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CHALLENGES TO INNOVATION POLICIES IN THE BRAZILIAN DEFENSE SECTOR: OBSTACLES AND STRUCTURAL BARRIERS

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ABSTRACT

The objective of this research is to analyze the main cultural and structural barriers that hinder interaction and, consequently, the innovative process of the Defense sector. The motivation for studying cultural and structural matters in the Defense sector comes from the perception that the innovation indicators currently used in the academic field of work transcend aspects related to research, development, protection, production, and application of knowledge, which complement the understanding of the essence of innovation and the whole amplitude and complexity of and environment proper for innovation. From the methodological perspective, this work is a product of a pool of interviews, and of bibliographical and documental research on the culture of innovation present in the Brazilian Armed Forces. The data was categorized and analyzed by the method of Content Analysis. The results indicate suggestions regarding public policies structural, educational and operational in character, consolidated in the form of strategic directives (Appendix A), striving to contribute to an improvement of an organizational culture that inspires trust, *spirit team*, and the capability to work together while accepting differences. Furthermore, the investigation into possible structural barriers corroborates the perception that the Ministry of Defense must coordinate the innovations in the sector.

Keywords: Innovation. Defense. Culture of Innovation.

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INTRODUCTION

Many researchers have sought to understand the reasons for Brazil occupying the 66th position in the Global Index of Innovation (GII)[4] ranking of 2019, alongside Colombia (67th) and Qatar (65th). Some authors in this field are dedicated to studying the main barriers that stand in the way of innovations (HADJIMANOLIS, 2003, MUSSI; SPULDARO, 2008; BRANDÃO; BRUNO-FARIA, 2017). This research follows this line and aims to analyze the main cultural and structural barriers that hinder interactions and, consequently, the innovation process in the Defense sector.

The environment in which such interactions and innovative activities in the defense sector occur is conceptualized in the literature as the Defense Sector Innovation System (SIS-Def) (LONGO; MOREIRA, 2013). The general objective of the system is to foster the sector's innovation process, i.e., it aims to increase the interaction between the actors so that they can produce a product, marketing process, or organizational method (AZEVEDO, 2013, p. 60-61). Thus, the present research directs its analysis specifically to the SIS-Def.

The motivation to study cultural issues in the Defense sector comes from the perception that the GII indicators transcend aspects directly related to research, development, protection, production, and application of knowledge. In the view of Galdino (2017), they are essential to understand the essence of innovation and the full breadth and complexity of the so-called "innovation ecosystem." In other words, the index cannot efficiently capture aspects inherent to the culture, values, agents' interests, aspects that contribute to forming an environment conducive to innovations.

From a methodological point of view, this work is the result of a survey carried out since 2013, contemplating a database consisting of a bibliographic and documentary review, interviews, and participant observation about the culture of innovation present in the Armed Forces. From 2013 to 2019, a total of 59 (fifty-nine) open and structured interviews were conducted. The interviews were conducted based on the

[4] The GII innovation indicators assess Innovation Inputs and Innovation Products. Based on them, metrics are generated that allow the assessment of the global innovation capacity of a country or its National Innovation System (SNI) (GALDINO, 2018) (JANKOWSKA, 2017, p. 81) (CRESPO; CRESPO, 2016).

protocol proposed by McCracken[5] (1988), with open and semi-structured questions, resulting in more than sixty hours of recording. Interviewees were selected based on relevance, representativeness, and accessibility and were carried out with four groups of agents: Government, Armed Forces, Defense Industrial Base (BID), and Higher Education Institutes (IES). It is worth mentioning that the focus of the interviews was on agents of the Armed Forces.

In turn, participant observation allowed the observer to understand everyday situations and events, often challenging to capture through interviews or self-assessment instruments (ATKINSON, HAMMERSLEY, 2005; SILVERMAN, 2006). While this is not the primary source of data in this work, its main advantage was the possibility of recording the fact as it happens. The consistency of the information brought to light in the other instruments was verified, unintentional behaviors and unconscious aspects were identified. They highlighted facts and aspects that could not be explicitly observed in the various publications and documents analyzed. We sought to observe people's daily lives responsible for carrying out innovations, only recording what was related to the research object, covering elements related to the environment, context, and organizational culture. This does not mean that observations on other uncategorized phenomena have gone unchecked.

It is worth mentioning that the observations were made during the Expedite Course on Defense Engineering at the Military Institute of Engineering (IME), held in the auditorium of EMBRAER S.A[6]. Approximately 20 (twenty) BID companies, the Brazilian Association of Defense and Security Materials Industries (ABIMDE)[7], the Aeronautics Institute of Technology (ITA), the IME, and other organizations attended

[5] Thus, the interviews begin with the characterization of the interviewee's profile through a series of biographical questions. Then, an open and undirected question is created, which allows the interviewee to address their story. The protocol characterizes this phase as the "Grand tour," i.e., its questions allow the respondent to tell their own story, with their terms, with minimal interference. The instrument also has planned questions (Planned Prompts) and space for floating questions (Floating Prompts). The planned questions are intended to induce the interviewee to address topics not mentioned during the Grand Tour. Floating questions are small verbal reinforcements given to the respondent when they touch on a topic of research interest (MCCRAKEN, 1988).

[6] Company headquartered in São José dos Campos (SP), is a Brazilian transnational conglomerate, manufacturer of aircraft for military and civil (commercial) use, and aerospace parts. More information at https://embraer.com/br/pt

[7] The IMM contributes to integrating ECEME (focused on high-level military studies) with the civilian academic milieu and the Centers for Strategic Studies (CEE) inside and outside Brazil. Information at https://abimde.org.br/pt-br/

the event. The course mentioned above is included in the Innovation Management Course, given within the scope of the IME until 2020, attended by managers, engineers, and researchers. Several workshops were organized, and representatives of the Ministry of Defense (MD), ABIMDE, the Department of Defense Industry together with the Federation of Industries of the State of São Paulo (COMDEFESA/FIESP), Army Command and General Staff College (ECEME), IME, and Meira Mattos Institute (IMM)[8], of the ECEME, attended one of them. Several meetings were also held with the Research Group "War of the Future, Defense Industry and Innovation" (GFIID), composed of military engineers, senior officers of the Army, Navy, and Air Force, entrepreneurs, and students from the High Command Schools from 2013 to 2019.

It has been chosen the triangulation strategy as a tool to assist in validation, reliability and accreditation of the data and sources, as argued by Abdalla et al (2018). This method is another form of validation for research with more than one data source, which reduces the risk of biased perspectives in the conclusions of a study and gives greater credibility to the research. Considering that the present research used different data sources, this strategy provided a richer and more detailed description of the phenomena about the culture of innovation (DENZIN; LINCOLN, 2000). Data were categorized and analyzed using the Content Analysis method, which required the ATLAS TI Software (employed for qualitative data analysis), which greatly facilitated data organization.

The article has 4 (four) sections, in addition to the introduction, to unveil the cultural and structural barriers that hinder interactions between actors in the Defense innovation sector, specifically on the Armed Forces. The two sections that follow present the theoretical framework, which seeks to describe the current theoretical model of what the SIS-Def would be (or is) and the theories on innovation and organizational culture, particularly on the cultural aspects that impact the innovation process in the Defense sector. Then, the main research findings are found, in which the main obstacles related to the current structure of the SIS-Def and the elements of the culture of innovation were described. Finally, brief final considerations were outlined, pointing out some actions or strategic options.

[8] More information available at http://www.eceme.eb.mil.br/pt/instituto-meira-mattos- imm

1 THE INNOVATION PROCESS IN THE DEFENSE SECTOR

According to Schumpeter (1934), innovation can be understood as combining existing resources to produce new goods or more efficient goods. The author defines five types of innovation: (1) new products, (2) new production methods, (3) new sources of raw materials, (4) exploration of new markets, and (5) new ways of organizing companies.

In general, innovation can be carried out from two distinct processes: closed or open (LINDEGAARD, 2010). The closed model understands that the success of innovation requires stakeholder control over all processes and steps (COOPER, 1990). In turn, open innovation considers that relationships with partners are differentiating factors for the innovative process (NONAKA et al., 2006).

The universe where these open model actors interact is the Innovation System (ASHEIM; SMITH; OUGHTON, 2011) (TANG et al., 2015). Cassiolato and Lastres (2003, p. 24) conceptualize the Innovation System as: "a set of distinct Institutions that jointly and individually contribute to the development and diffusion of technologies" (CASSIOLATO; LASTRES, 2003, p. 24).

In the defense field, the correspondence environment is conceptualized in the literature as the Defense Sector Innovation System (SIS-Def) (LONGO; MOREIRA, 2013). The system aims at fostering the sector's innovation process, i.e., the objective is to increase the interaction between the actors so that they result in a product; marketing process, or organizational method able to considerably change how to organize, prepare, and use the Military Power efficiently and effectively (AZEVEDO, 2013, p. 60-61).

Cunha and Amarante (2011), when analyzing the Defense Innovation System, identified some components, such as government agencies, especially those belonging to the Military Power, characterized by the Armed Forces and Auxiliary Forces; the Defense Industrial Base; research institutes and higher education institutions; the development agencies; and the laws and regulations surrounding the system.

Currently, the innovations of the Brazilian SIS-Def produced results below the expected for the sector (CUNHA; AMARANTE, 2011). This scenario, in a way, is a reflection of several factors, such as economic (LESKE, 2013), political (SILVA, 2015), management (AZEVEDO, 2018), or even by following the macro trend in the country. Cunha and Amarante

(2011) argue that this low efficiency is related to the fragmentation and disarticulation of the innovation system. According to the authors, the system agents are separated into distant blocks without necessarily interacting, hindering the innovation process, as illustrated in Figure 1.

According to Figure 1, the agent blocks are far apart from each other. The consequence of these weak ties is system fragmentation and, thus, the inefficiency of innovations in the sector. According to the literature, for the relationships between agents to be effective, there must be spaces that encourage the interaction[9] between agents (CUNHA; AMARANTE, 2011; AZEVEDO, 2018).

Figure 1 – Interaction between Agents of the Defense Innovation System

Source: Cunha and Amarante (2011)

In the Defense segment, such interactions can take place in several ways. The most common are the partnership, cooperation, collaboration, agreements, compensation agreements (Offset[10]; industrial compensation),

[9] In the Defense segment, Azevedo (2018) defines the interaction or alliance as the set of actions and relationships between the agents of innovation.

[10] Offsets are offsetting transactions in which the exporting company grants production-related concessions to the importing government. More information at http:// repositorio.ipea.gov.br/bitstream/11058/9216/1/td_2473.pdf

informal methods, and others (AZEVEDO, 2013, p. 165). The consolidation of these interactions between system agents allows SIS-Def to develop maturity.

Furthermore, intentions also allow agents to obtain new information, knowledge, technologies, production practices, human and financial resources, and new markets. It should be noted that such benefits will depend on how well knowledge is shared among agents, and trust among allies, on the values and norms at stake (OECD, 2005, p.87).

In the normative field, currently, Defense innovations in Brazil have some bodies to promote and coordinate these interactions. There are two systems within the Ministry of Defense, one responsible for technological innovations and another responsible for non-technological (doctrinal) innovations[11]. The System of Science, Technology, and Innovations of Interest of the Defense (SisCTID) aims to encourage synergies in the technological sphere of the defense sector to cooperate with collective results. The Combined Military Doctrine System (SIDOMC), in turn, coordinates the interactions of the non-technological defense innovation sector. The system seeks to promote the development, review, consolidation, approval, and dissemination of the joint military doctrine[12] (BRASIL, 2008).

In addition to these ministerial systems, each Armed Force presents two management subsystems, although not systematized or explicit in publications, one for technological innovations and one for non-technological innovations. In the Army, the management of technological innovations is coordinated by the Science, Technology, and Innovation System of the Brazilian Army (SCTIEx) (BRASIL, 2019), and the Army's non-technological innovations are managed through the Land Military Doctrine System (SIDOMT) (BRASIL, 2017a).

The Brazilian Air Force (FAB) has the Aeronautics Innovation System (SINAER) (BRASIL, 2017c) and uses the Aerospace Military Doctrine System (SIDMAE) in the non-technological scope (BRASIL, 2013b). Finally, in the Brazilian Navy (MB), technological innovations rely on the System

[11] Non-technological innovations are represented, in this work, not only by doctrinal innovations, which create competencies for the use of tangible innovations, but also those that are intangible, related to the Art of War: doctrinal, organizational, strategic, and military tactical principles. Therefore, doctrinal innovations fit into them (AZEVEDO, 2018).

[12] As a required clarification, the term Combined Doctrine is currently understood as a Joint Military Doctrine. "Joint" refers to operations involving the three single forces (Navy, Army, and Air Force). In turn, the term "combined" is currently understood as operations between Armed Forces of different countries (multinationals). (BRASIL, 2016c, p.190)

of Science, Technology, and Innovation of the Brazilian Navy (SCTMB) to promote dynamically and in an integrated way the filling of technological gaps identified in the process of determining naval capabilities (BRASIL, 2017b). Concerning non-technological innovations, to date, the Brazilian Navy has no management model similar to the others presented. Despite this, the Navy has the Doutrina Militar Naval publication (EMA-305, 1ª Edição-2017), which establishes the principles, concepts, and, broadly, the methods of use in combat, serving as a basis for the preparation of other documents doctrinaires of the MB. However, it is noteworthy that the document is not intended to point out a system of doctrinal innovations (BRASIL, 2017e, p. VIII).

In summary, in the Defense sector, the country has two innovation management systems (SISCTID and SIDOMC) and six subsystems for managing innovations in the Armed Forces. It should be noted that, despite the existing structures, they have not yet reached the desired degree of maturity (AZEVEDO, 2013), i.e., despite the existence of management mechanisms, there is disarticulation, and the distance between agents is not altered.

In the view of Azevedo (2018), changing the scenario requires identifying and adapting the cultural factors present or absent in the agents' cultures to increase the productivity of innovative interactions. Thus, each agent in the sector is immersed in an organizational environment. Such an environment can collaborate, or hinder, the establishment of alliances to innovate. The author aligns with Pettigrew (2007; 2013), who argues that, although it is not an easy task, cultural changes can be managed by adjusting certain factors, described in the next section.

2 THE CULTURE OF INNOVATION ANALYSIS MODEL

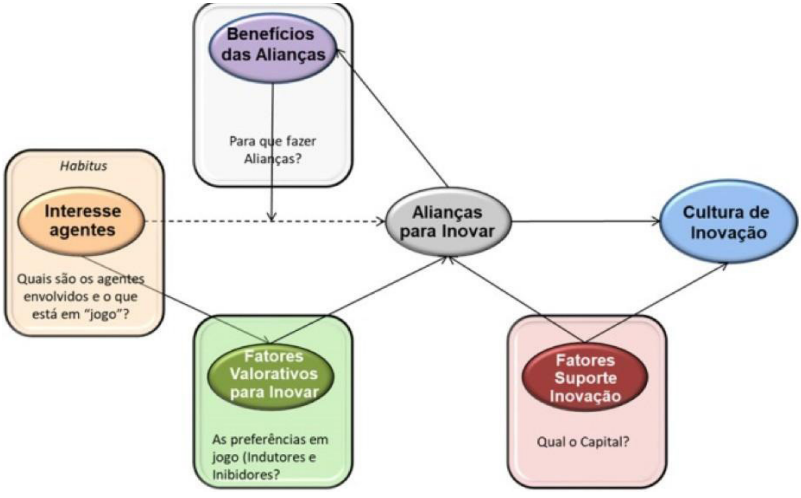
According to Schein (2009, p. 17), culture can be understood as the pattern of shared assumptions that were successful to the point of being considered valid for future teachings. Organizational culture is a possibility of approach within the field of study of culture. In a broad spectrum, organizational culture can be conceptualized as how the organization interprets its environment and relates to values, norms, and priorities (SOETERS, 2006).

The innovation culture, in turn, can be defined as the organizational culture that facilitates the development of innovation and

innovative processes (QUINN; KIMBERLY, 1984; CAMERON; QUINN, 2011). This perspective focuses on specific values, beliefs, and patterns of behavior.

To understand the culture of innovation in the Defense sector, Azevedo (2018) proposes a model containing elements that allow qualitative analysis of the culture of innovation. According to the research, this *corpus* of elements is constituted by the agents' interests (*illusio*); values or value factors of the innovation (*valorem*); supporting factors (*capitis*); alliances (*alliances*); and benefits visualized with the formation of alliances (*beneficium*) (Figure 2).

Figure 2 - List of elements that constitute the culture of innovation



Source: Azevedo (2018)

The first element of the model is the "Agents' Interest, or *Illusio*[13]," which are all sorts of motivations mobilized when the agent intends to innovate. The question that must be asked to understand the term is: what are the agents' interests when they are seeking to innovate in the Defense sector?

The Agents' interests are impacted by the values (Value Factors) present in the organizational culture of each agent and by the benefits seen

[13] In this work, Illusio (Agents' Interest) is impacted by the Habitus of the field, which, according to Bourdieu, is a socialized subjectivity, i.e., it can be understood as a system of dispositions, ways of perceiving, feeling, of doing, of thinking, that lead us to act in a certain way in a given circumstance (THIRY- CHERQUES,2006).

when they intend to ally. In theory, the more the "Benefits for Innovation" are visualized, and the more inducers the values, the greater the interest aroused in the realization of alliances.

Values or "Innovation Value Factors" (FVI) are composed of a set of organizations' values. According to Mendes and Tamayo (1999), when an organization recognizes its values and hierarchically organizes them, it is possible to analyze its degree of preference for certain behaviors, goals, or strategies. Thus, it can be said that the values are the agent's preferences in performing cooperation or interactions.

Azevedo (2018), based on the studies of Oliveira and Tamayo (2004), drew up a list of preferences that Defense sector actors prioritize when establishing alliances. The values systematized by the author are grouped to compose fifteen "Innovation Value Factors" (FVI) of the Defense sector. According to the author's proposal, there are inducing values tending to lead agents to an innovative attitude by forming alliances. Some tend to keep the *Status Quo*, the so-called inhibitors. According to the author, the environment will be more conducive to innovation, depending on the amount of inducing values the agents have or share (AZEVEDO, 2018). Figure 3 presents a dashed line that subdivides the groups of factors into two parts. The values above that line induce agents to an innovative attitude, and those below tend to keep the *Status Quo*.

Figure 3 - Structure of Innovation Value Factors

Source: Azevedo (2018) based on data from Oliveira and Tamayo (2004).

In turn, the "Benefits of Alliances" are the concrete or visualized results if there is an alliance, i.e., they necessarily result from interactions. The question here is: why establish alliances when the objective is to innovate?

The element "Alliances for Innovation" corresponds to establishing interactions between each of the primary agents of innovation in the Defense sector. Alliances, as previously presented, can occur at the inter-organizational, intra-organizational, or even between individuals' level. According to Freeman (1995), innovations fundamentally depend on Alliances for Innovation. In the authors' view, the greater the intensity of the established alliances (interactions), the greater the system's maturity (FREEMAN, 1995).

Azevedo (2018, p. 159) highlights that alliances do not provide leverage innovations self-sufficiently. Agents need to have "Innovation Support Factors" (FSI) to stimulate interaction, i.e., agents with weakened FSI do not encourage the formation of alliances.

The FSI comprises physical, human, and organizational aspects that allow creativity, learning, and teamwork in the Defense sector's innovation system (AZEVEDO, 2018, p. 162). It seeks to understand "what is the capital at stake?" According to the research, the production structures (what I have) and the institutional definition (what I want) influence these supporting factors.

3 OBSTACLES AND CULTURAL AND STRUCTURAL BARRIERS TO THE INNOVATION PROCESS

In light of the elements of analysis of the innovation culture, this section presents some structural and cultural barriers. According to this research, they hinder interactions between the SIS-Def actors. The section is separated into two subsections, initially raising the obstacles related to the structure of the SIS-Def. In this sense, the structural points of the system hindering innovation in the sector are analyzed in an updated way. Then, the barriers related to the culture of innovation are discussed, thus unfolding the barriers related to the "Innovation Value Factors" (FVI), the dynamics of interactions between the agents of the system, and the "Innovation Support Factors" (FSI).

3.1 OBSTACLES RELATED TO THE CURRENT SIS-DEF STRUCTURE

As presented in the second section of this work, the SIS-Def has two formally existing ministerial systems to manage the sector's innovations, the SisCTID and the SIDOMC. As already discussed, there are also the Single Forces' innovation subsystems.

This research demonstrates that there are updates on the points addressed by Azevedo (2013), present in the theoretical framework of this article. Initially, it is worth noting that the sectoral technological innovation subsystems of each of the Armed Forces remain without integration with the subsystems that control the advancement and diffusion of doctrinal (non-technological) innovations. There are only small links that interconnect such subsystems, but they are restricted to the field of process management.

At the ministerial level, there were also no changes in the management of innovations. As described by Azevedo (2013; 2017), both systems have not yet achieved the objective of integrating the subsystems of the Armed Forces, much less technological innovation systems with non-technological (doctrinal) innovation systems.

There was, however, the creation and development of structures considered essential in this management process, such as The Joint Defense Industry Commission (CMID), the Special Planning Advisory (ASPLAN), and the Secretariat of Defense Products (SEPROD). CMID, created through Decree No. 7970, of March 28, 2013, has the purpose of advising the Minister of Defense in decision-making processes and in proposing acts related to the National Defense Industry (BRASIL, 2013a). Some of its attributions are the coordination of studies related to the national policy of the defense industry, the promotion of integration between the Ministry of Defense and public and private bodies and entities related to the Defense Industrial Base, and the approval of policies and guidelines on the acquisition, import, and financing processes.

In turn, ASPLAN, according to the Internal Regulations of the Ministry of Defense (MD), is a body of direct and immediate assistance to the Minister of Defense and has the following attributions, among others: lead and coordinate the process of preparing and reviewing the strategic planning of the Ministry of Defense; and manage the Defense Strategic

Planning System (SISPED), which seeks to be an integrative, future-oriented document and is concerned with adapting the Armed Forces to a changing environment. The body aims to answer the following questions: "who are we?"; "where do we want to go?"; "have the external factors been evaluated?" and "how will the objectives be achieved?"

Finally, the Secretariat of Defense Products (SEPROD) is responsible for proposing the foundations for formulating and updating the national policy on defense science, technology, and innovation, among other attributions. Since 2012, the Secretariat has sought to implement the Monitoring System for Science, Technology, and Innovation Projects in the Interest of Defense (SAPID), as established in Ordinance No. 1120/MD, of May 10, 2011 (BRASIL, 2011). This is perhaps an essential public policy to integrate the planning of each of the Forces. Among its purposes, the following can be highlighted: optimization of the management of human and financial resources used in Science, Technology and Innovation Projects of Interest to National Defense, enabling the rational and economical allocation of resources; facilitating the identification, evaluation, selection, prioritization, and approval of Science and Technology (S&T) Project proposals.

In addition to the above initiatives, it was also possible to observe a relative evolution of management procedures such as a) strategic projects; b) capacity-based planning; c) elaboration of sectorial plans such as the Defense Articulation and Equipment Plan (PAED); among others. The existence of a complex set of structures, commissions, and advisory services, is noticed. The attributions would be impossible to discuss in an article section but are essential links in the innovative process. However, it is noteworthy that, even with the creation and improvement of the three structures above, innovation in the Defense sector still occurs incrementally (except for the exceptions in the aviation segment, led by EMBRAER).

In general, there is still no system that integrates the management of innovations in the field of Defense in its broad spectrum. There is also no interconnection between the technological and doctrinal innovations systems within the Ministry of Defense as expected by academic literature.

3.2 OBSTACLES RELATED TO THE ELEMENTS OF THE CULTURE OF INNOVATION

3.2.1 VALUE FACTORS AND AXIOLOGICAL FOUNDATIONS (INTERFORCES COMPARISON)

As described in the theoretical framework, one of the elements of analysis of the culture of innovation is the "Innovation Value Factors" (FVI). In this sense, this research space proposes to raise the values that interfere in the innovation process present in the Armed Forces.

In general, the FVI can be understood as a set of values that, when grouped, induce or inhibit an innovative attitude (AZEVEDO, 2018, p. 160). In the publications of the Brazilian Army (EB), the FVI, which may consist of one or more values, are called "Attitudinal Content" and are conceptualized, as provided for in the Norms for Development and Assessment of Attitudinal Contents (NDACA), as "content that helps in the process of forming the military identity, which can be taught through pedagogical activities and specific practices of military education" (BRASIL, 2014b, p. 10).

In the Brazilian Navy (MB), the FVI is called "Behavioral Competencies," defined as "skills directly related to attitudes, the expression of emotions, feelings, and personal values, necessary for the performance of a profession, position and function" (BRASIL, 2016b). In turn, in the Brazilian Air Force (FAB), they are known simply as "Values" and can be defined as

> "beliefs and attitudes that give personality to an institution. They function as a guiding compass for their behavior and adopted policies. They represent the ideals of attitude, behavior, and results that must be present in all its members" (BRASIL, 2016b).

Following this brief note, it is highlighted that the "Attitudinal Contents" (EB), the "Behavioral Competencies" (MB), and the "Values" (FAB), which will be analyzed below, should be understood, in this work, as "Value Factors." The EB, through the publication called 'Normas para Desenvolvimento e Avaliação dos Conteúdos Atitudinais' (NDACA) provides 45 (forty-five) Attitudinal Contents (BRASIL, 2014b).

In the Navy, several publications regulate how behavioral competencies are developed in military education, such as Ordinance

No. 197/DEnsM, of November 18, 2016, which approves the methodology for the preparation and revision of competency-based curricula; the Curriculum of Undergraduate Officers Courses; and DEnsM-1003, which addresses the Reference Competencies Catalog. These documents serve as the basis for this research.

In total, 34 (thirty-four) "Behavioral Competencies" were found in documents. It is worth pointing out that if the constant values of the "Rose of Virtues" (Figure 4) are considered, there are a total of 40 (forty) "Behavioral Competencies." It is also important to highlight that the Naval School, the institution responsible for training MB officers, has a set of values to be developed in each of its courses. The complete list of behavioral competencies can be found in Brasil (2016b).

Figure 4: Rose of Virtues of the Naval School

Source: Rodrigues (2014).

The FAB, in turn, conducts the "Program for the Formation and Strengthening of Values" (PFV), which establishes as a basic guideline the definition and development of 23 (twenty-three) "Values" (BRASIL, 2016a). Ordinance No. 37/1SC, of the General Staff of the Air Force (EMAER), of September 1, 2016, which provides for the Program, details the meaning of each value but does not specify how they should be evaluated. Analyzing the publications mentioned above and comparing the values, attitudinal contents, or behavioral competencies, some aspects appear and will be discussed later (Charts 1 and 2).

Chart 1 – Results of Comparison of FVI with Force Values

Fatores (FVI) e Valores	Propostos por Azevedo (2018)	Encontrados nas Publicações Vigentes	Observados no cotidiano	Ausentes
FVI indutores da inovação	8	3	———	
		37.5%		
FVI inibidores da inovação	6	1		
		16.7%		
Valores indutores da inovação	44	20	11	13
		45.5%	25.0%	29.5%

Source: Prepared by the authors.

Chart 2 – Results of Comparison of Force Values

Força e Valores	EXÉRCITO	MARINHA	FORÇA AÉREA
Valores constantes das publicações das Forças	45	40 *	23
Valores das Forças encontrados nos FVI Indutores	21 (47%)	14 (35%)	11 (48%)
Valores das Forças encontrados nos FVI Inibidores	2 (4%)	2 (5%)	4 (17%)
Total de Valores das Forças encontrados nos FVI	23 (51%)	16 (40%)	15 (65%)

* There are 36 (thirty-six) values disregarding the values of the Rose of Virtues.
Source: Prepared by the authors.

Of the 14 (fourteen) FVI presented by Azevedo (2018), summarized in Figure 2, only 4 (four) are directly included in the official publications of the Forces, which is equivalent to 28% of the FVI. Three of them are FVI inductors, two of which are *f*ound only in the Army's publications (*Spirit of the Corps* and Resilience) and one of them is represented in the Navy and Army's publications (Proactivity). Only one inhibiting FVI (hierarchy) was found in the publications of the three Forces.

Of the 44 (forty-four) inducing values listed in the inventory of values by Azevedo (2013), only 20 (twenty) are present in the Forces publications, which represents 45.5% (forty-five point five percent). There are 11 (eleven) values that, although not covered in these publications, were observed during the research through the participatory observation technique addressed in the introduction to this research. Another 13 (thirteen) are absent, i.e., they are not contained in publications, nor were they observed in everyday life. Considering the values observed in routine activities, the percentage of presence of these values increases to 70.5% (seventy point five percent).

When analyzing the Forces in a singular way (Chart 2), between 35% (thirty-five percent) to 48% (forty-eight percent) of the inducting values contained in the Forces publications were found in the FVI proposed by Azevedo (2018). In other words, more than half of the values that induce an innovative attitude in Defense are not worked on by the Forces.

Considering the inhibiting values, the percentage of values present in publications is low, i.e., around 12% (twelve percent). However, although the inhibiting values are not listed in the publications, a high percentage of them was observed in daily life, around 69% (sixty-nine percent). Therefore, considering the values observed in everyday life, the percentage of these values increases to 81% (eighty-one percent).

Singularly analyzing each Force, there are few inhibiting values in the publications. In the Navy and Army, about 5% (five percent) and about 17% (seventeen percent) of the total in the Air Force. Chart 2 shows that 19 (nineteen) values are absent from the publications of the Forces (thirteen inducers and six inhibitors). The analysis of the lists of values of the three Forces indicates they have only a small set of values in common. In other words, only 12 (twelve) values are found in the three Forces, 08 (eight) of them contained in the Military Statute (see Brasil, 1980).

It is worth remembering that, according to the theoretical framework, when an organization recognizes its values and hierarchically organizes them, it is possible to analyze the degree of preference of the organization for specific strategies (MENDES; TAMAYO, 1999) and analyze whether these values are inductors or inhibitors of innovation (OLIVEIRA; TAMAYO, 2004). According to Azevedo (2018), the environment will be more conducive to innovation, depending on the amount of inducing values the agents have or share. Thus, it is essential to highlight each of the Forces' common and specific values when the intention is to form partnerships to produce innovations.

The Brazilian Army and the Navy have 15 (fifteen) common values, while the Air Force has only 4 (four) in common. These numbers help to infer the need to propose a more in-depth study of new modeling in terms of values to be developed in schools and military training centers, aiming, in particular, to develop values that enhance alliances for innovation between the Forces. The literature discussed in this study supports the thesis that inducing values leads agents to an innovative attitude precisely because they contribute to forming alliances. Thus, the more inducing values they have or share, the more conducive to innovation the environment will become (FREEMAN, 1995; CUNHA; AMARANTE, 2011; AZEVEDO, 2018).

It is also necessary to analyze these numbers qualitatively to avoid distortions. For example, while the FAB presents 65% (sixty-five percent) of its values (fifteen to twenty-three) included in the inventory of values proposed by Azevedo (2018), it does not necessarily indicate that the Force mentioned above has a more innovative attitude than the Navy or the Army. Like the other Forces, the FAB does not have any composite FVI and has no value in important FVI inducers such as "Proactivity" and "Autonomy."

It is worth emphasizing that the FVI "Egalitarianism" has no value represented in the publications of the Forces. This factor expresses the need for the organization to define the type of relationship it will have with the physical and social media external to the institution (OLIVEIRA; TAMAYO, 2004). This FVI is composed of values such as democracy, decentralization, co-management, and equity. Such values are very dear to institutions that usually act in an Adhocratic way[14] and partnerships.

[14] In this model, the organizational culture has characteristics, flexibility, external focus, dynamism, entrepreneurship, and creativity, focusing on generating innovative products, processes, and services

Finally, it is appropriate to verify that there are values such as 'Systemic Vision' and 'Interpersonal Relationship' (presented by the Navy) and 'Efficiency' (presented by the FAB). Although not included in the values proposed by Azevedo (2018), they can increase an innovative attitude in the Defense sector.

3.2.2 OBSTACLES RELATED TO THE DYNAMICS OF INTERACTIONS BETWEEN SIS-DEF AGENTS

As recorded in the theoretical framework of this research, agents in open systems do not innovate alone (FREEMAN, 1995). Innovation is usually carried out through interactions, generally driven by interests and the possibility of obtaining benefits (AZEVEDO, 2018).

Several types of interactions can occur in the Defense sector. The present research, however, focused only on four types of interactions: those carried out between the military segment and the Defense Industrial Base (FA-BID); between the military segment and the Higher Education Institutes (FA-IES); between the Forces (FA-FA) and those between IES-BID.

Of the interactions presented, the literature considers the interaction of companies with universities and research centers as one of the most controversial (SBRAGIA, 2006). In the Defense sector, the IES-BID relationship has not been different, even when considering the Military Institutes of the Army and Aeronautics, IME and ITA, respectively, and the Navy Technological Center in São Paulo (CTMSP), which operates in cooperation with the University of São Paulo (USP). While in these educational establishments, resistance to building partnerships occurs with lesser intensity, the following aspects could be noticed during the interviews:

a. difficulty in penetrating Defense matters in IES, due to competition with the market and lack of understanding of the innovation's relevance in the Defense sector for the country;
b. of the Military Institutes in making alliances with volatile companies, which change owners quickly and are often absorbed by foreign industries

(QUINN; KIMBERLY, 1984).

c. apprehension of the Military Institutes in making alliances with volatile companies, which change owners quickly and are often absorbed by foreign industries;
d. cluelessness and lack of regulation of the 2016 New Innovation Law, especially concerning funding and financial incentives for researchers;
e. institutional vision that partnerships with the private sector encourage the hiring of military researchers, increasing the evasion of engineers from the ranks of the Forces;
f. feeling of mutual distrust of the human resources capacity of the actors involved. Companies are suspicious of the intellectual capacity of a good portion of IES researchers, except researchers trained in military institutes (Interviewee P12). On the other hand, researchers at military institutes are suspicious of the work capacity of researchers at companies;
g. view that the Federal Government should fund basic and applied research projects in the Defense sector, to the detriment of resources headed by companies.
h. absence of an S&T pole in the Army, making it difficult for the IME to interact with companies, with other IES and with Scientific, Technological, and Innovation Institutions (ICT); and
i. slowness caused by the bureaucratic and complex decision-making process of the Forces, which sometimes makes the partnership unfeasible.

In the above context, it appears that the IES-BID relationship presents several obstacles to be overcome. A large part of these difficulties permeates, according to the interviews, mistrust among agents. Since the trust value is not fully present in these relationships, the fear of increasing the rate of military evasion remains; the distrust in the human capacities produced by the IES and the low flow of hiring doctors by the BID.

In addition to the difficulties presented in the IES-BID binomial, more successfully, the interaction between the Armed Forces and companies (FA-BID relationship) has been beneficial for both parties. An indicator of the efficiency between the Defense-BID relationship is the strategic projects of the Forces, such as the Software-Defined Radio (RDS), which illustrates the relative success of interactions between the various actors. The three Armed Forces, the Financier of Studies and

Projects (FINEP - as a funding agency), and the Science and Technology Institutions (ICT)[15] are involved in this project.

Concerning the obstacles related to the interactions of these agents, in general, two points should be highlighted: the diffuse efforts present in the sector and the lack of priorities in the initiatives. In other words, several similar projects are being carried out in different phases in each of the Forces, generating fragmentation of efforts. Low integration regarding technological innovations gives freedom to each of the Forces. While healthy on the one hand, on the other hand, it leads to fragmentation. It can contribute to unnecessary expenditure of time and human and financial resources, as a former SEPROD director highlights:

> "One can build a national innovation system and seek integration, but who will lead and what direction will this system take? Resources will always be scarce. There will always be a need for prioritization. Thus, there must be synergy in the Defense sector. The Forces must work and direct their efforts in a harmonious and coordinated manner in carrying out complex tasks. In the scientific-technological sector, we have to map all the processes, the productive chain of defense products (PRODE), to have this synergy. Furthermore, the Defense Innovation Sectoral System is a division of the National Innovation System. I give an example, you go to LAAD[16], and you find an Unmanned Aerial Vehicle (UAV), developed by a University, financed by the State of São Paulo, and another developed by a certain industry, financed by the Federal Government. The other day, businesspeople came here, saying that they would be starting to manufacture armored vehicles to guard the borders (police level) in the State of Mato Grosso.

[15] The Army Technological Center (CTEx), the Naval Systems Analysis Center (CASNAV), the Navy Research Institute (IPqM), the Institute of Advanced Studies (IEAv), and the military IES (Military Institute of Engineering and Aeronautics Institute of Technology) are considered ICT.

[16] LAAD is the largest and most important defense and security fair in Latin America.

> It will be a mere automaker, as they will not have scale. So this pervasive effort doesn't lead to anything. Who should dictate the cadence and give the direction?"

It must be said that it is not just companies that work diffusely in the Defense sector, but the Armed Forces themselves. The UAV case, mentioned by the former SEPROD director, is emblematic. This project was developed by the FAB and competed with the EB's Remotely Piloted Air System (SARP), and both present precisely the same proposal. Another interviewee from an aeronautical communications company pointed out the second obstacle: while many important initiatives promote the Defense industry, it is challenging to assign priorities. This scenario, according to the interviewee, also results in the dispersion of already scarce resources.

> "P34: There is a positive perspective. Businesspeople see a stronger light at the end of the tunnel. However, concrete actions are still lacking. We observe the National Defense Strategy (END), the Defense Articulation and Equipment Plan (PAED), but we still see that this is not linked to the Union budget. It still does not give security to the business community. At one of the ABIMDE meetings, one of the businessmen said: 'how am I going to invest in something if I don't even know if I'm going to have a project contracted by the government?' So, I see there is an improvement in confidence, but I think it takes a while for things to happen. For example, I went to Brasília yesterday, and there were comments on the Multi-Year Planning (PPA) having only just been defined, and there is not much to celebrate. With few resources, priorities have to be defined, and I see that it is challenging to define priority projects."

In general, the Ministry of Defense and ABIMDE have sought a closer relationship with the Forces and the BID, coordinating important

initiatives to increase trust between the BID and the FA and disseminate the Forces' projects at fairs such as LAAD other seminars. However, some points still need attention, such as the coordination and dissemination of existing initiatives.

The interaction of the military segment with universities (FA- IES relationship) is increasing annually. The Navy, for example, as it does not have its technological institute, is the Force that produces the most advances in this type of partnership. The creation of the CTMSP on the USP campus brought the agents closer together. The Navy also has the Postgraduate Program in Maritime Studies (PPGEM)[17], linked to the Naval War School, which provides the Professional Master's and Professional Doctorate courses. These courses aim to prepare civilian and military personnel, improve the training of specialized personnel, and promote research to expand maritime academic knowledge in areas of interest to naval power and defense. In addition to these initiatives, the Force established several cooperation agreements, such as the Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (COPPE/UFRJ), Fluminense Federal University (UFF/RJ), and the University of São Paulo.

It is worth noting that the Army (illustrated here by the IME, CTEx, and ECEME, mainly through the Meira Mattos Institute) also has partnerships signed with educational establishments related to Defense issues. Among the partner institutions, the Getúlio Vargas Foundation, Federal University of Rio de Janeiro, and Fluminense Federal University stand out. However, despite the initiatives, the flow of interactions is considered low and does not address issues essential to innovations in Defense. The exception is the Pro-Defense III Program of the Ministry of Defense and, more recently, the Academic Cooperation Program in National Defense (PROCAD - Defesa), launched in 2019.

The Support Program for Teaching and Scientific and Technological Research in National Defense (Pro-Defesa) sought to implement scientific-technological research production projects. PROCAD-Defesa has been collaborating to increase academic cooperation networks in strategic areas, mainly for recognizing and disseminating academic productions and teaching programs with high productivity.

Finally, it is necessary to address the interaction between the Armed Forces or interForces (FA-FA relationship), an inter-organizational

[17] The PPGEM obtained a Grade 5 in the last four-year evaluation by CAPES, which confirms its quality and highlights the institution and the Force's commitment to the IES-FA integration.

relationship. It is worth exploring this type of relationship with one of the interviewees (P21) when commenting on the difficulty of interaction between the Forces.

Interviewee P21 argued that the MD found a formula to increase relationships, cooperation, and alliances concerning the military operational segment and doctrinal innovations. Among the initiatives, the courses of the Superior War School (ESG), the Superior Defense Course (CSD), the Advanced Studies in Politics and Strategy Course (CAEPE), and the exercises and joint operations (Ágatas, Atlântico I, II, and III, AZUVER[18], and others) stand out. P21 also states that, regarding the S & T segment, this did not occur to the same degree.

> "I think the System is still very immature concerning relationships. The MD itself has been in existence for just over a decade. There is little activity involving joint logistics and S&T, making matters worse. It has been easier to create and practice operational employment doctrine through common exercises or courses and exchanges in the services high schools than S&T subjects. There is more interest in the operational issue than in S&T. There are several operations in the year of instruction that cover the doctrinal and operational issues. There is nothing similar concerning S&T. Anyway, the integration of logistics and S&T is very incipient. It is not a reality. It assumes that someone will have to give up something. This is not only due to a dispute over resources; it is a cultural issue. We are not even able to standardize socks and shoes. It is impossible to imagine and believe that standardization is unfeasible. There is a lack of willingness to give up rights, prerogatives in

[18] AZUVER is a military exercise developed by ECEME that simulates a dispute between two countries, Blue and Red, facing each other over a particular fictitious region.
MB, EB, and FAB student officers concluding the courses of high studies put into practice the lessons learned during the respective courses, exercising all functions and tasks, both of a Joint General Staff and a Component Force, either Naval, Land, or Air. More information is available at http:// www.eceme.eb.mil.br/pt/noticias-eceme-m-pt/1001-azuver-2019

> favor of the common good. And this is due to the culture that exists in the Forces."

It is noteworthy that the above interview was conducted in 2013. Since then, considering the time frame of this article, other interviewees pointed out the same issue, presenting similar positions, i.e., they consider low the flow of interaction between the Forces in the scope of the S&T system. According to interviewee P21, this type of thinking is cultural.

Thus, the main barrier concerning the integration between Forces seems to be the lack of predisposition for partnerships and a possible mutual distrust regarding innovations, which needs to be overcome. The solution found by the MD meets the arguments of SBRAGIA et al. (2006). The authors point out that an alternative solution is an organization in networks to minimize the high costs of research and development (R&D).

Finally, it is appropriate to verify that there are values such as 'Systemic Vision' and 'Interpersonal Relationship' (presented by the Navy) and 'Efficiency' (presented by the FAB). Although not included in the values proposed by Azevedo (2018), they can increase an innovative attitude in the Defense sector.

3.3.3 OBSTACLES RELATED TO INNOVATION SUPPORT FACTORS

As identified in the theoretical framework of this research, the Innovation Support Factors comprise physical, human, and organizational aspects (AZEVEDO, 2013, p. 162). These aspects allow creativity, learning, and teamwork in the Defense sector's innovation system (AZEVEDO, 2013). The analysis of the aforementioned SIS-Def factors allowed us to identify several strengths of the system.

The Innovation Support Factors (FSI) observed in the sector are the high commitment of senior management and the existence of qualified human resources. In turn, three of the obstacles of the innovative process, which deserve to be identified and addressed, stand out: the difficulty of establishing extensive communication in the areas of innovation, the departmentalized organizational structure, and the difficulty in assigning priorities to strategic projects. It is worth highlighting the comment of one of the interviewees (engineer and innovation manager) on the difficulty of extensive communication and the organizational structure in the sector:

> "The non-existence of a General Management Body (ODG), at the MD level, generates issues in the Forces. The main consequence is the inability to arbitrate and distribute assignments to the Services. Lack of command unit.Each one acts within its field. As a result, there is a risk that two Forces will do the same thing or that they will not do something. […] France has a fourth force, the DGA, which generates unique thinking regarding Defense materials."

Thus, the lack of a centralized command network can lead to a scenario where each Service would operate according to its perspectives and innovative demands. This scenario could become an obstacle for the SIS-Def, considering that there would be a risk of double work or, even, in an extreme scenario, the non-performance of tasks or strategies. As seen, the MD seems to be aware of this need and has been implementing measures to minimize this barrier, such as the development of structures and systems (CMID, ASPLAN, SEPROD, and SAPID). Also, important initiatives work with the same purpose, as is the case of Strategic Projects in the academic area: Defense Academic Cooperation Program (PROCAD) and Scientific and Technological Research Program in Strategic Matters of National Interest (Pró-Estratégia).

According to interviewee P28, Brazilian Liaison Officer with TRADOC (US Army Training and Doctrine Command), a good case to be studied and investigated about the applicability to the Brazilian case is the French model of centralization of material goals. The General Department of Armaments (DGA) is a government agency subordinate to the French Ministry of Defense, responsible for the entire acquisition of military material used by the Armed Forces of that country and technological innovations in the defense sector (MELO, 2015, p.108). Its mission is to provide the troops with all the necessary equipment, coordinate research, and obtain synergy with academia and business. Usually, this process occurs through its programs and projects, determining the areas of technology that need to advance and demanding from civil industries and universities their needs in Defense products (MELO, 2015; DE MORAES, 2014, p. 8).

The North American model also opts for the centralization of the innovative process. The Defense Advanced Research Projects Agency (DARPA)[19] is an agency of the US Department of Defense (DoD) that funds military sector innovations with spillovers for commercial use. Project managers are recruited from research centers for a fixed period (SQUEFF; DE NEGRI, 2017 p. 413).

China took a similar path, initially using reverse engineering heavily. It currently has an integrated system with Defense technology leading globally, well systematized by the State Program "Made in China 2025."[20] It is no coincidence that China leads the number of patent applications globally (FARGE, 2021).

Concerning the culture of innovation, Russia has a very well-structured plan following the Doctrine Gerasimov[21] and the new doctrine of the Russian hybrid war. According to Ankov (2017), the Russian Ministry of Defense is not limited to creating training centers but recovers the Soviet practice of creating military departments in civilian universities.

According to Volchenko (2017), scientific progress processes in the Armed Forces of the Russian Federation are led by a structure called the Military Scientific Committee. Also, according to Volchenko (2017), the young owners of digital technologies will become the pillar of the state in the century of information wars that has arrived. Therefore, the Russian state structure not only encourages but orders the creation of a fertile environment for defense innovation.

In Brazil, according to the MD's Executive Summary for Defense (2020-2039) analysis, countries at the technological forefront, including the US, Russia, China, and France, among others, will maintain their level and the US due to the large sums required by the RD&I will encourage cooperation between other emerging and developed countries (BRASIL, 2017d).

Although the models of the countries discussed cannot be a solution to the Brazilian case, they demonstrate the importance of centralizing the innovation process in the hands of a central body, as it

[19] More information is available at https://www.darpa.mil/

[20] More information is available at https://www.csis.org/analysis/made-china-2025

[21] In 2013, Russian General Valery Gerasimov, Chief of Staff of the Armed Forces of the Russian Federation, published the article 'The Value of Science is in Prediction: New Challenges Demand Rethinking the Ways and Methods of Conducting Combat Operations,' in the newspaper Voyenno-Promyshlennyy Kurier (VPK) ("Military-Industrial Mail"). In this article, Gerasimov describes his perspective and the prevailing view in Russian security circles on the war's recent past, present, and anticipated future.

contributes to the coordination of research and development efforts in the sector to focus on low investments. In the Brazilian Ministry of Defense, SEPROD could be the embryo of an alternative similar to the DGA of the French model.

Concerning the obstacle of departmentalization, which sometimes makes communication difficult and makes the decision process slower, respondent P28 stated: "If there were a central body to coordinate, the decision-making process would be much faster. The great idea for the innovation management in the Defense sector is being able to act in a matrix with the actors."

Thus, it is interesting to study the structure adopted by COPAC (Combat Aircraft Program Coordinating Committee). COPAC, as provided for in Art. 129 of the Internal Regulation of the Aeronautics Command (RICA) No. 20-36/2009, coordinates the work related to the development and acquisition of combat aircraft and related systems for the Aeronautics Command (COMAER) and coordinating with the Organs of Sectoral Directorate, the actions necessary for the implementation of these aircraft and systems.

According to interviewee P13, although that body is subordinate to the Department of Aerospace Science and Technology (DCTA), its President does not report only to that Department. The Commission reports to several authorities, including the air force commander:

> "The Combat Aircraft Program Coordinating Committee (COPAC) is a large structure that works in a matrix way. COPAC is a great project office. The project manager only reports to the President of COPAC. The President of COPAC reports to several authorities: one of them is the air force commander. That depends a lot on the importance of the project. There is no organizational chart. […] COPAC has a characteristic that may seem a little strange by military standards. For example: for someone to be a leader or manager of a project, he needs to have experience. It is not enough just to have knowledge of theory or to be hierarchically superior. There are people here who are older

> than me and who are not project managers yet. And that's not a problem, or rather, we have a certain limit, as an older one can't be an adjunct to a more modern one; that doesn't happen."

In addition to reporting directly to the force commander, COPAC also presents other points that this research deserves to highlight. As interviewee P13 mentioned, to be a project leader, the military must have experience, not just the theoretical knowledge or the hierarchy in his favor.

This set of measures has been favoring the Force regarding the management of its innovations. There are noticeably successful cases with adhocratic structures in the model proposed by Mintzberg (2003), which can serve as a benchmark for solutions to overcome the pointed obstacles.

4 FINAL CONSIDERATIONS

This research sought to unveil cultural and structural barriers that hinder interactions between SIS-Def actors, causing the fragmentation and disarticulation indicated in the literature. Additionally, these final considerations present possible strategic actions that aim to streamline interactions and, therefore, increase the culture of innovation in the Defense sector.

While this study had participants from all agents of the Defense innovation system, this work kept the focus on the Armed Forces. However, as Abdalla et al. (2018) pointed out, collecting data from different sources contributes to the investigation's reliability, strictness, and validity.

It is no simple task to manage a complex system whose results depend heavily on the flow of interactions. The research showed a need to increase an organizational culture that inspires confidence, esprit de corps, and working together and accepting differences. Thus, raising cultural barriers (values, interests, support factors) was essential, which allowed inferring a little more about the dynamics of interactions between the Forces and how it can become more dynamic.

Also, the investigation of possible structural barriers enabled us to verify the perception of the Ministry of Defense's need to coordinate innovations in the sector. This fact can be observed in creating structures capable of contributing to the fragmentation pointed out by Cunha and Amarante (2011), especially concerning the top of the Defense

pyramid (Figure 1). However, no concrete initiatives still contribute to the defragmentation of technological and non-technological (doctrinal) innovations structures.

The study of obstacles and barriers allowed us to infer some Strategic Guidelines that, synthetically, can be categorized into educational, structural, and operational (Appendix A). The suggested educational strategic actions aim to develop attributes (values, attitudinal behaviors, or behavioral competencies) that induce innovations. Without them, the difficulty of interaction between the various agents will remain high due to obstacles, such as vanity, ambition, conservatism, and so many others.

Structural actions are related to organizational change in the design of the Defense Innovations System. They should induce more significant interaction between technological and non-technological innovations between the Forces' innovation systems (interForces) and between these and the other agents of the system (IES, BID, etc.) (extra Force).

Finally, there are those of an operational nature concerning how interactions and/or the interaction possibilities will be operationalized and disseminated. These, together with the other proposed actions, if implemented, should contribute to the increment of the innovation culture in the sector, strengthen the BID, and, consequently, expand the country's deterrent power.

DESAFIOS PARA A POLÍTICA DE INOVAÇÃO NO SETOR DE DEFESA BRASILEIRO: ÓBICES E BARREIRAS CULTURAIS E ESTRUTURAIS

RESUMO

A presente pesquisa tem como objetivo analisar as principais barreiras culturais e estruturais que dificultam as interações e, em consequência, o processo de inovação do setor de Defesa. A motivação de estudar questões culturais e estruturais no setor da Defesa advém da percepção de que os indicadores de inovação utilizados atualmente na área acadêmica transcendem aspectos relacionados com pesquisa, desenvolvimento, proteção, produção e aplicação do conhecimento, os quais complementam a compreensão da essência da inovação e toda a amplitude e complexidade do ambiente propício às inovações. Do ponto de vista metodológico, este trabalho é resultado de uma base de entrevistas, de pesquisa bibliográfica e de pesquisa documental sobre a cultura de inovação presente nas Forças. Os dados foram categorizados e analisados empregando-se o método denominado Análise de Conteúdo. Os resultados apontam sugestões de políticas públicas, de caráter estrutural, educacional e operacional, consolidadas em forma de diretrizes estratégicas (Apêndice A), visando contribuir com o incremento de uma cultura organizacional que inspire confiança, espírito de corpo e capacidade de trabalhar em conjunto, aceitando as diferenças. Além disso, vale destacar que a investigação sobre possíveis barreiras estruturais corrobora a percepção de que o Ministério da Defesa deva exercer a coordenação das inovações no setor.

Keywords: Innovation. Defense. Culture of Innovation.

REFERENCES

ABDALLA, M. M. et al. Quality in qualitative organizational research: types of triangulation as a methodological alternative. **Administração: Ensino e Pesquisa**. v.19, n.1, p. 66-98, 2018.

ACADEMIA DA FORÇA AÉREA. Programa de Formação de Valores. **Portaria EMAER nº 37/1SC**, de 1º de setembro de 2016. São Paulo. 2016a.

ALVES-MAZZOTTI, A. J.; GEWANDSZNAJDER, F. **O método nas ciências naturais e sociais**: pesquisa quantitativa e qualitativa. São Paulo: Ed Pioneira,. 1999.

ANKOV, Vitaly. A 'fórmula do sucesso' do exército russo: tradições soviéticas mais inovação. **Sputnik**, Rússia, 2017. Disponível em: https://br.sputniknews.com/defesa/201704188178255-exercito-russo-segredo sucesso/. Acesso em: 10 nov. 2019.

ASHEIM, Bjorn; SMITH, Helen Lawton; OUGHTON, Christine. Regional innovation systems: theory, empirics and policy. **Regional studies**, 2011.

ATKINSON, P.; HAMMERSLEY, M. Ethnography and participant observation. In: N. K. Denzin; Y.S. Lincoln (ed). **Handbook of qualitative research**. London: Sage, 2005. p. 248–261

AZEVEDO, Carlos Eduardo Franco. **Gestão de Defesa**: O Sistema de Inovação no Segmento de Não-Guerra. 2013. 423 f. Tese (Doutorado) - Fundação Getúlio Vargas, Rio de Janeiro, 2013.

AZEVEDO, Carlos Eduardo Franco. Os elementos de análise da cultura de inovação no setor de Defesa e seu modelo tridimensional. **Coleção Meira Mattos: Revista das ciências militares**, v. 12, n. 45, p. 145-167, 2018.

BRANDÃO, S. M.; BRUNO-FARIA, M. F. Barreiras à inovação em gestão em organizações públicas do governo federal brasileiro: análise da percepção de dirigentes. In: CAVALCANTE, P. et al. **Inovação no setor público**: teoria, tendências e casos no Brasil. Brasília: Ipea, 2017.

BRASIL. Estado-Maior da Armada. **Doutrina Militar Naval** - EMA-305. Brasília,DF, 2017e.

BRASIL. Escritório de Projetos do Exército Brasileiro. **Portfólio Estratégicos do Exército Brasileiro**. Brasília, DF, 2019. Disponível em: http://www.epex.eb.mil.br/index.php/texto-explicativo. Acesso em: 10 ago. 2019.

BRASIL. Ministério da Defesa. Diretrizes para organização e funcionamento do Sistema de Doutrina Militar Combinada (SIDOMC). **Portaria Normativa n° 558/EMD/MD**. Brasília, DF, 2008.

BRASIL. Ministério da Defesa. **Portaria Normativa nº 9/GAP/MD**, de 13 de janeiro de 2016. Glossário das Forças Armadas (MD 35-G-01). 5 ed. Brasília, 2016c.

BRASIL. Ministério da Defesa. **Cenários de Defesa 2020 – 2039**: Sumário Executivo. Ministério da Defesa: Brasília, DF, 2017d.

BRASIL. Ministério da Defesa. Comando da Aeronáutica. Sistema de Doutrina Militar Aeroespacial (SIDMAE). Portaria n° 19/3SC2, de 03 de junho de 2013. Brasília, DF, 2013b.

BRASIL. Ministério da Defesa. Comando da Aeronáutica. Sistema de Inovação da Aeronáutica (SINAER). **Portaria nº 881/GC3**, de 12 de Junho de 2017. Brasília, DF. 2017c.

BRASIL. Ministério da Defesa. Comando do Exército. Instruções Gerais para o Sistema de Doutrina Militar Terrestre (SIDOMT) (EB10-IG-01.005). **Portaria n° 1.550**, de 8 de novembro de 2017, 5. ed, Brasília, DF, 2017a.

BRASIL. Ministério da Defesa. Sistema de Acompanhamento de Projetos de Ciência, Tecnologia e Inovação de Interesse da Defesa. P**ortaria nº 1120/MD**, de 10 de maio de 2011. Brasília, DF, 2011.

BRASIL. Normas Especiais para as Compras, as Contratações e o Desenvolvimento de Produtos e Sistemas de Defesa. **Decreto nº 7.970**, de 28 de março de 2013. Brasília, DF, 2013a.

CAMERON, Kim S.; QUINN, Robert E. **Diagnosing and changing organizacional culture**: based on the competing values. San Francisco: Jossey-Bass, 2011.

CASSIOLATO, J. E. et al. **Interagir para competir**: promoção de arranjos produtivos e inovativos no Brasil. SEBRAE: FINEP: CNPq: Brasília, DF, 2002.

CASSIOLATO, José Eduardo; LASTRES, Helena M. M. **O foco em arranjos produtivos e inovativos locais de micro e pequenas empresas**. *In*: LASTRES, Helena; CASSIOLATO,José Eduardo; MACIEL, Maria Lucia. Pequena empresa: cooperação e desenvolvimento local. [Rio de Janeiro]: Relume Dumará, 2003. p. 21-34.

COOPER, R. G. Stage-Gate systems: a new tool for managing new products. **Business Horizons**, v. 33, n. 3, p. 44-55, 1990.

CRESPO, N. F., CRESPO, C. F. Global innovation index: Moving beyond the absolute value of ranking with a fuzzy-set analysis. **Journal of Business Research**, v. 69, n. 11, p. 5265-5271, 2016.

CUNHA, M. B.; AMARANTE, J. C. O Livro Branco e a Base Científica, Tecnológica, Industrial e Logística de Defesa. **Revista da Escola de Guerra Naval**, Rio de Janeiro, v. 17, n. 1, 2011.

DE MORAES, R. F. **Intermediação estatal nas exportações de equipamentos militares**: as experiências da Rússia e da França. Texto para discussão 1963. IPEA: Brasília, DF, 2014.

ESCOLA SUPERIOR DE GUERRA. **Manual Básico – Volume I**: Elementos Doutrinários. Rio de Janeiro: ESG, 2014a.

EXÉRCITO BRASILEIRO. Departamento de Educação e Cultura do Exército. Normas para Desenvolvimento e Avaliação dos Conteúdos Atitudinais (NDACA). **Portaria nº 143 - DECEx, de 25 de novembro de 2014**. Rio de Janeiro, 2014b.

FARGE, Emma. China Extends Lead Over U.S. in Global Patents Filings,

U.N. says. **Reuters**. Disponível em: https://www.reuters.com/article/us-un-patents idUSKCN2AU0TM. Acesso em: 10 abr. 21.

FREEMAN, C. The National Innovation Systems in Historical Perspective. **Journal of Economics**, v. 19, n. 1, 1995.

GALDINO, J. F. **Análise de desempenho, modelagem e planejamento estratégico do sistema de inovação do Brasil**: um estudo baseado nos indicadores do Global Innovation Index. 2017. 234 f. Monografia. Escola Superior de Guerra, Rio de Janeiro. 2017.

GALDINO, J. F. Sistema nacional de inovação do Brasil. **Coleção Meira Mattos: Revista das ciências militares**, Rio de Janeiro, v. 12, n. 45, p. 129-144, 2018.

HADJIMANOLIS, A. The Barriers Approach to Innovation. In: SHAVININA, L. V. (org.). **The International Handbook on Innovation. Oxford**: Elsevier Science, 2003. p. 559-571.

JANKOWSKA, B.; MATYSEK-JĘDRYCH, A; MROCZEK-DĄBROWSKA, K. Efficiency of National Innovation Systems: Poland and Bulgaria in The Context of the Global Innovation Index. **Comparative Economic Research,** Sciendo, v. 20, n. 3, 2017.

LESKE, Ariela Diniz Cordeiro. **Inovação e políticas na indústria de defesa brasileira**. 2013. Tese (Doutorado em Economia) – Instituto de Economia, – Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2013.

LINCOLN, Yvonna S.; NORMAN, Denzin. **Handbook of qualitative research**. Inglaterra: Sage, 2000.

LINDEGAARD, S. **The open innovation revolution**: essentials, roadblocks, and leadership skills. Wiley: Hoboken, N.J, 2010.

LONGO W. Pirró e; MOREIRA, William de Souza. Tecnologia e inovação no setor de defesa: uma perspectiva sistêmica. **Revista da Escola de Guerra Naval**, Rio de Janeiro, v. 19, n. 2, p. 277-304, 2013.

MARINHA DO BRASIL. Diretoria de Ensino da Marinha. **Portaria nº 197/ DEnsM, de 18 de NOVEMBRO de 2016**. Metodologia para a elaboração e revisão de currículos por competências. Rio de Janeiro, 2016b.

MARINHA DO BRASIL. Diretoria-Geral de Desenvolvimento Nuclear e Tecnológico da Marinha. **Estratégia de Ciência, Tecnologia e Inovação da Marinha do Brasil**. Brasília, DF, 2017b.

MCCRACKEN, G. **The long interview.** Ontario: Sage, 1988.

MELO, Regiane. **Indústria de Defesa e Desenvolvimento Estratégico**: estudo comparado França-Brasil. Brasília, DF: FUNAG, 2015.

MENDES, A. M.; TAMAYO, A. Valores e vivências de prazer-sofrimento nas organizações. In: ENCONTRO NACIONAL DA ASSOCIAÇÃO NACIONAL DE PÓS GRADUAÇÃO E PESQUISA EM ADMINISTRAÇÃO, 23., 1999, Foz do Iguaçu. **Anais** [...]. Foz do Iguaçu: Anpad, 1999.

MINTZBERG, Henry. **Criando Organizações Eficazes**: estruturas em cinco configurações. 2. ed. São Paulo: Ed. Atlas, 2003.

MUSSI, F.; SPULDARO, J. Barreiras à inovação e a contribuição da perspectiva institucional: um estudo de múltiplos casos. **INMR - Innovation & Management Review**, v. 5, n. 1, p. 36-52, 2008.

NONAKA, I.; VON KROGH, G.; VOELPEL, S. Organizational Knowledge Creation Theory: Evolutionary Paths and Future Advances. **Organization Studies**, v. 27, n. 8, p. 1179- 1208, 2006.

OECD, Oslo Manual. **Guidelines for Collection and Interpreting Innovation.** 3. ed. Paris: OrganiZation for Economic Co-operation and Development (OECD) Publications, 2005,.

OLIVEIRA, A. F.; TAMAYO, A. Inventário de perfis de valores organizacionais. **Revista de Administração de Empresas**, São Paulo, v. 39, n. 2, 2004.

PETTIGREW, A. M. A Cultura das Organizações é Administrável? In:

FLEURY, Maria; FISCHER, Rosa (org.). **Cultura e poder nas organizações**. São Paulo: Ed. Atlas, 2007.

PETTIGREW, A. M. . A cultura das organizações é administrável? In: FLEURY, M. T. L.; FISCHER, R. M. (Org.). **Cultura e poder nas organizações**. 2. ed. São Paulo: Ed Atlas, 2013. p.145-153.

QUINN, R. E.; KIMBERLY, J. R. Paradox, planning and perseverance: Guidelines for managerial practice. *In*: KIMBERLY, J. R.; QUINN, R. E. (ed.). **Managing organizational transitions**. Homewood, IL: Dow Jones-Irwin, 1984. p. 295–313

RODRIGUES, Rosane Pinto. **Sentinelas dos Mares**: a carreira militar e suas representações sociais para aspirantes e oficiais da Marinha do Brasil. 2014. 128 f. (Programa de Pós-Graduação em Psicologia) - Universidade Federal Rural do Rio de Janeiro, Rio de Janeiro, 2014.

SBRAGIA, R.; STAL, E.; CAMPANÁRIO, M.; ANDREASSI, T. (coord.). **Inovação**: como vencer esse desafio empresarial. São Paulo: Ed. Clio, 2006.

SCHEIN, E. **Guia de sobrevivência da cultura corporativa**. 6. ed. Rio de Janeiro, 2009.

SCHUMPETER, Joseph A. **Capitalism, Socialism, and Democracy**. New York: Harper and Row, 1934.

SILVA, Peterson Ferreira da. **A política industrial de defesa no Brasil (1999-2014)**: intersetorialidade e dinâmica de seus principais atores. 2015. 445 f. Tese de Doutorado – Universidade de São Paulo, São Paulo, 2015.

SILVERMAN, D. **Interpreting qualitative data. Methods for analyzing texts, talk and interaction**. London: Sage, 2006.

SOETERS, Joseph. Military culture. In: [CAFORIO, Giuseppe]. **Handbook of the Sociology of the Military**. Boston: Springer, 2006. p. 237-254.

SQUEFF, Flávia de Holanda Schmidt. DE NEGRI, Fernanda. **Ciência e Tecnologia de Impacto**: uma Análise do Caso DARPA. Brasília, DF: IPEA,

2017. 481 p.

TANG, Mingfeng et. al. Strengthening regional integration/cooperation with the Neighborhood System of Innovation conceptual framework: the case of China and ASEAN. **Asian Journal of Technology Innovation**, [s.l.], v. 23, n. 2, p. 205-229, 2015.

THIRY-CHERQUES, Hermano Roberto. Pierre Bourdieu: a teoria na prática. **Rev. Adm. Pública**, Rio de Janeiro, v. 40, n. 1, p. 27-53, feb. 2006.

VOLCHENKO, Nikita. **A combinação das tradições soviéticas com novos experimentos trouxe sucesso ao Ministério da Defesa**. Rússia, 2017. Disponível em: https://vz.ru/society/2017/4/11/865920.html. Acesso em: 10 nov. 2019.

Appendix A – Strategic guidelines (culture of innovation)

DIRETRIZES ESTRATÉGICAS PARA INCREMENTAR A CULTURA DE INOVAÇÃO (Dtz Estrt)	ATRBUIÇÃO /RESPONSABILIDADE
Dtz Estrt 10 (EDUCACIONAL) - Incluir nos currículos das escolas de altos estudos e aperfeiçoamento das Forças a disciplina Gestão da Inovação, a fim de difundir e ampliar conhecimentos sobre a temática. A formação de Grupos de Estudo e de Pesquisa deverão ser incentivados. Dentre os temas de estudo, sugere-se: a) Definições conceituais (inovação em Defesa, Sistema de Inovação Setorial de Defesa, inovações tecnológicas e não-tecnológicas etc.); b) Taxonomia das Inovações; c) Constituição dos Sistemas de Inovação do MD e das Forças; d) Rede de Inteligência para Inovação em Defesa; e) Prospecção tecnológica; f) Autonomia tecnológica e redução do hiato tecnológico; g) Proteção da propriedade intelectual; e h) outros.	DEPENS (MD), com apoio das Estrutura de Ensino das Forças

DIRETRIZES ESTRATÉGICAS PARA INCREMENTAR A CULTURA DE INOVAÇÃO (Dtz Estrt)	ATRBUIÇÃO /RESPONSABILIDADE
Dtz Estrt 01 (ESTRUTURAL) - Elaborar nova Portaria Normativa, criando o SIS-Def, englobando o funcionamento de todos os subsistemas componentes (subsistemas de inovações tecnológicas, não-tecnológicas e os respectivos subsistemas das Forças).	SEPROD, com apoio do EMCFA
Dtz Estrt 02 (ESTRUTURAL) - Elaborar Portaria Normativa, criando grupo de estudo para estabelecimento de ICT conjunta de Defesa, por evolução ou transformação da SEPROD ou por criação de nova estrutura.	SEPROD, com apoio dos gestores dos subsistemas de inovações das Forças e membros do MCTIC
Dtz Estrt 03 (ESTRUTURAL) - Elaborar Portaria Normativa, criando a Instituição de Ciência, Tecnologia e Inovação Conjunta de Defesa ou Departamento Geral de Materiais de Defesa-DGMD.	MD e MCTI
Dtz Estrt 01 (EDUCACIONAL) - Elaborar Portaria Normativa, contendo as Normas para Desenvolvimento e Avaliação de Competências Comportamentais (NDACC) ou FVI, visando desenvolver atitude e perfil inovador no pessoal das Forças.	DEPENS (MD), com apoio das Estrutura de Ensino das Forças
Dtz Estrt 05 (EDUCACIONAL) - Elaborar diretriz de ensino, orientando as Forças a conduzirem cursos de gestão de inovações em Defesa, contemplando discentes oriundos de todas as agências envolvidas com o SIS-Def (IES, BID, Forças).	DEPENS (MD), com apoio das Estrutura de Ensino das Forças

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