

# Brazilian Export Processing Zones & Green Powershoring: Challenges & Opportunities

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## Abstract

In 2023, Export Processing Zones (EPZs) are playing a very meaningful role in promoting exports, attracting foreign direct investment, and creating employment opportunities in more than 150 countries around the globe. EPZs have been important players in fostering the extraordinary growth and expansion of the global supply and value-added chains, further integrating the global economy. Brazil is a latecomer in adopting this tool and strategy of trade and investment promotion and liberalization. This paper addresses the global EPZ experience and discusses Brazil's latest policies and procedures to expand the role of EPZs in Brazil's foreign trade policy. This paper introduces the concept of Green Powershoring stressing the increasing importance of EPZs embracing the UN's 2030 Sustainable Development Goals. This paper also addresses Brazil's unique position in offering multinational companies moving into Brazilian EPZs the opportunity to benefit from the country's clean and renewable energy matrix and Brazil's abundant fresh water reserves, another key resource for manufacturing. Thus offering companies established in Brazilian EPZs additional ESGs competitive advantages. Thus, Brazilian EPZs are well positioned to benefit from the green power shoring economy permeating new trends in global foreign trade and global foreign direct investment.

## Keywords

Export Processing Zones, Brazil, Green Powershoring

## 1. Introduction

Since the mid-1950s countries have been introducing measures and policies to

increase their export earnings, diversify their export portfolios and attract foreign direct investment. In the late 1950s and in the 1960s, several Export Processing Zones (EPZs) were introduced as a panacea to address a number of these economic and social shortcomings experienced by these economies. Since then, EPZs have grown exponentially around the globe. EPZs have expanded their role not only in emerging economies, but also in developed countries, showcasing their important role in fostering the globalization process (Alansary & Al-Ansari, 2023; International Labour Organization, 2023; UNCTAD, 2023; Wong & Chu, 1984; Warr, 1989a, 1989b; Chen, 2019; McCallum, 2011).

By 2023, we have EPZs playing a vital role in a number of countries' overall foreign trade policy and strategy. EPZs have grown continuously since the mid-1960s and early 1970s. In 1975, 79 EPZs were operational in 29 countries. By 1998, the number of EPZs had expanded to 850, employing close to 27 million workers. A largest number of EPZs were located in North America, close to 320, followed by Asia with 225. Latin America and the Middle East followed suit expanding the role in their economies as well. It is estimated that by 2015, EPZs were employing close to 65 million workers in more than 3500 EPZs located worldwide (International Labour Organization, 2015, 2018; UNCTAD, 2020).

Illustrating the rapid expansion of EPZs, by 2023, it is estimated that more than 5400 EPZs were in existence worldwide, located both in developed and developing economies. However, the large majority of EPZs are located in developing economies, around 4772. China accounts for more than half of all EPZs in Asia, 2543, and for almost half of all global EPZs/SEZs. In Asia, we have a number of other countries that have embraced EPZs, such as the Philippines with 528 EPZs, and India with 373 EPZs/SEZs. Latin America and the Caribbean countries are late starters and they accounted for close to 486 EPZs/SEZs. The main country hosts of EPZs are: the Dominican Republic with 73 EPZs/SEZs, Nicaragua with 52, Costa Rica with 49 EPZs/SEZs, Honduras with 39 EPZs/SEZs, and Colombia with 30 EPZs/SEZs leading players in the Latin America EPZ scenery (UNCTAD, 2022, 2023).

This article is organized as follows: Section II reviews the EPZ literature, addressing the main opportunities and challenges concerning the establishment of EPZs. Section III, provides examples of the social and economic benefits of EPZs from a number of different countries' experiences and perspectives. Section IV, reviews Brazil's recent foreign trade and policy experience, addressing the importance of EPZs in promoting Brazil's foreign trade and integration in the global economy. Section V, discusses Brazil's EPZ program and Brazil's EPZs characteristics. Section VI, introduces the concept of Green Powershoring looking at the global and Brazilian EPZ programs. Section VII, provides final remarks, summarizing the article's main points and message.

**Methodology:** This paper is the result of an extensive review of the global literature related to EPZs, the result of the author's consulting activities related to the EPZ program in Brazil, as well as the result of extensive interviews conducted by the authors with leading Brazilian experts on the Brazilian Export

Processing Zone program.

## 2. EPZs: A Review of the Literature

EPZs can be considered as “enclaves”, that are located outside the normal regime of a country’s customs policies and guidelines, and regular administrative procedures. In other words, companies established in EPZs enjoy a number of benefits such as: 1) The exemption of payments or deferred payments on imports of intermediate goods, machinery and other vital inputs for companies established in these EPZs, 2) EPZs also contemplate the establishment and importation of a complete manufacturing plant into an EPZ. Thus, companies established in EPZs benefit from not having to comply with restrictions imposed on domestic companies. In general, companies established in EPZs tend to benefit from a number of fiscal and tax incentives that are not extended to domestic companies (Aggarwal, 2004; Warr, 1989a, 1989b).

EPZs tend to be mostly exempted from a country’s “Red Tape”, or excessive and time-consuming bureaucratic procedures. For instance, companies established in EPZs tend to have their import procedures facilitated and expedited, as well as their exporting procedures and documentation, leading to additional administrative and managerial gains for companies established in EPZs. Other incentives such as lack of restrictions on foreign ownership in EPZs, the possibility of keeping export earnings overseas and not regulated by domestic foreign exchange regulations and policies, as well as the possibility of staffing their ZPEs operations with foreign professionals, are amongst other advantages. Thus, companies established in a country’s EPZ tend to be exempted from the host country’s economic regulations and restrictions, with a few exceptions, that are applied to companies outside the EPZ. It is important to mention that these benefits tend to change from country to country. Moreover, not only manufacturing companies have been relocating to EPZs but also service companies have become increasingly more present in EPZs around the globe (Engman, Onodera, & Pinali, 2007; Carvalho, 2022; Davies & Desborders, 2018).

It is also important to note that companies established in EPZs are also expected to export a share of their EPZ production and that all inputs imported into an EPZ are expected to be used in the production inside the EPZ. Clearly, different countries have set different levels of expectations regarding the share of EPZ’s production that must be exported by the company established in the EPZ, as well as the share of their production that can sold in the domestic market. It is also important to mention that Export Processing Zones (EPZs) covers a number of different architectures and designs. For instance, industrial free zones, industrial export zones, free ports, duty-free zones are just some examples of EPZs (Cling & Letilly, 2001; Hasan, 2019).

EPZs come in different sizes, and also offer different levels of infrastructure development. In general, host economies provide all the infrastructure outside the EPZ, such as connection to the host country’s transportation and logistics

grid, in addition, connection to the country's telecommunication grid, as well as connection to the country's electricity, water, and sewage infrastructure. Inside the EPZ companies will find all the necessary services that will allow them to build their own facilities or rent buildings and floor space. EPZs can be managed by the host government or by the country's private sector (Jauch, 2002; Johansson & Nilsson, 1997).

EPZs are pursued by policy-makers expecting that EPZs will create a new economic, social, and environmental momentum for host countries. For instance, EPZs are expected to: 1) increase export earnings, 2) allow for the further diversification of their export portfolios, 3) promote employment in the exporting sector and other sectors related to the exporting sector, 4) connect their economies to global value-added and supply chains, 5) increase flows of foreign direct investment (FDI), and 6) promote the dissemination of new managerial innovations and expertise, and 7) promote technology transfers.

EPZs also foster and encourage industry agglomeration in the host country, thus, generating the creation of economic clusters that may foster the development of local human capital, know-how and technological spill-over effects throughout the host economy, among other spill-over effects. Moreover, EPZs also have the capability of inducing the creation of domestic specialized input suppliers (Picarelli, 2016).

Moreover, EPZs are also responsible for a number of other positive spill-over effects in host economies. For instance, EPZs tend to improve the efficiency of firms close to EPZs upstream and horizontal industries, benefiting their productivity and production dimensions. In the case of China, for instance, MNCs and domestic firms tend to benefit the most by their proximity to EPZs, and by the EPZs import-and-assembly processing trade (Wu & Hong, 2023).

The success of EPZs may be measured on a number of different dimensions. The traditional yardstick puts emphasis on amount of FDI invested, number of jobs created, local value-added, and volume of exports. However, it is also important to measure the impact of the EPZ via its backward and forward linkages. Backward linkages are created when companies located in EPZs engage in sourcing raw materials, semi-manufactured products, and capital goods from host countries' domestic companies. Forward linkages may materialize if the EPZ allows for a percentage of their production to be sold in the host country domestic market. For instance, backward linkages may materialize in the form of: 1) The upgrading of the technological sophistication and the quality of inputs acquired from local companies as a result of higher innovation and technological standards by companies established in the host country EPZs; 2) The amount of inputs acquired from local companies. Forward linkages can be materialized as a result of the number of finished products sold in the local domestic market. Clearly, the closer the backwards and forward linkages between the EPZs and the host country's local industry, the greater the spillover impact and effects on the host country domestic economy. Benefit-cost analysis has shown that EPZs have a positive economic and social impact on host economies. However, the impact

of EPZs on a host economy as a conduit for further industrialization is quite correlated to the backward and forward linkages generated by the EPZs (Karu-naratne & Abayasekara, 2013; Jayanthakumaran, 2003; Omar & Stoever, 2008; Wu & Hong, 2023).

One of the EPZs major benefits has been the creation of direct and indirect jobs. EPZs promote employment in other sectors of the host economy such as freight forwarders, transport providers, and shipping services. EPZs also contribute to building human capital as a result of the training of workers employed by EPZs, and that includes at the managerial and supervisory levels. Wages tend to be higher or equal to the prevalent wages in the host country. Still, issues such as gender discrimination, sex discrimination, long working hours, and health and safety issues are among some of the issues permeating the costs and benefits of EPZs (Ahmadu, 2021; Perman, Duvillier, David, Eden, & Grumiau, 2004; International Labour Organization, 2014; Madani, 1999; Karunaratne, 2012).

The success of an EPZ is also correlated to the host country's linkage to global value-added and supply chains, and to bilateral and regional economic integration agreements. Countries that have engaged in regional trade agreements and in bilateral trade agreements have created a much more favorable environment for companies that locate in their EPZs to increase their market opportunities given that regional trade agreements offer companies a much larger market. Here EPZs have showed their positive roles in cases such as the Maquiladora program, further enhancing synergies between the economies of Mexico, the U.S., and Canada (United Nations, 2021; Madani, 1999; Yabuuchi, 2003).

Moreover, companies moving into EPZs are attracted to host economies that have political stability and domestic business environment that are efficient and show stable legal rules and guidelines. EPZs also like to be locating in EPZs that receive government support, that have a skilled labor force, and advantageous labor costs, in addition, to having a solid energy infrastructure with a growing participation of renewable sources of energy, and abundant freshwater resources (Ahmadu, 2021; Frick & Rodriguez-Pose, 2023).

It is also important to realize that EPZs also have a political dimension since EPZs are expected to demonstrate the positive impacts of a more liberal trade policy and strategy for host countries. EPZs are able to streamline companies' operations and strategies, and in doing so allow companies to be more competitive and efficient. Moreover, the liberal policies pursued and implemented by EPZs attract foreign direct investment and foster and promote exports, creating jobs, amongst other economic and social impacts. Thus, EPZs are the harbinger of further social, economic, environmental, and political transformations in host economies. Thus, EPZs may act as engines for the further trade liberalization of trade policies in countries hosting EPZs. Thus, they work as a conduit for further trade liberalization in countries like Brazil, where the share of trade over GDP is one of the world's lowest, around 39% (Schrank, 2001; Richardson, Harrison, & Campling, 2017; World Bank, 2023).

The "enclave nature" of EPZs has created a perception that EPZs do not foster

further trade liberalization policies in countries hosting these EPZs, i.e., de facto creating a dual-development model. However, China offers a good counterpoint to these views, whereby EPZs were instruments for the further liberalization of the Chinese economy and for the exponential attraction of FDI and the exponential increase in China's volume of trade, as well as responsible for employing millions of workers (McCallum, 2011; Mavroidis & Sapir, 2023).

### 3. EPZs: The International Experience

EPZs have acted as catalysts for globalization over the past few decades. Countries have established EPZs in order to promote economic growth and development in their countries. EPZs, as discussed previously, promote a number of positive synergies and externalities for host economies. This section will provide some examples of EPZs experiences from around the globe.

Free trade Zones have existed for centuries, most often located in major global trade routes such as: Gibraltar, Singapore, Hong Kong, among others major trade hubs. However, they specialized in creating centers of excellence for international trade, with no manufacturing or processing facilities and operations on site. The Shannon EPZ in Ireland was in fact the first EPZ that combined the characteristics of a free trade zone, with a manufacturing park. The Irish EPZ provided the blueprint for a number of other countries and regions to follow. In the 1960s and 1970s, mainly India, South Korea, Taiwan region, Indonesia, Malaysia, Singapore, and the Phillipines, among others established their own EPZs, starting a global trend (Murayama & Yokota, 2009; Farole, 2011; Zeng, 2021).

EPZs can be characterized in four major clusters: 1) There are some EPZs that are enclaves, and are mostly isolated from the host economy; 2) There are EPZs that are used as conduits for the further economic liberalization of the host economy; 3) There are EPZs that an integral dimension of a country's overall trade liberalization strategy, such as the freeing up trade policies and exchange rate regimes, and 4) There are EPZs that never became engines of economic growth and development, but rather became infective as a result of a combination of factors such as: 1) Failure to attract FDI, mostly as a result of the host country not pursuing global economic integration strategies in the form of joining regional economic integration agreements, or 2) As a result of the poor quality of its labor, infrastructure, regional location, and the perceived political and economic risks (Omar & Stoeber, 2008; Sargent & Matthews, 2001; Warr, 1989a, 1989b; Cirera & Lakshman, 2014).

However, in the large majority of cases, EPZs have had a positive impact on host economies. The dramatic increase in the number of countries and EPZs joining the global supply and value-added global supply chains is a good testimony to their economic and social effectiveness. The following EPZs' experiences will highlight some host countries experiences with establishing EPZs in their economies (Willmore, 2000; Tanui, Martin, John, & Obara, 2023).

Jebel Ali Free Zone (Jafza) is an important dimension of Dubai's and UAE's

integrated business network hub. Dubai's free trade zone has expanded Dubai's trade opportunities turning into a catalyst for businesses growth opportunities. For instance, the Jebel Ali Free Zone is home to more than 9500 businesses from more than 100 countries and generates close to US\$ 104.2 billion annually on average. The free zone aggregates logistics, e-commerce, petrochemicals, food and livestock, electronics, manufacturing, and other industries (Jafza, 2023).

African EPZs are considered vital for the continent's ability to foster FDI attraction, stimulate economic development and growth, foster economic reforms, and accelerate industrialization across the continent. In 2023, a number of African countries are pursuing the expansion of their EPZs program, for instance, Kenya in establishing three new EPZs in Bonje, Bombululu, and in Mavoko, reaffirming the currency and importance of EPZs for a number of countries around the globe (African Union, 2022; HKTDC, 2023).

In 2023, the United Republic of Tanzania continues to expedite and simplify foreign direct investment procedures aiming at the country's EPZs as well as also paying heed to economic reforms aiming at creating a more efficient domestic business for companies. EPZs were first introduced in the United Republic of Tanzania in 2007. Since then, investments have grown to US\$ 2.6 billion, with export revenues in the range of US\$ 1.3 billion and generating employment to 50,000 people. These EPZs are located in a strategic country that provides the link between Eastern and Southern Africa regional markets, as well as fostering transportation and logistics for COMESA member nations, addressing further economic integration aspirations amongst African nations (EPZA, 2023).

Nigeria has also actively promoted the creation of EPZs. By 2023, the country had more than 40 EPZs in operation, generating more than 25,000 jobs, and has attracted more than US\$ 30 billion in investments. Manufacturing, services, and oil and gas constitute the major areas of activities or companies located in Nigeria's EPZ program (NEPZA, 2023).

In the case of the Uttara EPZ in Bangladesh, the poverty affected region has been transformed into a dynamic industrial hub. The EPZ improved the local infrastructure, such as paved roads as a result of the manufacturing taking place in the region. Moreover, the local population has also benefited from the improved services such as water supplies, educational and skilled training programs, as well as improved healthcare. The EPZ created a number of direct and indirect jobs, having a dramatic impact on local wealth creation, in addition to helping Bangladesh increase its exports of goods and services, attracting FDI, and creating direct and indirect jobs. In the case of EPZs in Mauritius, there were gains from the use of local inputs by EPZs as well as substantial gains from foreign export revenues, as well as the creation of jobs, and additional tax receipts (Woldekidan, 1993; Islam & Sarkar, 2023).

In 1978, the Chinese State Council's authorized the creation of the Special Economic Zones (SEZs) in Fujian and Guandong. China's impressive economic growth and development can be traced back to the establishment of EPZs/SEZs, beginning with only 4 zones in 1980. China has created a number of EPZs to

foster and facilitate greater penetration into the global supply chain and increase China's manufacturing upgrading (Fitting, 1982; Yeung, Lee, & Kee, 2009; Zeng, 2012; Wu & Hong, 2023).

In Mexico, the Maquiladora industry has revolutionized Mexico's economy and society. The Maquiladora program boomed after 1994, when the NAFTA agreement was signed creating the trade alliance between the U.S., Mexico, and Canada. In 2021, the NAFTA agreement was revamped aiming at expanding the scope of its agreement, creating the USMCA agreement. Mexico's Maquiladora industry has been a magnet for foreign direct investments from all over the globe aiming at participating in the USMCA trading block. The Maquiladora industry has also provided millions of jobs and has dramatically increased the exports of manufactured products from Mexico and attracted more than 3000 multinational companies. In 2021, the Maquiladora industry accounted for 58% of Mexico's manufacturing GDP, and accounted for close to 48% of Mexico's manufacturing employment. In 2023, the Mexican Maquiladora industry has turned Mexico into the leading vehicle producer in Latin America and the world's 7<sup>th</sup> largest producer of vehicles, and the world's fourth-largest exporter of automotive parts. Total trade between Mexico and the U.S. totaled US\$ 779 billion. In 2023, Mexico became the U.S. top trading partner, surpassing China (Hansen, 2003; Canas, 2022; Lopezlena, 2023; NAPS, 2023; Torres, 2023).

#### 4. Brazil'S Foreign Trade Policies & EPZS

The previous sections highlighted the importance and role of EPZs in promoting foreign trade, foreign direct investment, and employment around the globe. In the late 1980s, Brazil started to pay heed to the increasing role and importance of EPZs. Brazil saw EPZs as an opportunity to join the global EPZ bandwagon and speed up trade and investment liberal policies, despite Brazil's still pursuing an import-substitution strategy, with a strong bias against market-oriented reforms (Ministry of Development, Industry and Foreign Trade, 2013, 2022).

Brazilian policy-makers saw that these EPZ "enclaves" could offer the country a step forward in terms of introducing a liberal trade and foreign direct investment agenda, policies, and guidelines. By the late 1980s, Brazil's import-substitution strategy resulted in turning the Brazilian economy and business environment into a non-competitive, not efficient, not productive, and a costly environment for foreigners to do business in. As a result of Brazil's massive import tariff and non-tariff barriers, Brazil became a marginal player in global markets. During the same time, a number of Asian countries were leading a new cycle of economic prosperity in the global economy, led by export promotion strategies and by a strong push to attract foreign direct investment, while Brazil and most of Latin America was lagging way behind these Asian economies, such as China. The Asian export miracle was largely fueled by the massive creation of EPZs throughout Asia (Braga, 2019; Gouvea, 2012, 2014, 2020).

The Brazilian Export Processing Zone (EPZs) program was established in



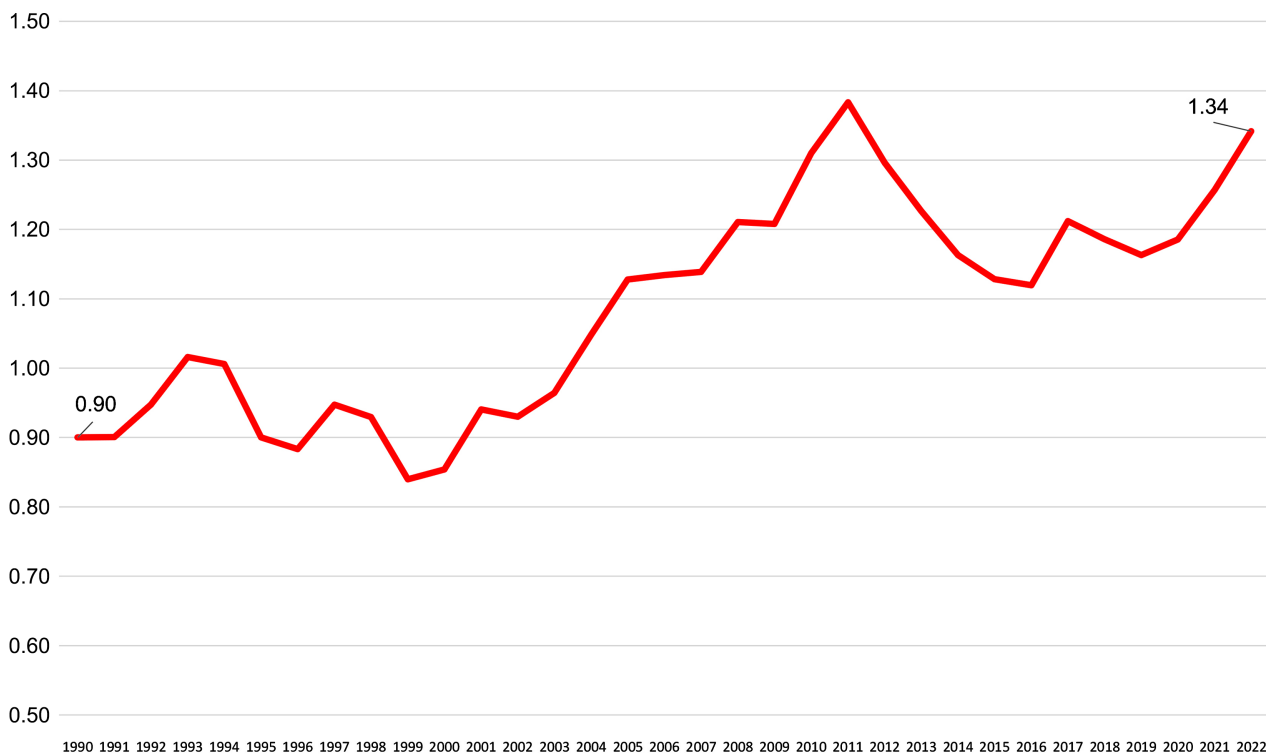
1988. Decree-Law No.2.452 formalized the Brazilian EPZ program. In 2007, Decree-Law No.11.508 further reinforced the importance of establishing a dynamic EPZ program in Brazil. As in many other countries around the globe, Brazilian policy-makers approached the EPZ program as potential engines of economic growth and development for the Brazilian economy (Braga, 2020b; Gaeta, 2022).

Policy-makers had a number of expectations about establishing an EPZ program in Brazil. EPZs was perceived as a way to attract foreign direct investments (FDI), as a way to increase Brazil's export earnings, easing balance-of-payment constraints, as a way to boost employment, as a way to disseminate and transfer modern managerial know-how and innovations (Carvalho, 2022).

Initially, Brazilian policy-makers also saw EPZs helping Brazil to address regional income and employment disparities by emphasizing the location of some EPZs in some of Brazil's poorest regions, such as Brazil's Northeast, North, and Center-West regions. However, Law No.8.396 corrected this distorted approach, thus allowing the establishment of EPZs all over Brazil's territory (National Council of the Export Processing Zones, 2015, 2023; Braga, 2020a).

The creation of Brazil's EPZ program followed an ambitious trade liberalization strategy pursued by the Collor de Mello administration in the early 1990s. Brazil in 1990 made dramatic changes to its archaic and heavily protectionist trade policy. However, the following administrations revoked a number of the trade liberalization initiatives by the Collor administration, including a rejection to the U.S. offer for Brazil to join the NAFTA agreement. Instead, Brazil decided to engage in developing regional trading agreements, such as the creation of Mercosur. Mercosur had a positive impact on Brazil's trade with Argentina but did not insert Brazil into the global value-added and supply chains that NAFTA would have promoted. Instead of pursuing bilateral agreements with the likes of U.S. and the EU, and even pursuing membership in other regional economic agreements, Brazil made a clear decision to avoid exposing its heavily protected industry from competition (Braga, 2019; Braga, 2020a; Gouvea, Gutierrez, Montoya, & Terra, 2021; Noronha, 2022).

**Figure 1** shows the participation of Brazilian exports as a percentage of global exports for the period 1990-2022. Brazil's marginal position is a direct result of its inward-looking strategies and reluctance to pursue a more dynamic insertion in the global economy. Contrary to Asian economies that were pursuing aggressive export-promotion strategies in the 1980s and 1990s, Brazil followed a dormant foreign trade policy, resulting in Brazil's lack of participation in the world's most dynamic regional trade agreements and consequently missing important commercial opportunities to expand and diversify its exports, in addition to preventing Brazil from attracting larger volumes of FDI aiming at exporting from Brazil. This lackluster foreign policy and trade performance resulted in Brazil becoming isolated from global value-added and supply chains, deeply affecting Brazil's ability to expand its exports and attract FDI.

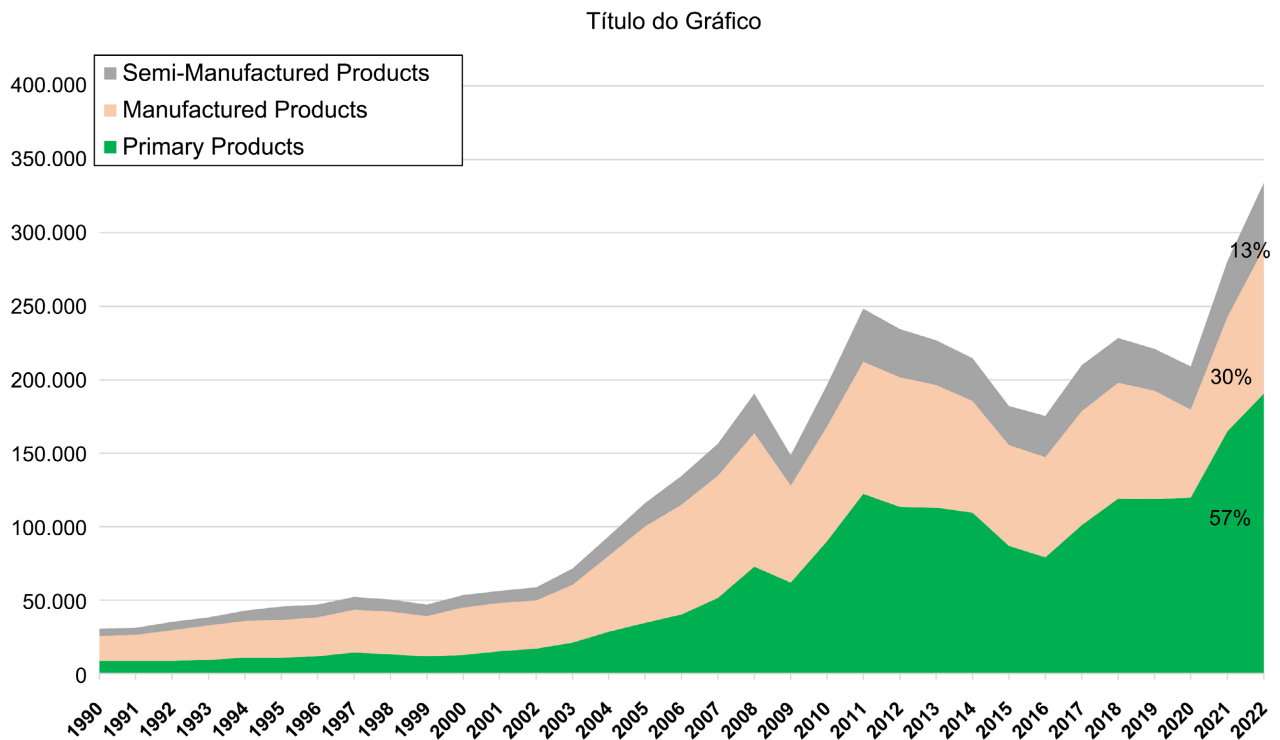


**Figure 1.** Share of Brazilian exports as a share of global exports, 1990-2022. Source: Elaborated by the authors, WTO/Database 2023.

Moreover, the lack of a pro-business business environment and a liberal trade policy further penalized Brazil's manufacturing and high-tech sectors, making access to foreign inputs extremely costly. Thus, with a few exceptions, Brazil's manufacturing sector started to lose global market share. In addition, Brazilian exports of manufactured products and semi-manufacture products started to lose share in Brazil's export portfolio. Brazil started to specialize in the export of mineral and agricultural commodities. As a result of Brazil's heavily protectionist foreign trade policies, Brazil's manufacturing lost ground globally, which eventually led to the reduction of Brazil's economic complexity (Gouvea, 2020).

These myopic policies were in place throughout the 1990s and 2000s. **Figure 2**, showcases the evolution of Brazil's export portfolio during the period 1990-2022, showcasing the increasing importance of agricultural and mining commodities and the diminishing role of manufactured and semi-manufactured products in Brazil's export portfolio.

Brazil's inward-looking trade policies of the 1990s and 2000s also resulted in Brazil's marginal role in global supply chain and added-value supply chains. This marginal role deeply affected Brazil's ability to increase its exports of manufactured products and its ability to attract manufacturing related FDI, deeply affecting the country's ability to increase employment in better paid economic sectors. Instead, Brazil started to rely increasingly on exports of commodities with low or no value-added, with a very low employment impact (Gouvea, Gutierrez, Montoya, & Terra, 2021).



**Figure 2.** The evolution of Brazil's export portfolio, share of commodities, semi-manufactured, and manufactured products, 1990-2022. Source: Elaborated by the authors, IPEADATA/Database 2023.

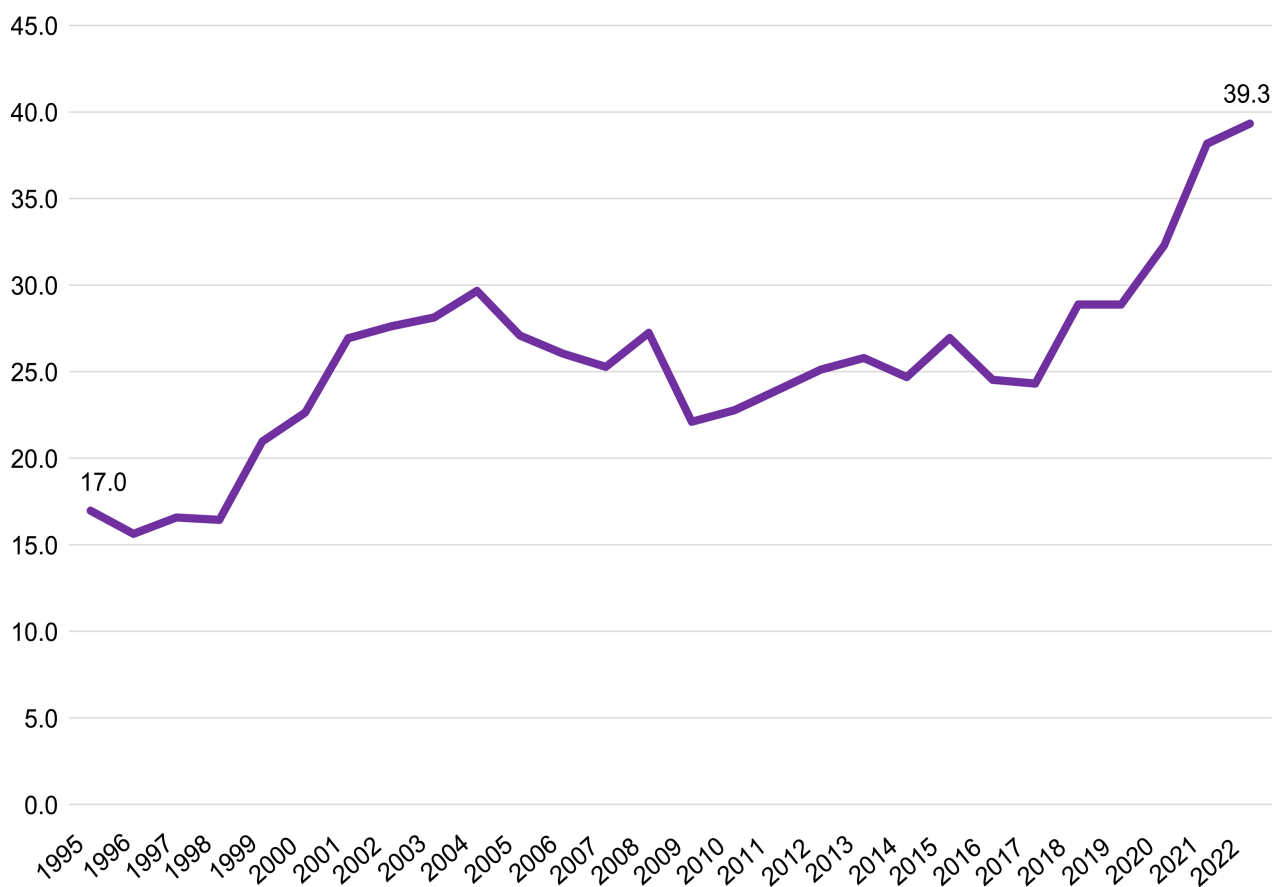
The lack of Brazil's government effort in promoting innovation and R & D, further penalized Brazil's ability to export its manufacturing products to foreign markets and to be able to develop high-tech industries in Brazil. In the 1990s and 2000s, most of the global high-tech manufacturing FDI was being directed towards Asian economies. Asian economies invested heavily in upgrading the quality of their labor force in order to accommodate these high-tech FDI flows moving into the region. Singapore is a good example. Singapore has become one of Asia's main IT FDI hubs. The same has happened in India where a number of Western software multinationals located their facilities in regions such as Bangalore. Around the same time frame, most of the FDI that moved into Brazil was related to the "brown economy" i.e., FDI seeking natural resources and energy-intensive types of investment. Thus, Brazil was not able to "connect" its economy into the globalization process as well as Asian economies did. Moreover, the lack of an emphasis on investments on innovation and R & D by both the Brazilian government and Brazil's private sector limits the backward linkages offered by EPZs as they engage in the procurement of inputs, parts and components, and capital goods as key components in their manufacturing and processing facilities. Thus, Brazil's lack of emphasis on innovation and R & D are also creating additional barriers for the further positive impacts created by EPZs located in Brazil. Moreover, it also limits Brazil's capability in attracting R & D-intensive foreign direct investments towards its EPZs (Gouvea, 2014).

**Figure 3** illustrates the share of imports and exports as a percentage of Brazil's

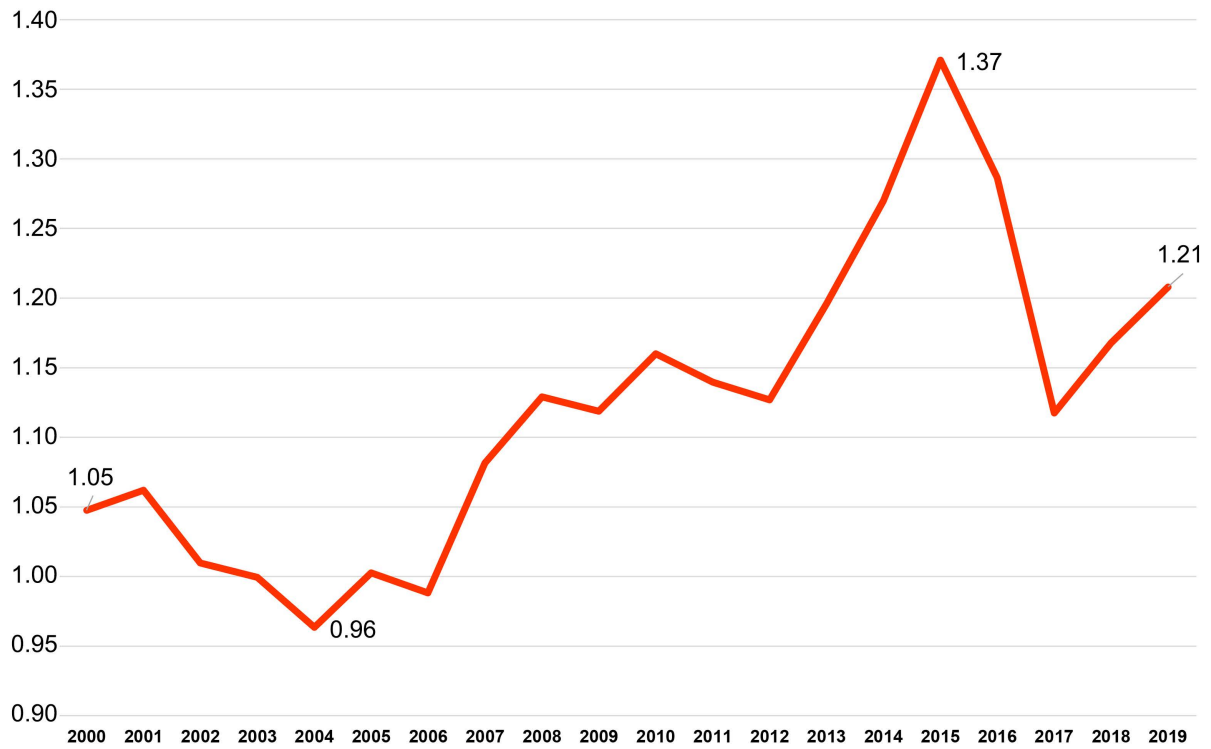
GDP during the 1990-2023 time period. Brazil has one of the world's closest economies as measured by the share of exports and imports as a percentage of Brazil's GDP, indicating Brazil's failure in capturing foreign trade opportunities, and also showcasing the country's low penetration in the globalization process.

**Figure 4** illustrates Brazil's total investment in R & D as a percentage of Brazil's GDP. Historically, Brazil has invested close to 1.1% of its GDP on R & D, a very low share when one compares the ranking of Brazil's economy in the global economy. The World Innovation Index also sheds light in Brazil's global rankings when comes to innovation and R & D. In 2022, Brazil was ranked in 52nd place, reflecting Brazil's lack of historical attention to promoting innovation and R & D (World Intellectual Property Organization, 2023).

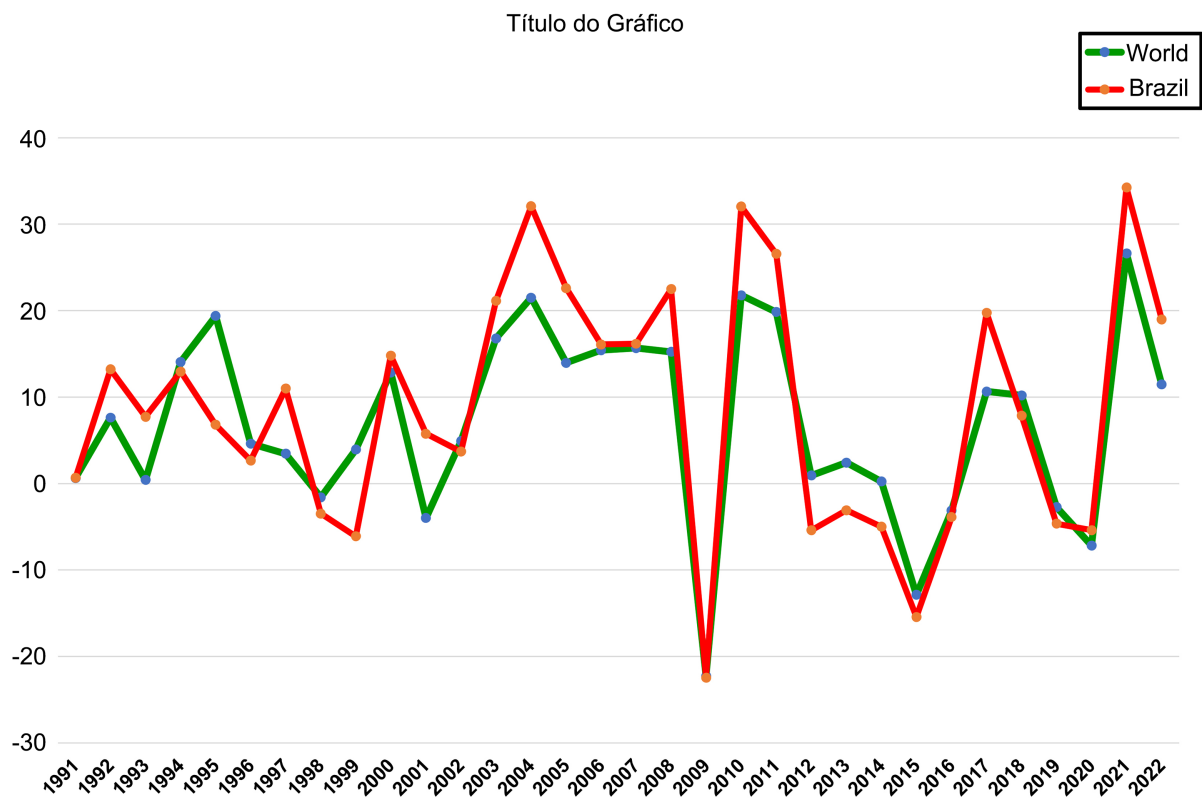
It is in this low economic growth scenario that efforts to create a dynamic EPZ program in Brazil gained traction and was gradually developed (**Figure 5**). In 2023, after a few decades, Brazilian policy-makers finally understood the importance of establishing an efficient and welcoming package of incentives and policies to foster the development of a dynamic EPZ program in Brazil. The next section will elaborate on Brazil's EPZ program (Braga, 2020a; Braga, 2022; Braga, 2023).



**Figure 3.** Share of Brazilian exports & imports as a percentage of Brazil's GDP, 1995-2022. Source: Elaborated by the authors, IBGE/National system account.



**Figure 4.** Brazilian R & D expenditures as a share of Brazil's GDP, 2000-2019. Source: Elaborated by the authors, world bank/world development indicators.



**Figure 5.** Rates of growth of Brazilian exports vis-à-vis growth of world exports, 1991-2022. Source: Elaborated by the authors, WTO/Database 2023.

## 5. Brazil's EPZ Program

In 2023, Brazil has renewed its efforts to establish a dynamic EPZ program, aiming at boosting Brazil's ability to attract foreign direct investment (FDI), diversify its export portfolio, increase export earnings, and expand employment opportunities. Thus, Brazil is following on the footsteps of a number of countries around the world that are currently relying on this economic, social, and environmental strategy. In Latin America alone, countries like Colombia, Costa Rica, the Dominican Republic, and El Salvador have established vibrant EPZ programs (Hirou, 2022).

In countries, such as Brazil that are reluctant to engage in trade liberalization policies and strategies, EPZs are capable to create a more competitive environment for domestic companies aiming to expand their global strategy. Countries like Brazil are a good case in point, where Brazilian policy-makers for decades have penalized Brazil's exporting sector by engaging and pursuing protectionist policies that hampered the ability of Brazilian companies to gain access to foreign made inputs and participate in global value-added supply chains. EPZs create the opportunity for Brazil to become a player in global supply valued-added chains as well as creating a new cycle of industrialization in Brazil.

The Brazilian EPZ program follows global trends when comes to the offering of incentives to promote the attraction of companies. Fiscal, customs, and administrative incentives tend to follow similar incentives offered by other EPZ programs from around the world (Alan, 2019).

Brazilian EPZs are created by presidential decree, after being approved by the National Council of EPZs (CZPE). The council is headed by the minister of Industry, Foreign Trade and Services (MDIC) and executive secretaries from another eight ministries. Until recently, EPZs could only be proposed by state governments or prefectures. However, Law No.14.184 of 2021 allowed for the creation of EPZs by the Brazilian private sector, thus creating a private-public partnership (PPP) between the government and the private EPZs investors. The private investor builds the EPZ on a piece of land owned by the private investor and making a petition directly to the Federal government. The government provides all the needed infrastructure surrounding the EPZ, while the government or the private sector provides all the internal infrastructure.

Companies established in Brazil's EPZs receive a number of incentives to promote their participation in Brazil's EPZ program. Law No. 14.184 of 2021 lists the incentives allocated to companies located in Brazil's EPZ. For instance: the Brazilian EPZ program contemplates the exemption of federal and state (ICMS) taxes and duties on imported or domestic inputs, such as raw materials, intermediate goods, and capital goods be these new or used. The Brazilian EPZ program also contemplates the exemption of the following taxes when companies located in ZPEs purchase raw materials, intermediate goods, and capital goods from Brazilian domestic producers, such as the Tax on Manufactured Products (IPI), the social contribution tax (COFINS), and the tax on social con-

tribution on a company's gross revenue (PIS/PASEP). In addition, when companies located in EPZs they are also exempted from the import taxes, IPI, COFINS applied to imports, and PIS/PSEF applied to imports, as well as exemption from taxes related to freight charges aimed at the renovation of Brazil's merchant industry (AFRMM).

The Brazilian EPZ program also shields the company installed in an EPZ from Brazil's bureaucracy's, Brazil's "Red Tape." For instance, the EPZ company is exempted from having to file and request an authorization and licenses to import inputs, such as raw materials and capital goods. However, EPZ companies still have to comply and follow Brazil's sanitary, environmental, and national security laws, regulations, and guidelines. Other incentives cover the exemption of Income tax on remittances aiming at export promotion activities and foreign market research. It also covers tax reductions for investments in R & D, automation, and brand registration, among other expenditures.

Companies established in the EPZs are also exempted from Brazil's "law of similars" when the equipment is manufactured domestically. Companies established in Brazil's EPZs are free to import any capital goods and equipment that may be made domestically in Brazil, companies can even bring a whole manufacturing plant from overseas with full import taxes exemption.

The new Brazilian EPZ legislation allows companies established in the EPZs to sell up to 100% of their production in Brazil's domestic market. However, when doing so, all related taxes will be applied that were previously suspended. When exporting all taxes are exempted, this regime is in place for 20 years, guaranteeing companies established in the EPZ the certainty that rules and guidelines will not be changed.

There are no discriminations regarding the sector or industry that wants to locate in Brazil's EPZ program. The only exceptions are related to the manufacturing of guns and explosives, and radioactive material. The Brazilian Armed Forces and Brazil's Commission on Nuclear Energy will analyze such requests and emit an authorization if the request is approved.

It is important to notice, that the Brazilian EPZ program has suffered a number of changes since its inception in order to become more appealing to foreign investors. For instance, at its inception, companies established in Brazil's EPZs could only sell up to 20% of their production in Brazil's domestic market. Law no.14.184 of 2021, changed these restrictions allowing companies established in Brazil's EPZ to sell up to 100% of their production in Brazil's domestic market.

Another major change that took place was the inclusion of services amongst the approved sectors present in Brazil's EPZ program. Following global trends, Brazil is now allowing service companies that linked to manufacturing industries inside the EPZ as well as service companies that are exporting their services such as IT companies or logistic companies, among other services sectors.

In 2023, Brazil is giving a renewed emphasis on revamping Brazil's EPZs). In 2023, Brazil has 14 EPZs authorized by the Brazilian federal government to op-

erate. They are: Acre, ZPE do Acu, Araguaina, Bataguassu, Boa Vista, Caceres, Ilheus, Imbituba, Macaiba, Parnaiba, and Pecem. The large majority of these EPZs are located in the Northeast region, North, and Mid-West regions of Brazil, addressing one of the objectives of EPZ program to address regional income inequalities. Moreover, the large majority of Brazilian EPZs are government driven, however, the Brazilian private sector is starting to develop private-led EPZs. For instance, Brazil's first private EPZ is located in the Southeast region of Brazil, Aracruz in the state of Espirito Santo (LegisWeb, 2023; Wilson Sons, 2022; Sa Malta, 2023).

The roles assigned to EPZs are shaped by the host country's overall goals and objectives for EPZs. In the Brazilian case, EPZs locations were initially geared towards addressing the social and economic needs of Brazil's poorest regions. Thus, efforts were made to locate a number of EPZs in Brazil's Northeast and North regions, Brazil's poorest regions (Jayanthakumaran, 2003).

Brazil has 11 authorized EPZs, of which two EPZs, Pecem and Parnaiba, both are located in Brazil's poorest region, the Northeast region, in the states of Ceara and Piaui, respectively. These two EPZs are government sponsored EPZs (Figure 6).

Brazilian EPZ's are also beginning to play a major role in Brazil's quest to become of the world's largest producers of green hydrogen. The Green Hydrogen Hub project in the state of Ceara will be established in the Pecem EPZ, aiming at developing and using renewable green forms of energy. In 2023, it is expected that close to US\$ 8 billion will invested in the Pecem EPZ for the production of green hydrogen (Paradella, 2023).



**Figure 6.** Geographical distribution of EPZs in Brazil's territory. Source: Ministry of Industry, Development, and Foreign Trade (2022).



## 6. Green Powershoring & Brazilian Epzs: Challenges & Opportunities

In 2023, environmental factors are increasingly shaping foreign trade and foreign direct investment global flows. Climate change is demanding a new environmental agenda one that it is impacting companies' environmental goals and objectives. Companies from around the globe are pursuing energy consumption and water consumption strategies aiming at reducing their water and carbon footprints.

Thus, companies are searching for production sites around the globe where they can address these urgent and pressing needs: to lower their water carbon footprints. Thus, locating to countries that can supply abundant green energy and abundant water resources are a must strategy for companies from around the world. Manufacturing is a water and energy intensive process. Companies striving to meet the 2030 ESG agenda are more than ever searching for these production sites in order to increase their global competitive edge and advantage vis-à-vis their competitors (Gouvea, Kassiech, & Montoya, 2013; Arbache, 2022).

Power shoring provides the answer to these questions, addressing the decentralization of production or the re-location of production to green energy intensive countries and water-intensive countries.

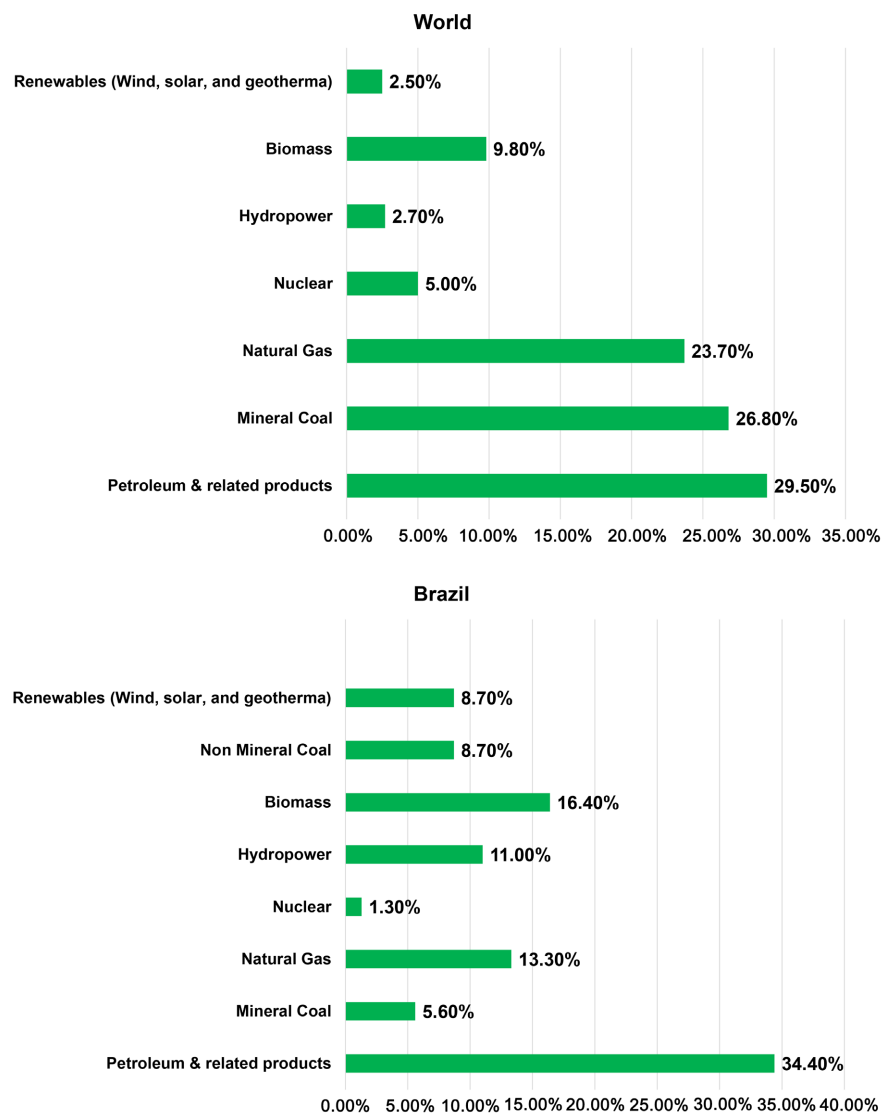
Latin America, especially Brazil can offer multinational companies pursuing power shoring strategies the ideal location for their foreign direct investment. Moreover, Brazil is also positioning itself as a major producer of hydrogen and green hydrogen further reinforcing its leading role in the power shoring global scenario. Energy-intensive and water intensive manufacturing, from aluminum to micro ships will find in Brazil EPZs one of the world's best sites for investment (Paradella, 2023; World Energy, 2023).

Recently, there have also increasing demands for companies participating in EPZs programs to follow and comply with SDGs guidelines in order to address an inclusive, equitable, and sustainable working environment at EPZs. For instance, EPZs in a number of countries are diversifying their energy matrix by adding renewable forms of energy sources as a contribution to address climate change concerns. Moreover, companies around the globe are also under pressure to diminish not only their carbon footprint, but also their water footprint (Lang, 2010; Neveling, 2017; Adu-Gyamfi, Asongu, Mmsi, Wamalwa, & Magori, 2020).

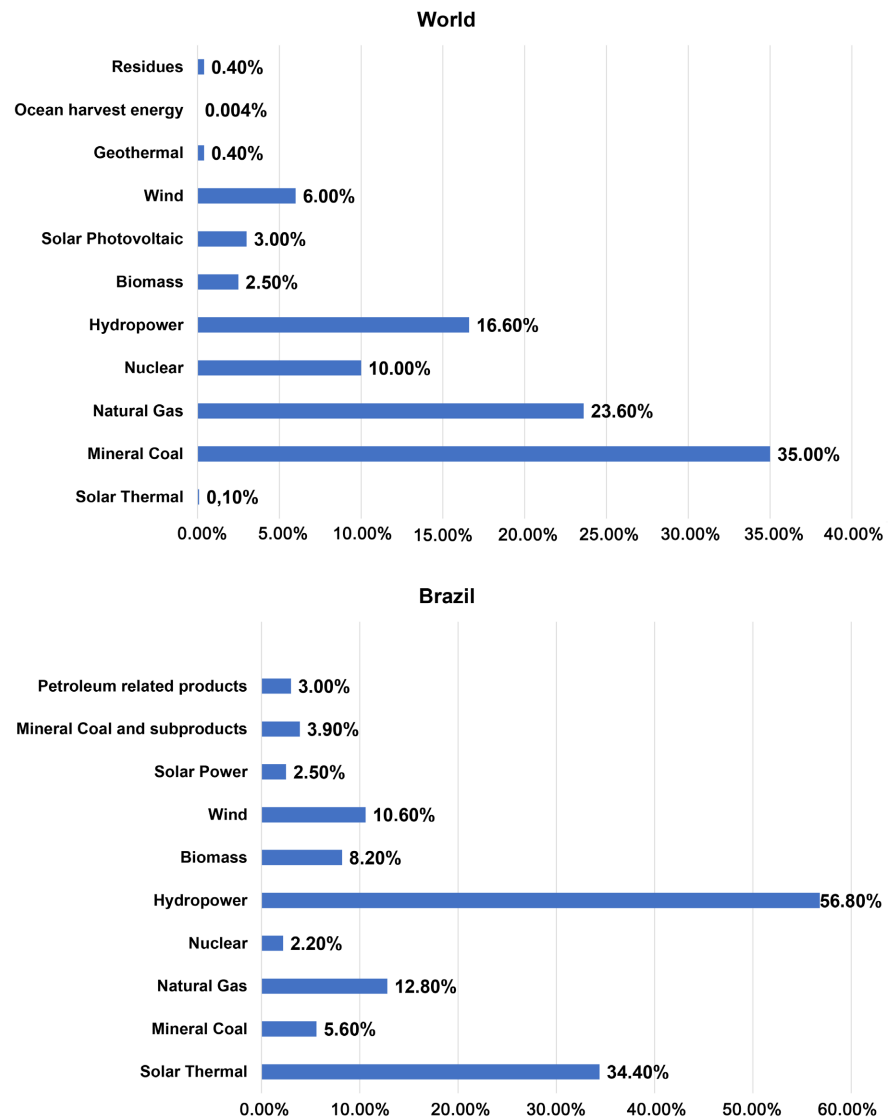
Brazil has a natural advantage when comes to be able to supply companies established in Brazil's EPZ with a wide array of choices of renewable sources of energy. Brazil has an energy and electricity matrixes much cleaner than the world's energy and electricity matrixes. **Figure 1** and **Figure 2** illustrate Brazil's competitive power shoring edge when comes to the increasing use of renewable sources of energy and electricity (MacAlister, Baggio, Perera, Qadir, Taking, & Smakhtin, 2023).

As illustrated by **Figure 7**, the world's energy matrix is mostly comprised of non-renewable sources of energy, such as mineral coal and petroleum and sub-products, alone contributing 56.3% to the world's energy matrix, with hydro power contributing with 2.7%, and wind, solar, and geothermal for only 2.5%. Adding, biomass, hydro power, solar wind, and geothermal, it only accounts for close to 15% of the world's energy matrix. On the other hand, renewables account for close to 44.8% of Brazil's energy matrix. Out of Brazil's energy consumption, renewables sources are responsible for 48.4% of Brazil's total energy consumption, compared to the world's 15%, showcasing Brazil's greener energy matrix than the world's energy matrix (IEA, 2022; EPE, 2023).

**Figure 8** illustrates Brazil's and the world's electricity matrixes. Brazil's electricity matrix is also much greener than the world's electricity matrix. Fossil fuels, such as natural gas and mineral coal powers the world's electricity matrix,



**Figure 7.** Brazil's and the world's energy matrixes, 2020. Source: Elaborated by the authors' Empresa de Pesquisa Energetica (2023), <https://www.epe.gov.br/>.



**Figure 8.** World's and Brazil's electricity matrices, 2020. Source: Elaborated by the authors, *Empresa de Pesquisa Energetica* (2023), <https://www.epe.gov.br/>.

accounting for close to 58.6% of the world's electricity matrix. Renewables are still secondary sources of electricity at the global level. Brazil's electricity matrix, on the other hand, shows a much greater share of renewable sources of electricity. For instance, hydro power accounts for close to 56.7% of Brazil's total electricity production, followed by wind power with 10.6%, solar with 2.5%, and biomass with a share of 8.2% (EPE, 2023).

Thus, while in Brazil renewable sources account for close to 82.9% of Brazil's electricity generation, the world only relies on renewables for 28.6% of its total electricity generation.

Companies around the globe are also pursuing sustainability strategies to lower their water footprint and increase their economic resiliency. It is expected that by 2030 close to one-quarter of the world's population will experience water stress. Moreover, by 2050, it is expected that close to 30% of the global GDP will

be threatened by high levels of water stress. Manufacturing is a very water-intensive activity. Countries facing water stress are facing a number of challenges and barriers attracting foreign direct investment. It is expected that by 2030, global freshwater demand will outstrip fresh water supply by 40% to 50%. Not only brown manufacturing demands lots of fresh water, but green manufacturing such as semiconductor chips also do, as well as most of the manufacturing related to renewable sources of energy such as wind and sun (Jacob, 2023; Kuzma, Saccoccia, & Chertock, 2023).

In Asia, India and China are experiencing high levels of water stress in the form of water pollution and shortage, affecting agriculture and water reliant-manufacturing. The nexus water and energy are also very present in countries that are still relying heavily on coal such as the case of India and China since water is a fundamental element in the coal power generation plants. Taiwan region also needs a steady and plentiful supply of water to power its semiconductor industry. Clearly, the continuous fresh water struggles may lead some of the manufacturing currently established in Asia to migrate to water-intensive countries and regions, such as Brazil (Gouvea, Kassiech, & Montoya, 2013; Jacob, 2023; Kuzma, Saccoccia, & Chertock, 2023; Collins & Reddy, 2022).

In the European continent, water shortages and stress are also very likely to increase in the next decades, making manufacturing an increasingly hard proposition. Countries like England are already facing some dimension of water stress. Close to 30% of Europe's population is exposed to water stress, and it is expected that climate change is bound to impact Europe as the frequency and geographical impact of droughts tend to increase (European Environment Agency, 2021; European Commission, 2023).

Brazil is a fresh water-rich country that accounts for 12% of the world's reserves. Brazil is also the world's number one country when comes to the world's highest volume of renewable freshwater assets and resources. Brazil's Amazon region accounts for 70% of Brazil's water resources. Brazil also has one of the world's largest aquifers, such as the Guarani and Alter do Chao. The Guarani aquifer is the world's second-largest aquifer system in the world. The Alter do Chao aquifer is Brazil's second-largest aquifer (Azevedo & Campos, 2021; Sahoo, Pontes, Salomao, Powell, Mittal, Souza Filho, & Guimaraes, 2021).

Clearly, Brazilian EPZs offer an unparalleled location advantage when one takes into account SDGs goals and objectives. Brazil's electricity matrix and availability of fresh water allow for the greening of manufacturing and production processes for companies located in Brazilian EPZs.

## 7. Final Remarks

In the last five decades, we have observed the rapid proliferation of EPZs, showcasing how EPZs have become an integral dimension of the globalization process. More than ever, EPZs play an important role in connecting countries to global supply value-added chains. Thus, EPZs have been labeled as agents of globalization, shaping flows of global trade and investment, and creating jobs worldwide.

More recently, EPZs have also advanced the SDGs agenda by promoting the use of renewable sources of energy and water saving technologies, fostering the expansion of global green value-added supply chains.

As discussed previously, EPZs have become engines of growth and development for a number of host economies around the globe. China symbolizes the transformative nature and impact of EPZs on host economies ability to increase their participation in the global economy. Chinese EPZs propelled China's transition from a manufacturer of light manufacturing to a high-valued added, knowledge intensive producer of products and services. In 2023, Chinese EPZs account for roughly close to half of all global EPZ employment, showcasing EPZs role in generating employment in China, as well being a magnet for foreign direct investment and strong inducers of foreign trade. Not only China has benefited from EPZs. In Bangladesh, for instance, EPZs have had a positive impact on women employment and empowerment, on poverty alleviation, in addition to generating export revenues and attracting foreign direct investment.

Recently, there are also increasing demands for companies participating in EPZs' programs to follow and comply with SDGs guidelines in order to address an inclusive, equitable, and sustainable working environment at EPZs. For instance, the introduction of renewable energy to EPZs' energy matrix has gained traction in the last years, allowing companies established in EPZs to lower their carbon footprint and green their manufacturing and production processes. Companies located in EPZs have also been more concerned about freshwater availability and their water footprint when selecting EPZs, thus, contributing to addressing ESG guidelines and climate change challenges and opportunities.

The longevity and the life-cycle of EPZs are connected to their ability to adapt to the changing nature of global trends related to environmental related issues, social issues, foreign trade and foreign investment trends and issues. For instance, nearshoring and the green power shoring recent trends, represents a major departure from the early days, when cost of labor was a major driver of foreign trade and foreign direct investment flows. These new drivers will certainly reshape the EPZ global landscape.

In 2023, Brazil is renewing its efforts to establish a vibrant EPZ program. The timing couldn't be better as the country is well positioned globally to establish itself as one of the premier sites for the green power shoring trend, as EPZs embrace a greener approach to operations and manufacturing processes. As discussed in this paper, Brazil is well positioned to address the challenges and opportunities created by these EPZs trends, such as the green power shoring trend. Brazil's green energy matrix and green electricity matrix, allied to its abundant fresh water resources, makes Brazil one of the leading countries for the Green EPZ trend that is materializing worldwide.

As discussed in this paper, Brazil is in a unique position to market its EPZs globally. The country possesses a natural competitive advantage in the green energy and fresh water dimensions, two key pillars of UN's 2030 SDGs. A few countries around the globe possess this unique environmental asset. Brazilian

policy-makers should capitalize on it and increase their efforts to work with Brazil's private sector to foster the creation of new EPZs in Brazil. Several countries, such as India and China have demonstrated the economic, social, and environmental impact of EPZs. In 2023, Brazilian politicians and policy-makers are finally working together to expedite the creation of new EPZs in Brazil. There is a growing understanding by Brazilian politicians, Brazilian policy-makers, and Brazil's private sector, that EPZs hold the key for the further expansion of Brazilian exports and inclusion in the global supply chains.

In August of 2023, a meeting took place in Brasilia, capital of Brazil, where a number of politicians representing Brazil's different political parties, showcased their support for the expansion of Brazil's EPZ program. This is a major inflection point in Brazil's ability to foster the development of Green EPZs. Brazil has lacked the political support to foster the expansion of its EPZ program, which largely explains its latecomer status.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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