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Defense Industrial Base and Armed Forces: potentialities and challenges in the context of Defense Economics

Base Industrial de Defesa e Forças Armadas: potencialidades e desafios no contexto da Economia de Defesa

Abstract: In Brazil, the consolidation of a Defense Industrial Base (DIB) made up by state and private, civil and military companies, focused on the development of strategic defense products (SDP), goes through constant challenges such as the irregular allocation of budgetary resources destined to the Armed Forces. Studies have shown the importance of the defense sector for industrial development, pointing out that innovations in the sector generate technological spillovers for the growth of the national economy. The methodology used is a case study, as this article analyzes the current context of the Armed Forces and the DIB and the phenomena that influence them from the perspective of the defense market-budget binomial.

Keywords: national defense; economics of defense; defense industrial base; armed forces.

Resumen: En Brasil, la consolidación de una Base Industrial de Defensa (BID) compuesta por empresas estatales y privadas, civiles y militares, enfocada en el desarrollo de Productos Estratégicos de Defensa (SDP), enfrenta desafíos constantes, como la irregularidad en la asignación de recursos presupuestarios destinados a las Fuerzas Armadas. Investigaciones han demostrado la importancia del sector de defensa para el desarrollo industrial, señalando que las innovaciones en el sector generan desbordamientos tecnológicos para el incremento de la economía nacional. La metodología utilizada es un estudio de caso, ya que este artículo analiza el contexto actual de las Fuerzas Armadas y la BID, así como los fenómenos que los inciden desde la perspectiva del binomio mercado-presupuesto de defensa.

Palabras clave: defensa nacional; economía de defensa; base industrial de defensa; fuerzas armadas.

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1 INTRODUCTION

Since World War II, military spending has been considered one of the relevant factors for the economic development of a country. Such development would be driven by huge investments in technological innovations and the production of goods with higher added value defined by the defense industry. Thus, the war industry was positioned as an important player in the national innovation system, particularly in countries whose public spending on defense and security is historically high, such as the United States and some European states.

However, the theme of national defense has little appeal and interest from society at large. Steinbrecher and Biehl (2020 *apud* SILVA, 2023) describe that the academic literature widely assumes that, despite some skepticism, most people do not know about defense policies and armed forces and, therefore, knowledge in this field is quite limited. Additionally, the theme has little political attraction and is not culturally studied.

In this sense, there is still resistance in sectors at different levels of the country regarding the understanding that defense is a theme of interest to all the Brazilians. Therefore, it is necessary to socialize and further develop the debate on national defense, inserting it into all structural spheres of the nation.

The National Defense Policy (*Política Nacional da Defesa* – PND) defines national defense as "the set of measures and actions of the State, with emphasis on military expression, for the Defense of the territory, sovereignty and national interests, against potential or explicit external threats" (BRASIL, 2020, p. 11, our translation).

Brazil, as an emerging power, has the challenge of being consolidated as a full power: to be endowed with military, technological, and industrial instruments vital to this condition. To this end, Brazil has sought to transform its Armed Forces, requiring the development of new capabilities to fulfill peace missions supported by the United Nations (UN).

Based on the PND and the National Defense Strategy (*Estratégia Nacional de* Defesa – END) (BRASIL, 2020), it is possible to identify future challenges for the Brazilian defense policy and for the Defense Industrial Base (DIB), such as, for example, the need to develop strategies to better structure the allocation of resources to the area, in order to foster industrial production in the sector, both within the state and private spheres.

The Defense transformation goes through the modernization of management and the reorganization of the DIB, aiming at national productive and technological capacity-building. The transformation of the Armed Forces has occurred in the light of the concepts and principles that guide Brazil's strategic insertion in the world, characterized by non-intervention, defense of peace and peaceful solution of conflicts, and its strategy of defense.

Therefore, it is important to have a better understanding of the role that public and private companies play in the industrial defense production – the institutional frameworks that rule the sector and encourage the industrial defense production – and which must be in full operation so that the Brazilian economics of defense may be a fundamental part of the national development process.

In this strategic light, Brazil lacks a defense industrial sector that, while supplying the government's domestic demand, is also able to export and generate goods and technologies that allow the spillover effects onto the civil industry.

Dosi (2006) observed that in the United States the technological spillover effects from military projects, such as the Internet and semiconductors, made the defense industry a major source of new technologies, including for the civil sector. The author also highlights that, even if these effects have not been constant over time, their main players continue to be a relevant part of the American innovation system. In this context, the following research question arises: In the context of public budget and defense market, what are the potentialities and challenges faced by the strategic projects of the Armed Forces and the Defense Industrial Base?

To answer that, we have used the case study methodology. According to Moraes, Pereira, and Franchi (2022), case studies have contributed to understanding social and political phenomena in the field of political science.

Thus, this research intends to contribute with research related to the area of defense in Brazil by filling gaps that may exist in the topic of defense economics, considering the importance of investments in strategic projects developed by the Armed Forces, and the increase in the DIB both in the production and national technological development and its expansion and insertion into the international market.

The work is divided into seven sections, including this introduction. The second section presents the DIB panorama. The third section is devoted to the characteristics and legal aspects of the Strategic Defense Companies (SDC). The fourth section lists the main policy documents on defense with special attention to the National Defense Strategy. Sections five and six deal with the focal point of this article, encompassing the topics on budget and defense market. In the last section, final considerations are made and further studies on the subject of defense economics are suggested.

2 DEFENSE INDUSTRIAL BASE

Dunne (1995) establishes that the DIB can be viewed as a sector or group of industries somewhat dependent on public defense spending, where the state also has some degree of dependence for self-sufficiency in the production of defense and warfare means.

The DIB is a core element of a state's defense. Its importance comes both from its strategic nature resulting from the production of the country's defense equipment, essential to ensure defense and its autonomy, and from its economic aspects related to the mastery of sensitive technologies, many with a dual character, and to the generation of innovation, of highly qualified jobs and of high added value exports.

Despite the reduced percentage of the defense budget for investments, the DIB has generated a significant number of direct and indirect jobs. Some companies, such as Embraer and Taurus, have been able to maintain a regular flow of exports, even with high and medium technology products, being an alternative for improving the Brazilian trade balance surplus.

In relation to the Gross Domestic Product (GDP), the DIB develops, produces, and commercializes products and equipment of high added value, fulfilling an important role in the national economic growth. The DIB accounts for 4.46% of the GDP, generating 2.9 million of direct and indirect jobs (BRASIL, 2021).

Moraes (2012) highlights four major companies in the defense sector in Brazil in the period 1975-2010, as they obtained the highest values of exports of war products, namely: Engesa, Embraer, Avibras, and Helibras.

Engesa, a company that went bankrupt in 1993, stood out for developing and manufacturing armored vehicles, with most of its production being exported mainly to Iraq. Embraer, founded in 1969, is one of the largest civil aircraft manufacturers in the world; their work is oriented to the production, development, maintenance, and marketing of fixed-wing aircraft focusing on the segments of regional and executive jets, as well as some military aircraft that are intended for early warning, control, remote sensing, aerial surveillance, and maritime patrol (MORAES, 2012).

Avibras, founded in 1961, initially stood out in the military segment by producing the Falcão aircraft intended for basic training. As of the 1980s, this company started developing missiles and rockets for the exclusive use of the military. However, despite its importance, it still remains behind Embraer and Engesa with approximately only 10% of the Brazilian exports in the last decades of the 20th century.

Helibras, created through an agreement between Brazil and France in the 1970s, is the only manufacturer in South America and one of the few companies in the Brazilian military sector that has predominantly foreign capital (MORAES, 2012).

Notably, the country has a relevant history of participation in the export market of military and defense materials, with some companies that stand out in the international market of this productive sector.

The structuring and strengthening of the DIB is a strategic priority for a country like Brazil that, in addition to having a considerable heritage of strategic natural resources that should be protected, is seeking an active insertion in the international political and economic scene.

For Brick, Sanches, and Gomes (2017), Brazil is a country whose DIB has potential to be developed but needs knowledge about its current and potential industrial capacity and potential strategic partners. Strategic partnerships with other countries in the defense sector are important for internal development and the gradual reduction of the dependence on external technology, as well as the increase of the Brazilian competitiveness in terms of Defense Products. Thus, the perspective of expanding demand for strategic defense products (SDP) offers an excellent opportunity for the development and strengthening of the DIB.

Brick (2011) emphasizes that, in strategic sectors considered critical, it is up to the state to finance the development of technologies and to assume full responsibility for their production when the economic conditions that ensure the sustainability of these companies cease to exist.

In this context, the DIB funding advanced in the year 2020. The Ministry of Defense and the Brazilian National Development Bank (BNDES) executed a protocol of intentions for the structuring of actions aimed at developing the Defense Industrial Base (DEFESANET,

2020). The initiative aims at fostering technological development and the Brazilian exports in the sector. The agreement is aligned with the Strategic Defense Action (*Ação Estratégica de Defesa* – AED-43) of the END-2020, that is, to improve funding mechanisms for the Defense Industrial Base (BRASIL, 2020).

Notably, Brazil keeps on assigning its work as a complement to the work of the private sector: "The state component of the Defense Industrial Base should, in principle, design and produce what the private sector cannot do profitably in the short and medium terms [...]" (BRASIL, 2020, p. 42; our translation). It is also up to the State to use its purchasing power to ensure conditions for sustainability and improvement of the DIB.

The END-2020 devotes a space to explain the direction that, ideally, should be adopted in state purchases, which should prioritize the use of products in the sphere of both defense and public security (BRASIL, 2020). Moynot (2010) points out that the DIB, as a strategic asset, should be guaranteed and preserved by the state, which implies the adoption of protection, development, and expansion measures. The author argues that

> The effect of scientific discoveries, advanced technologies, and the development of new fields of activities makes it strategically necessary for the state to directly or indirectly have appropriate financial instruments and an ability to promote strategic investments that pave the way for new industries. (MOYNOT, 2010, p. 133, our translation)

Sandler and Hartley (2007) clarify that even if one opts for the supposed simplicity of defining the DIB based on the set of companies that comprises it, which are found in different sectoral classifications with varied productive processes (technology, inputs) and applications and products for diverse use in the civil and military market, which are characteristics of Strategic Defense Companies.

3 STRATEGIC DEFENSE COMPANIES (SDC)

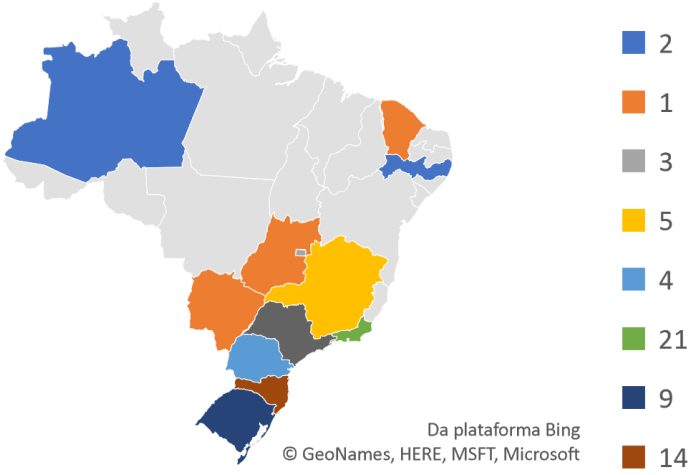
According to Law No. 12.598 of March 21, 2012 (BRASIL, 2012), which sets special rules for procuring, contracting, and developing defense products and systems, SDC is defined as any legal entity accredited by the Ministry of Defense upon meeting the following cumulative conditions:

> a) have as a purpose, in its corporate objective, the execution or conduction of research, project, development, industrialization, provision of the services referred to in art. 10, production, repair, conservation, revision, conversion, modernization, or maintenance of SDP in the Country, including the sale and resale only when integrated to the industrial activities mentioned above;
> b) to be based in Brazil with its administration and the industrial establishment, equivalent to industrial or service provider;
> c) to have, in Brazil, proven scientific or technological knowledge of their own or complemented by partnership agreements with Scientific and Technological

> Institution to carry out joint activities of scientific and technological research and development of technology, product or process, related to the activity developed, observing the provisions in clause X of the header;
> d) ensure, in its constituent acts or in the acts of its direct or indirect controller, that the set of foreign partners or shareholders and groups of partners or shareholders cannot exercise in each general meeting a number of votes higher than two-thirds (2/3) of the total number of votes that can be exercised by the Brazilian shareholders present; and
> e) ensure the continuity of production in the country. (BRASIL, 2012; our translation)

According to data from the Support Center of Defense Logistics Systems (CENTRO DE APOIO A SISTEMAS LOGISTICOS DE DEFESA, 2021) belonging to the Ministry of Defense, in Brazil there are 120 registered SDC, 69.2% (n = 83) of which are located in the Southeast region (57 in the state of São Paulo, 21 in the state of Rio de Janeiro, and 5 in Minas Gerais), 22.5% (n = 27) are located in the South region, 9 in Rio Grande do Sul, 14 in Santa Catarina, 4 in Paraná, and 8.3% (n = 10) are located in the states of Distrito Federal (n = 3), Amazonas (n = 2), Pernambuco (n = 2), Ceará (n = 1), Mato Grosso do Sul (n = 1), and Goiás (n = 1) (Figure 1).

Figure 1 – Strategic Defense Companies



Source: elaborated based on Centro de Apoio a Sistemas Logísticos de Defesa (2021)

Amarante (2012) suggests that the existence of the productive functional activities in the company's operational mode defines whether it can effectively be considered an SDC, that is:

> **Production**: activity of manufacturing products or components with the industry's basic technology, the one that characterizes its industrial sector, in this case aimed at military purposes.

> **Integration**: necessary activity for the industry that aims to work with weapon systems. Its competence reaches the level of design and manufacture of means of weapon and system integration.
> **Logistics**: procurement, supply and maintenance of weapon systems, military assets, and components.
> **Post-sale**: activity carried out after the sale of the military equipment, with the objective of maintaining it operational, including reengineering and the revision of production processes, among others.
> **Technological mastering**: constant and permanent activity with the basic technology of military systems and means, demonstrating that the company masters this technology. (AMARANTE, 2012, p. 29, emphasis added, our translation)

These characteristics reveal the scenario of SDCs' performance in the market, highlighting their obstacles, limitations and, at the same time, possibilities and capabilities of these ventures.

In times of transformation, clearly recognized by the companies involved in the national defense industry, it is necessary to develop and apply new strategies for future successes. Among these, the literature points to technological diversification and the establishment of national and international cooperation.

4 DEFENSE POLICY DOCUMENTS

Among the public policies aimed at national defense, the National Industrial Defense Policy (*Política Nacional da Indústria da Defesa* – PNID) (BRASIL, 2005) is charged with emphasizing the defense industry. This policy establishes the gradual decrease of dependence on foreign strategic defense products to develop and produce them domestically. In addition, it aims to increase the competitiveness of the Brazilian IDB in order to expand exports (BRASIL, 2005).

Chart 1 – Defense Documents and Objectives related to the IDB

Document	Objectives
National Policy on Industrial Defense – PNID (2005)	• Strengthen the Defense Industrial Base • Make society in general aware of the country's need for a strong Defense Industrial Base • Gradually reduce the dependence on external strategic defense products, developing and producing them internally • Expand the Armed Forces' capacity to acquire strategic defense products from the national industry • Improve the technological quality of strategic defense products • Increase the competitiveness of the Brazilian Defense Industrial Base to expand exports • Improve the capacity of industrial mobilization in the Defense Industrial Base

(continues)

Chart 1 – Continuation

Document	Objectives
National Policy on Defense – PND (2020)	• Foster the State's investment in advanced technology sectors • Promote the permanent upgrading and equipping of the Armed Forces with emphasis on the support of science and technology for the development of the DIB • Develop a DIB oriented towards achieving autonomy in indispensable technologies • Ensure that the industrial sector contributes to guarantee that the needs of defense products are met with technology under national control • Ensure the capacity of the DIB, including the mastery of dual use technology, to achieve the supply of defense products • Promote the integration of the South American defense industry as the object of measures that provide mutual development, as well as technological qualification and autonomy
National Defense Strategy - END (2020)	• Strengthen three sectors of strategic importance: space, cyber, and nuclear • Empower the defense material industry to achieve autonomy in technologies that are indispensable to Defense

Source: Brasil (2005, 2020)

The END (BRASIL, 2020) pays special attention to the DIB, emphasizing the prioritization of the development of independent technological capabilities, subordination of commercial considerations to strategic imperatives, and the use of defense technology development as a focus for the development of operational capabilities.

4.1 National Defense Strategy

The END is characterized by the adoption of a systematic orientation and the implementation of the measures established by the National Defense Goals in medium and long-term actions, presented by the PND (BRASIL, 2020).

The first edition of the END (BRASIL, 2008) brought several provisions regarding science, technology, and innovation (ST&I), with emphasis on what is considered to be opportunities to be explored supported by the identification and analysis of the main positive aspects and vulnerabilities of the country's defense structure, considerations that were reproduced in their entirety in the current edition of the END:

> (a) Greater integration between scientific and technological institutions, both military and civilian, and the national defense industry;
> (b) Definition of dual use research; and
> (c) Fostering research and development of products relevant to the defense. (BRASIL, 2008; our translation).

As for dual use defense equipment and systems, Longo (2007, p. 122) teaches that the term "dual use technologies" was coined by the Americans, and that "dual use technology

could be defined as that technology that can be used to produce or improve goods or services of civilian or military use" (our translation).

When designating the "era of dual use technologies", Dagnino (2010) notes that as it

> [...] increases the speed of introduction of innovations in the civilian sector, the military organizations of most countries producing weapon systems have turned to the civilian sector, both domestic and foreign, for dual use technologies and revolutionary scientific breakthroughs. (DAGNINO, 2010, p. 168, our translation)

For Herteman (2008) *apud* Melo (2015, p. 46), competitiveness is drawn by technological duality, which allows the intersection of civilian and military activities, in a "virtuous" circle. The author also states that duality has become fundamental to reduce the costs of defense materials and gain export markets, "contributing to the perennity of technological competencies in countries facing serious budget constraints" (MELO, 2015, p. 46, our translation).

It is worth noting that the END asserts that the Science, Technology and Innovation Policy for National Defense aims at fostering scientific and technological development and innovation in areas of interest to the national defense and this will occur

> [...] through national planning for the development of products with high technological content, with the coordinated engagement of civilian and military scientific and technological institutions (ICT), industry and universities, with the definition of priority areas and their respective technologies of interest and the creation of instruments to foster research on materials, equipment and systems of defense or dual use. (BRASIL, 2008; our translation)

The END brings guidelines, objectives and strategic actions. However, these are presented superficially, with emphasis on the need to associate the investment in defense as a diffusion of development and, as in previous documents, the progress of the related major strategic projects of each armed force (BRASIL, 2020).

In the technological and learning fields, the END points out that the future of national defense capabilities depends both on the development of technological apparatus and the training of human resources. Therefore, it is important to develop a policy to train researchers in the areas of basic and applied science to bring scientific research closer to activities related to technological development of the DIB (BRASIL, 2008).

One can notice the relevance pointed out by the END as to the need for strengthening the DIB; however, it presents some challenges to keep up with the growth in demand for Strategic Defense Products (SDP), in order to consolidate the DIB competitively: (1) increase investments in research, development, and innovation (RD&I); (2) promote tax isonomy with respect to imported products/materials; (3) expand participation in the domestic and foreign markets; and (4) strengthen the supply chain in Brazil (BRASIL, 2008).

Moreover, it would be important to seek the mastery of dual use technologies to favor the use of products for military and non-military purposes.

For Reppy (1999, p. 269, free translation), dual use technology "is at the core of the current American technological policy." In the United States, the demand and implementation of dual use technologies received a renewed impulse with the consolidation of the Homeland Defense policy, enacted after the attacks of September 11, 2001.

Nevertheless, the END highlights challenges in keeping up with the expansion of demand and consolidate the national defense industry in a competitive manner, which includes increasing investments in research and innovation; expanding participation in domestic and foreign markets; and strengthening the supply chain in Brazil.

According to Bohn (2014), the defense industry of a developing country, as is the case of Brazil, should fulfill four types of obligations: maintenance demands, such as maintaining the war infrastructure in times of peace and enabling increased production in times of crisis; quality maintenance, maximizing product quality at the lowest possible cost; production of systems that are unavailable from other suppliers; and the production of specific armaments in a given region, creating or maximizing comparative advantages through local demands.

For Lessa (2004), the paradigm of the defense industry that each country and national society practices is directly related to the stage of development of the productive forces of that particular nation.

The productive capacity of the DIB currently presents some important characteristics, including: partial technological autonomy; incomplete production structure; few national anchor companies with corporate, productive, and financial scale compatible with the standard of international competition; educational, scientific, and technological infrastructure that is still deficient; and, reduced densification of the production chain, which prevents greater productive and technological linkages (MELO, 2015).

In this context, the project of modernization and re-equipment of the Armed Forces, through its strategic projects, should be a priority for the State, enabling the expansion of national productive, technological, and competitive capabilities. International, bilateral, or regional partnerships are of special importance in this process.

Initiatives – such as the creation of the Secretariat of Defense Products (*Secretaria de Produtos de Defesa* – SEPROD) in the Ministry of Defense and the adoption of Law No. 12.598, of March 22, 2012 (BRASIL, 2012), which established a new framework for state and market activities in the field of the defense industry – indicate that progress has been made in the direction of reorganizing the DIB. In coordination with the Brazilian Agency for Industrial Development (*Agência Brasileira de Desenvolvimento* Industrial – ABDI), SEPROD is conducting a nationwide mapping with the purpose of diagnosing the capabilities and potentialities of the DIB and establishing industrial and procurement policies for defense products.

However, it is up to the State to strengthen the productive chain, and, thus, it should be devoted to the development of financing lines and specific guarantees for the DIB. The choice of industrial autonomy in defense matters is essential and should be a national priority.

5 DEFENSE BUDGET

In Brazil, one of the most noticeable impediments to the full development of the DIB concerns budgetary constraints (BRICK; SANCHES; GOMES, 2017). In relation to the permanent members of the United Nations (UN) Security Council and the set of emerging countries that form the BRICS (Brazil, Russia, India, China, and South Africa), the Brazilian national defense investments fall short of these countries.

Hartley and Sandler (1995, p. 6) conceptualize defense economics as "the study of resource allocation, income flow, economic growth and stabilization applied to Defense-related topics" (our translation). The topics covered by defense economics gain more or less relevance according to the need and interest of the international and national contexts.

The theme can draw on several approaches, including industrial organization, the vulnerability of strategic equipment, research and development potential and the effects on economic growth, including comparing them to other budgetary functions (MORAES; TERNUS; PINTO, 2020).

Despite the COVID-19 pandemic, in 2021, world military spending for the first time in history exceeded 2.1 trillion dollars (US$), according to a survey published by the Stockholm International Peace Research Institute (SIPRI). About 2.2% of the global GDP was directed to the military sector – a nominal increase of 6.1% when compared with 2020 and 0.7% in real terms, considering the change in inflation over the same period.

The amount allocated to the defense sector was approximately ten times higher than the revenue goal set by the World Health Organization (WHO) to combat the global health emergency (HARTMAN, 2022).

The leading countries are the United States (US$ 801 billion), China (US$ 293 billion), India (US$ 76.6 billion), United Kingdom (US$ 68.4 billion), and Russia (US$ 65.9 billion). These countries concentrate 61.8% from the total of US$ 2.1 trillion, while the sum of the others corresponds to 19.2% (Figure 2).

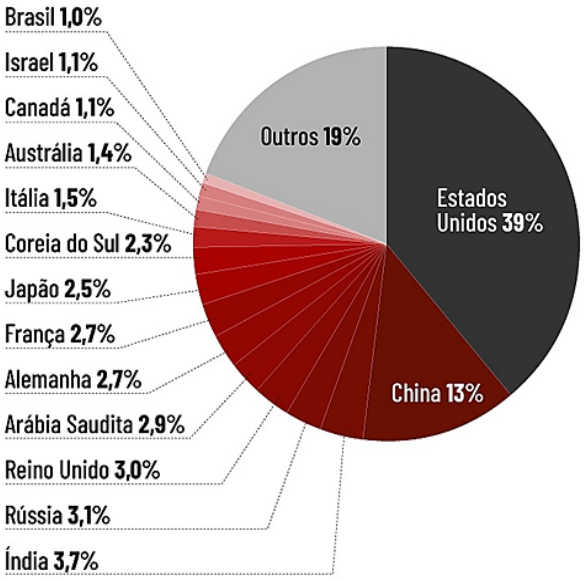
On December 15, 2022, the U.S. Senate passed a bill authorizing a record $858 billion for annual defense spending (CONGRESS.GOV, 2023). The figure exceeds that proposed by the US President Joe Biden by US$ 45 billion and is 10% higher than this year's (US$ 778 billion).

In the year 2021, Brazil ranked 15th, remaining distant from the other BRICS countries, with the exception of South Africa. At the same time, Brazil tops the list in Latin America, concentrating 1% of the total value of investments.

Moreover, by the year 2021, eight country-members of the North Atlantic Treaty Organization (NATO) reached the goal of investing 2% or more of GDP in their armed forces. The largest increase was in Japan, which allocated US$ 54.1 billion for defense in 2021 - 7.3% more than the year 2020 budget (HARTMAN, 2022).

Thus, despite the low percentage of the budget allocated to National Defense – which does not represent a low absolute value – one realizes that it is possible to invest in the development of the DIB through joint efforts between the Armed Forces and the public and private sectors, in order to achieve the potential for expansion of the national defense industry.

Figure 2 – Defense budget in relation to world spending (2021)



Source: Hartman (2022)

The Brazilian Army General Staff (BRASIL, 2019), through the Army Projects Office (*Escritório de Projetos do Exército* – EPEx), reveals what are the risks arising from the lack or unpredictability of budget for the Brazilian Army Projects, among which: non-fulfillment of contractual commitments causing loss of confidence in the relationship between the DIB and the Federal Government; losses for the DIB with the closing of assembly lines and supplying companies, generating unemployment and reflecting on social issues; discontinuity of programs due to unfeasibility of mobilization effort of the productive chains of the contracted companies; and increased costs of defense products.

Evidence points out that the DIB, before any strategic action, should recognize its capacities and limitations and prospect the future in an integrated way in the economic, social, and political dimensions. This implies the elimination of production activities for which there is no internal or external demand and that do not generate added value, defining which technological competence niches and areas of excellence demand investments.

Likewise, the most promising dual use technologies should be analyzed in order to identify those that can contribute the most to the consolidation of the sector's industries and give them a truly international dimension.

Regarding the Defense budget for 2023, the Annual Budget Law (*Lei Orçamentária Anual* – LOA) fixed the expenditure of the Ministry of Defense at 122.85 billion Reais (R$), of which R$ 8.66 billion (7%) are allotted for investments. The 2023 budget exceeds the previous year's R$116.43 billion by 5.2%, which represents a correction that practically only restores the inflation rate for the period.

It is worth mentioning that 77% of the budget is for the payment of personnel (salaries, pensions, and retirements of the Armed Forces' military personnel) (CONTROLADORIA-GERAL DA UNIÃO, 2023).

However, according to the 2023 LOA, the amount allocated to the main Navy, Army and Aeronautics projects totals R$ 5.2 billion (Table 2).

Table 2 – Armed Forces Projects – 2023 Budget

BRAZILIAN NAVY	
Construction of conventional submarines	681.3 million
Navy Nuclear Technology Systems Development	345.5 million
Construction of Shipyard and Naval Base for the Construction and Maintenance of Conventional and Nuclear Submarines	315.0 million
Construction of nuclear propulsion submarine	248.8 million
Construction of 500 tons Patrol Vessels (NPa 500t) – Macaé Class	58.9 million
Development of National Anti-Ship Missile	53.9 mi
Total	**1.7 billion**
THE BRAZILIAN ARMY	
Implementation of the Armored Forces Project	840.4 million
Implementation of the Integrated Border Monitoring System - SISFRON	345.5 million
Modernization and Strategic and Operational Transformation of the Brazilian Army	208.4 million
Implantation of the Military School of São Paulo (CMSP)	142.1 million
Implementation of the ASTROS Strategic Defense System	84.9 million
Implementation of the Army Aviation System	42.0 mi
Acquisition of Anti-aircraft Artillery Systems	17.9 million
Implementation of the Cyber Defense System for the National Defense	15.2 million
Implementation of the Army Strategic Program LUCERNA (Prg EE LUCERNA)	14.5 million
Expansion and Adaptation of Salvador General Hospital (HGeS)	9.6 million
Total	**1.7 billion**
BRAZILIAN AIR FORCE	
Acquisition of Fighter Aircraft and Related Systems – Project FX-2	1.37 billion
10 to 20 Ton Military Tactical Cargo Aircraft Acquisition - KC-390 Project	310.7 million
Development of Military Tactical Cargo Carrier from 10 to 20 Tons (KC-X Project)	172.7 million
Implementation of the Infrastructure for the Strategic Program of Space Systems (PESE)	4 million
Total	**1.8 billion**

Source: prepared by the author based on the National Congress (2023)

The Budget of Investment in the Ministry of Defense also covers the Naval Projects Management Company (EMGEPRON) and NAV Brasil Serviços de Navegação Aérea, in addition to other specific projects of the ministerial office.

The total revenue envisaged in the Annual Budget Law Project (PLOA) for 2023 is R$ 5.3 trillion, of which R$ 2 trillion are destined to the payment of interest and charges of the federal public debt and R$ 213.9 billion to investments.

In relation to the Gross Domestic Product (GDP), the estimated value in the PLOA 2023 is R$ 10.63 trillion, that is, the Ministry of Defense budget for 2023 corresponds to approximately 1.1% of the GDP.

We can see that the budget allotted to defense is still far short of what is recommended in the Strategic Defense Action (AED) 14 of the END (2020), whose goal is to "allocate budgetary and financial resources able to meet the needs of articulation and equipment for the Armed Forces, through the Annual Budget Law, at a level of 2% of the GDP" (BRASIL, 2020, p. 63; our translation). AED 14 is part of the Defense Strategy (ED-3), which aims to

> [...] enable the Defense Sector to better plan the use of budgetary resources, and thus rationalize their use, making defense expenditure more efficient. Additionally, it seeks to make the defense budget compatible with the country's size in the global scenario. (BRASIL, 2020, p. 63, our translation)

6 DEFENSE MARKET

Brick (2014) notes that defense industries operate in the defense, security, and civil segments; therefore, suppliers of these products usually operate in a competitive market. The civil segment follows traditional market laws of supply and demand, suppliers and buyers competing for the best value for money; however, market laws do not prevail in the defense segment.

The defense industry is very specific in that its size, structure, and trade are determined by the policy of the government, its main customer and regulator of the sector's exports. Such characteristics are known as monopsony, i.e., there are many suppliers, in the case of defense national producers of arms and ammunition, but only one customer, the Federal Government, unlike a monopoly in which there are many customers but only one supplier. If the other states are considered, the market can be seen as oligopsony, that is, without effective competition.

Dunne (2015) points out some characteristics of the defense market: emphasis on the performance of high-tech weapons rather than cost; risk borne by the government, which often funds research and development and in some cases provides capital and infrastructure investment; rules and regulations on contracts, to compensate for the absence of any form of competitive market and ensure public accountability; and emphasis on government contracts, rather than expanding supply in private markets.

Moreover, arms production is a laboratory of capitalist production methods. For Samuels (1996), in testing new methods, arms production takes industrial and economic risks that civilian enterprises would not take, i.e., military production [...] "increases the built-in

savoir-faire[1] of management, sales, and systems integration that can be built into products, and that feeds the technological infrastructure of the entire economy" (SAMUELS, 1996, p. 18, our translation).

The firms' competitive nature suggests that no strategy that can be freely replicated can ensure profitability rates above the market average. Vasconcelos and Cyrino (2000, p. 32) describe that, under these conditions, "for a firm to maintain high profitability, it must rely on permanent innovation strategies, derived from elements that are difficult for competitors to imitate" (our translation).

It has been observed that certain companies manage to sustain a superior performance, despite the continuous efforts of competitors to imitate their strategies, products, production methods, and distribution schemes (VASCONCELOS; CYRINO, 2000).

In this scope, the Brazilian arms industry has sought to increase its competitive potential with the development of additional weapon systems to export and expand its technologies to go beyond domestic military needs, in order to occupy space in the international market. Such strategy is supported by the news published on April 1, 2020, which reports that "the Swiss company, SIG Sauer, manufacturer of the weapons, would be in advanced negotiations with Indústria de Material Bélico do Brasil (IMBEL), the main supplier of ordnance to the Brazilian Armed Forces, to enter into a major partnership" (PORTAL GOV.BR, 2020). According to Infodefensa (2021), Imbel plans, in partnership with SIG Sauer, to begin production of the P320 pistol at the Itajubá Plant in Brazil.

Regarding exports, Brazil is not an established producer in the global trade of conventional weapons. In the ranking of world exporters, in the period from 2010 to 2015, the country occupied the 23rd position, while in the ranking of importers Brazil occupied the 26th position, with a moderate participation in the global transactions of the arms industry. However, it is worth analyzing the markets in which Brazil has a participation.

In the ranking of the largest buyers of Brazilian arms, from 2010 to 2015, 3 are from Asia, 5 from Africa, and 6 from Latin America (Bolivia, Chile, Colombia, Ecuador and Paraguay). One of the benefits for Brazil as a supplier of armaments to its neighboring countries, is the intensification of its influence over the purchasing countries, contributing to maintain the regional balance of sovereignty. As a buyer, the benefits include technology transfer and industrialization for military purposes.

Also, South American countries often cannot afford the costs or maintenance of advanced high technology systems, which leads Brazil to occupy a niche in the market of medium and low technology items, lowering the price of goods, and attracting peripheral buyers.

Regarding imports from Brazil, the largest volume comes from Germany, France, USA, Israel, Italy, and Russia, which are mostly established powers in the international market of this industry. Defense procurement is understood as the process of "attending to needs from a wide range of options, from the national development of the product to the purchase of ready

1 know-how, knowledge.

and finished equipment in the international market" (LONGO; MOREIRA, 2013, p. 295, our translation).

For the authors, the demands for goods and services that justify a sectoral system of defense innovation gain tangibility in the PED, such as platforms and combat systems that make up the material base of the national defense system. Due to the high technological standard of these products, some are considered strategic and generate special technological orders to the productive sector, particularly from the IDB, through government purchases (LONGO; MOREIRA, 2013).

Investments are characterized as long term and high risk, often leading government defense managers to opt for obtaining products abroad, thus worsening the technological dependence (LONGO; MOREIRA, 2013). The authors also point out that the SDC suffer from: lack of incentives; low levels of investment in equipment for the Armed Forces with the consequent lack of continued demand; lack of a regulatory framework that favors domestic industry in international competition; absence of an integrated system of planning and defense procurement that facilitates the articulation with the sector and provides long-term predictability for investments in infrastructure and R&D; and difficulty in obtaining resources for the acquisition of opportunities abroad.

Likewise, the obsolescence of existing military employment materials (MEM) of the Armed Forces, as end-users of the SDP, also observe external technological dependence and the lack of continuity in investments for the re-equipment and modernization of the forces, as well as the difficulty in meeting targets, deadlines, and project specifications by companies in some projects.

Thus, the demand for defense products is determined by strategic and geopolitical factors of the States, rather than by economic logic, making this the main component to define the production of companies.

In order to reduce the impact of the low demand of the Defense Industrial Base, one of the strategies pointed out by Hartley (1999), is for the state to use its regulatory and purchasing power (defense procurement) to define the structure, the size, the companies that enter or leave the base, the technological goals, prices, and profits of this industrial sector.

Having said this, it can be observed that the DIB, composed of the SDC and strategic defense (SD) is a sector of great relevance to Brazil, both economically and socially. However, it still depends on political decisions that aim to solve existing problems and support the needs presented by the sector.

7 FINAL REMARKS

Considering the theme of this article – economics of defense – it is observed that the governmental and industrial sectors and the academic environment, focused on science, technology, and innovation, should be integrated in order to ensure the supply of defense products supported by domestic technologies. Such technologies are acquired by stimulating and fostering, synergistically, the defense industries and the academia.

Regarding the DIB, dual use technologies are essential to obtain the supply of defense products aiming at the technological autonomy of Brazil. Promoting DIB tends to stimulate economic growth since it produces jobs and expands useful products for both the civil and military sectors. Likewise, the DIB competitiveness should be leveraged, aiming at the export of military goods, services, and technologies.

Therefore, it is up to the government to think strategically about these issues, ruling the control of access to national products to other countries via exports. It is worth mentioning that the civil-military technological duality may restrict the possibility of controlling foreign trade. Furthermore, international policies define the importance of technological standards with a view to sovereignty.

In this context, it is up to the State to use its purchasing power to ensure minimum conditions of sustainability and strengthening of the DIB, so that the production chain does not depend on the export policy and commercialization of dual products.

On the other hand, when supplying defense products to the international market, it is necessary to follow global product standardization, such as the National Stock Number of the North Atlantic Treaty Organization (NSN/NATO), imposing a balance between internal needs and access to the external market.

The relevance of effective government action is also evident in the regulatory definitions of the defense market. The specifications and hypotheses of use of military equipment are defined by the doctrines of the Armed Forces which, in turn, impact the formulation of requirements, certifications, and technologies of these products.

No less important, in geopolitical terms, is the non-participation of Brazil as a member of an international military block, which can make it hinder the participation in international competitions, depending on the level of economic, technological or operational relevance of the products, equipment, or materials.

Economically, the search for new markets is one of the greatest challenges for the DIB and is a relevant factor for its development. Thus, the State should be a facilitating and supporting agent for financing programs, research projects, development, production, acquisition, and commercialization of defense products to provide greater confidence to potential international buyers.

In this context, this article achieves its objective by identifying the potentialities and challenges of the Defense Industrial Base and the Armed Forces from the perspective of the defense budget-market binomial as an element that induces economic and social development and guarantees national sovereignty.

As the theme of economics of defense is a fertile and inexhaustible field of research possibilities both nationally and internationally, or comparatively, under different approaches and methodologies, it is suggested that new studies might encompass the efficiency of public expenditures in the field of Defense, the impact of strategic defense projects on social and economic aspects, new business models in the national and international Defense market, including empirical research that can be conducted with the SDC.

REFERENCES

AMARANTE, J. C. A. **A Base Industrial de Defesa Brasileira**. Rio de Janeiro: IPEA, 2012. Available from: https://repositorio.ipea.gov.br/bitstream/11058/1091/1/TD_1758.pdf. Access on: Jan. 28, 2023.

BOHN, E. C. **Indústria de defesa e processos de aquisição no Brasil**: uma sugestão de debate baseado em modelos para países em desenvolvimento. 2014. Dissertação (Mestrado em Estudos Estratégicos Internacionais) – Universidade Federal do Rio Grande do Sul, Porto Alegre, 2014.

BRASIL. Ministério da Defesa. **Portaria Normativa nº 899, de 19 de julho de 2005**. Aprova a Política Nacional da Indústria de Defesa (Pnid). Brasília, DF: Diário Oficial da União, 2005.

BRASIL. Ministério da Defesa. **Decreto nº 6.703, de 18 de dezembro de 2008**. Aprova a Estratégia Nacional de Defesa, e dá outras providências. Brasília, DF: 2008. Available from: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2008/decreto/d6703.htm. Access on: Jan. 15, 2023.

BRASIL. **Lei nº 12.598, de 22 de março de 2012**. Estabelece normas especiais para as compras, as contratações e o desenvolvimento de produtos e de sistemas de defesa; dispõe sobre regras de incentivo à área estratégica de defesa e dá outras providências. Brasília, DF: Diário Oficial da União, 2012. Available from: https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12598.htm. Access on: June 13, 2023.

BRASIL. Impactos Socioeconômicos dos Programas Estratégicos do Exército. **Estado-Maior do Exército**, Brasília, DF, 2019.

BRASIL. Ministério da Defesa. **Política Nacional de Defesa e Estratégia Nacional de Defesa**. Brasília, DF: 2020. Available from: https://www.gov.br/defesa/pt-br/arquivos/estado_e_defesa/pnd_end_congresso_.pdf. Access on: Jan. 15, 2023.

BRASIL. Ministério da Defesa. Assinatura de Protocolo entre Brasil e Suécia fortalece Base Industrial de Defesa. **Portal Gov.br** Brasília, DF, 27 out. 2021. Available from: https://www.gov.br/defesa/pt-br/centrais-de-conteudo/noticias/assinatura-de-protocolo-entre-brasil-e-suecia-fortalece-base-industrial-de-defesa. Access on: Jan. 28, 2023.

BRICK, E. S. Base Logística de Defesa: conceituação, composição e dinâmica de funcionamento. *In*: ENCONTRO DA ASSOCIAÇÃO BRASILEIRA DE ESTUDOS DE DEFESA, 5., 2011, Fortaleza. **Anais** [...]. Fortaleza: Associação Brasileira de Estudos de Defesa, 2011.

BRICK, E. S. O Mercado das Empresas da Associação Brasileira das Indústrias de Materiais de Defesa e Segurança. **Relatórios de Pesquisa em Engenharia de Produção**, Niterói, v. 14, n. 6, p. 91-149, 2014.

BRICK, E. S.; SANCHES, E. S.; GOMES, M. G. F. M. Avaliação de capacidades operacionais de combate: conceituação, taxonomia e práxis. **Revista Brasileira de Estudos Estratégicos**, Niterói, v. 9, n. 17, p. 11-43, 2017. Available from: https://defesa.uff.br/wp-content/uploads/sites/342/2020/11/REST-11-Artigo-Prof-BRICK.pdf. Access on: Jan. 12, 2023.

CENTRO DE APOIO A SISTEMAS LOGÍSTICOS DE DEFESA. Guia de Empresas e Produtos de Defesa. **Portal gov.br**, Brasília, DF, 25 mar. 2021. Available from: https://www.gov.br/caslode/pt-br/central-de-conteudo/guia-de-empresas-e-produtos-de-defesa. Access on: Jan. 26, 2023.

CONGRESS.GOV. **H.R.7776 – James M. Inhofe National Defense Authorization Act for Fiscal Year**. Washington, DC, 18 maio 2022. Available from: https://www.congress.gov/bill/117th-congress/house-bill/7776. c: Jan. 20, 2023.

CONGRESSO NACIONAL. **Orçamento da União**. Exercício Financeiro de 2023. Brasília, DF: Congresso Nacional, 2023. Available from: https://www.camara.leg.br/internet/comissao/index/mista/orca/orcamento/OR2023/red_final/Consolidado.pdf. Access on: Jan. 26, 2023.

CONTROLADORIA-GERAL DA UNIÃO. Orçamento da Despesa Pública. **Portal da Transparência**, [*s. l.*], [20--]. Available from: https://portaldatransparencia.gov.br/orcamento/despesas?ordenarPor=ano&direcao=desc. Access on: Jan. 15, 2023.

DAGNINO, R. P. **A Indústria de defesa no Governo Lula**. São Paulo: Expressão Popular, 2010. 237 p.

DEFESANET. **Ministério da Defesa e BNDES assinam acordo para fomentar a Base Industrial de Defesa**. [*S. l.*], 20 fev. 2020. Available from: http://www.defesanet.com.br/bid/noticia/35846/Ministerio-da-Defesa-e-BNDES-assinam-acordo-para-fomentar-a-Base-Industrial-de-Defesa. Access on: Jan. 28, 2023.

DUNNE, P. The Defence Industrial Base. *In*: HARTLEY, K.; SANDLER, T. (org.). **Handbook on Defense Economics**. Amsterdam: Elsevier, 1995.

DUNNE, P. Sector Futures: Defence industry. European defence industry – What Future? **Eurofound**, Dublin, 23 dez. 2015. Available from: https://www.eurofound.europa.eu/observatories/emcc/articles/business/sector-futures-defence-industry. Access on: Jan. 10, 2023

DOSI, G. **Mudança Técnica e Transformação Industrial**: a teoria e uma aplicação à indústria dos semicondutores. Campinas: Editora Unicamp, 2006. 464 p.

HARTMAN, A. Gasto militar mundial bate recorde e supera US$ 2 trilhões em 2021, aponta relatório. **Brasil de Fato**, São Paulo, 25 abr. 2022. Available from: https://www.brasildefato.

com.br/2022/04/25/gasto-militar-mundial-bate-recorde-e-supera-us-2-trilhoes-em-2021-aponta-relatorio. Access on: Jan. 20, 2023.

HARTLEY, K. O Futuro da Política de Aquisições na Indústria Europeia de Defesa. **Revista Nação e Defesa**, Lisboa, n. 90, p. 17-33, 1999. Available from: https://comum.rcaap.pt/bitstream/10400.26/1498/1/NeD90_KeithHartley.pdf. Access on: Jan. 20, 2023.

HARTLEY, K.; SANDLER, T. Introduction. *In*: HARTLEY, K.; SNADLER, T. (ed.). **Handbook of defense economics**. Amsterdam: North-Holland, 1995, v. 1, p. 1-11.

HERTEMAN, J. P. La Technologie: un impératif stratégique pour la France. **Revue de Défense Nationale**, Paris, n. 707, p. 135-146, 2008.

INFODEFENSA. **Imbel e Sig Sauer planejam iniciar produção da pistola P320 no Brasil**. [*S. l.*], 2021. Available from: https://www.infodefensa.com/texto-diario/mostrar/2964358/imbel-e-sig-sauer-planejam-iniciar-produco-da-pistola-p320-no-brasil. Access on: Jan. 15, 2023.

LESSA, C. Indústria de Defesa. *In*: PINTO, J. R. A.; ROCHA, A. J. R.; SILVA, R. D. P. (orgs.). **As Forças Armadas e o desenvolvimento científico e tecnológico do país**: pensamento brasileiro sobre defesa e segurança. Brasília, DF: Ministério da Defesa, 2004. v. 3, p. 13-22.

LONGO, W. P. Tecnologia militar: conceituação, importância e cerceamento. **Tensões Mundiais**, Fortaleza, v. 3, n. 5, p. 111-143, 2007.

LONGO, W. P.; MOREIRA, W. S. Tecnologia e Inovação no Setor de Defesa: uma perspectiva sistêmica. **Revista da Escola de Guerra Naval**, Rio de Janeiro, v. 19, n. 2, p. 277-304, 2013.

MELO, R. **Indústria de defesa e desenvolvimento estratégico**: estudo comparado França-Brasil. Brasília, DF: FUNAG, 2015, 314 p.

MORAES, R. F. **A inserção externa da indústria brasileira de defesa**: 1975-2010. Brasília, DF: Ipea, 2012.

MORAES, C. H. A.; PEREIRA, D. M.; FRANCHI, T. O reflexo socioeconômico da presença militar na fronteira norte: Barcelos-AM e o 3º Batalhão de Infantaria de Selva. **Coleção Meira Mattos**, Rio de Janeiro, v. 16, n. 55, p. 107-132, 2022.

MORAES, G. I.; TERNUS, C. H.; PINTO, G. P. Economia da Defesa: Notas para uma Pesquisa Integrada. **Análise Econômica**, Porto Alegre, v. 38, n. 76, p. 7-30, 2020. Available from: https://seer.ufrgs.br/AnaliseEconomica/article/view/77607. Access on: June 16, 2023.

MOYNOT, J. L. **Politique industrielle et Europe Politique**: le cas de l'industrie stratégique de Défense. La politique industrielle d'armement et de Défense de la Ve République: evolution, bilan et perspective. Paris: L'Harmattan, 2010. 133 p.

PORTAL GOV.BR. **Parceria Tecnológica, Comercial e Industrial IMBEL® e SIG SAUER/ USA**. Brasília, DF, 2020. Available from: https://www.imbel.gov.br/noticias-imbel/288-parceria-tecnologica-comercial-e-industrial-imbel-e-sig-sauer-usa. Access on: Jan. 10, 2023

REPPY, J. Dual-Use Technology: Back to the Future? *In*: Markusen, A.; Costigan, S. (ed.). **Arming the Future**: a defense industry for the 21st century. New York: Council on Foreign Relations Press, 1999.

SAMUELS, J. R. **Rich Nation, Strong Army**: national security and the technological transformation of Japan. New York: Cornell University Press, 1996. 480 p.

SANDLER, T.; HARTLEY, K. **Handbook of Defense Economics**: Defense in a Globalized World. Amsterdam: Elsevier, 2007. v. 2.

SILVA, M. V. G. Estudos de Defesa Nacional: bases epistemológicas e interdisciplinares. **Revista Humanidades e Inovação**, Palmas, v. 9, n. 24, p. 1-18, 2023. Available from: https://revista.unitins.br/index.php/humanidadeseinovacao/article/view/6296. Access on: Jan. 28, 2023.

STEINBRECHER, M.; BIEHL, H. Military Know-Nothings or (at Least) Military Know-Somethings? Knowledge of Defense Policy in Germany and Its Determinants. **Armed Forces & Society**, London, v. 46, n. 2, p. 302-322, 2020. Available from: https://journals.sagepub.com/doi/10.1177/0095327X18811384. Access on: June 13, 2023.

VASCONCELOS, F. C.; CYRINO, A. B. Vantagem competitiva: os modelos teóricos atuais e a convergência entre estratégia e teoria organizacional. **Revista de Administração de Empresas**, São Paulo, v. 40, n. 4, p. 20-37, 2000. Available from: https://www.scielo.br/j/rae/a/MN7C5t7BLHf8vLvdjqm3sLj/?lang=pt. Access on: June 13, 2023.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