

The military-industrial complex and its foundations: geopolitics, development, and technological advance


El complejo industrial-militar y sus fundamentos: geopolítica, desarrollo y avance tecnológico

Abstract: The objective of this paper is to highlight the importance of the military-industrial complex for the process of economic development, as well as for the geopolitical strategy of countries that aspire to greater autonomy in the international system. In this regard, we will divide the article into two parts: in the first part, we will analyze the reasons for the development of a military-industrial complex and its importance for the great powers; in the second part, we will investigate the economic and technological contributions related to the defense economy; finally, in the third part we will briefly analyze the cases of the United States and China.

Keywords: Geopolitics; development; Military-Industrial Complex

Resumen: El objetivo de este trabajo es resaltar la importancia del complejo industrial-militar para el proceso de desarrollo económico, así como para la estrategia geopolítica de los países que aspiran a una mayor autonomía en el sistema internacional. En este sentido, dividimos el artículo en tres partes: en la primera trataremos de analizar las razones para el desarrollo de un complejo industrial-militar y su importancia para las grandes potencias; en la segunda parte, investigaremos acerca de las contribuciones económicas y tecnológicas vinculadas a la economía de defensa; por último, en la tercera parte haremos un breve análisis de los casos de Estados Unidos y China.

Palabras clave: Geopolítica; desarrollo; Complejo Industrial-Militar.

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1 Why develop a military-industrial complex?

The war played an important role in the development of states and military technological advancement. Historically, the great empires have benefited from wars and, modernly, colonialism and imperialism have been instruments of State enrichment that have allowed economic leaps in the benefited societies. Thus, the United Kingdom, France and the United States were largely rewarded for the use of force against their opponents (HOSSAIN-ZADEH, 2006).

The great world powers have always sought to develop military capabilities that would ensure their role in international relations. A preponderant aspect for the construction of sophisticated national means of defense is autonomy, or military independence. No power conceives the scenario of dependence on others, that is, all States that aspire to an elevation of their *status quo* in the international system seek to build up arms production capabilities autonomously. It is undoubtedly necessary to understand that there is a transition period between dependence and autonomy, such as the Chinese case of the early 2000s or even the Indian one, which, with difficulties, has been striving to reduce the import of armaments.

As States underwent transformations in their military, technological and financial structures, the need for the development of sophisticated military apparatuses became pressing. With the explosion of wars and the “military revolutions”¹ – with special attention to the Industrial Revolution (MCNEILL, 1982) –, new techniques and degrees of technological complexity have created profound inequalities not only in the economic field, but especially in the military field. Being a great power² has come to mean having power of influence and domination in the most varied areas, however, it will be in the military sector that the difference will be more contrasting (CHIN, 2019). Today, a great power has a highly destructive military capability and a deterrent guarantee. The United States, Russia, France, the United Kingdom

1 Krepinevich on “*From cavalry to computer: the pattern of military revolution*” argues that there were at least ten major military revolutions, among which were those promoted by the Hundred Years’ War, the Naval Revolution of the 19th century and the Nuclear Revolution of the second half of the 20th century. The author’s central argument is that States that are capable of developing a military revolution tend to distance themselves from others and take different positions of power (KREPINEVICH, 1994). On the influences fostered by the Industrial Revolution in Military Affairs see: Zapotoczny (2006) and McNeill (1982).

2 Initially it is necessary to approach the concept of power itself. Here we use that of Max Weber who defines it as “the ability of an agent to impose one’s own will in a social relationship, even if against the will of the other” (WEBER, 1922, p. 28). The realist theory of International Relations (IR) has a varied reading about power and its application and finding in the international system. There are different approaches within the realist school, such as Morgenthau’s view that States reflect the impulsive and aggressive nature of man (MORGENTHAU, 2002), or that power units seek to secure a prominent place in the structure of the balance of power (WALTZ, 1979) or the interpretation that States seek the condition of hegemony in the international system, however, as such an objective is unlikely, the great powers transform the world into a stage of perpetual competition (MEARSHEIMER, 2001). For the latter author (John Mearsheimer) to be a great power means ultimately having the ability to militarily confront the strongest State in the international system. We believe that the strictly realistic view of IR does not fully translate the concept of “great power”, as it focuses excessively on the military aspect. Thus, we prefer to draw on the contributions of International Political Economy and its realist/mercantilist interpretation of history and the international system. Authors such as Robert Gilpin (Global Political Economy), Paul Kennedy (*Global Political Economy*), and José L. Fiori (História, Estratégia e Desenvolvimento [History, Strategy and Development]) dialogue with the economy, that is, it is not only military power alone that counts to characterize the influence capacity of a world power, but also its economic strength as a lever for financing the war and the other States of the international system.

and China have sophisticated military-industrial complexes (MIC) that guarantee them a position in the privileged capitalist interstate system. The size of the State's power capacity in international relations should be measured by the ratio of its military, but equally, economic and political power. In fact, the MIC is an instrument of State power and a lever in the direction of global protagonism. It is not possible to accumulate power and wealth in the capitalist interstate system and guarantee influence over other States without the military, technological and economic means achieved with or from the MIC.

Another relevant element of the MIC is its impact on foreign policy. By being able to export armaments, countries usually also export services, technical assistance, military cooperation programs and, to some extent, imposes some degree of dependence on importers. An example of the dependence caused by cooperation agreements in defense and assistance is the one carried out between the United States and Brazil in 1952 (FLORES, 1982). This agreement lasted until its denunciation by the government of General Ernesto Geisel in 1977 and was based on the sale of used and often obsolete armaments at a more affordable price. The North Atlantic Treaty Organization (NATO) is also an example of creating a captive market to the American MIC (HARTLEY; BELIN, 2019).

Developing a military-industrial complex does not only mean having the capacity to manufacture armaments, but to master complex cycles of technology, create sophisticated conditions with the national economy and achieve internal and external market to have scale in production. Thus, the national innovation system of a large country ends up being deeply influenced by the issue of national security (NELSON, 1993). Other fundamental elements are geopolitics and international insertion. Having a sophisticated MIC means supporting autonomous and low-constraint international insertion.

Thus, an important dilemma is discussed among specialists of various strains: import armaments or develop internal capacity? In view of the historical geopolitical framework, there is no condition to achieve the degree of world power without the ability to produce sophisticated defense devices internally. As we discussed above, the instabilities inherent in the international system do not allow great powers to be dependent on others in any sector, much less in the sensitive field of defense and security.

Having a sophisticated military capability meant the main element of expanding imperial or State power in historical perspective. The countries that managed to develop the complex equation: threats and opportunities for expansion of power + economy (industry, financing the demand for cutting-edge weapons and R&D) + political stability, were able to influence or build the regional or international order in which they were or are present (KENNEDY, 1989). World powers tend to create difficulties and obstacles for peripheral countries or countries below the hierarchy of power that have pretensions to change their status in the international system. This fact poses a problem, which for some is insoluble: not every peripheral country can change its level on the scale of power. However, despite the fact that today the technological and financial difference between the great powers and peripheral countries is abysmal, history shows us that Rome was once periphery and became center, England was once periphery and became center, the United States was once periphery and today is at

the top of world power (COSTA, 2009). Therefore, through “founding insubordination” (GULLO, 2014), that is, from a geopolitical rebelliousness and daring, peripheral countries can break the restraints of access to power. In the case of India, it is important to note that the country was once center and, together with China, led the Asian and even world economy through the coveted manufactures and spices (NAYYAR, 2014).

A striking example of the performance of the great powers in the sense of vetoing access to peripheral countries in the development of cutting-edge military capabilities is the nuclear sector. If in the past, the veto was in the form of treaties in which the tonnage of ships or the number of warships allowed to the defeated in war was the rule, as in the case of Germany after World War I (CARR, 2001), with the advent of nuclear energy and its use for military purposes, it was decided to restrict it to a few countries. The central concern of governments with the right to military use of nuclear energy – the five permanent members of the UN Security Council, mainly – is that the process of enrichment of uranium and plutonium, either through the process of ultracentrifugation (as in the Brazilian case), or through the use of pressurized heavy-water reactor (used by India, Canada and others), for civilian purposes, can be directed at any time for military purposes (BUNN; SAGAN, 2014).

Thus, the United States and the Soviet Union led the process of creating the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1968. Large peripheral countries, such as Brazil and India, reacted by declaring that such an attitude was, in addition to being hypocritical, harmful to World Peace by guaranteeing the most effective instrument of war – the atomic bomb – to few. This situation was denounced as a “freezing of world power” (ARAÚJO CASTRO, 1972). It is important to emphasize that there is a prediction of the extinction of nuclear weapons by the possessors, however, what is observed is that the States that have the “right” to develop atomic arsenals for military purposes have never applied a satisfactory reduction policy, much less the agreement to extinguish their stockpiles. This situation of maintenance of nuclear privilege encourages policies of autonomous affirmation by countries that were prevented from developing nuclear enrichment systems and suffered retaliation, such as Iran, or even those that did not adhere to non-proliferation treaties, such as India, Pakistan, Israel and North Korea, which defied the regime and developed nuclear capabilities for military purposes.

In addition to the NPT, the nuclear-armed countries, with the support of the United Nations and other States, pressed for the creation of an international non-proliferation regime³ organized on the basis of a network of treaties, namely the aforementioned NPT, the *Missile Technology Control Regime* (MTCR)⁴, *Comprehensive Nuclear Ban Test* (CTBT) and the *Nuclear Suppliers Group* (NSG).

3 International regimes have different approaches according to the theory used. Our work is guided by realistic perception and, therefore, understands that international regimes are instruments of influence or even domination of the great powers over other States. For more information on the realistic approach to regimes see: Strange (1982) and Krasner (2012).

4 This regime is not directly aimed at non-proliferation, but reinforces it towards the use of long-range missiles with nuclear warheads.

It is salutary to understand that the non-proliferation regime is linked to the international security architecture that was put together throughout the Cold War. There was, then, a different bipolar international order with fewer rising States. Today, the global power structure has a number of emerging actors with broad military power, such as India, Pakistan, Israel and North Korea. These countries possess atomic artifacts and demonstrate the non-proliferation regime's failure to control access to nuclear energy for military purposes. Another relevant fact is the insecurity caused by the States themselves benefited by the pre-1968 NPT, such as the United States that generate instabilities in the world order due to unilateral actions as in the case of the invasion of Iraq in 2003, claiming that there were weapons of mass destruction (RAJAGOPALAN, 2018).

Another example very well used to restrict access to sensitive technologies or simply applied to combat competitors through the use of "law" or supposedly lawful mechanisms, are economic, commercial and or financial sanctions. This instrument was widely used by the United States during the Cold War; against Iraq (1991 and 2003), due to the Gulf War; Serbia, due to the war in the Balkans and widely used contemporaneously against Iran, Venezuela and China.

India also suffered from such retaliatory measures precisely because it dared to break the nuclear restriction of the NPT and explode its atomic bomb in 1974 (*POKHRAM I* tests). The Indian nuclear program began shortly after independence and was led by nuclear physicist Dr. Bhabha and had the decisive support of Prime Minister Nerhu. Initially developed with a peaceful purpose, the country's nuclear program took another turn after the conflict with China in 1962, and due to the unfair approach and guarantor of the privilege of the big five (USA, UK, France, USSR and China) to possess nuclear artifacts in the NPT negotiations in 1968 (SUBRAMANIAN, 1982). In 1998, the process of discussing the country's first nuclear doctrine began, in which the *No First Use* and *Second - Strike Capability* initiatives were established ⁵. This strategy of using nuclear weapons is important in the scenario of discussions on non-proliferation, as it places India as a "politically correct" nuclear State, that is, without aggressive intentions of indiscriminate use (KANWAL, 2014).

There is yet another considerably relevant element in the relationship between world *status* and arms production, namely participation in conflicts (KINSELLA, 1998). As war was an integral part of the formation of States and vice versa (TILLY, 1996), the testing of armaments and the constant preparation for the conflict helped in the formatting of an industrial park aimed at military innovation that, in addition to benefiting the great powers with the most sophisticated defense equipment, also benefited them in the strategy of conquering markets for export.

5 The doctrine of "*no first use*" means that a nuclear power cannot use atomic weapons unless it has been attacked by nuclear artifacts and the "*Second - Strike Capability*" is the country's ability to use the nuclear attack as a response to the nuclear aggressor. More information in Siracusa (2008).

Indeed, as the military-technological complex became more and more sophisticated and the financing capabilities of war more difficult, few States were able to master productive defense systems that would guarantee them enough power to occupy the top of the world hierarchy. Thus, we insist with the question: is it possible for a peripheral country like India (or any other) to develop a military-industrial complex capable of offering defense solutions compatible with the country's global aspirations? At this time, we intend to highlight the advances in the military sector of the so-called traditional powers, but placing emphasis on the geopolitical factor. That is, our objective in this discussion is to illustrate the strategic component of the power and affirmation relationship with the development of critical military capabilities, either in the operational field or in the ability to design and manufacture defense devices.

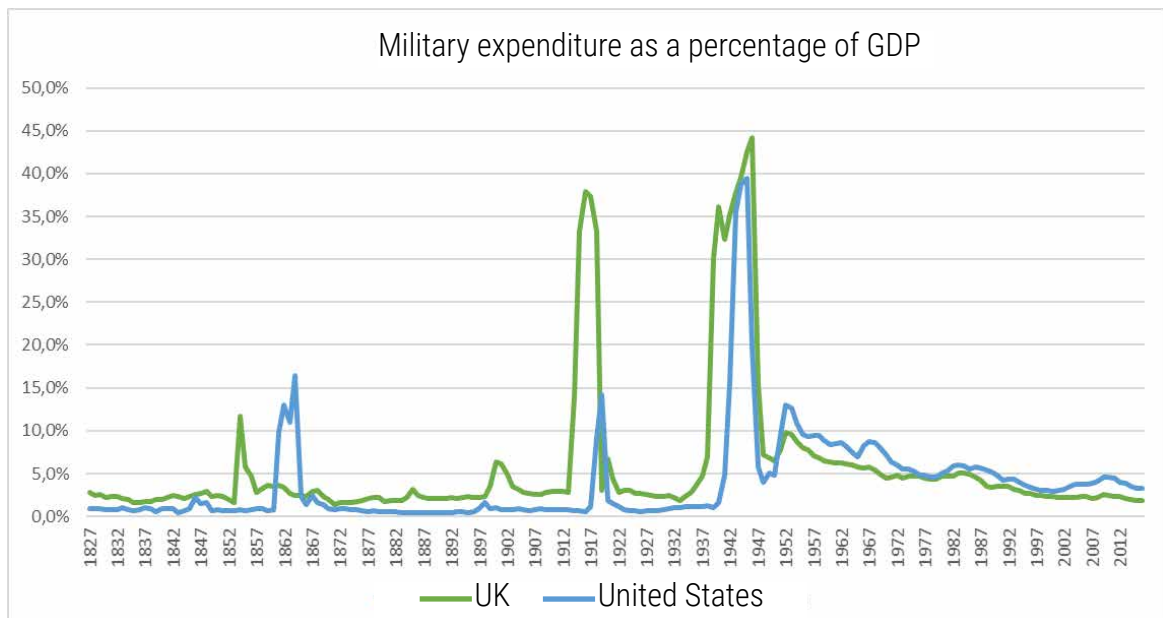
In fact, before analyzing the advances of the great powers in the field of development of productive and technological capacity aimed at defense and security, we will make a discussion that seems fundamental to us in the investigation about the military-industrial complex, which is the Defense Economy. This field of research seeks to analyze the relationship between military spending and economic growth, as well as the benefits or harms that come from this relationship.

2 Defense Economics: military spending and economic growth/development

In this topic, we will investigate the positive points (mainly) in the tax economy of military spending. Our goal is to discuss the main dilemmas and issues concerning the Defense Economy.

Historically, military spending increases when there are security dilemmas (HERZ, 1950) or conflicts. There were times when countries spent more than half their GDP on defense, such as Britain at the end of World War II, 52%/GDP (CHANTRIL, 2015), or Louis XIV's France in the 17th century, which had a budget average of 30% of GDP, however, rising to 57% during the war with the Netherlands in 1683 (BURNS, 1988; ELORANTA, 2005). Military spending, up to the social revolutions from the end of the 18th century, as well as with the creation of the mechanisms of control and transparency of the public budget, were quite broad. From then on, social spending was prioritized for the benefit of the majority of society and military spending became more controlled and "transparent".

Graph 1 – Share of military spending in the GDP of the United Kingdom and the United States of America between 1827-2012.



Fuente: Our World in Data (2016).

Thus, one of the most frequent discussions about defense spending concerns the *guns x butter* dilemma⁶. This dilemma has long been addressed by decision-makers, but above all by liberal (neoclassical) economists who tend not to perceive the strategic element involved in military spending, but only the accounting factor⁷.

There is an interesting and well-established literature on defense economics that analyzes a series of schools and approaches on the issue, including those with an econometric profile (DUNNE; SMITH; WILLENBOCKEL, 2005). In addition to neoclassical authors, there are also those of Keynesian tradition who understand that military spending is positive, because through its multiplier effect they are able to stimulate aggregate demand and product growth (AMBROS, 2017).

In this sense, Pivetti (1992) defends the positive participation of the increase in military spending for the growth of the economy, since there would be an increase in aggregate demand pulled by military investments and expenditures. The author illustrates this relationship by analyzing the United States during the Cold War. In the two moments in which the US government increased military spending, 1947-1969 and the 1980s, there was a reduction in unemployment and economic growth.

⁶ In the past, there was a certain ease for politicians, kings and those responsible for the military budget to spend what was necessary for the strengthening of the State, however, with the advent of more representative governments, the dilemma reappeared with more vigor and imposed more democratic and transparent discussions. However, it is important to note that defense spending at the expense of social spending – or any increase in military spending seemingly without justification – affects developing countries that still need large sums of investment to carry out their structural change. For more information see: Garfinkel and Skaperdas (2007).

⁷ However, one of the greatest icons of economic liberalism, Adam Smith, understood the need for State interference in the economy when it came to national defense. For him, defense was a public good and therefore not liable to suffer the oscillations of the free market. More information in Smith (1983).

Another important element posed by Pivetti (1992) is that there would not be an opportunity cost in the issue of military spending and investments in other civilian sectors, since the former is a specific expenditure and, therefore, does not divert investment, but rather generates a new expenditure and stimulates the demand for new private investments. In addition, there would be the benefit of encouraging technological progress as a result of military spending, as well as a stimulus to private investment. There are, however, criticisms of the issue of “technical training diversion” from the market to the military sector. Nevertheless, Pivetti argues that the demand for specialized professionals tends to increase as the demand of the military sector for this manpower increases, as demonstrated in the American case of the arms race with the Soviet Union (USSR) during the Cold War. Finally, the author, as well as Sandler and Hartley (2007) and Mazzucato (2014), points out that military spending brings a contribution to the civilian sector through the *spin-off*, that is, the technological diffusion of the military sector to the market (PIVETTI, 1992).

Nevertheless, it is important to emphasize that the positive elements of military spending, as advocated by the aforementioned authors, will depend on the situation of each State analyzed. In particular, with regard to developing countries, Pivetti argues that, despite the general benefit of military spending as an aid to aggregate demand, one should investigate each particular case (PIVETTI, 1989). However, it is important to emphasize that there is research on the effects of military spending on the economic growth process of developing countries showing positive results. Benoit (1973) did a study with 44 emerging countries⁸ between the years 1950 and 1965 and the result was that these countries, considering the “military burden”, that is, a relative high military expenditure, achieved greater economic growth than those who spent relatively less (BENOIT, 1973).

McGuire (1995) advocates that economics can contribute to Defense and Security Studies on at least six points: 1) defense strategy and resource allocation; 2) analysis of deterrence; 3) economic alliance models; 4) national power, economic survival, and international trade – here the emphasis would be on protecting the National Defense Industry; 5) arms race and strategic interactions; 6) economic ecology and international conflicts. In this last point, the author uses the analysis of the demographic question (extinction and human survival) as an important element of security.

In addition to these points of contribution of economics to Defense and Security studies, McGuire argues that there are four levels of interdependence between areas. The first of these would be the question of the effectiveness of economic policies aimed at defense. The second is the national economy as a support and source of funds for security, as well as the use of the economy for the weakening of enemies, through sanctions, embargoes, financial advantages, that is, *geo-economics*⁹. The third level of interdependence would be macro effects on national

8 Selected countries included India, Israel, China, Mexico, South Korea, Argentina and others.

9 According to Blackwill and Harris (2016), *geo-economics* is “the use of economic instruments to promote and defend national interests and produce beneficial geopolitical outcomes; and the effects of other nations’ economic actions on a country’s geopolitical goals” (BLACKWILL; HARRIS, 2016, p. 20, translated by the author). The strategic use of the economy as an instrument to achieve geopolitical ends is historical, many powers have done so and still do. Sanctions, blockades, loans with counterparts and so many other ways of using economic power as a weapon are present in the prescriptions of the most powerful nations. In this sense, the “modern *geo-economics*” is necessarily linked to the use of traditional military power and diplomatic actions as an instrument of a country’s foreign policy (BLACKWILL; HARRIS, 2016).

economies, such as economic stability, growth and prosperity. Finally, the fourth and final level is the economy as an explanation or source of the country's security problems. Examples of this would be: colonization (colonialism), distribution of wealth and all movements made by the State to ensure access to wealth (MCGUIRE, 1995).

There is a consensus that having a sophisticated military-industrial complex and state-of-the-art Armed Forces goes beyond geopolitical motivations. It is not enough just to have the will to be more powerful, it is necessary to create systematic conditions for the modernization of military power. This involves the decision to spend less on personnel and more on critical technologies – one of the problems that involves, above all, developing countries such as India and Brazil.

However, it is also known that there are emerging countries with greater international prominence and that need to accompany the great powers or simply develop deterrent devices that are costly.

Nonetheless, there are authors who argue that military expenditures are configured as burdens and, therefore, bring serious doubts about their contribution to national development and economic growth, because with military expenditures, important civilian investments would no longer be made (DUNNE, 1990; SEN, 1987; SMITH, 1977). For Sandler and Hartley (2007), however, defense spending brings considerable benefits to the development process, as they are positive in times of unemployment and economic crisis, generate *spillover* and *spin-offs*, can contribute to economic growth when focused on the construction of infrastructure and can generate an important sector of highly qualified human resources.

The benefits of military research and its *spillover* for the market was widely studied by Mariana Mazzucato who showed the numerous benefits of the constant policy of public investment in R&D in the Defense sector. It is through this initiative that devices such as *smartphones* and its components, such as the *touchscreen* or even the internet could, from the financing of military research, be widely used by the market and have become items of very high civilian consumption (MAZZUCATO, 2014). We could cite a huge list of inventions that derived from investments in defense, such as GPS, the microwave oven, superglues and many others from everyday use, such as razors and canned food (FROHLICH; COMEN; SUNESON, 2019).

Corroborating with the studies and positions of the aforementioned authors about the benefits of military spending for Economic Development, Ram (1994) reinforces the positive points of the *spin-off* and advocates that national defense spending promotes long-term economic growth, even if this is not the immediate goal. In addition to the long-term benefit, defense spending brings advantages such as the formation of human capital, advancement in infrastructure and technological progress.

However, despite the enormous contribution of the spillover of research in the defense sector – there is a myriad not yet spillovered and that, probably, will not be – for the market and its civilian use, the effectiveness of the final product cannot be credited only to its ability to be assimilated by the civil sector. The purpose of military research is to ensure, first of all, national defense and the possibility of maintaining or expanding the international power of the State.

The “Revolution in Military Affairs” (RAM)¹⁰, a term that some defend, happens concomitantly with the most critical technological advances and needs to be understood as a strategic issue, as it completely alters the way of making war and seeks to create conditions to achieve victories in conflicts in a decisive way. As we commented in paragraphs above, the most developed powers are able to deepen the *gap* already quite large among advanced and backward with regard to military capabilities and everything indicates that this should be the rule, that is, the richest and most powerful countries should become even more capable of imposing their will on the least developed and dependent. Few states are able to do the technological-economic military *catch-up* and avoid domination and dependence.

However, it is of fundamental importance to reflect that technological military superiority is not enough to win the war – striking cases, such as the defeat of the United States in Vietnam and the difficulties of the same superpower in dominating the Afghan territory, are important findings of this – however, it is equally important to point out that the more means the country has to win the war – financial capacity, for example – the closer it will be to victory.

Our objective in this section is not to be guided by mathematical, econometric models or that analyze Defense Economics with an emphasis on cost-effectiveness. Most economists who study Defense leave aside the geopolitical element, that is, the strategic nexus that goes far beyond the accounting of spending itself. Even if we agree with the approaches to economics that meet the thesis that military spending is positive, we are not guided by such a line of thinking, since we understand that defense and security issues have always been the true pillars of the expansion of State power throughout history. For some defense economists – especially those of the neoclassical strain – war, and therefore conflicts, can be avoided if there is more transparency of information, after all *decision-takers* are rational agents capable of observing the effects of war under the lens of cost-benefit (BRITO; INTERLIGATOR, 1985; SÁNCHEZ-PAGÉS, 2004).

Although we agree that the economic element, such as the export of products and the financing of the military-industrial complex are important, it does not seem to be the main vector of stimulating the development of the National Military sector, but rather geopolitical threats and the need to strengthen the foundations of the expansion of power in the international system – or in the immediate space. It is necessary to make it very clear that our work is not only concerned with the macroeconomic or accounting aspects of defense, that is, we do not focus on budget disputes within the State – which we have already claimed to be a relevant factor – but whether there is the perception that the construction of a military-industrial complex is salutary for a State to establish itself as a world power. Thus, we go against the neoclassical perception of Brito and Interligator (1985) and Sánchez-Pagés (2004) – and many others of the same approach – about the vision of war, because these are, first of all, politics by other

10 The term is not consensual in the specialized literature. There are authors who argue that there were “military revolutions” that completely changed “making war”, such as Michael Roberts (2018). There are also those who understand that the technological changes of war take place in the “long-term” (BLACK, 1991). Our objective here, however, is to highlight the efforts in the direction of strengthening the strategic advantages aimed at the military field that guarantee conditions to win the war and or maintain the *status quo* in the hierarchy of world power. For more information on the topics see: Saint-Pierre and Gonçalves (2018) and Teixeira (2009).

means (CLAUSEWITZ, 2017) and the main definer of the hierarchy of power and wealth in the international system (FIORI, 2015). Therefore, there is a fundamental relationship between the economy and defense, not as a mere instrument of quantitative analysis of the costs and benefits of rational agents and their *trade-offs* about whether or not to invest in military power, but in understanding the economy as a pillar of the political and geopolitical strategy of the State in its struggle for survival and empowerment in the international system.

Before closing the section, it is important to emphasize the issue of technological advancement to overcome dependence in the military field. Indeed, it is worth mentioning an issue not always addressed by defense economists about developing countries, namely economic constraints. Few emerging states are able to break the shackles of technological dependence, often linked to intellectual property and the costs of developing sophisticated devices in the military sector. There is also, in spite of the problem of technological dependence mentioned, the issue of pressures suffered by developing countries to buy defense equipment from developed countries, see the recent case of Turkey that has been suffering pressures to apply sanctions by the United States due to the purchase of the S-400 anti-aircraft defense system from Russia (SELIGMAN, 2019). This reinforces the need for developing countries to build policies aimed at structural change in order to enable their productive systems to develop armaments and reduce dependence on the import of defense products from more advanced countries.

3. Military-industrial complex is power: a brief analysis of the cases of the United States and China

The United States

“The basic innovations that shaped modern American technology after World War II (and quickly spread around the world as the jet plane, the transistor, fiber optics, nuclear energy, the computer, the internet) were conceived, developed and directed as a military enterprise” (SMITH apud MEDEIROS, 2004, p. 225).

Despite the military and economic advances of the 19th and early 20th centuries, it will be after WWII that the American economy and power will know a colossal advance. With the economic instruments built in the post-war period, such as the International Monetary Fund (IMF), the *General Agreement on Tariffs and Trade* (GATT) and the World Bank, the United States was able to accumulate considerable wealth and shape the international economic order according to its discretion (HOSSEIN-ZADEH, 2006).

This fabulous economic advance allowed the country an equal military expansion of an imperialist character, especially after the end of the Cold War. With a series of conflicts and military interventions – Gulf War, 1991; Serbia, 1999; Afghanistan, 2001; Iraq, 2003; Libya,

2011; Syria, 2013 – the United States has allied economy, production and sale of weapons and geopolitics like no other State so that its MIC has become the most complete and critical in the world. This relationship is called by Hossein-Zadeh “*The Political Economy of US Militarism*” and would have an imperialist form, the “militaristic” and “parasitic imperialism”¹¹ (HOSSEIN-ZADEH, p. 3, 2006). El imperialismo militar del país sería una especie de amplia distribución de la riqueza para los más ricos por medio del aumento del gasto militar y de la remuneración de las empresas que actúan en las guerras (HOSSEIN-ZADEH, 2006).

However, military spending and its instrumentalization via the “political economy of imperialism” is not consensual and faces a dispute between “factions”. On one side there would be the armamentist *lobby*, nationalist and inciter of external conflicts, on the other the group of more neoliberal characteristics, which is not even a sponsor of the instabilities derived from military incursions, as they bring economic uncertainties to business. Thus, despite the more common perception that the United States acts internally in consensus in the decision-making process linked to conflicts, especially those in the Middle East, supposedly motivated by oil control, Hossein-Zadeh argues that there is a criticism on the part of American energy companies to the instabilities caused by the permanent military presence. Thus, there would be strong pressure from the militarist *lobby* for the country’s external action in order to guarantee large financial returns to companies in the defense sector (HOSSEIN-ZADEH, 2006).

Indeed,

[...] since the post-war period – and with the impetus of the Cold War – the role that militarism assumed in the construction of American International hegemony has been discussed. Since, by consolidating its military preponderance, the United States created an industrial demand that was responsible for boosting its domestic economy and fostering other productive sectors in times of crisis, stagnation or recession, making “continuous war” occupy a strategic role in the design of industrial policy and in the scientific and technological development of the country. Called the Military-Industrial Complex, this structure, which combines industrial demand with external military action, is for many authors the main responsible for the warming of the North American economy in periods of internal difficulties (MOREIRA JR, 2015, p. 27).

11 *Parasitic* because, according to the author, American militarism is inefficient and highly costly in economic terms. In the author’s words: Historically, parasitic military imperialism has almost always evolved out of a higher stage of economic or classical imperialism: a prolonged reliance on military power for economic, territorial, or geopolitical gains gradually creates a dynamic out of which evolves a large standing military apparatus that tends to perpetuate itself — and develop into a bureaucratic military empire. Though military force in the economic sense of imperialism is usually a means for economic, territorial, or geopolitical gains, under parasitic military imperialism it becomes an end in itself (HOSSEIN-ZADEH, 2006, p. 3, translated by the author). Original source: Historically, parasitic military imperialism has almost always evolved out of a higher stage of economic or classical imperialism: a prolonged reliance on military power for economic, territorial, or geopolitical gains gradually creates a dynamic out of which evolves a large standing military apparatus that tends to perpetuate itself—and develop into a bureaucratic military empire. Though military force in the economic sense of imperialism is usually a means for economic, territorial, or geopolitical gains, under parasitic military imperialism it becomes an end in itself.

It can therefore be concluded that competition and rivalry, as with Germany (WWII) or the Soviet Union (Cold War) were striking elements of the advancement of the country's military technology.

In fact, the project *Manhatan* (atomic bomb), *Apollo* (space exploration) and *Strategic Defence Initiative* (known as “Star Wars”) were examples of this. In this sense, the US National Defense Strategy of 2018 thus refers to the competition and threats of the “revisionists” Russia and China:

The central challenge to U.S. prosperity and security is the reemergence of long-term, strategic competition by what the National Security Strategy classifies as revisionist powers. It is increasingly clear that China and Russia want to shape a world consistent with their authoritarian model – gaining veto authority over other nations’ economic, diplomatic, and security decisions (EUA, 2018, p. 2)¹².

There has always been awareness on the part of American policy makers, and the manifest destiny¹³ reinforces this, that the United States should be the great world reference (RESENDE, 2012). For such a project to become viable it was necessary to create a broad technological, economic and political base around the defense sector that would contribute to the progress and development of the country (MEDEIROS, 2004). In this sense, the US Department of Defense was, along with other federal agencies, such as the *Defense Advanced Research Projects Agency* (DARPA), or *National Research Council* (NRC) or yet the *National Aeronautics and Space Administration* (NASA) – in addition to a network of universities with research focused on the sector –, important to organize and induce modern technological innovation generating great benefits to the military leadership of the United States in the post-World War II. Thus,

[...] the participation of the State through the so-called military Keynesianism is not restricted to the provision of resources to the research and development process and to government purchases and public contracts with weapons manufacturers, but presents itself as an articulation between public and private institutions that influenced the process of selection, diffusion and induction of modern technologies in the post-war period. All this under the commitment to maintain a strategic superiority over the opponent (MOREIRA JR., 2015, p. 34).

12 Original: The central challenge to U.S. prosperity and security is the reemergence of long-term, strategic competition by what the National Security Strategy classifies as revisionist powers. It is increasingly clear that China and Russia want to shape a world consistent with their authoritarian model – gaining veto authority over other nations’ economic, diplomatic, and security decisions.

13 The term *Manifest Destiny* was initially coined by journalist John O’Sullivan, in 1845, and is based on the idea that the United States of America would have been blessed by God and, therefore, would have special rights to conquer territories and peoples. There is a strong Protestant religious influence in the term and practice, but there are also geopolitical and economic elements that would justify the expansion of American power to the west of the North American subcontinent. In this way, the domination over the natives and the taking over of their territory, as well as the conquest of part of the Mexican territory, were morally linked to manifest destiny. Subsequently, American imperialism was justified on the moral basis of the same principle. For more information about the term and its historical application see: Montjoy (2009) and Merk (1978).

In fact, strategic superiority is not only the result of State orders and inductions through military investments and expenditures, it is also necessary to create what Holley (1997) calls the “academic military-industrial complex”. For the author it is necessary a system that can relate the best ideas to a doctrine and its strategic application. That is: “new weapons, when not accompanied by the corresponding doctrinal adjustments, are only several external additions to the Armed Forces Corps” (HOLLEY, 1997, p. 14, translated by the author).

In terms of share in the global armaments market, the country has 43 companies in the top-100 and 5 in the top-10. The country is the largest arms exporter, US\$175 billion. According to SIPRI, in 2021, the country concentrated 39% of global sales. The main companies in the US defense sector – and also top-5 in the world – are: *Lockheed Martin*, *Boeing*, *Raytheon*, *Northrop Grumman* and *General Dynamics*. The defense budget of the United States in 2021 was US\$778 billion – almost the same amount as the subsequent top 10 countries (SIPRI, 2021).

The MIC, in general, but the American in particular, is the most complete example of political-economic-military coordination of a global power project. The dynamics of this complex are highly sophisticated and have deep potential for spillover and *spin-off* – which proves the thesis defended by Mazzucato (2014), Block (2008) and others that the State is the great diffuser of innovation and development. The MIC cannot be detached from the national innovation system and in the case of the United States, the expansion of its economic and military power in the international system cannot be understood without interstate competition (arms race) and the development of its military-industrial complex.

It is in this sense that the *Interim National Security Strategic Guidance* – document that gives the main guidelines of U.S. policy for national security, while the *National Security Strategy* of the Biden administration was not disclosed – reinforces the link of the country's strategic objectives with the needs of investment in military R&D. The aforementioned document proposes a resumption of Washington's technological and economic prominence, given the loss of industrial competitiveness and innovation of the country to China and Russia. Thus, defense is explicitly cited as one of the pillars of ensuring the objectives of American power for the 21st century, as well as the maintenance of a large spending and investment budget (THE WHITE HOUSE, 2021).

China

China has been implementing a national development strategy since 1978 with the clear objective of transforming the country into one of the main forces of the international system. The government of Deng Xiaoping (1978-1992) announced the need to promote the national “Four Modernizations”. The goal was to develop agriculture, defense, science/technology and industry as instruments to transform the country's economic and strategic structure. In fact, these measures of “opening up” China to foreign investment and international trade proved to be fundamental instruments of a national development project that, judging by its results, has been successful (JABBOUR; DANTAS, 2017).

In this sense, the development of a military-industrial complex – precipitously motivated to respond to threats and ensure autonomous international insertion – has transformed China into the third military force and the second largest defense budget in the world. Indeed, in 2019, Beijing released its Defense White Paper – *China's National Defense in The New Era* – official document that points out the main strategic objectives of the country for the 21st century. In addition to analyzing the international security landscape, the Chinese White Paper reiterates the mission of the country's Armed Forces and analyzes the needs for reform of military institutions. Another key point of the document is the relevance given to defense spending and the constant modernization of production and innovation capabilities in the military field in order to reach a global reference position by 2035 (HUI, 2019).

The country's strategic arsenal ranges from the ability to manufacture and launch intercontinental ballistic missiles, through sophisticated air defense systems (HQ-16), cyber warfare devices to fifth-generation attack fighters (J-20 and FC-31). Naval progress is equally extraordinary, the country is able to design and build a number of warships, such as frigates, destroyers, submarines (with nuclear propulsion) and aircraft carriers, such as the “Type 001A” (the project is to have 6 nuclear aircraft carriers by 2035). Today China has an ability to develop, produce and export state-of-the-art armaments (such as the hypersonic missile *Xingkong-2*), consolidating its position in the global military power hierarchy.

In the early 2000s, the Chinese military-industrial complex employed more than three million people – 300 thousand of them engineers alone – and has thousands of state-owned and private companies (BITZINGER, 2008). Today, there is a considerable technological advance and integration between the military and civilian sector in the country. Differently from what was seen in the first decades of communist China – which maintained a separation between sectors for numerous reasons, including economic backwardness and external threats – the progress achieved by the political effort to integrate the civil and military productive and technological system contributes for the dynamization of the Chinese economy and its development process (TREBAT; MEDEIROS, 2014).

To coordinate the policy of integration between the military and civil sectors, the *Comission of Science, Technology and Industry for National Defense* (COSTIND) was created in 1982. Its goal was to work with civilian agencies on technology transfer and *know-how* del sector militar. El efecto de tal política se puede notar en el cambio de la composición del sector de defensa que, en 1978, tenía solo el 8% de participación de empresas del sector civil, mientras que a fines de la década de 1980, dicha cifra aumentó al 70% (TREBAT; MEDEIROS, 2014).

Effectively, the advance towards the sophistication and modernization of the Chinese military-industrial complex was due to the political decision to increase military spending and to mirror the technological advances presented to the world by the United States during the Gulf War (1991). Advances in microelectronics and other items of critical technology, associated with the geopolitical changes of the 1990s, made China understand the need to adapt the people's Liberation Army to new ways of waging war and implement “military-industrial” reforms. Another factor that motivated the advancement and deepening of investments in military innovation was the US embargo on dual-use technologies exported to China, as well as the country's booming and constant economic growth (TREBAT; MEDEIROS, 2014).

In order to advance in the field of critical technologies, the Chinese government created Project 863 *High-Tech Research Program* focusing on information technology (IT), laser, biotechnology and other highly complex niches. A relevant aspect of the program is its link with universities, which receive funds for R&D focused on the military area (TREBAT; MEDEIROS, 2014)

China has become a major arms exporter. The country is among the five largest exporters in the world (SIPRI, 2021b). Its main customers are Pakistan, Bangladesh and Myanmar, as well as African and Middle Eastern countries. If NATO is a captive market and export platform for US defense products, the *Belt and Road Initiative* (BRI) has been a promising market for arms exports from China (SHAO, 2019). With regard to arms imports, Europe is the country's main partner with almost 99% of sales, with special emphasis on Russia with 68% (CSIS, 2019).

The main Chinese defense companies are: *Aviation Industry Corporation of China* (AVIC), *China South Industry Group* (CSIG), *China North Industry Group Corporation*, *China Aerospace Science and Industry Corporation*, *China Shipbuilding Industry Corporation*, *China Electronics Technology Group Corporation* and *China Aerospace Science and Technology Corporation* (ZHEN, 2018). A relevant fact of the Chinese MIC is that all large companies in the sector are state-owned.

In 2020, China managed to achieve an important place among the largest producers and exporters of defense equipment internationally. The *Aviation Industry Corp. of China* (AVIC), the company responsible for the fifth-generation J-20 fighter and the H-20 bomber aircraft, was, that year, the sixth largest arms exporter in the world; while the *China Electronics Technology Group Corp.* (CETC), the eighth, and the *China North Industries Group Corp.* (NORINCO), the ninth (SIPRI, 2021d).

Chinese defense spending/investment in 2020 was US\$252 billion (13% of the world total) and the fifth largest arms exporter with 5.5% of the total (SIPRI, 2021). It is the world's second largest military budget and has been growing systematically. However, it is important to reinforce the jump in both spending and development of the Chinese MIC, in 1989 the country occupied only the twelfth world position with regard to military spending (TREBAT; MEDEIROS, 2014).

Despite the enormous progress in terms of technology and productive capacity – which can be seen as one of the few countries to provide the majority of military equipment to their Armed Forces (BOUTIN, 2017) – the Chinese MIC still cannot be compared to the American and even the Russian, as there are still some degrees lacking in the technological domain. Areas that require higher density and technological maturity, such as aerospace, still demand a *catch-up*. Another relevant aspect in this process of technical mismatch is the fact that Chinese armaments have not yet been widely tested in conflicts and therefore still lack a quality stamp when compared to the two military superpowers.

However, soon, China should become a country with complete independence in the military sector and compete with the United States and Russia for the most complete and sophisticated MIC *status* among nations, as this is the goal and the Chinese government has not been sparing efforts to reach it. In less than 40 years China's MIC has grown into one of the five most sophisticated and complete in the world. Considering the level of investment, training of human resources and geopolitical motivation, the country should not have great difficulties in materializing the goal of becoming a military superpower in the long term, if it manages to overcome the technological gaps that make the country need partners today in the supply of sensitive components, such as Russia.

In this sense, the proportional expenditure on R&D focused on the military sector in China, in 2014, was around 15 to 25% of GDP (TREBAT; MEDEIROS, 2014). Another relevant data on Chinese defense spending is personnel spending, which accounts for around 30.8% of the budget, with 28.1 remaining for training and maintenance and 41.1 for equipment (CSIS, 2019).

In short, despite the enormous technological advancement in the military sector and the fact that it is the world's largest economy (PPP – Purchasing Power Parity), China is still not on a par with the United States. The evolution of the production system and R&D is unquestionable, largely due to the abandonment of the Soviet-inspired model and adherence to an industrial-military organization inspired more by the American formula from the late 1970s onwards. Thus, seeking to deepen the military technological modernization, the *Medium to Long-Term National Science and Technological Development Plan 2006-2020* was launched, focused on increasing endogenous innovation capacity (REPUBLIC OF CHINA, 2020).

Final considerations

In this article, we seek to analyze the importance of the military-industrial complex as a fundamental element of the geopolitical strategy of the State, especially of the one that has aspirations for world power. Thus, the discussion of the first session had the role of justifying the development of the military-industrial complex, reinforcing its historical importance for the international affirmation of the great world powers. In this sense, the discussion made in the second part aimed to investigate the positive economic elements, such as the *spin-off*, for the economic development and strategic innovation of the State. Finally, in the last part, our intention was to apply the concepts and contributions of the first two sessions. Thus, we analyze the cases of the United States and China, illustrating the importance of thinking strategically about the defense economy.

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