REVIEW

Analysis of the economic development of the Brazilian Defense Industrial Base

Análisis del desarrollo de la Base Industrial de Defensa Brasileña

Análise do desenvolvimento econômico da Base Industrial de Defesa brasileira

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ABSTRACT

This article examines the development of the Brazilian Defense Industrial Base (DIB), from the economic point of view. The objective is to evaluate the growth of the defense industry since the 2000s, mainly regarding exports and Gross Domestic Product - GDP. First, a general contextualization is made, by presenting relevant terms. Subsequently, the companies that make up the DIB are characterized in order to understand the business profile of the sector. In addition, Brazil's position in the world defense market is studied. Brazilian exports are also evaluated, which are important to expand the consumer market of Brazilian products, for example. Finally, the importance of formulating public policies for the development of the DIB is briefly presented.

Keywords: DIB; GDP; Development; Exports; Public policies.

RESUMEN

Este artículo investiga el desarrollo de la Base Industrial de Defensa de Brasil - BID. El objetivo es evaluar el crecimiento de la industria de defensa desde la década de 2000 en adelante, especialmente en lo que respecta a las exportaciones y el Producto Interior Bruto - PIB. Primero, hay un contexto general, que presenta términos relevantes. Posteriormente, se caracterizan las empresas que integran el BID con el fin de conocer el perfil empresarial del sector. Además, se ha estudiado la posición que ocupa Brasil en el mercado mundial de defensa. También se evalúan las exportaciones brasileñas, que son importantes en términos de, por ejemplo, la expansión del mercado de consumo de productos brasileños. Finalmente, se presenta brevemente la importancia de formular políticas públicas para el desarrollo del BID.

Palabras clave: *BID; PIB; Dessarrollo; Exportaciones; Políticas públicas.*

RESUMO

Este artigo pesquisa o desenvolvimento da Base Industrial de Defesa brasileira – BID, sob o aspecto econômico. O objetivo é avaliar o crescimento da indústria de defesa a partir dos anos 2000, principalmente no que diz respeito às exportações e ao Produto Interno Bruto - PIB. Em primeiro lugar, faz-se uma contextualização geral, apresentando termos relevantes. Posteriormente, caracterizam-se as empresas que compõem a BID, de forma a entender o perfil empresarial do setor. Além disso, estuda-se a posição que o Brasil ocupa no mercado mundial de defesa. Avaliam-se, também, as exportações brasileiras, importantes no sentido de, por exemplo, ampliar o mercado consumidor dos produtos

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The acronyms and abbreviations contained in this article correspond to the ones used in the original article in Portuguese.

brasileiros. Por fim, apresenta-se, brevemente, a importância da formulação de políticas públicas para o desenvolvimento da BID.

Palavras-chave: *BID; PIB; Desenvolvimento; Exportações; Políticas públicas.*

1 INTRODUCTION

Historically, investments in national defense industries are associated with two factors. The first one concerns the defense of geopolitical, economic interests or the claim of territories. The second factor is related to the development of the Defense sector for the National Security, i.e. the territorial defense, aimed to protect against potential attacks and/or external threats.

Consensus about the impact of the Defense sector on the economy of the country is sought in the literature. In fact, discussions are centered on two relations. On the one hand, it is sought to understand the link between economic growth and military spending. On the other hand, the research in the military field and the technological development of the society is discussed, that is, it is intended to analyze whether the technology developed by defense product companies can bring benefits to the society as a whole. Thus, as in every theoretical discussion, the conclusions drawn by each author depend on the economic school – be it neoclassical, Keynesian, new-classical, etc.

This article is based on a bibliographic research which was established mainly on socioeconomic studies, in order to better understand the economic importance of the DIB in the country.

The Defense Economics field is in development in Brazil. There is also some difficulty in finding data on the Defense Industry, due to its dual character, which means that products and services aimed at this area can also be used in a civilian environment. This is a problem to monitor the companies and formulate policies aimed at the growth of the industry. In face of this problem, one of the objectives of the article is to investigate the growth of the Brazilian defense industry in order to contextualize it, since such initiative aims to contribute to the study and knowledge on socioeconomic data from the Internal Defense Base. In addition, it is intended to understand the importance of the international market for the sector, seeking information from international institutions and academic articles.

The article will be divided into four parts. First, important concepts will be introduced to understand the Brazilian defense sector, such as Defense Companies (DC), Strategic Defense Companies (SDC), Defense Products (DP), Strategic Defense Products (SDP). In addition, the DIB is characterized, presenting some data from the companies that compose it.

From this initial contextualization, it is possible to make a more in-depth analysis of the defense industry. Thus, in the third part, the global conjuncture of the defense market is studied, to understand the position that Brazil occupies in the world market. Finally, Brazilian exports of defense products are evaluated, and public policies focused on the sector are briefly mentioned.

2 DEVELOPMENT

2.1 Initial concepts

It is important to briefly explain, the phenomenon of "crowding out". In economics, according to AMBROS (2017), "crowding out" happens when the State, to stimulate aggregated demand, increases its expenditures. Given that the government is financed by contracting debt or issuing bonds, the increase government spending leads to an increase in interest rates – it is worth noting that this increase makes government bonds more attractive, consequently removing currency from the market to keep balance. However, rising interest rates have a negative effect on private investment as it increases its cost. Therefore, "crowding out" is an exchange between government and private sector participation.

The discussion on military technological research and its relation to national development is somewhat less controversial. That is because, according to Ambros (2017, p. 142), "it is demonstrated that the technology involved in the processes of defense-related companies can contribute to the development of a country".

To analyze this relationship, it is important to understand three similar concepts, according to BOHN (2014): "spill-over", "spin-off" and "spin-on". These three terms relate to the overlaps that can occur between the military area and civilian society, due to the development of these two sectors. More broadly, "spill-over" is any externality caused by military projects. In turn, the "spin-off" occurs when technological advances from defense industries are harnessed by the private sector and

ultimately the "spin-on" can be considered the opposite of the "spin-off," that is, technological advances from private companies that are used in the military sector.

In fact, authors such as DAGNINO (2008) point out that the spin-off has been used as an argument to justify defense spending. The spin-off phenomenon was observed, especially after World War II. Technologies discovered because of the War – such as nuclear power, encryption, cell phone, microwave, and internet – have benefited society as a whole in later years. Currently, the discussion involves the relevance of the spin-off, as over time, technological discoveries become increasingly incremental to the economy.

Dual technology is "that technology that can be used to produce or improve goods or services for civilian or military use", according to Longo (2011, p. 13). In Brazil, companies such as Embraer, Iveco and Atech, for example, produce products/services to meet the demands of the military sector and civil society, that is, it can be observed that Embraer, in addition to civil aviation, also produces military aircraft such as the KC-390; Iveco, which manufactures the Guarani combat vehicle and commercial trucks; and Atech, as a Embraer group company, also has products used in both markets.

2.2 DIB characterization

The number of Defense Enterprises and Strategic Defense Companies is known, however it is difficult to size the number of companies that make up the DIB, although it is possible to scale its impact on the economy. Considering the data of the Fundação Instituto de Pesquisa Econômica – Fipe, through a study presented to the Confederação Nacional da Indústria (CNI) on the Defense Sector production chain in 2021, it is known that, based on the multipliers originated from the methodology used (product-input matrix and calculation of the GDP of Defense and Security), from IBGE data and Federal Government systems, spendings on the Defense and Security sector, including exports, (involving the Ministry of Defense, the Armed Forces, Federal Police, State Policed and private security) generate a multiplier effect on the Economy of 2.199, that is, for each R$ 1.00 spent, an additional R$ 1.199 is created in the Brazilian economy. It is noteworthy that the vast majority of companies do not produce solely for the military sector, but also offer products and services aimed at civil society (these are dual companies). The government listing to characterize a company as belonging to the DIB is:

> The group of state or private companies participating in one or more stages of research, development, production, distribution, and maintenance of strategic defense products are called the Defense Industrial Base (DIB) - goods and services that, due to their features, can contribute to the achievement of objectives related to the security or defense of the country. (BRAZIL, 2014).

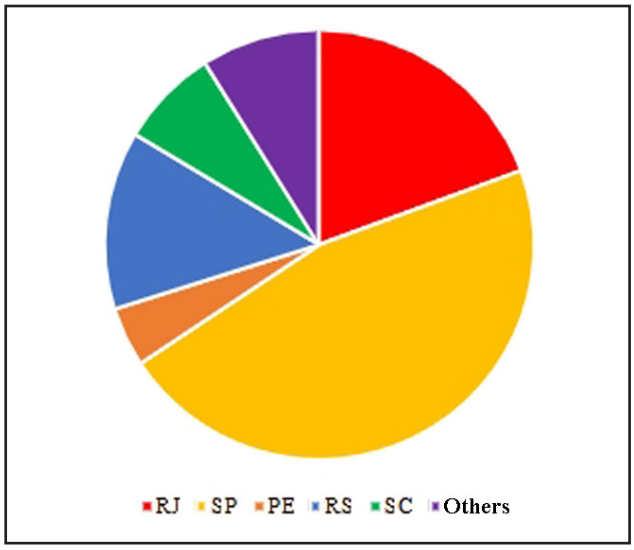
In addition, the Ministry of Defense (MD) classifies products that relate to national defense into two categories: Defense Products (DP) and Strategic Defense Products (SDP). According to information supplied in the Normative Regulation N° 86/GM-MD (BRAZIL, 2017), DP is "any good, service, construction or information used in defense activities". In turn, a Strategic Defense Product is "every DP that, due to its technological content, difficulty in obtaining or indispensability, is of strategic interest to the National Defense" (BRASIL, 2019).

In relation to companies, they can be accredited in two ways: Defense Companies (DC) and Strategic Defense Companies (SDC). According to the MD (2019), a Defense Company is "every legal entity that produces or integrates the production chain of a Defense Product". On the other hand, according to Normative Ordinance No. 86 of December 13, 2018, a Strategic Defense Company must meet the following conditions:

> a) have the purpose, in its objects clause, of executing or conducting research activities, design, development, industrialization, providing the services referred to in art. 10 of Law No.12,598, of March 21, 2012, production, repair, conservation, revision, conversion, modernization or maintenance of SDP in the country, including sale and retail, only if associated with the previously mentioned industrial activities.
> b) Have its head office, administration, and the industrial establishment in the country, equated to industrial or service provider.
> c) Have, in the country, proven scientific or technological knowledge or complement by agreements of partnerships with Scientific and Technological Institutions for joint scientific and technological research and technology development, products or processes, related to the activity developed, observing the provisions of item X of art. 2nd of Law No. 12,598, 2012.
> d) Ensure, in its constitutive acts or in the acts of its direct or indirect controller, that the set of partners or shareholders and groups of foreign partners or shareholders may not exercise at each general meeting a number of votes greater than 2/3 (two thirds) of the total votes that can be cast by the Brazilian shareholders present; and
> e) Ensure the productive continuity in the country. (BRAZIL, 2017).

In more detail, in March 2020, the Defense Economy Division (DIVED), that belongs to the Department of Defense Finance and Economics (DEPFIN) of the Ministry of Defense, prepared a questionnaire with the objective of characterizing the Brazilian defense industry. According to the survey, approximately 91% of the companies were in five states: São Paulo, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and Pernambuco.

Graphic 1 - Location of Companies.



Source: Brazil, 2020.

Regarding revenues, 40.9% of the companies are medium-sized, followed by small businesses1. In addition, 36.4% of the sample employed between 20 and 99 employees.

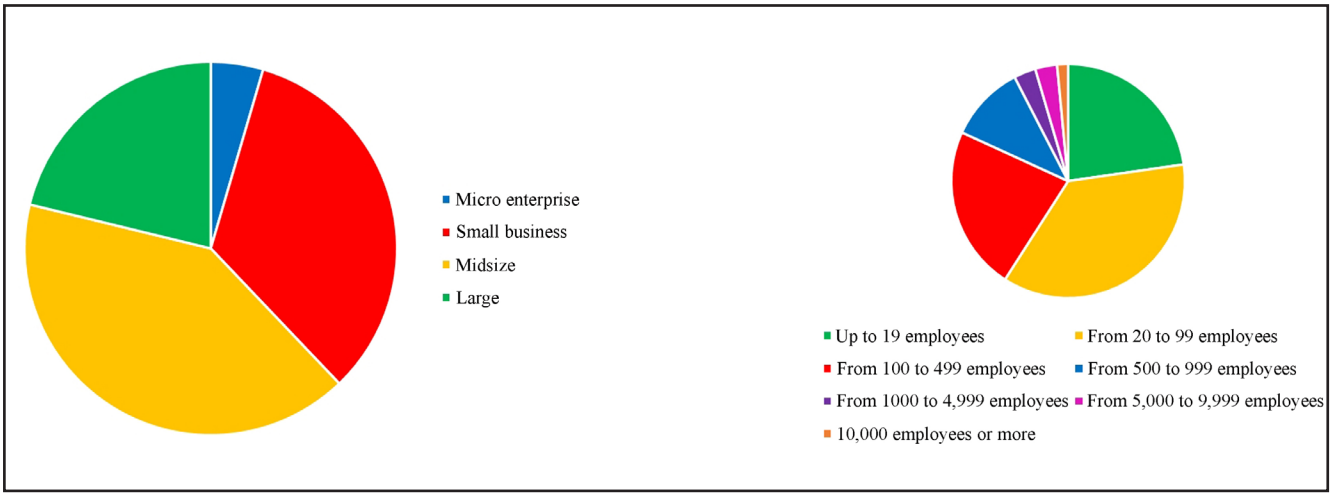
Regarding gross domestic product (GDP), Fipe has measured the impacts of the Defense and Security GDP on the national economy, based on IBGE product-input matrix, from expenses data from the Ministries of Defense, Federal Public Safety and State Public Safety, in addition to private security and the industrial sector supplier of products and services typical of Defense and Security, including export. The sector has proved to be quite prosperous and has positively influenced economic growth, with increasing developments, as presented in Graph 4.

2.3 Global defense scenario

Historically, Brazil is the main country in terms of military spendings in South America. According to the Stockholm International Peace Research Institute (SIPRI), in 2019, Brazilian defense expenditures accounted for approximately 51% of the sub-region's total.

By 2020, South American military spendings reached $43.5 billion. In the global context, the five countries that had the most military spending in 2020 were: the United States, China, India, Russia, and the United Kingdom. According to the ranking prepared by SIPRI, Brazil ranks 15th in relation to military spending (which includes the country's military spendings on defense including personnel, material, and services, basically, according to the expenditure database found on the SIPRI website).

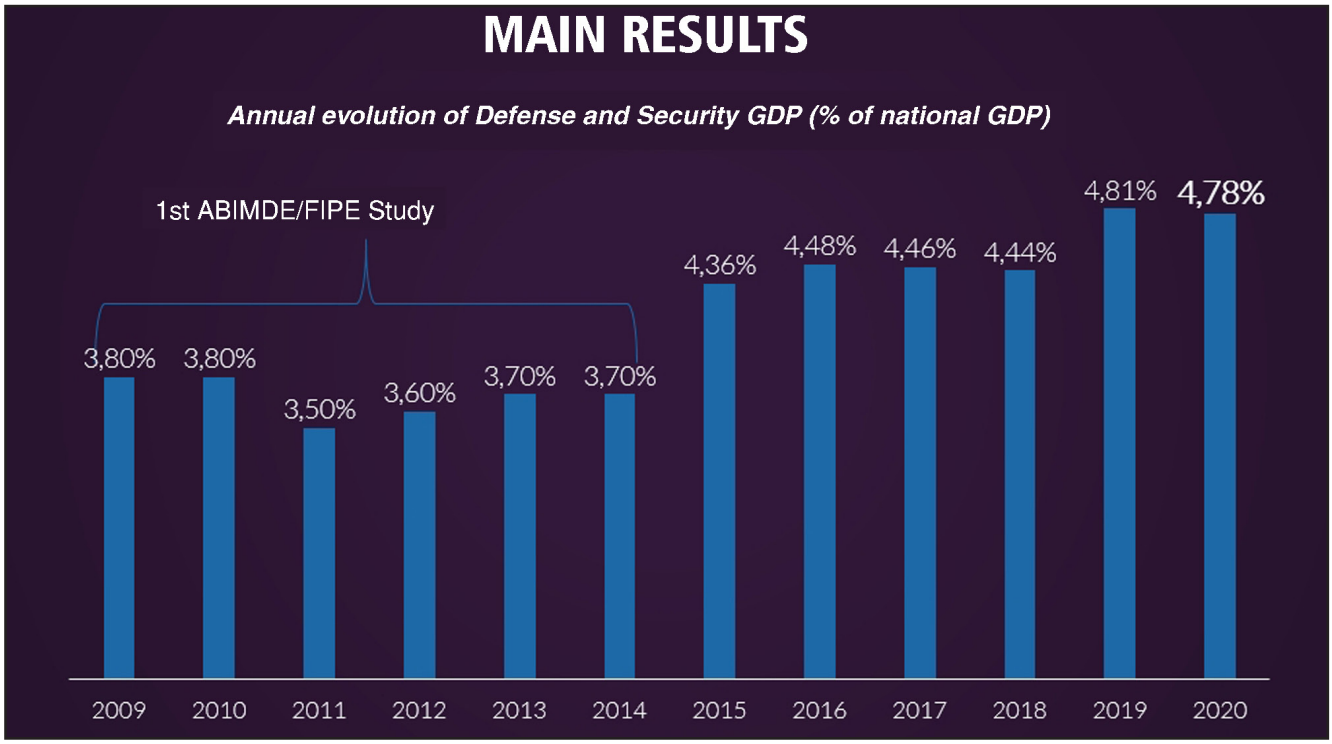
Graphic 2 and 3 - Size and Number of Employees of companies.



Source: Brazil, 2020.

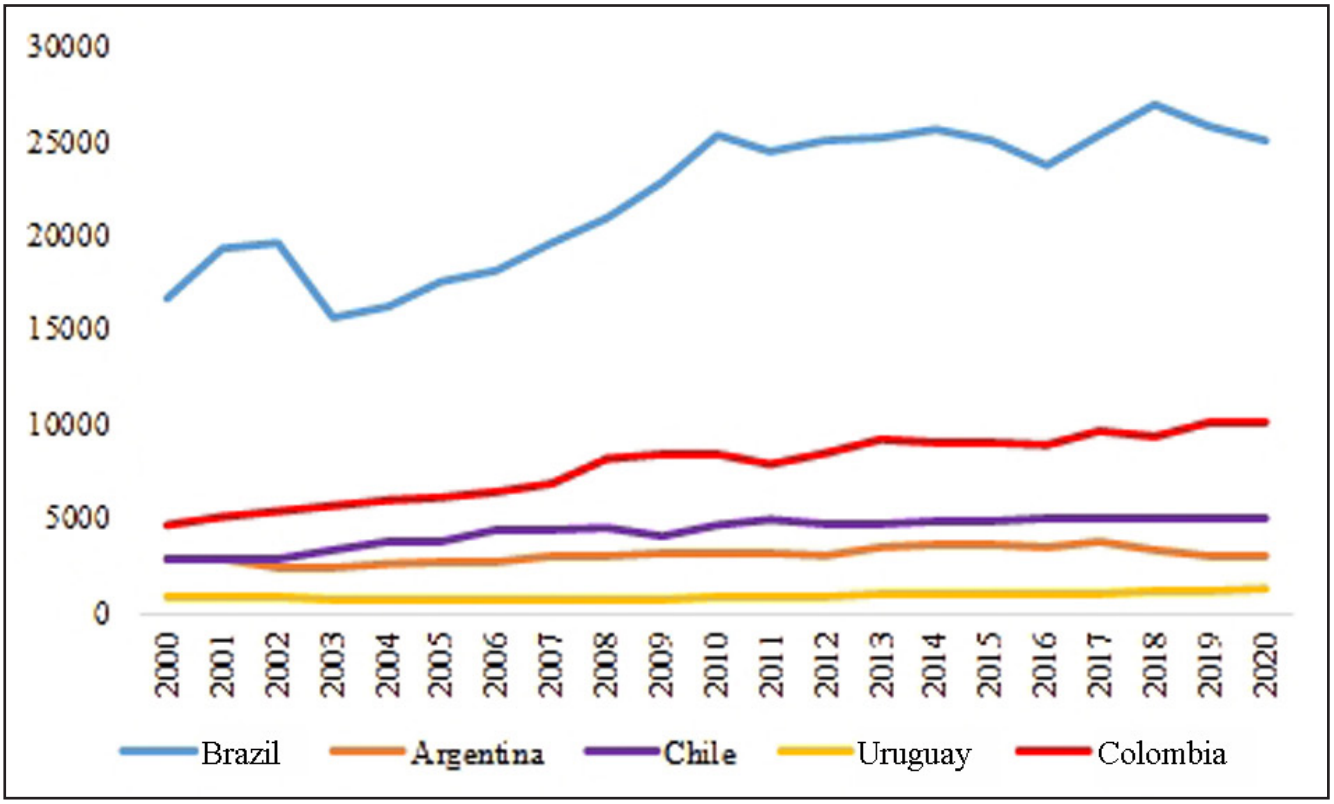
[1] Annual income higher than R$ 4.8 million and lower than or equal to R$ 300 million, for medium-sized companies; and small companies higher than R$ 360,000 and lower than or equal to R$ 4.8 million.

Graphic 4 - Defense and Security GDP.



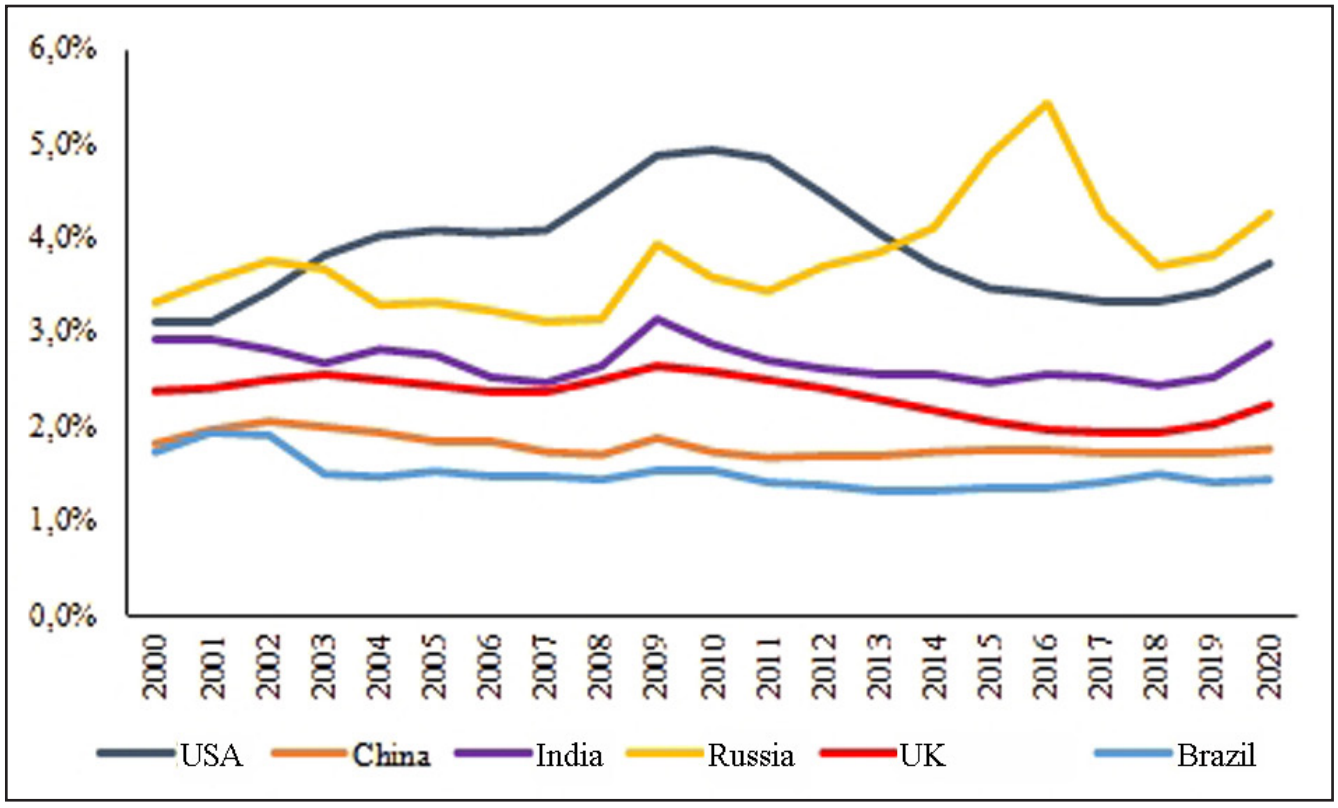
Source: Brazil, 2021.

Graphic 5 - Military Spendings in Millions of US$ (in constant values, 2019).



Source: Stockholm International Peace Research Institute (SIPRI), 2020.

Graphic 6 - Military Spending in Percentage of GDP.



Source: Stockholm International Peace Research Institute (SIPRI), 2020.

Given the situation, there are some factors that have promoted the development of the Brazilian defense sector, especially since the 2000s. Among them, one can mention: globalization, which facilitated trade between countries and, consequently, exports, which are vital for the Defense Industrial Base – DIB, the strengthening of associations (such as the Brazilian Association of Defense and Security Material Industries – ABIMDE, for example) and the support given by the Federal Government, through the National Defense Strategy (NDS), Law 12,598/12 and other regulations that started to contribute to the organization, the financial incentives and the promotion of the mentioned sector.

2.4 Brazilian Exports

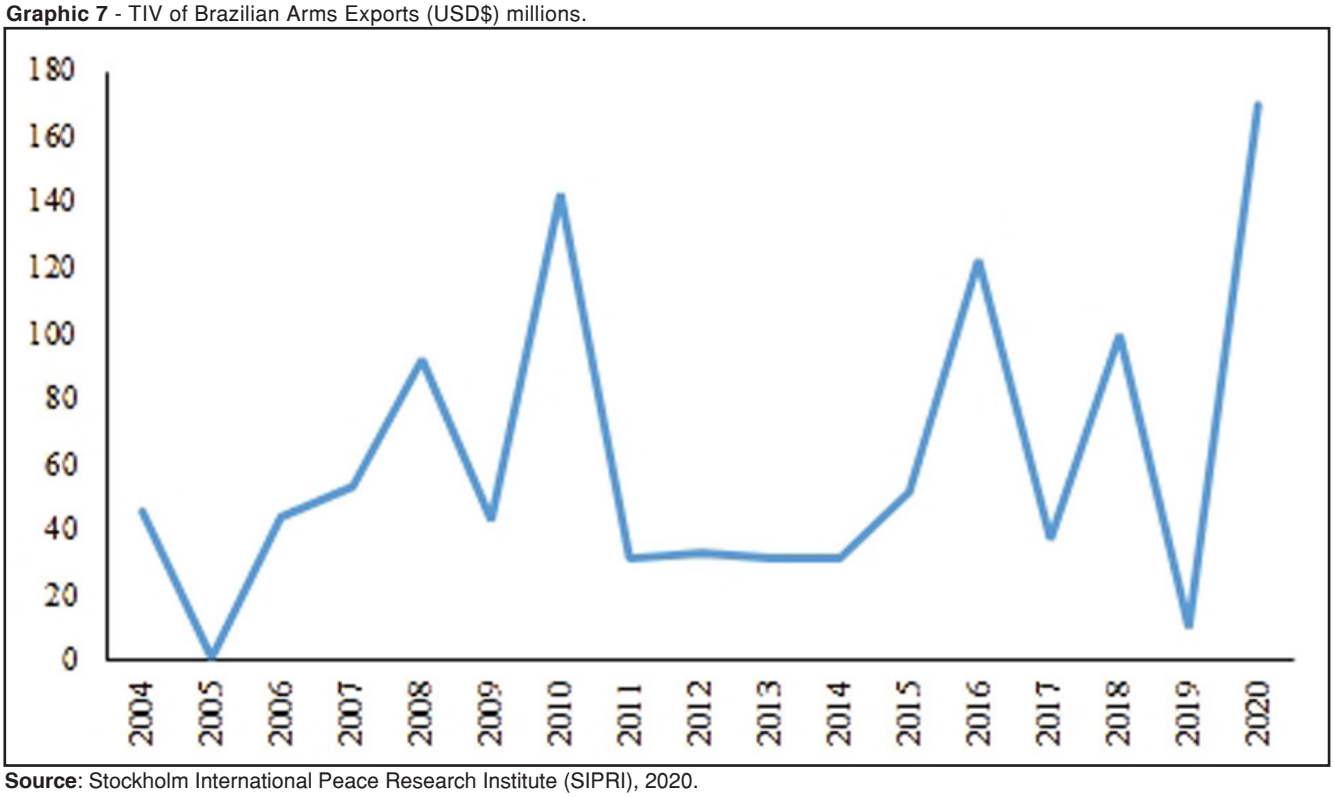
The international market is of significant importance to the defense industry. In 2020, US$ 1 billion was exported. According to the Ministry of Defense, through the Department of Defense Products (SEPROD), in the previous year, the value of exports reached US$ 1.3 billion.

This decrease can be explained by the Covid-19 pandemic, which negatively impacted both supply (due to lockdown measures) and demand (due to increased consumer uncertainty) of products. In fact, pre-pandemic expectations were positive. Between 2019 and 2020, a 30% higher value in exports was expected.

SIPRI provides data on the world trade of defense products. One of the indicators provided by the institution is the Trend-Indicator Value (TIV). Graph 7 presents the evolution of the TIV of the Brazilian weapon exports. The value of the index is expressed in million and, by SIPRI definitions, transfers valued in less than US$500,000 are not accounted.

From the graph, it is possible to observe that, although there are some oscillations, Brazilian exports have increased over time. This increase in exports shows the development of the DIB. In addition to the general indexes, it is also important to analyze trades in a more specific manner, observing the products exported by Brazil.

Graphic 7 - TIV of Brazilian Arms Exports (USD$) millions.



Source: Stockholm International Peace Research Institute (SIPRI), 2020.

The tables below present the transfers of weapons (Brazilian exports and their destinations) from 2010 to 2020.

The tables show that the main products exported by Brazil are aircraft and rockets.

Therefore, it is noticeable the relevance of companies such as Embraer and AVIBRAS. A critical point to be emphasized is that, in many cases, the formulation of public policies, such as military partnerships, can help increase exports.

Table 1 - Brazilian Exports 2010 - 2020.

Supplier/ recipient (R)	ordered	No. designation	Weapon description	Year(s) Weapon of order	Year delivery	of delivered	No. Comments
Brazil							
R: Afghanistan	20	EMB-314 Super Tucano	Trainer/combat ac	2013	2016	(20)	$427 m 'LAS' deal (financed by USA); ordered via USA from US production line
		6	EMB-314 Super Tucano		Trainer/combat ac	2017	2018 (6) Financed by USA; ordered via USA from US production line
Nigeria	12	EMB-314 Super Tucano	Trainer/combat ac	2018			$329 m deal; from US production line; delivery planned 2021-2024
Portugal	5	C-390	Transport aircraft	2019			$920 m deal (incl 12 years support and production of components in Portugal); delivery planned 2023-2027
UAE	24	B-250	Trainer/combat aircraft	2019			AED2.3 b ($620 m) deal; produced in UAE
Angola	6	EMB-314 Super Tucano	Trainer/combat ac	2011	2013	(6)	
Bolivia	4	Bell-205/UH-1H	Helicopter	2011	2012	4	Second-hand; aid; for anti-narcotics operations
Burkina Faso	(3)	EMB-314 Super Tucano	Trainer/combat ac	(2010)	2011	3	
Chile	12	EMB-314 Super Tucano	Trainer/combat ac	2008	2009-2010	12	$140 m deal
	6	EMB-314 Super Tucano			Trainer/combat ac	2017	2018 6
	4	EMB-314 Super Tucano			Trainer/combat ac	2019	2020 4
Colombia	(50)	SMKB	Guided bomb	(2009)	2012	(50)	
Comoros	1	L-410 Turbolet	Light transport ac	2012	2012	1	L-410UVP version; second-hand
Dominican Republic	8	EMB-314 Super Tucano	Trainer/combat ac	2008	2009-2010	8	Incl for combat role (anti-narcotics operations)
Ecuador	18	EMB-314 Super Tucano	Trainer/combat ac	2008	2010-2011	18	$220 m deal; originally 24 ordered but changed to 18
France	(2)	A-330	Transport aircraft	2020	2020	(2)	Second-hand (but only used 2 years); to be modified after delivery to A-330 MRTT tanker/transport aircraft
Guyana	2	BN-2 Islander	Light transport ac	2018	2018	2	Second-hand
Hungary	2	C-390	Transport aircraft	2020			KC-390 version; delivery planned 2023-2024
India	(2)	ERJ-145	Transport aircraft	2008	2017-2019	2	Part of $210 m deal; modified in India to AEW&C aircraft with Indian radar

Source: Stockholm International Peace Research Institute (SIPRI), 2020.

Table 2 - Brazilian Exports 2010 - 2020 (Continued)

Indonesia	8	EMB-314 Super Tucano	Trainer/combat ac	2011	2012-2014	8	
	36	ASTROS-2	Self-propelled MRL		2012	2014-2015 36	$403 m deal; ASTROS-2 Mk-6 (ASTROS-2020) version
	8	EMB-314 Super Tucano	Trainer/combat ac		2012	2015-2016 8	
	(27)	ASTROS-2	Self-propelled MRL		(2019)	2020 (27)	ASTROS-2 Mk-6 (ASTROS-2020) version
Lebanon	(20)	VBTP Guarani	APC	2014	2017	(20)	Part of EUR30 m deal; ordered via Italy; VBTP-MR version
	6	EMB-314 Super Tucano	Trainer/combat ac		2015	2017-2018 6	$173 m deal; A-29B version; from US production line; for combat role
Malaysia	18	ASTROS-2	Self-propelled MRL	2007	2010	18	$300 m deal
Mali	4	EMB-314 Super Tucano	Trainer/combat ac	2015	2018	4	
Mauritania	(2)	EMB-314 Super Tucano	Trainer/combat ac	2011	2012	(2)	
Mozambique	3	EMB-312 Tucano	Trainer aircraft	2014	2014	(3)	Second-hand; aid
Pakistan	100	MAR-1	ARM	2008	2013-2017	(100)	BRL111 m ($100-126 m) deal
Paraguay	3	EMB-312 Tucano	Trainer aircraft	(2009)	2010	3	Second-hand; exchanged for 4 EMB-326GB (Xavante) trainer aircraft and 1 Boeing-707 transport aircraft
Philippines	6	EMB-314 Super Tucano	Trainer/combat ac	2017	2020	6	PHP5 b ($100 m) deal; A-29B version; incl for combat role
	28	VBTP Guarani	APC	(2020)			'Wheeled APC Acquisition Project'
Saudi Arabia	(10)	ASTROS-2000	Self-propelled MRL	2014	2016	(10)	
Turkmenistan	(2)	EMB-314 Super Tucano	Trainer/combat ac	(2019)	2020	2	
United Kingdom	5	Phenom-100	Light transport ac	2016	2017-2018	(5)	Part of 'MFTS' programme; for UK company for training of UK armed forces in 'MFTS' programme; UK designation Phenom T-1
Unknown recipient(s)	(50)	SMKB	Guided bomb	(2010)	2013	(50)	Recipient is South American country (possibly Ecuador or Peru)
Uruguay	15	M-41B	Light tank	(2013)	2018	15	Second-hand (deal incl 10 more for spare parts); aid; M-41C version

Source: *Stockholm International Peace Research Institute* (SIPRI), 2020.

In fact, there are several military agreements and memorandum of understandings (MoU) signed by the Brazilian State, through SEPROD/MD. In most cases, the partnerships seek to facilitate trade of defense products among the countries involved, promote exchanges of knowledge in the military sphere or assist research and development (R&D) of new technologies.

As an example, Saudi Arabia is a country of utmost importance in the international defense market. SIPRI data shows that by 2020, the country was the sixth largest military investor in the world. In 2019, Brazil signed some agreements with the Middle Eastern country. First, the cooperation agreement in defense aims at:

> Strengthen the bonds of friendship between the two countries through defense cooperation, seeking to promote international peace and stability. The cooperation between the parties should include the following areas: Defense Industries; transfer and adoption of military technology; military training and exercises; loan of military systems; logistical support; research, development, and studies in Defense projects; emergency and crisis management; exchange of military information; military medical services; military legislation; and any other field agreed by the parties. (FEDERAL GOVERNMENT, 2019).

In addition, a partnership was established related to the following themes: acquisitions; industry; research; development; and defense technology. According to the Federal Government (2019), the partnership seeks to "establish the main guidelines of a strategic partnership between Brazil – Saudi Arabia related to cooperation in government procurement, industrial research, development and defense technology."

In 2019, 2 (two) other MoU were signed with the United Arab Emirates with the intention of continuing to build and expand bilateral relations in all fields of common interest with Brazil, especially in the economic, commercial, and financial investment areas, especially in the industrial and technological areas. It is also noteworthy the exchange of policies to facilitate industrial projects, particularly in the fields of industrial energy efficiency, naval construction, and technical training for establishing and managing small and medium projects and the development of innovation skills.

3 CONCLUSION

The DIB started a process of constant development from the 2000s on. Currently, the companies belonging to the Brazilian Defense Industry are mostly located in the South and Southeast regions of the country. In addition, in terms of impact on GDP, the Defense Industry has shown that it is growing and has good participation in the national economic scenario. DIB growth can also be seen in the global defense sector statistics. According to data from SIPRI, oBrazil is the most relevant country of South America in terms of

military spendings and, in a global context, the country is the 15th largest investor.

Defense applications are extremely important because it enables to deduce that Brazil employs significant financial and human resources in the Defense sector, to the point of becoming the reference in its sub-region, when considering the neighboring countries. The values of exports also need to be mentioned, as they dictate the size of the consumer market of Brazilian products. Although it has oscillated, an increase in export values of Defense products since the 2000s can be observed, and the main exported products are aircraft, rockets, weapons, and ammunition.

Part of the Brazilian success in the world market is due to public policies, especially agreements in the military area signed by the Ministry of Defense – MD, lead by SEPROD. The agreements signed with Saudi Arabia and the United Arab Emirates in 2019, for example, may generate positive results in a near future, as they are Defense product consuming countries, and due to this partnership, the economic relations between the countries tend to grow even stronger.

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