

Machiavelli and the importance of the national military power

Maquiavelo y la importancia del poder militar nacional

Juraci Ferreira Galdino
Rio de Janeiro, RJ, Brasil.
jfgaldino675@gmail.com

Décio Luís Schons
Rio de Janeiro, RJ, Brasil.
schons79@gmail.com

COLEÇÃO MEIRA MATTOS

ISSN on-line 2316-4891 / ISSN print 2316-4833

<http://ebrevistas.eb.mil.br/index.php/RMM/index>



Biografia do Autor

General de Brigada Engenheiro Militar, Comandante e Reitor do Instituto Militar de Engenharia (IME)

Biografia do Autor

General de Exército da Reserva, Antigo Chefe do Departamento de Ciência e Tecnologia e Reitor da Escola Superior de Guerra

Abstract: This work brings into consideration the teachings of Machiavelli regarding the consolidation of Nation-States. Under the hypothesis that the survival of the State would be attached to its capacity to provide its own defense by its own means, Machiavelli advocates that the creation of national armies formed by conscripts and promptly rejected the deployment of mercenaries, as well as rejected an army relying upon the aid from other States in the case of crisis or war, which were very common during his time. Nowadays, citizen armies became a reality, however the fast evolution of science, technology and innovation, as well as their consequences to the military expression of the national power, suggests that the existence of such armies no longer assure to any State the capacity to fully defend itself by its own means. This is true, particularly, for countries in which the processes of industrialization came late and that do not fully possess the knowledge required to develop critical and sensitive technologies, or those nations that operate with modest defense industry and, due to that, are heavily dependent upon other countries in regard to essential weaponry, weapon systems or other equipment's. Aware of the importance of such aspects for the Military Power, we present in this work the characteristics of the defense market, as well as some of the difficulties faced by countries under late industrialization. Moreover, we introduce proposals for the development of a national core for defense industry, such as the exploration of dual technologies and process optimization for the purchase of military systems and weaponry. The ideas explored within this essay should be seen as a warning to anyone tasked to formulate public policies that defend the reduction of personnel and financial resources directed to the development of armed forces and its national defense industrial core.

Keywords: Machiavelli; Defense Industrial Base; Military Expression of National Power; sovereignty; science; technology; innovation.

Resumen: En este ensayo traemos a consideración las enseñanzas de Maquiavelo, en particular con relación a la consolidación del Estado. Respaldo en la hipótesis de que la supervivencia del Estado estaría condicionada a la capacidad de él realizar su defensa por sus propios medios, Maquiavelo abogaba por la creación de ejércitos nacionales de conscriptos y refutaba perentoriamente el empleo de mercenarios y de recurrir a la ayuda de otros Estados en los momentos de crisis y de guerras, práctica habitual en su tiempo. En la actualidad, ejércitos formados por nacionales se han convertido en una realidad, pero la evolución vertiginosa de la ciencia, tecnología e innovación y las consecuencias de esa evolución en la Expresión Militar del Poder Nacional sugieren que la existencia de tales ejércitos no garantiza al Estado la condición de defenderse por sus propios medios, particularmente en países que han vivido procesos de industrialización tardío, que no dominan conocimientos esenciales para desarrollar tecnologías críticas y sensibles, que cuentan con modesta Base Industrial de Defensa (BID) y cuyas capacidades militares dependen esencialmente de armamentos, equipos y sistemas de empleo militar importados. Conscientes de la importancia de estos aspectos en la composición del Poder Militar, presentamos características del mercado de defensa, algunas dificultades enfrentadas por países de industrialización tardía y propuestas para el progreso del BID nacional, como la explotación de la dualidad tecnológica y la optimización de los procesos de obtención de sistemas y materiales de empleo militar. Las ideas exploradas en este ensayo sirven de alerta a los formuladores de políticas públicas que defienden la reducción de los efectivos y de los recursos financieros destinados al desarrollo de las Fuerzas Armadas y de la BID Nacional.

Palabras clave: Maquiavelo; Base Industrial de Defensa; Expresión Militar del Poder Nacional; soberanía; ciencia; tecnología; innovación.

1 Reflections on Machiavelli's thinking regarding the Art Of War

Machiavelli lived in a transitional age between the Middle and Modern Ages. In Europe, this was a period marked by great transformations, especially in Italy, where wars, betrayals, conspiracies and murders of members of the ruling class often occurred.

He took an active part in the political life of Florence, where he was born in 1469 and died in 1527 (RIDOLFI, 2003). At the age of 29, he took the role of Head of the Second Chancellery of the Republic of Florence, a position he held for more than 14 years. In this position, he dealt with internal and extraordinary affairs, among which were matters related to wars, and had the opportunity to get to know the main European states deeply, while participating in more than 20 diplomatic missions in which he represented his homeland. He was also a member of the council of the Ten of War, in which he focused on the practical tasks of organizing a military force.

In 1512, when the Medici resumed the rule of Florence, Machiavelli was removed from his office and went into exile. While in forced retreat, Machiavelli wrote his three great works: *The Prince* (1513), *The Discourses on the First Decade of Titus Livius* (1513-1521)¹ and *The Art Of War* (1519-1520).

His knowledge in history, especially of the Roman Empire, and his exceptional experience in the political, military and diplomatic fields supported these works whose contents transcended merely theoretical issues, but also had the pragmatic objective of offering ways to mitigate the impotence, decadence and fragility of the principalities of the Italian peninsula². Although most prominent in *The Art of War*, the military question permeated these three important books by Machiavelli.

The originality, importance and depth of these works have raised Machiavelli to the status of founder of the Modern Political Science and his masterpiece, *The Prince*, is one of the most cited books in this area of human knowledge. Since he understood that conflicts are characteristic of a political nature, the military issue has become one of his main concerns and the object of consistent analysis. Despite this, his most complete work and in which he specifically addressed this subject, *The Art of War*, had no repercussions comparable to that achieved by his most famous work, in addition to having received criticism for not recognizing the revolutionary importance of artillery and firearms in general.

More than 500 years and a completely different historical context separate us from the time when Machiavelli produced his emblematic works in the early sixteenth century. However, this Florentine thinker continues to be analyzed, studied and quoted copiously, because his writings have captured aspects of human nature that endure despite the centuries elapsed. Undoubtedly, the main ideas of this sharp philosopher remain current.

According to Machiavelli's thought, military forces are essential for the formation and consolidation of the State. However, this empirical historian strongly warned, with inci-

1 The term "decade" in the title established in the Portuguese translation is imprecise, given that Machiavelli only comments on the first ten books of the *History of Rome*, by Titus Livius, composed of 142 books. Thus, the correct term would be "ten" and not "decade".

2 Rousseau disagrees with the majority by asserting that Machiavelli's intention was in reality to warn the people of atrocities that could be committed by tyrants.

sive argumentation based on historical facts, that such military forces should be composed of members recruited from among nationals. He thus peremptorily refuted the then customary practices of resorting to mercenary troops to promote the defense of the State, as well as to the absolute European monarchies for aid in their conflicts.

The Art Of War (MAQUIAVEL, 2006), analyzed the forms of recruitment, training, organization, planning and employment of troops made up of a kingdom's subjects, in addition to addressing financial, tactical, logistical and moral aspects of these troops. In this book, he defended the idea that the organization of its own military force is crucial for a city to ensure its independence and give vent to its political ambitions, in addition to serving as a powerful instrument for consolidating civic virtue. In fact, the role of the citizen in the defense of the State assumed special prominence in this work.

It should also be noted that Machiavelli devoted special attention to military training in peacetime, believing that one could compensate for the inexperience of the kingdom's subjects through it, instill discipline and develop the necessary capabilities to wage wars. Well-trained and disciplined subjects would greatly outperform those who made war their livelihood, even though the latter were more accustomed to military conflicts.

According to this pragmatic political thinker, those who made wars their business, the mercenaries, sought to prolong them and therefore did not fight with impetus or will. Since they did not strive for an ideal or belief, but only for financial compensation, they tended to be unfaithful, greedy, and, despite their bravery before their friends, often cowered before their enemies. Machiavelli supported these assertions through several examples of situations in which they offered no resistance to the enemy, did not seek the decisive battle, and betrayed their prince, changing sides for purely financial reasons. Thus, the expectations that were created in peacetime were usually frustrated during the war.

Also for financial reasons, mercenaries despised recent advances in the state of the art of military thought. For example, they despised the infantry, whose massive employment would entail increasing the number of troops and therefore the costs of long military campaigns. They prioritized cavalry, which was very fragile in the face of technological advances that occurred, especially at the end of the fifteenth century. They acted in this way to increase their profits and established a code of conduct aiming to strive for the reduction of risks, efforts and hardships in battles. Definitely, the relationship between the prince and the mercenaries was not dictated by trust and alignment of purposes, but by mistrust and conflicting interests. In short, for Machiavelli the princes who entrusted the security of the principalities to mercenary troops were doomed to failure, for no principality could be safe without having Forces of its own. According to Machiavelli, one of the first signs of weakness of the Roman Empire was the enlistment of the Goths in their phalanges.

The state of the art of military thought has accompanied scientific-technological progress over the past five centuries and has incorporated technological innovations and doctrinal advances that have completely transformed not only the face of the battlefield, but the very perception of the battlefield that has come to involve cities, critical infrastructures for the survival of a State, the electromagnetic spectrum, and the cyber and space fields. In this tuning fork, the

very will of a nation to defend itself, an essential aspect of Clausewitz's thinking, can be undermined without the use of conventional war weapons, but only by making use of cyber artifacts capable of promoting chaos in a country, through the denial of its capacity to generate and distribute electricity, gas and oil, in addition to the shutdown of Health Services, the financial sector, commercial transactions and of relevant defense systems.

Over the past five centuries, many seminal and visionary ideas of the Florentine thinker have been perfected, tested and become commonplace, as is the case with the adoption of national armies and the incorporation of conscripts. Despite this and the fact that there is no similarity between the current conjuncture and that experienced by Machiavelli, lessons drawn from history in this period suggest that the assertion remains current that a strong State must be able to carry out its defense by its own means. In fact, a State without Military Expression of strong and autonomous National Power is relegated to a marginal condition in international relations.

But how do we assess the capacity or strength of the Military Expression of National Power today? Certainly, in Machiavelli's time, military might depended essentially on numerous armies, well trained and aligned with the objectives of the principalities. However, in modern times, in spite of the importance of these elements, this power transcends aspects merely related to military personnel.

According to the National War College (2019, p. 109), the Military Expression of National Power is "the manifestation of a preponderantly military nature of National Power, which contributes to achieving and maintaining National Objectives" and whose most striking feature is the possibility or use of force in order to discourage possible threats (deterrence), neutralize or face them.

Certainly the Military Expression of National Power involves several elements, such as Military Doctrine and Strategy, Military Structure, Command and Control Capacity, Mobilization Capacity, Logistics Capacity, Education, Training and Readiness, Materials and Systems of Military Employment, Preparation and Employment, Human Resources and Scientific and Technological Capacity. However, the evolution of military conflicts shows a tendency of increasing importance of technological scientific capacity in the Military Expression of National Power, emblematic examples of this tendency can be extracted from the ongoing war between Russia and Ukraine.

Manifested not only by research and development activities of critical and sensitive technologies, but also by the technological and industrial readiness, particularly of the sector engaged in basic and applied research, research and development, production and modernization of military employment systems and materials, such as the enterprises that make up the country's Defense Industrial Base, the scientific, technological and national innovation capacity becomes a central element of the Ground Military Power. In short, the Sectoral System of Innovation (SSI) of defense becomes central to the development and support of military power.

The history of war conflicts, especially after the scientific revolution and the industrial revolution, suggests that States that rely on the scientific, technological and innovation capacity of third parties are doomed to failure, since they are unable to dissuade actions against their sovereignty and to promote their defense without weapons, defense systems and foreign

production capacity, thus being, in times of crisis, not only at the mercy of the existence of large financial resources, but above all geopolitical alignments that confer to them the condition of obtaining the supply of inputs in the quantity and quality necessary to sustain their Armed Forces in time of war.

In modern times, the State's ability to defend itself and to give vent to its political ambitions depends to a large extent on its strength in the scientific, technological and innovation fields, in short, on the efficiency of its Sectoral System of Defense Innovation. This system contributes to the development of a genuinely national doctrine and facilitates the preparation and employment of the Armed Forces, being an essential element for the success of the war effort.

2 Reflections of the SSI's ability in the Military Expression Of National Power

In the current stage of development of human society, and from the perspective of Machiavelli's thought, the ability of the State to defend its sovereignty, to achieve its national objectives and to give vent to its political and strategic ambitions with a reasonable degree of freedom of action depends, to a large extent, on the mastery of critical and sensitive technologies and the availability of a strong Defense Industrial Base capable of being mobilized to meet the needs of the country's Armed Forces.

Nowadays, vulnerabilities of the military expression of National Power have served as a stimulus to actions aimed at questioning, relativizing, or even vilifying the sovereignty of a nation, on the grounds of humanitarian and transnational problems such as environmental issues, transboundary crimes, climate issues and the lack of care for vital and scarce resources for an increasingly larger world population more demanding of vast quantities of resources. As foreseen by Machiavelli in the early sixteenth century, nowadays a strong State with military forces that appear to be incapable of defending its sovereignty and its interests in the concert of Nations is also not conceived.

The military expression of national power depends on inseparable factors such as doctrine, organizational structure, training, materials and systems of military employment, educational systems, personnel and infrastructure of the Armed Forces, as well as the ability to mobilize and other expressions of National Power (ESCOLA SUPERIOR DE GUERRA, 2019). Due to its transversality, the scientific-technological expression of National Power and, in particular, the National Defense Industrial Base (DIB), assumes a prominent role in the military expression of national power. It is up to this industrial sector the basic task of providing military employment systems and equipment in any situation, whether in peace or war. However, far beyond this, the DIB also contributes to the evolution of the doctrine of readiness and employment of the Armed Forces, since it develops specific systems, weapons and materials, according to operational and technical requirements established according to national physiographic conditions and military capabilities perceived as necessary for the Defense of the Nation.

Countries with small territorial dimensions and that have experienced a late industrialization process tend to find it difficult to develop an important industrial complex aimed at the military sector. The Defense market, marked by its protectionist characteristics, is domi-

nated by large *players* and is monopsonic, the State itself being the main buyer. In this area of the economy, supply to the domestic market is a prerequisite for enterprises to succeed in the foreign market. This is an important obstacle to the development of the sector in countries with modest and irregular demand. In addition, military employment products and systems employ high technology and, therefore, the military industry sector needs to be supported by advanced university and scientific-technological research and development centers. In this way, small countries that have a process of industrialization still in consolidation, usually resort to alliances with central countries to ensure their defense. However, even in countries with these characteristics, historical facts suggest caution in the face of the risk of conditioning the defense of sovereignty and vital interests to actions that depend on third parties.

Since its creation in 1948, Israel had good relations with France and found in that European country an important supplier of war supplies. From 1955, Israel began to receive fighter aircrafts from France, in addition to diversified equipment and modern armaments in large quantities. The alliance between these countries included a secret agreement aimed at the joint development of nuclear weapons and collaboration between national spy agencies. In April 1956, with the Suez Canal Crisis, relations between France and Israel were further strained and the supply of weapons from France to Israel was intensified.

In 1960, France undertook to supply Israel, over the course of ten years, with 200 AMX i3 tanks and 72 Mystère fighters. However, on June 2, 1967, three days before Israel launched a preemptive strike against Egypt and Syria, France ceased the supply of war material to Israel. Apparently, this decision was a reflection of changes in the geopolitical scenario that led to France's rapprochement with the Arab world, according to an article published at the time by a French newspaper: "The Gaullist France has no friends, only interests" (SENOR; SINGER, 2011). Let's face it, international relations are motivated by interests.

As a result of this strategic reorientation, the 200 AMX i3 tanks that would be supplied to Israel were sold to Libya and fifty fighters already paid for by Israel were sent to Syria, one of Israel's main enemies (SENOR; SINGER, 2011). The arms race in the Middle East was accelerating just as Israel was losing its main supplier of weapons. The French embargo of 1967 left Israel in an extremely vulnerable position at a critical time.

Faced with this emblematic episode, Israel made the strategic decision to no longer depend on another country to secure its own defense. It promoted accelerated and successful development in high-tech sectors, built an important global war industry and an exemplary model of technological transfer from the war sector to the conventional market (CUKIERMAN; ROUACH, 2019; SENOR; SINGER, 2011).

Strategic embargoes, like that suffered by Israel, and technological restrictions are generally practiced by the central countries, committed to maintaining the *status quo* and in defending their interests on the world geopolitical board (LONGO; MOREIRA, 2009). These actions represent clear indications not only of the importance of military power for the sovereignty of the State, but also of its Defense Industrial Base and scientific and technological deve-

lopment. It should be noted that these actions, which intensified after World War II, when the importance of Science, Technology and Innovation and industrial mobilization in war conflicts became evident (KENNEDY, 2014), they reached even higher heights with the end of the Cold War and the rise of non-State actors, transnational organized crime and terrorism, particularly with the attacks suffered by the USA on September 11, 2001.

Although legitimized by the pretext of having the purpose of containing new threats, technological curtailment initiatives greatly hinder the development of a vast list of important technologies for the generation of essential military capabilities autonomously, particularly in countries that have experienced a late industrialization process, even if there is no history of association with the threats that are intended to be inhibited by such curtailment policies.

2.1 Considerations on the Defense Market

The fall of the Berlin Wall in 1989, a milestone that started the easing of the bipolarization between the US and the USSR and the undeclared state of belligerence, impacted the reduction of defense budgets across the globe during the last decade of the twentieth century. As a result, there were bankruptcy and merger processes, but also portfolio diversification of the DIB companies, seeking to apply the technologies in the development of products for other markets as a way to overcome the reduction of the demands of the defense sector. Budgets would grow again after "September 11, 2001", with the attack on the Twin Towers, the outbreak of the war on terror and the growing commercial, technological and geopolitical rivalry between the US and China.

Since then, the global defense market has been growing, even in recent years, despite COVID-19 and the courtship of restrictive measures of movement and social distancing, remote work and stoppage of commercial activities, along with enormous operational challenges. Revenue is estimated to exceed US\$550 billion in 2025, with a Compound Annual Growth Rate (*CAGR*) of approximately 5%.

These indicators suggest that the defense industry can represent a valuable component of the Economic Expression of National Power, however to infer about the characteristics of this market it is important to analyze the performance of companies operating in this sector. This analysis can also provide subsidies on trends or future-bearing facts, changes in the world geopolitical board, infer about the scientific and technological capacity in areas of military interest and point out the strength of the Military Expression of the National Power of the host countries of companies.

Several approaches could be adopted to evaluate the performance of companies in the defense sector, considering separately or jointly several indicators that allow to: perform quantitative or qualitative analysis of intangible intellectual property assets; understand the capacity of intellectual capital; measure the infrastructure of research and development (R&D) and fac-

tory park; and assess the product portfolio and contracts concluded between companies and the Armed Forces and public security agencies.

Having access to this list of variables would be unenforceable due to the notorious difficulty of accessing information covering industrial, business and even State secrets, in addition to being theoretically complex, due to the genuine difficulty of weighing so many indicators and thus defining an aggregate metric capable of faithfully reflecting reality. Faced with such a laborious and sophisticated problem, there is the possibility of analyzing and confronting the revenues of companies as an exceptional way to infer about the performance of those who work in the Defense Area. This simple approach makes it possible to carry out an exploratory study with some degree of assertiveness, insofar as it expresses, in a certain way, the innovation effort and competitiveness of companies and reflects public policies aimed at the sector.

In this matter, it is worth not only to consider the list of the 100 (one hundred) global companies in the defense sector with the highest turnover, elaborated annually since 2001 by the magazine *Defense News*, but also data provided by SIPRI (*Stockholm International Peace Research Institute*) about the 100 (one hundred) companies in the Defense market with the highest turnover.

According to these data, the total turnover of these companies reached the approximate amount of 200 billion US dollars in 2001 and exceeded the level of 500 billion in 2019, evidencing a significant increase, particularly if we consider the various economic crises that occurred in the period (DEFENSE..., 2020; FLEURANT et al., 2019; SIPRI, [2020?]). In this trajectory, there is a vertiginous growth in the revenues of these companies from 2015, adducing a vigorous recovery in investments in the defense sector after the retraction occurred with the fall of the Berlin Wall.

When analyzing in detail the information of SIPRI in the last two years, other important aspects are highlighted, such as the intense dynamics of change in the 100 (one hundred) companies with the highest turnover. These modifications go beyond significant classification variations, such as the one that occurred with EMBRAER, the only Brazilian company on the list, which moved from the 69th position in 2018 to the 84th position in 2019; they also cover significant changes in all companies. It is verified, for example, that 16 (sixteen) companies that are part of the 2018 list do not appear in the 2019 list.

This accentuated dynamic can highlight marked characteristics of the defense market, such as the inconstancy of acquisitions and the high amounts usually involved when contracts are concluded. In addition, it may reflect an unusual phenomenon: the inclusion of Chinese companies that until then were not considered because of the difficulty of access to information. The magazine, apparently, overcame this obstacle by associating with partners who succeeded in the endeavor.

It is observed that the 15 (fifteen) main countries on the list concentrate 91 companies and about 93% of the total turnover. The United States leads the ranking with 41 companies that together account for more than 50% of total revenues. In second place is China, with 8 (eight) companies, of which 6 (six) of them are among the 15 (fifteen) highest ranked, making up more than 20% of the total turnover of companies. Despite its powerful physiography, natural and mineral wealth and outstanding economy, Brazil does not integrate this relationship of countries that have an expressive Defense Industrial Base.

It should be noted that China's surprising performance does not necessarily mean a sudden advance of its defense sector, since, as previously reported, in previous years the data of this country were not considered in the magazine's rating. However, it undeniably signals a country with a strong Defense Industrial Base, certainly as a result of a major State policy, especially if we take into account the situation in which the People's Liberation Army of China stood until the end of the last century, considered by international observers and experts as a "scrap army" or "the largest military museum in the world" (CLIFF, 2020).

Considering the period from 2002 to 2018, SIPRI data demonstrate an interesting trend in the policies of companies operating in the Defense Market (FLEURANT et al., 2019; SIPRI, [2020?]): the importance of dealing with technological duality, in that they use their critical technologies to develop product portfolios not only for the defense market, but also for the conventional market.

According to SIPRI data (FLEURANT et al., 2019; SIPRI, [2020?]), in the aforementioned period, less than 10 companies, on the annual average, depended solely and exclusively on defense revenues, and these represented a small portion of the total revenues of companies operating in the defense sector. From 2006 to 2010 these companies earned, on average, around 2% of the total amount and after 2010 this share did not even reach 1% of the market, suggesting that this is a trend that is consolidating as a common practice of companies that work in the field of Defense

The sum of total revenues of the largest companies in the sector between 2002 and 2018, according to SIPRI data, reaches the figure of \$20.2 trillion dollars, being \$6.94 trillion, or 34.44%, arising exclusively from orders from the defense sector (FLEURANT et al., 2019; SIPRI, [2020?]). This evidence suggests that such companies are competitive in the conventional market and highlights the importance of exploring the duality of technologies and products. The ambivalence of the market allows that any reductions of exclusive acquisitions of the defense sector can be compensated by the common market, favoring sustainability, the maintenance of installed capacity and the stock of knowledge, essential to meet future demands. It is also observed that companies whose exclusive revenues from the defense market are greater than or equal to 70%, on average, contribute less than 20% of the total revenues of companies, while those with a percentage of less than 30% dominate more than 60% of this market. Therefore, taking as a reference the data released by SIPRI, the defense market is dominated by companies whose largest share of revenues comes from the conventional market.

Despite the fact that such figures show that the main companies in the defense market are competitive in the conventional market, the reverse path is not always successful, since the large players they seek to prevent neophytes from thriving and succeeding in the global defense market. In this sector, which involves the sovereignty of countries, economic forums and multilateral organizations exert little or no interference on the commercial practices adopted by companies and host countries.

2.2 Development of DIB in countries of late industrialization process

The data presented here indicate that, although initially focused on the domestic and monopsonic market, throughout the process of forming the current geopolitical map, the Defense Industrial Bases, developed a peculiar business model to meet not only the strategic and operational demands, but also the needs of the conventional market.

This may represent an auspicious strategy to be exploited by countries that cannot maintain a constant demand for defense systems and products and whose DIB companies have difficulties establishing themselves in the global defense market. A critical success factor of this strategy lies precisely in the perception that the defense and conventional markets have complementary characteristics and that many of the main technologies essential for the development of modern military capabilities are also of great commercial interest, particularly those that fall at the heart of the 4th Industrial Revolution (BRANCO et al., 2014; CASTRO, A., 2014; CASTRO, M. et al., 2014; GALDINO, 2019; SCHWAB, 2015; SILVA et al., 2014).

The strategic importance of the defense sector and the reflections of technological advances in military capabilities lead to the allocation of large resources for research activities, research and development and procurement of equipment, systems and armaments. Even if they are not constant and stable, even in the main countries of the defense sector (DALL'AGNOL, 2020), these resources create excellent business opportunities with the business environment. By verifying that the leading companies in the defense market are able to act strongly in the conventional market, which generates constant demands, but of smaller numbers, through the exploitation of technological duality, one can glimpse a strategy of insertion in the defense segment of companies capable of thriving without relying exclusively on state orders. This can contribute to the entry of new *players* in the DIB, to increase the competitiveness and, above all, the sustainability of the sector. Additionally, the dynamism required to meet the conventional market and the overcoming of the technological challenges imposed by the R&D orders from the defense sector contribute to the constant improvement of the technological capacity of companies. Finally, this finding relieves the pressure that falls on the State, showing that it is possible to develop the DIB without it having to be the exclusive buyer or even the main customer, responsible for the sustainability of national companies.

Although large budgets and government purchases are important drivers of the development and procurement of Military Employment Material Systems, the ongoing technological changes and empirical evidence point to emerging market niches and opportunities for new defense equipment suppliers, especially for technology-based companies that are independent of the supply of goods and services to the State (GALDINO, 2019).

The development of the ambivalence of companies bequeaths robustness, versatility and readiness to meet the high-tech demands of the Defense sector and the market in general. By adapting their business model to the dual political, economic and technological context, suppliers promote sustainability and business resilience in the face of commercial, budgetary or seasonal acquisitions common to Defense scenarios.

This paradigm creates insertion opportunities for technology-based companies operating in other market niches, generating value in the global chain of the defense industry and

favoring companies of the war industry, whose products or technologies meet the demands of the market in general.

The growing importance of new technologies of a dual nature in obtaining sophisticated military capabilities tends to increasingly intensify the participation of technology-based companies in the common market and in the Defense area, while strengthening the DIB and the conventional market and, consequently, the State, by reducing their technological dependence on areas of interest of National Defense (MESA, 2020).

Another fundamental aspect for the development of DIB in countries with late industrialization process is to seek to optimize the processes of obtaining military employment systems and materials, reconciling short, medium and long-term actions, prioritizing, when possible, the attainments by research and development process at the national level, to the detriment of imports.

The countries that develop their systems, equipment and weapons, or that adequately induce the technological development of the internal state of the art, make extensive use of national technical capabilities and establish a long-term vision in favor of strengthening the Military Expression of National Power. Investments in defense cooperate for technological overflow, that is, technical solutions originally conceived for a certain purpose achieve more comprehensive results, generating, among other assets, scientific knowledge, patents, trained professionals and new companies, which will serve as inputs for a new virtuous cycle. Thus, a synergistic procedure is generated, resulting in the strengthening of Military and Scientific-Technological Expressions of National Power. Israel is one of the most successful countries in this endeavor.

Countries that do not have an efficient State strategy to boost science, technology and innovation, especially in matters of military interest, conduct procurement processes prioritizing acquisition in the foreign market, to the detriment of their own development. Among the reasons for abdicating the internal technological development or restricting it, we can mention the urgency of time to preserve the operational capacity, since national R&D activities can cause budgetary, administrative and manufacturing delays that result in the unavailability of the product or its availability at a late time, after the needs of The Force.

In short, impact technology ventures should reconcile pressing operational needs with the strengthening of the national DIB, seeking to achieve a good compromise between international procurement and domestic RD&I, particularly with a view to increasing national content in critical areas without lengthening procurement schedules of products, systems and central weapons to maintain the operational capability of the Armed Forces. Studies show that an appropriate approach in this attempt consists in gathering information on the levels of technological maturity of possible national technology suppliers and taking this information into account on the decision-making processes of the bodies in charge of acquisitions (FRANÇA JUNIOR; GALDINO, 2019, 2022).

The predominance of acquisitions in the international market should be avoided, as it contributes to the increase in the trade balance deficit and can cause invaluable losses in times of crisis, since the items purchased, or in use, do not always have parity with the version used in the country where the products are manufactured. This threat can be even more serious if the operation of imported products, systems or weapons is purposefully vulnerable to interference and the actions of adverse forces, or when such inputs, for geopolitical or commercial reasons, are denied at times of greatest need, which may, thus causing irreparable damage to the country and the achievement of its permanent national objectives (ESCOLA SUPERIOR DE GUERRA, 2019).

In spite of different dynamics of innovation of the countries and their different degrees of efficiency in the application of resources, the prominent States in technology show similarities, such as State policies that favor the continuity of budgets destined to the defense portfolio over years. As a result of these large investments, the stimulation of competitiveness and innovation, companies have been created in these countries whose productive capacities support national sovereignty and contribute to generating foreign exchange, as suggested by the significant resources earned by prominent companies in the Defense sector.

Essential to induce innovative projects, especially those directly related to National Defense, the mechanisms adopted by the State to benefit the DIB have few studies that characterize the multiple factors involved in their genesis or development. However, it is known that protagonists in this sector, such as the USA, England and Russia, supported their achievements in the main wars of the twentieth century in a powerful Defense industry and continued investments in education, science and technology, proving the importance of this triad for their peoples in the solution of conflicts.

It should also be noted that, in order to achieve the internal development of critical technologies of Defense interest, greater integration between government, Academia and the productive sector should be promoted, the stock of national knowledge should be expanded, the capacity to carry out R&D and the culture of innovation should be improved (AZEVEDO, 2018; BARBOSA; CALDEIRA, 2021). Without this, it is unlikely that a country will reduce its dependence on external suppliers. The sectoral Defense Innovation System interacts with and viscerally depends on the National Innovation System (SCHONS; PRADO FILHO; GALDINO, 2020).

3 Final Considerations

Statesmen, strategists and policy makers praise the value of freedom, democracy and sovereignty, recognizing that the preservation of this achievement depends on eternal vigilance and a National Defense capable of repelling current and future threats. The permanent state of alert is the price to pay for something so crucial. As Rui Barbosa summarizes: "An army can go 100 years without being employed, but it cannot go a minute without being prepared". This thinking underpins the feeling of self-preservation and national cohesion that should guide investments in defense. Although various sectors of National Power can be mobilized to act for the benefit of a country's sovereignty, it is the State's duty to orchestrate, obtain and integrate

the systems and materials of military employment in order to strengthen the military capabilities of its Armed Forces. Essential to the survival of States and dependent on technological innovations of high added value, the Defense Sector Drives scientific and technological development, mobilizing a billionaire market of companies that integrate the Defense Industrial Base, while fundamentally dependent on the very capacity of the scientific-technological expression of National Power and, in particular, the National Innovation System.

Machiavelli's teachings remain valid that a strong State must possess military forces capable of promoting its defense using its own means. As time passed, his conviction that a modern Republic could not be founded and maintained by relying solely on mercenaries and warlords (*condottieri*) and that only a conscript army, well trained and committed to the principality's objectives, could securing the independence of the Italian city-states proved farsighted.

In present times this condition refers, more than ever, to the need to develop National Science, Technology, Innovation and DIB as essential factors to raise the Military Expression of National Power to a prominent level in the concert of Nations. As discussed in this essay, the Scientific-Technological Expression influences the various constitutive elements of military capacity, such as doctrine, education, training, preparation and employment of Military Power, transcending more visible aspects of the domain of critical technologies and the supply of armaments, materials and military employment systems.

Machiavelli's teachings also serve as a warning regarding the vulnerabilities that may arise from the employment of private military companies in the modern world and the discussions or political positions that subsidize the reduction of budgets of the Armed Forces, imposing a reduction of their structures and personnel. Foreigners who exploit war as an instrument of trade may, for purely financial reasons or to serve the geopolitical and ideological interests of host countries, miss long-standing commitments made, and this usually tends to occur in times of greatest need and national crisis.

In this work, were also discussed characteristics of the defense market and, in particular, the difficulties imposed by technological curtailment and those naturally faced by countries that experienced late industrialization processes, especially in the sense of accumulating stock of knowledge and reaching the technological frontier in sophisticated areas, such as those that include the defense systems and products adopted by the Armed Forces. Ambivalence and acquisition processes were also discussed as mechanisms to be explored aiming at the progress of the National Defense Industrial Base.

In fact, it is necessary to adequately explore the technological duality in the DIB consolidation process of developing countries, which have modest budget resources to invest in the sector and which have experienced a late industrialization process. This strategy can both facilitate the search for resources in various ministries and funding bodies, and can represent a solution for the sustainability of companies operating in the military sector.

The defense of the Fatherland and National Sovereignty is indelible. No one will do our homework for us.

References

AZEVEDO, Carlos Eduardo Franco. Os elementos de análise da cultura de inovação no setor de defesa e seu modelo tridimensional. **Coleção Meira Mattos**, Rio de Janeiro, v. 12, n. 45, p. 145-167, set./dez. 2018. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/582/1527>. Accessed on: 19 abr. 2022.

BARBOSA, Fernanda Geórgia de Figueiredo Tabora; CALDEIRA, Aldélio Bueno. Desafios da inovação como estratégia para a geração de capacidades militares terrestres. **Coleção Meira Mattos**, Rio de Janeiro, v. 15, n. 53, p. 273-293, set./dez. 2021. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/6904/6946>. Accessed on: 19 abr. 2022.

BRANCO, Marcos Guimarães Castello et al. Rádio definido por software do Ministério da Defesa – visão geral das primeiras contribuições do CPqD. **Cadernos CPqD Tecnologia**, Campinas, v. 10, n. especial, p. 9-16, nov. 2014. Available at: https://www.cpqd.com.br/wp-content/uploads/2018/08/Cadernos_CPqD_Tecnologia_v10_edicao_especial_Tecnologias-de-Defesa.pdf. Accessed on: 19 abr. 2022.

CASTRO, Alexandre Taschetto de. Materiais de carbono – aplicações em eletrônica e sua pesquisa no Exército Brasileiro. **Cadernos CPqD Tecnologia**, Campinas, v. 10, n. especial, p. 77-88, nov. 2014. Available at: https://www.cpqd.com.br/wp-content/uploads/2018/08/Cadernos_CPqD_Tecnologia_v10_edicao_especial_Tecnologias-de-Defesa.pdf. Accessed on: 19 abr. 2022.

CASTRO, Marcelo Silva Bortolini de et al. Pesquisa e desenvolvimento de tecnologias de visão noturna no Exército Brasileiro. **Cadernos CPqD Tecnologia**, Campinas, v. 10, n. especial, p. 41-48, nov. 2014. Available at: https://www.cpqd.com.br/wp-content/uploads/2018/08/Cadernos_CPqD_Tecnologia_v10_edicao_especial_Tecnologias-de-Defesa.pdf. Accessed on: 19 abr. 2022.

CLIFF, Roger. **O poderio militar da China: avaliação de suas capacidades atuais e futuras**. Rio de Janeiro: Biblioteca do Exército, 2020.

CUKIERMAN, Édouard; ROUACH, Daniel. **O vale de Israel: o escudo tecnológico da inovação**. Rio de Janeiro: Best Business, 2019.

DALL'AGNOL, Gustavo Fornari. Análise de programas de defesa de alto custo e longo prazo: estudo de caso do Joint Strike Fighter. **Coleção Meira Mattos**, Rio de Janeiro, v. 14, n. 49, p. 51-75, jan./abr. 2020. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/2197/2680>. Accessed on: 19 abr. 2022.

DEFENSE global market report 2021: COVID-19 impact and recovery to 2030. [S. l.]: Business Research Company, 2020.

ESCOLA SUPERIOR DE GUERRA (Brasil). Departamento de Estudos. **Fundamentos do poder nacional**. Rio de Janeiro: Escola Superior de Guerra, 2019. Available at: https://www.gov.br/defesa/pt-br/assuntos/esg/centrais-de-conteudo/publicacoes/FPN2020_Fundamentos_do_Poder_Nacional.pdf. Accessed on: 19 abr. 2022.

FLEURANT, Aude et al. The SIPRI Top 100 arms-producing and military services companies, 2018. **SIPRI Fact Sheet**, [s. l.], Dec 2019. Available at: https://www.sipri.org/sites/default/files/2019-12/1912_fs_top_100_2018.pdf. Accessed on: 18 abr. 2022.

FRANÇA JUNIOR, José Adalberto; GALDINO, Juraci Ferreira. Aquisição de sistemas e produtos de defesa: conciliando objetivos de curto e longo prazo. In: AZEVEDO, Carlos Eduardo Franco; RAMOS, Carlos Eduardo de Francis Ramos (org.). **Estudos de defesa: inovação, estratégia e desenvolvimento industrial**. Rio de Janeiro: FGV Editora, 2022. p. 42-71.

FRANÇA JUNIOR, José Adalberto; GALDINO, Juraci Ferreira. Gestão de sistemas de material de emprego militar: o papel dos níveis de prontidão tecnológica. **Coleção Meira Mattos**, Rio de Janeiro, v. 13, n. 47, p. 155-176, maio/ago. 2019. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/1910/1989>. Accessed on: 18 abr. 2022.

GALDINO, Juraci Ferreira. Reflexos da Era do Conhecimento e da 4ª Revolução Industrial na Defesa. **Artigos Estratégicos**, Brasília, DF, v. 6, n. 1, p. 7-27, jan./jun. 2019. Available at: <http://ebrevistas.eb.mil.br/index.php/CEEEArE/article/view/2492>. Accessed on: 18 abr. 2022.

KENNEDY, Paul. **Engenheiros da vitória: os responsáveis pela reviravolta da Segunda Guerra Mundial**. São Paulo; Rio de Janeiro: Companhia das Letras, 2014.

LONGO, Waldimir Pirró e; MOREIRA, William de Sousa. O acesso a “tecnologias sensíveis”. **Tensões Mundiais**, Fortaleza, v. 5, n. 9, p. 73-122, 2009. Available at: <https://revistas.uece.br/index.php/tensoesmundiais/article/view/669>. Accessed on: 18 abr. 2022.

MAQUIAVEL, Nicolau. **A arte da guerra**. São Paulo: Martins Fontes, 2006.

MESA, Antonio Fonfría. Os conflitos do futuro: novo cenário para a Indústria de Defesa. **Coleção Meira Mattos**, Rio de Janeiro, v. 14, n. 51, p. 235-249, set./dez. 2020. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/3879>. Accessed on: 19 abr. 2022.

RIDOLFI, Roberto. **Biografia de Nicolau Maquiavel**. São Paulo: Musa Editora, 2003.

SCHONS, Décio Luís; PRADO FILHO, Hildo Vieira; GALDINO, Juraci Ferreira. Política Nacional de Inovação: uma questão de crescimento econômico, desenvolvimento e soberania nacional. **Coleção Meira Mattos**, Rio de Janeiro, v. 14, n. 49, p. 27-50, jan./abr. 2020. Available at: <http://ebrevistas.eb.mil.br/RMM/article/view/3063>. Accessed on: 19 abr. 2022.

SCHWAB, Klaus. **A quarta revolução industrial**. São Paulo: Edipro, 2015.

SENROR, Dan; SINGER, Saul. **Nação empreendedora: o milagre econômico de Israel e o que ele nos ensina**. 2. ed. São Paulo: Évora, 2011.

SILVA, João Abdalla Ney da et al. Uma visão geral sobre os radares desenvolvidos pelo Exército Brasileiro. **Cadernos CPqD Tecnologia**, Campinas, v. 10, n. especial, p. 27-40, nov. 2014. Available at: https://www.cpqd.com.br/wp-content/uploads/2018/08/Cadernos_CPqD_Tecnologia_v10_edicao_especial_Tecnologias-de-Defesa.pdf. Accessed on: 19 abr. 2022.

SIPRI. **SIPRI Arms Industry Database**. Solna, Sweden: Stockholm International Peace Research Institute, [2020?]. Available at: <https://www.sipri.org/databases/armsindustry>. Accessed on: 19 abr. 2022.