English Edition

ISSN 2316-4891 (Online)
ISSN 2316-4833 (Print)

Coleção Meira Mattos

revista das ciências militares

Escola de Comando e Estado-Maior do Exército
v. 13 n. 47 May/August 2019

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Rio de Janeiro

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ABOUT
A Coleção Meira Mattos, is an academic not for profit publication circulated three times a year by the Military Sciences Post-Graduation Program of the Escola de Comando e Estado-Maior do Exército (ECEME) based on the policy of free access to information.

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EDITORIAL SERVICES
Tikinet Edição

PRESS
Triunfal Gráfica e Editora

COVER GRAPHIC DESIGN
Designed by the Production, Publicity and Cataloging Section, based on art by Harerama Santos da Costa, ECEME Desktop Publishing Section.

AVAILABLE IN ENGLISH / DISPONIBLE EN ESPAÑOL
<http://ebrevistas.eb.mil.br/index.php/RMM/index>

Dados Internacionais de Catalogação na Publicação (CIP):

C691 Coleção Meira Mattos : revista das ciências militares. — Vol. 1, n. 24- .
— Rio de Janeiro : ECEME, 2007-
v. : il. ; 28 cm.

Quarterly.
Published from no. 1-14 with the title Padeceme, and from no. 15-23 with the titles Padeceme and Coleção Meira Mattos.
Padeceme e Coleção Meira Mattos.
ISSN 2316-4891 (Online). — ISSN 2316-4833 (Print)

1. DEFENSE. 2. MILITARY SCIENCE. I. Escola de Comando Estado-Maior do Exército (Brasil).

CDD 355

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ECEME

DOI 10.22491/cmm.a012

Editorial

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ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

Over the last decade, Brazil witnessed a qualitative leap in the field of Defense Studies and the rapid growth in the cooperation between the University Academia and educational institutions linked to the Armed Forces and the Ministry of Defense. New graduate courses were created – usually in the area of Security and Defense –, and new periodic publications surfaced. However, the path to the sustained growth and development of the area is not the competition between courses and journals, but of the specialization and complementarity.

Given this context, traditional and reputable vehicles undergo transformations – such as *Coleção Meira Mattos*: *Revista de Ciências Militares* (Meira Mattos Collection: Military Sciences Journal) – while seeking to strengthen the relationship between Defense, Academia and Society. A Journal written by an institution that operates the Defense and reflects on it opens space for dialogue and dissemination with other institutions and a broader public. This is because there were Defense studies within the Armed Forces/Brazilian Ministry of Defense and within the traditional Academia, which was expressed through the *Associação Brasileira de Estudos de Defesa* (Brazilian Association for Defense Studies – ABED). Only now these two areas associate themselves, with the participation of Civil and Military researchers in several events, and in the presentation of their research projects via scientific articles.

The *Escola de Comando Estado Maior do Exército* (ECEME), through the *Instituto Meira Mattos*, created a successful Graduate program in Military Sciences – the only one in Brazil. This occurrence assigned a new status to the traditional *Coleção Meira Mattos* journal – deepening the to do-to know relationship –, which here presents another edition, assembling civilian and military researchers.

The topics include technical issues of the utmost relevance such as the use of drones and motorized cavalry, the recruitment and training of reservists in Recife, and the system of technological material. But also encompass political-strategic themes such as Geoeconomics and Development: the *II Plano Nacional de Desenvolvimento* (2nd Brazilian Plan for Development – PND) and the national autonomy, counterterrorism actions in large events, among others. Thus, within the Defense area, the Military Sciences develop a vehicle of interaction with other fields of study.

The institution and its competent and dedicated Editor, Professor Tássio Franchi, must be congratulated for the publication of this edition of the *Coleção Meira Mattos: Revista de Ciências Militares.*

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ECEME

ARTICLE DOI 10.22491/cmm.a007

Counterterrorism in the great events: terrorism perception and tactical legacy under the perspective of Brazilian Army Officers

Contraterrorismo en los grandes eventos: percepción del terrorismo y del legado táctico desde la perspectiva de los Oficiales del Ejército Brasileño

Abstract: This article proposes the analysis of the doctrinal evolution of the Brazilian Army during the preparation for the "Mega Events". Admittedly one of the major concerns for events security, terrorism has stood out as a motivating force for the improvement of Ground Force tactics, techniques and procedures. Some operational capacities have played a leading role in counterterrorism, among which are Anti-aircraft Defense, Chemical, Biological, Radiological and Nuclear Defense, and the Employment of Special Operations Hunters. The investigation included questionnaires and interviews with experts, establishing a research sequence in the conceptual-theoretical and practical domains, materialized by the analysis of experiences. The sample group included intermediate officers, to obtain a tactical-level perspective of the operators. The methodological options allowed to conclude about the importance of this decade of events for the evolution of the terrestrial military doctrine, particularly in the capacity to combat terrorism.

Keywords: Terrorism. Counterterrorism. Mega Events. Tactics. Doctrine.

Resumen: Este artículo propone el análisis de la evolución doctrinal del Ejército Brasileño a lo largo de la preparación de los "Grandes Eventos". El terrorismo es reconocido como una de las mayores preocupaciones para la seguridad de los eventos, destacándose como una fuerza motivadora para el incremento de tácticas, técnicas y procedimientos en el campo de la Fuerza Terrestre. Algunas de las capacidades operativas han tenido un papel destacado en el contraterrorismo, entre las que se encuentran la Defensa Antiaérea, la Defensa Química, Biológica, Radiológica y Nuclear y el Uso de Cazadores de Operaciones Especiales. La investigación incluyó cuestionarios y entrevistas con especialistas, estableciendo una secuencia de investigación en los ámbitos teórico-conceptual y práctico, materializada en el análisis de experiencias. El grupo de muestra incluía a los oficiales intermedios, con el fin de obtener una perspectiva de los operadores a nivel táctico. Las opciones metodológicas nos permitieron concluir sobre la importancia de esta década de eventos para la evolución de la doctrina militar terrestre, particularmente en la capacidad de combatir el terrorismo.

Palabras Clave: Terrorismo. Contraterrorismo. Grandes Eventos. Tácticas. Doctrina.

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Received: Oct. 22, 2018
Accepted: May 06, 2019

COLEÇÃO MEIRA MATTOS
ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

1 Introduction

The 2016 Olympic and Paralympic Summer Games in the city of Rio de Janeiro marked the end of a cycle of "Mega Events" in Brazil, which included, among others, the Pan American Games 2007, the Military World Games 2011, the World Youth 2013, FIFA Confederations Cup 2013 and FIFA World Cup 2014 (BRASIL, 2012).

The period in which these events occurred coincided with the "War on Terror" and the increase in spending to combat global terrorism (INSTITUTE FOR ECONOMICS AND PEACE, 2017). The United States has been able to impose its agenda as a universal principle (BUZAN, 2006, p. 1103) and, although South America's recent history presents a significant decrease in terrorist episodes (SUAREZ, 2012, pp. 384-387), the Mega Events imposed a necessary change of the Brazilian position about the subject.

Legal instruments, notably the National Defense Policy and the National Defense Strategy, have established specific directives for the Armed Forces and other offices and agencies, governmental or non-governmental, directing high-level sector planning and establishing the objectives and guidelines for preparation and employment aimed at defending the homeland and guaranteeing constitutional powers (BRASIL, 2012c).

The National Defense Strategy, when it addresses the strategic topic "National Security" states that:

> All instances of the State should contribute to the increase of the National Security level, with a particular emphasis on:
> [...] the prevention of terrorist acts and massive attacks on Human Rights, as well as the conduct of counterterrorism operations by the Ministry of Defense and Justice and the Institutional Security Office of the Presidency of the Republic (BRASIL, 2012b, p. 134, our translation).

Based on this demand, and in line with the diffuse and multifaceted characteristic of terrorism, it is imperative to interact with the academic world in the attempt to better understand this phenomenon. In the national literature, studies on the subject of terrorism are still incipient. As for research in international nuclei, the investigation lenses are diffuse, but can be grouped under four main perspectives: efficacy of terrorism, comparative study between actors or cases, process of extinguishing a terrorist group, and counterterrorism (CRENSHAW, 2014, p. 557).

The first step in dealing with this phenomenon lies invariably in its definition. The incessant quest to create labels or concepts may be related to the fear of dealing with subjectivity, and for some, value judgment can affect their interests. This situation is aggravated in a country whose high political status has several former members of social movements of resistance that have used violence as a political tactic (LASMAR, 2015, p. 55).

However, this discussion is not a Brazilian exclusivity. In several countries, for different reasons, there is a difficulty in depoliticizing a possible conceptualization. In 2005, Braizat analyzed

the political idiosyncrasies that existed in some states of the Middle East and demonstrated - through the perception, among several situations, of what would be a terrorist act - that the political context is determinant in the definition.

Regarding the term terrorism, what cannot be denied is that it is an expression currently used in the securitized system of Copenhagen School (AMARAL, 2007, p. 46) and that it brings a moral aversion on the part of society. Thus, it has been explored for the imposition of rhetoric of particular interests and selective interventions, mainly by the United States, which use the phenomenon as a solution to a post-Cold War threat deficit (BUZAN, 2006, p. 1103).

Despite the understanding that excessive efforts for the conceptualization have shifted the focus of the fight against terrorism, the lack of consistency of official definitions has provided a range of polarized and politicized solutions. Although aware of the subjective bias, natural of a personalistic analysis, this author had to analyze first the main views about the subject, and then to propose a definition that allowed the framing of situations and that directed the study.

In this sense, and for understanding the present study, this author adopted the following perception: terrorism is the systematic use of terrorist attacks; and these are understood as an irregular war tactic characterized by the use or threat of premeditated surreptitious violence perpetrated against the State and/or society, represented by symbols, principles, people and goods, excluding military targets in direct confrontation, for the purpose of coercion, intimidation or self-promotion of ideological interests.

To conclude the conceptual analysis, we emphasize that the above-mentioned definition disregarded the ideological legitimacy of the perpetrator, as well as the distinction between State terrorism and the one practiced by actors without international recognition, due to the belief that violence is unjustifiable.

Delving deeper into the main aspect of this essay, counterterrorism, we find that just a few researchers in the literature dissociate it from antiterrorism. In this research, the segmentation proposed by Forest (2015) and Pinheiro (2011, p. 5) was adopted for the analysis of actions to prevent and combat terrorism: antiterrorism, intelligence support, counterterrorism and consequences management.

Chart 1 - Stages of terrorism prevention and combat

Term	Definition
Antiterrorism	Passive defensive measures taken to reduce the vulnerabilities to acts of terror
Intelligence Support	Production and dissemination of terrorism-related data to counteract terrorism in all fields
Counterterrorism	A set of offensive measures taken to prevent, deter and respond to terrorism
Consequence management	Preparedness to respond to the consequences of a possible terrorist event

Source: Forest (2015) and Pinheiro (2011, p. 5).

This understanding is in line with what is explained in the EB (Brazilian Army) manual on Special Operations:

> While Antiterrorism is based on the protection action through ostensive presence, of a merely preventive character, Counterterrorism requires the execution of direct, eminently repressive/retaliatory contact actions against terrorist organizations in presence (BRASIL, 2017, p. 5-24, our translation).

In view of these definitions, we notice an undeniable interaction between the phases of a plan designed for prevention and combating of terrorism. This interrelation requires, from the coordinators of the process, a multidisciplinary and integrated plan. In Brazil, notably during the 2016 Olympic Games, interagency action was very relevant, in which several agents, with different responsibilities in the area of security and defense, worked together, sharing tasks or areas of responsibility, depending on their specificity.

Among the military vectors, the Brazilian Army had an undeniable prominence in counterterrorism, given its effectiveness, capillarization throughout the national territory and operational capacity in various tasks. In the attempt to solve this "military problem," many developments occurred in the scope of Ground Force along the period of preparation for the Mega Events.

Aiming to put the focus of this study on a perception more inherent to counterterrorism, we opted for an approach of the operational capabilities at the tactical level, which is defined in the manual of the EB on the Military Doctrine of Defense:

> At the tactical level, fractions of military forces, organized according to their own characteristics and capabilities, are used to achieve operational objectives or to accomplish missions. At this level, there are confrontations between opposing forces, and the use of standardized procedures and techniques associated with military leadership training and leadership (BRASIL, 2007, p. 26, our translation).

From a tactical perspective, the Brazilian Army decomposes the solution of each military problem into a series of tasks to be accomplished.

> During the planning phase of operations, commanders and their General Staffs identify all tasks to be accomplished, select the most appropriate capacities so that each task is effectively fulfilled and start to describe how to accomplish the mission received (BRASIL, 2016c, our translation).

The specificity of the terrorist threat left to the Brazilian Ground Force the analysis of peculiar tasks, quite distinct from what one expects in a so-called "conventional" combat. New capabilities had to be developed, requiring flexibility and generating an adaptation in the existing structure, which can present a relevant evolution for the ground military doctrine.

Thus, to guide the research and go deeper in this theme, the following research questions were formulated: what is the perception of the military regarding the conceptualization of terrorism and what are the main doctrinal legacies at the tactical level, coming from the preparation for the Mega Events?

To add the knowledge from this experience during the Mega Events, this study aims to recognize the most relevant tactical changes in priority tasks in combating terrorism and to evaluate its applicability by the Ground Force operations in the short term.

Also, the perspective used as a reference stands out as a differential of this research. The option of collecting information directly with the intermediate officers (captains) had the objective of obtaining reports from the commanders of the subunit level, a fraction with relevant performance at the tactical level. Thus, the expectation was to gather perceptions of military personnel who had to be trained with modern tactics and equipment and acted directly in operations.

To enable the attainment of the target of the study, the following specific objectives were formulated, which allowed the logical chain of descriptive reasoning presented in this study:

a. To identify tactical level military perceptions of the definition of terrorism, as well as possible tactical scenarios in the short term, in which the Ground Force can act in combating terrorism or other threats that require a similar tactical structure ; and

b. To recognize the most significant tactical evolutions in the tasks considered as priorities, along the preparation period for the Mega Events and to identify some lessons learned that can optimize the employment in short-term scenarios.

From this systematic of objectives, this study is justified for promoting a research on a current and important theme for the preparation of the Brazilian Army in view of the new threats. As there has been an increase in the tactical structure regarding counterterrorism, it is an opportune time to optimize them for future operations.

The task of studying the future is not simple. Most of the futuristic predictions of the late twentieth century were not able to anticipate the rise of non-state actors based on religious and cultural fundamentalisms. In this era of rapid changes, in which the future is not a linear extension of the past, scientific methodologies of futurology encounter great and unpredictable barriers of impact, such as "September 11, 2001".

Avoiding a greater degree of subjectivity, this study restricted the projection of scenarios to a period of five years, based on observable tendencies and perceptions of a sample group composed of EB captains.

In this sense, this research also intends to supply military decision-makers at the tactical level with reflections that can anticipate the needs inherent in future operations and subsidize decisions to counter the threat of terrorism. In addition, we hope they may contribute as theoretical presuppositions to other studies that propose to approach the same theme.

2 Methodology

To collect subsidies to find a possible solution to the problem, the design of this research included analytical reading and registration of sources, interviews with specialists, questionnaire, argumentation and discussion of results.

As for the general objective, the exploratory modality was used, due to the scarce knowledge available, notably written, about the tactics of counterterrorism, which required an initial familiarization, materialized by the exploratory interviews, followed by a questionnaire for a sample with relevant professional experience on the subject and, finally, specific interviews with some specialists in the intended scope.

Regarding the form of approach to the problem, we mainly used the concepts of qualitative research. In spite of the statistical analysis of the questionnaire, the understanding of the tactical legacies, the focal point of this investigation, was the result of interpretation of interviews with specialists who worked in the priority areas of counterterrorism. In addition, comparing the collected data with theoretical references present in the literature, we drew considerations and conclusions about the subject in question.

2.1 Literature review

The design of the research began with the definition of terms and concepts, in order to make possible the solution of the research problem, being based on a literature review in the period from September 2001 to April 2018. It is noteworthy that theoretical references before the period known as "War on Terror" - identified by US foreign policy after September 11, 2001[1], were restricted to conceptual subsidies and historical analyses.

2.2 Data collection

initially, and as a means to understand the military's perception about the central theme of the research, semi-structured interviews were conducted with some officers who were engaged in combating terrorism in one of the "Mega Events".

From this interaction, it was possible to establish tasks that stand out as priorities in the tactical level of counterterrorism. Thus, in support of the predominance of the themes explored in EsAO monographs, the Anti-Air Defense (DAAe), the Chemical, Biological, Radiological and Nuclear Defense (Def QBRN) and the Employment of Special Operations Hunters are outstanding areas in the terrorism combat operation.

The questionnaire served as a complementary tool to analyze the conceptual perception of terrorism with a specific group: captains during the officer improvement training. This sample group is representative for this study because it constitutes the moment in the career of the EB combatant officer in which, after some years of acting in the small fractions, the military consolidates his professional competences on the doctrine at the tactical level.

In view of divergences regarding definitions and, consequently, different assessments regarding the classification of an event as a terrorist attack, we chose to use a model similar to the one carried out by Braizat (2005), in which some situations are presented, and asking the respondent to judge them, indicating whether they are considered as terrorist attacks.

1 After the attacks on the World Trade Center, resolutions were adopted that expanded the importance of combating terrorism in the global security agenda (SUAREZ, 2012, p. 388-389).

The situations were defined based on real and hypothetical facts, adapting to the Brazilian reality: violent action by social movements, drug trafficking groups, indigenous groups and the massacre at the School in Realengo. Some international events were also included in the options for comparison with Braizat study in the case of the World Trade Center Attack, and to evaluate officials' perceptions of recent issues, such as the American attack on Syrian Air Base, cyber attacks and the use of drones and precision snipers allied with the terror propaganda.

Fares A. Braizat (2005) sought to expose political idiosyncrasies and the importance of the political context for the analysis of terrorism. In a similar way, this investigation proposes to understand these influences with the universe of intermediate officers of the EB. Despite the superficial political-strategic theoretical depth of the sample, it should be noted that most of the respondents have already acted in terrorism prevention and combat, even during the Mega Events. To preserve the randomness between the interpretations of situations and to evaluate the possible interference of the previous options in the subsequent judgment, two (2) types of questionnaires were elaborated, with the presentation of events in inverted order.

The second question of the questionnaire sought, more objectively, to identify the perception of the sample about some divergent concepts concerning the conceptualization of terrorism. Based on the study by Schmid and Jongman (2005, p. 5), in which they evaluated the frequency of certain terms in the academic definition by 109 researchers, the questioning was formulated in an inverse way: respondents should judge, among predefined terms, which should necessarily be part of a definition of the terrorism phenomenon.

The textual elements presented as an option were selected from the analysis of scientific literature, which reflects the diversity of approaches. In this context, the second question asked the informant not to rely solely on legal forecasts or technical-professional manuals, presenting, for judgment, the following terms: political motivation (direct or indirect), use of violence or force, perpetrated only against individuals, premeditated action perpetrated against the State, perpetrated only by non-state groups and perpetrated only against non-military targets.

Finally, the third item of the questionnaire proposed a prospective reflection on the probability of an attack with terrorist characteristics within simulated scenarios. These events were defined, subjectively, from the considerations of some studies used as reference[2], regardless of the personal perception to be classified as terrorist, and were described as follows:

a. Attack against the troop in Peace Operations under the aegis of the UN, in the African continent, in a country with active and structured terrorist groups;

b. Systematic attack of drug trafficking groups against state troops or symbols;

c. Attacks of social movements in search of destabilization of political power.

2 Brasil sends... (2017), Silva (2017), and Visacro (2009).

Regarding the distribution and conduction of the questionnaire, a pre-test was initially carried out with five EsAO instructional officers. No flaws were found that might be detrimental to the investigation and, therefore, the others were followed in an identical way. Subsequently, in June 2017, 387 captains were gathered in the EsAO Auditorium, among which the questionnaires were distributed in a random manner.

Then, the results of the work used as a basis for the questionnaire were presented as follows: Braizat (2005) and Schmid and Jongman (2005). This introduction was necessary to illustrate the diversity of opinions and to generate previous reflections, which tends to avoid the simplistic automatism in the answer.

After presenting the objectives of the work and requesting that the answers follow the expected sequence, the questionnaire was authorized. The maximum time for accomplishment was 16 minutes. From the total of questionnaires distributed, 22 were disregarded due to the occurrence of fill-in-double-response errors, erasures that impaired the interpretation of the data or not filling, thus totaling 365 valid answers.

In spite of the importance of other means of data collection, interviews with specialists were the main tool that subsidized the present study. The selection of the interviewees had as main criterion the combination of the degree of technical knowledge with the theoretical-scientific depth acquired from scientific research on the subject.

In this way, structured interviews were conducted with captains with professional experience in terrorism combat during Mega Events and who have conducted or are conducting research about the area in question. In this sense, there was interaction with eight experts in the areas of Anti-aircraft Defense (RBS-70 and Gepard), Special Operations Hunters and Chemical, Biological, Radiological and Nuclear Defense.

Although the questions were previously formulated and standardized in a similar manner for all the interviewees, regardless of the specialization, the personal contact made it possible to capture particular opinions and reports of experiences, which considerably broadened the scope of the study object.

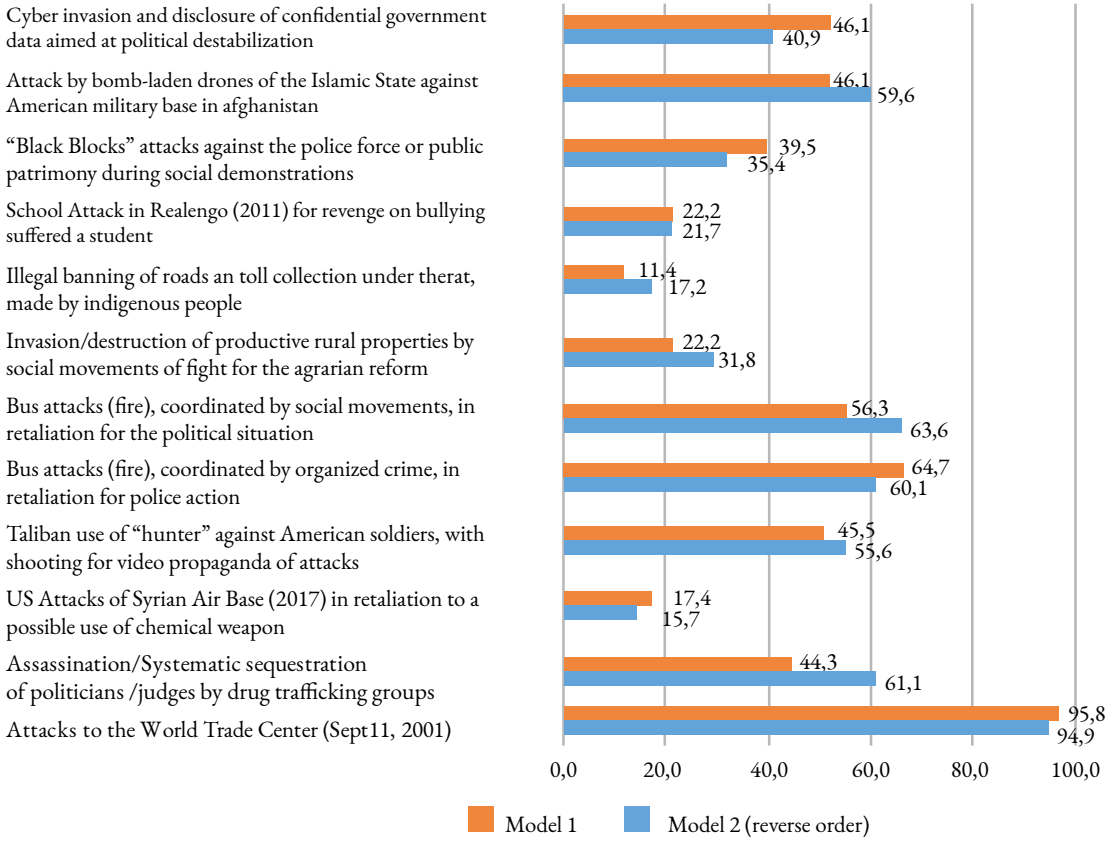
3 Results And discussion

In this section we present the results of the questionnaire, duly tabulated and interpreted through a descriptive and inferential statistical analysis, as well as considerations arising from interviews with specialists.

3.1 Captains perception about terrorism and future scenarios

Initially, when the sample was asked to classify certain events as terrorism, the ordering of the situations was not significant, since the difference between the answers was minimal when comparing the two questionnaire models, being the options arranged in reverse order. We validated 167 questionnaires from model 1 and 198 from model 2, and the distribution of responses, as a percentage, is shown in the following graph:

Graph 1 - Comparison between the answers of the 2 questionnaire models (percentage data)



Source: The author (2018).

Thus, it was possible to compile and tabulate the data in a centralized way, favoring the interpretation of each option, based on the proposed objectives. The results are represented in Table 1 and are illustrated by the absolute frequency and percentile tools.

With information obtained from the sample, there is a tendency, practically consensual, of the intermediate officers of the EB to consider the attacks on the World Trade Center as a terrorist act. This perception, divergent from the one observed in some of the countries of the Middle East, according to a study by Braizat (2005), can come from a Westernized conception and influence of the international security agenda determined after the resolutions of September 21, 2001.

Among the other situations, no other one presented a tendency to be classified as terrorist with a percentage higher than 65%. Two events were described as terrorist by a percentage between 60 and 65% of the sample: bus attacks (fire), coordinated by the organized crime, in retaliation for police action; and bus attacks (fire), coordinated by social movements, in retaliation for the political situation.

Examining these results, although there is no consensual consistency, it can be seen that the sample majority does not corroborate with the veto to item II of paragraph 1 of article 2, of the Brazilian Antiterrorism Law (BRASIL, 2016b), which characterized as terrorism the act of

burning or depriving means of transportation or any public or private property. It should be noted that, for the respondent captains, there is the possibility of characterizing organized crime and social movements as perpetrators of terrorist acts, and there is no apparent distinction between the performing actor, since the results are very similar between the two.

Table 1 - Perception of the sample regarding the classification of pre-defined situations

Situations	Terrorism		Other Types of Crime		Should not be framed as a crime	
	Frequency (*fi*) / % of *n*					
Attacks to the World Trade Center (Sept11, 2001)	348	95.3%	10	2.7%	7	1.9%
Assassination / Systematic sequestration of politicians/judges by drug trafficking groups	195	53.4%	161	44.1%	9	2.5%
US Attacks on Syrian Air Base (2017) in retaliation to a possible use of chemical weapon	60	16.4%	145	39.7%	160	43.8%
Taliban use of "hunter" against American soldiers, with shooting for video propaganda of attacks	186	51.0%	119	32.6%	60	16.4%
Bus attacks (fire), coordinated by the organized crime, in retaliation for police action	227	62.2%	136	37.3%	2	0.5%
Attacks on buses (fire), coordinated by social movements, in retaliation for the political situation	220	60.3%	139	38.1%	6	1.6%
Invasion/destruction of productive rural properties by social movements of fight for the agrarian reform	100	27.4%	255	69.9%	10	2.7%
Illegal banning of roads and toll collection under threat, made by indigenous people	53	14.5%	305	83.6%	7	1.9%
School Attack in Realengo (2011) for revenge on bullying suffered as a student	80	21.9%	278	76.2%	7	1.9%
"Black Bloc" attacks against the police force or public patrimony during social demonstrations	136	37.3%	223	61.1%	6	1.6%
Attack by bomb-laden drones of the Islamic State against the American military base in Afghanistan	195	53.4%	110	30.1%	60	16.4%
Cyber invasion and disclosure of confidential government data aimed at political destabilization	158	43.3%	203	55.6%	4	1.1%

Source: The author (2018).

Between 50 and 60% of the sample understands that three of the situations presented should be considered as terrorism: systematic murder/kidnapping of politicians/judges by drug trafficking groups; the bomb-laden drone attack by the Islamic State against a US military base in Afghanistan and the Taliban use of a "hunter" against American soldiers with footage to publicize the attacks.

The first of these indicates that, in the opinion of the sample, there is no automatic relationship between terrorism and politics, a fact that differs from what has been mostly observed among the 109 scholars investigated by Schmid and Jongman (2005, p.5-6). The possibility of

narcoterrorism as an actor of violence has also not been clarified. Undoubtedly, there may have been influence between these two associations, which indicates the need for new studies that can independently evaluate these variables.

The Islamic State bomb-drones attack on the US military base in Afghanistan and the Taliban's use of a "hunter" against American soldiers, with footage for propaganda of the attacks were classified as terrorism by 53.4% and 51.0% of the sample, respectively. In addition to not forming a clear majority opinion, these events highlighted a relatively significant sample result - when compared to other situations - that would not classify them as crimes. This view may come from the understanding that the Taliban and the Islamic state are contenders for a war against the United States.

In these acts, the result was also inconclusive for the debate as to the possibility of terrorism against military targets or the analysis of the use of modern means, such as drones, in attacks.

The cyberattack, even for political purposes, showed a low tendency to be described as terrorism, since only 43.3% of the sample classified it as such. Evaluating one of the items of the subsequent question, which investigated textual elements for the conceptualization of the phenomenon, we find that 69.9% of the respondent captains understand the use of violence/ force as mandatory. So, this perception may have an influence on the de-characterization of cyberterrorism.

With 37.3% of the sample reporting "Black Bloc" attacks against the police force or public assets during social demonstrations as terrorist acts, it seems that this type of more systematic, premeditated and violent force resistance must not be understood as terrorism.

This opinion may be related to the target of the attacks, pre-positioned military forces, and with specific employment for this type of action, ie there is no characterization of the "surprise" effect. It is noteworthy that, with the increase of violence by some groups, the disproportionality of the attack can generate this effect, since the troops are willing, in these events, to control low-intensity disturbances.

The invasion / destruction of productive rural properties by social movements fighting for agrarian reform was described as terrorism by 27.4% of the respondents. Despite the low percentage, we still observe a relevant part of the captains that associates some more violent tactics employed by groups with ideology linked to the struggles for agrarian reform.

The massacre at the School in Realengo-RJ was defined as a terrorist act by 21.9% of the sample group. This event, of a wide national repercussion, despite having great similarity with events occurred in the United States classified as terrorism by the media, presented a low tendency to integrate the list of terrorist attacks. The motivation appears to be one of the foundations of this sample perception, since the perpetrator, in spite of having premeditated the action, had no direct link with any group self-proclaimed as terrorist.

Finally, the illegal interdiction of roads and toll collection under threat, made by indigenous people, was defined as terrorist by 14.5% of the sample, consisting of the situation, among the ones presented in the questionnaire, with a lower percentage in this sense. It can be inferred that the absence of premeditated violence, as the next item evaluated as essential for the characterization of the phenomenon, may have contributed to this understanding of the respondents.

In the subsequent question, the objective assessment of the assumptions considered mandatory in a characterization of a terrorist attack obtained the results described in the following table:

Table 2 - Sample opinion about the mandatory assumptions for the characterization of a terrorist attack

Assumptions	Frequency (*fi*)	% of *n*
Political motivation (direct or indirect)	177	48.5%
Use of Violence/force	253	69.3%
Perpetrated only against people	38	10.4%
Advertising/media purpose	191	52.3%
Premeditated Action	228	62.5%
Perpetrated against the State	54	14.8%
Perpetrated only by non-state groups	52	14.2%
Perpetrated only against non-military targets	75	20.5%

Source: The author (2018).

From the results obtained, it can be deduced that the sample opinion is less determinant, as to the association of political motivation for the conceptualization of terrorism, when compared with the perception of 109 researchers evaluated in the Schmid and Jongman study (2005, p. 5-6). While in the study referenced the terms violence/strength were found in 83.5% of the definitions of scholars, in the present study 69.3% of the respondents presented this understanding.

Besides the violence/force, which obtained the highest percentage indication, the premeditated action and the media/advertising purpose were the other textual elements described, by the majority of the sample, as obligatory for the characterization of the phenomenon studied.

Political motivation, which in the study of Schmid and Jongman (2005, pp. 5-6) presented a frequency of 65.0% in the conceptions of academics, reached the 48.5% of the opinion of the captains interviewed in this study. This fact, confronted with the sensorial observations perceived during the interviews, indicates an automated association of terrorism with the religious "wave" (RAPOPORT, 2002), a major media focus today.

The other assumptions obtained acceptance of low relevance for the definition in vogue, indicating the possibility of being considered terrorism: attacks against military targets, perpetrated by the State, perpetrated against other targets distinct from the State or people.

In this sense, it can be inferred, in a synthetic and merely illustrative way, that for the intermediate officers, terrorism can be described as violent action, with the use of premeditated force, with media/publicity purposes and with a tendency to have political motivation, without distinction of the target, with respect to persons, patrimony or symbols, as well as without limitation of the perpetrator, not differing if executed by the State or non-state groups.

In the last item of the questionnaire, the probability analysis of terrorist attacks was evaluated based on some predetermined scenarios. It should be noted that the initial recommendation, while conducting the instrument, requested that the sample followed the

sequence of questions. This was done to avoid that this last question could influence in the previous ones. This item obtained the perception described in Table 3.

Table 3 - Perception of the sample as to the probability of a terrorist attack occurring from simulated scenarios

Scenarios	Improbable		Somewhat improbable		Probable		Very Probable	
	Frequency (*fi*)/% of *n*							
Attack against the troop in Peace Operations under the aegis of the UN, in the African continent, in a country with active and structured terrorist groups	17	4.7%	134	36.7%	167	45.8%	47	12.9%
Systematic attack of drug trafficking groups against state troops or symbols	24	6.6%	106	29.0%	161	44.1%	74	20.3%
Attacks of social movements in search of destabilization of political power	14	3.8%	57	15.6%	164	44.9%	130	35.6%

Source: The author (2018).

From these data, it is inferred that, in the perception of the sample, the majority considers a terrorist attack as probable or very probable in the three presented situations. It is noteworthy that, among these, the "attacks of social movements aiming at the destabilization of political power" presented the highest probability of occurrence. Explanation for this result may be due to the similar history that occurred in the 1960s and 1970s in South America (SUAREZ, 2012, page 384), as well as the particularity of the political situation experienced by Brazil in the last decade - marked by successive political crises followed by escalating social protests.

3.2 Tactical legacies in priority tasks

Among the tasks developed in preparation for counterterrorism operations in Major Events, Anti-aircraft Defense, Chemical, Biological, Radiological and Nuclear Defense (Def CBRN) and the use of Special Operations Hunters stand out for the specificity of the activities.

In the face of the recent terrorist attacks, these three tasks have shown great tactical evolution and military employment materials. As a result of this relevance, there is a growing volume of research on these issues in the EsAO, besides the acquisition of equipment and the accomplishment of exchanges inherent in the tasks.

The interviews with experts were elaborated in a structured way, based on similar basic questions for all. It should be noted that the analysis of the areas focused on Capacity-Based Planning, a basis currently adopted by the EB to oppose a scenario of uncertainties.

Capacity is understood as the ability of a force to fulfill a particular mission or task and is acquired through determining factors that together form the acronym DOTMEPI (Doctrine, Organization, Training, Material, Education and Infrastructure):

> [...] a) Doctrine - this factor is the basis for the others, being materialized in doctrinal products. For example, the capacity generation of a Unit begins by formulating its Doctrinal Base, which considers the range of missions, activities, and tasks that this Unit will accomplish.
>
> b) Organization (and Processes) - it is expressed through the Organizational Structure of F Ter's employment elements. Some capabilities are gained by processes, to avoid redundant competencies when these have already been covered in other structures.
>
> c) Training - comprises the preparation activities, following specific programs and cycles, including the use of simulation in all its modalities: virtual, constructive and living.
>
> d) Material - comprises all the materials and systems for use in the F Ter, following the evolution of military employment technologies and based on technological prospection. It is expressed by the Material Distribution Table of the employment elements and includes the needs arising from the permanence and sustenance of the functionalities of these materials and systems throughout their life cycle (permanence in the inventory of F Ter).
>
> e) Education - comprises all continuing formal and non-formal training activities aimed at the development of the F Ter member as to their required individual competence. This competence should be understood as the ability to mobilize, at the same time and in an interrelated way, knowledge, skills, attitudes, values and experiences, to decide and act in different situations. Among these competences, we highlight the development of Military Leadership, a fundamental factor in the generation of capabilities.
>
> f) Personnel - covers all activities related to the force members, in the following functionalities: career plan, movement, endowment and filling of positions, military service, physical health, evaluation, professional and moral valorization. It is a systemic approach toward capacity building that considers all actions related to the planning, organization, direction, control and coordination of the competencies necessary for the human dimension of the Force.
>
> g) Infrastructure - encompasses all structural elements (physical facilities, equipment and necessary services) that support the use and preparation of the employment elements, according to their specificity and fulfillment of functional exercise requirements (BRASIL, 2014, p.3-3, our translation).

Thus, the respondent was asked to synthesize, based on the determining factors, which tactical evolutions stood out during the period of preparation for the Mega Events. In addition, respondents should identify any adaptation needs for the tasks in prospective counterterrorism

scenarios. To facilitate the understanding and organization of ideas, the subjects were subdivided as follows.

3.2.1 Air Defense

The air defense activity has become indispensable in view of the new threats, since the attacks of September 11, 2001 have an undisputed role in this relevance. Thus, the inherent magnitude of the mega events based in Brazil required an increase in capacities in this area.

The apparatus for the event itself, as well as other sensitive points - hotels, water treatment plants, power substations, TV broadcasting towers, expressways, among others - tend to become attractive to terrorist media exploitation. Added to this, the increase in violent actions with the use of drones and small aircrafts motivated an evolution of the defense against air vectors.

In this sense, the Brazilian Army, through the Strategic Anti-Air Defense Project, acquired new products, notably the MK2 missiles of the Swedish RBS 70 Weapons Systems, and the German-made Gepard 1A2. Regarding the organization, the 1st Antiaircraft Artillery Brigade, responsible for the coordination, employed its subordinate Antiaircraft Artillery Groups, as well as organic Antiaircraft Artillery Batteries of the EB Cavalry and Infantry Brigades (PIRES, 2017).

Besides these two Weapon Systems, the EB troops were already equipped with the IGLA-S missile and, regarding this weaponry, a specialist points out that the preparation period for the Mega Events was of fundamental importance for the training and improvement of the doctrine. These objectives were achieved, according to the interviewee, thanks to the execution of several drills, with deployments and shooting executions, provided by the priority given to this theme.

Regarding the combined use of the RBS 70 and Gepard 1A2 systems at the Olympic Games, Pires (2017) concludes on the great influence of the proximity of urban areas on the positioning of weapon systems, as well as a subsequent reduction of firing sectors. The difficulty in areas available for the deployment led to the positioning of weapons on ground elevations of the Military Village area, unlike what was done at the London Olympics and the 2014 FIFA World Cup, when systems were deployed high above residential buildings.

Also according to a study by Pires (2017), the integrated use of Gepard Systems 1A2 and RBS 70 is recommended, in two lines of defense, marked by concentric circles, being the first best used near the points to be defended, due to its high rate of fire, while the second can have its optimal use being positioned in the "peripheries", ensuring the threat's engagement as far as possible.

Among the interviewees' considerations, it is important to highlight the assessment as currently "non-existent" about an Air Defense structure to counter terrorist attacks against troops in Peacekeeping Operations under the aegis of the UN. About this, one of the specialists emphasizes the need for studies and the effective use of tools that address the asymmetric threats typical of terrorism, such as small drones with explosives.

Corroborating this need for evolution, some experts suggest the adoption of specific Air Defense modules for Peace Operations and Law and Order Guarantee Operations. However,

another expert understands that Air Defense should be sized by the air threat rather than the type of operation, given the range of possibilities, which may vary from drones to rockets, such as those employed by Hezbollah.

The interviewees also reiterate that the action must be systemic, with the integration of the means of communications, control and alert and the system of weapons and logistics. The failure or absence of either one implies the collapse of the entire defense system.

3.2.2 Chemical, Biological, Radiological and Nuclear Defense (Def CBRN)

The relevance of Def CBRN was highlighted by the study of Aghlani and Unal (2016, p. 3), which quantified the attacks that occurred from 1970 to 2014, reaching a total of 143 episodes, being 35 biological, 95 chemical and 13 radiological.

Since assuming an autonomous structure in 1987 - in the context of the employment of 70 military personnel in the cesium 137 accident in Goiania, EB's Def CBNR has evolved sharply. Exercises at the Angra I and II nuclear plants, international exchanges, and the monitoring and preventive decontamination of material and troops carrying out peacekeeping missions in Haiti became part of the routine of the Def QBNR subunit (VASCONCELOS, 2018, p. 43-44).

In line with skills development, technological updating, and undoubtedly influenced by the preparation for the Mega Events, the Brazilian Army acquired a range of state-of-the-art military employment materials, such as protective equipment (gas masks and protective clothing), identification of agents (conventional and electronic detectors) and decontamination (decontamination shelters and decontaminating applicators), as well as specialized CBRN vehicles and mobile laboratories for analysis of agents collected in the field (DIRETORIA..., 2015).

As a result of doctrinal evolution and staff training, EB was, in 2015, the only Armed Force in Latin America certified by the International Organization for the Prohibition of Chemical Weapons (DIRETORIA, 2015). For the 2016 Olympic Games, the Brazilian Armed Forces, in conjunction with other public security agencies, deployed approximately 1,200 officers to work in that area (SEMINÁRIO..., 2015).

According to the expert interviewed, doctrinal updating through the use of FAMES characteristics - flexibility, adaptability, modularity, elasticity and sustainability (GUIMARÃES; SILVA, 2015), by both combat and support personnel, allowed the adoption of tactic protocols between different interagency vectors.

The interviewed expert indicated that the exchange of knowledge and the adoption of procedures with other national agencies was essential for the evolution of Def CBRN capacity, especially regarding staff training. This feature is crucial for the tactical fractions to take advantage of the possibilities of new defense products with increasingly effective technology aggregates.

Another highlight during the added transformation process was the improvement of the CBRN Command and Control System, ensuring a better situational awareness of the teams operating in the field, as well as the coordination of actions. Colonel Vasconcelos (2018, p. 45-51) points out the importance of implementing the command and control course, designed to optimize the strategic advice of the supported Great Commands. In the meantime, the use of a

monitoring system managed by the Army Technological Center favored the situational awareness on the part of the Operations Coordination Center.

The previous training of health modules in the specificities of a CBRN attack also deserves attention. By integrating emergency response teams, health agents contributed to the planning, installation and operation of the screening stations. They were therefore able to provide emergency medical care to exposed victims, working in total decontamination units (VASCONCELOS, 2018, p. 49-51).

It is also worth mentioning the lessons learned and legacies of the Mega Events presented by the current commander of the 1st Def CBRN Battalion:

> - the existence of a single coordinator for the actions was fundamental to the success of the mission;
> - the staff training should start as early as possible and be repeated as many times as possible;
> - Detailed reconnaissance of facilities should be done as soon as possible and repeated within two weeks before the event, so as to align procedures with the possible structural changes made by the organizing committee;
> - CBRN Defense protocols should be established well in advance to allow their dissemination and training among agencies, taking into account the peculiarities of the actions; and
> - Strategic mobility is fundamental for the use of the CBRN Defense fractions (VASCONCELOS, 2018, p. 51, our translation).

When asked about the effectiveness of the current structure of the EB facing possible threats, the expert considered it to be fully efficient for situations like the Mega Events and partially effective to face terrorist attacks by "lone wolves" during daily activities of the population. However, the interviewee believes that there are deficiencies in combating CBRN attacks perpetrated against troops in UN Peacekeeping Operations, in communities ruled by organized crime in the national territory or even in large social manifestations.

Concluding the formulation of questions, when asked about the adaptations and evolutions to face future threats, the interviewee made two suggestions:

> a. Establishment of a specialized team within the Def CBRN System, in the framework of the EB, in conformity with NATO - SIBCRA Team, focused on complex and forensic capacity tasks;
>
> b. Expansion of training for the organic troops of Unit and Large Unit levels, so that they can survive, operate and carry out CBRN Def activities in their respective areas of responsibility, distinguishing basic, intermediate and advanced levels of action. Likewise, there should be teams, specialized in these levels, composing the Peace Missions to which the country is involved in sending troops.

3.2.3 Special Operations Hunters

Due to their diffuse nature, preventing and combating terrorism requires the use of specialized troops to act in sensitive and hostile environments. Thus, military personnel trained in Special Operations are an important tool in this process. Under Land Force, Special Operations are defined as:

> Operations conducted by specially organized, trained and equipped military forces in hostile, denied or politically sensitive environments to achieve military, political, informational and / or economic objectives by employing specific military training not found in conventional forces. These operations often require covered, covert or low-visibility capabilities. They may be conducted independently or in conjunction with operations by conventional forces and/or other government agencies, and may include native irregular forces as well as the forces of FOpEsp (Special Operations Forces) from allied nations (BRASIL, 2017, p. 1-2, our translation).

In Brazil, the Special Operations Command is the Large Unit responsible for conducting Special Operations. Its organizational structure includes, among its basic employment fractions, the Hunters' Teams. In the context of the Prevention and Fight against Terrorism, hunter teams are dedicated to executing the compromise shot and updating situational awareness. In addition to precision long-range target engagement, the "hunter doctrine" allows the human-material set to infiltrate, select targets, and adjust to conditions encountered, within the expected response.

On this subject, two specialists who participated in various events were interviewed, after having performed the function of instructor of the "hunter system". One of the respondents highlighted, among the major developments in training personnel in preparation for the Mega Events, the internal leveling of Army and Navy personnel in 2012, and interagency training, including various federal and police officers from different states, occurred in 2013. The military respondent also highlighted the acquisition of new products, such as the MSR (.300, .308 and .3380) multi calibre rifle and optronic weapons, which, in his view, provided an operational gain for techniques, tactics and procedures. in this capacity.

Still on the main evolutions, another expert pointed out the change in the composition of the team that traditionally acted with two elements - the Hunter, responsible for the precision shooting and the Observer, more experienced military, responsible for direct assistance to the shooter - beginning to work with four military fellows, including a Communications Assistant, responsible for transmitting data and operating the team's various organic media and another one in Health sector, responsible for the security of the position and for providing first aid to team members, if necessary. In Mega Events, due to the existence of dispersed teams in the same event, a military man was employed as Controller, whose main tasks were to coordinate the teams and intermediate their contact with the upper echelon.

The use of special operations hunters also provided better situational awareness on the upper echelons. Real-time transmission of images and data through a modern and secure

communication channel optimizes the Crisis Cabinet's positive threat identification process, as well as facilitating more effective decision-making.

Both respondents consider the current structure of EB's "Special Operations Hunter doctrine" partially effective for operations similar to the Mega Events and in support of troops in the case of terrorist threats, while participating in Peace Missions. For effectiveness, experts suggest the use of drones that can transmit high-definition images directly to the hunter team, to enable proper target identification and support during actions.

Finally, one of the specialists emphasizes staff training through the regulation of instructions and the establishment of a specific instruction center, which could prepare and differentiate the various types of hunters, depending on the type of mission they are assigned to.

4 Final considerations

Regarding the study questions and objectives proposed at the beginning of this paper, we conclude that the present investigation broadened the understanding of tactical level combatant officers' opinion about the phenomenon of terrorism, as well as investigating expert perceptions of areas considered relevant in counterterrorism.

Initially, the literature review highlighted the difficulty in standardizing a global definition for terrorism, due to politicized interpretations, dependent on the sociocultural context. Nevertheless, there is international consensus on the rejection of the phenomenon, and this has resulted in a change in the security agenda of several states, including Brazil, which, in the beginning of this century, attracted attention from all over the planet, hosting the largest events in the world.

Despite widespread discussions throughout society and even the enactment of the Anti-Terrorism Act (BRASIL, 2016a), the compilation of data obtained from the questionnaire presented a conceptual divergence, even in a homogeneous group consisting of intermediate Ground Force officers.

The judgment of predefined situations, by this same sample, pointed out that only the World Trade Center Attack has a clear classification as terrorism. Among the others, attacks (fire) on buses, perpetrated by social movements or organized crime, were included in this phenomenon by most respondents. Actions by non-state groups such as "Islamic State" and "Taliban" against North-American forces, regardless of the means employed, were perceived similarly, although a significant portion deemed these events to be "non-crime," probably because they understood it is a conflict between contenders at war.

Interpreting and summarizing the views of the respondent captains, terrorism can be described as a violent action, with the use of premeditated force, with media/advertising purpose and with a tendency to have political motivation, with no distinction of the target, regarding people, patrimony or symbols, and without limitation of the perpetrating agent either, making no difference if executed by the State or non-state groups.

Regarding the projection of scenarios, a significant portion of the sample understands that terrorist attacks against Brazilian troops are likely to occur, when participating in missions

in countries with terrorist groups. In the national territory, the opinion also indicates a probable act coordinated by the organized crime or coming from social movements. The latter presented a percentage higher in understanding than the others, possibly influenced by the troubled political landscape.

Actively participating in various phases of counterterrorism throughout the Mega Events, the Ground Force has made remarkable progress, especially at the tactical level. Some capabilities of EB have a prominent role in counterterrorism - air defense, chemical, biological, radiological and nuclear defense, special operations hunters and cyber protection. The latter, due to its imminently strategic-political character, was not the object of this study.

Assessing, through expert interviews, developments during the preparation period for the Mega Events, as well as the perception of needs to meet future challenges, this study concludes on the relevance of knowledge exchange with other agencies and foreign forces in the qualification of the personnel and even in the adequacy of techniques.

The acquisition of new defense products undoubtedly revolutionized Brazilian tactics, but military specialization and organizational reformulation played a major role in tactical effectiveness. Modularity tends to be an interesting solution in the composition of troops to deal with new threats, whether under Internal Security or under the aegis of the UN. Thus, systems that facilitate interoperability should be a priority.

Drones are considered as a tool to be explored for future tactical evolutions. Whether to increase observation capability or even as a projection of force by a weapon system, remotely piloted air systems tend to be a differential in relative combat power against terrorist threats. In this sense, further studies on this subject are recommended, particularly integrating engineers and combatants of the tactical level, in order to subsidize relevant projects for the terror combat.

Finally, this article highlights to the EB decision-making echelon, a feedback on the investments made in priority tasks during the Mega Events. From the perspective of tactical commanders, system integration, driven by the acquisition of Mk2 missiles, and exercises on separate areas, such as Vila Militar and Maracanã, contributed to a tactical evolution of Air Defense. With regard to Def CBRN, the captains emphasize the incorporation of protocols and the gains in expertise with interagency performance. For special operations hunters, intensified training and exchanges have provided extremely useful experiences for tactical evolution throughout this decade of events.

Therefore, the relevance of the Mega Events in the doctrinal evolution of the Brazilian Army is concluded and, despite the necessary changes to face new terrorist threats, in the national territory or projecting force under the aegis of international organizations, the Ground Force is in an advanced stage of preparation, regarding the determining factors to achieve counterterrorism capacity.

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ECEME

ARTICLE DOI 10.22491/cmm.a008

Geoeconomics and development: the II PND as a strategic vector of national autonomy

Geoeconomía y desarrollo: el II PND como vector estratégico de la autonomía nacional

Abstract: In this work we will present the Geisel government's attempt to relaunch a broad development program with profound structural changes in the national economy, the Second National Development Plan (II PND). We hypothesize that the plan main goal was to better position the country in the competitive international geo-economic order. For that, two objectives are presented. The first is to analyze the "development" theme, which has been re-read and adapted since the Costa e Silva government, since the DSN (National Security Doctrine) needed to be updated to the world and national conjuncture of the 1970s. is to show that, in order to achieve the ambitious Plan, Geisel has adopted an autonomous foreign policy in order to represent national interests in accordance with development goals. Thus, the article is divided into two sections, in addition to an introduction and conclusion: in the first, we present the international context; in the second, we analyze the II PND in detail and its strategic developments.

Keywords: Development. Geoeconomics. Autonomy.

Resumen: En este trabajo presentaremos el intento del gobierno de Geisel de relanzar un amplio programa de desarrollo con profundos cambios estructurales en la economía nacional, el II Plan Nacional de Desarrollo (II PND). Se plantea la hipótesis de que el objetivo principal del plan era posicionar mejor al país en el competitivo orden geoeconómico internacional. Con este fin, se presentan dos objetivos. El primero es analizar el tema del "desarrollo", que fue, desde el gobierno de Costa e Silva, releído y adaptado, porque la DSN (Doctrina de Seguridad Nacional) necesitaba ser actualizada al marco coyuntural mundial y nacional de la década de 1970. El segundo es mostrar que, para lograr el ambicioso Plan, Geisel utilizó una política exterior autónoma para representar los intereses nacionales de acuerdo con los objetivos de desarrollo. Así, el artículo se divide en dos secciones, además de una introducción y una conclusión: en la primera, hacemos una presentación de la situación internacional; en la segunda, analizamos el II PND en detalle y sus desarrollos estratégicos.

Palabras clave: Desarrollo. Geoeconomía. Autonomía.

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Received: Dez. 7, 2018
Accepted: Abr 26, 2019

COLEÇÃO MEIRA MATTOS
ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

1 Introduction

> [...] Politics, nation and war are essential elements of all and any economic calculation, insofar as, for him [List], the production and distribution of world wealth is a negative sum game where there is and there will be always place for very few powerful national states. (FIORI, p. 21, 1999, our translation)

The elements mentioned in the epigraph, by Fiori (1999), are fundamental for a better understanding of power relations in the history of nations. These are the elements that led Geisel to strategically see the development process, and within the geopolitical and geoeconomic reading of the country's most developmental and modernizing military (CERVO, 2008). The 1970s and 1980s international economic and geopolitical conjuncture was relentless with Third World "developmentalist projects" (FIORI, 2004) and, as a result, Geisel's autonomous development project was heavily criticized and eventually dismantled in the 1980s and, especially, in the 1990s.

In this study, we aim to analyze how the II National Development Plan was used as a tool to expand national power and respond to geoeconomic challenges. For some time, the military – as one can see in the "Young Turks" and the tenentism movements, as well as in the National Security Doctrine (DSN) of the Superior School of War (ESG) – had been thinking on how they could contribute to modernizing the Brazilian state and, therefore, its productive structure. It is within this perspective that, with the civil-military regime of 1964-85, the military implements a development strategy linked to the project of transforming Brazil into a world power – this is known as "Brazil Power".

Notwithstanding the military's decisive contribution to national developmentalism, it should be noted that experiments in this field were initially carried out by Getúlio Vargas (1930-45, 1951-1954), Juscelino Kubitschek (1956-1961) and João Goulart (1961- 1964). These presidents were of paramount importance for national developmentalism to become a relevant ideological tool for national structural change[1], and undoubtedly to influence the economic policy pursued by military governments.

Our work will be divided into two sections, the first of which will be a presentation of the international conjuncture and the geopolitical constraints of the global political and economic order. In this first section, we will look at how the United States intervened in the international economic system to benefit and constrain the autonomy of competing countries, as well as a brief analysis of the economic and geopolitical conjuncture of the time. The second section will be an analysis of the II PND and its unfolding regarding the national autonomous development strategy. In this section, the largest and most important part, we will delve further into the formulation process and key initiatives of the Plan and will unfold it into two subtopics,

1 We understand the term "structural change" from Syrquin's (2008) contribution, that is, a change in the productive structure, in economic aggregates, an important role for industry and the urbanization process.

namely "geoeconomics and military developmentalism" and "the II PND in detail". Finally, the conclusion shall be a synthesis of the aforementioned subjects.

2 International conjuncture and geopolitical constraints

Before addressing the Geisel government's development plan, a brief introduction about the global economic and geopolitical conjuncture is required, so that we can better understand internal and external influences on the government's decision-making process.

According to Fiori, from 1945 to 1973 the global political and economic system was under the "benevolent hegemony" of the United States and a quest for "global governance" with supranational institutions such as the UN and the Bretton Woods institutions: the World Bank (WB) and the International Monetary Fund (IMF) (FIORI, 2004). The Agreement provided for the organization and regulation of the world economic system by the creation of the above-mentioned multilateral institutions, with the IMF operating to adjust the imbalance of payments of the signatory countries and the WB would be a reconstruction and development bank (BARRETO, 2009).

The world economy was organized, shortly after World War II, to combat the flattened alternative of Soviet socialism and to benefit capitalist expansion throughout the world, especially in Western countries. The western leadership fell to the United States that imposed its currency, the dollar, as an international reference (KILSZTAJN, 1989) and, according to Serrano, "... defeated the whole of Western Europe for good. It was over this initial position of particularly asymmetrical US power that the post-war international financial and monetary order was built" (SERRANO, 2004, p. 182, our translation). Also according to this author, there was the proposal of three Bretton Woods: the Keynesian [Bretton Woods], which he calls "utopian"; the rules that were approved in the Agreement itself; and the manner in which the United States actually administered the system – which would be the winning proposal (SERRANO, 2004).

However, the global economic system underwent a "geopolitical adjustment" in 1947, which meant a widespread US effort to combat the Soviet threat and change the 1945 agreement. This effort can be summed up as stimulating, through loans, investments and donations to Western Allied countries, their reconstruction and economic restructuring. This period of economic abundance became known as the "golden age of Keynesianism" (SERRANO, 2004).

Global economic system and geopolitics go hand in hand, so much that one cannot understand one without looking at the other. An example of this is the 1970s events, witnessed in the Vietnam War – the United States' defeat to the poor, socialist Asian country – and the abandonment of the Bretton Woods Agreement by the US superpower, which now embraces the flexible dollar and acts to deregulate the financial system. This movement, which was the beginning of what Conceição Tavares called "strong dollar diplomacy," was based on framing Japan and Germany – economies with great competitive capacity – and retaking world economic hegemony, which will be seen more intensely from 1979, when the Federal Reserve (FED) President Paul Volcker will raise the US interest rate, generating a profound global economic crisis with a major impact on peripheral countries such as Brazil (TAVARES, 1985). If this US hegemonic resumption

movement were not enough, the two oil shocks (1973 and 1979) contributed to destabilizing the balance of payments of most Third World countries, including Brazil.

Thus, one can see the rather delicate and unstable scenario in which the Geisel government will be inserted. There was, at this geoeconomic juncture, an international movement for changes in the international political and economic order, of which Brazil was a part. Many countries called for a New International Economic Order (NOEI) that contemplated underdeveloped peoples and assisted in their material development process. Thus:

> This process began with the success of OPEC's strategy on rising oil prices, which in turn spurred the emergence of the Group of 77 and its proposal, approved by the Sixth Special Session of the United Nations General Assembly in 1974, in favor of the creation of a New International Economic Order, which included (...) defending the right of developing countries to: 1) create producer associations; 2) link the prices of their export products to the price movement of industrial products imported from developed countries; 3) nationalize companies linked to the exercise of sovereignty over their natural resources; 4) define their own rules for the operation of multinationals in their territories. Added to this agenda is the defense of the urgent need to re-discuss the tariff system and the international monetary system itself. (FIORI, 1999, p. 78, our translation)

Faced with this movement for more autonomy, the United States reacted energetically by framing the developmentalist projects of various Third World nations, including Brazil. The strategy was spelled out by various US government analysts and provided for the co-optation of national elites and the use of monetary and financial mechanisms to constrain autonomous development plans (FIORI, 1999).

Next, we will analyze the II PND, implemented by the government of President Ernesto Geisel as an attempt to deepen Brazilian industrialization and give productive strength to the country. One should be able to see how this initiative was the spearhead of a geoeconomic strategy for Brazil's project of transformation into a global power.

3 The II National Development Plan as an instrument to overcome dependency and as support of a power project

3.1 Geoeconomics and military developmentalism

The strategic use of Economics as a tool to achieve geopolitical ends is historical; many powers have done and still do so. Sanctions, blockages, counterpart loans and many other ways of using economic power as a weapon are present in the methods of most powerful nations. According to Blackwill and Harris (2016), this is "geoeconomics", i.e., the use of economics for geopolitical purposes. The Indian Sanjaya Baru (2012, p. 47, our translation) defines Geoeconomics in two ways: "as the relationship between economic policy and changes in national power and geopolitics" and "the economic consequences of trends in geopolitics and national power". The author

advocates a thesis that the intellectual roots of geoeconomics come from mercantilism. In this sense, the II PND conforms to a strategy in which the Brazilian government uses a variety of economic instruments, such as industrial policy, increased public spending, increased investment, among others, with a very clear objective: to transform the country into a competitive power in the international system.

To analyze the development strategy of the Geisel administration, we see great relevance in investigating and understanding the II PND and its structural developments in the national productive system. Thus, some questions arise as guidelines for our research and analysis: i) what were the government's motivations for launching the II PND, since the recommendation was for fiscal adjustment and recession, as the developed world did?; ii) Is there a rationale behind the Plan, or was it only the result of nationalism within the "Brazil Power" military thinking? Another important question: Is the II PND the result of a modernizing mentality or a response to the end of the 1973 "economic miracle", the need for legitimizing regime support through economic growth?

Our analysis relies on a political approach to the issue of development by the "modernizing" and developmentalist military. This does not mean we will neglect the relevant economic aspects of the II PND; our intention, however, is to clarify the country's modernization strategy via the authoritarian military developmentalism that had been nurtured from the "Young Turks" movement, passing through tenentism, to Góes Monteiro's "Army Policy[2]" and the DSN of ESG – without neglecting the influence of civil developmentalist experiences –, the value given to Brazilian modernization and the project of transforming Brazil into a world power (BARCELLOS, 2016).

It is important we do not to lose sight of the fact that our research is aimed at the geoeconomic and geopolitical analysis of development during the Geisel administration, which, from this reading, tried to build a "Great Strategy"[3] for the country's change of scope in the capitalist interstate system.[4] We seek a interpretation of the period slightly different from other military governments; we understand the Geisel government aimed, through its national development project, to deepen the ideal of "Brazil Great Power" through an autonomous foreign policy, a defense and security policy less involved in internal repression and more concerned with the construction of material capacities (military-industrial complex and nuclear issue), and an ambitious autonomous economic development project, which aimed to transform the national productive structure – the II PND.

We understand there are elements of continuity of the "army policy" and authoritarian modernization in the II PND, but we believe the conjunctural, geoeconomic and geopolitical aspects also had considerable influence over the interpretation and implementation of a security and development agenda in the period that was different from the previous ones.

2 Phrase attributed to Góes Monteiro, who, in general terms, aimed not to subject the Army to the common political game, but rather the opposite, given the inability of society at that time to lead the modernization of the country (TREVISAN, 1985).

3 For "Great Strategy" we use the concept of Parmar (2012), which would be the State use of political, military, and economic means and ends, in times of peace and war, to safeguard national interests and development.

4 As for this approach to the system of states that interact among themselves according to wealth and power, we use Fiori (2015).

In fact, there was a clear and ambitious power project by the developmental military (FIORI, 2015), which included a substantial change in the Brazilian position in the global geopolitical and geoeconomic environment. There is a relationship between the conjuncture (oil crisis, Cold War, etc.) and the structure (economic and technological dependence, underdevelopment, military weakness and vulnerability, etc.) that condition our analysis. From the point of view of a more 'long-term' perception, for example, the military thinking[5] carries within itself a clear intention of national modernization and world grandeur, which, by inserting itself in the conjuncture reality, transforms and adapts this intention in order to shape development and security policies.

Sometimes, the conjunctural factor arouses and deepens structural intentions, as seems to be the case of the oil energy crisis and the proposal of the II PND. The need or concern for economic dynamism has been present in military thinking at least since the coup of the Republic in 1889 and manifested itself most strongly in the DSN, but it lacked the momentum or the appropriate conjuncture to "radicalize" certain postures, such as the opportunity that came with the 1964 coup. However, while on the one hand the conjuncture may awaken certain national forces in the country to change directions – as in the case of the oil crisis, the nuclear agreement with West Germany, the diplomatic crisis with Jimmy Carter and the denunciation of the military agreement with the US –, on the other it can also awaken or deepen the action of great powers to pursue more aggressive policies that are asymmetric in nature or to frame the others, as in the case of the increased US interest rate, constraining the economic policy of competing countries in the First and Third World.

In the next section, we will investigate the fundamental role played by the II PND as the last major national effort for structural change in Brazil. Some aspects of the plan's decision-making process will be analyzed, such as the characters directly involved – President Geisel and his ministers João Paulo dos Reis Veloso, Mario Henrique Simonsen, and Severo Gomes. Another key aspect to be investigated will be the role of the state and its development-promoting institutions, such as the Brazilian Development Bank (BNDES).

3.2 The last major plan of structural change in the Brazilian economy: economy as an instrument of power and the II PND decision-making process

The unfavorable global economic environment contributed to the Geisel government decisions. However, if the general-president had followed the conjunctural influences and listened to some of the most important economic advisers, such as Mario Henrique Simonsen, he should have chosen to implement a recessive, non-expansive economic policy, not such as his own. However, the orthodox Simonsen was not the protagonist of the economic plan, and Geisel concentrated decision-making power on himself, as Mantega shows us:

5 By "military thinking" we mean here the political, economic, cultural and social elements that made up and organized the military's view of Brazil and the world. For more academic density we use the contributions of Leonardo Trevisan (*The Brazilian Military Thought*), Eliézer R. de Oliveira (*Military: Political Thought and Action*), José L. Fiori (*History, Strategy and Development*) and Oliveiros Ferreira (*Elos Partidos: a new view of military power in Brazil*).

> Geisel would make one of the most interventionist governments in the military cycle, responding to the recessionary scenario that was forming on the international horizon by maintaining high investment rates. He reacted to the neoliberal winds, which were blowing very strongly from the most advanced countries towards the Latin American continent, with a strictly developmentalist economic program, which only expanded the already considerable participation of the Brazilian state in the economy. From day one of his administration, he shifted the axis of economic policy to Planning, reducing the power of the Treasury, and placed himself as commander and chief of the major decisions of this strategic area of Government, occupying the seat of President of the Economic Development Council (MANTEGA, 1997, p. 5, our translation).

Another important aspect of the Plan was that the decentralization of investments gave space to industrialists and national entrepreneurs in the sector of capital goods and basic inputs, which generated criticism from groups and sectors of the liberal press (MANTEGA, 1997).

The II PND should be seen as an instrument of structural transformation of the national economy, converging with the policy of "forced modernization", which has its identity anchored in the military and national developmentalist thinking of transformation of the country into a world power and a more modern nation as its main motto. Our hypothesis meets this interpretation and raises a question: was this thought of modernization structural in military thinking or did it stem from the current conjunctural reactions such as the oil shock? Our answers embrace both the structural and the conjunctural points.

In convergence with our thesis, Luciano Coutinho (1987) states that:

> During the Geisel period, foreign policy and certain elements of domestic economic policy were perceived as *strategic*, that is, long-term, irreducible nationals, defined in the light of a "grand national project". [...] Such project ("Brasil Grande") gained a very strong expression. In fact, much stronger and more autonomous than, for example, at any time in the past. (COUTINHO, 1987, p. 178, our translation).

The need to keep the pace of growth high, even in times of crisis, contributed to the quality jump in the national industrialization project. There was a need for a strategy of change in the Brazilian productive foundation, and the II PND is the exact unfolding of this perception (CASTRO; SOUZA, 1985). In this sense, its economic planning followed not only a political rationale, which was for long being gestated in the military thinking about national development, but also an economic rationale, as it was not only the result of a conjuncture but also of a need for deepening the Brazilian capitalism (FONSECA; MONTEIRO, 2007).

According to João Paulo dos Reis Velloso, Geisel's Planning Minister and one of the great supporters of the II PND, the government, despite criticism of experts favorable to the recessive adjustment, would have made a slow and gradual adjustment so as not to impact the public accounts. So much so that there was a reduction of growth from 14% to 6% in 1974. But most importantly, if the government had opted for deep adjustment, as many advocated, the

II PND would be unfeasible (VELLOSO, 1998). Geisel himself reinforces this view by stating that the recession would be very bad for the poor and would create a major social problem (D'ARAÚJO; CASTRO, 1997).

Therefore, given what Geisel understood about the 1967 recession, one can see that:

> There were evident signs of depletion of the pattern of durable goods accumulation. Against this background, the new 1974 government faced a serious dilemma. On the one hand, it would make a conservative adjustment, always along the lines suggested by the IMF, and promote that general recession of dubious effectiveness but infallible to erode any government. Or it could promote another type of adjustment that would allow further growth. The latter was the path followed by the Geisel Government with the II PND (MANTEGA, 1997, p. 32, our translation).

It should be emphasized that, in 1973, still as Médici's Minister of Planning, Reis Velloso had already made a survey with the IPEA about the limitations of the Brazilian productive structure and the depletion of import substitutions of durable and non-durable consumer goods. According to the minister, a development plan should be thought of, one that would make the country grow face the limitations imposed by the oil shock (VELLOSO, 1998).

Decisions about economic policy under the Geisel government were made by the president, who commanded the Economic Development Council (CDE), the economic advisory and planning body of the Presidency, created in 1974 (MANTEGA, 1997). According to Velloso, there was a weekly meeting to discuss the projects under the II PND and budget planning, which was attended by President Geisel; he, Reis Velloso, Minister of Planning; Mario Henrique Simonsen, Minister of Treasury, and other advisers such as the Minister of Industry and Commerce, Severo Gomes. Treasury took care of short-term issues such as inflation, monetary policy, etc., while the PND, the coordination of BNDES, Finep and CNPq policies were under the responsibility of Planning (VELLOSO, 1998). It is worth remembering that, during his military career, Geisel had held various administrative positions, mainly the head of Petrobras, which gave him competence and affinity with the economic and planning areas, and where he probably acquired a realistic view of the tough international economy competition between nations and their companies.

Geisel's economic planning team deserves a brief analysis, as there were clearly two trends, the most nationalistic and developmentalist, with Reis Velloso in the Ministry of Planning and Severo Gomes in Industry and Commerce and, on the other hand, in the Treasury office, Mario Henrique Simonsen, a liberal economist with restrictive and orthodox economic policy ideas (MANTEGA, 1997). Reis Velloso became a privileged minister, who met Geisel daily at the so-called "9 a.m. meeting," at which the President met with the Heads of the Civil House, Golbery do Couto e Silva, the National Information Service (SNI) and the Military Office to plan the daily agenda (MANTEGA, 1997).

The Minister of Planning, João Paulo dos Reis Velloso, had previously been Minister of the same office under the Medici government (1969-1974), but had been overshadowed by the almighty Delfim Neto, then Minister of Treasury. Reis Velloso made a career at Banco do Brasil (BB) and was a student of Mario Henrique Simonsen. He had the opportunity to graduate in the United States at Yale University, where he met James Tobin, who presented him with the Keynesian perspective of economics (MANTEGA, 1997). According to Mantega, before becoming an advocate of developmentalist ideas, Velloso swayed between Eugenio Gudin's monetarist view, CEPAL structuralism, and economic nationalism. Prior to becoming Minister of Planning for Medici and Geisel, Velloso was invited by Roberto Campos in 1964 to found what would become the Institute for Economic and Social Planning, later called the Institute for Applied Economic Research (IPEA) (MANTEGA, 1997).

Another important minister of the II PND was Severo Gomes, who at the Ministry of Industry and Commerce (MIC) sought at all costs to privilege domestic companies over foreign ones in the allocation of resources and tax benefits. This improvement occurred through Resolution No. 9 of the CDE, which provided that orders from state-owned companies should be placed with the national industry, and sought to increase the degree of nationalization of the components produced (SILVA, 2003).

Regarded as a businessman and a nationalist minister, Severo was critical of foreign investment and the indiscriminate arrival of foreign companies to underdeveloped countries (MALIN; COSTA, c2009). He will be disconnected from MIC following a public disagreement with the adviser to the French and Brazilian Bank Carlos Lousada, who accused him of being a "leftist minister," while Severo retorted calling him as a "fascist businessman." The case became more delicate as the minister himself publicly defended political openness (MALIN; COSTA, c2009).

Minister Mario Henrique Simonsen, a follower of a more orthodox and liberal line[6], was an adviser to Roberto Campos and one of the creators of the Government Action Plan (PAEG) during the Castelo Branco period. Prior to assuming the Ministry of Treasury, he taught at the FGV in Rio de Janeiro and published some economic theory books, including "*Inflation: Gradualism vs. Shock Treatment* " (1970) and "*The New Brazilian Economy"* (1974), along with Roberto Campos.

Returning to the analysis of elements that influenced the construction and implementation of the II PND, one should expose the president's own view on the subject. Geisel reports, in an interview quoted above, that he had been deeply concerned about the social situation the recessionary adjustment of the Castelo Branco's PAEG had caused, and would seek to prevent such a situation of unemployment and hopelessness from recurring in the country. Perhaps that is at the base of his "predilection" for Velloso and his developmentalist proposal for the execution of the II PND. According to Geisel himself, Simonsen was usually worried and showed irritation with the option for growth (D'ARAÚJO; CASTRO, 1997). An example of the submission of Treasury to Planning is when "the day-to-day economic policy that belonged to this important Ministry (*Treasury*) was parameterized by the great macroeconomic goals defined in the II National Development Plan, developed in Planning" (MANTEGA, 1997, p. 29, our translation).

6 Guido Mantega (1997) states that Simonsen and Roberto Campos were not as orthodox as Eugenio Gudin and other leading economists, but rather "moderate interventionists".

We will now proceed to a more detailed analysis of the II PND. The main purpose of this subtopic is to illustrate the most important details of the plan, to emphasize issues not always discussed or appreciated about the period, such as Law No. 6,151 of 1974.

3.3 The II PND in detail

The II PND aimed at overcoming the economic dependence on capital goods and sought to invest widely and substantially in capital goods, basic inputs, oil, electricity, among other areas considered as priorities by the government. Investments were not only made by state-owned companies, but also by private companies interested in participating in the Plan (BRASIL, 1974).

According to Mantega, there was an increase in exports in the period, which went from 7.5% of GDP to 9.5%, in addition to a 27% increase in exports of manufactured goods. Between 1973 and 1978, the increase of exports was considerable, reaching up to 105% (MANTEGA, 1997).

The developmentalist background of the II PND is not only the result of a need to adopt measures of structural change in the economy, as the modernizing military imagined, but also corroborates theses of the nationalist developmentalism of Presidents Vargas, Juscelino Kubitschek[7], João Goulart; and important civil theorists such as Celso Furtado and intellectuals from the Higher Institute of Brazilian Studies (ISEB). The Plan, which envisaged the need to deepen import substitution in sensitive areas such as capital goods and basic inputs, resembled João Goulart's Triennial Plan, which had, by hands of its Minister of Planning, Celso Furtado, set clear targets to deepen Brazilian capitalism and structurally transform the national economy, emphasizing decentralized investments and focusing on the energy sector (FONSECA; MOREIRA, 2012).

According to Guido Mantega, the II PND,

> ...was the last major economic plan of the developmentalist cycle, in terms of repercussion and scope. The II National Development Plan (II PND) was probably the most extensive state intervention program in the country, and that significantly transformed the Brazilian industrial park, with the establishment of a hub of basic inputs and capital goods. (MANTEGA, 1997, p. 3, our translation)

Given the industrial backwardness in several areas, the II PND definitely sought to overcome underdevelopment and the "atrophy of sectors producing basic inputs and capital goods" (CASTRO; SOUZA, 1985, p. 33, our translation).

In this sense, for Geisel, development was the only way to modernize Brazil. He said that, after the "economic miracle," one could not, due to the rise in oil prices in 1973, throw thousands

7 It is important to point out that, according to Moreira (2017), there is a difference from Vargas, Goulart and Geisel's national-developmentalism to that of JK's, since the latter gives foreign capital an exaggerated importance, while those seek to reinforce national capital.

of Brazilians into misery due to an economic policy of recession and contraction of investments (D'ARAÚJO; CASTRO, 1997). According to the president, in analyzing the problem of income distribution and the resolution of problems arising from a possible recession, he argued that "a long-term solution, a definitive solution, must be found. That is why I have always been opposed to recession. I had seen the recession at the end of Castelo government and I was willing to do everything to prevent it." (GEISEL apud D'ARAÚJO; CASTRO, 1997, p. 288). And he complements, saying:

> If Brazil wants to be a modern nation, without the problem of hunger and without a series of other ills we suffer, it must develop. And for that, the main instrument, the great driving force is the federal government. The nation does not develop spontaneously. There needs to be someone who guides and drives it, and that is the role of the government. (GEISEL apud D'ARAÚJO; CASTRO, 1997, p. 287, our translation).

Referring to the question of national entrepreneurship and national capital, Geisel outlines a very particular view that meets the structural problem of the capitalist interstate system and its conflict-driven and competitive dynamic for wealth and power: "The British had and have an excess of capitals. They stole the whole world for 300 years and gathered all the money in their hands" (GEISEL apud D'ARAÚJO; CASTRO, 1997, p. 250).

Thus, the "74 option" (CASTRO; SOUZA, 1985), which professors Barros de Castro and Pires de Souza refer to as the path chosen for development, imposed a courageous and firm attitude, which according to Moniz Bandeira, Geisel had to spare (BANDEIRA, 2011). In this way, the author illustrates the broad leap toward technological and economic autonomy sought by the general-president:

> In order to restrict technology purchases, which weighed as much as oil imports, he created three state-owned companies – Investimentos Brasileiros SA (Investibras), Mecânica Brasileira SA (Embramec) and Financiamento de Insumos Básicos (Fibase) – as subsidiaries of the National Development Bank. The purpose was to sustain, through association with state capital, the expansion of Brazilian private companies, mainly in the sectors of capital goods and basic inputs (aluminum, copper, fertilizers, barrel, etc.). (BANDEIRA, 2011, p. 190-191, our translation)

Corroborating with Bandeira, Carlos Medeiros points out that:

> Structurally, with the change in the terms of trade in 1973 and the active policy of II PND to promote substitutive investments in basic inputs and capital goods and, at the same time, to promote exports, the Brazilian economy deepened its industrialization process reaching unprecedented levels among developing countries, both in terms of extension and diversification of its industrial park (MEDEIROS, 2015, p. 20, our translation).

Having made this introduction to the general aspects of the II PND, we will proceed to analyze the details and priority areas of the plan. As an ambitious project to deepen the Brazilian industrial capitalist revolution, the plan envisaged making Brazil as independent as possible of the basic and complex goods and inputs in the supply chain. To do so, one must confront interest groups, especially of sectors from São Paulo that were refractory to the idea of decentralized investments (SILVA, 2003). These, in addition to fulfilling a fundamental role of including neglected regions throughout the industrialization process, such as the Northeast and the North, also fulfilled a geopolitical function of colonization of the country's most remote and impoverished interior (BRASIL, 1974).

In order to deepen national integration through the decentralization of public investments, a hitherto neglected or at least unexplained element in the development plans of other military governments, namely the social issue and income distribution, draws attention. In this sense, the first page of the official document that presents the II PND, Law 6,151 of 1974, states that "Brazil will endeavor, until the end of the decade, to maintain the momentum the Revolution has been trying to generate, to cover the border area between underdevelopment and development" (BRASIL, 1974, p. 3, our translation).

The document states that, due to international instabilities, the country should live with them without giving up development and the increase of the average income of Brazilians (BRASIL, 1974). In addition to projecting economic growth so as not to neglect the social aspect and the increase of employment.

Briefly, we present here some relevant points of the document: i) the need to adjust the economic structure face the scarcity of oil. On this point, the document is emphatic about the need for expansion of the basic input and capital goods sectors; ii) reaching the end of the decade as a competitive and fully industrial economy; iii) the country should expand its power generation capacity. This requires a broad infrastructure package that brings together nuclear, hydroelectric and petroleum expansion by Petrobras[8]; iv) a national science and technology policy with an emphasis on a national postgraduate program; v) planning aimed at national integration; vi) productive occupation of the Amazon and the Midwestern region; vii) a social development strategy that contemplates the massive generation of employment, income, qualified human resources in education and health; viii) the need for integration with the world economy without regional or ideological discrimination (BRASIL, 1974).

8 About this, namely the diversification of energy sources, it is worth emphasizing the importance of a strategic alcohol program, Proálcool, which emerged in 1975, by Law 76,593, as an important substitute for oil dependence. In addition to substantially reducing the imports of oil and gasoline, the creation of a specific and comprehensive program such as Proálcool contributed to the generation of a considerable ethanol market niche for Brazil. Through state funding, private companies have invested in large-scale ethanol production, which has spurred a broader process of manufacturing and selling alcohol-powered cars. According to Bautista Vidal, the nationalist physicist who devised alcohol engines, "PROÁLCOOL, (...) is the tiny tip of a huge *iceberg* located in the tropics... and most of it is possible on the Brazilian continent." (BAUTISTA VIDAL, 1987, p. 185, our translation). Another important factor of the National Alcohol Program was the generation of jobs in rural areas. In 1986, Brazil had up to 95% of its fleet of passenger vehicles fueled by ethanol.

These eight basic points – called the "synthesis" of the fourth "Revolutionary Government" plan[9] – form the foundation of the II PND, which is divided into three parts. The first, whose theme is: "Development and Greatness: Brazil as an Emerging Power", has seven chapters. In the second part, the title is: "Great Themes of Today and Tomorrow." It is divided into two chapters: "Energy Policy" and "Urban Development: Pollution Control and Environmental Preservation". In the third part of the plan there are a number of topics about Brazil at the end of the decade, in which the government makes a comprehensive inventory of all production, sectors, economic and social indicators and growth projections. Finally, the fourth and final part of the II PND is the so-called "Action for Development", which details the government's investment program.

Our commitment will not be to analyze each part, chapter and topic, after all, the whole plan is 118 pages long and it is not the primary object of this study to do so, but to analyze the most relevant points of the economic development project with characteristics of structural changes in the national productive system.

In this regard, draws attention to the figure of the total to be invested in the five years of government (1974-79), Cr$ 716 billion in basic industry, science and technology and economic infrastructure, as well as the budget of Cr$ 760 billion, aimed at a "social development strategy" that sought to massively increase employment generation and aimed at the real increase of the minimum wage (BRASIL, 1974). Another point to be considered is the financing capacity of this huge program of productive expansion which, according to the law that implemented the II PND (Law 6,151, of 1974), counted expressively on external financing, the inflow of foreign capital and the large participation of state investment.

The expansion and the effort to improve export quality, especially to conquer markets for products with greater industrial complexity, is now seen in the II PND. Thus, pragmatism in foreign trade policy becomes geoeconomic in character, in accordance with the national interest guidelines established by the regime, namely to transform Brazil into a world power. Thus, less and less has the country was taken hostage to the ideological constraints of the Cold War.

Thus, one can see that the international economic conjuncture – the oil shock and the new world economic order of the 1970s – will significantly affect the national development strategy. Thus states the document of the II PND:

> Brazil is trying to adjust quickly and fully to the new circumstances, as much as possible, by adopting the necessary measures later this year. The main concern is to adapt, from the point of view of the economic structure, safely and quickly, to the needs of the created situation. This should make it possible that, with a careful and intelligent external financial scheme, accelerated development can be preserved. (BRASIL, 1974, p. 13, our translation)

This "conjuncture pressure" contributed, it seems, to the course of the II PND, but in a different way, as we have seen, because despite the pressures of pro-recession groups the guideline

9 It is interesting to note the proposition of "step-by-step modernization," which was in principle intended by the military in power.

followed a broad developmentalist program that sought to reconcile the coming of foreign capital with the national capital in order to guarantee a:

> Positive nationalism orientation, aimed at ensuring the execution of the national development strategy, striking the balance between national and foreign capital and ensuring, in articulation with the international economy, the achievement of the country's goals. (BRASIL, 1974, p. 19, our translation)

Therefore, this "positive nationalism orientation", which reminds us of Jaguaribe's "nationalism of ends"[10], was the basis of Geisel's development project and, in a way, as we have sought to illustrate, of military developmentalist thinking. As said above, Geisel himself reinforces the need to build integral development, based not only on economic growth but also on the modernization of national economy, the improvement of social standards and productive autonomy.

According to Law 6,151, 1974, productive investments sought to decentralize industrial production and integrate the national territory as a whole into the production chain. The intention was, therefore, to change the model of national development itself (FONSECA; MONTEIRO, 2007). However, this will generate great friction with the Southeast industrialists, mainly from São Paulo, and will trigger a crisis that will reflect on the scenario of government's political support. In accordance with Law 6,151, the CDE (Economic Development Council) issues Resolution No. 14, which determines the decentralization of productive investments of the II PND (GARCIA, 1983). With this, the entrepreneurs from São Paulo, represented by FIESP (Federation of Industries of the State of São Paulo) expressed their opposition to the decentralization of investments from 1978 through a note sent to Minister Reis Velloso. According to Mariene da Silva:

> Resolution No. 14 was interpreted in São Paulo as an act of discrimination against the state, the implications of which would be stagnation, deterioration, devitalization and paralysis (to name a few of the terms used) of the country's main industrial hub. There was then a strong reaction from the São Paulo business community (FIESP, ACSP, FCESP, São Paulo Engineering Institute49), local public authorities (municipal and state) and the São Paulo press (OESP newspaper). (SILVA, 2003, p. 15, our translation)

The strategy of decentralization of investments was based on the creation of new metropolises capable of producing sophisticated goods with high technological complexity and avoiding being just a producer of unprocessed goods. This would build the capacity to innovate and expand the export of manufactured goods. Another aspect of the plan was the "adjustment of multinational companies to the national strategy" (BRASIL, 1974, p. 20).

For Barros de Castro and Pires de Souza – who reinforce our argument that the II PND was not only a response to the conjuncture but also a necessity of Brazilian capitalism –, in 1974

10 "Purpose nationalism" was based on the idea that foreign capital was needed to assist in the process of national development (JAGUARIBE, 1958).

the national economy had ceased to be competitive in many sectors and needed to deepen our productive capacity. The deterioration of the terms of trade would have left the Brazilian economy in a delicate situation, hence:

> Faced with problems of this nature and magnitude, it would be of no use to hinder the economy and/or reorient domestic spending. More precisely, the mere slowdown of the economy and/or the activation of certain branches and the retraction of others would leave an unbalanced and proven vulnerable economic structure intact, in the face of a world whose instability could no longer be ignored. (CASTRO; SOUZA, 1985, p. 36, our translation)

However, according to the same authors, a large increase in public investment was not enough for the realization of this great undertaking – the change in the productive structure by the II PND. For this reason, the State guided all the instruments of development, such as BNDE financing, and used all political power to pressure entrepreneurs from strategic sectors, such as Ermínio de Morais, from Votorantim, to expand their investments and productive capacity (CASTRO; SOUZA, 1985). To state-owned companies, however, was reserved the protagonist role in the II PND, which led to heavy criticism of the government by some sectors of the economy. In this regard:

> The huge investments made by Eletrobrás, Petrobrás, Siderbrás, Embratel and other public companies were, strictly speaking, the mainstay of the program. This is twofold: *for their strategic function* (our emphasis) and for the fact that, from its orders, many projects were carried out by the private sector. In addition, some of the projects run by the state-owned companies, due to their exceptionally long maturity, would cause the influence of the 74 strategy to go far beyond the decline in private investments associated with it – whose end seems to date back to 1976. (CASTRO; SOUZA, 1985, p. 38, our translation)

The authors go so far as to say that the "strategy of 74" was so important that, even with the change of government and the economic team, the effects of the II PND on the restructuring of the national productive system could not be altered (CASTRO; SOUZA, 1985). Our thesis – that military developmentalism, together with the "Brazil Great Power" thought, has matured and been taken to its ultimate consequences – converges with this argument. The real foundations of the country's development and productive modernization had to be deepened; hence, Geisel did not slow down the process of growth and change in the economic structure that he expanded and crystallized.

Nevertheless, this statement does not disregard the influence of two other factors for the deepening of modernization and structural change: the legitimacy of the political regime and the world economic conjuncture. What we seek to argue, however, is that these two factors were less relevant in implementing the Geisel government's development agenda, precisely because military developmentalist thinking had long advocated the need for more productive and strategic

autonomy. It is worth mentioning that, according to Carlos Lessa, "the very strengthening of national capital, repeatedly emphasized by the II PND, would be only the first moment of a Nation-Power Strategy" (LESSA apud CASTRO; SOUZA, 1985, p. 45, our translation). Lessa considers the military command of politics, with its corollary of "Brazil Great Power," as not necessarily good. Nicknamed the "Prince State," according to the author, the state becomes a kind of historical and active subject, while society becomes the passive object of this power (LESSA, 1998).

Castro and Souza argue the II PND caused a great confrontation between the "market forces" because, as in the current development project (1974) – converging and deepening the ideal of "Brazil Great Power" – the aim was to decentralize investments so as to form an industrial bourgeoisie in the regions of the whole country and thereby fill the voids and make the development process more balanced. The II PND was the fruit and, in our opinion, the maturation of the ideal of military developmentalism. Thus:

> The national industrialization project, which had as its first major milestone the battle for the modern steel industry, is ostensibly assumed there. Such a project, sometimes adopted, sometimes neglected by successive administrations, has deep roots in segments of the civil bureaucracy and the Armed Forces, has the intermittent support of a portion of the native bourgeoisie, and even came to enjoy some popular support in the episode of the struggle for oil. (CASTRO; SOUZA, 1985, p. 45, our translation)

And they go on, "but never ceased to bear the mark of a political determination that seeks to overcome the so-called game of market forces" (CASTRO; SOUZA, 1985, p. 45, our translation). The authors argue that the idea of the "Brazil Great Power" project takes root in the past, specifically in the left and right nationalist groups throughout the twentieth century in Brazil. The question of being above the "game of market forces" is striking in developmentalist and authoritarian military thinking. As we have been trying to show throughout the study, the "mission" of modernizing the country from top to bottom and recognizing that national elites were weak and unable to lead the development process reinforces the argument that the "Brazil Power" project and Geisel's "Great Strategy" are driven by a political perception of the national development process. That is, the economy is subordinated and instrumentalized according to the political project of power.

An important aspect regarding the choice for development, or the choice for the expansion of productive capacity as an instrument to overcome external constraints and economic dependence, was the criticism of the II PND. However, as we shall see, many of these occurred at the post-Geisel time, when the international economic developments stemming from the two oil shocks and strong dollar diplomacy (TAVARES, 1985) were harshly felt around the world.

Anachronistic criticism, therefore, since no one expected that such developments could occur and, moreover, face the ease of access to low interest external financing. Why should a government seeking economic modernization – like Geisel's – fail to take advantage of such a fundamental instrument for the implementation of its national development plan? For Barros de Castro and Pires de Souza, the diagnosis made in 1974 by the government was precisely to prevent

the country from suffering the consequences of international turmoil in the future. In the 1980s, trade gains from the large favorable balance of exports are due to the positive effects of the II PND on the Brazilian industrial park, which had gained robustness and greater competitiveness and complexity (CASTRO; SOUZA, 1985).

Another widespread criticism, especially in the business world, was that the II PND was a strategy of deepening state domination over the national productive system (AGUIRRE; SADDI, 1997; BONELLI; MALAN, 1976). Strategic sectors of the economy, such as the steel industry, petrochemical, paper and pulp, fertilizers, minerals, base industry, among others, were criticized. The newspaper *O Estado de Sao Paulo* even published a few editorials in a row about nationalization and the risks of the country becoming a socialist economy.[11] However, Geisel himself will say the state invests in and occupies sectors that entrepreneurs cannot or will not because they do not have available capital or are not interested in the low rate of return on the short term (D'ARAÚJO; CASTRO, 1997). Beyond this view of Geisel, one must not lose sight of the fact that economic nationalism has historically occupied a captive place to both the left and right of the national political spectrum. Both structuralists, authoritarian and progressive developmentalists, as well as nationalist military, understood that it was necessary to preserve sectors of production and the possession of strategic minerals in the hands of the state.[12]

In addition to criticism that the II PND was an instrument of nationalization of the productive system, the Geisel government also received criticism and disagreement from sectors of the economy that were not addressed or that had not been met with priorities, such as the automobile sector – this sector openly criticized Proálcool and advocated for the adoption of diesel engines in passenger cars (CASTRO; SOUZA, 1985). Foreign debt was another element of criticism from the media and sectors of the economy, as well as orthodox economists. However, as Luciano Coutinho points out, about debt:

> It was a global phenomenon of unforeseen indebtedness, but in our case it corresponded to the construction of the last major blocks of infrastructure and industrial capacity (capital goods and inputs) needed as the basis of the "Brasil Grande" project. (COUTINHO, 1987, p. 179, our translation).

These criticisms from sectors of the economy – which supported the regime of exception from its outset – begin to criticize the military government just as it proposes a productive decentralization and the creation of regional economic poles. This coincidence of criticism with the II PND will come to light at a time when the government is beginning to struggle with political openness. As mentioned above, various sectors are beginning to criticize the nationalization of the economic process, such as São Paulo newspapers – Folha and Estadão –, companies from the same state that were not benefited by the heavy investments of the II PND, and other sectors of society,

11 For more details see the old editions of *Estadão: O Estado de S. Paulo, São Paulo, jul/1973 – dez/1975.*

12 See Góes Monteiro's cited works, doctrines such as National Security (DSN), ISEB publications, and the works of Alberto Torres and Oliveira Vianna.

such as the Catholic Church, the Brazilian Bar Association, among others. These demonstrations are in line with the launch of the 1977 "April Package", when the government closes Congress and maneuvers to regain the parliamentary majority lost for the MDB-centered opposition at that time (BRESSER-PEREIRA, 2014).

Another element that aggravates the loss of support from economic sectors is that the II PNB finally proposes to "share the cake" accumulated by the growth and speaks clearly, on page 04, of the need to increase the income and living conditions of the worker and middle class. In this sense, the document states:

> With such a result [from the II PND's investments and developments], broad prospects for the income increase of the middle and working classes are opened, either by the effect of the economic program or by the Government's social policy. (BRASIL, 1974, p. 4, our translation)

Admittedly, the policy of decentralizing investments and the strengthening of "new regional economic elites", coupled with the increased role of state-owned enterprises in building new productive capacity, caused discomfort in those businessmen who had long enjoyed government benefits and, at the same time, were an important pillar of political support for the regime.

4 Conclusion

In this study, we tried to present Geisel government's strategy for implementing an ambitious project for developing and overcoming economic dependency via the II PND. Considering Brazil's peripheral place in the International Labor Division (ILD), the II PND was an instrument for building economic autonomy and attempting to deepen industrialization and the national capitalist revolution itself.

Despite internal and external pressures – mainly from the United States via interest rate increases in 1979 – the Geisel administration's geoeconomic strategy was broadly in line with its objectives and resumed the developmentalist project of Vargas and João Goulart, as it favored economic nationalism and structural change.

In seeking to make conditions for the Brazilian production system to become more complex and competitive, some results are relevant: exports from 1974 to 1980 were multiplied by 2.8 and there was a 20% increase in exports of industrial products in the same period (MEDEIROS, 2015); the growth of the manufacturing industry, of up to 7.1%; and, above all, the development of the capital goods industry, with 8.5% growth. Thus, "the economy would climb the ladder of capital-intensive and technological-intensive industries" (CASTRO; SOUZA, 1985, p. 76). These data are relevant because they reinforce the developmentalist vision of the Geisel period and its strategy of structural transformation of the Brazilian economy, to overcome the obstacles that prevented the deepening of an autonomous national development.

The balance was quite positive for some analysts, such as Guido Mantega, who argues "the II PND generated a much more integrated industrial structure with a complementary

intersectoral dynamic, which reduced the dependence of the Brazilian economy on hegemonic capitalist centers" (MANTEGA, 1997, p. 38, our translation). In addition, the II PND privileged the national capital that would be in imbalance with foreign capital.

It should not be overlooked that Brazil was one of the fastest growing countries from 1930 to 1980, at an average 6.3% (DATHEIN, 2006). We can attribute this success to the developmentalist projects of great national leaders, while recognizing the exogenous elements of each conjuncture and situation. The "military developmentalism," as well as its civilian form, had the merit of thinking a strategy of modernization and transformation of the country, to change the place of Brazil in the hierarchy of world power. Ernesto Geisel, with the II PND, is part of this praiseworthy process and serves as an example for us to think about the current directions of the country, which has since lost the "consensus for growth" (CASTRO; SOUZA, 1985) and, therefore, one of the main elements of structural change: the nationalist development strategy.

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ARTICLE DOI 10.22491/cmm.a009

Management of military systems: the role of technology readiness levels

Gestión de sistemas de material de empleo militar: el papel de los niveles de disposición tecnológica

Abstract: The management of Military Systems (MS) usually involves a complex network formed by distinct actors with diverse backgrounds and cultures. In this context, to promote knowledge communication, integrate tacit knowledge, and understand stakeholders' perspectives is a challenge. The objective of this study is to investigate the management of MS from the perspective of Technology Readiness Levels (TRL), which standardize the common understanding and identify milestones of critical technologies maturation. Based on literature review and using as reference the Science and Technology Innovation System of the Brazilian Army (SCTIEx – *Sistema de Ciência, Tecnologia e Inovação do Exército Brasileiro*), this article shows that the TRL scale originally created for highly complex space technologies and systems does not meet the particularities of MS networks. Therefore, this article presents research questions raising important themes that, if explored, can contribute to the management of MS.

Keywords: Military System. Knowledge Integration. Technological Readiness Levels. Complex Product and Systems. Product Life Cycle.

Resumen: La gestión de Sistemas de Material de Empleo Militar (SMEM) normalmente involucra una red compleja compuesta por actores con formaciones y experiencias bastante diversificadas. En ese contexto, se convierte desafiador promocionar la comunicación del conocimiento, integrar conocimientos tácitos y entender las perspectivas de las partes interesadas para incorporarlas en las estrategias de gestión tecnológica. Este artículo tiene el objetivo de investigar la gestión de SMEM bajo la óptica de niveles de disposición tecnológica, que regula el entendimiento común e identifica marcos de la madurez de tecnologías críticas. Basado en revisión de la literatura y teniendo como referencia el Sistema de Ciencia, Tecnología e Innovación del Ejército Brasileño, este artículo muestra que la escala de niveles de madurez tecnológica, originalmente creada para tecnologías y sistemas espaciales altamente complejos, no atiende las necesidades de redes de SMEM. En razón de eso, son presentadas cuestiones en abierto, suscitando temas de investigaciones que pueden contribuir con la gestión de SMEM.

Palabras clave: Sistemas de Materiales de Empleo Militar. Integración del Conocimiento. Niveles de Disposición Tecnológica. Sistemas de Productos Complejos. Ciclo de Vida del Producto.

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Received: Jan. 02, 2019
Accepted: Mar. 18, 2019

COLEÇÃO MEIRA MATTOS
ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

1 Introduction

The *Sistema de Ciência, Tecnologia e Inovação do Exército Brasileiro* - SCTIEx (Science and Technology Innovation System of the Brazilian Army), whose central body is the *Departamento de Ciência e Tecnologia* - DCT (Science and Technology Department), is responsible for the teaching of Engineering, Research, Development and Innovation in the scientific and technological field of interest of the Brazilian Army (BRASIL, 1994).

Several and diverse products, systems, and supplies are from the interest of the Army. They include, for example, food rations, uniforms and bulletproof vests, which are mass-produced; tactical radios, produced in hundreds of units; radar systems, produced in dozens of units; and missile systems, usually produced in a few units. Several of these products result from the integration of various critical and highly complex technologies, have custom subsystems, are produced on a small scale and intended for specific markets (oligopolistic). Therefore, associated research and development (R&D) activities require sophisticated management tools.

The stakeholders of the network formed by SCTIEx belong to several public and private organizations, come from various areas of expertise and have diverse backgrounds, cultures and professional experiences. This is a favorable scenario for misunderstandings about important issues that arise throughout the product life cycle, and not only in its R&D phase. It is worth noting that several products and systems with long life cycles (measured in decades) are the core of the SCTIEx portfolio, and its main stakeholders from various organizations change over time.

To illustrate further the richness of this scenario, we bring the example of strategic plannings to obtain such products through R&D, commercializing the innovation and its operation afterward. This type of planning usually integrates the perspective of researchers, engineers, users, and life-cycle managers. Although they have different understandings on how these products should evolve, these actors contribute to the definition of costs, goals, deadlines, and requirements. Besides, they interact differently and more intensely at each phase of the life cycle. While the researcher is more involved in the stage of exploring generic technologies for various applications, the engineer has a more focused view on integrating technologies and designing, whereas the entrepreneur is interested in the commercialization. At the same time, the user is concerned about the performance, reliability, upgrades, and corrections of any failures while using the product. In this context, life-cycle managers try to optimize resources by synchronizing and aligning the efforts spent in these phases.

The literature on Complex Products and Systems (CoPS) addresses the issue of knowledge diversity that need to be integrated and the actors that need to be involved in the process, recognizing the complexity and uncertainties generated in the planning, coordination, and development of CoPS (DAVIES et al., 2011; HOBDAY, 1998). In this context, the importance of achieving common understanding between these actors (GRANT, 1996b; SCHMICKL; KIESER, 2008)and establishing efficient communication is highlighted (AXELSON, 2008).

To achieve common understanding, stakeholders interact through personal mechanisms, such as workshops and meetings, and impersonal mechanisms, such as

policies, rules or norms, (GRANT, 1996b). The technology readiness level (TRL) scale can be considered an impersonal mechanism of interaction, as it normalizes communication between different actors, establishes a common language, standardizes critical milestones, and measures the capacity of technological advancement throughout the innovation process (MANKINS, 2009).

Studies that explore impersonal mechanisms in knowledge integration and communication activities, particularly about the TRL tool in the CoPS context, are scant. These studies become even uncommon when the focal element of the analyzed network is a public organization that acts as a contractor, R&D executor and user of the innovation generated in the network, which therefore needs to manage the entire product life cycle or system. Therefore, aiming to fill this gap, this article seeks to investigate the management of Military Systems (MS) from the technology readiness perspective. To this end, this exploratory study investigates the literature on the TRL tool and analyzes the DCT under the issue of knowledge communication and in the context of Complex Product and Systems, considering that, generally, an MS is an example of CoPS. Next, a new research field is proposed, which can contribute to several open questions regarding MS and CoPS management.

The literature review shows the use of the TRL scale in contexts that are different from the ones when it was originally proposed, being broadly employed in the management of CoPS, as in the preparation and monitoring of strategic planning. Additionally, with the analysis of diagnostic documents and management plans of organizations belonging to the DCT, it can be inferred that the adoption of a technological readiness assessment scale could meet the CoPS management needs of DCT, contributing not only to knowledge communication but also with R&D strategic planning at decision-making levels (UNITED STATES, 2009). However, the original TRL scale cannot meet such needs, being able to only contribute to the solution of problems arising from very specific situations. In this context, due to the importance of the theme for the large community of actors involved in the CoPS life cycle, this article presents new research questions and opening new avenues for future studies.

The article has the following organization. Section 2 presents a literature review on knowledge integration and the search for common understanding in the context of CoPS management. Section 3 is devoted to a literature review of the TRL's role in CoPS management. Section 4 presents the research methodology. The details and importance of the representative case are presented in Section 5. Proposals for future studies on CoPS management based on technology readiness are discussed in Section 6. Finally, the conclusions of the article are presented.

2 Achieving common understanding in networks of diversified actors

Knowledge communication problems have been widely discussed in the organizational theory literature in different contexts, focusing, directly or indirectly, on mechanisms that increase common understanding. Regarding R&D activities, the topic addresses causes and effects of inefficient communication and their impacts on common understanding between decision-makers and experts (EPPLER, 2007). According to

Russo e Schoemaker (1990), inefficient communication contributes to several improper decisions made by managers and policymakers. Rambow (2000) discusses the "illusion of terminology", indicating that specialists often overemphasize the importance of technical terms and become frustrated in realizing that people with different backgrounds have difficulty in understanding terminologies, and therefore do not process the knowledge communicated. In this context, Cantoni e Piccini (2004) discuss the "projectionism", a concept in which the expert, when presenting his/her results to decision makers, does not customize his/her analysis to the target audience.

"Common understanding" is essential in the implementation of R&D projects of CoPS, especially those dealing with different organizational cultures and knowledge domains (DAVIES et al., 2011; FRANÇA JUNIOR, 2018). CoPS are defined as capital goods, systems, networks, control units, software packages, specific construction, and services, which are expensive and of sophisticated technology (HOBDAY, 2000). They are distinguished by being integrated by custom components and subsystems; manufactured in units or small batches; designed for specific customer markets with pre-defined requirements; and are eventually governed by political and strategic decisions rather than technical ones (HOBDAY, 1998). These characteristics create many uncertainties in R&D undertakings, especially in the early stages, particularly when there is a reduced level of common knowledge (GRANT, 1996a; SCHMICKL; KIESER, 2008) and common understanding among participants (AXELSON, 2008; OKHUYSEN; BECHKY, 2009) in collaborative programs or projects.

Axelson (2008, p. 11) addresses the issue of common understanding in R&D management as follows:

> [...] it occurred to me that understanding one another's product technology and product development knowledge is one major challenge facing companies in product development collaborations. For example, several managers I met expressed frustration over not being able to make the partner understand e.g. their points of views regarding how to conduct product tests, how to evaluate product quality and how to organise documentation routines. It was often difficult e.g. to understand one another's product design ideas, system interface specifications and component material preferences. [...] Consequently, it was a major issue to company managers how to enable knowledge communication [...].

To achieve common understanding, research on organizational theory suggests that companies relocate people; form coordination groups; create specific roles; and establish organizational interfaces or integration mechanisms (GALBRAITH, 1973; GUPTA; GOVINDARAJAN, 2000; INKPEN, 1996; MAIDIQUE; HAYES, 1984).

In particular, integration mechanisms provide conditions for efficient coordination and for people from different organizations to interact and optimize knowledge communication (SICOTTE; LANGLEY, 2000; SINGH, 2008; TUSHMAN; KATZ, 1980). They are usually framed in two distinct groups: personal and impersonal mechanisms (GRANT, 1996b). Personal mechanisms are those that require intense communication and interaction between the parties, such

as visits to partner's organizations, periodic meetings, exchange of employees, job rotation, and so on. On the other hand, impersonal mechanisms are represented by norms, rules, and routines.

Knowledge communication, therefore, refers to the integration mechanisms that organizations use to share, transfer and integrate knowledge (AXELSON, 2008). The literature argues that integration mechanisms create conditions for an improved knowledge communication between different organizations. However, little attention has been devoted to the problem of knowledge communication within networks of very diverse actors, such as those developing CoPS. Also, this literature discusses the issue by highlighting especially the role of personal mechanisms, as they are considered the main mechanisms of integration of tacit knowledge (SRIKANTH; PURANAM, 2011). Impersonal mechanisms have been little explored in the literature, probably due to their supposed ineffectiveness in integrating tacit knowledge (GRANT, 1996b), and not providing the necessary flexibility for organizations, subjected to constantly changing environments, to reinvent and innovate.

3 Technological maturation by readiness levels

To manage CoPS, simple and traditional project management methods, tools, and techniques can be inadequate and inefficient (DAVIES et al., 2011). The high risks, unpredictability, uncertainties, and communication problems of complex system projects require more sophisticated approaches and long-term planning, with intermediate control points, and integration mechanisms. In this context, it is recommended to employ personal and impersonal communication mechanisms (GRANT, 1996b) to break the design in phases (DAVIES; BRADY, 2016), and to use the concept of prototyping, widely used to reduce development risks (SCHMICKL; KIESER, 2008; STEEN; BUIJS; WILLIAMS, 2014).

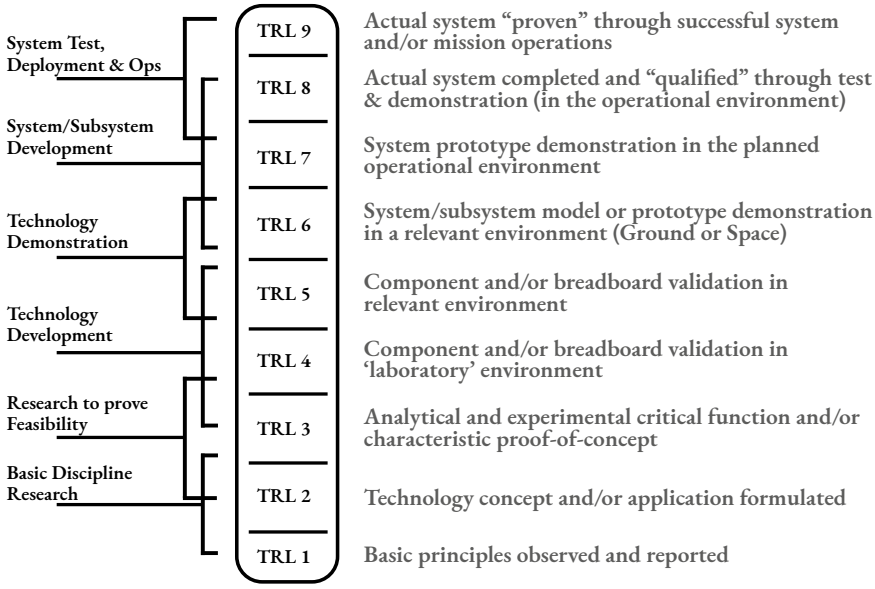
Prototyping favors the rapid development of components, subsystems or systems, aiming at anticipating or predicting design problems and solving them at intermediate stages of development. It is, therefore, a process that allows interactions between specialists, with a focus on component interfaces (SCHMICKL; KIESER, 2008; STEEN; BUIJS; WILLIAMS, 2014). These intermediate versions of a system accelerate development, reduce uncertainties, and shorten the learning curve (ELVERUM; WELO, 2015). According to these authors, prototypes are essential for project teams to absorb the tacit knowledge of their partners, to understand better the problem, and communicate not only with each other but also with key stakeholders.

To standardize the long prototyping process adopted in the development of spacial systems, in mid-1970s, NASA developed the TRL scale to provide a measure of the state of new technologies relative to its readiness for operation. This scale is organized into 9 readiness levels, as shown in Figure 1.

In national innovation systems (LUNDVALL, 2007), such as the Swedish, the TRL scale has been serving as a common framework of technology maturation assessment aiming to implement mechanisms of innovation (FRANÇA JUNIOR; LAKEMOND; HOLMBERG, 2017). In a study of the Swedish aerospace system, França Junior, Lakemond, and Holmberg (2017) observed that companies, universities, research institutes, and other organizations use the TRL scale to plan strategies for aerospace technology development, such as the creation of

a national innovation agenda (INNOVAIR, 2016). In this context, stakeholders jointly develop research agendas to define roadmaps and prioritize technologies to be developed in collaboration and according to the different TRL levels.

Figure 1 - Technological readiness scale



Source: Mankins (2009).

Other organizations adapt or modify the original TRL scale to their organizational processes and meet their specific needs (JEAN; LE MASSON; WEIL, 2015). For example, the U.S. Department of Defense (DoD) uses a customized nine-level scale for hardware, a second for software, and a third for biomedical technologies (UNITED STATES, 2009). The U.S. Department of Energy (DoE) uses a slightly different scale from the original (UNITED STATES, 2008), particularly at level 9. While NASA requires for TRL 9 an "actual system 'flight proven' through successful mission operations", criteria that can be met with only one mission, DoE specifies for this level an "actual system operated over the full range of expected conditions", which usually requires more than one mission. The customization of the original TRL scale is explored by Straub (2015), who suggests the inclusion of the tenth level (TRL 10), for the context of space systems development. At this level, investments are made to correct faults and bugs identified during continued use, not only after a single use as prescribed in TRL 9.

In Brazil, important government agencies also use the original TRL scale to reduce the risks and uncertainties of R&D projects, but particularizing how levels are assessed, such as the *Agência Espacial Brasileira* – AEB (Brazilian Space Agency) (AGÊNCIA ESPACIAL BRASILEIRA, 2018) and the *Departamento de Ciência e Tecnologia Aeroespacial* - DCTA (Department of Aerospace Science and Technology). In the latter case, a TRL level calculator based on Nolte, Kennedy e Dziegiel (2003) was developed to meet specificities of the Brazilian Air Force (ROCHA; MELO; RIBEIRO, 2017).

Moreover, it is worth mentioning other technological readiness scales that were derived or inspired by TRL. Important scales in this context are the Manufacturing Readiness Level (MRL) scale, the Integration Readiness Level (IRL) scale, and the System Readiness Level (IRL) scale.

The MRL scale was developed by DoD to measure a system's manufacturing maturity. Besides evaluating aspects related to R&D (UNITED STATES, 2016), the scale has the primary objective of inferring about the reproducibility quality of mass-produced products.

Concerned about the insertion of new technologies into existing products, the U.K. Ministry of Defense developed, based on the TRL, the IRL scale (SAUSER et al., 2010). This scale, also graded in nine levels, aims to measure the risk of integrating technology by analyzing the characteristics of its interfaces.

However, it was found that these scales did not fully meet the objective of assessing the technological readiness of complete systems composed of various technologies. The SRL scale was then created to fill this gap (SAUSER et al., 2008).

In summary, different organizations have been using the concept of technology readiness levels and adapting them to their specific needs, suggesting that the original TRL scale does not fully meet CoPS development needs. Moreover, the TRL tool and its variations can be considered impersonal mechanisms of interaction, as they normalize a standardized language structure identifying critical milestones of the technological maturation process (SAUSER et al., 2010). Therefore, the use of these tools improves knowledge communication in a complex network aiming at developing collaborative R&D designs (SAUSER et al., 2010).

4 Methodology

From an exploratory approach, this paper investigates the role of TRL scale when diversified actors search for common understanding in the management of Military Systems. Exploratory studies are appropriate when little is known about the reality in question and a pathway for further research is sought (YIN, 1994).

4.1 Research Design

To achieve the proposed objective, the Science and Technology Innovation System of the Brazilian Army (SCTIEx) is analyzed from the perspective of its focal organization, the DCT, using primary and secondary documentation on its strategic management processes.

4.2 Data collection

This study considers bibliographic and empirical data. Bibliographic data were obtained from a literature review on the personal and impersonal integration mechanisms that contribute to knowledge communication during CoPS's R&D, particularly with the use of the TRL tool. This review covers scientific articles, theses, dissertations, and strategic planning models from

other international organizations similar to SCTIEx, such as DoD. The empirical data refer to SCTIEx and were obtained from documentary investigations on government reports, ministerial ordinances, regulatory instructions, management plans, and strategic agendas. Specific documents are the Army's Strategic Plan 2016-2019; Guidelines for Management Restructuring 2015; Guidelines for Transition to DCT Restructuring 2015; the Strategic Plan of ST&I 2016-2019; and the Strategic Diagnosis and Planning of SCTEx 2010[1].

These documents contain information on the short, medium and long term strategies of the military organizations directly subordinate to DCT, such as the *Instituto Militar de Engenharia* – IME (Military Institute of Engineering), the *Centro Tecnológico do Exército* – CTEx (Army Technology Center), and the *Centro de Avaliações do Exército* – CAEx (Center of Army Evaluations), as well as diagnostics addressing their internal (strengths and weaknesses) and external (threats and opportunities) environments. To carry out these investigations in these documents, all the Commanders, Chiefs and Directors of these organizations were interviewed, as well as the Executive Manager of the *Programa Polo de Ciência e Tecnologia do Exército em Guaratiba* - PCTEG (Army Science and Technology Complex Program in Guaratiba), and, as guests, the Presidents of the *Fundação de Apoio a Pesquisa, Desenvolvimento e Inovação – Exército Brasileiro* - FAPEB (Research, Development and Innovation Foundation – Brazilian Army), the *Fundação Ricardo Franco* – FRF (Ricardo Franco Foundation) and the Supervisor of the *Fábrica de Material de Comunicações e Eletrônica* - FMCE (Communication and Electronics Material Factory) of *Indústria de Material Bélico* - IMBEL (Military Material Industry).

4.3 Data analysis

Data analysis was held according to an abductive approach using the matching process suggested by Dubois e Gadde (2002), consisting of systematic comparisons between empirical observations and the theoretical framework. Therefore, this study aimed to match problems identified in diagnoses with theoretical issues related to knowledge communication in CoPS's R&D with the use of the TRL tool. After a continuous and iterative process of bibliographic review and data analysis, the TRL tool became the focus of the study as an impersonal integration mechanism, since its functions match with the SCTIEx's needs of improving their management processes.

In addition, the authors participated in some important R&D projects of the DCT that were at various stages of progress. Therefore, the authors' experience and the iterative process between bibliographic investigation and data analysis increased the internal validity and reliability of the exploratory study (RIEGE, 2003). Additionally, to verify the external validity of the study (RIEGE, 2003), this paper aimed to capture the perspective of three key managers of DCT through informal interviews and feedbacks of this research.

Therefore, this paper presents an overview of the TRL's characteristics, an integration mechanism that enables knowledge communication, together with the strategic aspirations of SCTIEx, a network that is an undergoing transformation process to adapt to the new knowledge era and boost technological innovation. Moreover, it was evaluated the possibilities of using the TRL tool, according to SCTIEx's needs.

1 Plano Estratégico do Exército 2016-2019; Diretriz para Reestruturação da Chefia do DCT 2015; Diretriz de Transição para a Reestruturação do DCT 2015; Plano Estratégico de CT&I 2016-2019; Diagnóstico e Planejamento Estratégico do SCTEx 2010.

5 The science and technology innovation system of the brazilian army (SCTIEx)

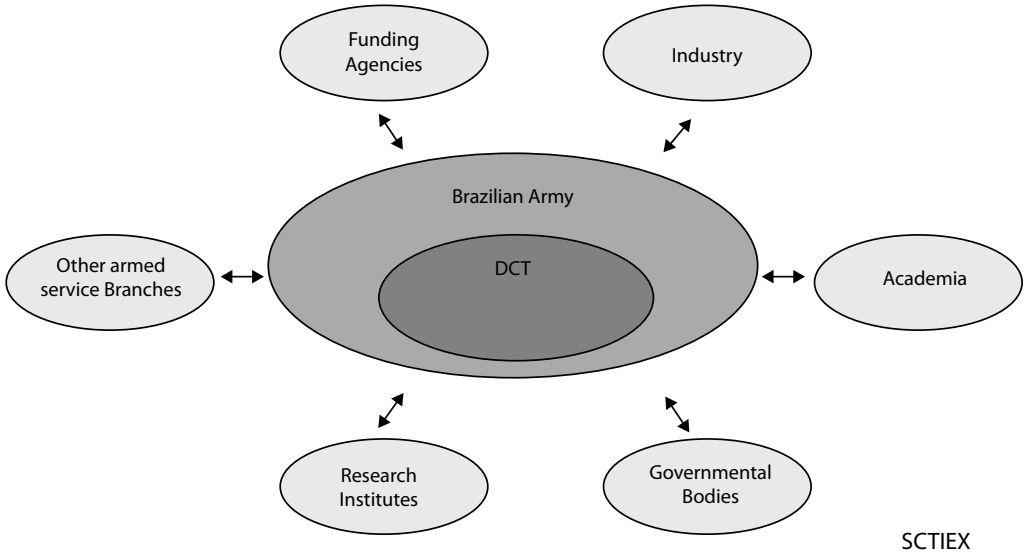
The Brazilian defense sector is fragmented, disjointed, and has low interaction among its actors (CUNHA; AMARANTE, 2011). In addition, this sector interacts with, depends on, and is conditioned by Brazil's National Innovation System, which in turn has been quite inefficient in converting innovation investments into concrete results (GALDINO, 2018). To change this situation, this sector has been undergoing a profound transformation to create an organizational culture that promotes a suitable environment for innovation (FRANCO AZEVEDO, 2018). In this regard, SCTIEx, a key component of the defense industry, actively participates in this transformation process.

5.1 The transformation process

The Science and Technology Innovation System of the Brazilian Army (SCTIEx) "is designed to plan, guide, coordinate, control and execute scientific and technological activities related to Military Systems (MS) and their influences in the areas of the Ground Military Doctrine, Logistics and Personnel" (BRASIL, 1994, our translation). Throughout time, this system has been transforming by adapting to changing national and international scenarios (PRADO FILHO, 2014).

Figure 2 illustrates the current structure of SCTIEx, consisting of military and civil, public and private organizations that interact to promote Science, Technology and Innovation to the Army and the Country.

Figure 2 - Army Science, Technology, and Innovation System



Source: adapted from Brasil (2012).

The relevance of SCTIEx to knowledge communication is due to the following reasons. First, most studies on this subject consider companies to be the focal element and the primary means of coordinating the network. Therefore, choosing a government agency with a similar role of coordinating

and directing technological development may bring additional knowledge to the literature, given the State's prominence in taking risks in the maturation of cutting-edge technologies in the early stages of innovation. These risks are hardly assumed by companies, which take advantage of the state-sponsored overflows of these technologies to develop their products (MAZZUCATO, 2014).

Second, DCT is the central element of a system that undertakes several strategic projects, moves hundreds of millions of reais, employs thousands of people and creates partnerships with small, medium and large companies from the most diverse branches of activity, and with universities, research institutes and funding agencies. SCTIEx maintains a close relationship with national Science, Technology and Innovation and is a major player in the Defense sector, responsible for potential overflows into other technology areas (LESKE, 2013).

Third, SCTIEx forms a huge and complex network of diverse players whose R&D projects are long-term, expensive, and have high degrees of uncertainty and technological risk. These characteristics are typical of Complex Product Systems (CoPS) projects (HOBDAY, 1998) that need to integrate a wide range of knowledge that is hardly available in a single organization. Therefore, the complex nature of the SCTIEx network highlights the importance of the common understanding issue.

To support the ongoing transformation process of SCTIEx, DCT conducted diagnoses in its organizations related to teaching, research, development, and innovation – such as IME, CTEx, and CAEx – covering key opportunities of improvement and outlining strategies that are related to the interaction of these organizations with the external environment and thus indicating the need for development and adoption of integration mechanisms.

IME is the Military Organization responsible for training the military engineers, teaching engineering (graduate and pos-graduate programs) and conducting basic and applied research, particularly for SCTIEx projects. From the diagnosis made by IME, it was found that there is little integration with CTEx and the industry. As a result, according to Guidelines EB80-D-07.006 (Project Implementation of the New Military Engineering Institute)[2], IME needs to restructure the graduate programs so that its researchers are increasingly engaged in R&D projects, boosting the system innovation capacity. In addition, it was identified the need to promote greater integration with companies and other organizations by using management models that create a common vision, communicate the vision, and attracts employees aligned with that vision.

CTEx conducts applied scientific research, experimental development, scientific and technological assistance, and knowledge application to obtain MS for the Army. This can be achieved with the support of companies, through new R&D contracts; with the scientific community; or in partnership with companies, ICT and universities altogether. CTEx participates in important Army's projects, including: AV-TM 300 Tactical Missile; OLHAR VDN Military Monocular; Light Preload Mortar 60 mm; Surface-Surface Missile 1.2 AC (MSS 1.2 AC); SABER M200 Radar; SABER M60 Radar; Software-defined Radio (SDR); Automated Machine Gun Repair X (REMAX); Esquilo and Fennec Helicopter Simulator (SHEFE); and Light General Purpose 4×4 Vehicle (VLEGA)[3].

2 Implantação do Projeto do Novo Instituto Militar de Engenharia.

3 Reparo de Metralhadora automatizada X (REMAX); Simulador de Helicópteros Esquilo and Fennec (SHEFE); Viatura Leve de Emprego Geral Aerotransportável (VLEGA GAÚCHO).

The CTEx's diagnosis reported: low integration with universities and other research centers; few national companies trained and interested in developing MS; insufficient financial resources offered by funding agencies; heterogeneous and unequal distribution of financial resources; dispersed efforts from stakeholder to achieve common objectives; lack of formal tools, systems and practices that contribute to decision-making processes; low standardization of risk analysis processes; low maturity of process and project management; and poor performance indicators.

As a result, CTEx defined that it needs to increase integration with the scientific community (IME included) and with companies; master critical technologies that ensure strategic and operational advantages to the Army; improve R&D management of projects; and organize information and knowledge management with a compatible Information Technology infrastructure.

The primary mission of CAEx is to evaluate prototypes and pilot batches of MS, products from the National Defense Industrial Base (BID), or purchased from other nations, and Army Controlled Products (PCE)[4], as well as to develop studies on metrology. In its strategic diagnosis, it was indicated the low maturity of documented and widespread rules of MS evaluation processes and the possibility of fostering the defense industry through R&D collaborations, taking advantage of the success of the existent PCE evaluation process and the established relationship with companies.

Therefore, in its diagnosis, DCT demands several strategic initiatives that essentially highlight the need to develop methodologies, tools, and procedures to:

- Measure innovation;
- Develop technological roadmaps;
- Support the R&D strategic planning of the military organizations; and
- Strengthen the integration of SCTIEx stakeholders into a Triple Helix model of innovation.

5.2 The SCTIEx characteristics

To operationalize the strategic initiatives demanded by DCT, it is necessary in-depth studies and sophisticated management models that need to be proposed, tested and validated. These studies and models should take into account the listed attributes that characterize SCTIEx and similar networks, as well as take advantage of the current knowledge available in the specialized literature. Next, two attributes from SCTIEx are highlighted.

First, the TRL scale covers only part of the life cycle of complex systems (SAUSER et al., 2008). When analyzing the life cycle of military systems, six phases are identified (Lima, 2007) (Chart 1).

Chart 1 - Life Cycle of Brazilian Army Materials

1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	6th Phase
Survey of Needs and Conceptual Formulation	Planning and Scheduling	Research and Development (R&D)	Production or Acquisition	Use	Disposal

Source: Lima (2007).

4 Base Industrial de Defesa (BID); Produtos Controlados pelo Exército (PCE).

In the 1st phase, the needs are identified, the strategies and priorities are defined, and the operational and technical requirements are elaborated. In the 2nd phase, the Army senior management decides whether the material should be purchased on the market (national or international) or developed by SCTIEx through R&D. Once decided, an acquisition or development project is included in the Army's strategic planning. In the 3rd phase, if the decision of obtention involves R&D, the following sub-phases take place: R&D of the system and prototype generation; prototype evaluation; production of a pilot batch; evaluation of the pilot batch. In the 4th phase, the product is acquired, received, stocked, and distributed. In the 5th phase the use and detection of deficiencies, failures and opportunities for improvement are held, generating the possibility of incremental innovations, as well as data collection that will support the R&D of new product generations, with the possibility of more innovations. Over time, the information collected will be able to support modernization, improvement and disposal decisions. In the 6th and last phase, the material is deactivated, removed from its inventory, and disposed.

Throughout these six phases, the utilization of the original TRL scale would cover only part of the third phase, i.e. the R&D phase. However, the other phases of the life cycle are equally important. For example, for many military systems, the cost of use (5th phase) is around 70% of the total life cycle cost, whereas the development cost is around 20%, as (SAÚDE, 2010) shown in Chart 2.

Chart 2 - Percentage distribution of life cycle costs of some equipment

System	R&D costs	Acquisition costs	Operation and maintenance costs
Airplanes	20%	18%	62%
Warships	2%	23%	75%
Missiles	52%	30%	18%

Source: Paulo (2006).

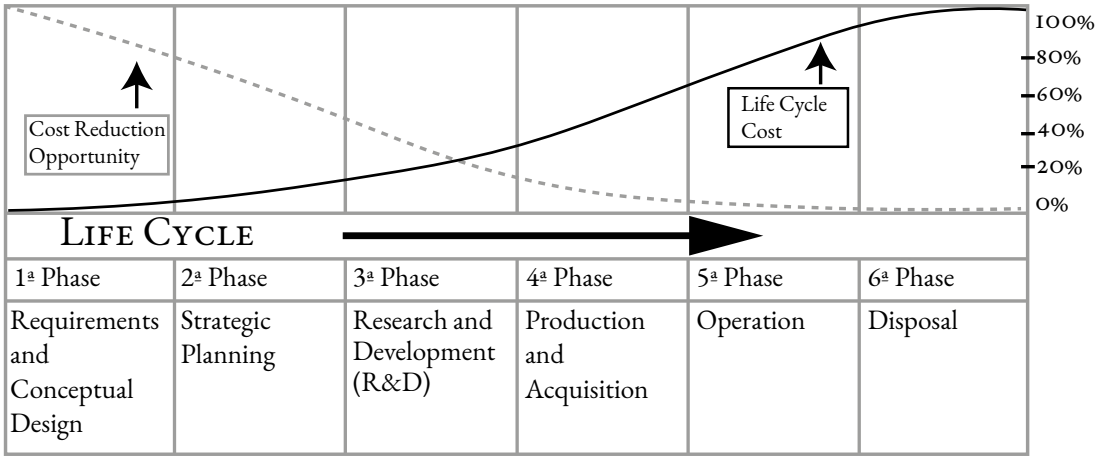
Besides, as discussed by Barringer e Weber (1996), the first two phases present the greatest cost reduction opportunities (Figure 3), highlighting the importance of an efficient management of the life cycle phases.

The limitations of the original TRL scale were described in Section 3. Several organizations use different TRL-based readiness scales to meet their needs, such as the MRL, SRL, and IRL scales, and even the modified TRL scale with additional levels. Although these variations increase the scope of the concept of technological readiness, there are still important gaps regarding its use in complex networks such as the SCTIEx.

For example, the original scale does not consider the production and evaluation of the pilot batch of the 3rd phase. Despite the fact that the MRL scale involves these activities, it does not consider the particularities of the Brazilian Defense Industrial Base, as it does not assess the risks and obstacles created with critical components purchased from other

nations, and the uncertainty of regular financial resources for ongoing R&D projects and of government procurement. These aspects impact negatively on R&D capabilities and MS manufacturing activities. Another important phase not covered by technological readiness levels is the 6th. Although Straub (2015) proposes the inclusion of level 10th in the TRL scale to address user's operation, there are still many issues to be clarified regarding the need for modernization, improvement, disposal or even reengineering (i.e. to return to initial levels of the TRL scale).

Figure 3 - Cost evolution according to life cycle of materials



Source: Adapted from Barringer and Weber (1996).

Moreover, the military systems acquired by the Army varies largely in terms of complexity. The Army manages the life cycle of complex products such as missiles, tanks, and radars, as well as mass-produced products such as uniforms, assault rifles and bulletproof vests. Between these extremes there are systems sharing common features, such as long-range unmanned aerial vehicles (UAV), which are costly and intended for specific customer markets but can also be mass-produced and integrated largely by commercial off-the-shelf products (HAMBLING, 2015). This variety of systems and products is addressed in the CoPS literature in terms of degrees of complexity (HOBDAY, 1998).

Therefore, the TRL scale, originally designed for highly complex space technologies and systems, does not fully meet the needs of networks such as the SCTIEx, as it is not suitable for less complex products and systems that do not need to reach all levels of the scale; nor cover all phases of the MS life cycle that need to be managed by the SCTIEx.

6 Proposal for future studies: management of complex systems based on technological readiness

Proposals for future studies are presented next to fill the gaps identified in the previous section.

6.1 Technology readiness scale customized for complex networks

Despite the benefits of adopting a readiness scale in complex networks such as SCTIEx, the specificities of this type of network cannot be met by scales available in the literature, requiring customizations. However, these customizations should adhere to the original TRL scale, in order to enable knowledge communication with exogenous actors of the network, including other countries. Moreover, it deems necessary a technology readiness scale that covers the key phases of the life cycle of complex products (Figure 3) and takes into account its degrees of complexity. In this context, the following questions need to be answered:

1. What phases of the life cycle should a custom technology readiness scale encompass? And with how many and which levels of readiness?

2. How to frame/audit the maturity of a product or system at each level?

3. How the importance of adopting a technology readiness scale in the product life cycle management is influenced by degree of the product complexity?

6.2 Strategic planning of R&D based on technology readiness

As resources are often limited, focal organizations of a complex network cannot effectively participate in all R&D undertakings. Thus, during early stages of the life cycle (1st and 2nd phases), to prioritize critical technologies and decide on the appropriate form and intensity of involvement in a project, it is important to adopt strategic management models that optimize employment of human and financial resources. For this, managers need accurate information on the readiness levels of universities, companies, research centers in critical areas and technologies.

An analysis based on technological readiness levels may reveal different scenarios with distinct implications for the allocation of human and financial resources, stakeholders' involvement, staff training, chronogram setting, dual technology development, and overall objectives. For example, a technology of interest of the Army that has a national R&D capacity between TRL 3 and TRL 5 indicates a potential for generic technology development, capable of attending more than one application. With technological roadmaps, a common R&D agenda can be developed among actors of the Triple Helix (INNOVAIR, 2016) with the aim of prototyping and advancing the maturity of critical technologies. Therefore, the following research questions are proposed:

1. How to define the criticality of technologies in a national context?

2. How to map national and international organizations that supply critical technologies according to the technological readiness level?

3. How can a technology readiness scale help to design technological roadmaps and common R&D agendas among actors in a complex network?

4. How to include the concept of technology readiness in life cycle management methodology?

6.3 Analysis of technical feasibility and risks of R&D based on technology readiness

For the DoD, a Critical Technology can be defined as a technology belonging to a complex product system, being essential to meet established technical and operational requirements (within acceptable costs and deadlines) which use or application is new or has high technological risks during its development (UNITED STATES, 2015). When trying to develop a product whose critical technologies indicate low TRL, the assumption is that there is a great risk that R&D obstacles and chall enges increase. This causes inaccuracies in budgeting and chronogram estimations, increasing chances of higher development costs and schedule delays (UNITED STATES, 2015), which in turn makes stakeholders insecure and frustrated.

In a study held in 62 R&D programs from DoD, the U.S. Government Accountability Office (GAO) found that 33% of these programs began with some immature critical technologies (Below TRL 7). These programs suffered an average cost increase of 32% and an average delay of 20 months. In contrast, the others experienced a cost increase of only 2.6% and an average delay of 1 month (UNITED STATES, 2015).

Based on these studies, several countries adopt TRL levels 6 or 7 as a critical milestone that indicates the technical feasibility of starting an R&D project aiming at designing a product by integrating various critical technologies. Whereas critical technologies do not reach these levels, the U.S. GAO (UNITED STATES, 2015) recommends that the R&D effort falls on its maturation.

This approach raises the following fundamental question: How to develop a methodology for risk analysis and technical feasibility based on technological readiness for decision-making on:

- purchase the desired system in the international market or perform R&D (in the country or in collaboration)?
- R&D procurement for the entire product design and its integration, or for the maturation of its critical technologies?

6.4 Knowledge communication mechanism

The literature review on the TRL indicated its potential in helping achieve common understanding by identifying R&D stages of technologies that need maturation. With maturation milestones standardized across a complex network of diverse actors, decision-makers and managers can have a broader and fine-grain view of the technological evolution throughout the product life cycle, which facilitates the strategic planning of R&D projects and programs (of integration and maturation of subsystems). In this sense, the prototyping of technologies and its framing into a TRL level encodes the tacit knowledge of the specialists involved.

Therefore, it is implied that the technology readiness tool, an impersonal mechanism, can facilitate the use of personal mechanisms and enable the integration of tacit knowledge, and not only codified knowledge. Thus, it is suggested that, although representing an impersonal mechanism (generally used to integrate codified knowledge) (SRIKANTH; PURANAM, 2011), has attributes of personal mechanisms given its potential to support common understanding and enable the codification of tacit knowledge.

To confront these expectations on the TRL scale, the following questions are raised:

- How can the TRL tool support common understanding among diverse actors in a complex network?

- What is the role of the TRL scale in the codification of tacit knowledge?

7 Conclusion

This paper revealed that the TRL scale covers only part of a Military System life cycle. On the other hand, it illustrated how adopting a customized technology readiness scale can increase the efficiency of complex product system management and support decisions that go beyond R&D.

As this topic is not much explored in the literature, this study raised important research questions, analyzing a specific case, the SCTIEx. The answers can bring large benefits not only to the aforementioned network, raising the level of management of Science, Technology and Innovation within the Brazilian Army, but also to society as a whole, given the technological spillover effects that the defense sector is capable of generating, contributing to economic growth and national development. Given that SCTIEx has similarities to other networks that deal with complex products, further studies aiming at investigating the questions under discussion may contribute not only with the diverse community of experts working with military systems but also with CoPS literature.

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ECEME

ARTICLE DOI 10.22491/cmm.a010

Broadening the vision of the Mechanized Cavalry Platoon: the remotely piloted aircraft system

Ampliación de la visión del Pelotón de Caballería Mecanizado: el Sistema Aéreo Remotamente Pilotado

Abstract: The paper proposes to contribute to the debate about the use of the Remotely Piloted Aircraft System (RPAS) as an auxiliary tool, expanding the results of the reconnaissance operations of the Mechanized Cavalry Platoon. Thus, based on an approach that considers the definitions, the relevant legislation and the characterization of use, it seeks to contextualize its operational application, concluding with the suggestion of a way for the systematic and standardized use of RPAS, also connecting some basic logistical aspects.

Keywords: Drones. Unmanned Aerial Vehicles. Remotely Piloted Aircraft System. Mechanized Cavalry Platoon.

Resumen: El presente artículo se propone a contribuir al debate acerca del empleo del Sistema Aéreo Remotamente Pilotado (SARP) como herramienta auxiliar, expandiendo los resultados de las operaciones de reconocimiento del Pelotón de Caballería Mecanizado. Así, desde un abordaje que considera las definiciones, la legislación pertinente y la caracterización de uso, se trata de contextualizar su aplicación operativa, y se concluye con la sugerencia de un camino para el uso sistemático y estandarizado del SARP, conectando también algunos aspectos logísticos básicos.

Palabras clave: Drones. Vehículos Aéreos No Tripulados. Sistema Aéreo Remotamente Pilotado. Pelotón de Caballería Mecanizado.

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Received: Jun. 19, 2018
Accepted: Apr. 26, 2019

COLEÇÃO MEIRA MATTOS
ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

1 Introduction

The aim of this article is to contribute to the studies on the Remotely Piloted Aircraft System (RPAS), suggesting a viable path for its systematic incorporation, more specifically into the recognition function of the Brazilian Army (BA) Mechanized Cavalry Platoon (Pel C Mec). It is not intended to "reinvent the wheel", but to present data that can reinforce discussion, analysis and consequent decisions, based on the documents "Bases for the Transformation of Terrestrial Military Doctrine"[1] (BRASIL, 2013, our translation), from the Army Special Bulletin No. 28/2014 (bee 28-14) (BRASIL, 2014a)[2] and the "Development Plan of the Terrestrial Military Doctrine 2016/2017"[3], in its Annex "E", which addresses the "Essential Elements of Doctrinal Information" (BRASIL, 2015, p. 24, our translation).

Bee 28-14 (BRASIL, 2014a) shows the operational allocation of RPAS to surveillance activities (Activity 1.2.4.3: "Continue to distribute RPAS and Ground Surveillance Radars for the modernization of the 4th Bda C Mec"), as part of the SISFRON/Sentinela da Pátria projects from the program Obtenção da Capacidade Operacional Plena (OCOP – Full Operational Capacity Achievement). This document was also a motivational aspect for the research on the option of utilization targeting of the RPAS by the Pel C Mec.

In addition to obtaining the different information and field verifications, the relevance of the study is supported by its scope, since it not only considers the operational issue, but also connects management/organizational and logistical aspects.

In this sense, and based on the synthetic understanding of AKVA (Sanskrit word meaning position superiority during combat, obtaining advantage or fighting in position advantage — origin of the term "Cavalaria", or Cavalry, in Portuguese), the article is anchored in primary recognition function of the Pel C Mec according to the parameters that guide it.

"Gaining advantage in combat" follows the logic that recognition must present as a product specific and relevant information (about the terrain and the opposing force) that leads to decision-making by the superior command. Obviously, the combat in advantageous position must be the consequence of the decisions taken.

Bibliographic and documentary searches (literature, manuals, applicable legislation and other specific documents), online surveys, field surveys (with visits and personal interviews at manufacturing companies and operating units — not just in the Army), as well as observation and interviews with Cavalry type military (and others involved in reconnaissance missions) are the basic components of the methodology used.

1 Approved by Ordinance No. 197-EME of September 26, 2013, it is intended to "guide the introduction of doctrinal conceptions and concepts aiming at incorporating into the Earth Force the skills and competencies required for its use in the Knowledge Age." (our translation) This approach replaces the planning conception model based simply on an "Employment Hypothesis." Referring to required competencies, it cites Geoinformation and Remotely Piloted Aircraft Systems as examples of systems that significantly alter military capabilities.

2 Approved by Ordinance No. 1.507 of the Army General Secretariat (Army Strategic Plan 2016-2019, part of the Army Planning System).

3 Approved by Ordinance No. 339-EME of December 17, 2015, it guides the planning and coordinates the implementation of actions related to the production of the Terrestrial Military Doctrine, in the 2016/2017 biennium. See details in Chart 3, p. 15 of this article.

To achieve the proposed objective, the article uses as a "guiding thread" a brief passage on the genesis of unmanned aerial vehicles (UAVs), their general characterization, explanations regarding existing nomenclatures and a brief visit to the applicable legislation in Brazil, distributed according to the protagonism of the various organisms involved. It then discusses the current use of this equipment by our Armed Forces, contextualizing Pel C Mec's operational mission and the use of RPAS. It establishes basic considerations on some logistical aspects, such as the acquisition and maintenance of equipment and the necessary training. It concludes with the presentation of a proposal — considering an optimal model — for the operational structuring of the RPAS, which lists the main necessary activities, prioritized through a simple management support tool (GUT Matrix).

2 Probable Genesis And Evolution

Although the use of UAVs seems to be a recent subject, its application dates back to the 19th century, when Austrians loaded unmanned balloons with explosives to attack targets in Venice (UBIRATAN, 2015, p. 12). Even before World War I, people studied ways of sending explosive artifacts through the air to targets tens of kilometers apart, which is now accepted as the embryo for missile creation.

However, the first UAV, as it is now known, appeared in 1951, when the Ryan Aeronautical Company went on to develop the Firebe, a jet UAV intended to serve as an air target launched from an airplane. Following development, a new generation used a computer control system. It could also be launched from the ground, through a catapult.

But it was in the Second Gulf War, which began in 2003, that they became better known to the general public, as they were widely used by US forces for enemy monitoring, targeting, and even launching guided weapons (PECHARROMÁN; VEIGA, 2017, p. 7).

These aircraft are currently at the cutting edge of the latest technology, being used in the most varied activities, such as precision agriculture, generation of photos and images in general, whether for civil use, defense or security.

As seen, drones[4] have been used for a long time around the world and their applications are increasingly innovating. In Brazil, mainly from the regulation of its use, the market has seen great growth. According to Granemann (2018), the country already has more than 700 companies, among which — according to Pecharromán and Veiga (2017) — 15 manufacturers have already been identified[5].

4 Also known as UAV (Unmanned Aerial Vehicles).

5 AEL Sistemas, AGX Tecnologia Ltda, ARPAC (ex-Agrone), AVIBRAS, Avionics Services, BRVant, Brasil Aircrafts, FT Sistemas S/A, Gyrofly Innovations, Santos Lab Com. and Ind. Aerospace Ltda, Sensormap, SkyDrones and XMobots. See more information at Pecharromán and Veiga (2017).

3 Characterization and nomenclatures

In order to facilitate the contextualization of the theme, it follows the characterization of the various terminologies used for the designation of unmanned aerial vehicles, according to ANAC (2017a, 2017c), Você... (2017) and Gomes (2016).

UAV – is a terminology used to define the scope of the activity. UAVs are aircrafts designed to operate without a pilot on board. However, in order to live up to this terminology, the aircraft must not have a recreational character, besides needing to have payload (cameras, sensors, etc.) on board. UAVs can be classified as multi-rotor and fixed wing (Figures 1-1 and 1-2).

Figure 1-1 - multi-rotor UAV

Source: Gomes (2016).

Figure 1-2 - fixed wing UAV

Source: Gomes (2016).

The multi-rotor UAVs are the best known and most used models in the world, especially the quadcopter. They use the same flight principle of helicopters, through rotor wings, which have high RPMs, which allows the flight. Multi-rotor UAVs have limitations on spcΩeed, endurance and range (BOON; DRIJFHOUT; TESFAMICHAEL, 2017; CHAPMAN, 2016). However, they are easier to control, can be static in the air and take pictures and record videos of fixed points or smaller areas. Commonly used batteries allow the model a range of 20 to 30 minutes, although there are already multi-rotors with more modern systems that use battery plus combustion generator, which offer more than two hours.

Fixed wing UAVs are completely different from the multi-rotor model and are very similar to airplanes. They usually have a delta wing, which creates lift for flight, and a propeller-like engine at the rear that propels it forward. Because they only need power to propel them forward rather than hold them in the air — as in the case of the multi-rotor model — they are much more efficient. They can cover large distances and wide areas by monitoring various points of interest. They have a considerably longer range compared to the multi-rotor model. The fixed wing model is widely used in military operations for reconnaissance, considering its higher energy efficiency, maneuverability and speed. Through the use of high-resolution sensors and cameras, fixed wing UAVs have allowed great advances in many areas. Further details of the differences between both models are shown in Table 1.

According to Pecharromán and Veiga (2017), rotary-wing UAVs dominate the global market, with a participation of 77%. Fixed wingers hold 21%, as their customer base is smaller

and higher priced, and hybrids (inclined wing) represent an innovative concept, still without expression in the market.

Table 1 - Differences between multi-rotor and fixed wing UAVs

Type	Advantages	Disadvantages	Typical uses
Multi-rotor	• Greater ease of use • Operation in confined areas • Static flight • Vertical take-off and landing (VTOL) • Lower cost	• Low flight range • Lower load capacity • Lower cost • Limited speed • Lower flight resistance	• Short period operations. • Aerial photos • Filming • Entertainment
Fixed wing	• Great flight range • Higher speed • Larger coverage area • Higher load capacity • Great flight resistance	• Greater operational complexity • Higher cost • Lower overall accuracy of obtained data	• Aerial photos • Aerial mapping • Remote sensing • Long distance inspection

Source: Boon, Drijfhout e Tesfamichael (2017); Chapman (2016); Gomes (2016).

Among other UAV models, we can mention, for example, helicopters (which represent only a small niche market) and hybrids (represent an innovative concept, but still without commercial expression). Helicopters (also known as heli-drones) have greater efficiency over multi-rotors, especially for their resistance, due to a general aerodynamic rule (the larger the rotor blade and the slower it rotates, the higher its efficiency is), which gives it a bonus point: the possibility of static flight with a heavier load. Its disadvantages are complexity, cost and vibration, as well as the danger posed by its large rotating blades. Hybrids, with various types under development, combine the benefits of fixed wing UAVs with static flight capability, and can also take off and land vertically. They still show operational difficulties such as stability, but this has been corrected with technological improvement (CHAPMAN, 2016).

DRONE – This is just a name, without technical support in legislation. It is a generic and informal name that has been spreading as a characteristic of any unmanned flying object, for any purpose (professional, recreational, commercial, defense or security), origin or structure. Note that not every drone can be considered a UAV, since, because it is used as a hobby or sport, it fits, by legal definition, the legislation pertaining to model aircraft, not UAV.

RPA – There are two different types of UAV. The most known and used worldwide is the RPA (Remotely Piloted Aircraft). In this situation, there is no pilot on board, but the aircraft is controlled remotely by the interface of a device (computer, simulator, remote control etc).

The other type of UAV is known as "Autonomous Aircraft", which does not allow operator intervention during the flight, from its programming. In Brazil, its use is prohibited. Thus, RPA is the appropriate terminology for reference to non-recreational UAVs.

RPAS – Remotely Piloted Aircraft System. According to the Department of Airspace Control – DECEA, "4.2.4 (...), an RPAS consists of a RPA (aircraft), a RPS (remote piloting station), the piloting link (also called Command and Control Link or C2 Link) and associated components such as launch and recovery systems, communication equipment, navigation, flight management, autopilot and emergency and flight termination systems, among others" (BRASIL, 2017c, our translation). Remotely Piloted Air System is also a terminology used by some institutions. The term technically adopted by the International Civil Aviation Organization – ICAO and DECEA, specified in the ICA 100-40 (BRASIL, 2017c) with international scope, is Remotely Piloted Aircraft System.

4 Applicable regulation in Brazil

Unmanned Aircraft Systems (UAS) are a new component of world aviation that operators, industry and various international organizations are studying and working to understand, define and ultimately promote their complete integration into airspace. Relying on various types, sizes, performances and applications, the regulation of the use of a UAV is complex and has been a challenge worldwide for a number of issues, especially those related to the fact that there is no pilot on board (MAGELLA, 2016, p. 11).

In Brazil, we have already seen many advances, with the creation of the recent and necessary legal framework. The National Civil Aviation Agency (ANAC), the National Telecommunications Agency (ANATEL), the DECEA and the Ministry of Defense (MD), each in its area of competence, are the institutions that legally guide, control and supervise the use of UAVs, for any purpose, with its regulations embodied in the Brazilian Aeronautical Code – CBA (Law 7.565/86) (BRASIL, 1986).

In addition, the activity is not exempt from compliance withthe laws regarding civil, administrative and criminal liability that may apply to the use of unmanned aircraft, with special emphasis on those provisions regarding the inviolability of intimacy, privacy, honor and people's image. Although current legislation does not apply in its entirety to the use of UAVs in Defense and Security activities (with the exception of DECEA regulation), it does not seem permissible for operators in these areas not to know it, or to know only the parties that concern their operations.

The **ANAC** (2017c)**,** through the Brazilian Special Civil Aviation Regulation – RBAC-E nº 94, addresses the general requirements of its competence for unmanned aircraft. It legislates on the entire chain of activity, from authorization for new aircraft manufacturing projects to flight regulations, such as operational risk assessment[6].

Generally speaking, regulation is based on the aircraft's Maximum Take-Off Weight (MTOW) rating. Unmanned aircraft with a maximum takeoff weight of up to 250 grams do not

6 It means the assessment of the consequences of a hazard, expressed in terms of probability and severity, with reference to the worst possible condition. See Ordinance No. 1.474 /SPO, of May 02, 2017 (ANAC, 2017a).

need to be registered with ANAC or identified. Similarly, they do not need to have third party damage insurance (ANAC, 2017c).

Class 1 – RPA with maximum takeoff weight > 150 kg;

Class 2 – RPA with maximum takeoff weight > 25 kg and ≤ 150 kg; and

Class 3 – RPA with maximum takeoff weight ≤ 25 kg.

And, to make the regulation easier to understand, ANAC (2017b) published, in May 2017, the document "Guidance for drone users."

ANATEL's protagonism concerns radio frequency. Its control serves to prevent radio frequency transmitters, present in the remote controls of the equipment, from generating interference in other services, such as satellite communications. ANATEL's supervision is based on the mandatory approval to which UAV operators are subject, whose guidance is available in the "User's Manual" (ANATEL, 2017).

DECEA, as the central agency of the Brazilian Airspace Control System (SISCEAB), has as its scope the regulation of responsibilities and procedures necessary for safe access to Brazilian airspace. Regarding the scope of this article and among the various publications in force, we selected five.

1. Instruction ICA 100-40: Remotely piloted aircraft systems and access to Brazilian airspace. This instruction is applicable to all operations that are not exclusively for recreational purposes, that is, that do not include model aircraft (BRASIL, 2017c). We highlight the following:

    a. The RPAS Airspace Access Request System (in which military aircraft should also be registered) is a system that facilitates the recently restructured airspace access request process that works on a web platform (BRASIL, 2017a); and

    b. the NOTAM[7] (Notice to Airmen) Guidance, which is defined as "the notice containing information concerning the establishment, condition or modification of any aeronautical installation, service, procedure or hazard, the prompt knowledge of which is indispensable for the personnel responsible for flight operations" (our translation). When operating under the General Air Circulation rules, RPAS operations should follow the provisions of this Instruction. If they are operating under the rules of Military Operational Circulation, they should follow the specific document, the ICA 100-13.

2. AIC N 17/18, effective on January 2nd, 2018: aircrafts remotely piloted for recreational use — model aircraft (BRASIL, 2017b).

7 A NOTAM aims to disclose in advance aeronautical information of direct and immediate interest for the safety and regularity of air navigation (BRASIL, 2017c, p. 37).

3. AIC N 23/18, effective on January 2nd, 2018: aircrafts remotely piloted for use to the benefit of federal, state or local government agencies. These include, among others, the aircrafts employed by the Fire Department, the Military and Civil Police and the Municipal Guard. Note that this instruction provides: "NOTE 2: Military aircraft operators will be automatically recognized as RPA pilots if they meet at least one of the following: (a) Aviation Officers (QOAV) of the Brazilian Air Force; or (b) have QOAV-equivalent training in other forces (Brazilian Navy and Brazilian Army)" (BRASIL, 2017a, p. 10, our translation).

4. AIC N 24/18: Remotely piloted aircraft for exclusive use in operations of the public security, Civil Defense and IRS supervisory bodies (operations carried out with organic remotely piloted aircraft). This Instruction states that they are understood as Public Security Bodies (BRASIL, 2018, p. 1-2): Federal Police (FP), Federal Highway Police (FHP), Federal Railway Police (FRP), Civil Police (CP), Military Police (MP) and Military Fire Brigade (MFB).

5. Instruction ICA 100-13 (Air traffic rules for military operational circulation). It addresses the regulation of the use of RPAS by the organic units of the Armed Forces. For the context of this study, this is the most specific publication, obviously classified as RESERVED. For this reason, we will no longer comment here.

Finally, the **MD**, through the Head of Logistics and Mobilization of the Joint Armed Forces General Staff (CHELOG/EMCFA), is responsible for controlling the aerial survey activities, in compliance with Decree-Law No. 1,177, of June 21, 1971[8]. "This control is conditional on the registration of aerial survey entities in the MD and the authorization of their projects, in order to maintain full knowledge, by this Ministry, of the aerial survey areas in the country and to avoid aerial surveys in areas not allowed, for national security reasons." (AEROLEVANTAMENTO..., 2015, p. 1, our translation). The Armed Forces, as well as other federal agencies, are exempt from this registration, according to Normative Ordinance No. 953/MD, of April 16, 2014.

5 Use of Rpas in the brazilian armed forces

The Armed Forces began their operations with RPAS, aiming at its use as an air target. Interest in employment for other purposes grew after US results in operations in Iraq and Afghanistan.

8 "Art. 3rd: For the purposes of this Decree-Law, aerial assessment is understood to be the combination of air and/or space operations of measurement, computation and recording of terrain data with the use of appropriate sensors and/or equipment, as well as the interpretation data collected or their translation in any form" (BRASIL, 1971, p. 1, our translation).

In 2010, the Air Force acquired four units for doctrinal development and, in April 2011, two Hermes 450 manufactured by Elbit were received[9]. These aircraft allowed the deployment of the first UAV squadron at the Santa Maria/RS Air Base. Subsequently, this fleet was expanded with two Hermes 900, from the same manufacturer. (PERCHARROMÁN; VEIGA, 2017, p. 20).

In the Navy, although UAVs are also used as air targets, we focus our observation on the application of RPAS by the Brazilian Marine Corps (BMC) Aerotactic Control and Air Defense Battalion (BtlCtaetatDAAe), the most specific reconnaissance unit. The RPAS used is the Horus FT-100 (Figures 2-1 and 2-2), acquired from FT Flight Tech Sistemas SA (São José dos Campos/SP) in March 2016 for R$ 1,300,000.00. The system consists of 02 Horus FT-100 (aircraft), a Ground Station, 02 gyro-stabilized cameras with dual EO/IR (electro-optical and infrared/thermal) sensors, supplies, operator training, maintenance and technical assistance. BtlCtaetatDAAe also has other fixed wing UAVs, specifically used for training of operators.

Figure 2-1 - Horus FT-100 (BMC)

Fonte: Beni (2016).

Figure 2-2 - FT-100 Ground Station

Fonte: Beni (2016).

Also in the BA, RPASs have been used for some time, though still modestly, for various purposes. To name a few more recent and well-known applications: (i) Operation Ágata, where, since 2011, supported by the Joint Armed Forces General Staff (EMCFA), large-scale actions have been undertaken to strengthen the security of nearly 17 thousand kilometers of land borders in Brazil. It is part of the Federal Government's Strategic Border Plan (PEF), created to prevent and repress criminal activity in Brazil's border with ten South American countries (OPERAÇÃO..., 2014); (ii) operations during the 2014 World Cup (using four[10] Carantá model two UAVs (the same one already used by BMC/BN), one Dragonfly and another Orbis model, manufactured by Santos Lab) and (iii) the 2016 Olympic Games.

At Minustah (Figure 3), RPASs were used as a command and control tool (C2), providing aerial images. Although we have not obtained this confirmation, it is very likely that the RPASs currently in place at the 11th Bda Inf L units[11] will be those used by the BAat that time.

9 Read AEL Sistemas, a Brazilian company belonging to the groups Elbit Systems Ltda and Embraer Defesa e Segurança.

10 Two of the Carcará model (the same one already used by BMC/BN), one Dragonfly and another of the Orbis model, manufactured by Santos Lab.

11 Manufactured by the company SZ DJI Technology (China), model Phantom, acquired in Miami/USA in 2014, at a cost of U$ 3,000 (FREITAS, 2015).

Figure 3 - RPAS operating in Haiti (DJI Phantom)

Source: Drones... (2016).

In November 2015, the BA had already acquired three Horus FT-100 RPASs (configuration identical to BMC) for the total amount of R$ 3,719,821.36. This acquisition was based on Ordinance No. 227 – EME of September 22, 2015, which approved the standardization of the RPAS Horus FT-100. The standardization is the result of Special Committee Opinion no. 04/2015 for the standardization of materials for use by the BA. Of these three RPASs, one was allocated to the 9th Field Artillery Group (FAG) in Nioaque/MS, and two to the Parachutist Precursor Company (Cia Prec Pqdt) in Rio de Janeiro - RJ.

The BA is currently estimated to have six RPASs in this standardization. This equipment is suitable for reconnaissance missions, considering — among other features — its ability to provide geo-positioning and, as mentioned before, thermal sensor, enabling night operation. The UAV weighs 8 to 10kg and nominally has a range of 90 to 150 minutes, a range of 15 km and can fly up to 12,000 feet.

We have found that the batteries of existing BA equipment (same as BMC) have an average operating time of one hour at an altitude of 3,000 feet. Two other observations, which provide an opportunity for improvement: (i) regarding relative fragility: as the UAV landing is through a parachute located on its "belly", it reaches the ground inverted, which sometimes causes the breakdown the wing and/or tail; (ii) at higher altitudes, camera zoom is poor.

The Cia Prec Pqdt uses the FT-100 in its reconnaissance operational missions and additionally utilizes the DJI Phantom IV (it has 3 units). This additional/complementary use is important and often necessary, since Phantom can be used to provide optimal quality images in smaller and/or confined physical spaces. This complementarity has been positive, particularly in recent Garantia da Lei e Ordem (GLO – Law and Order Assurance) missions, where the Cia Prec Pqdt has often acted in support of the various units involved. It is important to highlight, however, that there are other models, from DJI itself and from other manufacturers, more suitable for military use. As an example, we refer to the Black Hornet PRS, manufactured by Flir System, Inc. The equipment draws attention for its operational characteristics, presenting valuable capabilities for gaining immediate situational awareness.[12]

12 Known as "nano drone", it has extreme portability (weighs 33 grams, 16.8 cm long), is very quiet and does not interfere with airspace, and can fly up to 2 km, with autonomy of 25 minutes. It can be used in both day and night operations, with good performance in confined spaces. It is currently used by many countries, such as the USA, France, and Australia (https://www.flir.com/products/black-hornet-prs/).

6 Operational mission of the Mechanized Cavalry Platoon and the use of Rpas

6.1 Operational mission

This is how the reconnaissance activity is defined: "it is an operation conducted in a campaign, by the use of land **or aerial** environment, with the purpose of obtaining information about the enemy and the area of operations" (BRASIL, 1999, p. 3-2, our emphasis and translation). Air assets, when available, increase speed, fronts and depth of recognition. The same document states that "Mechanized cavalry is the most appropriate element of ground forces to conduct any kind of reconnaissance. Its characteristics, organization and instruction make it highly capable to perform such missions" (BRASIL, 1999, p. 8-7, our translation).

According to the Cavalry employment doctrine, among the basic aspects that characterize what is understood as "modern combat", we highlight: (i) greater need for information and security; (ii) faster operations; (iii) synchronization of actions; (iv) (...) and (v) demand for greater leadership, initiative, agility, synchronization, and information management capacity by commanders at all levels (BRASIL, 1999, p. 1-3).

These aspects are directly addressed when referring to the use of RPAS as a recognition tool. The other aspects listed in the referenced doctrine are, so to speak, a consequence of the quality of acquisition of the four aspects mentioned.

Pel C Mec is the smallest operating force of Mechanized Cavalry — its basic element of employment — thus becoming the "front line" regarding the reconnaissance function and others, especially safety.

According to Campaign Manual C 2-20 – Mechanized Cavalry Regiment, "Recognition and security complement each other and are closely linked. A reconnaissance mission provides a certain degree of security, notably in reconnaissance missions that seek intelligence on the enemy" (BRASIL, 2002, p. 62, our translation). It is therefore natural that the training and availability of material to Pel C Mec should have as its principle the expansion of its recognition capacity, which provides increased information gathering.

With the effective 36-man standard, Pel C Mec is organized into five teams:

1. Command Group: 03 men (commander, radio and driver), boarded in a light tactical vehicle (LTV) — currently the Agrale Marruá AM2;

2. Group of Explorers (G Exp): is responsible for the execution of several actions, among others, those of recognition. It has a staff of 12 men, divided into two patrols. Each patrol uses two LTV — it is "seeing and speaking";

3. Armored Reconnaissance Vehicle Section (Seç VBR): With the effective of six men, it is the shock element of Pel C Mec (reconnaissance, security, defense and attack). It is endowed with two ARV EE-9 Castavel — it is the "seeing and shooting";

4. Combat Group (CG): it uses the Urutu or Guarani armored personnel carriers (APC), with a garrison of 10 men (08 marines, 01 gunman and 01 driver), engaged in combat on foot.

5. Support Piece (Pç Ap): is the fire support element (mortar) of the Pel C Mec, normally responsible for rear safety. It consists of 05 men, using an Agrale Marruá cargo car.

According to Mesquita (2014), the structure of the Pel C Mec, of combined weapons, is identical to the structure of its similar (Army Cavalry Platoon), being related to the influence of that doctrine on the BA.

6.1.1 A Brief Approach: Security, Counterintelligence (C Intlg) and Counter-reconnaissance (C Rec)

Among the affected missions to the Mechanized Cavalry units are mainly reconnaissance and security. As mentioned before, recognition is an activity in which information is a critical aspect.

The elaboration and success of any planning depends on the quality (relevance, credibility, timeliness, comprehensiveness, etc.) of the available reports[13], which, due to the ability of the RPAS (real time image availability) employed in the recognition activities, can be accepted as information. Likewise, information is critical for decision making (at any level), even if it is not originally included in a planning process, that is, it needs to be taken to the extent that the immediacy produced by new (unforeseen) facts require it.

The security mission has as its scope a set of measures to varying degrees (protection, cover and surveillance), with the main purpose of preserving the troops against surprise and observation by the opposing force. Most security is provided by C Rec activities, where the use of RPAS expands its conditions.

Information also represents the intelligence work base for both friendly forces and opponents: "it is intended to obtain, through detailed and centralized planning, specific knowledge about a particular geographical area or human activities" (BRASIL, 1999, p. 144, our translation). Therefore, the actions of the C Intlg are highly necessary. Among C Intlg's purposes are "Preventing an actual or potential enemy force from acquiring knowledge about our battle order, material situation, personnel, plans, vulnerabilities and possibilities" and "Thus, C Intlg must detect, identify and analyze the enemy threat from human sources, signals, images, cybernetics and others, planning actions and measures to neutralize or eliminate these threats" (BRASIL, 2016, p. 51, our translation).

C Rec translates into a set of measures that permeate, in particular, missions of security, intelligence and counterintelligence. "Counter-Reconnaissance is intended to destroy or neutralize the enemy's reconnaissance elements" (BRASIL, 1999, p. 46, our translation).

13 Reports are data obtained by any means. Information is the confirmed reports.

In this regard, one must keep in mind that the opposing force can also use RPASs in its reconnaissance missions. Thus, we will stick only to the aspect of the possible neutralization of a UAV, used in reconnaissance mission by the opposing force, through equipment that increases the effectiveness of C Rec actions, by the possibility of its early location. Technically, for an aircraft to be detected by primary radar, it must have a minimum size of approximately $2m^2$ or have a transponder that sends electronic signals to secondary radars. About 80% of RPASs worldwide are small and unable to fly with the equipment. Therefore, there is the difficulty of detection by traditional systems.

In our field research, we identified the DroneBlocker 0100[14] (for military applications), equipment capable of blocking a radio-controlled UAV over long distances. The use of the equipment eliminates the need for operators, with independent operation, having been successfully used by BA during the Rio 2016 Olympic Games. It should be clear, however, that this equipment does not have features for neutralizing a non-radio operating UAV. There are already UAVs operated through Bluetooth connection with a smartphone and others whose connection is via satellites.

6.2 The use of Rpas

Considering the organizational structure of the Cavalry and observing the doctrines that guide the requirements and possibilities of employment, we set the focus of this study on reconnaissance missions, naturally extended to those of C Rec and Security, where the reconnaissance activity is paramount.

From the existing knowledge, the observations made and especially the documentary references already cited, the benefit offered by the use of RPAS by Pel C Mec is more than clear. This tool offers a great ability to observe, identify and locate, assisting the action of G Exp.

It is noteworthy that the use of this feature does not replace that provided for in the original doctrine of reconnaissance; it is complementary, as Rosenberger (2004) wrote in "Breaking the Saber". It should also be noted that perhaps the greatest advantage in its use is the physical preservation of men, as it greatly minimizes exposure to the risk of slaughter, with access to relevant and up-to-date information, allowing for greater accuracy and agility in decision making.

As already seen, the use of RPAS is pointed out in more than one reference document produced by the BA. In particular, there is the Annex "E" – Essential Elements of Doctrinal Information – of the Plan of Development of Terrestrial Military Doctrine 2016/2017 (BRASIL, 2015), as shown in Chart 2.

14 Manufactured by IACIT Solucoes Tecnológica S / A, in São José dos Campos, it monitors, detects and acts against *drone*/UAV attacks.

Chart 2 - Essential Elements of Doctrinal Information (EEDI)

ITEM	EEDI	AUTHOR'S CONSIDERATIONS
2 - INTELLIGENCE	"d. What means with aggregate technology are employed for intelligence activity?" "k. What is the observation material used by the fractions that perform reconnaissance actions? (Mat type, observation range etc.)"	d. The basis of intelligence activity is good information, in which the use of RPAS greatly contributes operationally. k. See the characteristics of the RPAS operation.
3 - FIRE	"e. Can RPAS be used to observe and conduct field artillery fire?"	Undoubtedly, the features and capabilities of RPAS operation are favorable.
5 - COMMAND E CONTROL	"g. Are there direct support tactical modules to meet the needs of combat units with regard to Geointeligence (in Brazil, Geoinformação)? If so, how is it employed?"	RPAS has geoinformational capacity.
8 - SPECIAL OPERATIONS	"f. What are the vehicles, the equipment intended for the acquisition of targets and the aid to the conduct of the air fire (laser designators, ground plane means of communication, among others), remotely piloted aircraft systems (RPAS), intended for the FOpEsp of the Armed Forces (AF), particularly those of the Army?"	Undoubtedly, the features and capabilities of RPAS operation are favorable.

Source: our elaboration, from Brasil (2015)

This direction also finds support in Mesquita (2014), in his study "A Brigada de Cavalaria Mecanizada na Transformação da Doutrina", in which he suggests the "modernization in the C Mec fractions of the Bda C Mec"[15]. From these suggestions, we selected those directly related to the focus subject of this study, which are shown in Chart 3.

Chart 3 - Suggested upgrades to C Mec fractions of the Bda C Mec

Fraction	Suggested upgrades
RC Mec	• Combat in low visibility conditions • Perform night operations • Having a RPAS
Esqd C Mec	• Having ground surveillance (not necessarily radars) • Able to operate supported by Av Ex and RPAS • Arrange provisional platoons • Combat in low visibility conditions • Perform night operations
Pel C Mec	• Having ground targeting means • Having film and photography media capable of real-time data and voice transmission

Source: Author's adaptation, from Mesquita (2014)

15 Our translation.

6.2.1 RPAS definition and standardization

Considering the current employment profiles, according to recognition needs, it is necessary to observe the possibility of using two RPAS configurations:

1. the Horus FT-100 (fixed wing), already standardized and in use, which has longer range, higher altitude operation and geolocation capability;

2. a multi-rotor SARP (as a reference, the DJI, also existing in the BA). This RPAS does not have the capabilities of the FT-100 and its battery lasts an average of 30 minutes. However, it is very useful for flights in more restricted areas (where it is not possible to use the FT-100) and also offers excellent quality images in real time.

Thus, further standardization of a multi-rotor RPAS is suggested.

6.2.2 Strategic Definition (or lines of action for the RPAS operation)

According to Mesquita (2014), the transformations that are being developed in the BA are strongly influenced by the doctrine employed in the US army. For this reason, we sought some data on the use of RPASs in that army.

Fox (2017), in his study "The State of the Cavalry: An Analysis of the U.S. Army's Reconnaissance and Security Capability" on the US Army, states that "At the most elementary level, reconnaissance and security operations are conducted on the ground and in the air. Therefore, all echelons of command must maintain organic ground and air reconnaissance and security capabilities."

Within the US Army structure, the battalion has a reconnaissance and UAVs squad, and the BCT (Brigade) has the cavalry squad and the operations with UAV squad. However, Fox, opposing the current direction of Cavalry missions — with regard to reconnaissance — argues for the existence of organic elements of reconnaissance and security at the division and army command levels, because "as the echelon of command increases, so too does its need for multidimensional reconnaissance and security assets."

However, our analysis offers a counterpoint, based on the fact that the high need for high command recognition (namely information) is obvious, but this does not need necessarily to be met at the high command level, as subordinate operational levels have exactly that responsibility.

On the other hand, the effectiveness of RPAS operation above R C Mec needs to be observed, which is not so clear. At this point, we are in agreement with Mesquita (2014) in his suggestions for modernization (see Chart 3), as explained below.

Operationally, the Pel C Mec is "the tip of the spear", having in its G Exp the most particular recognition function. For this reason, we believe that the use of RPASs will always be more effective from Pel C Mec. However, it appears that its current structure, due to its attributions and endowment, does not show conditions to assume responsibility for this employment. Thus,

our suggestion is to create a specific team/section, which would be added to the current platoon structure, which, for the purpose of this study, will be identified as Section RPAS (Sec RPAS).

This Sec RPAS would be composed of 03 men (operator, launcher and observer, one of them being the commander), boarded in an LTV. Briefly, the Pel C Mec Sec RPAS would be structured as[16] follows: 01 FT-100 RPAS, 01 multi-rotor RPAS, 03 men and one LTV.

Considering the C Rec and Security aspects, RC Mec would also have a Sec RPAS, operated by the Command and Support Squadron (Esqd C Ap). For Esq C Mec, there would be no need for Sec RPAS because of the existing allocation in their Pel C Mec. Any Sec RPAS could be requested, considering the need and flexibility of employment, composing a provisional structure. According to this suggested **viable model**, each RC Mec would be equipped with 09 Sec RPAS in the Pel C Mec and one additionally equipped with a UAV blocker to provide C Rec and Security (see section 6.1 "A Brief Approach: Security, Counterintelligence (C Intlg) and Counter-reconnaissance (C Rec)").

7 Logistical aspects

In an overview of the most representative logistical aspects for the systematic use of RPAS, the acquisition, maintenance and training process (with comments that include knowledge of the relevant legislation, the operation itself and maintenance) were addressed.

7.1 Acquisition process

From the official standardization of RPASs, it is possible to make acquisitions through "exemption from bidding", using the benefits provided by Law 12.59/2012 (RETID), with the previous accreditation of its manufacturers in the Defense Industrial Base (DIB), complemented by the previous qualification of the Federal Revenue (RFB).

Law 8.666/93 shall be used in a subsidiary manner, in view of its Art. 24. "The bidding is unnecessary: (...) XIX – for the purchase of materials for use by the Armed Forces, except for personal and administrative materials, when there is a **need to maintain the standardization** required by the logistical support structure of naval, air and ground means, upon the opinion of a committee consisting of decree" (BRASIL, [2001], emphasis added, our translation). It is worth remembering that, in negotiations with manufacturers, it is necessary to observe the price reduction percentages, due to the benefits of RETID.

7.2 Maintenance

For the maintenance of RPASs, the following aspects must be met:

1. preventive maintenance – establishment of routines (1st step – part of the operators training);

16 There are 3 UAVs, considering that the RPAS Horus FT-100 consists of two aircrafts.

2. ability to perform preventive and/or corrective maintenance (2nd step);

3. immediate spare parts and accessories stock.

On December 2, 2012, ANAC approved RBAC No. 43 (Amendment No. 01), which addresses "Maintenance, Preventive Maintenance, Reconstruction and Alteration". This document should be observed as a support to the composition of maintenance programs.

7.3 Training

In any activity, the human factor needs to be strategically considered. The SARP operation, due to its relative complexity, requires specific and adequate training of all personnel involved, especially regarding the following items. And, in light of what was mentioned during the study, we seek to present a generic suggestion regarding the instructional needs for training in these areas.

1. **Basic knowledge of topography, geolocation and meteorology:** The FT-100 RPAS has requirements for filming, photographing and georeferencing (terrain profile, obstacles, fixed and moving targets, etc.). Understanding of flight characteristics is necessary to recognize the influences of wind speed, temperature, altitude and UAV speed — relations/conditions that affect it.

The Cia Prec Pqdt's operational flights have been found to deliver good results, in large part because of their operators' existing knowledge, due to the characteristics of natural formation for the precursor activity.

Therefore, for the training related to this subject, it is suggested that the responsible instructors be recruited at Cia Prec Pqdt. This is an aspect that leads to practicality, since two knowledge is combined in the same instruction team: the specific and what concerns Operation RPAS (2), below.

2. **RPAS operation:** RPASs (standardized and in the process of standardization) have specific technological characteristics due to their use. A strong understanding of RPASs is required, not only to make the most of their capabilities, but also to maintain their physical integrity.

3. **Legislation:** This is a sensitive aspect, as, in the event of an accident, the relevant regulations must be complied with in order not to create unnecessary problems. As a source of instruction for this content, it is suggested the collaboration of a professional of the Air Force Command/DECEA, in view of the main origin of the legislation. It should be remembered that the ANAC document RBAC no. 43 (Amendment No. 01) (referenced above: Maintenance, p.18-19) is also a component of applicable law.

4. **Recognition:** In view of the need for a new doctrine (now expanded), a new training standard in RPAS recognition is needed. The instructor(s) responsible shall be assigned as determined by the competent command. However, attention should be paid to the detail that this/these instructor(s) should participate, preliminarily, in the instructions detailed in items (1) and (2) above.

5. **Maintenance:** Refers to the maintenance of the systems. It is important to define the basic process from the manufacturers. We refer to the establishment of a planned/scheduled maintenance program, with the respective maintenance routines, considering the levels of such activity (1st: operators; 2nd: designated maintenance unit; 3rd: manufacturer). It should always be borne in mind that proper maintenance is primarily responsible for compliance with the equipment's life cycle as originally intended.

This instructional content demands two steps.

Step 1: destined for those responsible for 2nd level maintenance operations (designated unit). Its development should be carried out by manufacturers' professionals, which should be negotiated upon the acquisition of RPASs.

Step 2: Intended for operators, for basic maintenance. This simpler step should be conducted by the designated maintenance unit.

In order to assist in addressing and prioritizing the main action needs (which are obviously not fully represented), the result of the application of the GUT Analysis/Matrix[17], a management support tool, is shown below (see Table 1). Simply designed, this tool assists in the formation of strategies, project management and information gathering, based on their definitions.

The application of this matrix considers the Gravity, Urgency and Tendency (GUT) of the analyzed situation/problem, whose aspects are scored as follows:

Gravity (G)

5 = extremely severe; 4 = very severe; 3 = severe; 2 = not very severe; 1 = no severity.

Urgency (U)

5 = needs immediate action; 4 = is urgent; 3 = as soon as possible; 2 = little urgent; 1 = can wait.

Tendency (T)

5 = will get worse quickly if nothing is done; 4 = will get worse soon if nothing is done; 3 = will get worse; 2 = will get worse in the long run; 1 = will not change.

17 The **GUT** Priority Matrix (Gravity x Urgency x Tendency) was proposed by Charles H. Kepner; Benjamin B. Tregoe (1981), as one of the tools used in problem solving. It is a quality tool used to set priorities given to various action alternatives.

Table 1 - GUT Analysis/Matrix

Actions required	G	U	T	G × U × T	Solution order
A. Definition and standardization of multi-rotor RPAS (or other model for the same purpose)	5	5	3	75	**3**
B. Definition and standardization of anti-drone equipment (blocker)	5	5	3	75	**3**
C. Making and disseminating specific doctrine (Operation RPAS)	4	4	1	16	**7**
D. Strategic definition and delivery schedule of contemplated OMs	5	5	1	25	**5**
E. RPASs acquisition schedule (budget dependency)	5	4	1	20	**6**
F. Definition of the composition of the operator structure (personnel strategy)	3	3	1	9	**9**
G. Training of operators	3	3	1	9	**9**
H. Definition of capacity structure	3	4	1	12	**8**
I. Definition of the organizational structure (and general reporting) of the RPAS operation[1]	5	5	4	100	**1**
J. Maintenance Structure	4	5	3	60	**4**
K. Acquisition process (elaboration)	4	5	1	20	**6**
L. Definition and negotiation with suppliers	4	4	1	16	**7**
M. DIB Accreditation and qualification Actions	4	4	1	16	**7**
N. Definition of UAV blocker usage and standardization	5	5	3	75	**3**
O. Purchase of new batteries for FT-100 (longer life)	4	5	4	80	**2**
Q. Purchase of additional batteries for multi-rotor RPASs currently in use	4	5	4	80	**2**

Source: elaborated by the authors (2019).

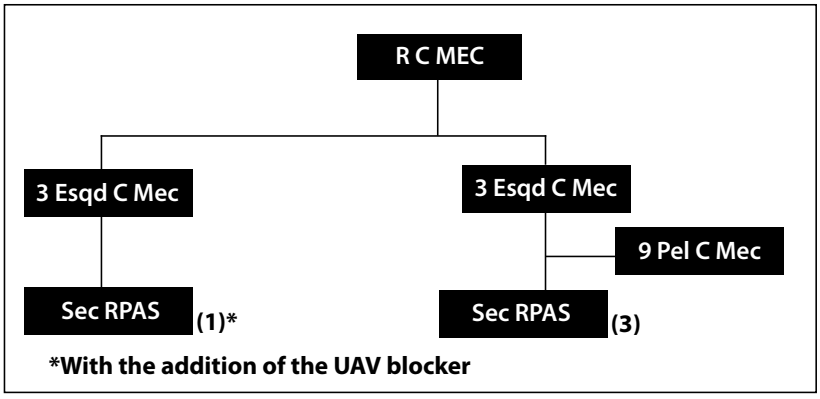
8 Final considerations

The BA is currently undergoing a deep transformation process, based on strategic projects that seek to create new skills, tailored to the needs of the "knowledge age". In this context, the systematic use of RPASs by the Pel C Mec, due to the facts and reasons exposed throughout this study, is strongly recommended.

However, considering the current economic situation and the high cost of implementing the **viable model** suggested in item 6.2.2 (p. 17), a more realistic option from a budgetary point of view (synthetic demo in Chart 4) is shown, with a **reduction from 10 to 04 Sec RPAS**, which may also meet the operational needs already discussed, according to experts on the subject, interviewed throughout the investigation. Rather than being exclusively dedicated to Pel C Mec, each RC Mec would be endowed with 04 Sec RPAS: one in each Esqd C Mec and one in the Esqd C Ap. The latter would be additionally equipped with a UAV blocker.

Operationally, it will be up to the commander of each of the three Esqd C Mec to define their Sec RPAS application for enhancing the reconnaissance ability of the Pel C Mec (purely strategic decision).

Chard 4 - Synthesized structure of the suggested option



Source: elaborated by the authors (2019).

From the priorities identified as a result of the GUT Analysis (the author's understanding), the next step should be developing action plans, with allocation of responsibilities, budgets and schedules, listed in Table 2.

Table 2 - Priority order for basic actions

Required actions	Priority order
H. Definition of the organizational structure (and general reporting) of the RPAS operation	1
N. Purchase of new batteries for the FT-100 (lasting two hours)	2
O. Supplementary battery purchase for multi-rotor RPASs in use	2
A. Definition and standardization of multi-rotor RPAS	3
M. Definition of UAV blocker usage and standardization	3
I. Maintenance Structure	4
C. Strategic definition and delivery schedule of contemplated OMs	5
D. RPASs acquisition schedule (budget dependency)	6
J. Acquisition process (elaboration)	6
B. Making and disseminating specific doctrine (Operation RPAS)	7
K. Definition and negotiation with suppliers	7
L. DIB accreditation and qualification actions	7
G. Definition of capacity structure	8
E. Definition of the composition of the operator structure (personnel strategy)	9
F. Training of operators	9

Source: elaborated by the authors (2019).

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ECEME

ARTICLE DOI 10.22491/cmm.a011

An analysis of military draft of reservists in RMR (Recife's Metropolitan Region) and its importance to National Mobilization

Un análisis del reclutamiento y formación de reservistas en la RMR (Región Metropolitana de Recife) y su importancia para la Movilización Nacional nacional

Abstract: This study analyzes how the Seventh Military Region (7th RM), subordinate to the Military Command of the Northeast (MCN – CMNE), manages the recruitment and training of reservists of the Brazilian Army in the Metropolitan Region of Recife (MRR – RMR). Thus, we understand its importance for National Mobilization in the face of a hypothetical need to expand the capabilities of the Army in the Amazon region through its numerical enlargement and deployment of troops. To this end, this study refers to the recent global and regional instabilities and analyzes the geopolitical importance of the Northeast region of Brazil. Next, we explore the vision of scholars who studied this issue as well as the federal laws and documents produced by the Ministry of Defense and the Brazilian Army on mobilization and recruitment. In this research, we analyze the role of the 7th RM in the recruitment and training of reservists in the RMR and draw conclusions on the importance of the management of the Mandatory Military Service (MMS – SMO) in times of peace.

Keywords: Mobilization. Army. Military Service. Analysis.

Resumen: Este estudio analiza cómo la Séptima Región Militar (7ª RM), subordinada al Comando Militar del Nordeste (CMNE), maneja el reclutamiento y entrenamiento de reservistas del Ejército de Brasil en la Región Metropolitana de Recife (RMR). Por lo tanto, entendemos su importancia para la Movilización Nacional ante la hipotética necesidad de expandir las capacidades del Ejército en la región amazónica a través de su expansión numérica y de su envío de efectivo. Con este fin, se señalan las recientes inestabilidades mundiales y regionales y se analiza la importancia geopolítica de la región Nordeste de Brasil. Luego, se explora la opinión de los pensadores que se ocupan del tema, las leyes federales y los documentos producidos por el Ministerio de Defensa de Brasil y el Ejército Brasileño que se ocupan de la movilización y del reclutamiento. De este ejercicio, se concatenó sobre la importancia de la operación del Servicio Militar Obligatorio (SMO) en tiempos de paz y el papel de la 7ª RM en el reclutamiento y entrenamiento de reservistas en la RMR.

Palabras clave: Movilización. Ejercito. Servicio militar. Análisis.

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Received: Aug. 31, 2018
Approved: Mar. 13, 2019

COLEÇÃO MEIRA MATTOS
ISSN on-line 2316-4891 / ISSN print 2316-4833
http://ebrevistas.eb.mil.br/index.php/RMM/index

1 Introduction

Among the guidelines of the National Defense Strategy – END (BRASIL, 2012), there is reference to the importance of training the Armed Forces for the following scenario: "asymmetric war, especially in the Amazon region, to be sustained against an enemy of superior military power" (BRASIL, 2012, p. 82). Based on this guideline, this research asks: How does the Brazilian Army recruits and trains reservists in the Metropolitan Region of Recife (RMR), and what is its importance for National Mobilization? To this end, this research pinpoints the instabilities of the international context and considers the regional conjuncture. The study also analyzes the relevance of both soldier and recruitment for National Mobilization and considers the importance of the "population" factor to National Power[1]. Other aspects are analyzed, such as the relevance of the geographical area under the responsibility of the Military Command of the Northeast (CMNE)[2] to assist the Amazon region with troops; the legal framework of the SMO (Mandatory Military Service, also called Initial Military Service – SMI), and how the 7th RM would carry out the recruitment and training of reservists in the RMR[3].

The study of a metropolitan region within a specific Military Region may provide a practical example of how legal mechanisms and norms related to SMO/SMI and National Mobilization are put into practice. Recife's Metropolitan Region (*Região Metropolitana de Recife* – RMR) was chosen because of its population, amounting to 4,054,861 million inhabitants (IBGE, 2018)[4] – , which is the third largest area within the area under CMNE responsibility; and its relative proximity to the Northern Military Command (CMN) as well as the links between the latter, the Amazon Military Command and the Military Command of the Northeast. Furthermore, the concentration of Army's bases in this metropolitan region facilitates the mobilization of populace. Finally, RMR is the only metropolitan region under CMNE area of responsibility that prepares both soldiers and aspiring officers (trained in all Army Branches). This aspect frames the metropolitan region as strategic for the Army's operability.

Soldiers receive the patent during the one-year school period from their incorporation into an OM, while those who hold the Reserve Officer Preparation Centers (CPOR) leave with the rank of aspiring officer after one year of instruction[5] (BRASIL, 2014a). There is a CPOR in the city of Recife,

1 The Superior School of War (ESG) defines National Power as "the capacity the group of man and means that compose the nation have to reach and maintain national goals, in accordance with national will" (BRASIL apud SERRÃO; LONGO 2012, p. 20).

2 For operational purposes of the Brazilian Army, Brazil is divided into eight Area of Military Commands. The Amazon Military Command (CMA), based in Manaus; the Northern Military Command (CMN), based in the city of Belém; the Northeast Military Command (CMNE), based in Recife; the Western Military Command (CMO), with headquarters in Campo Grande; the Military Command of Planalto (CMP), based in Brasilia; the Military Command of the East (CML), based in Rio de Janeiro; the Military Command of Southeast (CMSE), based in São Paulo; and the Military Command of the South (CMS), based in Porto Alegre (BRASIL, 2003b).
Military Regions subordinate to the CMNE are: the 6th Military Region (6th RM), responsible for the states of Bahia and Sergipe, with headquarters in Salvador; the 7th Military Region (7th RM) responsible for the states of Rio Grande do Norte, Paraíba, Pernambuco and Alagoas, with headquarters in Recife; and the 10th Military Region (10th RM), responsible for the states of Ceará and Piauí, with headquarters in Fortaleza (BRASIL, 2003b).

3 The municipalities that make up the RMR are: Abreu e Lima, Araçoiaba, Cabo de Santo Agostinho, Camaragibe, Goiana, Igarassu, Itamaracá Island, Ipojuca, Itapissuma, Jaboatão dos Guararapes, Moreno, Olinda, Paulista, Recife and São Lourenço da Mata.

4 This calculation was made as follows: we searched the official website of IBGE (Brazilian Institute of Geography and Statistics) for the estimates for 2018 of the total population of each city of RMR and summed them all.

5 The term "reservist" refers to citizens who have already performed mandatory military service. The steps for recruiting or not recruiting are as follows: Convening, Enlisting, General Selection, and Incorporation. Becomes a recruit he who is incorporated into the Force.

namely CPOR – Recife. This CPOR is, together with that of Porto Alegre, the only one in Brazil to be held outside the Southeast region[6] (BRASIL, [20--]), a fact that increases its responsibility concerning the North region, which does not have this type of OM and that, therefore, would not have the same means and conditions of mobilizing aspiring officer reservists on all weapons at the same speed as the RMR.

For this investigation to be carried out with precision regarding information and data, we resorted to official documents such as laws, decrees and ordinances related to the topic. In addition, we recall that current legislation specifies various types of military recruitment and/or services, such as military service for women (BRASIL, 1994a, 1994b) and health professionals (medical, pharmacy, dental and veterinary students, and Doctors, Pharmacists, Dentists and Veterinarians) (BRASIL, 1967). These specific recruitment forms are beyond the scope of our analysis, as we seek to understand how, essentially, the RMR can supply numerical military lags in the Amazon region.

It is concluded that there is robust legal backing in the country for the convening of nationals who have provided the SMO, as well as a structure managed by the Ministry of Defense and Armed Forces regarding peacetime recruitment and convening in case of mobilization. A more comprehensive study should consider the role of the Navy and Air Force in peacetime recruitment and mobilization decree, as well as the conditions related to strategic logistics[7] (highways, airways, waterways) related to the deployment of RMR troops to the Amazon region[8].

2 International, Regional and Local Context

This decade (2010-2020) has witnessed important geopolitical developments, such as rising tensions in the South China Sea, affecting China, neighboring countries and the US; deep Middle East instability, and worrying events in the Korean Peninsula due to continuing ballistic capacity tests operated by North Korea. With regard to the latter, there are signs of cooling belligerence due to the efforts of both Koreas as well as the US. Other highlights include the Middle East refugee crisis in Europe as a result of the region's continuing instability and the tension between NATO and Russia, occupying opposing positions on issues concerning the Ukrainian sovereignty and which led to the promotion of military exercises near their borders (NATO and Russia).

In South America, there is also a tendency towards instability. At the borders of the Brazilian states of Amazonas and Roraima, the coming of nationals of from Venezuela is growing due to the serious political-economic crisis this country faces. So far, Brazil has received about forty thousand Venezuelans (RENDOM; SCHNEIDER, 2018). In addition, it has to deal with

For CPOR/NPOR entry, "candidates for enrollment in Reserve Officer Preparation Centers (CPOR) or Reserve Officer Preparation Nucleus (NPOR) must attend the selection as indicated by the Military Service Board." (BRASIL, 2014b). If deemed fit in the General Selection, they "will be referred to the Special Selection to CPOR/NPOR." (Idem).

6 The other CPOR are in the municipalities of Rio de Janeiro, Sao Paulo and Belo Horizonte (BRASIL, 20--)

7 Strategic logistics is one designed "routinely during peacetime through well-designed work" (KRESS, 2002, p. 26, our translation). Strategic logistics plans are "robust and have a long-lasting effect on the capabilities of the military operation" (KRESS, 2002, p. 26, our translation). Kress identifies four dimensions of this logistics, namely: technological, industrial, transportation, and inventory/storage. Therefore, strategic logistics thinks of structures that may have direct or indirect, but long-lasting impact on military activity/operations.

8 By "Amazon region" we refer to the geographical area under the responsibility of the CMA that encompasses the states of Rondônia, Acre, Amazonas and Roraima, and to the area under the responsibility of the CMN, which includes the states of Amapá, Pará, Maranhão and part of Tocantins; the other part is under the responsibility of the Military Command of Planalto.

another geopolitical challenge, i.e., the neighborhood with two NATO countries, French Guiana and Colombia (NATO Global Partner).

Finally, Latin America has increasingly gained attention of the United States. The instability in Venezuela and the potential for this instability to further hit its neighbors and the oil market is one of the *Hegemon*'s main concerns (SPETALNICK, 2016).

Other concerns are related to instabilities in Central America that encourage immigrants and/or refugees to go to the US (GRILLO, 2018). In addition, the Northeast region of Brazil grows in importance to the US. The region has one of the best rocket launch locations in the world, where the Alcântara Launch Center is installed. This is due to the strategic location of the Center, according to the Câmara Agency:

> The Alcântara Base (MA) has a strategic geographical position, close to the equator, which saves 30% on the fuel used for launching satellites. This allows for competitive advantages over other countries that exploit this market. (BRASIL, 2005)

The United States has continually attempted to make an agreement with Brazil to allow the country to make use of this Center (OTTA, 2018). The Alcântara Base grew in strategic importance following President Donald Trump's announcement to begin the steps towards the creation of a "Space Force" (ROGERS, 2016).

Aside from the above-mentioned aspects, it is noteworthy that North and South America have US military operational bases in Panama, Puerto Rico and Colombia, under the guise of combating drug trafficking (LINDSAY-POLAND, 2015). There is also the activation of the Fourth Naval Fleet, whose areas under supervision are: Caribbean, Central America and South America (GRAGG, 2008). The fleet has been inactive since 1950 and resumed operation in 2008.

In addition to these geopolitical issues, internally, the country is experiencing instability. The Executive Branch has increasingly made use of the Armed Forces, especially the Army. Between 2010 and 2017, the Executive Branch decreed, in different states, 29 GLO operations guarantee of Law and Order (BRASIL, 2017a). In February 2018, a federal intervention was enacted in Rio de Janeiro's public security, an intervention that is also being headed by the Army. Also, in 2018, the Army and Navy were summoned to assist the federal government in dealing with roadblocks throughout Brazil, promoted by associations of (and autonomous) truck drivers. Finally, the most recent GLO decreed by the Executive was to give the country better capabilities to respond to the intense wave of immigrants from Venezuela to Roraima. Decreed on 9/28/2018 and renewed on 10/30/2018 and on 12/28/2018, this GLO is expected to last until March 2019 (COSTA, 2018). All these events point to the relevance of studies on National Mobilization and military service in Brazil.

3 Military Instruction and the Importance of the "Population" Factor for National Mobilization

One of the commonalities in classical strategy writers such as the Florentine philosopher Niccolò Machiavelli and the Prussian military Karl Von Clausewitz concerns the importance of the

state or statesman having the ability and means to manage the population for war purposes. In works such as "The Prince" (1505) and "The Art of War" (1520)[9], Machiavelli discusses the theme pointing out the dangers of the prince maintaining an army of mercenaries or auxiliary troops and the virtue of maintaining or preparing a force of subjects/ruled that should be activated in case of war, i.e., the militia.

For Machiavelli, the ruler should keep up the effort to train and recruit his own citizens or subjects (Machiavelli, 1998). Mercenary weapons would be useless or dangerous, according to the author (1998, p. 73): "They are ready enough to be your soldiers whilst you do not make war, but if war comes, they take themselves off or run from the foe." Auxiliary troops, that is, those who present themselves when the prince or ruler asks a third party to send his troops to protect him, also pose a risk to the country, as Machiavelli (1998, p. 80) puts it: "Auxiliaries may be excellent and useful soldiers for themselves, but are always hurtful to him who calls them in; for if they are defeated, he is undone, if victorious, he becomes their prisoner."

Thus, the Florentine argues that regardless of the qualities or defects of the citizen or subject, the ideal would be for the head of state to recruit those born in his territory. In fewer lines, "the purpose of anyone going to war should be to fight any enemy on the field and to be able to win a battle" (MAQUIAVEL, 2003, p. 20, our translation). For this it is necessary to "find the men, arm them, command them and train them in small or large orders, quarter them and then present them, profiled or marching, against the enemy" (MAQUIAVEL, 2003, p. 20, our translation).

The Florentine advocates that the men summoned should be those under the yoke of the ruler, which would give him the right to appoint those who best suited him. In this respect, Machiavelli teaches:

> Each republic and each kingdom must choose their soldiers from their own countries, whether hot or cold or temperate. From this it can be seen from ancient examples that, with training, good soldiers are forged in every country. Where nature fails, industry can be auspicious and provide more than nature. And selecting them from elsewhere cannot [truly] be considered a recruitment, because a recruitment means extracting the best from a province and having the power to select those who do not want to serve in the military, as well as those who do (MAQUIAVEL, 2003, p. 21, our translation).

Machiavelli's analysis points to the importance of forming a militia, it predates the formation of permanent armies. This formation began to occur in Europe from the seventeenth century onwards, when European states began to continually remunerate their soldiers for the purpose of maintaining a permanent army (CLAUSEWITZ, 1979)[10]. This professionalization of the armies conditioned its quality on the treasures of each country (CLAUSEWITZ, 1979). This treasure was not completely foreign to other states and led Europe to the following situation, described by the Prussian general:

9 The publication we use here of "The Prince", as set out in the bibliography, is from 1998. The publication we use here of "The Art of War", as stated in the bibliography, is from 2003.

10 The publication we use of "On War", as set out in the bibliography, is from 1979, but the work dates from 1832.

> No expansion could be made when the war broke out. Knowing the limits of enemy power, men knew that they were reasonably safe from utter ruin and, being aware of their own limitations, were in turn bound to restrict their purposes. Safe from the threat of extremes, it was no longer necessary to reach them. (CLAUSEWITZ, 1979, p. 699)

This reality ends when war in Europe becomes the object of concern and direct engagement of the people and not just the states. This was the situation perceived by the monarchies of Austria and Prussia that, by choosing to intervene in France and suppress the liberal impulses of the French Revolution, hoped to have to fight only against the already battered French Army. However, they were surprised by the involvement of the French population (CLAUSEWITZ, 1979). This involvement is close to the idea of a universal/total National Mobilization, that is, the war effort of an entire nation and not only of its professional army. About this engagement, Clausewitz writes:

> The people took part in the wars. Instead of governments and armies, as hitherto, the whole weight of the nation was thrown on the scales. The resources and efforts now available to use have exceeded all conventional limits. Nothing now obstructed the vigor with which war could be waged, and consequently France's opponents faced greater danger (CLAUSEWITZ, 1979, p. 701)

Thus, the variable "people/population", as well as its greater involvement, gave new features to the war in Europe, according to Clausewitz (1979, p. 220): "In tactics, as in strategy, numerical superiority is the most common element in victory". A contemporary description of this population-wide effort is found in the texts of Vietnamese General Vo Nguyen Giap, founder and commander of the Supreme People's Army of Vietnam. In his work "Vietnam According to Giap" (GIAP, 1968), the general refers to the 30 years of "revolutionary mobilization" led by the Communist Party of Vietnam. Illegal mobilization for the first 15 years, and legal for the last fifteen years, from the year the party assumed power in the country in 1945. "Revolutionary mobilization" illustrates how the Party has managed to gather a sizable portion of that country's population for the war effort against the French, Japanese, the landowning bourgeoisie, and sometimes even Chinese and British (GIAP, 1968).

The key point explored by Giap's work concerns not only the entire effort of the population, but also their will and engagement, as the Vietnamese general mentions:

> In the south, the British actively sought to accelerate the return of the French imperialists. Never before have there been so many foreign troops on Vietnam soil. But never before has the Vietnamese people been so determined to rise in combat to defend their country. (GIAP, 1968, p. 5, our translation)

Giap's work highlights important subjective points for the success of a people mobilization. The Communist Party, which commanded the army to gain the support of the peasantry, offered the peasantry not only the independence of Vietnam but also the right to land

they had not previously had. In the following passage, Giap's considerations show the party's bet on peasantry union:

> The Central Committee also formulated a new policy for the Party, temporarily setting aside its land reform slogan and replacing it with the slogan of reducing land rents and interest and confiscating land belonging to Vietnamese imperialists and traitors and distributing it to peasants. (GIAP, 1968, p. 37, our translation)

From the works of these three authors, we can reach some conclusions. Although they were written at different times (sec. XVI in the case of Machiavelli, XIX in the case of Clausewitz, and sec. XX in Giap's case), the nature of war retains some similarities. One concerns the advantages of a good relationship between the ruler and his people, as well as their ability to make use of their citizens or subjects to participate in the war.

The relationship between "population" and its importance to the country's military power is also examined by Brazilian military and politic Golbery do Couto e Silva. This author suggests that National Power[11] should be understood from four means or dimensions; the "economic, political, psycho-social and military means" (COUTO E SILVA, 1967, p. 24). The division suggested by Golbery is relevant because we find it in current documents that guide National Mobilization, such as in the Basic Doctrine of National Mobilization (BRASIL, 1987), which aims to "establish the doctrinal foundations to be considered in dealing with the activities of Mobilization" (BRASIL, 1987, p. 07).

The doctrine analyzes and defines actions to be taken in the four dimensions of power highlighted by Golbery. Regarding the military means, the doctrine says that "depending on the nature of the actions to be taken, the Armed Forces will become the major users of the resources and means of national power, whether human, material or financial" (BRASIL, 1987, p. 16). In the next section, we study how these "human resources" are distributed across the country and what legislation governs the SMO and deals with reservists.

4 Demographic Distribution and Legislation

4.1 Demographic Distribution

With the fifth largest population in the world[12], an aspect that works in favor of its National Power, Brazil has the advantage of being able to prepare highly effective Armed Forces in occasion of litigation. Despite its advantage in terms of absolute population, it is unevenly distributed. According to data from the Brazilian Institute of Geography and Statistics (IBGE),

11 The issue of the importance of the population or people for the national power of a country is also analyzed in the literature on power measurement indices. Serrão and Longo, in "Assessing National Power" (SERRÃO; LONG 2012), offer an important synthesis of a range of power measurement studies in which several authors address what they consider to be important factors or variables (population, installed capacity of steel production, economy, etc...) to the power of a nation. The importance of the variable "population" for the National Power is the most common among the studies analyzed by Serrão & Longo, being present in 13 of 21 studies.

12 According to the projection on the IBGE website, the estimated total population of Brazil in 2018 is 209,108,766 million inhabitants (IBGE, 2018). According to the official census page of the United States government, Brazil has the 5th largest population in the world, only behind, in descending order, of China, India, the United States and Indonesia (UNITED STATES OF AMERICA, 2018).

the demographic density of the Southeast region is 86.92 inhab/km2 (inhabitant per square kilometer), whereas the South region is 48.58 inhab/km2; the Northeast, 34.15 inhab/km2; the Center-West region, 8.75 inhab/km2 and, in the North region, 4.22 inhab/km2. The most populated region is the Southeast, with 80.36 million inhabitants, followed by the Northeast with 53.08 million, and the South with 27.38 million. The least populated are the Midwest region with 14.05 million, and the North region, with 15.86 million (IBGE, 2011).

That is why it is important one understands the recruitment mechanisms of nationals in the metropolitan region of another macro-region, which emerges to cover the low density and low mobilization potential of nationals in the Northern region, staffed by the CMA and CMN. Although it is located in the Northeast region, the state of Maranhão is under the responsibility of CMN. In this regard, it is not strange to the Army that the population of the Northeast can be useful in meeting the military needs of the country in the Amazon in a conflict situation. On this subject, McCann writes when he mentions the concerns of the Army Staff in the 1920s and 1930s:

> The Amazon was another concern to which little was done. Tasso Fragoso noted in 1927 that 'the Brazilian Amazon is abandoned to its own resources'; it had no battleship that deserved her name, nor aircraft. He noted with suspicion that an American expedition of geographers was photographing the region from an airplane under the 'dubious' pretext of scientific research (Tasso Fragoso, 1927: 83). The 1934 proposal suggested the construction of two highways for the Amazon; one from the Northeast, which was seen as a 'nature reserve' of human power to the Amazon and the other through the state of Mato Grosso, linking Madeira-Mamoré with Cuiabá and São Paulo (MCCANN *apud* FRAGOSO, 1983, p. 312, *our translation*)[13]

This idea is again found during the Military Government (1964 – 1985) within the National Integration Program (PIN), one of its objectives being to build the Transamazon Highway (BR – 230) that connects the city of Cabedelo, in Paraíba, to Labrea, in the Amazon, and the Cuiabá-Santarém highway (BR – 163) (BRASIL, 1970). About the Transamazon Highway, Abreu notes that:

> The construction of this highway through the Amazon basin would have been determined by two distinct and complementary reasons: on the one hand, a geopolitical concern with the 'territorial and demographic voids' and, on the other, the excess of poor population in the Northeast (ABREU, c2009).

Although McCann's passage more accurately refers to the use of the Northeast's population for emergencies in the North, Abreu also identifies military government concerns about the "territorial and demographic voids" in the region, as well as the population robustness of the Northeast that could heal such "voids". Another important fact of the geopolitical relationship between the Northeast and the North region is the history of CMNE itself. Before being called Military Command of the Northeast, the CMNE was called the Military Zone of the North, reaching all the states of the Northeast and the

13 Author's note: At the time of writing the phrase McCann mentioned, Tasso Fragoso was Army General.

North, and had its Command created by decree no. 9,510/1946 (BRASIL, 2003a). Ten years later, "the denomination is changed to IV Army, the Amazonian portion was broken up to constitute the Military Command of the Amazon" (BRASIL, 2003a). Headquartered in Manaus, this command was responsible for the entire northern region, until the Northern Military Command was created, in 2013, to be responsible for the states of Pará, Amapá, Maranhão and parts of Tocantins, headquartered in Belém.

It is in this context that the Metropolitan Region of Recife (RMR) is highlighted in a national strategy of mobilization of reservists, especially to meet the needs of troop numbers in the Amazon region. There are 21 Military Organizations in Recife; however, in our calculation we consider only 20, because an OM is a school, the Military College of Recife (CMR). Overall, there are 23 OM in the RMR that can act in the event of a National Mobilization decree (BRASIL, 2003b), the 14th Motorized Infantry Battalion (14th BIMTZ), which is based in Jaboatão dos Guararapes, the 7th Campaign Artillery Group (7th GAC), in Olinda and the Marshal Newton Cavalcanti Instruction Camp (CIMNC), in Abreu e Lima. In addition, of the 15 municipalities that are part of RMR, eight are tributaries, that is, municipalities that contribute to the Armed Forces with young people to provide the SMO[14]. There are some specifics of this universe, that is, the municipality of Jaboatão dos Guararapes is tributary of both the Army and the Air Force, Olinda is tributary of the Navy and the Army. Recife, in turn, is a tributary of the three Forces and the other municipalities are tributaries of the Army only (BRASIL, 2018).

4.2 Legislation

Military Service is a compromise between Machiavelli's model of militia instruction, the professional army that emerged in Europe in the seventeenth century, and the total engagement of the people (total mobilization) observed in France during the French Revolution. A considerable part of the countries of the globe adopt Military Service for men and, eventually, for women, in different formats and according to their geopolitical reality. In Brazil, the country has a robust legal apparatus for the Compulsory Military Service, as well as for National Mobilization.

According to Law 11,631 of 2007, National Mobilization is: "the set of activities planned, oriented and undertaken by the State, complementing the National Logistics, aimed at enabling the Country to carry out strategic actions in the field of National Defense, in the face of foreign aggression" (BRASIL, 2007). National Mobilization involves several areas, namely: "political, economic, social, psychological, security and intelligence, civil defense, scientific-technological and military" (BRASIL, 2007),[15] and is managed by the National Mobilization System (SINAMOB), composed of a series of ministries and bodies of the Presidency of the Republic. Its central body is the Ministry of Defense (MD).

Regarding the military dimension of mobilization, below SINAMOB there is the Sector Military Mobilization Subsystem (SSMM), which is also under the MD direction and coordination, which also

14 A resident in a non-tax municipality (MNT) for more than a year "may, at the discretion of DN [Naval Districts], RM [Military Regions] and SEREP [Recruitment and Staffing Services], be accepted as a volunteer for the purpose of meeting the specific needs of the Armed Forces" (BRASIL, 2018c).

15 If there is a National Mobilization that can be decreed for the whole territory (full mobilization) or for part of the territory (partial mobilization) (BRASIL, 2007), the executive branch has its rights extended on several fronts. Backed by Decree-Law No. 4,812, of October 8, 1942, as regards the scientific-technological and economic area for example, the State has the right to request as well as direct the country's industrial capacities for the supply of war materials or those necessary for the conduct of war (BRASIL, 1942).

coordinates the Military Expression Sector Management Body (ODSEM), composed of the Mobilization Systems of the three Forces, the Maritime Mobilization System (SINOMAR), the Army Mobilization System (SIMOBE) and the Aerospace Mobilization System (SISMAERO) (BRASIL, 2015).

The Armed Forces of Brazil train and prepare permanent soldiers and officers, as well as soldiers and officers providing the SMO. The table below lists the legal mechanisms that support SMO and National Mobilization.

Table 1 - Legal Mechanisms of Mobilization and Military Service

Law	What does it say?
Law No. 4,375 of August 17, 1964	Provides for the Nature, Obligation and Duration of Military Service.
Decree No. 57,654 of January 1966	Establishes Rules and Procedures for the Application of the Military Service Law, designated by the abbreviation LSM (Law No. 4,375 of August 17, 1964, as amended by Law No. 5,754 of August 1965)
Decree No. 63,704, of November 29, 1968	Regulation of the Law on the Provision of Military Service by students of Medicine, Pharmacy, Dentistry and Veterinary and by Doctors, Pharmacists, Dentists and Veterinarians – RLMFDV
Ordinance No. 422-SC-5 of February 21, 1990	State support for the conscript
Decrees No. 1,294 and No. 1,295, of October 26, 1994	Military service for women
Complementary Law 97 of 1999	Provides for the general rules for the organization, preparation and employment of the Armed Forces.
Law No. 11,631, of December 27, 2007	Provides for National Mobilization and creates the National Mobilization System – SINAMOB
Decree No. 6,592, October 2, 2008	Regulates the provisions of Law No. 11,631 of December 27, 2007, which provides for National Mobilization and creates the National Mobilization System – SINAMOB
Legislative Decree No. 373, of September 26, 2013	It deals with the National Defense Policy, the National Defense Strategy and the National Defense White Paper and makes other provisions.
Normative Ordinance No. 31 / MD, of August 29, 2017	Provides for the unification of enlistment, selection, distribution and assignment of enlistments to the SMO.

Source: The authors (2018).

In addition to the aforementioned laws, we highlight the importance of END and the National Defense Policy (PND) (BRASIL, 2012). Within the strategic planning methodology of the Armed Forces, the National Defense Policy is the document that guides the Armed Forces and is a standard to be followed by mandatory observance. On mobilization and SMO, the PND highlights some important points. Among the national defense objectives of the state is "to develop the potential of defense logistics and national mobilization" (BRASIL, 2012, p. 30). In addition, according to the PND, national mobilization capacities should be part of the national deterrence strategy as identified in the following passage:

> Diplomatic action in conflict resolution is compounded by the military strategy of deterrence. In this context, it is important to develop the capacity of national mobilization and the maintenance of modern, integrated and balanced Armed Forces, operating jointly and properly deployed in the national territory under conditions of ready employment (BRASIL, 2012, p. 32).

The importance of the soldier and the SMO is found in the END, which says that "to deter, one must be prepared to fight" (BRASIL, 2012, p.47). Thus, "Military mobilization demands the organization of a mobilizable reserve force" (BRASIL, 2012, p. 60) and, for this, the compulsory military service must be highlighted as "one of the conditions for mobilizing the Brazilian people in defense of national sovereignty" (BRASIL, 2012, p. 62). Thus, the role of the Brazilian Army is highlighted, since it is "above all the ground force that will have to multiply in case of armed conflict/war" (BRASIL, 2012, p. 82).

5 Recruitment and recruitment at RMR

5.1 Recruitment

The SMO in Brazil "consists of the exercise of specific activities performed in the Armed Forces – Army, Navy and Aeronautics – and comprises the mobilization of part of the population for all charges related to National Defense" (BRASIL, 1966). In times of peace, the Service "Is based on the conscious cooperation of Brazilians, in the spiritual, moral, physical, intellectual and professional aspects, in national security" & "Cooperates in the moral and civic education of Brazilians of military age and provides them with adequate instruction for national defense" (BRASIL, 1966).

According to the Reprint to Army Bulletin No. 1/2018, the Military Service and Mobilization System:

> ... comprise a set of management and executive bodies, primarily intended to ensure: I – the recruitment of the personnel necessary for their peacekeepers; II – the licensing of its incorporated or registered personnel; and III – the administration and control of its Reserve, aiming at the Mobilization of Human Resources (HR). (BRASIL, 2018f, p. 5).

Also, according to this document, in the Army's scope the "Military Service and HR Mobilization takes place in the territory of the Military Regions (RM), under the technical and doctrinal supervision of the Military Service Directorate (DSM)" (BRASIL, 2018f, p. 5). The function of this board is to "guide, monitor and control the activities of the regional agencies of planning, coordination, execution and supervision of the Military Service and Mobilization, throughout the national territory" (BRASIL, 2018f, p. 5). These Army sections are linked to the Army Staff (EME).

Thus, the Military Regions, through the Military Service and Mobilization Organs (OSMM), "are in charge of the Military Service and Mobilization activities in their jurisdictions, in liaison with the Naval Districts (DN), Recruitment and Staff Preparation Services (SEREP), Military Police and Military Fire Brigades" (BRASIL, 2018f, p. 6). The OSMMs are divided into

four types – the Regional Military Service Sections -, which are "regional agencies for planning, coordinating, executing and overseeing the Military Service and Mobilization" (BRASIL, 2018f, p. 6); the Recruitment and Mobilization Posts. (PRM),which are: "Regional Military Service and Mobilization Enforcement and Inspection Bodies" (BRASIL, 2018f, p. 6); the Military Service Boards (JSM), which are "Military Service executing bodies in the administrative municipalities" (BRASIL, 2018f, p. 6), and the Mobilizing Sections (SM), which are "mobilizing organs belonging to the military organizations, with mobilization duties of GU/Gu/OM, and subordinate to the RMs in whose territory they are based." (BRASIL, 2018f, p. 6)[16].

Since 2003, the selection process for the incorporation of conscripts for the Mandatory Military Service for the three Forces has been unified (BRASIL, 2018d). In 2018, the *online* enlistment came into effect nationwide[17], to enlist the 18-year-old fills in his data on the Army Military Recruitment and Mobilization Electronic System (SERMILMOB). The scheme below concerns the hierarchy of military institutions/organizations that deal with SMO/SMI of MD at 7th RM:

MD > EB (EME) > DGP > DSM (SERMILMOB) > 7th RM (SSMR)

5.2 RMR Recruitment

Recruitment at the 7th RM, responsible for the RMR, is regulated by the Military Service Section of the Region (SSMR). The Online Enlistment of the young person who may or may not be incorporated is managed by the Recruitment and Mobilization Posts (PRM) of the Region, if the conscript has not enlisted online he may apply to a Military Service Board (JSM) and do so "by completing an electronic form provided by SERMILMOB." (BRASIL, 2017b). Then, those selected by the system will go to the Presentation Post (PA), where they are evaluated by the Armed Forces Permanent Selection Commission (CSPFA) and, shortly thereafter, will be referred to the selection of Military Organizations.

The CPOR case,[18] which deals specifically with the training of aspiring officers, is managed by a Special Selection Commission attached to the CSPFA (BRASIL, 2018d). About this, the Normative Ordinance No. 3/MD says:

> Candidates enrolled in Higher Schools or in the last year of high school, volunteers to CPOR/NPOR, will only be referred to the Special Selection after being judged fit in the General Selection. 3.3.10.1. Appointed conscripts, not availed of in the Special Selection for Reserve Officer Training Bodies (OFOR), will return to the normal

16 By GU is meant Great Unity. By OM is meant Military Organization.

17 Exception is made for wastelands of the country with little or no internet access, such as areas under the responsibility of the 12th RM reporting to the Amazon Military Command (BRASIL, 2018x).

18 The municipalities of RMR tributary to CPOR Recife are Recife, Olinda, São Lourenço da Mata, Jaboatao dos Guararapes and Camaragibe (BRASIL, 2018d).

distribution process to Active Military Organizations (OMA) through SERMILMOB (BRASIL, 2018d).

The chart below, in hierarchical order, shows the order of military organs or sections of the Army engaged in RMR recruitment:

7th RM (SSMR) > PRM > JSM – CSPFA (Recife) – (Jaboatão dos Guararapes) – (Olinda); Army Selection Commission (other cities)

The term "reservist" refers to citizens who have already performed compulsory military service. The Brazilian state records an average of one million eight hundred thousand enlisted per year, of which six hundred thousand are referred to the general selection and one hundred thousand are incorporated (BRASIL, 2018b). The data presented here relate to the recruitment and training of reservists at RMR; our calculation considers reservists who have performed military service over the past five years, so between 2013 and 2017. We established this time-frame because it is during the period of five years, starting from the year following the service provided, that the reservist has the obligation to update his registration data, in person or over the internet, with the Armed Forces within the scope of EXAR – Presentation Exercise of the Reserve (BRASIL, 2017b). The purpose of the exercise is to "practice the convening mechanism and evaluate the efficiency of the mobilization system, while cultivating the civic spirit of the reserve members." (BRASIL, 2017b).

Another occasion, depending on the urgency, could lead to the calling of citizens who did not perform military service and who would receive some training to take up positions within the Army. Because we seek to analyze the recruitment and calling of those who provided the SMO, this hypothesis escapes the scope of this study.

In peacetime, the recruitment of civilians in the RMR works as follows: an average of 1850 young men are recruited and educated on different weapons, who after one year of SMO leave with the rank of soldier. The CPOR, in turn, instructs and trains an average of 170 young men who, after a year of military service, leave with the training of aspiring officers. The instruction for them is distributed as follows: 1. Intendency (30 students), 2. Communications (20), 3. War Material (30), 4. Artillery (20), 5. Cavalry (20), 6. Infantry (20) and 7. Engineering (30) (BRASIL, 2018c).

If it is assumed that most of the reservists who served the Army in the RMR remain there, and if we specifically count those who have to report annually within five years of service, the RMR would have approximately 9,250 deployable troops within reach, as well as 850 aspiring officers, which would total 10,100 reservists who could be put into readiness quite quickly.

This feature of RMR makes it particularly important for the defense of the country, and the Amazon in particular. The profile of reservists we analyzed (soldiers and aspiring officers) has the necessary training to supply the contingent army, according to the predicted employment hypotheses (HE)[19] :

19 According to the document "Siplex Army Planning System/2017" (BRASIL, 2017d): "Employment Hypothesis" means the anticipation of possible employment of the Armed Forces in a given situation or area of strategic interest for national defense. It is formulated considering the high degree of indeterminacy and unpredictability of threats to the country. Based on the employment hypothesis,

> Defense of sovereignty, preserving territorial integrity, heritage and national interests: in the Amazon – HE "A", in the Atlantic Ocean – HE "B", regionally (except Amazon) – HE "C", conflict between South American countries HE "D", meeting international commitments HE "E", defending national interests and safeguarding Brazilian people, goods and resources, or under Brazilian jurisdiction, outside national territory – HE "F" , Guarantee of Law and Order – HE "G" (BRASIL, 2016, p. 20 – 22)

Although the theater of operations of the Amazon region is different from that prevailing in the 7th RM, essentially due to climatic and topographic differences, the training the reservist receives throughout the national territory, especially in relation to GLO and preparedness to respond to foreign aggression, is the same (BRASIL, 2009). This enables the reservist to operate throughout the national territory. The peculiarities of the Amazon region, if they become a hindrance to the mobilized reservists, must be remedied by the Army with their formation and adaptation in that area.

6 Final considerations

The people/population factor is a key element for the National Power. This is fundamentally due to the number of people who can be mobilized directly or indirectly for war and guarantee the survival of the state. This exercise pointed out the vulnerabilities, in the demographic aspect, of the region under the responsibility of the CMN and CMA, and part of what could be done in the RMR, hypothetically and in line with current laws, decrees and ordinances, to remedy this vulnerability.

The motivation of this study was due to both internal and external issues. Externally, we pointed to elements of global instability that stimulated analyzes of defense issues in Brazil. In this context, the Northeast region is noteworthy because it was where the US installed (due to its strategic position in the Atlantic) under the consent of President Getúlio Vargas, between 1942 and 1945, an air base, "Paranamirim Field". Located in the state of Rio Grande do Norte, the air base served as a starting point for missions in North Africa and Southern Europe. Although the context of this early century is not the same, the instabilities in Asia and especially in Europe serve as a warning for a broad and contemporary analysis of the potentialities and weaknesses of the Northeast region of Brazil.

At the regional, as well as local (domestic) level, we highlight the deep instability that Venezuela is going through and the lack of contingent of the Armed Forces of Brazil in the state of Roraima, a fact that has mobilized military personnel from other parts of the country to the region. This is the case with Operation *Acolhida*. In 2018, CMNE's role as Area Command that could meet the needs of the CMA or CMN was confirmed with the sending of the 3rd Army contingent, under Operation *Acolhida*, to Roraima (CMA); the largest since the beginning of the operation, with 500 military personnel, most of them subordinated to CMNE (150 military personnel)

the strategic joint employment plans and the resulting operational plans will be prepared and kept up to date, in order to enable the continued preparation of the nation as a whole, and in particular of the Armed Forces, for employment in the defense of the country. (BRASIL, 2017d, p. 07).

(BRASIL, 2018a). The purpose of the operation is "to provide logistical and humanitarian support to Venezuelan immigrants who are in vulnerable situations in Brazil" (BRASIL, 2018a).

Finally, while not being the subject of our study, we recommend that a broader examination of National Mobilization, in view of the advantages and disadvantages of mobilizing RMR reservists for the Amazon, should consider the strategic logistics challenges for moving personnel to the northern region. A brief review using Google Earth-Maps software tells us that a road trip from Recife to Belém (CMN headquarters) takes approximately 29 hours, while a trip from Recife to Manaus (CMA headquarters) would take about 68 hours. This logistical challenge must be mitigated through coordinated action between the three forces.

For the purposes of troop transport, the FAB has qualified squadrons (the Transport Squadrons) and a range of aircraft, including the **C-130** Hercules and Boeing KC-767 (BRASIL, 2018e). The Army also plans to incorporate the aircraft KC – 390 in 2019 (BRASIL, 2018e). Also, in Recife, is located the Recife Air Base (BARF), a fact that enables the transport of military personnel, as could be seen by their sending to Roraima during Operation *Acolhida*.

Already the Navy, although it has its warships concentrated in Rio de Janeiro, also has the preparation and the necessary means for the deployment of troops. There are mainly two warships for this purpose, the Bahia Multi-Purpose Dock Ship and the Atlantic Multi-Purpose Helicopter Carrier. In RMR, there are two ports that enable the embarkation of troops, the Port of Recife, located in Recife, and the Port of Suape, located in the municipality of Ipojuca. This feature reflects a strategic advantage of RMR, as the other city with CPOR near Manaus and Belém, i.e. Belo Horizonte, is not a coastal city.

This analysis was limited to understanding the functioning of the SMO/SMI in RMR, for soldiers and aspiring officers. National Mobilization, on the other hand, is much broader than the dimension studied here, as it also concerns the emergency use of industry, the requisition of third-party goods for the war effort, among others. A more thorough study of National Mobilization at RMR would consider these other dimensions, how they would be managed, as well as the role of the Navy and Air Force in recruitment and their role in deploying troops, supplies, and war material.

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