry of Regional Development (MDR) with the Inter-American Development Bank (IDB) and WRI Brazil. February, 2022, p. 22. Available at:<https://www.gov.br/cidades/pt-br/central-de-conteudos/publicacoes/mobilidade-urbana/Guia_Eletromobilidade.pdf>. Accessed on September 19, 2023.

pilot projects[47]. Therefore, to make electric buses viable, Brazil and São Paulo need to take a global view of their implementation. Finally, for the implementation of electric buses and trolleybus fleets according to Brazilian federal rules and the legislation of São Paulo, it is necessary to also bear in mind important tools for the effective operation of electric collective transportation, such as to analyze the type of battery, charging method, diagnosis of the public bus transport system, emissions analysis, market study, and testing protocols.

2.2 CHINA AND SHENZHEN

A. CHINESE FEDERAL LEGISLATION

China Ministry of Science & Technology of China established the national High Technology Research and Development Program (or 863 Program) in 2001.This program involved the main research institutes, manufactories, and universities related to the automotive industry in China[48]. It certainly reveals the Chinese political choice to combine education, science and technology, government incentives, and private sector – a long term success formula to develop a leading sector.

In 2005, China enacted a new Renewable Energy Law supporting the renewable industry, in addition to a series of regulations and requirements for its suppliers to operate in the electricity grid, such as financial incentives, research and development subsidies and fees preferred for projects with renewable matrices[49]. This Law was an important achievement in China's commitment to electric transportation as a way of reducing fuel dependency and helping to preserve the environment.

In 2009, the central government of China adopted the Program Thousands of Vehicles, Tens of Cities (TVTC) featuring some subsidy policies with monetary incentives to encourage the electric bus fleet and selected Shenzhen, as one of the 10 pilot cities[50]. The (TVTC) is China's first step to move from the laboratory stage to market deployment. This program was implemented with city-based pilot projects focused on the use of electric vehicles in public transport[51]. This project was achieved through a combination of Chinese government funding and subsidies from the Shenzhen Municipal Finance Commission and was also favored by economic service models[52]. Financial subsidies were provided to encourage EV procurement including: (1) direct payments to approved auto manufacturers and (2) subsidy levels determined based on the rate at which petrol can be saved.

The development and circulation of electric buses received a kick-off from the Chinese Federal Government through tax incentives. In June 2012, the Ministry of Finance responsible for formulating fiscal and taxation policies, issued the Notice on the Purchasing of electric buses

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[47] Tumi E-BUS Mission. This international coalition supports 20 cities to become leaders in electric buses and promotes exchanges that will benefit hundreds of other cities around the world. WRI BRAZIL. Available at:<https://www.wribrasil.org.br/projetos/tumi-missao-onibus-eletricos>. Accessed on September 19, 2023.

[48] CONSULATE GENERAL OF THE PEOPLE'S REPUBLIC OF CHINA IN NEW YORK. National High-tech R&D Program (863 Program). Available at:<http://newyork.china-consulate.gov.cn/eng/kjsw/std/201603/t20160305_5520599.htm>. Accessed on September 24, 2023.

[49] PEREIRA JR, Amaro Olimpio, op. *quote,* p. 116.

[50] The main cities are Pequim, Xangai, Shenzhen, Hangzhou, and Beijing.

[51] LI, Ying; ZHAN, Changjie; DE JONG, Martin; LUKSZO, Zofia. Business innovation and government regulation for the promotion of electric vehicle use: lessons from Shenzhen, China. Journal of Cleaner Production , v. 134, 2016, p. 372.

[52] BRITO ANTUNES, Verônica Nascimento; DOS SANTOS SILVA, Jacilene; DO CARMO HERMIDA, Camila., op. *quote,* p. 250.

for Urban Public Transport Enterprises exempted from Vehicle Purchasing Tax. The tax exemption represented a considerable amount of money to stimulate the replacement of the old fleet with an electric one and this policy lasted from January 1st, 2016, to December 31st, 2020. The Ministry of Industry and Information Technology released the Safety Technical Conditions for Electric Buses, which put higher requirements on the diffusion of batteries to ensure safe operation. At that time electric buses were already considered a reality, which was why there was so much concern about the regulation and safety of electric buses.

In 2012, China adopted the Energy Conservation and New Energy Vehicle Industry Development Plan drawn up for the period 2012-2020. It created a strategic program for the development of electric vehicles in China. The program emphasized China's electric strategic orientation to transform the automobile industry while promoting the country's industrialization[53]. In this sense, it is important to highlight that this plan is an example of the clear orientation of the Chinese government in intrinsically combining sustainability and industrialization because both purposes thrive together.

According to Planet Smart city[54] (2018), China is the country with the largest number of smart cities in the world, with around 500 pilot projects. These projects began in 2012 when the Chinese government started the national development program for smart cities, seeking to encourage the use of the most current technological innovations (artificial intelligence, internet of things, among others), to favor the flow of traffic, improve employment and make public buildings more efficient in terms of energy. The city of Shenzhen is a great example of a smart city serving as a development model with a strong presence in advanced technologies and sustainability [55].

Another initiative announced by the federal government, in 2015, is the Made in China 2025 (MiC 25) development policy, which oriented Chinese factories to manufacture technological products, aiming for innovation, quality with a mastery of low-carbon technologies, car intelligence, lightweight materials, and better drive batteries[56].China seeks to end its reliance on international technology and upgrade its industrial capability and smart manufacturing by ensuring that innovation, product quality, efficiency, and integration drive manufacturing[57]. This policy can be seen in the government's incentives for the manufacture of electric buses, in which Chinese manufacturers are developing all the technology, from the battery to the structure of the bus.

China organizes its public policy priorities in five-year plans and the issue of electrifying the public transport fleet has been included in the latest five-year plans. The 13th Five-Year Plan (2016-2020) sets out China's most important national strategies for the five years following its implementation. Among the planned objectives is the improvement of the electric vehicle industry in an integrated way, the improvement of batteries and charging

[53] BISPO, Scarlett Queen Almeida; CECHIN, Alícia. Electric vehicles: how is China preparing to become the world's biggest power in the segment?. Brasilia, IPEA, August, 2023, p. 50.
[54] "Smart cities" are defined as those that promote energy efficiency, quality of life and environmental, social and economic sustainability. They attempt to satisfy population demands without compromising socio-economic development and environmental preservation.
[55] BRITO ANTUNES, Verônica Nascimento; DOS SANTOS SILVA, Jacilene; DO CARMO HERMIDA, Camila, op. *quote,* p. 247.
[56] BISPO, Scarlett Queen Almeida; CECHIN, Alícia. Electric vehicles: how is China preparing to become the world's biggest power in the segment?. Brasília: IPEA, August, 2023, p. 59.
[57] Made in China 2025. Institute for Security & Development Policy. June, 2018, p. 3.

infrastructure, with the aim of building a globally competitive energy battery industrial chain[58]. Succeeding this guideline, the 14th Five-Year Plan (2021-2025) provided the construction of an ecological Chinese civilization, reassuring the purpose of reducing carbon to achieve zero emissions targets, promoting the green transformation of economic and social development[59].

Regarding tax incentives, on April 1, 2018, China announced the official application of the parallel management method of average fuel consumption and electric power vehicle for passenger vehicle enterprises, which is known as "credit policy double"[60]. The double credit policy is a way of referring to the Parallel Management Regulation for Average Fuel Consumption by Companies and credits for new energy vehicles. Manufacturers are required by the Corporate Average Fuel Consumption (CAFC) credit requirements to manufacture fuel-efficient vehicles, and to meet the credit requirements for electric and hybrid vehicles, they must produce these vehicles. If manufacturers exceed established targets, they get extra credits; noncompliance, however, results in deficits[61].

In September 2020, the Central Government pledged a “dual carbon target” (carbon peak before 2030 and carbon neutrality before 2060). In fact, authorities have stepped up measures for decarbonizing electricity generation and transport since the 2010s spanning across replacing dirtier fossil fuels with low carbon and renewable energy, popularizing EV and decarbonizing water and air transport activities[62]. In 2020, with the publication of the New Energy Vehicle Industrial Development Plan for 2021 to 2035 by the Central Government announced a new round of subsidies so efforts to be expanded with coordination between the various players (companies in the sector, universities, research centers), now focusing on assembly and integration technologies for vehicles and systems, and on improving manufacturing technologies for key components with lower costs and higher performance, such as automotive chips, operating and general control systems, advanced motors and batteries, and fast charging systems.

The Chinese government's strategies and policies have shown positive results towards development of domestic industry combined with gas reduction targets. A great example of this coordination was the development of the BYD manufacturer, encouraged by the Thousands of Vehicles, Tens of Cities (TVTC) program.

BYD Ltd. is the largest local electric vehicle manufacturer in Shenzhen, specializing in IT, automobile, and new energy technologies. BYD's products include passenger vehicles, buses, cabs, logistics, sanitation, and official cars, and it is also developing for the foreign market, occupying 90% of the electric bus market in the United States in 2019. BYD's products include passenger vehicles, buses, cabs, logistics, sanitation, and official cars, and it is also

[58] BISPO, Scarlett Queen Almeida; CECHIN, Alícia. Electric vehicles: how is China preparing to become the world's biggest power in the segment?. Brasília: IPEA, August, 2023, p.60.
[59] BISPO, Scarlett Queen Almeida; CECHIN, Alícia. op. *cit,* p.66
[60]YANG, Dong-xiao. MENG, Juan. YANG, Lei. NIE, Pun-yan. WU, Qian-ge. Dual-Credit Policy of new energy automobiles in China: Inhibiting scale or intermediary of innovation?. Energy Strategy Reviews, v. 43, 2022, p.2.
[61] CHEN, Zhinan.; HE, Hui. How will the dual-credit policy help China boost new energy vehicle growth?. International Council on Clean Transportation. 2022, p.1-2.
[62] Decarbonization strategy in Shenzhen and Singapore. Research Office Shenzhen and Singapore Legislative Council Secretariat, 2022, p.9. Available at:<https://www.legco.gov.hk/research-publications/english/2022in03-decarbonization-strategy-in-shenzhen-and-singapore-20220706-e.pdf#page=11&zoom=100,0,921>.Access in September 2023.

developing for the foreign market, occupying 90% of the electric bus market in the United States in 2019[63].

The company has received the benefit of Chinese legislation to expand its operations in the manufacture of electric buses and electric cars. BYD has become the most innovative and independent domestic car brand and leads the development of electric vehicle manufacturing in China[64]. The Thousands of Vehicles, Tens of Cities (TVTC) Program has encouraged the Chinese government to invest more in the development of the electric transport industry and companies such as BYD (the largest Chinese electric vehicle producer), located in Shenzhen, have benefited by selling electric buses to 300 cities in other countries, such as Japan, Europe, the USA, and others.

In sum, all these policies and incentives are made by the Chinese federal government to foster environmental sustainability in China, and it has been reassured in the new Five-Year Plan, the cornerstone of the Chinese legislation. The electrification of vehicles is undoubtedly one of the main tools of China for it, which has been more precisely addressed by its municipalities and their legal framework. All the policies indicate one important issue: to China, fostering sustainability and protecting the environment are as important as industrialization, and both may help each other to evolve together.

B. MUNICIPAL LEGISLATION

The Shenzhen municipal government has taken a strong lead in designing high-level institutional arrangements to promote the expansion of EVs and coordinate the roles of different stakeholders to limit the market for conventional vehicles and give priority to electric ones[65]. Shenzhen is a reference city in the implementation of autonomous electric buses, investing in operations and charging infrastructure. It adopted a type of bus in which a five-hour charge supports 250 kilometers of driving, sustaining almost a whole day of operation [66]. The early phase of electric bus adoption faced challenges, including the need for large capital investments, the mismatch between vehicle and battery life, and insufficient charging facilities.

The Regulations on the Administration of Passenger Transport for City Buses and Trams (Decree No. 5, issued in 2017 by the Minister of Transport) is a franchise model to allow companies operating charging facilities, bus, and battery production companies to enable the production of electric buses and electric cars[67]. The local government has managed to develop charging infrastructure and promote the local electric vehicle market[68]. In the bus field, the

[63] BISPO, Scarlett Queen Almeida; CECHIN, Alícia. op. *quote,* p.43

[64] LI, Ying; ZHAN, Changjie; DE JONG, Martin; LUKSZO, Zofia. op. *cit,* p.377.

[65] LI, Mengnan; YE, Haiyi; LIAO, Xiawei; JI, Junping; MA, Xiaoming. How Shenzhen, China pioneered the widespread adoption of electric vehicles in a major city: Implications for global implementation. Wiley Interdisciplinary Reviews: Energy and Environment, v. 9, no. 4, 2020, p.12.

[66] GRAY, A. Shenzhen just made all its buses electric, and taxis are next. 02 Nov. 2018. Available at:< https://www.weforum.org/agenda/2018/11/shenzhen-just-made-all-its-buses-electric-and-taxis-are-next>. Access in September 2023.

[67] LUMIAO, Li; ZHANHUI, Yao. New Energy Buses in China Overview on Policies and Impacts. China Automotive Technology and Research Center Co, Ltd CATARC. Published by: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Beijing, 2020, p.7.

[68] LI, Ying; ZHAN, Changjie; DE JONG, Martin; LUKSZO, Zofia. Business innovation and government regulation for the promotion of electric vehicle use: lessons from Shenzhen, China. Journal of Cleaner Production, v. 134, 2016, p.6.

Shenzhen Government endows the franchise rights to the charging facility operators, thus enabling them to step into the industrial chain of new energy vehicles and forming the "Shenzhen model" characterized by "financial leasing, separation of vehicles and battery, and integration of charging and maintaining"[69].

Shenzhen issued the "Shenzhen Transport Sector Energy Saving Regulation" and the "Shenzhen Energy Saving and New Energy Vehicle Regulation" at the start of its electric vehicle development, both setting out long-term goals and targets for Shenzhen EV development[70]. In terms of administrative arrangement, the Shenzhen Municipal Development and Reform Commission is responsible for overall coordination, and the Shenzhen Municipal Transport Commission is specifically tasked with promoting the development of the EV market, with the support of several different government agencies [71].

To achieve the "dual carbon target", a Chinese national policy announced in 2020 by the city of Shenzhen, it is expected to reduce carbon intensity by a further 18% during 2020 to 2025 and attain carbon peak before 2025[72]. The policies are geared towards replacing coal and oil in power plants in Shenzhen, promoting generation and import of electricity from renewable energy, promoting new energy and electric vehicles, decarbonizing maritime and aviation sectors and emission caps and permit trading for heavy polluters.

In 2017 the city reached the milestone of 100% of its bus fleet becoming electrified. Electrification began with the TVTC program in 2009. Shenzhen's municipal franchise model initiative, created in the city to enable the production, operation, and cost reduction of electric buses, resulted in the global electrification of the city's fleet.

The Municipal initiative in Shenzhen has also shown positive results in terms of bus circulation on a larger scale and in a shorter period of time. A great example of success is the Potevio New Energy Co Ltd. It is an EV charging company, founded in 2010, and it was one of the first state-owned enterprises in China focused on the construction and operation of charging networks for electric vehicles. Currently, the company operates 50,000 charging points in over 50 cities in China. In 2010, the Shenzhen government and Potevio Ltd. agreed to jointly accelerate the promotion of electric buses in Shenzhen.

The bus companies, Potevio, financial leasing companies, and electric buses production companies have been cooperating to achieve the operation of electric buses, forming a "financial leasing, separation of vehicles and battery, and integration of charging and maintaining" model[73]. Basically, the companies sign a contract to buy and sell the electric buses. Potevio separates the leasing of batteries from vehicle bodies to the Shenzhen Bus Group. For the leasing of EV bodies, Potevio offers the Shenzhen Bus Group an eight-year lease for EV bodies. Shenzhen Bus Group Ltd. is an electric bus manufacturing company founded in Shenzhen, founded in 1975 is a domestic industry that provides most buses and public

[69] ZHANG, Qihang. Analysis of "Shenzhen Model" for New Energy Vehicle Promotion in Public Transportation. In: IOP Conference Series: Earth and Environmental Science. IOP Publishing, 2019. p.2.
[70] LI, Mengnan; YE, Haiyi; LIAO, Xiawei; JI, Junping; MA, Xiaoming., op. *quote,* p.4.
[71] LI, Mengnan; YE, Haiyi; LIAO, Xiawei; JI, Junping; MA, Xiaoming., op. *quote,* p. 4.
[72] JIANG, Qi; YIN, Zhigang. The Optimal Path for China to Achieve the "Dual Carbon" Target from the Perspective of Energy Structure Optimization. School of Mining, Liaoning Technical University, June, 2023, p.1.
[73] ZHANG, Qihang. op. quote, p.2.

transportation services to citizens of Shenzhen. Its largest shareholder (55%) is the Shenzhen Municipal Commission for Supervision and Administration of State Assets (SASAC)[74].

The company initiative works as the leasing company pays the purchase price of the bus (without the battery), with a deduction for the tax subsidies offered by the city of Shenzhen. The battery is purchased or leased from the charging facility operator Shenzhen Lineng, which receives financial subsidies from both the central government and the municipality of Shenzhen and the buses are leased and Shenzhen Lineng provides a guarantee to the leasing company. The "Shenzhen Model" adopted by the city ends up making it possible for electric buses to circulate, since the cost is lower and there is a significant reduction in the financial expenses of the bus companies.

The process of full electrification took about 8 years and the fact that electric vehicle manufacturing companies such as Potevio and BYD Bus Group grew in parallel as a result of federal legislation and incentives that influenced the result.

The municipality of Shenzhen has extended its intention to decarbonize to achieve the goals of the Federal Government including the electrification of 100% of the taxi fleet and is committed to promoting the increase of electric vehicles especially with tax incentives and the population. Thus, Shenzhen shows that the decarbonization policy in combination with the implementation of a long-term policy to adopt electric buses could be a great achievement for the cities.

3. THE BRAZILIAN CHALLENGES IN THE ELECTRIFICATION ON BUS FLEETS

Concerning challenges to the electrification of bus fleets in Brazil and China, on the one hand, Brazil has the challenge to implement electric buses in its infrastructure that connect the country's major economic centers. On the other hand, the Chinese still need to increase their energy grid with renewable energies. While in Brazil the problem of dependence on the road network, local infrastructure, such as roads, is reflected, above all, in terms of increased costs and loss of competitiveness, in China, due to the larger dimensions of its economy and infrastructure, the struggle against pollution and the search for efficiency energy are more challenging than in Brazil[75].

There is some production of electric buses in Brazil, but it is still too incipient for the demand of a continental country, and of the city of São Paulo, considering that it, along with its metropolitan area, has 20 million habitants. In July of 2023 it was announced that Brazil will have five electric bus manufacturing companies in the coming years: two from Higer Bus, two from BYD and the recently opened Eletra plant in São Bernardo do Campo (SP)[76]. The imports of electrical buses, including the chassis and batteries could be an alternative. However, importing high value-added goods is expensive and time-consuming. There is another challenge

[74] LI, Ying; ZHAN, Changjie; DE JONG, Martin; LUKSZO, Zofia. Business innovation and government regulation for the promotion of electric vehicle use: lessons from Shenzhen, China. Journal of Cleaner Production, v. 134, 2016, p. 377.

[75] PEREIRA JR, Amaro Olimpio, op. *quote,* p. 122.

[76] MOBILIZE BRASIL. Brazil will have another electric bus factory. July, 2023. Available at: <https://www.mobilize.org.br/noticias/13708/brasil-tera-mais-uma-fabrica-de-onibus-eletricos.html#:~:text=Com%20o%20an%C3%BAncio%20de%20hoje,Bernardo%20do%20Campo%20(SP)>. Accessed on September 2023.

connected not only to the factoring of the bus itself, but also its auto parts of the bus components. The new value chain of sustainable vehicles implies that vehicle manufacturers will have to cooperate with their production line to other players to coordinate the process, to attend to the demand, and to comply with its contracts. The battery manufacturers, for example, must be in full coordination with the chassis manufacturers, otherwise the vehicle will not be able to operate. Thus, all these players need to be interconnected for the development of electric vehicles to succeed in terms of production and to provide electrical buses to countries and cities[77].

Larger loads of energy would not be a problem for Brazil as it is in China, because it can already support the increase in demand for electricity. For example, locally, even if there is an additional increase, according to São Paulo Power and Light Company (CPFL) data, the city will be able to manage and will not run out of energy, according to a simulation. São Paulo Power and Light Company (CPFL) also carried out simulations of the penetration of electric vehicles in its concession area. Considering a share in the total vehicle fleet of 4% to 10% by 2030, the additional electricity consumption caused by these vehicles would increase from 0.6% to 1.6%, which would be fully manageable by the Brazilian electrical system, which already is used to dealing with much larger load swings than predicted in the simulations [78].

The insertion of EVs, mainly with external energy supply, represents an important change in the current technological model based on road transport[79]. According to Amaro Olimpio Pereira Junior[80] the road base causes the level of atmospheric pollution to be high in large cities, caused by the burning of fuels, in addition to the increasing problems of urban mobility [81]. In this context, grid connected EVs, such as light rail vehicles and trolleybuses, are considered a mature technology in which eventual innovations will be incremental.

In this sense, the Environmental Company of the State of São Paulo (CETESB), the agency responsible for controlling, inspecting, monitoring, and licensing activities that generate dirt, encourages the renewal of fleets and the use of vehicles with less polluting impact such as electric vehicles, the expansion of structural networks and the creation of a differentiated electricity tariff for public transport, and a tariff policy that favors alternatives with low polluting impact.

However, it is impossible to discuss the electrification of the bus fleet without dealing with the waste generated by this new technology. Patrícia Iglesias, former president of CETESB, points out that the regulation of electronic waste in Brazil is still timid. It points out that the Technological Waste Law of the State of São Paulo, Law 13,576, of 2009, uses the expression "technological waste", defined in its art. 2.º as "domestic appliances and electronic equipment and components for domestic, industrial, commercial use or in the service sector that are in disuse and subject to final disposal, such as: III – energy accumulators (batteries and cells). The

[77] DELGADO, Fernanda. COSTA, José Evaldo Geraldo. FEBRARO, Julia. DA SILVA, Tatiana Bruce., op. *quote,* p. 50.
[78] DELGADO, Fernanda. COSTA, José Evaldo Geraldo. FEBRARO, Julia. DA SILVA, Tatiana Bruce., op. *quote,* p. 79
[79] PASCOAL, ET; FURTADO, AE; FERREIRA FILHO, V. S., op. *cit,* p.11.
[80] Professor of the Energy Planning Program of the Coordination of Graduate Engineering Programs of the Federal University of Rio de Janeiro (PPE /COPPE/UFRJ). Federal University of Rio de Janeiro (PPE /COPPE/UFRJ). Visiting researcher at Ipea's National Development Research Program (PNPD). Ipea. E-mail: <amaro@ppe.ufrj.br>.
[81] PEREIRA JR, Amaro Olimpio, op. *quote,* p. 121.

Law established that the responsibility for the destination of technological waste will be jointly and severally between the companies that produce, sell, or import electronic products and components.

The study "The path to decarbonization of the automotive sector in Brazil", carried out by the Boston Consulting Group (BCG) in partnership with the National Association of Automotive Vehicle Manufacturers (ANFAVEA), shows, in a first scenario, that the hybrid and electric car market in Brazil will have a participation of 12% in 2030 and 32% in 2035, considering a scenario in which the country still has lower levels of electrification and incentives. In the second scenario presented, in which the country invests in electrification, including production and purchase incentives, the share of hybrid and electric vehicles rises to a level of 22% in 2030 and 62% % in 2035 [82]. It means that public policies have a central role in the maximization of the production, that will attend to demand created also by legal means, considering the decarbonization commitments created by the federal and local governments to achieve the Paris agreement goals and to foster environmental sustainability.

Moreover, the issue of fewer local companies factoring electrical buses in Brazil is a great obstacle to fostering it in the country and to municipalities to fulfill their commitments. An alternative in the next few years, as it was already mentioned, could be import it. However, one question that arises is about the environmental responsibility of these foreign manufactures. According to Law 13,576, of 2009 from the State of São Paulo, foreign manufacturers would apparently also be jointly and severally liable with the seller and the importer by electronic waste, including batteries. It is important to question if, in the future, if producers and importers of electrical buses and batteries could be issued by the governments (from the State of São Paulo or other regions) in terms of civil responsibility regarding the destination of technological waste.

4. LEARNINGS FROM BRAZIL BASED ON THE CHINESE EXPERIENCE

Finally, it is crucial to mention that the encouragement for cooperation between China and Brazil and the internalization of new production techniques is already on course with the presence of Chinese manufacturers in Brazil. There is a BYD plant in Campinas and a new plant in Bahia, which will increase local production. BYD is an example of an electric vehicle factory, including electric buses, that has succeeded in China. The federal and municipal public policies such as the creation of charging infrastructure, a strong internal production chain, with a system of "financial leasing", separating vehicles and batteries, and integrating charging and maintenance are largely responsible for the success of 100% electric buses in Shenzhen.

In São Paulo as well as in Shenzhen bus recharges take place in an average period of 14 hours, lasting between two and four hours [83]. The next step for both cities is to foster technological innovation and efficiency in the use of inputs and reduce this time lapse for recharging, but sustainably. It would reassure that energy efficiency and renewable energies are now on the agenda of government strategies[84].

[82] OSHIMA, Eduardo Issamu. Barriers and facilitators for the adoption of electric cars in Brazil. Dissertation, Fundação Getulio Vargas, School of Business Administration of São Paulo, 2023, p. 11-12.
[83] BRITO ANTUNES, Verônica Nascimento; DOS SANTOS SILVA, Jacilene; DO CARMO HERMIDA, Camila, op. *quote,* pp 253.
[84] PEREIRA JR, Amaro Olimpio, op. *quote,* p. 107.

The Chinese legal devices allied with the five-year plans reveal an instrumentality of the policy of transport electrification. However, China still faces environmental challenges linked to the disposal, recycling, and reuse of vehicle components, especially batteries. That is, the waste management of electrical devices derived from electric buses is still an issue that has been dealt with in China and will have to be addressed soon in Brazil.

China also faces some challenges in building a domestic battery production chain in which the current gaps are filled, for example through investments in the refining and processing of raw materials, in the manufacturing and recycling of batteries[85]. The government emphasizes the coordination of efforts to build an efficient battery recycling system to recycling system to reduce pressure on the reserves of key strategic minerals[86]. Brazil, which intends to implement and expand its e-bus fleet, should observe Chinese strategies for battery disposal and recycling as a way of reducing any externalities throughout the production chain. The development of specific legislation for the disposal of bus batteries and electric vehicles in general can help the country create a highly connected infrastructure.

In China, in 2012, the Chinese government started the National Smart Cities Development Program,[87] seeking to encourage the use of high technology resources in the management of urban space. Faced with the problem of the emission of pollutants into the atmosphere and the international commitments adopted, the city of Shenzhen was somehow forced to take measures to slow down and reduce environmental impacts. The electrification of 100% of the buses was a measure that combined the development of a potential technology with the result of alleviating a latent problem.

The Brazilian Federal Law No. 12.305/2010, known as the National Solid Waste Policy, provides for the integrated management and management of solid waste, including hazardous waste, to the responsibilities of generators and public authorities through reverse logistics. However, this Law does not concern the electric vehicle battery market. There is a latent question regarding the lifetime and disposal of batteries, a discussion that is still in formation and will need regulation to avoid waves of solid waste generation without post-treatment [88].

Brazil and China have committed themselves to carbon neutrality and are two central countries for discussions on combating global warming. Brazil has important elements such as land availability and vast water resources, which China does not have in abundance. At the same time, China is a leader in the production of electric cars [89], which could have potential for expanding manufacturing to other developing countries such as Brazil, helping the country to

[85] FERREIRA DA CRUZ, Robson. Industrial policies for the electric bus production chain: lessons learned and experiences based on international benchmarking in the United States, China, Mexico and the Netherlands. United Nations publication LC/TS. Santiago, 2023, p. 29.
[86] FERREIRA DA CRUZ, Robson., op. *quote,* p.31.
[87] A smart city is one that makes use of technological innovations to benefit the lives of individuals, performing urban services in an efficient way, thus improving the quality of life of the population, and modifying the connection that involves local institutions, companies and individuals.
[88] PROMOB-E. Norms and regulations for mobility for Electric Vehicles in the framework of Brazil. Rio de Janeiro, July 2020, p. 1-62. Available at: < https://www.pnme.org.br/biblioteca/normas-e-regulamentos-para-a-mobilidade-eletrica-no-enquadramento-do-brasil/ >. p.56. Accessed on August 17, 2023.
[89]BRAZILIAN CENTER FOR INTERNATIONAL RELATIONS. China's XIV Five-Year Plan Prospects for Sino-Brazilian Cooperation. Available at:< https://www.cebri.org/media/documentos/arquivos/XIVPlanoQuinquenalDaChinaPersp.pdf >. Accessed on August 22, 2023.

achieve its commitments with the Paris Agreement and the cities like São Paulo, to make possible the electrification of their bus fleets.

São Paulo is part of a pilot project by SPTrans that has electric buses that are operating on lines in the southern part of the city. The city of São Paulo is starting to operate 50 new 100% battery electric buses in September of 2023 with the participation of the national industry, the first step in a plan to reach 2,600 units by the end of 2024. São Paulo's total fleet is around 13,000 buses and until now only 18 were electric, running in pilot projects. In the model implemented in São Paulo, it is up to the concession operator to choose the bus manufacturer, the charging technology and even the electricity supplier, since the new volume of electric charge makes bus companies eligible to enter the free energy market[90].

The Chinese experience, in the city of Shenzhen for instance, can be very valuable for Brazil and for the city of São Paulo if it is observed. China has a lot of subsidies from the federal government and municipal strategy plans for sustainable urban development. The franchise model, with development bank loans, and a long-term policy have also been largely responsible for the development of high-end local manufacturers, and it could be observed by the Brazilian government.

5.CONCLUSIONS

The next step towards environmental protection is to reorient economic sectors to produce sustainable goods looking at urban transportation. It is connected not only to renewable energies, but also clean air, the reduction of GHG emissions and the contention of the greenhouse effect, and a more well-being of citizens in urban centers.

Paris Agreement and other international agreements have also played an important role in changing the Chinese mentality to achieve the global environmental goals. Brazil, as a signatory to these international conventions, is already concerned about and aligned with the global objectives of reducing pollutants, as already observed in national and municipal legislation. All these laws need to be coordinated with the objective, which must be achieved through a well-structured internal plan.

The commitments on reduction of GHG assumed by China and Brazil, as well as Shenzhen and São Paulo symbolize the current world movement towards urban decarbonization, and a great tool to better achieve it is to electrify urban bus fleets.

China invested in the expansion of electrical vehicle and electrical battery factories in its territory. Brazil has started a\this process to follow the same path. Undoubtedly, electrical vehicles plants in the Brazilian territory will be important to diminish transition costs with imports and to accelerate the process of decarbonization. It would be also important to overcome possible supply problems in times of crisis or resource crunches. Battery charging, cost, lifetime and driving autonomy are the main issues under debate and the greatest difficulties for the penetration of electric vehicles in the market, as well as the charging infrastructure, which is not properly available [91].

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[90] PRIETO, Carlos. São Paulo starts operating first batch of 50 electric buses It's the first step in a plan to reach 2,600 vehicles by the end of 2024. September, 2023, Economic Value. Available at:<https://valor.globo.com/google/amp/empresas/noticia/2023/09/18/so-paulo-comea-operar-primeiro-lote-de-50-nibus-eltricos.ghtml>. Accessed on September 22, 2023.

[91] TEIXEIRA, Ana Carolina Rodrigues et al. A review on electric vehicles and their interaction with smart grids: the case of Brazil. Clean Technologies and Environmental Policy, v. 17, 2015, p. 848.

The legal measures adopted by China and the city of Shenzhen based on short- and long-term plans are success factors in the uptake of electric buses. The autonomy that the Shenzhen government gained by stimulating a cost-cutting policy in the production of the entire bus infrastructure made it possible for the combustion-powered fleet to be replaced at a similar cost to a combustion-powered bus. The Five-Year Plan is a cornerstone with achievable goals, a mandatory framework to foster full collaboration between all the players involved in the project, such as the government, manufacturers, banks, companies for the implementation of the charging structure, and battery suppliers.

The TVTC Program was the kick-off to encourage Shenzhen and other Chinese cities to promote an increase in the electric bus fleet to achieve the national goal of reducing gas emissions and lowering pollution levels. Subsidy policies with monetary incentives were responsible for instrumentalizing the entire plan. Brazil can and must learn with China to develop a strong national policy in coordination with individualized plans for each Brazilian city, taking into account the different structures present in cities.

It expects that there will be an increase in the circulation of electric buses in Brazil in the next few years. The future of the market is promising, and most likely China will be dominating the battery production market, which may result in a certain dependence on this raw material over the years. It seems that the problem of "disposal" and environmental treatment of electric vehicles and their batteries is a serious problem and a common challenge both for China and Brazil. It is necessary for systemic planning for the lifespan of electrified public transport and the treatment or reverse logistics of the batteries.

Finally, the discussion of the implementation of the electric bus fleet is extremely important for the quality of urban mobility, especially in large cities. This implementation is linked to the concept of Smart City and should help to achieve Brazil's targets for reducing gas emissions, as China has already done. Considering the international commitments assumed by Brazil and China with sustainability, reduction of the emission of polluting gasses, and concern for the environment, it is necessary to certify that the components and resources necessary to move electric buses will honor not only providing renewable electric energy, but also deal with the responsible disposal of solid waste to keep true the green purpose.

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CONTINUITIES AND CHANGES: TRACING THE EVOLUTION OF BRAZIL-CHINA RELATIONS FROM THE CARDOSO ERA TO LULA'S THIRD TERM (1995-2023)

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ABSTRACT: This paper examines the evolution of Brazil's foreign policy towards China from the era of President Fernando Henrique Cardoso (1995-2002) through to President Luiz Inácio Lula da Silva's third term (2022-present). It explores the varying dynamics of this bilateral relationship under different Brazilian administrations, highlighting the key aspects and shifts in policy. The Cardoso era initiated Brazil's engagement with China, focusing on globalization and technological cooperation. The Lula administration (2003-2011) saw the rise of the BRICS nations and a diversified foreign policy, intensifying Brazil-China relations amidst complex political and trade challenges. Under President Dilma Rousseff (2011-2016), the focus shifted towards science, technology, and culture, with a nuanced approach to China. Despite industrial challenges, Michel Temer's presidency (2016-2018) marked a return to economic strengthening in China. The Bolsonaro era (2019-2022) was characterized by ideological alignment with the United States, affecting Brazil-China relations with political tensions and economic pragmatism, especially during the COVID-19 pandemic. Under Lula's third term (2022-present), it has seen a reinvigoration and intensification of bilateral cooperation, enhancing economic, environmental, and technological partnerships. The paper concludes by highlighting the resilience and institutional consistency in Brazil-China relations, which have remained crucial for continued bilateral cooperation, irrespective of the changing political landscape in Brazil.

Keywords: Brazil-China Relations; Foreign Policy; Bilateral Cooperation; Political Dynamics; Economic Engagement

1. Policy and Brazil-China Relations / Fernando Henrique Cardoso (1995 – 2002)

This essay seeks to critically examine the trajectory of Brazilian foreign policy towards China, traversing the tenures of Presidents Fernando Henrique Cardoso (FHC), Luiz Inácio Lula da Silva (Lula) in both his earlier and current terms, Dilma Rousseff (Dilma), Michel Temer (Temer), and Jair Bolsonaro (Bolsonaro). It offers a narrative that tries to capture the complexities and strategic recalibrations underpinning Brazil's engagement with China—an ascendant global power. The analysis not only delves into the economic, diplomatic, and

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political dimensions that have shaped this partnership but also considers the influence of domestic and international vicissitudes on this crucial bilateral relationship.

Based on Mariano (2007), the ascensions of Presidents Fernando Collor in 1991, Itamar Franco in 1992, and Fernando Henrique Cardoso in 1995 marked pivotal shifts in Brazil's geopolitical stance amid an evolving global landscape. In 1991, President Collor assumed office at the dawn of a post-Cold War era characterized by the dissolution of the bipolar ideological divide that had previously dominated global relations. This transition fostered a new world order where international organizations and inter-state cooperation emerged as cornerstones of international diplomacy.

The 1990s witnessed the burgeoning reality of globalization, a transformative process that significantly increased the interconnectivity of individuals, institutions, and corporations on an unprecedented scale. (Maccgrew, 2008). Concurrently, the era underscored the ascendance of economic might as a bedrock of geopolitical influence. The United States exemplified this shift under President Clinton, who championed the expansion of "market democracy," embedding economic imperatives within the core of foreign policy agendas. (Baracuhy, 2015).

Having this international scenario as a "backdrop," in 1995, Fernando Henrique took over, who, except the first military government (Castelo Branco) and the Collor government, guided his foreign policy with two fundamental objectives, one of an economic nature and the other of political nature (Albuquerque, 2006). Regarding the economic aspect, according to Professor Guilhon Albuquerque (2006), FHC guaranteed an external environment conducive to Brazil's economic growth, trying to take advantage of international commercial globalization. In the political arena, the former president maintained the image of self-determination, especially regarding the foreign policy actions of the United States, seeking to expand its bilateral relations with other developing countries, such as Angola, India, and China (Vigevani and Cepaluni, 2009; Albuquerque, 2006). Furthermore, according to Vigevani and Cepaluni (2009), FHC's objective was to replace a reactive foreign policy agenda based on *autonomy through distance* with a proactive international agenda aligned with neoliberalism and by the logic of autonomy through participation.[1]

Concerning China, the adoption of these objectives can be seen in the search for expanding bilateral relations with that country (Vigevani and Cepaluni, 2009). FHC, in his inauguration speech, defined Asia as an essential geopolitical aspect to be promoted by Brazil, having visited China before Japan in a symbolic demonstration of Beijing's importance in relation to Tokyo in Brazilian Foreign Policy. (Altemani, 2012). From a technological point of view, the agreement for the production of satellites is worth mentioning. Initially signed in 1988, the agreement was expanded in 1995 under the FHC government. The first satellite developed jointly between Brazil and China was launched in 1999, and the second was launched in 2003.

[1]According to Vigevani and Cepaluni (2009): "the notion of autonomy is characterized by the ability of the State to implement decisions based on its objectives, without outside interference or restriction, through its ability to control processes or events produced beyond its borders." Furthermore, based on Vigevani and Cepaluni (2009): *"autonomy through distance* has been characterized by an anarchic development, based on a strong nationalist feeling, and by distancing itself from major international issues, seeking South-South alliances. Autonomy *through participation* concerns greater international involvement and the acceptance of liberal norms and the main international regimes, with the expectation of influencing and participating in their elaboration. Finally, *autonomy through diversification* implies approaching the countries of the South to obtain greater insertion and greater power within the framework of international regimes, betting on multilateral solutions, instead of a unipolar world".

(Altemani, 2012). In the commercial sphere, China reached second place as Brazil's trade partner in 2002 and was one of the first to support China's entry into the WTO.[2] According to Vigevani and Cepaluni (2009), these facts have economic, political, and strategic importance. For them, this relationship consolidated *"the ideas of universalism, a global player and global trader"*. [3] From an international political angle, the request for intermediation from the United States stands out so that Brazil, during a visit by Chinese President Jiang Zemin in 2001, could intervene in the crisis of the Sino-American dispute caused by the invasion of Chinese airspace by a North American plane. (Vigevani and Cepaluni, 2009).

During the administration of President Fernando Henrique Cardoso (FHC), Brazil-China relations saw progress, particularly in the realms of political and technical-scientific cooperation. However, these relations did not reach their full potential, mainly due to the internal economic crises Brazil faced at the time. (Altemani, 2012; Vigevani and Cepaluni, 2009; and Albuquerque, 2006). This situation was partly attributed to the critics of the adjustments and devaluation of the Brazilian currency at that time concerning the successful implementation of the Plano Real, a monetary strategy designed to eradicate the severe inflation plaguing Brazil. Additionally, FHC's last term was marked by the significant energy crisis known as the "apagão," involving widespread power rationing and attracting criticism towards his privatization programs.

According to FHC's diaries (2015), during his visit to Beijing, the former president emphasized the importance of deepening relations with China, recognizing the pivotal role the country was poised to play in the 21st century. Burges (2017) notes that Zhu Rongji, the Chinese premier during FHC's tenure, frequently highlighted the strategic partnership between Brazil and China. Despite this recognition and the former president's long-term vision, the enhancement of this partnership faced challenges. Why? In his first term, FHC was under intense pressure to stabilize Brazil's economy. His second term was further complicated by the currency crisis that affected the Asian Tigers, Brazil, and its major trading partner, Argentina (Vigevani and Cepaluni, 2009; Burges, 2017).

This scenario illustrates how a country's internal economic, political, or social conditions can significantly impact its foreign policy, either positively or negatively. Had these internal challenges been less severe, Brazilian foreign policy towards China might have been more successful, demonstrating a clear example of domestic circumstances influencing international relations.

2. Lula's Foreign Policy and Brazil-China Relations (2003 – 2011)

The period between 2003 and 2008 was characterized by the rise of emerging countries, particularly China, to new poles of economic and political power. Practically all regions, including Latin America and Africa, experienced an expansion in income and an improvement in the external and fiscal solvency situation (APEX, 2011). After joining the WTO in 2001,

[2] See Ministry of Foreign Affairs: < http://www.itamaraty.gov.br/pt-BR/ficha-pais/4926-republica-popular-da-china >. It is accessed on 10/24/2023.

[3] According to Lessa (1998), *universalism*: "Observation of Brazil's system of bilateral relations highlights the vocation for *universality*, which finds its origins in the fact that, to a greater or lesser extent, the establishment of peaceful relations was achieved and can be used with countries located on all continents" (gn). For Lafer (2001), cited by Ribeiro (2006): "*universalism* is identified as a trait of diplomacy in which the establishment of non-exclusive partnerships is valued to promote autonomy itself".

China began to expand its participation in the world economy through trade flows and foreign direct investments, which led to a rise in commodity prices (APEX, 2011)[4]. Contrary to this positive cycle in the international economy, in 2008, the financial crisis occurred, which had a significant impact on central economies, revealing the excesses of financial and regulatory liberalization, especially in the United States. As a result, the eurozone is also hit by the financial crisis, affecting more developed countries (for example, France) or those with a lower degree of economic development (for example, Greece) without distinction. Given this panorama, the objectives become, from 2009 onwards, the search, by both developed and developing economies, for a new rebalancing *"of global economic and geopolitical power with the consolidation of China's notable economic rise and the emergence of other power poles among emerging countries, such as Brazil and India"* (Baracuhy, 2015). As essential characteristics of this geoeconomic transformation experienced by the world after the 2008 crisis, the political redesign of the G-20 stands out; the articulation of the BRICS; the geopolitical competition between China and the United States; the Chinese *"One Belt, One Road"* geoeconomics strategy; exchange rate misalignments and impacts on world trade, among others (Baracuhy, 2015).

In this international geoeconomic context, Lula took over the Brazilian government in 2003. He continued until the end of his second term in 2011, characterizing his foreign policy as the search for autonomy through diversification (Vigevani and Cepaluni, 2009). During his government, Lula seeks to leverage Brazil's power projection. Without disregarding international relations with the North, Lula brings to the government a new foreign policy vision for Brasília, focusing on the opportunities the Global South could provide for the country, with China being a key partner (Burges, 2017). Lula, FHC, and later Dilma also visited first China and then Japan in a clear demonstration of the prestige of Brazil-China relations within Brazilian Foreign Policy (Altemani, 2012). Thus, like FHC, China continued to be an essential partner in Brazil's international relations and, consequently, in its foreign policy.

In addition, between 2002 and 2005, China's share of Brazil's exports increased from 4.2% to 5.8%, while exports rose from around US$2.4 billion to approximately US$5.3 billion (Vigevani and Cepaluni, 2009). In the second term of his government, China would further expand its trade partnership with Brazil, becoming Brazil's leading trade partner in 2009 [5]. Ricupero (2017) points out that this moment was crucial for Brazil's external relations. The Chinese became Brazil's largest trading partner for the first time, displacing the United States, which had held the position since approximately 1870. He said this event was not trivial and represented *"tectonic changes in the configuration of world power."*

China played an important role in Brazil's economic recovery during the 2008 financial crisis, as the country had China as one of the leading importers of Brazilian products. Furthermore, China stands out for the country's growing share of foreign direct investment. This role of China, however, is *"(...) in the function of China's economic and financial interests, and not as a result of a partnership"* (Altemani, 2012).

[4]In what way? China caused an increase in demand for agricultural products and natural resources, contributing to the rise in *commodity prices* on the international market after 2002. (APEX, 2011).

[5] See Ministry of Foreign Affairs: < http://www.itamaraty.gov.br/portal.itamaraty/index.php?option=com_content&view=article&id=4926&Itemid=478&cod_pais=CHN&tipo=ficha_pais&lang=pt-BR> . It was accessed on 11/25/2017.

Finally, concrete advances in the economic field marked Lula's Foreign Policy towards China, although this aspect is still under evaluation by academia.

3. Dilma's Foreign Policy and Brazil-China Relations (2011 – August, 2016)

In 2011, when former president Dilma Rousseff took over the government, the international situation differed from when Lula took office in 2003. Differently, the international economy, notably the central economies, was in contraction due to the 2008 financial crisis. On the other hand, while emerging economies grew 6.3%, advanced economies grew 1.7% in 2011.[6] However, after that year and throughout the first term and the beginning of the second (12.05.2016), the domestic economic scenario gradually reversed in comparison to the international one in such a way that in 2016, the Brazilian economy ended the year with a drop of 3.6% in GDP.[7]

Based on this international and domestic economic scenario, former president Dilma Rousseff maintained her predecessor's foreign policy initiatives to improve relations with China on a smaller scale, giving special attention to science, technology, and culture. During his mandate[8]: (i) the Brazil-China Joint Action Plan on Health (2011) was signed; (ii) the cultural event *"Month of Brazil in China (September 2013) and China in Brazil (October 2013)"* took place; and (iii) the launches of the CBERS 3 and CBERS 4 satellites (2013 and 2014) took place.[9]

From a political angle, the Dilma government's actions concerning foreign policy concerning China were that of a discreet withdrawal. Unlike the universalist pattern that guided Lula's foreign policy, Dilma was more selective in relation to strategic partners, with one of the most striking changes being foreign relations with Japan. (Casarões, 2017). In 2014, the Japanese government – Brazil's sixth trading partner – elevated bilateral relations with Brazil to a Global Strategic Partnership. In addition, Dilma sought to distance herself from Ahmidinejad's Iran and improve relations with the United States, which had been damaged during former president Lula's last term. Among the reasons that led to Brazil's rapprochement was its growing commercial dependence on China,[10] although attempts at rapprochement were interrupted in 2013 by the US spying scandal against Brazil. (Casarões, 2017).

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[6] See Central Bank of Brazil. Available at: < http://www.bcb.gov.br/pec/Indeco/Port/indeco.asp . It was accessed on 11/25/2023.

[7] See Folha de São Paulo/IBGE. Available at: < http://www1.folha.uol.com.br/mercado/2017/03/1864275-pib-do-brasil-cai-36-em-2016-e-amarga- Segundo-ano-de- fall.shtml . Accessed on 11/25/2017.

[8] See Ministry of Foreign Affairs. Available at:< http://www.itamaraty.gov.br/pt-BR/ficha-pais/4926-republica-popular-da-china >. It was accessed on 11/26/2023.

[9] The Sino-Brazilian Earth Resources Satellite (CBERS) program is a consequence of the signing, on July 6, 1988, during the presidency of José Sarney (1985-1990), of a partnership agreement involving INPE (for Space Research), linked to the Ministry of Science and Technology on the Brazilian side, and CAST (China Academy of Space Technology), linked to CASC (China Aerospace Science and Technology Corporation) on the Chinese side, for the development of a program to build two advanced remote sensing satellites, called the CBERS Program. At the time, the project envisaged investments of over US$300 million, with divided responsibilities (30% Brazilian and 70% Chinese), to implement a complete international-level remote sensing system. One of the fruits of this cooperation was obtaining a powerful tool to monitor the immense Brazilian territory with its remote sensing satellites, seeking to consolidate significant autonomy in this segment. (INPE, 2018).

[10] As Saraiva (2014) noted, the commercial partnership with China began to prove disadvantageous for Brazil, creating an unwanted dependence on the Asian country. "In 2009, it became Brazil's main trading partner country and, in the following year, it occupied the position of the largest investor in the country. However, it is a buyer of raw materials emphasizing commodities, establishing a North-South style relationship and creating a dependence on Brazilian exports from the Chinese market". (Saraiva, 2014).

Finally, during the Dilma government, foreign policy towards China could not avoid increasing economic dependence on the Asian giant. In contrast, the other achievements of the Lula government in terms of foreign policy were being diluted or dismantled, for example, in Africa. (Casarões, 2017; and Ricupero, 2017).[11]

4. Temer's Foreign Policy and Brazil-China Relations (August 2016 – 2018)

According to Almeida (2019), with the impeachment of Dilma Rousseff, speculation arose that there would be a setback in relations between Brazil and China due to their character being supposedly based on political and ideological proximity. However, that was different from what was seen. On the contrary, between 2016 and 2017, relations between Brazil and China deepened, notably in trade and direct investment from the Asian giant.

The accumulated Sino-Brazilian trade flow between January and October 2017 totaled approximately US$64 billion, a value 28% higher than that presented in 2016. Brazilian exports reached US$41 billion, indicating a jump of 35%, while imports from the Asian country had a positive variation of 17%, totaling US$22.6 billion. The balance between the two countries presented a surplus of US$18.7 billion for Brazil. (CEBC, 2017).

According to the following table and graph, prepared by the Brazil-China Business Council (CEBC, 2017), based on data from the Ministry of Industry, Foreign Trade and Services (MDIC), in global terms, the Asian country continued to be the main trading partner of Brazil, with a 21% share of the country's trade with the world, ahead of important jurisdictions such as the European Union (18%), Asia (15%), the United States (14%) and Mercosur (9%).

Table 1 – Trade Balance (US$ Millions) – Comparison 2016-2017

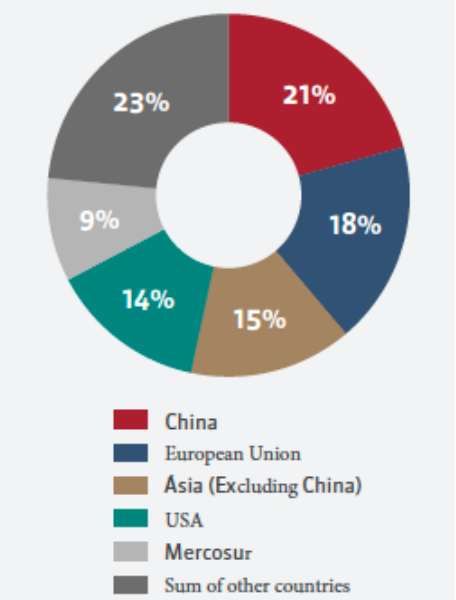
TABLE 1 - TRADE BALANCE (US$ MILLIONS): JANUARY-OCTOBER 2017 IN COMPARISON WITH JANUARY-OCTOBER 2016

	EXPORT			IMPORT			BALANCE			CURRENT		
	2016	2017	Var. %	2016	2017	Var. %	2016	2017	Var. %	2016	2017	Var. %
January	1.391	2.840	104%	2.305	2.291	-1%	-914	549	160%	3.696	5.130	39%
February	1.822	3.406	87%	1.714	1.863	9%	108	1.542	1323%	3.536	5.269	49%
March	3.752	5.539	48%	1.927	2.102	9%	1.826	3.438	88%	5.679	7.641	35%
Aprill	4.302	5.170	20%	1.431	1.798	26%	2.871	3.373	17%	5.733	6.968	22%
May	4.427	5.141	16%	1.845	2.077	13%	2.581	3.063	19%	6.272	7.218	15%
June	4.076	4.858	19%	1.991	2.132	7%	2.085	2.726	31%	6.066	6.990	15%
July	3.370	3.836	14%	1.786	2.244	26%	1.583	1.592	1%	5.156	6.080	18%
August	2.816	3.994	42%	2.145	2.621	22%	671	1.373	105%	4.961	6.615	33%
September	2.323	3.356	44%	2.048	2.788	36%	275	568	106%	4.370	6.144	41%
October	2.431	3.216	32%	2.069	2.692	30%	362	525	45%	4.501	5.908	31%
ACCUMULATED	30.709	41.350	35%	19.261	22.604	17%	11.448	18.745	64%	49.971	63.955	28%

Source: Ministry of Industry, Foreign Trade and Services (MDIC) – Prepared by: CEBC (Carta Brazil-China Jan-Oct 2017).

[11]From a commercial point of view, in 2012, China became the primary importer of Brazilian products - See Ministry of Foreign Affairs. Available at:< http://www.itamaraty.gov.br/pt-BR/ficha-pais/4926-republica-popular-da-china >. It was accessed on 11/26/2023. As Ricupero (2017) points out, in the final years of Dilma's government, China's share of Brazil's trade had increased by 17% (2014) and 18% (2015), while that of the Americans had fallen to 14% and that of Mercosur, the 8%.

Graph 1 – Main Commercial Partners in Brazil (Jan-Oct 2017)

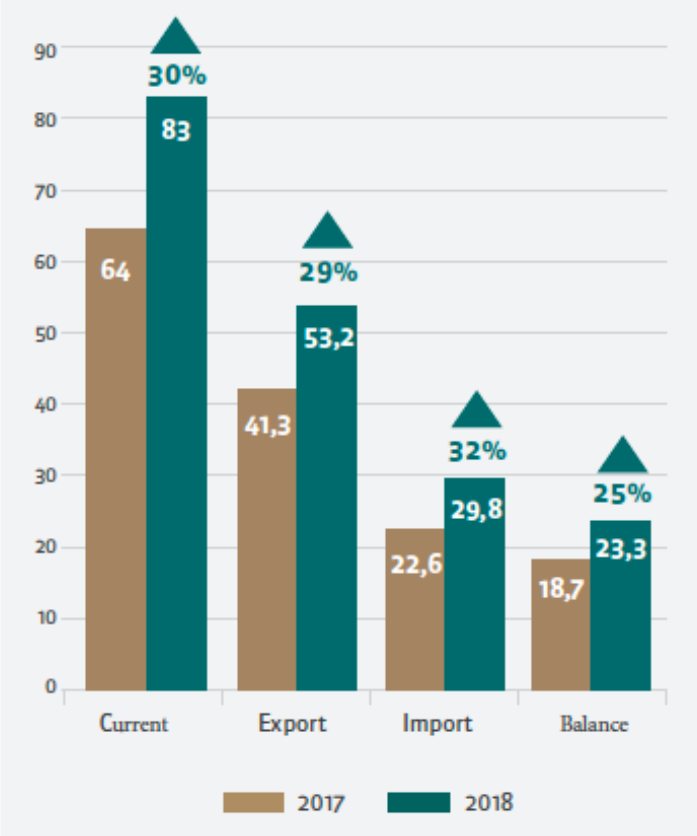


TRADING PARTNER	US$ (BILLIONS
World	308,5
China	64,0
European Union	55,8
Asia (excluding China)	44,9
USA	43,0
Mercosur	28,5
Sum of other countries	72,4

Source: Ministry of Industry, Foreign Trade and Services (MDIC) - Prepared by CEBC: (Carta Brazil-China Jan-Oct 2017).

Based on information from the MDIC and analyzed by CEBC (2018), exports from Brazil to China grew 84% when compared to October 2017, with sales equivalent to US$5.9 billion. Imports grew by 14%, totaling purchases that totaled approximately US$3 billion. The accumulated Sino-Brazilian trade flow from January to October 2018 totaled US$83.1 billion, a value 30% higher than that presented in 2017. Brazilian exports reached the US$3 billion mark, indicating a jump of 29%, while imports from the Asian country had a positive variation of 32%, totaling US$29.8 billion. Between January and October 2018, the balance between the two countries presented a surplus of US$23.3 billion for Brazil. (CEBC, 2018). Graph 2 illustrates the increase in trade volume between Brazil and China for the last and second consecutive year of the Michel Temer government as president of Brazil.

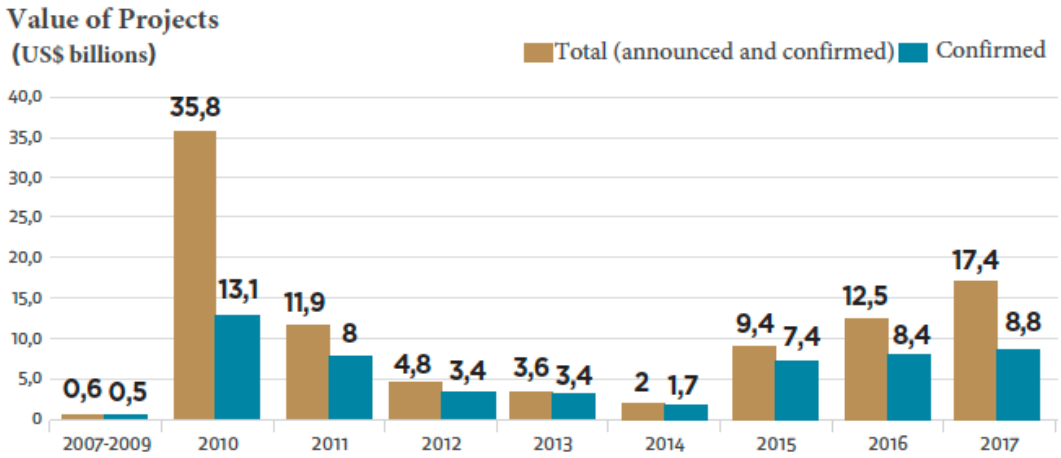
Graph 2 – Trade Balance: January-October 2018 compared to January-October 2017.



Source: Ministry of Industry, Foreign Trade and Services (MDIC) – Prepared by: CEBC (Carta Brazil-China November 2018).

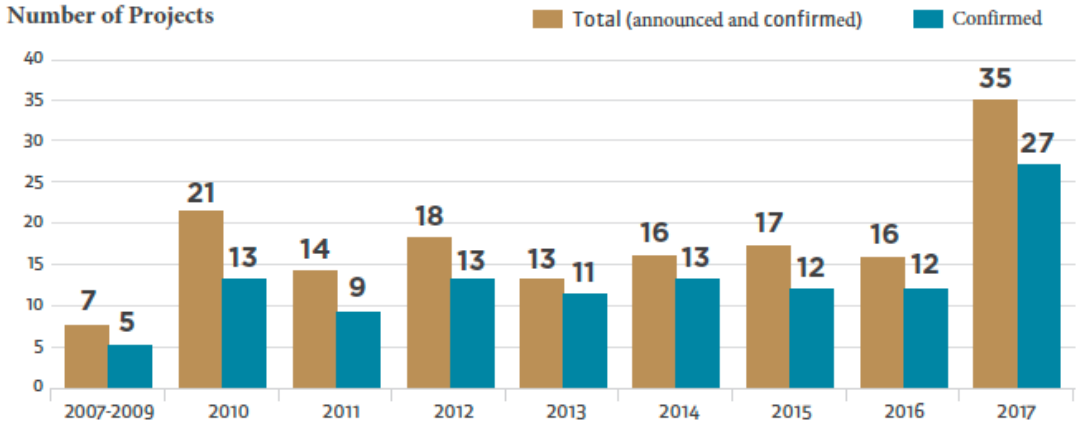
In 2017, China's leadership in the ranking of acquisitions in Brazil was notable, reaching a total of US$8.8 billion in confirmed projects, according to CEBC (2018). This value represented an increase compared to US$8.4 billion in 2016, a year in which China had already stood out as the country's leading investor, as shown in Graphs 3 and 4 (CEBC, 2018). According to Almeida (2019), during that period, Brazilian businesspeople and market analysts considered this flow of Chinese capital extremely beneficial, particularly in a context in which the then-president of the United States, Donald Trump, signaled a reduction in American investments abroad and the possible repatriation of capital already invested.

Graph 3 - Historical series of Chinese investments in Brazil (2007 - 2017)



Source: CEBC (Chinese Investments in Brazil – August/2018).

Graph 4 - Historical series of Number of Projects in Brazil (2007 - 2017)



Source: CEBC (Chinese Investments in Brazil – August/2018).

When analyzing comparatively registered investments in 2017 and the historical series of projects in previous years. It is possible to notice the progressive increase in the value of investments from 2014. The number of projects in 2017 surpassed the values recorded in the previous year, taking into consideration both confirmed investments as advertised. The total number of projects listed showed considerable growth, going from 16 enterprises in 2016 to 35 in 2017, a variation of 119%. If only investments are confirmed, the increase is even more significant, presenting a jump from 12 projects in 2016 to 27 in 2017, an increase of 125%. This is the most significant number of Chinese investments registered in Brazil in a year. (CEBC, 2018).

In June 2017, Brazil and China took a significant step by operationalizing the Brazil-China Cooperation Fund for Expansion and Productive Capacity. With an initial contribution of US$20 billion, this fund was made up of US$15 billion from *Claifund* (Chinese Cooperation Fund for Investments in Latin America) and US$5 billion from Brazilian sources, whose specific origin was not clearly defined at the beginning of its operations. The creation of this

fund was announced in 2015 during the Chinese Prime Minister's visit to Brazil, an event that then-President Dilma Rousseff also attended. (Almeida, 2019).

This context of growing Chinese investment in Brazil reflects the strategic importance of the South American country for China, not only as a consumer market but also as a critical partner in its global economic expansion.

From the perspective of political relations, it was witnessed several high-level visits and dialogues. Michel Temer visited China in 2016 and 2017 to attract investment and expand Brazilian exports. These visits were fundamental to strengthening the global strategic partnership between the two countries. Temer visited China shortly after taking office in 2016, when he participated in the G20 leaders' meeting, trying to increase the participation of foreign investors in Brazil. In 2017, Temer traveled to China to conduct a state visit and participate in the BRICS summit meeting, a group formed by Brazil, Russia, China, India, and South Africa. (Agência Brasil, 2017; 2016). During this visit, several agreements were signed, including (i) a memorandum of understanding on electronic commerce, (ii) licensing of Phase 2 of the Belo Monte Plant, (iii) framework agreement between the National Bank for Economic and Social Development (BNDES) and *Sinosure* to provide guarantees to Chinese investors in Brazil; and (iv) financing contract from China *Communication and Construction Company* (CCCC) for the Construction of the Private Use Terminal at the Port of São Luís.

In summary, relations between Brazil and China during the Temer government were characterized by economic strengthening and increased trade and investment. However, we understand that improvements were needed in the industrial field and the export of products with more value added, as illustrated in Tables 2 and 3, prepared by CEBC (2018), which compare Brazil's export and import patterns.

Table 2 – Export Schedule / January-October 2018 compared to January-October 2017

TABLE 2 - EXPORT AGENDA
JANUARY-OCTOBER 2018 IN COMPARISON WITH JANUARY-OCTOBER 2017

EXPORT	2017		2018		Var. (%) US$	Var. (%) Ton (K)	PARTICIPATION AGENDA 2018 (US$)
	US$ MILLIONS	Ton (K)	US$ MILLIONS	Ton (K)			
Soy, even crushed	18.821	49.913	23.944	60.104	27%	20%	45%
Crude petroleum oils	6.223	19.103	11.464	25.951	84%	36%	21,5%
Iron ores and their concentrates	8.786	179.649	8.840	187.564	1%	4%	16,6%
Chemical wood pulps, except for dissolving	1.719	3.896	2.583	4.798	50%	23%	4,9%
Beef, frozen	717	166	1.198	259	67%	56%	2,2%
Edible poultry meat and offal	645	334	669	365	4%	9%	1,3%
Iron garters	473	63	634	58	34%	-9%	1,2%
Chemical wood pulp, for dissolving	338	524	280	402	-17%	-23%	0,5%
Fresh, chilled or frozen pork	78	38	258	133	230%	247%	0,5%
Tuned copper and copper alloys, in raw forms	167	28	247	37	48%	36%	0,5%
Others	3.382	7.927	3.131	6.741	-7%	-15%	5,9%

Source: Ministry of Industry, Foreign Trade and Services (MDIC) – Prepared by: CEBC (Carta Brazil-China November 2018).

Table 3 - Import Tariff / January-October 2018 compared to January-October 2017

TABLE 3 - IMPORT AGENDA
JJANUARY-OCTOBER 2018 IN COMPARISONWITH JANUARY-OCTOBER 2017

IMPORT	2017		2018				
	US$ MILLIONS	Ton (K)	US$ MILLIONS	Ton (K)	Var. (%) US$	Var. (%) Ton (K)	Participation AGENDA 2018 (US$)
Machines, electrical materials and parts	7.331	508	8.017	588	9%	16%	27%
Machines, mechanical instruments and parts	3.427,4	449,5	3.977	521	16%	16%	13%
Vessels and floating structures	1,3	0,2	3.688	182	*	*	12%
Organic chemicals	1.809	394	2.375	441	31%	12%	8%
Motor vehicles and parts	727	173	894	210	23%	22%	3%
Plastics and their products	690	268	850	300	23%	12%	2,8%
Instruments, control /precision devices	566	25	700	29	24%	17%	2,3%
Cast iron, iron and steel	555	801	639	749	15%	-7%	2,1%
Synthetic or artificial filaments	519	205	575	218	11%	6%	1,9%
Cast iron, iron or steel products	435	228	530	254	22%	11%	1,8%
Others	6.545	4.548	7.614	4.824	16%	6%	26%

Source: Ministry of Industry, Foreign Trade and Services (MDIC) – Prepared by: CEBC (Carta Brazil-China November 2018).

5. Bolsonaro's Foreign Policy and Brazil-China Relations (2019 – 2022)

The international context in which President Jair Bolsonaro took power in January 2019 was marked by geopolitical uncertainties and a global trend toward nationalism. These factors profoundly influenced Brazil's foreign policy, leading to significant changes in how the country positioned itself in relation to traditional partners, regional integration, and engagement with multilateral institutions. The Bolsonaro government's foreign policy reflected a new dynamic in international relations, where unilateralism and ideological alignment with certain countries became more prominent.

Leaders such as Donald Trump in the United States and Viktor Orbán, among others in Europe, promoted a nationalist and, often, anti-globalist agenda. This global trend influenced Brazilian foreign policy, with Bolsonaro adopting a more assertive and, at times, confrontational stance on the international stage. The Bolsonaro administration has sought closer alignment with the United States under the presidency of Donald Trump. This rapprochement represented a significant change, given the previously more balanced relations with other global powers, including China. This alignment was reflected in several areas, including the stance towards Venezuela, security issues, and environmental policy.

The period was also marked by intense trade tensions, especially between the United States and China. As an important trading partner of both countries, Brazil found itself in a delicate position. The need to balance these complex relationships directly impacted the formulation of Brazilian foreign policy.

The pandemic, which began in late 2019, added another layer of complexity. Management of the health crisis and relations with countries that supply inputs and vaccines, such as China, have become central elements of foreign policy.

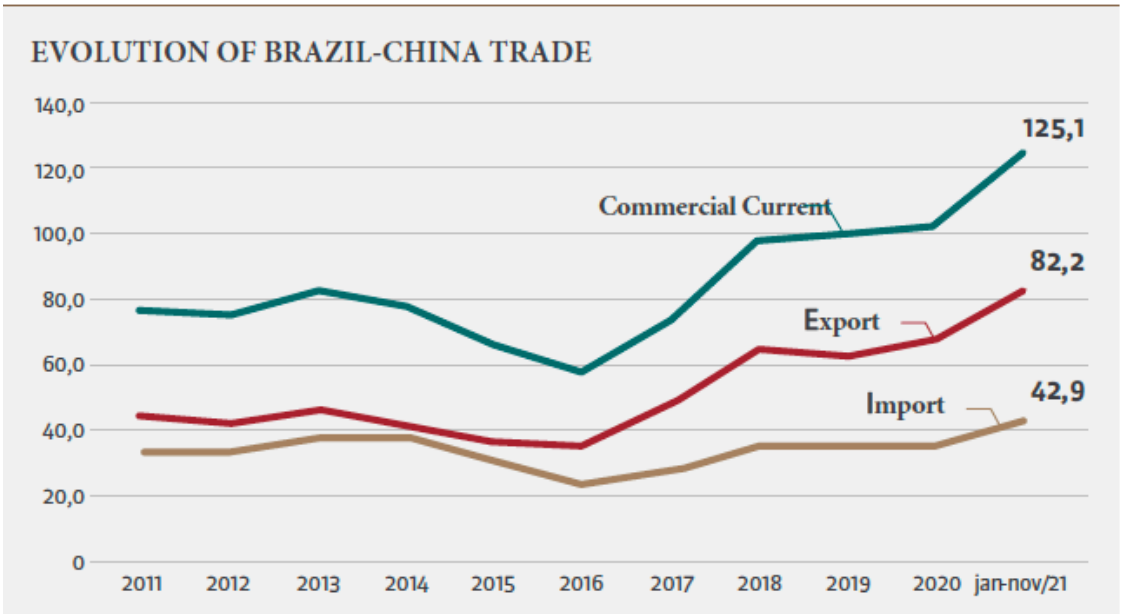
Notably, about China, relations between Brazil and our largest trading partner since 2009, during the government of President Jair Bolsonaro, represent a complex mosaic of political tensions and economic pragmatism. This period was marked by a dichotomy between political rhetoric and economic reality, reflecting the challenges and opportunities inherent to the relationship between the two nations.

The Bolsonaro government initially adopted a critical stance towards China. During the election campaign and in the first years of his term, Bolsonaro and his close circle expressed skepticism about Chinese influence in Brazil and the world. These criticisms aligned with a broader vision of alignment with the United States under the Trump administration, which saw China as a strategic rival. Bolsonaro's visit to Taiwan in 2019, an unusual diplomatic move for a country that adheres to the "One China" policy, exacerbated tensions, raising concerns about the impact on Sino-Brazilian relations.

However, despite this initial rhetoric, the economic reality between the two countries followed a different path. China remained Brazil's largest trading partner, a link strengthened by Chinese demand for Brazilian commodities such as soybeans and iron ore.

Trade between the two countries reached the historic mark of US$125 billion. The result was driven by records in exports and imports, which registered US$82.2 billion and US$42.8 billion, respectively. The historic mark was driven by the growth in exports and imports, which also reached new peaks. In the comparison between the first eleven months of 2021 and 2020, sales to China grew 30.2%, reaching US$82.2 billion and surpassing the US$67.8 billion recorded in the year. In the same period, purchases originating in Asian countries increased by 32.2%, reaching US$42.8 billion, surpassing the previous record of US$37.8 billion recorded in 2014, according to Graph 5, which shows commercial records from a historical perspective, highlighting the values in the period from January to November 2021. (Cariello e Amigo, 2021).

Graph 5 – Historical Evolution of Trade between Brazil and China between 2011-2021



Source: Ministry of Industry, Foreign Trade and Services (MDIC) – Prepared by: CEBC (Carta Brazil-China December 2021).

Regarding to the Chinese investments in Brazil, *"The year 2022 was marked by contrasting movements."* (Cariello, 2023). On the one hand, *Chinese companies* demonstrated a significant presence in Brazil, investing in 32 projects, marking a 14% increase from the previous year. This surge surpassed the peak seen in 2018 and established a new record in the volume of

projects. Conversely, in financial terms, there was a notable decline. Investment values plummeted by 78% compared to the previous year, amounting to just US$1.3 billion – the smallest figure recorded since 2009. (Cariello, 2023).

As previously mentioned, the Bolsonaro administration's confrontational rhetoric towards China introduced additional complexities into Brazil-China relations, particularly during the COVID-19 pandemic. In May 2021, President Bolsonaro's insinuations that the pandemic might be a part of China's "biological warfare" significantly heightened tensions. However, in a paradoxical twist, Brazil found itself heavily reliant on Chinese-produced vaccines to combat the pandemic. This reliance underscored a pragmatic interdependence between the two nations, highlighting international relations' intricate and sometimes contradictory nature where practical needs can override political rhetoric.

Over the years, relations between Brazil and China have demonstrated remarkable resilience and an ability to remain stable and productive, regardless of ideological changes in Brazilian governments. This finding is particularly evident when we analyze the governments of Michel Temer and Jair Bolsonaro, who kept diplomatic relations flowing effectively despite their ideological differences in relation to China.

Under the Bolsonaro government, for example, high-level diplomatic relations were maintained and even reinforced through the Sino-Brazilian High-Level Commission for Concertation and Cooperation (COSBAN), in which vice-president Hamilton Mourão represented Brazil. The sixth plenary session of COSBAN, held in May 2022, is an emblematic example of this continuity and pragmatism. COSBAN, created 18 years ago and co-chaired by the Vice President of Brazil and the Vice Prime Minister of China, is the main forum for strategic discussions on bilateral cooperation.

During this session, the diversity and depth of the bilateral relationship became evident, covering areas such as trade, investment, finance, energy and mining, agriculture, science, technology and innovation, space cooperation, industry and information technology, culture, and education. This broad spectrum of cooperation illustrates Brazil-China relations' multifaceted and robust nature.

Brazil and China's relationship has unique characteristics not found in relations with other countries. An example of this is the decision by the governments of both countries to move forward with medium-term plans, defined with precise objectives in the context of the Strategic Partnership established more than a decade ago.[12] This was evidenced by implementing the Joint Action Plan 2015-2021 and the Ten-Year Cooperation Plan 2012-2021. At the COSBAN meeting in 2022, negotiations on new ten-year plans for the bilateral relationship were concluded: the Strategic Plan 2022-2031 and the Executive Plan 2022-2026, which express the priorities that Brazil and China intend to impose on their relationship in the coming years. (Barbosa, 2022).

This highly institutionalized and strategic approach demonstrates that, despite political and ideological changes in Brazil, relations with China have remained consistent and focused on

[12] Brazil maintains consultation mechanisms with many other countries. However, the United States is the only one with whom the bilateral relationship has been institutionalized. Although in a less ambitious manner and without ten-year plans with established goals, high-level consultations, and dialogues take place, as well as joint working group meetings in areas such as trade, science and technology, agriculture, and energy, in addition to a forum with presidents of major companies from both countries. (Barbosa, 2022).

long-term objectives. Trade between the two countries, for example, continued to break records during the Bolsonaro government, reflecting the strength and importance of this partnership.

In short, Brazil-China relations during the Temer and Bolsonaro governments illustrate how diplomacy and economic cooperation can transcend ideological differences. The continuity and pragmatism in these relationships, especially evidenced by COSBAN's performance, reinforce the importance of China as a strategic partner for Brazil and vice versa, regardless of the head of the Brazilian executive. The ability to maintain and deepen these relationships despite internal political changes is a testament to both countries' long-term vision and mutual commitment to strengthening their strategic partnership.

Furthermore, this duality between politics and economics reflects a fundamental characteristic of contemporary international relations, where economic ties often transcend political divergences.

In conclusion, Brazil-China relations during the Bolsonaro government illustrate the complexity of international relations in the 21st century. While political and ideological tensions presented challenges, economic reality and interdependence prevailed, underlining China’s importance to the Brazilian economy.

6. Lula's Foreign Policy 3 and Brazil-China Relations (2022 – present)

At the international level, President Luiz Inácio Lula da Silva resumed the presidency of Brazil in January 2023, and his government has been immersed until now in an international political context marked by several complex dynamics and significant challenges. Among them, the following stand out: (i) COVID-19 pandemic and its consequences: The world is dealing with the impacts of the COVID-19 pandemic, which triggered health, economic and social crises on a global scale. Pandemic management and economic recovery are priorities for many countries, including Brazil; (ii) global geopolitical tensions: the international scenario is characterized by growing geopolitical tensions, including rivalry between the United States and China, conflicts in Eastern Europe, especially the war in Ukraine, and instability in the Middle East. These tensions reflect an international system in transition, with changes in the balance of power and world order; (iii) climate change and environmental challenges: environmental issues, especially climate change, remain at the top of the global agenda. Brazil, which owns a significant portion of the Amazon, faces international pressure to implement adequate environmental protection and combat deforestation policies; (iv) reconfiguration of International Relations: President Lula's government is inserted in a context of reconfiguration of International Relations, with countries seeking new alignments and strategic partnerships, notably due to the war in Ukraine, the recent conflict between Israel and Hamas, the elections in the United States in 2024, and the recent election of the libertarian-leaning President in Argentina, Javier Milei. For Brazil, this represents an opportunity to redefine its relations with global and regional powers and to reaffirm its position as a relevant actor on the international scene; (v) economic challenges: The world faces significant economic challenges, including inflation, high national debts and the need for post-pandemic economic recovery; (vi) technology and digital transformation: digital and technology transformation, as well as the advancement of artificial intelligence, continue to reshape global societies and economies. As a large emerging market, Brazil faces the challenge of integrating into this new digital order, taking advantage of opportunities, and managing the associated risks.

Still, from the point of view of the international environment in which the Lula government operates, there are also positive points to be highlighted: (i) relations with the Biden government: Joe Biden's administration in the United States demonstrated goodwill towards the Lula government. Unlike the Trump administration, Biden emphasizes the importance of climate issues, human rights, and multilateralism, which tend to align more closely with the Lula government's priorities. This paves the way for potential closer collaboration between Brazil and the United States on global and regional issues; (ii) European support and climate agenda: Europe, under leaders such as Emmanuel Macron of France, also shows signs of a positive relationship with Brazil, especially around the climate agenda. The European Union, committed to the Paris Agreement and the promotion of sustainable environmental policies, sees Brazil as a crucial partner in the fight against climate change, especially with regard to the conservation of the Amazon; (iii) re-engagement with multilateral institutions: the Lula government indicates re-engagement with multilateral institutions, which could strengthen Brazil's position on the global stage. Actively participating in forums such as the United Nations, the G20, and other international platforms can reinforce Brazil's influence in discussions on sustainable development and global health; (iv) strengthening south-south relations: There is also the possibility of strengthening south-south relations, with Brazil seeking to intensify ties with other emerging economies and developing countries, such as, for example, the recent expansion of BRICS. This could not only diversify Brazil's economic and political partnerships but also consolidate its position as a leader among developing countries; (v) potential for leadership on environmental issues: With the growing importance of environmental issues on the global stage, Brazil, under Lula's leadership, has the opportunity to assume a leadership role in environmental initiatives. This can not only improve Brazil's image abroad but also open doors for new partnerships and investments in green and sustainable technologies; (vi) post-pandemic economic recovery: the post-pandemic period offers an opportunity for Brazil to restructure its economy, with a focus on greater sustainability and social inclusion. International cooperation, especially with countries with similar concerns, can be crucial to achieving a robust and sustainable economic recovery.

Concerning China, *"in 2023, the third term of President Luiz Inácio Lula da Silva began, notably the Brazilian president who most expanded relations with the PRC in the present century."* (Simões, 2023). As 50 years of diplomatic relations between Brazil and China approach (2024), the prospects for the following years are for a deepening in both the intensity and quality of bilateral relations, surpassing the dynamics of previous years. This strengthening of relations can be exemplified by several factors, including the agreements signed in April 2023 [13], with the presence of Dilma Rousseff, as president of the BRICS Bank. (Simões, 2023).

With Lula's election, there was a resumption and intensification of dialogue and strategic cooperation between Brazil and China. Lula, known for his foreign policy aimed at diversifying international relations and strengthening ties with emerging partners, has sought to strengthen relations with China. Bilateral trade between Brazil and China will likely grow during his term. China, which was Brazil's largest trading partner, may increase its imports of Brazilian commodities, such as soybeans and iron ore, and may also seek to diversify its imports with

[13]List of agreements signed between Brazil and China in April 2023 – Source – Ministry of Foreign Affairs: < https://www.gov.br/mre/pt-br/canais_atendimento/imprensa/notas-a-imprensa/lista -and-integrates-of-the-acts-signed-in-the-grand-palace-of-the-people-on-the-occasion-of-the-visit-of-president-luiz-inacio-lula-da-silva-to-the-popular-republic-of -china >. It was accessed on 11/27/2023.

products with higher added value. In addition, Chinese investments in critical sectors of the Brazilian economy, such as infrastructure, energy, and technology, can be strengthened.

Furthermore, there is also the highlight in the monetary area. In April 2023, Brazil took important steps to strengthen its commercial and financial relations with Asian countries further. The signing of a memorandum of understanding between the Central Bank of Brazil and the People's Bank of China, together with the accession of Banco BOCOM BBM to China Interbank Payment System (CIPS) and the designation of the Brazilian subsidiary of Industrial and Commercial Bank of China (ICBC) as the official clearing bank for transactions carried out in *renminbi*, signals a pragmatic and future-oriented vision.

These institutional arrangements will allow the Brazilian payment system direct access to China's domestic and cross-border payment platforms. This possibility of carrying out foreign exchange transactions directly in *the renminbi* will not only favor the competitiveness of Brazilian companies, but it will also align the country with an emerging trend of monetary multipolarity. This could allow Brazil greater flexibility and resilience in its commercial relations, distinguishing itself from other nations that still depend exclusively on the dollar or the euro.

Finally, despite strengthening relations, the Lula government will face the challenge of balancing its relations with China with those of other strategic partners, especially the United States and the European Union. In this context, Brazilian diplomacy must navigate carefully to maintain balanced and mutually beneficial relations.

In summary, the period from January to November 2023 under the Lula government likely strengthened Brazil-China relations, emphasizing economic, environmental, and technological cooperation. This period will have been marked by a conscious effort to deepen the strategic partnership while maintaining a diplomatic balance with other global partners.

7. Concluding Remarks

This article analyzed Brazilian foreign policy in relation to China, highlighting a relationship marked by strong institutionality and strategic continuity. The analysis from the government of Fernando Henrique Cardoso to the current mandate of Luiz Inácio Lula da Silva demonstrates how this relationship developed independently of the ideological changes in the governments of both countries, notably in the commercial sphere, although too focused on exports, on the part of Brazil, of commodities.

The strong institutionality between Brazil and China has been a pillar for sustainable and effective diplomatic and commercial relations. Regardless of the government's political orientation, the bilateral relationship remained stable, with an emphasis on shared economic and strategic interests. As Brazil's main trading partner, China plays a fundamental role in the Brazilian economy, standing out in investments and bilateral trade.

Under Lula's presidency, we have seen a strengthening of economic, environmental, and technological cooperation, maintaining the trend toward deepening relations. This continuity indicates a pragmatic approach to Brazilian foreign policy, where economic interests and the search for technological development overlap ideological differences.

The resilience and institutional consistency of these relationships are essential for the continued success of bilateral cooperation. The future of Brazil-China relations will depend on the ability of both countries to maintain this commitment to cooperation, regardless of changes

in the political landscape. This will continue to be crucial for Brazil's foreign policy and economic development.

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