

Organizational Innovation in the Military Context: Influential Paradigms and Research Gaps in Advancing the Defense Sector

Innovación Organizacional en el Contexto Militar: Paradigmas Influyentes y Brechas de Investigación en el Avance del Sector de Defensa

Abstract: Innovation in the defense sector is driven by currents of thought that tend to favor its practical applicability over its theoretical foundation, which influences the scarcity of in-depth reviews on the subject. Thus, the central purpose of this article is to map the current state of research in military innovation, identifying gaps in the national context and prominent international paradigms. The methodology adopted was an integrative literature review in the main databases on the subject, with an exploratory and descriptive character. The results obtained offer an overview of the predominant currents of thought and propose a research agenda focused on the main gap identified, namely, organizational innovation in the military context. The main theoretical contribution is to highlight organizational innovation and its operationalization as the main barriers to be studied and overcome. In the practical field, ways of implementing it through sectors dedicated to innovation are proposed.

Keywords: Organizational Innovation; Brazilian Military Institutions; Research Gaps; Integrative Review.

Resumen: La innovación en el sector de defensa está guiada por corrientes de pensamiento que tienden a favorecer su aplicabilidad práctica en detrimento de su fundamentación teórica, lo que influye en la escasez de revisiones en profundidad sobre el tema. Por lo tanto, el propósito central de este artículo es mapear el estado actual de la investigación en innovación militar, identificando brechas en el contexto nacional y paradigmas internacionales destacados. Se adoptó, como metodología, una revisión integradora de la literatura en las principales bases de datos sobre el asunto, de carácter exploratorio y descriptivo. Los resultados obtenidos ofrecen una visión de las corrientes de pensamiento predominantes y proponen una agenda de investigación centrada en la brecha clave identificada, a saber, la innovación organizacional en el contexto militar. El principal aporte teórico consiste en resaltar la innovación organizacional y su operacionalización como barreras esenciales a estudiar y superar. En el campo práctico, se proponen medios para ponerla en acción a través de sectores dedicados a la innovación.

Palabras clave: Innovación Organizacional; Instituciones Militares Brasileñas; Brechas de Investigación; Revisión Integradora.

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1 INTRODUCTION

Academic research in the field of military innovation assumes a role of considerable relevance due to its potential to make substantial contributions, both theoretically and practically (Griffin, 2017). However, its influence within the realm of scientific knowledge is still considered superficial (Griffin, 2017; Althoff et al., 2020), except within a highly specialized circle composed of scholars and professionals exclusively dedicated to this field. Fundamental topics in the research agenda on innovation in public or private organizations, such as organizational culture, the inherent challenges of institutional learning, and the assessment of the relative influence of internal and external factors on change processes remain underexplored in the military context (Griffin, 2017; Althoff et al., 2020).

Barry R. Posen (1984, cited in Griffin, 2017), who is considered a pioneer in the study of military doctrine, postulates that innovation in the military environment is a scientific field regulated by specific and little-accessed currents of thought. Furthermore, such currents tend to favor practical applicability over “theoretical purity,” which certainly contributes to the minimal number of publications on the subject. To change this scenario, this field of study needs innovative perspectives that maintain its intellectual integrity, transcend theoretical compromises, and incite fundamental epistemological and ontological discussions (Griffin, 2017). The strategic sensitivity of its activities, aimed at defending and maintaining national sovereignty, often prevents the transparency needed for more in-depth empirical research (Griffin, 2017; Althoff et al., 2020). The imperative for the armed forces to learn, adapt, and anticipate remains valid in both conflict and peacetime situations. However, there is a natural tendency within these organizations to focus on innovation dynamics only when deficiencies in addressing a potential threat become evident or when they find themselves ill-equipped to face an existing one (Franco-Azevedo, 2018; (Griffin, 2017).

Organizing and implementing planned changes that add value, i.e., innovating is something widely recognized as essential for enhancing the State’s problem-solving capacity and driving societal advancement (Maia et al., 2021). Organizations’ innovative competencies include not only the ability to understand and react to changes in its context but the need to explore new perspectives and develop knowledge and creativity, with special attention to the human element (Dobni, 2008).

Studies on military innovation highlight two main branches: technological and non-technological innovation (Franco-Azevedo, 2018; Marinho, 2022; Brites, 2022). Technological innovation encompasses the development of military equipment, weapons, and systems, focusing on improving tangible products such as weapons and military vehicles intended for defense use. In contrast, non-technological innovation relates to changes in strategic, tactical, and doctrinal principles of military operations, involving processes improvements (Franco-Azevedo, 2018; Marinho, 2022; Brites, 2022).

Additionally, innovation can be observed from two perspectives: top-down and bottom-up. Top-down innovation, aligned with hierarchy and strategic planning, involves

the development of new technologies and the acquisition of equipment initiated by higher hierarchical levels (Grissom, 2006). On the other hand, bottom-up innovation arises from the practical knowledge of combatants and needs identified on front lines, and it is more challenging to implement due to cultural and organizational resistance (Grissom, 2006).

An organization's capacity for innovation is a characteristic that develops over time. Thus, organizations do not need to attempt to develop all "innovation competencies" simultaneously. Instead, they should focus on their specific organizational gaps (O'Connor et al., 2008).

Therefore, the purposes of this study are to conduct a comprehensive analysis of the current state of research on military innovation in Brazil and to identify the main paradigms influencing the subject at the international level, through an integrative literature review. As a result, we hope to identify possible gaps in military innovation, guide future research, and provide a deeper understanding of areas requiring greater attention and investigation.

This paper is logically structured as follows. The applied methodology is presented, along with an analysis of the main studies supporting the research. Next, the body of the text is subdivided into two categories of results. First, internationally influential paradigms and the most relevant works returned in the Brazilian context are presented. Finally, the main gaps and directions for future research are identified, along with an alternative theoretical model based on hypotheses identified within the scope of military innovation, particularly in the Brazilian context

2 METHODOLOGY

In this study, a systematic literature review (SLR) was adopted for its methodical, clear, and reproducible approach. Methodologically, SLR requires the formulation of a well-defined question, the development of a search strategy, the establishment of inclusion and exclusion criteria for articles and most importantly, a careful evaluation of the quality of the obtained literature (Depaepe, Verschaffel, Kelchtermans, 2013).

The search strategy employed used the terms "innovation" and "military" in the main databases on the subject: the *Repositório Institucional da Produção Científica da Marinha do Brasil*, DSpace DECEX *Exército*, the institutional repository of the Brazilian Air Force (FAB), Defense Technical Information Center, Web of Science, and Scielo. However, this strategy returned few works within the Brazilian context, and thus, considering the scarcity of available studies and the uniqueness of the country's armed forces, an integrative literature review was chosen (Torraco, 2004).

The insufficiency of academic sources on the subject is tangibly reinforced by the systematic review conducted by Althoff et al. (2020). In Chapter 5 of the book *Gestão da produção em foco*, the authors conducted a comprehensive analysis of the literature on innovation management in military organizations in Brazil and worldwide, aimed at exploring the main scientific contributions in this context.

Considering the intrinsic importance of the innovation management process for entities of all kinds, the authors highlight that, in military organizations, this process assumes an even more fundamental role, as they are responsible for defending a nation's sovereignty (Althoff et al., 2020). Notably, the authors concluded and demonstrated that the most prominent countries in researching this topic are the United States, China, and India, which together account for more than 50% of the publications on the subject. In contrast, Brazil had just two articles and ranked 42nd in the year of the study.

The choice of an integrative literature review was based on academic principles. According to Patterson (1986), a subject gains relevance by having applicability in various situations, transcending restricted boundaries, and sustaining its importance for empirical behavior. Thus, the literature review offers substantial contributions, enriching the field with new strands (Torraco, 2004).

Torraco (2005) asserts that the characteristics of a review are conditioned by the maturity of the topic addressed. An integrative literature review of a mature topic encompasses the need to critique and possibly reconceptualize a knowledge base that continues to expand and becomes increasingly diverse. On the other hand, an integrative literature review of new or emerging topics provides a comprehensive conceptualization and synthesis of the literature to date (Torraco, 2004).

During the data search, it became evident that this study was characterized as an integrative review pertaining to the latter category, as it aimed at addressing a new and emerging topic, albeit within a consolidated and mature context. Certainly, as highlighted by Torraco (2005), it is rare for reviews to cover all aspects of research. Instead, the intention is to address the main international schools of thought, Brazilian empirical research, and potential gaps (Torraco, 2005), without intending to exhaust the subject.

According to Torraco (2005), the development of a comprehensive synthesis of the literature generally results in the creation of a new perspective. The most common forms of synthesis involve the proposal of a research agenda, a taxonomy (Doty & Glick, 1994), an alternative conceptual model or framework, and a metatheory (Ritzer, 1992). Hence, this study aims at presenting a research agenda based on an alternative conceptual framework, with propositions that guide the course of future investigations.

2.1 Main methodological steps

The first phase consisted of defining the research theme, which focused on innovation within the context of Brazilian military organizations. The second phase concentrated on establishing the inclusion and exclusion criteria for studies, as well as sampling and literature search. The articles' selection and rejection process was conducted with meticulousness and transparency (Torraco, 2005). Thus, articles, dissertations and theses were carefully selected when directly related to the theme of innovation, addressing the analysis of the implementation process of technological and non-technological innovations within the Brazilian defense

sector. Due to the scarcity of obtained studies, topics such as innovation management, open innovation, innovation ecosystems, barriers or inhibiting factors, as well as innovation-focused culture and leadership, were also considered. The main references selected during this phase of the review are listed below:

Table 1. Main references related to innovation and the Brazilian defense sector

TOPIC	DEFENSE SECTOR	REFERENCES
Engine & Art - of War: innovation in the defense sector	Defense Industrial Base (DIB) Brazilian Air Force (FAB) Higher Education Institutions (HEI) Government	Mota (2009)
Defense management: the innovation system in the non-war segment	DIB FAB HEI Government	Franco-Azevedo (2013)
Science, Technology, and Innovation in Defense: notes on the Brazilian case	DIB FAB HEI Government	Schmidt (2013)
Innovation management audit	Brazilian Navy	Almeida et al. (2016)
Military culture and professional mindset	Brazilian Army	Cruz (2022)
Culture of Innovation in Military Organizations	FAB	Borba (2022)
The role of military organizations in innovation ecosystems: an analysis in the Brazilian context	DIB Brazilian Army HEI Government	Pereira (2022)
Development of Innovations in the defense sector in Brazil: FX-2/Gripen NG Program	FAB	Brites (2022)
The influence of information technology management in the military sphere	FAB	Albuquerque et al. (2019)
Challenges of innovation as a strategy for generating land military capabilities	Brazilian Army	Caldeira e Barbosa (2021)
Proposals for open innovation strategies for public administration institutions: case study of the EB	Brazilian Army	Marinho (2022)
The innovation system in the defense sector in Brazil: prospective analysis of scenarios	DIB Brazilian Army HEI Government	Freitas (2013)

Source: the authors

In the global defense sector, the following studies were selected.

Table 2. Main references related to innovation and the global defense sector

TOPIC	DERENSE SECTOR	REFERENCES
Innovation management in military organizations: a systematic review from 1945 to 2019	DIB FAB HEI Government	Althoff et al. (2020)
Challenges of innovation as a strategy for generating	International Air Forces	Caldeira e Barbosa (2021)
land military capabilities	International Air Forces	Hill (2015)
Military Innovation and Military Culture	Força Aérea Americana	Borba (2022)
Subcultural Influence on Military Innovation	U.S. Air Force	White (2019)
The future of military innovation studies	U.S. Air Force	Grissom (2006)
Military Innovation Studies: Multidisciplinary or Lacking Discipline?	Internacional Air Forces	Griffin (2017)

Source: the authors

Moreover, studies with related themes, conducted within public administration entities such as the Military Police (Oliveira, 2008), the Military Fire Brigade (Souza, 2017), the Federal Court of Accounts (Souza, 2017), and the Federal Police (Morales, 2021), were selected and thoroughly reviewed. The purpose of it was to broaden the scope of the literature review and provide a solid foundation for potential comparisons and recommendations.

In the third phase, the elements to be extracted from the selected studies were determined, aiming at categorizing the collected data. The aim of this step was to structure and summarize the information, setting up a readily accessible and manageable database containing the main conclusions, limitations, and future perspectives outlined in the reviewed studies (Torraco, 2005).

The fourth phase was characterized by the critical evaluation of the studies incorporated into the review. The analysis was conducted to elucidate underlying reasons for divergent or conflicting results among the examined texts, primarily employing epistemological research, investigating relevant quantitative evidence, and ontological research by examining narratives of interviews conducted in the selected studies.

In the fifth phase, the synthesis of topics, identification of conclusions, and formulation of a research agenda were conducted, specifically targeting the most notable gap: studies on non-technological innovation and the development of an alternative conceptual model including all hierarchical levels in the analysis (Torraco, 2005).

3 RESULTS OF THE INTEGRATIVE REVIEW IN THE INTERNATIONAL AND BRAZILIAN CONTEXTS

3.1 Current state of research on military innovation in the international context: influential paradigms on military innovation

Military innovation investigates which changes in operational practice can result in a substantial increase in military effectiveness (Grissom, 2006). Currently, research in this domain employs both International Relations (IR) theories and Organizational Theory (OT) models. It focuses on methods that highlight the influence of environmental and cultural factors on the innovative productivity of armed forces, in addition to exploring the role of other elements that may facilitate or hinder innovation in military organizations (Lee, 2019).

To understand how this process unfolds in institutions characterized by traditionalism and hierarchy, theorists initially turned to debates in IR, particularly those derived from neorealism, which consider power as the central factor of analysis.

The main paradigms identified in the international literature center on Grissom's (2006) perspective. The author, one of the most influential in military studies, identified three schools of military innovation considered rational and objective: the civil-military model, the inter-service rivalry model, and the intra-service dynamics model. All three indicate that the determining factors of military innovation are primarily constructed around a neorealist perspective. Additionally, the author identified a fourth school, predominantly cultural in nature, which describes the role of norms in military innovation (Grissom, 2006).

The rational models constitute theories that explain innovation in the military context from neorealist perspectives centered on the concept of power, usually adopting objectivist approaches. In such approaches, innovations are motivated by the pursuit of strategic advantage and security in an anarchic international system, in which the relative power of states influences their interactions (Grissom, 2006). From this perspective, research takes a neutral stance, and the researcher assumes the role of an impartial observer whose responsibility is to describe culture via a representational method (Janićijević, 2011).

The civil-military model is the oldest theory in the field of military innovation, originating from Barry Posen's book, *The Sources of Military Doctrine*, published in 1984. Posen (1984) argues that the combination of balance-of-power theory with organizational theory provides a more comprehensive explanation of why military organizations innovate or fail to do so.

By conducting case studies, Posen's research (1984) analyzed how civilians compel military organizations to innovate in response to changes in the balance of power. However, these organizations resist change due to their own organizational imperatives. The author validated this model by investigating the military doctrines of France, Britain, and Germany between the two world wars, concluding that the civil-military dynamic determined whether the militaries of that period innovated (Grissom, 2006). The civil-military model argues that civilian statesmen foster military innovation after conducting a rational assessment of security threats to the state.

In scenarios of scarce security, these agents promote military innovation in collaboration with officers who share the same perspectives. However, military organizations tend to resist, seeking to maximize their power in the face of structural and material constraints (Grissom, 2006).

The second current of military innovation, the inter-service rivalry model, identified by Grissom (2006), focuses on the dynamics among a state's armed forces. The main argument of this model is that the scarcity of resources within the forces, such as materials, budgetary authority, and size acts as a catalyst for innovation (Grissom, 2006). This model posits that the armed forces compete to lead innovative projects, enhancing their technical capabilities and solutions to these innovations, aiming to secure increased resources for their organizations (Sapolsky, 2013). Harvey Sapolsky presents an example of this model in the work *Polaris System Development: Bureaucratic and Programmatic Success in Government*. The author showed that the development of the Polaris submarine-launched ballistic missile system was driven by competition between the U.S. Navy and the U.S. Air Force, the latter with its intercontinental missile, Minuteman. Such rivalry between the forces spurred the U.S. Navy, removing bureaucratic obstacles and helping the Polaris program to manage and allocate talent and resources more efficiently than most programs (Sapolsky, 2013).

The third theoretical current in the field of military innovation, known as the intra-service dynamics model, focuses on the internal interactions among military personnel from the same armed force (Grissom, 2006). In this context, "sub-communities" within the military environment compete for material resources, from budgetary authority, power, and promotions, aiming to promote their particular visions of innovation within the organization (Grissom, 2006). This model suggests that, to understand innovation processes in military organizations, it is essential to analyze the agents that constitute them (Grissom, 2006). The seminal work of this current, *Winning the Next War* by Stephen P. Rosen, proposed this model after analyzing more than 20 instances of military innovations. Rosen (1994) argued that successful innovation requires a very specific alignment among senior leaders, mid-level officers, and institutional structures to ensure the longevity of an innovative proposal. The intra-service dynamics model indicates that, given that threat perception is inherently subjective, sub-communities emerge within the armed forces themselves, with distinct interpretations of imminent threats and related solutions (Rosen, 1994). As they gain support in terms of funding, authority, and influence, these demands become institutionalized, promoting innovation. In addition to these realist aspects, Rosen (1994) also implicitly recognized the potential of culture in influencing innovation, observing that actors' assessments of the threat environment are shaped by the unique perception of each sub-community, which is influenced by culture (Lee, 2016).

Finally, the fourth approach proposed by Grissom (2006) identifies culture as a crucial variable in explaining how military innovations explicitly materialize. The cultural perspective embraces the constructivist view and conceptions from the field of organizational culture. It argues that norms provide agents with fundamental understandings of their identity and interests, conferring a potentially significant power that explains why military organizations innovate (Lee, 2019).

In the cultural model, a set of implicit beliefs exerts a substantial influence on the trajectory of military innovation (Desch, 1998). The senior management, holding higher ranks and operating at the strategic level of the organization, plays a key role in establishing this culture. In this model, senior officers and/or civilians with significant political influence are the agents of innovation (Grissom, 2006). Certainly, the idea that cultural norms can instigate change seems apparently contradictory, considering that such cultural norms are internalized as axioms after being institutionalized as rules or practices deemed effective (Farrell & Terriff, 2002).

Despite their disparities, the currents share some relevant conclusions. The four contemporary currents of military innovation, along with most prominent studies on the subject, argue that “*military organizations are inflexible, prone to inertia, and resistant to change*” (as cited in Griffin, 2017, emphasis added). Given their substantial bureaucratic dimensions, “*Almost everything we theoretically know on large bureaucracies suggests not only that they are difficult to change but that they are designed not to change*” (as cited in Griffin, 2017, emphasis added), as pointed out by Rosen.

However, such implications merely suggest that military organizations need to be instigated to innovate (Grissom, 2006). According to Barry Posen, even the most successful military organizations require a significant external influence to promote innovations. Moreover, it is important to note in this review that all the main models of military innovation operate hierarchically, from the top down (Grissom, 2006). According to the author, none of the major models of military innovation postulate the possibility of innovation occurring from the bottom up.

In this context, theoretical studies such as that of Samuel P. Huntington (1996), an American political scientist, emphasize that military culture, by valuing ceremony, tradition, and historical knowledge, strengthens ties with the past, providing learning and preparation for future challenges. However, resistance to change can be a characteristic of military culture, especially when it comes to innovation. The conservative culture hypothesis postulates that certain elements of military culture can inhibit innovation, such as the emphasis on collectivism over individualism and the focus on tasks and convergence rather than ideas and divergence. The value placed on uniformity may also restrict diversity (Kier, 2017).

The balance between control and individual initiative in executing military operations is critical. Innovation can influence this balance, affecting how to interpret and adapt orders to ever-changing conditions on the battlefield. During peacetime, tolerance for uncontrolled experimentation is reduced, which may hinder innovation (Dougherty, 2018).

In this scenario, strategic leadership in the armed forces plays a vital role in creating an environment conducive to the development of good ideas into effective war strategies. The future depends on the military’s ability to innovate and face constantly evolving challenges (Dougherty, 2018).

3.2 Current state of research on military innovation in the Brazilian context

In Brazil, there have been cases in which the state played a fundamental role in advancing scientific and technological fields, resulting in notable achievements in sectors such as agriculture, oil, and telecommunications. In addition to these, the aerospace platforms sector is currently the most comprehensive within the Defense Industrial Base (DIB) (Martins, 2023).

However, most of the reviewed authors (Freitas, 2013; Martins, 2013; Franco-Azevedo, 2018; Brites, 2022; Marinho, 2022) agree that the Brazilian defense sector is highly dependent on foreign technology for high-tech products, systems, or components (Martins, 2023). This is evident, for example, in state-of-the-art military aircraft such as the French Rafale and the Swedish SAAB. In some cases, the national production structure is almost non-existent, either due to disorganization over past decades—as seen in the armored vehicles sector—or because of the use of sophisticated technologies not yet developed in the country, such as in the nuclear submarine segment (Martins, 2023).

Regarding research, it is pertinent to compare its scarcity to the dependence on the importation of international inputs. In other words, there are few examples of empirical research focused on the Brazilian context. The Brazilian Army stands out as a pioneer and leader in publications on military innovation. Mota's work (2009) is notable as a precursor by conducting a case study on the Command and Control Project of the Brazilian Army. The applied methodology explored all stages of the innovation process, revealing its gaps and strategic advantages (Mota, 2009). However, like other researchers, the focus was on the perception and inclusion of samples from the strategic level of top leadership. A plausible assumption that may explain the predominance of studies centered on the tactical and strategic levels in the military context is the “standpoint” of the researchers themselves, who occupy these hierarchical levels.

Cunha (2017) illustrates successful cases, such as the project *RDS-Defesa*, based on the triple helix model formulated by Etzkowitz and Leydesdorff. However, the author expresses a deep and exclusive concern with technological innovation, particularly regarding defense products, analyzing the partnership among government, universities, and industry from the perspective of technological innovation and economic development (Cunha, 2017).

Marinho (2022), in his thesis, collected data through documentary research and fieldwork through interviews with military personnel and civilian employees of the Army who coordinate undergraduate and graduate courses at the Military Institute of Engineering (IME), as well as project managers at the Army's Technological Center (CTEx). Once again, there is a clear emphasis on studying innovation from a predominantly technological perspective, always from the point of view of top management in military organizations (Marinho, 2022).

Marinho (2022) conducted a diagnosis of the level of expertise and intellectual property within the researched organizations, finding a very low percentage of qualified personnel. The author concluded that the Brazilian Army presents itself as a promising case study on open innovation in the public administration, given the institution's extensive structure dedicated

to innovation activities. This structure ranges from basic and applied research at the IME to research and development at CTE_x, and later evaluation at the Army Evaluation Center (CAEx), sometimes reaching the production stage at the war arsenals.

The Brazilian Navy was studied by Almeida et al. (2016), who investigated the presence of management factors conducive to innovation in military research institutions associated with it, such as the Naval Systems Analysis Center (CASNAV) and the Navy Research Institute (IPqM), based on the innovation management audit model proposed by Tidd (2015). The approach used was qualitative and exploratory, and in addition to theoretical and empirical bibliographic sources, and included direct observation research, application of questionnaires based on innovation management process audits proposed by Tidd, Bessant, and Pavitt (2008), and open interviews. As a result, the authors concluded that “the culture of innovation is still in development within the organization.”

The FAB was the subject of study in Brites’ thesis (2022). This author highlighted the main barriers to technological innovation in the sector, such as difficulties in intersectoral coordination, legal restrictions, hierarchical organizational structure, risk aversion, budgetary and financial resource limitations, among others (Brites, 2022).

Thus, the review of the Brazilian literature shows that the environment of the national defense sector is still only partially conducive to innovation (Freitas, 2013). This is partly due to the fragmentation and lack of integration between the institution’s internal and external agents (Franco-Azevedo, 2018). Moreover, it can be inferred that research in the Brazilian military defense sector is still in its early stages and approached in a limited manner, possibly due to restricted access to organizations, with an exclusive focus on the technological dimension and the top-down perspective.

4 DISCUSSION AND IDENTIFIED RESEARCH GAPS

The integrative review on military innovation, both in Brazilian and global contexts, highlights the intricate complexity involved in understanding the impacts of changes and advances in operational practices to improve the effectiveness of the armed forces (Franco-Azevedo, 2018).

However, the reviewed works, while employing various theoretical approaches, focus only on the technological aspect and the top-down perspective when analyzing military innovations. None of the reviewed Brazilian or international studies addressed organizational innovation from the perspective of differentiation by military subcultures, such as officers, non-commissioned officers, and enlisted personnel, despite indications of its importance (Grissom, 2006).

Thus, there is a significant gap in the literature regarding the lack of empirical studies in both non-technological or organizational dimension and the bottom-up perspective. Additionally, the absence of recent investigations addressing the relationship between internal and external drivers of change is another important gap, especially considering the central importance of this topic in the debate on the dynamics of military innovation.

The identification of this theoretical gap is not a critique of the quality of the various innovation theories developed by scholars. However, it is relevant to confirm the natural tendency in the field to prioritize practical utility over theoretical purity, which limits the research agenda.

It is also noted that, although there seems to be a commitment from the high command of the armed forces to innovations, initiatives in this area are not always adequately communicated to the audience that needs to be aware of them (Grissom, 2006). There are communication failures leading to a lack of knowledge on innovation systems in use in the sector, which Franco-Azevedo (2013) calls the “*Complexo de taciturnos*” [Taciturn Complex] or fragmented communication. There is also the situation characterized by the underutilization of existing creative capacity, which this author calls “*Complexo do Clone Anfibiológico*” [Amphibiological Clone Complex].

The prevalence of the hypothesis of a conservative culture in the military sphere suggests that its elements may constitute obstacles to innovation. However, this approach does not consider that characteristics that may limit idea generation, such as a strong respect for authority, can also facilitate the implementation of correspondent ideas. Studies conducted at FAB indicate that, when adopting an agile methodology tool known as Scrum, researchers identified challenges arising from the hierarchy, yet discipline was recognized as a facilitating element (Sá, Vieira, Cunha, 2022). It is important to note that military culture is inherently execution-oriented (Govindarajan & Trimble, 2010). It increasingly consists of professionals with unique technical, cognitive, and behavioral skills that can be directed toward the middle-up implementation of innovations (Nonaka & Takeuchi, 1997). In this model, innovation ideas and initiatives are driven by all hierarchical levels of the organization, combining strategic vision and resources from top management with the operational knowledge and experience of the execution levels.

As theoretical grounding for future studies, the theory of Organizational Development is suggested, based on concepts proposed by Edgar Schein (2010), which emphasizes substantial cultural metamorphosis for the effective accomplishment of planned changes. This approach not only acknowledges but also insists on overcoming mere structural modifications, shifting the focus toward a holistic revitalization of norms, values, and entrenched practices within the organizational context. The essence of this theory lies in the understanding that genuine innovation cannot be achieved through superficial reforms, known as “innovation theater,” in which organizations present unstructured initiatives lacking continuity and without a mindset for transforming organizational culture (Blank, 2019).

Thus, the importance of studying the concept of resilience in the military context related to the organizational capacity to respond to disruptive phenomena by using gradual positive adaptations, reaching higher levels of complexity without losing stability is highlighted (Vasconcelos et al., 2017). Thus, even in the face of multiple disruptions, a resilient organization is capable of learning, evolving, and still maintaining its stability.

Finally, it is worth mentioning that the main research reviewed on innovation in the defense sector focused on innovations within this sector in a general and undifferentiated manner. Thus, they encompass both military and civilian innovations in a homogenized way. However, the internal defense agents, such as the Navy, Army, and Air Force, have completely unique operating dynamics compared to external agents, composed by DIB, HEI, and the Government.

5 CONCLUSIONS

The armed forces need to adapt and modernize to fulfill their functions in better ways, both in times of peace and war (Teixeira Junior & Gama Neto, 2018). The urgency of collaborative innovation and culture in enabling this dynamic is evident, promoting superior military capabilities and versatility in combat (Dougherty, 2018). Despite this, a conclusion based on this review is that research on military innovation remains, at best, in a developmental phase. This is due to peculiarities of the field and resistance to conduct empirical studies within the military context. Innovation requires cultural changes that foster an awareness of change, adding value at all hierarchical levels.

Based on this, future investigations are recommended to map the trajectory of non-technological innovation and its barriers within military organizations. At the micro-level perspective, the individual level requires special attention, until reaching the macro perspective (Melo et al., 2021). Thus, the validation of operationalizing organizational innovation through the successful implementation of the Innovation Function in the military context is suggested. This function, known as a crisis cell focused on innovation in both forms (technological and non-technological) and perspectives (top-down and bottom-up), is formally established within the institution and consists of trained personnel dedicated exclusively to innovation. By integrating into the preexisting organizational structure, the Innovation Function enables the implementation of changes without significant structural disruptions (O'Connor et al., 2018).

Considering that sustained innovation results from a culture conducive to it, and that the human factor exerts the greatest influence on the formation of such culture (OECD, 2015), future empirical studies on innovation and military culture as complementary or mutually exclusive concepts are suggested.

Finally, this integrative review aimed to synthesize existing knowledge on military innovation research. However, it is not free from limitations regarding the selection and inclusion of studies, as such choices can be subjective, leading to the inclusion of works that confirm the reviewers' hypotheses. Furthermore, the interpretation of the results may be influenced by the authors' own perceptions and biases. To mitigate these biases, triangulation of researchers in the review process is recommended.

6 CONTRIBUTION OF THE AUTHORS

All authors participated equally in the preparation of the article.

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