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FROM ARROWS TO ALGORITHMS: A BIBLIOMETRIC ANALYSIS OF MILITARY INNOVATION STUDIES

MASTER STUDENT

PATRICK S. O'REILLY

SUPERVISOR

PROFESSOR MANUEL MIRA GODINHO

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You can't say civilization don't advance, however,
for in every war they kill you in a new way.

– Will Rogers
New York Times, Dec. 23, 1929

ABSTRACT

This dissertation investigates the evolving intellectual landscape of military innovation studies, a critical yet underexplored area within strategic studies and international relations. Through a bibliometric analysis of 151 articles published between 1975 and 2024, this research identifies the thematic and disciplinary boundaries of military innovation literature while examining its evolution, influence, and collaboration networks. The findings reveal a field shaped by a robust intellectual core centered on key themes such as organizational learning, technological adaptation, and doctrinal change, alongside emerging topics like artificial intelligence and drones. Notable contributors, institutions, and countries form a fragmented but interconnected research network, emphasizing the interdisciplinary nature of the field. By integrating citation analysis, co-occurrence mapping, and bibliographic coupling, this study provides a comprehensive view of the structural and thematic dynamics of military innovation research, offering insights into its historical continuity and adaptation to contemporary security challenges. Despite its contributions, the field remains constrained by fragmented collaboration networks, limited cross-disciplinary engagement, and regional disparities in research output, underscoring the need for further integration and expansion.

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I would like to express my gratitude to my supervisor, Professor Manuel Mira Godinho, for his continuous support and expertise throughout this journey.

To my dear friends, your presence has been the gentle breeze that steered my ship through calm waters and stormy seas alike. Without you, this voyage would have been an altogether different tale.

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As I close this chapter, the statement that *"to travel is better than to arrive"* comes to mind, and stays. It is not the finality of this work that brings me the greatest satisfaction, but the rich experiences, the unexpected learnings, and the cherished connections formed along the way. To all who have been a part of this adventure, knowingly or unknowingly, I extend my heartfelt thanks.

FOREWORD

This master's final work comprises 46 pages – a length that far exceeds the customary bounds of such endeavors at ISEG. This, however, is not a case of undue verbosity but rather a necessity dictated by the inclusion of many charts. These visual accompaniments, indispensable to the clarity of analysis, demanded a scale befitting their informative purpose. To have rendered them smaller would have been an affront to both the reader's comprehension and the dignity of the data itself. Thus, any accusation of excess should be leveled not at the author's indulgence but at the unyielding requirements of empirical rigor.

1. INTRODUCTION

Warfare remains the ultimate trial of human ingenuity. The stakes of survival compel relentless innovation – a pursuit that reverberates throughout history, spanning from the firing of arrows to the programming of algorithms, and even as far back as Thucydides' account of a proto flamethrower in 423 BC (Grissom, 2006; Thucydides, n.d.). In modern strategic studies, the enduring themes of innovation and stagnation have evolved into a theoretical exploration of the factors driving changes in military practices over time (Grissom, 2006). Although historically rooted in security studies and military history, the study of military innovation has increasingly transcended disciplinary boundaries, gaining recognition for its relevance and potential contribution across a wider array of academic disciplines (Griffin, 2017). Despite this, the influence of military innovation studies remains largely confined to a specific scholar-practitioner community (Griffin, 2017).

Today's combat zones and evolving geopolitical dynamics underscore the multifaceted importance of military innovation studies. Renewed debates around a potential revolution in military affairs have gained momentum, driven by the convergence of bleeding-edge technologies, novel operational doctrines, and reimagined organizational structures (Raska, 2020). The deployment of drones from Bakhmut to Kyiv has showcased, not only the integral role of technologies in war, but also how their production and diffusion are critical factors in their optimal use (Kunertova, 2024). Moreover, ongoing strategic competitions, like between China and the USA, further fuels research in this field, as nations race to achieve technological superiority in transformative

areas such as artificial intelligence, quantum computing, and autonomous systems (Raska, 2020).

This dissertation seeks to answer two primary research questions: (1) What is the thematic and disciplinary landscape within the military innovation literature, and how can it be defined through bibliometric indicators? (2) How has military innovation literature evolved in terms of research focus, influence, and collaboration? By identifying these boundaries and tracking shifts in focus, this study provides a comprehensive view of how themes, disciplines, and collaborative networks shape the contours of military innovation research. This bibliometric approach offers a data-backed understanding of the intellectual landscape of military innovation, revealing both its historical continuity and its adaptations to modern security challenges. In answering these questions, this analysis not only delineates the thematic limits of military innovation but also traces the field's development, revealing how scholarly and technical priorities have evolved alongside new data and strategic focuses.

Beyond this introduction, the research is structured into several key sections, concluding with a comprehensive summary. Section 2 provides the literature review, establishing the foundational context for the study. Section 3 outlines the methodology employed to address the research questions. Section 4 presents the bibliometric findings, offering detailed analysis and discussion. Finally, the dissertation concludes by evaluating the study's usefulness, acknowledging its limitations, and suggesting avenues for future research.

2. LITERATURE REVIEW

This chapter explores the multifaceted nature of military innovation. It begins by tracing the evolution of scholarly engagement with the field, highlighting key milestones and the growing body of research. Section 2.1 delves into the core concepts, examining definitions of military innovation and exploring the theoretical frameworks used to understand its drivers, processes, and outcomes. This includes discussions on evolutionary theory, organizational theory, and the role of technology. Section 2.2 reviews the existing empirical literature on military innovation, identifying the factors that drive change within military organizations. Section 2.3 examines the constraints that impede military innovation, providing insight into institutional, logistical, and strategic barriers. Finally, Section 2.4 contextualizes military innovation within the broader framework of International Relations (IR) theory, with a particular focus on Neorealism. This section highlights how structural pressures, power dynamics, and security dilemmas shape the development and diffusion of military innovations, providing a theoretical lens through which to understand military adaptation in an evolving geopolitical landscape.

2.1. MILITARY INNOVATION: EVOLUTION, FOUNDATIONS AND DEBATES

Since 2000, the field of military innovation research has experienced a remarkably productive period (Griffin, 2017). Both the breadth and quality of scholarship have expanded significantly, with a notable increase in research output following Grissom's (2006) seminal article. Grissom (2006) not only identified critical gaps in the field but also encouraged other scholars to address these voids (Griffin, 2017). Furthermore, the growing willingness of Western militaries to engage with the academic community, particularly in the wake of the Iraq and Afghanistan wars, has provided unparalleled

access to military organizations, greatly enriching the field with valuable empirical data (Griffin, 2017). This section will aim at delineating this evolution of scholarly engagement with the field of military innovation to deepen our understanding of the foundational themes and debates.

2.1.1. DEFINING MILITARY INNOVATION

Innovation, a term already subject to a kaleidoscope of interpretations, becomes even more elusive when the adjective "military" is appended (Horowitz and Pindyck, 2021). The term "military innovation" remains a concept without an agreed-upon definition – and its ambiguity complicates the advancement of knowledge beyond individual case studies and limits the policy relevance of ongoing research (Horowitz and Pindyck, 2021). An in-depth exploration of this term's evolution, therefore, is not merely a scholarly exercise but an indispensable necessity.

Joseph Schumpeter (1942), who famously characterized the notion of creative destruction, captured the paradoxical essence of innovative progress: a relentless cycle where the new ruthlessly replaces the old. In his evocative framing, innovation emerges not as a polite evolution but as a disruptive force – tearing through outdated systems, dismantling entrenched structures, and rendering established paradigms obsolete. Yet, in this upheaval lies renewal, a promise of advancement as the rubble of obsolescence clears the path for new opportunities. As it pertains to the military field, for much of the twentieth century, scholarly works on military innovation were predominantly shaped by grand historical narratives, detailed operational histories, and case studies focusing on bureaucratic and political dynamics (Grissom, 2006). Indeed, the early analyses of military innovation were largely descriptive, they were focused on recounting significant battles, technological milestones, and the complexities of military bureaucracies

(Grissom, 2006). These narratives, while insightful, lacked a systematic approach to understanding innovation. In 1984, Barry Posen's *The Sources of Military Doctrine* marked a pivotal shift in the study of military innovation (Griffin, 2017). By examining interwar innovations in Britain, France, and Germany, Posen (1984), who is often cited as the father of military innovation studies, introduced a methodologically rigorous approach that applied principles of organizational and strategic theory to the study of military change, providing new insights into the development of military doctrines (Griffin, 2017). In other words, Posen's methodology amounted to a new social scientific approach for studying how and why military organizations innovate, establishing a structured foundation for the field.

Rosen (1988) adds further nuance, defining military innovation as significant changes that reorient core military operations, including shifts in concepts of operation and relationships between military branches. Farrell (2010) offers a complementary perspective, defining military innovation as a significant, institutionalized change within a military organization. This transformation, he points out, can manifest itself in several key areas: the creation of new doctrines, which reshape the principles and guidelines that govern military operations and strategies; the establishment of new organizational structures, which reorganize units and command dynamics to enhance effectiveness and adaptability; and the integration of new technologies, which fundamentally alter how military operations are conducted.

In their article *What is a Military Innovation and Why It Matters*, Horowitz and Pindyck (2021) critique the inconsistencies in military innovation literature and review key studies to establish a foundational definition of the term. They propose that the discrepancies could, in part, stem from the dual nature of military innovation as both a

process and an outcome. Horowitz and Pindyck (2021) find that scholars agree on two key points: (1) military innovation requires fundamental changes in combat approaches, and (2) it mandates organizational realignment. Conversely, Horowitz and Pindyck (2021) identify five key areas of scholarly disagreement that need to be addressed: (1) the role of technology, (2) political purpose, (3) bottom-up, adaptation, and horizontal innovation, (4) the process of innovation, and (5) whether success is essential to defining innovation. Here are their conclusions:

Ultimately, Horowitz and Pindyck (2021) define a military innovation as "*changes in the conduct of warfare designed to increase the ability of a military community to generate power"*. Furthermore, they highlight that true military innovation requires three distinct stages: invention, incubation, and implementation. Therefore, military innovation goes beyond merely adapting new technologies; it must culminate in a structural shift that fundamentally alters military strategy and practice. This approach reinforces the idea that innovation is more than technological advancement – it represents a comprehensive change that redefines how warfare is conducted.

Additionally, concepts like *terrorist innovation* align with military innovation studies. Dolnik (2007) and Crenshaw (2011) categorize terrorist innovation into tactical, strategic, and organizational forms, paralleling military innovation processes. For the purposes of this dissertation, terrorist innovation will be considered a subset of military innovation (Moghadam, 2013).

2.1.2. INNOVATION DIFFUSION IN MILITARY CONTEXTS

The process of diffusion is an integral part of military innovation, showcasing the spread and integration of new practices, technologies, and doctrines across and within military organizations (Gilli and Gilli, 2016). Military technology, particularly hardware,

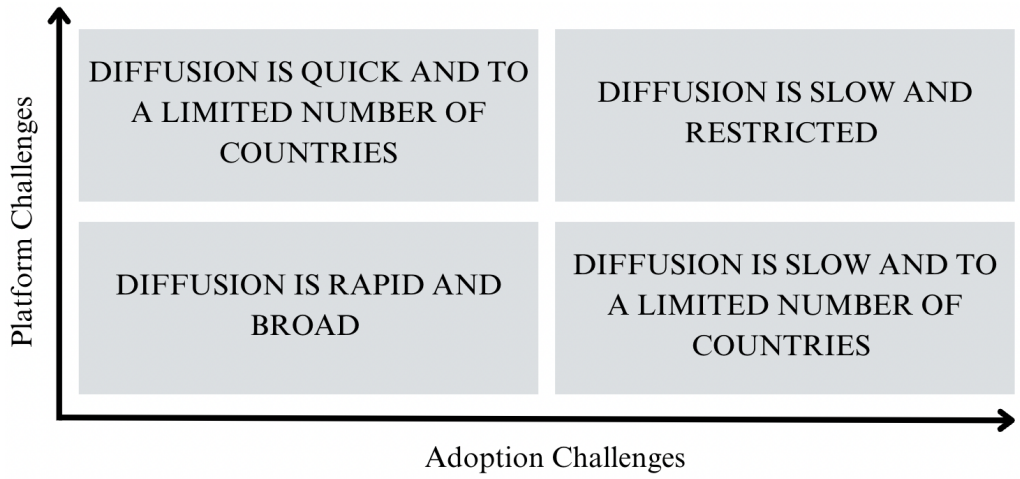
is widely recognized for its ability to spread rapidly and with ease (Gilli and Gilli, 2016). However, as Gilli and Gilli (2016) argue, diffusion is a complex process, especially when it involves advanced technologies such as drones. They discuss the concepts of platform and adoption challenges, which are limitations that further complicate the diffusion of advanced military innovations.

Platform challenges arise from the technical expertise and industrial capacity required to design and manufacture advanced military systems. As technology advances, the complexity of weapon systems increases, demanding sophisticated infrastructure and expertise (Gilli and Gilli, 2016). For example, platforms like the F-35 rely on intricate subsystems, where even minor issues can jeopardize operational performance (Bellamy III, 2014). Countries lacking advanced industrial bases struggle to overcome these barriers, limiting diffusion to technologically capable states. Adoption challenges involve the organizational and infrastructural adjustments necessary to deploy innovations effectively. This includes developing new doctrines, restructuring military units, and investing in specialized training and logistics (Gilli and Gilli, 2016). For instance, aircraft carrier adoption demands extensive operational support systems, rendering it inaccessible to nations without significant maritime infrastructure (Gilli and Gilli, 2016).

With those challenges brought up from Gilli and Gilli (2016), four scenarios can be defined (see Figure 1). When platform and adoption challenges are minimal, diffusion occurs more rapidly and broadly (Gilli and Gilli, 2016). Innovations surrounded by high adoption challenges, but relatively modest platform challenges spread more slowly and to a more limited number of countries (Gilli and Gilli, 2016). Conventionally propelled aircraft carriers illustrate this dynamic: while their production may not impose insurmountable industrial or technological demands for countries with a defense

shipbuilding industry, the adoption process requires extensive organizational and infrastructural adaptations (Gilli and Gilli, 2016). Innovations with low adoption challenges but significant platform challenges often spread quickly, albeit only to nations capable of domestically producing the platform or securing its foreign supply (Gilli and Gilli, 2016). Examples include surface-to-air missile batteries, cruise missiles, and small submarines for coastal defense (Gilli and Gilli, 2016). When both platform and adoption challenges are high, the diffusion of military innovations tends to be slow and restricted (Gilli and Gilli, 2016).

FIGURE 1. MATRIX OF PLATFORM AND ADOPTION CHALLENGES



Geography also influences diffusion, as neighboring states with shared threats often adopt similar innovations (Parent and Rosato, 2015). For example, the Prussian military system, incorporating breech-loading rifles, railroads, and telegraphs, rapidly diffused across Europe, with France, Russia, and Italy adopting elements to enhance their militaries (Parent and Rosato, 2015). In contrast, Britain, a naval power, was slower to adopt land-centric innovations. Political and economic factors further shape diffusion. Alliances and geopolitical proximity often determine access to advanced systems, while domestic politics influence how innovations align with national defense priorities (Farrell, 2001; Parent and Rosato, 2015).

2.1.3. ADAPTATION IN MILITARY FORCES

Innovation alone is neither a necessary nor sufficient condition for victory in war; success ultimately depends on a military's ability to adapt to its operational environment and evolving challenges (Farrell, 2010). While much of the literature emphasizes competing models of innovation – typically contrasting top-down military-led approaches with civilian-led initiatives – Farrell (2010) highlights the relative neglect of adaptation as a distinct and essential process. Despite extensive historical analysis of tactical change, a comprehensive theory of military adaptation remains underdeveloped (Farrell, 2010). Farrell (2010) defines adaptation as the adjustment of tactics, techniques, or existing technologies to enhance operational performance. This process tailors innovations to specific missions, terrains, and capabilities, ensuring practical relevance over rigid application (Farrell and Terriff, 2002; Grissom, 2006). Over time, incremental adaptations can accumulate to drive broader innovation, highlighting the fluid relationship between the two processes (Farrell, 2010). Two primary approaches underpin military adaptation. The first, *exploitation*, focuses on refining core competencies through incremental adjustments to existing methods and technologies (Farrell, 2010). The second, *exploration*, involves developing new capabilities, operational models, or technologies. When exploration results in doctrinal or structural shifts or the acquisition of new systems, it transitions into innovation (Farrell, 2010). However, exploration often yields battlefield-driven changes that enhance performance without being fully institutionalized (Farrell, 2010). Farrell (2010) notes that military organizations, governed by routines and a drive for efficiency, tend to favor exploitation over exploration. This inclination underscores the importance of recognizing adaptation as equally vital to innovation in shaping military effectiveness (Farrell, Osinga, and Russell, 2013). Scholars

argue that adaptation and innovation exist along a continuum rather than as separate processes, reinforcing the need to view them as interconnected aspects of military change (Farrell, 2010; Marcus, 2014). Gilli and Gilli (2016) further emphasize that successful adaptation requires strong infrastructural and organizational support, including skilled personnel, aligned doctrines, and interoperable systems. By balancing adaptation with innovation, military organizations can maintain operational effectiveness and respond flexibly to emerging threats and challenges.

2.1.4. SCHOOLS OF MILITARY INNOVATION RESEARCH

The study of military innovation has evolved through several distinct theoretical perspectives, each offering unique insights into the forces surrounding change within military organizations. Grissom (2006) identified four primary schools of thought in this field: civil-military relations, interservice politics, intraservice politics, and organizational culture. This section outlines these schools, offering a framework to understand the complex factors behind military change. Detailed exploration of the specific drivers will follow in section 2.2.

The civil-military model, developed by Barry Posen (1984) in *The Sources of Military Doctrine*, highlights the role of civilian leadership in shaping military doctrine and driving innovation. Posen argues that innovation thrives when civilian leaders intervene, often relying on maverick officers to bypass conservative military hierarchies (Grissom, 2006). Case studies of Germany's blitzkrieg and Britain's radar defense system during WWII exemplify how civilian involvement spurred innovation, while France's lack of intervention led to stagnation (Posen, 1984; Grissom, 2006). Avant (1993, 1994) and Beard (1976) reinforce this model, demonstrating how U.S. ICBM development and British counterinsurgency strategies benefited from civilian direction.

The interservice model, grounded in Sapolsky's (1972) study of the Polaris missile program, centers on competition between military branches as a driver of innovation. Services vying for dominance in emerging mission areas innovate to secure resources and strategic relevance (Grissom, 2006). While competition often accelerates innovation, Cote (1998) highlights how excessive rivalry can hinder collaboration and limit progress, as seen in the development of the Trident II missile system (Grissom, 2006).

Rosen (1991) introduces the intraservice model, emphasizing internal competition within branches of the same service. Innovation, according to Rosen, occurs when senior leaders adopt a "new theory of victory" and promote officers aligned with emerging capabilities (Grissom, 2006). This process fosters new branches within services, exemplified by the creation of U.S. Special Operations Command (SOCOM) in the 1980s, which consolidated and promoted special forces innovation (Marquis, 1997; Grissom, 2006).

The cultural model, led by Farrell (1998), underscores the role of organizational culture in shaping military innovation. Farrell defines culture as shared beliefs influencing strategic decisions, operational frameworks, and the adoption of innovations (Grissom, 2006). Cultural change can be driven by leadership, external shocks, or professional emulation across militaries (Farrell, 1998). Builder (1989) and Lock-Pullan (2005) illustrate this by exploring how distinct service identities—such as the U.S. Navy's independence or the Air Force's technological focus—impact innovation trajectories (Grissom, 2006). Mahnken (2002) further highlights how cultural biases shape the interpretation of foreign innovations, affecting adaptation and military preparedness (Grissom, 2006).

2.1.5. RESEARCH LANDSCAPE AND FIELD MAPPING

The field of military innovation studies is enriched by a robust network of academic and professional events that facilitate idea exchange, research dissemination, and collaboration among scholars, practitioners, and policymakers. Key platforms include conferences, workshops, and symposia organized by prominent institutions and organizations.

The International Studies Association (ISA) Annual Convention is one of the most notable events. Established in 1959, ISA is a leading interdisciplinary association dedicated to the study of international, transnational, and global affairs, boasting over 7,000 members worldwide (International Studies Association, 2024). Its Annual Convention, along with regional and international conferences, serves as a vital hub for networking, rigorous discussion, and knowledge-sharing across a range of topics. ISA also supports early career scholars and underrepresented groups through funding, mentorship, and professional development opportunities (International Studies Association, 2024). Institutions like King's College London, particularly its Department of War Studies, further contribute to the field through specialized conferences and workshops. Known for its interdisciplinary approach to conflict, security, and international politics, the department attracts leading scholars and shapes discourse on military adaptation, strategy, and innovation (King's College London, n.d.). Professional organizations and think tanks, such as the Munich Security Conference (MSC) and the RAND Corporation, offer additional platforms for dialogue on emerging military technologies and their strategic implications. The MSC, regarded as the world's premier forum for international security policy, hosts an annual conference attended by over 450 high-profile participants, including heads of state, ministers, academics, and civil society

leaders (Munich Security Conference, n.d.). The MSC also organizes regional events and thematic discussions throughout the year and publishes the *Munich Security Report*, offering critical insights on global security challenges (Munich Security Conference, n.d.). The RAND Corporation, a nonprofit, nonpartisan research organization founded in 1948, is another key player. RAND conducts rigorous, interdisciplinary research on national security, international relations, emerging technologies, and defense innovation (RAND, 2024). Supported by diverse funding sources, RAND delivers actionable insights to policymakers and fosters collaboration through testimony, media engagement, and outreach. Operating globally, RAND maintains offices in the United States, Europe, and Australia and produces research that informs public discourse and policy decisions (RAND, 2024).

Collectively, these academic and professional events underscore the interdisciplinary and collaborative nature of military innovation studies. By facilitating the exchange of ideas and addressing both theoretical advancements and practical applications, these forums play a crucial role in shaping the trajectory of the field.

2.2. DRIVERS OF MILITARY INNOVATION

Military organizations, confronted by the ever-evolving landscape of warfare, are driven to adapt not only out of necessity but by the relentless imperatives of survival. Whether spurred by the looming threat of defeat or by the ambition of individuals seeking to reshape doctrine, the forces driving military innovation are varied, persistent, and often tumultuous. These internal and external drivers guide the trajectory of change, reshaping military affairs. The four primary schools of thought on military innovation, as discussed in the previous section, outline distinct processes through which innovation can occur within armed forces (Foley, 2012). This section will explore common themes and

perspectives in the literature regarding the key drivers within the innovation process. To provide a concise overview of these drivers, Table 1 summarizes the key factors identified in the literature and their role in the innovation process.

TABLE 1. DRIVERS OF MILITARY INNOVATION

Driver	**Description**	**Key references**
Prospective defeat	The threat and fear of defeat creates conditions for innovation by discrediting outdated doctrines, making change imperative. However, experiencing defeat itself does not always lead to innovation, as some defeated militaries fail to adapt post-conflict.	Farrell (2010), Grissom (2006), Rosen (1988)
Culture (Bottom-up, Top-down, Sideways)	Risk-taking cultures promote innovation, while conservative ones hinder it. Innovation may stem from senior leadership (top-down), field units (bottom-up), or intraservice competition (sideways).	Grissom (2006), Rosen (1988), Farrell (2010), Horowitz & Pindyck (2021), Terriff (2006)
Mavericks	Individual innovators challenge bureaucratic inertia, sometimes appealing to civilian leadership or public support to bypass resistance.	Burke II (2020), Rosen (1988)
Context-Specific Factors	Innovation is influenced by tactical needs, geography, socio-political factors, and technological advancements. Limited infrastructure may constrain implementation.	Farrell (2010), Posen (1984), Rosen (1988), Gilli & Gilli (2016)
Institutional Learning	Militaries that systematically analyze past conflicts improve adaptation and innovation. Horizontal knowledge-sharing enhances continuous learning.	Farrell (2010), Foley (2012)

By recognizing these factors, these authors underscore that military innovation is not simply a response to external pressures but is also shaped by internal dynamics, organizational culture, and the unique challenges faced by military forces in different operational environments.

2.3. FRICTION TO MILITARY INNOVATION

While various internal and external drivers propel military innovation, constraints define the boundaries within which innovation can occur. These constraints often represent one side of a coin: they don't inherently block innovation, but can become bottlenecks that slow or restrict progress. Mathematically, these constraints can be perceived as factors – when managed effectively, they have a neutral value of 0, neither aiding nor hindering. If managed poorly, they impose a negative value of -1, impeding innovation, and only rarely do they reach an optimal value of 1, actively enhancing progress. Some of the most commonly identified areas of friction in the literature are presented in the table 2.

TABLE 2. CONSTRAINTS TO MILITARY INNOVATION

Constraint	**Description**	**Key references**
Transnational Norms	International norms and alliances impose strategic constraints. States operating within NATO or UN frameworks must align with coalition expectations, limiting unilateral innovation. Norms also influence doctrine by setting global military standards, which can sometimes prioritize conformity over national needs.	Farrell (2001), Grissom (2006)
Infrastructure & Logistics	Advanced military capabilities, such as drones or cyber warfare, require substantial industrial and logistical support. States with weak military-industrial infrastructure struggle to integrate cutting-edge technology, despite having strategic intent.	Gilli & Gilli (2016), Grissom (2006)
Institutional Resistance	Hierarchical structures and entrenched traditions create barriers to change, particularly in peacetime when urgency is lower. Risk-averse cultures often view innovation as disruptive, leading to slow adoption of new technologies or strategies. Even when external pressures demand adaptation, institutional inertia can impede meaningful reform. The difficulty of overcoming bureaucratic conservatism is a recurring theme in military innovation studies.	Grissom (2006)

2.4. CONTEXTUALIZING MILITARY INNOVATION THROUGH NEOREALISM

Military innovation is not an isolated process; it is shaped by the broader political, economic, and strategic environment of the international system. International Relations (IR) theories can provide valuable frameworks for understanding the forces that drive military innovation. Realism, particularly Neorealism, offers a compelling explanation by emphasizing the role of competition, power dynamics, and the security dilemma (Mearsheimer, 2001). This section focuses on Neorealism as a dominant perspective in the literature on military innovation.

Neorealism, or structural realism, builds on classical realist ideas but shifts the focus from human nature to the structure of the international system (Waltz, 1979). In an anarchic system lacking a central authority, states prioritize survival and engage in self-help behaviors to maintain power and security. According to Waltz (1997), states balance threats either by increasing their own military capabilities (internal balancing) or by forming alliances (external balancing). Internal balancing, through technological advancement and military buildup, is central to military innovation. States monitor rivals and adopt or develop new capabilities to maintain strategic parity (Parent and Rosato, 2015). For example, great powers historically integrated key innovations, such as blitzkrieg tactics and carrier warfare, within a short period after their demonstration (Parent and Rosato, 2015). This dynamic underscores the importance of imitation and adaptation in military competition. In contrast, external balancing (forming alliances to counterbalance threats) is viewed by Neorealists as less reliable. While alliances offer temporary strategic benefits, they are often driven by necessity in times of war and are prone to uncertainty and mistrust (Mearsheimer, 2001). Historical cases, such as the Franco-Russian Alliance, reflect how alliances emerge under pressure but are seldom the

primary means of ensuring long-term security (Parent and Rosato, 2015). Neorealism's emphasis on internal balancing highlights why states invest heavily in military innovation, preferring self-reliance over dependence on external actors.

A core tenet of Neorealism is the security dilemma, where actions taken by one state to enhance security inadvertently threaten others, triggering arms races (Parent and Rosato, 2015). This dynamic creates competitive spirals, as states respond to perceived threats by accelerating military development, fostering further instability. Thucydides's Trap, popularized by Allison (2017), reinforces this concept by describing how fear of a rising power can lead to conflict with an established hegemon. The rivalry between the United States and China exemplifies this, with both nations engaging in internal balancing through military innovation and defense investments (Allison, 2017). These frameworks not only explain past patterns but also offer insights into the future of military innovation. As global power shifts continue, Neorealism suggests that military competition and technological advancement will remain central to maintaining strategic stability in an increasingly contested international landscape.

3. METHODOLOGY

Since the introduction of the term "bibliometrics" by Alan Pritchard in 1969 to describe "the mathematical and statistical analysis of bibliographic records", the discipline has seen significant development and widespread adoption (Pritchard, 1969; Caviggioli and Ughetto, 2018). Standing as a rigorous method for exploring large volumes of scientific data, bibliometrics offers a structured approach to analyze the evolution of a field, uncover trends, collaboration patterns, knowledge gaps, and identify emerging areas of research (Donthu *et al*., 2021). Unlike traditional review methods, such as systematic literature reviews and meta-analyses, bibliometric analysis excels in managing the complexity and scale of datasets in fields that span multiple disciplines (Donthu *et al*., 2021). This widespread adoption of bibliometrics is relatively recent, particularly in disciplines like business, management, economics, and social sciences, and reflects the growing need and desire to understand how research fields evolve and behave (Donthu *et al*., 2021; Wallin, 2005). Numerous studies across various disciplines have employed bibliometric techniques to map the state of a field and analyze its evolution over time (e.g., Caviggioli and Ughetto, 2018; Wallin, 2005; Donthu, Kumar and Pandey, 2020). Following the methodologies established in these works, this study applies a standard bibliometric approach to investigate the intellectual corpus of the growing yet relatively underexplored research field of military innovation.

The review process began by defining the conceptual boundaries that frame this research. The objective was to gather articles and other published documents that explore military innovation. To achieve this, a broad dataset of works was collected from the Web of Science (WoS) Core Collection database. The WoS database was chosen over other

bibliometric databases such as Scopus or Google Scholar due to its superior reliability in tracking historical citation links, its high-quality abstract and keyword data essential for topic modeling, and the availability of comprehensive organizational metadata (Martín *et al*., 2018). These features make WoS particularly suited for a robust and detailed bibliometric analysis of the military innovation literature. Literature reviews generally serve two purposes: (a) summarizing existing research by identifying key themes and issues, thus providing a foundation for future work (Seuring *et al*., 2005), and (b) positioning scientific literature within the context of existing knowledge and theories (Saunders *et al*., 2009). Therefore, in this first phase of the study, the focus was on contextualizing the field and inform the subsequent bibliometric analysis by extracting critical themes, keywords, research trajectories, and delineating the field's thematic and disciplinary boundaries.

The second phase of the study comprised of collecting, curating and analysing the bibliometric database. The collection was conducted, first, by using the search term *military innovation* in the topic field, a database of 2 093 results was amassed. After a quick analysis, the irrelevance of several papers became apparent. Using the search term "*military innovation"* in quotation marks allowed for papers with the exact term appearing in the topic field. From this search, 209 papers published between 1975 (when the first related article appears) and 2024 (when this analysis took place) were collected. The first 30 articles were briefly reviewed to identify additional terms that are frequently used in the literature. This review helped ensure the inclusion of key concepts and terminologies relevant to the field. Then, a new search was executed in the WoS database using the search query "*military innovation*" OR "*military adaptation*" OR "*military*

diffusion" OR "*military change*" OR "*military evolution*" OR "*defense innovation*" in the title OR topic OR abstract fields.

The database of the 352 results was exported into an excel file for the curation of the set and to identify outliers. After examination and brief reviews of the papers, the search was refined by including only the documents by the types of "articles" and "early access" (which refers to articles being released early). Book reviews were excluded from the dataset primarily because they do not typically present original research or new findings, which does not align with the study's focus on analyzing the intellectual structure of the field. Including book reviews could also introduce potential noise into the data, as they are not directly comparable to original research articles in terms of metrics like citation analysis or co-authorship networks. A second broad review of the 169 papers was conducted which led to identifying papers unrelated to military innovation research. The search was further refined by the inclusion of the following WoS categories: International Relations OR Political Science OR History OR Economics OR Area Studies OR Sociology OR Social Issues OR Management OR Humanities Multidisciplinary OR Multidisciplinary Sciences. The final dataset comprises 151 articles published between 1975 and 2024, collectively accumulating 1 463 citations. According to the WoS Citation Report, the dataset exhibits an average H-Index of 19, reflecting its scholarly impact. Its evolution and relevance today can be visualized in Figure 2. The articles are distributed by categories as follows; International Relations (96), Political Science (70), followed by History (18), Economics (10), Area Studies (7), Sociology (7), Social Issues (5), Engineering Industrial (4), Management (4) and Humanities Multidisciplinary (3) (see Figure 3).

Then, the examination of the bibliometric data, involving techniques such as citation analysis and co-occurrence analysis was carried out (Broadus, 1987; Pritchard, 1969). The data was analyzed through VOSviewer, a tool used to facilitate the visualization of results, providing both quantitative and qualitative insights into the field's development (Donthu *et al*., 2021).

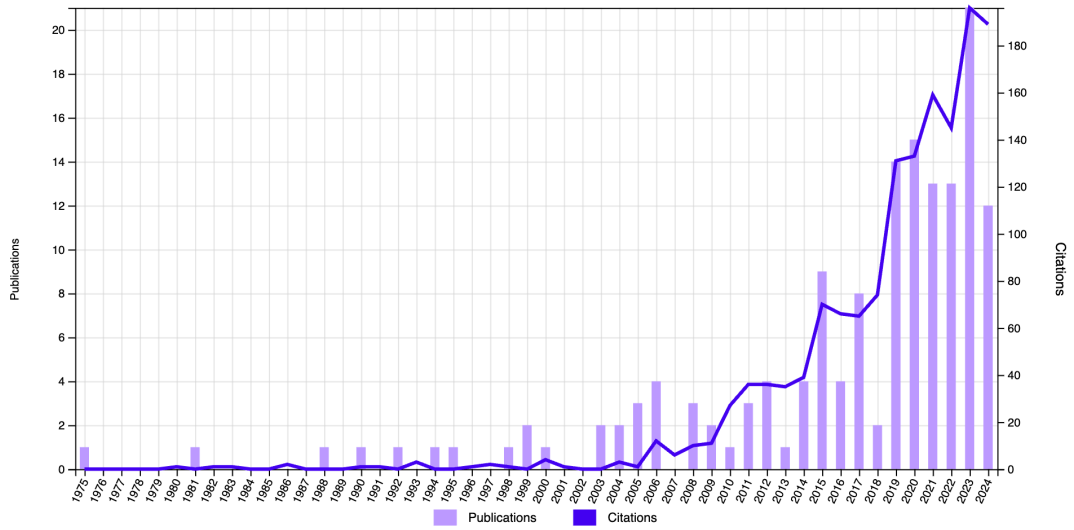


FIGURE 2. TIMES CITED AND PUBLICATIONS OVER TIME

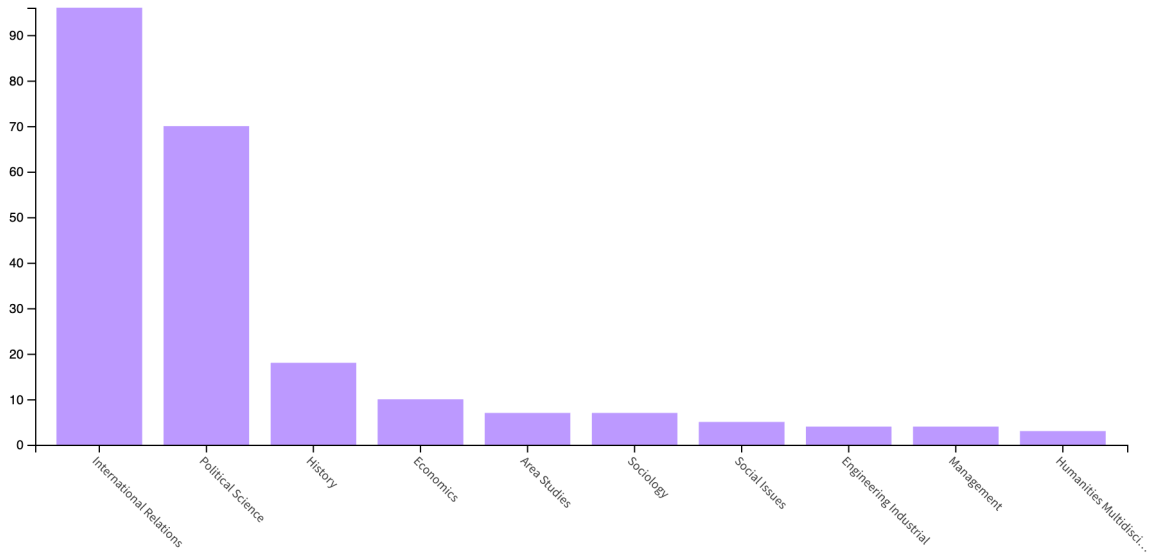


FIGURE 3. CATEGORY DISTRIBUTION OF THE DATABASE

4. ANALYSIS

This section presents the findings from the bibliometric analysis, following the methodology outlined earlier. Each analytical unit (keywords, collaboration networks, citations, and bibliographic coupling) is explored in detail, providing a comprehensive view of the intellectual landscape of military innovation research.

4.1. KEYWORD CO-OCCURRENCE ANALYSIS

The initial focus was on the co-occurrence of author keywords to understand the core topics addressed by the research. With a minimum threshold set at three occurrences, 31 out of the 385 author keywords identified in the dataset met the criteria, resulting in the identification of seven distinct clusters. Among the author keywords depicted in Figure 4, *military innovation* and *military adaptation* emerged as prominent keywords in the most integrated network, which can be explained by studying the interlinking lines between the keywords. The lines in the visualization represent the strength and relevance of the connections between nodes (keywords) (Donthu, Kumar and Pandey, 2020). These findings align with expectations based on the preliminary literature review. Notably, the *military adaptation* cluster demonstrates a strong linkage to context-specific keywords, such as *Afghanistan*, *counter-insurgency*, and the *British army.* The connections to *learning* and the *First World War* indicate an exploration of historical cases of military adjustment to evolving challenges. This reinforces earlier critiques that the field often remains confined to specific case studies, potentially limiting broader theoretical development and generalizability. The findings also highlight the academic interest in exploring topics such as *organizational learning* and *military culture*, which reflect broader efforts to understand how militaries behave. Specific nodes, such as those related

to *Afghanistan*, *China*, and the *British army*, underscore the field's focus on context-driven case studies. Additionally, the emergence of keywords like *artificial intelligence* and *drones* points to growing interest in advanced and niche areas of military innovation. Table 3 presents the top 10 author keywords along with their total link strength (TLS), offering a revealing glimpse into the core concepts shaping the military innovation discourse. The decision to focus on the top 10 stems from their clear representational strength – these keywords encapsulate the central themes of the field, whereas the remaining terms, while still relevant, exhibit a more diffuse presence and do not contribute as distinctly to the field's intellectual structure.

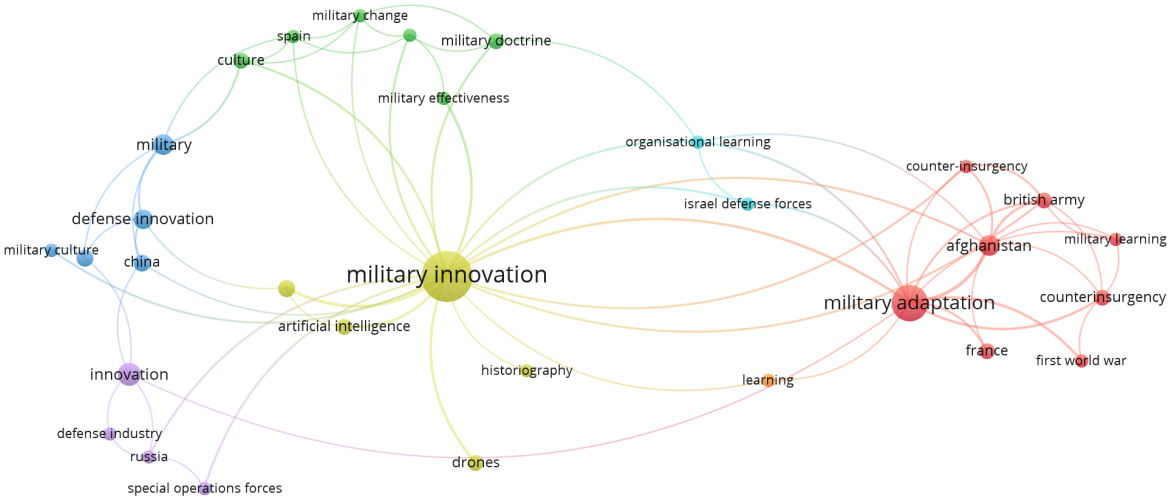


FIGURE 4. KEYWORD CO-OCCURENCE

TABLE 3. TOP 10 AUTHOR KEYWORDS

#	*Keyword*	*Occurrence*	*TLS*
1	Military innovation	41	43
2	Military adaptation	21	26
3	Innovation	9	5
4	Afghanistan	7	16
5	Military	7	7
6	Defense innovation	6	6
7	China	5	5
8	Emerging technologies	5	6
9	Technology	5	4
10	British	4	11

4.2. COLLABORATION ANALYSIS

For the collaboration analysis, the first unit of analysis was set to authors. The minimum number of documents per author was set to one, as well as the minimum number of citations per author. Of the 184 authors identified in the dataset, 153 authors met the threshold, forming the basis for the co-authorship network analysis. 96 clusters appear, with 86 links (see Figure 5). The network visualization highlights the collaborative landscape within the field, where each node represents an author, and the edges between them indicate co-authorship relationships. Larger nodes, such as those representing authors like *Farrell, Theo* and *Dyson, Tom* suggest individuals with significant contributions and influence within the dataset. The network also reveals

thematic groupings, with distinct clusters representing specific research groups or areas of focus within military innovation studies. Interestingly, the presence of smaller clusters and isolated nodes indicates a field with several semi-independent research networks rather than a single cohesive collaboration structure. This structure provides insight into the diversity and specialization within the field, emphasizing both its fragmented and interconnected nature.

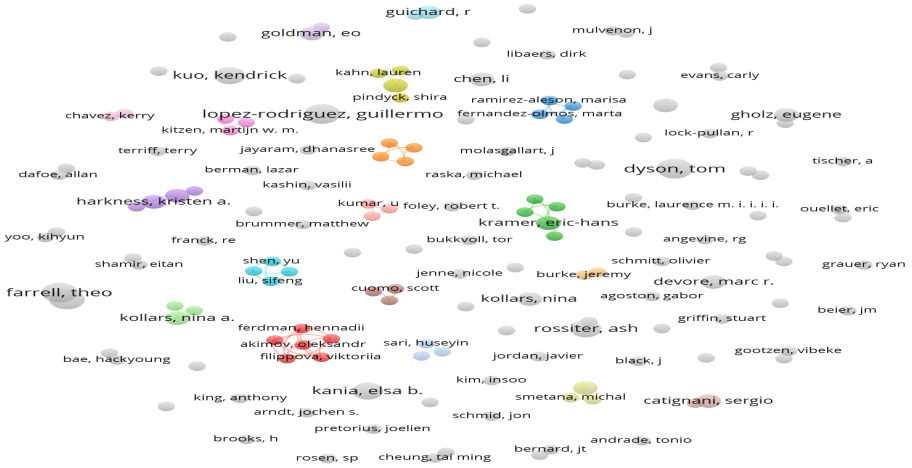


FIGURE 5. NETWORK OF AUTHOR COLLABORATION

The second unit of collaboration analysis was set to organizations, with the minimum number of documents of an organization set to one as well as the minimum number of citations. Of the 141 organizations, 120 met the threshold. The co-authorship network at the organizational level is illustrated in the Figure 6. Larger nodes, such as those representing *Harvard University, Netherlands Defense Academy,* and *King's College London*, highlight institutions with significant contributions and influence in the field. These institutions serve as key hubs of collaboration, with their size reflecting their central role in fostering research networks. The geographic diversity of institutions is notable, encompassing entities such as *Rand Corporation* in the United States, *Nanyang Technological University* in Singapore, *University of Valencia* in Spain, and *Norwegian Defense Research Establishment* in Norway. This diversity reflects the international

scope of military innovation research and highlights collaborations spanning defense-focused organizations and academic institutions worldwide. Defense-specific institutions, such as *US Naval War College, Korea Military Academy*, and *Norwegian Defense Research Establishment*, underscore the field's applied focus, addressing practical challenges in military adaptation and innovation. Smaller or isolated nodes, such as *University of Bath* or *Manipal Academy*, represent institutions with limited collaboration in this dataset, potentially contributing independent or niche research efforts. In contrast, larger institutions, such as *Harvard University* and *King's College London*, play a pivotal role in bridging gaps between academic and applied research, likely facilitating interdisciplinary studies on military innovation and adaptation.

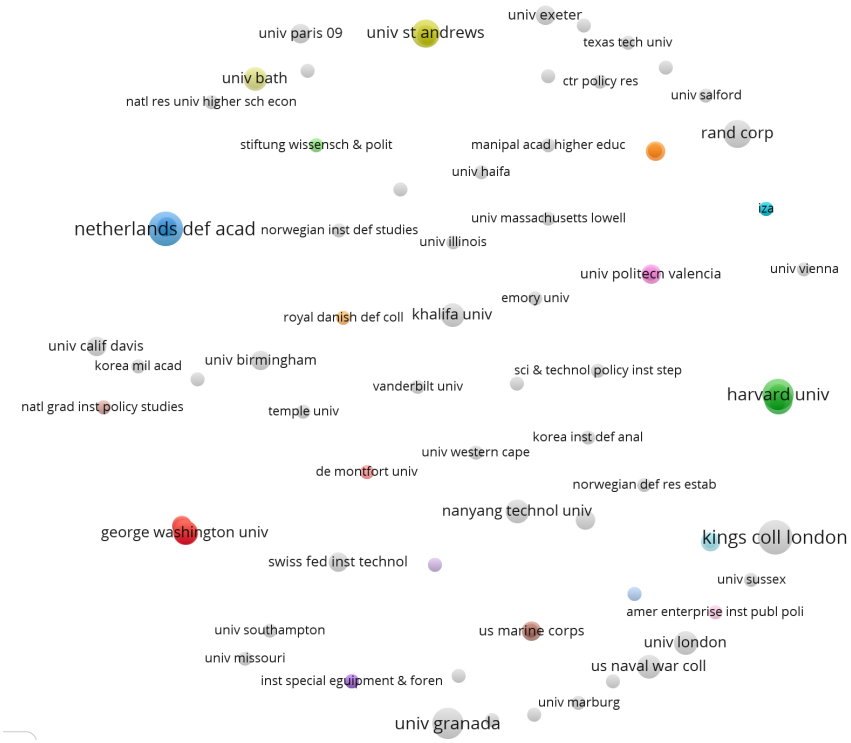


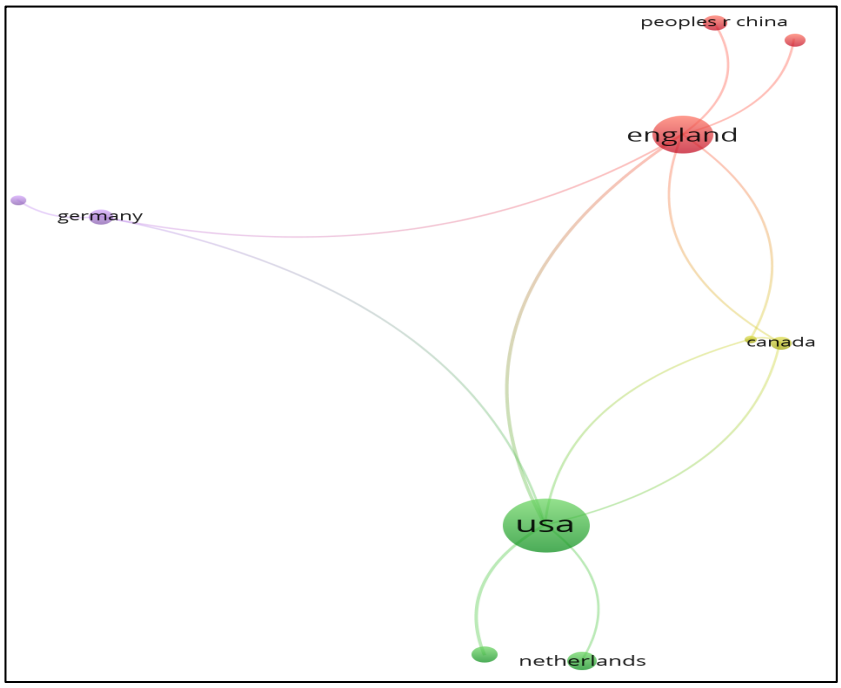
FIGURE 6. NETWORK OF ORGANIZATION COLLABORATION

The third unit of analysis was set to countries, with the minimum number of documents and citations of an organization both set to one. Of the 32 countries, 29 met the threshold. The full view of the country-level co-authorship network (Figure 7) provides a comprehensive perspective on global collaborations in military innovation research, building on the insights from the previously discussed key cluster. The *USA* emerges as the most prominent and central node, reflecting its dominant role in driving global research collaborations and contributing a substantial volume of research. This key cluster featuring the *USA*, *England*, *Netherlands*, and *Canada* are integral to understanding the broader network (see Figure 8). Peripheral nodes and smaller countries contribute to niche areas or emerging trends, while the field remains centered around this dense and cohesive Western core. *England* plays a pivotal role as a key hub, acting as a bridge between Western and non-Western countries. Its collaborations with nations like *Germany* and *People's Republic of China* highlight its importance in connecting diverse research traditions, though these relationships remain less dense compared to the stronger intra-Western collaborations. Supporting roles are observed in countries like *Netherlands, Canada,* and other Western nations such as *France* and *Denmark*, which frequently collaborate with the larger hubs, further reinforcing the dominance of the Western research network. Beyond this core, the network includes peripheral nodes and isolated countries, such as *Burkina Faso, South Africa,* and *UAE*, suggesting either independent or emerging contributions to the field. Countries like *India, Italy*, and *Japan* show limited connections, reflecting niche research interests or domestic priorities that limit broader international integration. Despite their peripheral positioning, nations like *Singapore, Israel,* and *South Korea* show signs of becoming regional hubs, particularly in areas like artificial intelligence, drones, and cybersecurity, which are increasingly relevant to

military innovation. The limited representation of countries from Africa and Latin America, apart from isolated nodes like *Burkina Faso* and *Chile*, highlights regional disparities in contributions and collaborations. This reinforces the dominance of economically advanced and defense-oriented nations in the field of military innovation research.

FIGURE 7. NETWORK OF COUNTRY COLLABORATION

FIGURE 8. A CLOSER LOOK AT THE MAIN CLUSTER



4.3. CITATION ANALYSIS

The first unit of analysis was set to documents. The minimum number of citations of a document was set to three to amass a reasonable depth in the field, while restricting the low cited papers. Of the 151 articles identified in the dataset, 88 met the threshold. The citation network visualization illustrates the interconnectedness and intellectual influence of key works in military innovation research (see Figure 9). At the center of the network, foundational works such as *Grissom (2006)* and *Farrell (2010)* stand out as the most frequently cited and central nodes (see Figure 10 for a closer look). These publications serve as cornerstones for the field, providing theoretical and empirical frameworks that are widely referenced across a variety of subfields and research themes. Other significant contributions, including *Farrell (2008)* and *Rosen (1988),* further reinforce the core intellectual foundation of military innovation studies.

The temporal diversity of the network, ranging from earlier works like *Rosen (1988)* to more recent studies such as *Raska (2021)* and *Horowitz (2023)*, highlights the evolution of the field and its responsiveness to contemporary challenges and technological developments. The dense connections between core publications, particularly *Farrell (2010), Grissom (2006),* and *Farrell (2008),* suggest that these works are not only highly influential individually but also frequently referenced together. This interconnectedness reflects their complementary roles in advancing theoretical and empirical discussions, particularly around key topics like organizational learning, doctrinal change, and the integration of technological advancements in military contexts. Additionally, emerging contributions such as *Raska (2021) and Horowitz (2023)* are positioned close to the central nodes, indicating their growing influence in extending and refining existing theories. These newer works demonstrate how the field continues to evolve, incorporating modern technological and geopolitical considerations. At the same time, more peripheral works, such as *Moghadam (2013)* or *Lock-Pullan (2005),* focus on specific conflicts, regional studies, or niche methodologies, contributing to the field's diversity.

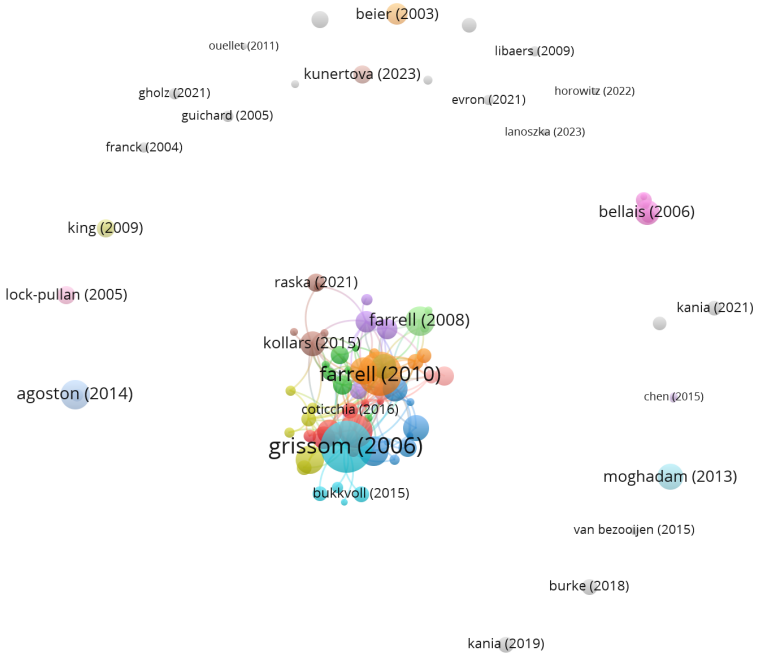


FIGURE 9. NETWORK OF DOCUMENT CITATION

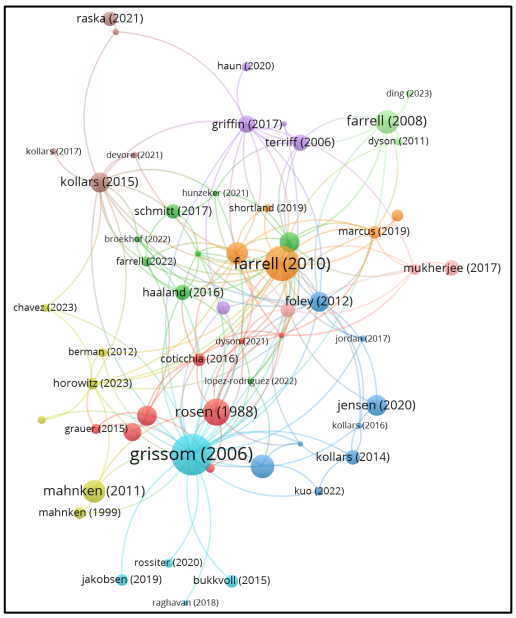


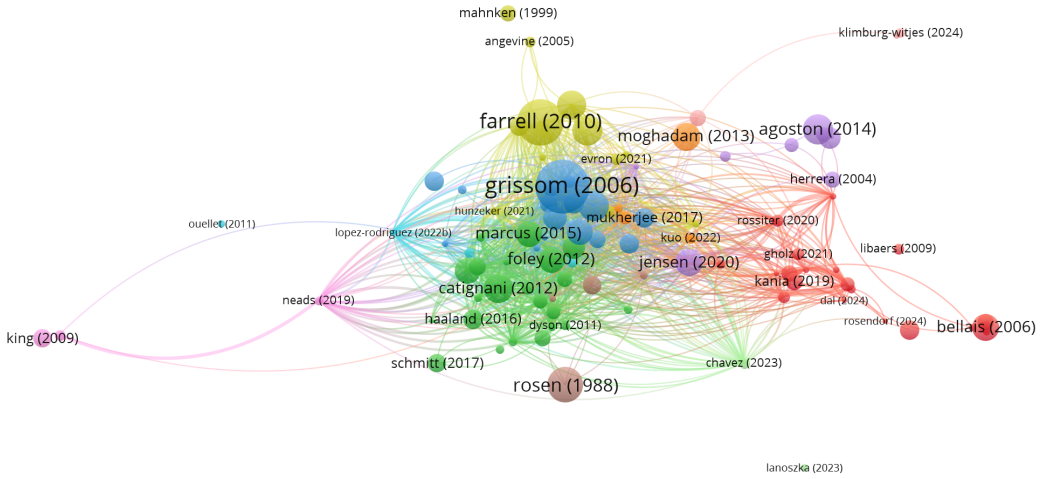
FIGURE 10. MAIN CLUSTER OF THE NETWORK OF DOCUMENT CITATION

4.4. BIBLIOGRAPHIC COUPLING

The first unit of analysis for the bibliographic coupling was set to documents. The minimum number of citations of a document was set to one to amass a reasonable depth in the field, while restricting the never-cited papers. Of the 151 articles identified in the dataset, 122 met the threshold. Of the 122 documents, 104 were connected, which are the ones seen in the visualization of Figure 11. This cluster highlights a dense and interconnected network of key documents in the field of military innovation research. At its core are works by *Grissom (2006)* and *Farrell (2010)*, which serve as central nodes due to their substantial influence and frequent co-citation with other studies. These publications form the intellectual backbone of the cluster, addressing foundational theories of military innovation, adaptation, and organizational dynamics. Surrounding these central nodes are additional highly interconnected works such as *Rosen (1988)*, *Foley (2012)*, and *Catignani (2012)*. Their proximity to the core reflects their critical engagement with these seminal texts and their contribution to the broader discourse. The cluster also features more recent works, including *Raska (2021)*, *Horowitz (2023)*, and

Jensen (2020), which occupy prominent positions close to the central nodes. These studies demonstrate how contemporary research is extending and refining the established theories by addressing emerging challenges, such as the integration of advanced technologies and the evolving nature of modern conflict. Their inclusion underscores the field's dynamic evolution, with newer contributions engaging directly with the intellectual core while adding fresh perspectives. A notable feature of this cluster is the high density of connections, which indicates frequent overlap in references and a shared reliance on foundational works. This interconnectedness highlights the cohesive nature of the cluster, suggesting that these documents collectively define a central body of literature within military innovation research. Peripheral but still relevant contributions, such as *Bellais (2006)* and *Agoston (2014)*, represent more specialized studies within this cluster. Their connections to the core highlight their importance in addressing specific aspects of military innovation while remaining anchored to the central theoretical frameworks.

FIGURE 11. BIBLIOGRAPHIC COUPLING OF DOCUMENTS



The second analysis of the bibliographic coupling was based on the sources, which provides valuable insights into the intellectual landscape of military innovation research, highlighting key journals and their relationships within the field. With a minimum

threshold of one citation and one document per source, 50 of the 66 identified sources met the inclusion criteria, ensuring a comprehensive yet focused examination. In the overview of the source network (see Figure 12), the distinction between the main cluster and the peripheral clusters is clear. The main cluster (see Figure 13), dominated by the *Journal of Strategic Studies*, is characterized by its high density of connections and central positioning. This cluster represents the intellectual core of military innovation research, with tightly interconnected journals such as *Survival*, *International Security*, and *Armed Forces & Society*. These journals frequently cross-cite one another, reflecting shared themes and a cohesive focus on key topics like military strategy, technological adaptation, and organizational dynamics. In contrast, the peripheral clusters are more loosely connected and positioned farther from the main cluster. Journals such as *Economic Inquiry* and *Impact of Science on Society* appear at the edges of the network, with weaker and fewer connections to the central journals. These peripheral sources likely focus on niche or tangential topics, contributing specialized insights that complement but do not directly engage with the core discourse of military innovation. The distance of these clusters from the main cluster underscores their more isolated role within the broader field, often addressing unique or interdisciplinary perspectives that expand the scope of research without directly anchoring it. The view of the main cluster seen in Figure 14 provides greater detail about the central journals and their interconnections. The *Journal of Strategic Studies* remains the dominant node, with a dense web of links connecting it to other influential sources. Journals like *European Journal of International Relations*, *Small Wars & Insurgencies*, and *Armed Forces & Society* are closely integrated into this cluster, reflecting strong thematic overlaps and mutual influence. This interconnectedness highlights the shared reliance on key journals and their role in shaping

the central debates and frameworks of the field. The visual contrast between the overview and the main cluster reinforces the hierarchical structure of the network. While the overview illustrates the broader ecosystem of sources, with a clear separation between the core and the periphery, the zoom-in reveals the intricate relationships within the main cluster itself. Together, these visualizations underscore the dual nature of the field: a tightly connected intellectual core driving the primary discourse, supported by a diverse array of peripheral sources that bring fresh perspectives and expand the boundaries of military innovation research.

FIGURE 12. BIBLIOGRAPHIC COUPLING OF SOURCES

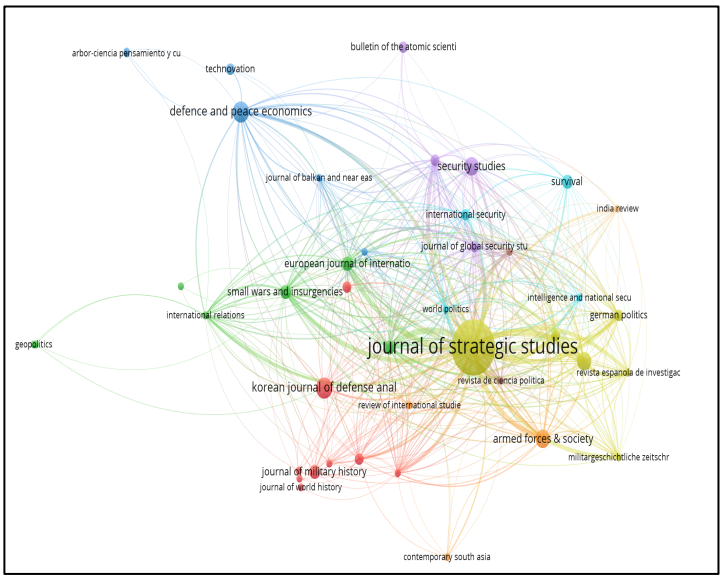


FIGURE 13. MAIN CLUSTER OF THE BIBLIOGRAPHIC COUPLING OF SOURCES

The bibliographic coupling's third unit of analysis was based on the authors, which provides a comprehensive view of the intellectual connections within military innovation research. With the minimum threshold set to one document and one citation

per author, 153 authors met the inclusion criteria out of the total 184 identified. This approach captures a wide range of contributors, from central figures in the field to more peripheral contributors. The complete network visualization seen in Figure 14 highlights a clear distinction between the main cluster of closely interconnected authors and more peripheral authors with weaker connections to the core. The central cluster (see Figure 15) represents the intellectual core of the field, where influential authors frequently cite each other and share thematic and methodological overlaps. Key figures, such as *Farrell*, *Dyson*, and *Rossiter*, are positioned at the heart of this cluster, reflecting their significant contributions and influence in shaping the discourse on military innovation, adaptation, and organizational dynamics. In contrast, peripheral authors like *Ouellet* and *Bae* are positioned at the edges of the network, with fewer connections to the central group. The peripheral position of these authors underscores their unique contributions to specific subfields while maintaining a degree of separation from the main body of literature. The close-up view of the main cluster reveals a dense and highly interconnected network of authors. *Farrell*, *Dyson*, and *Lopez-Rodriguez* are prominent nodes within this cluster, indicating their pivotal roles in the field. The strong links between these authors suggest frequent co-citation and shared research interests, particularly in areas such as the evolution of military doctrine, technological diffusion, and organizational learning. Other authors, such as *Goldman* and *Hunziker*, also occupy significant positions within the main cluster, highlighting their active engagement with the central themes of the field. The intricate web of connections between these authors reflects a robust intellectual ecosystem, where ideas and methodologies are continuously exchanged and refined. The zoomed-in view of the main cluster further highlights the collaborative and interconnected nature of the core authors. Their dense network reflects the maturity of the

field and the ongoing dialogue between key contributors. This interconnectedness is critical for driving theoretical advancements and maintaining the relevance of military innovation research in addressing contemporary challenges. The bibliographic coupling analysis of authors illustrates a well-structured and dynamic scholarly network. The main cluster, dominated by key contributors like *Farrell* and *Dyson*, serves as the intellectual backbone of the field, while peripheral authors enrich the discourse with specialized perspectives. Together, these elements reflect the interdisciplinary and evolving nature of military innovation research, highlighting both its cohesive foundation and its capacity for diversification and growth.

The fourth unit of analysis for bibliographic coupling are the organizations, which highlights the contributions of institutions to the field of military innovation research. With the thresholds set at one publication and one citation, 120 organizations out of 141 met the inclusion criteria. The analysis reveals a clear distinction between a dense core cluster of closely connected institutions and more loosely connected peripheral organizations.

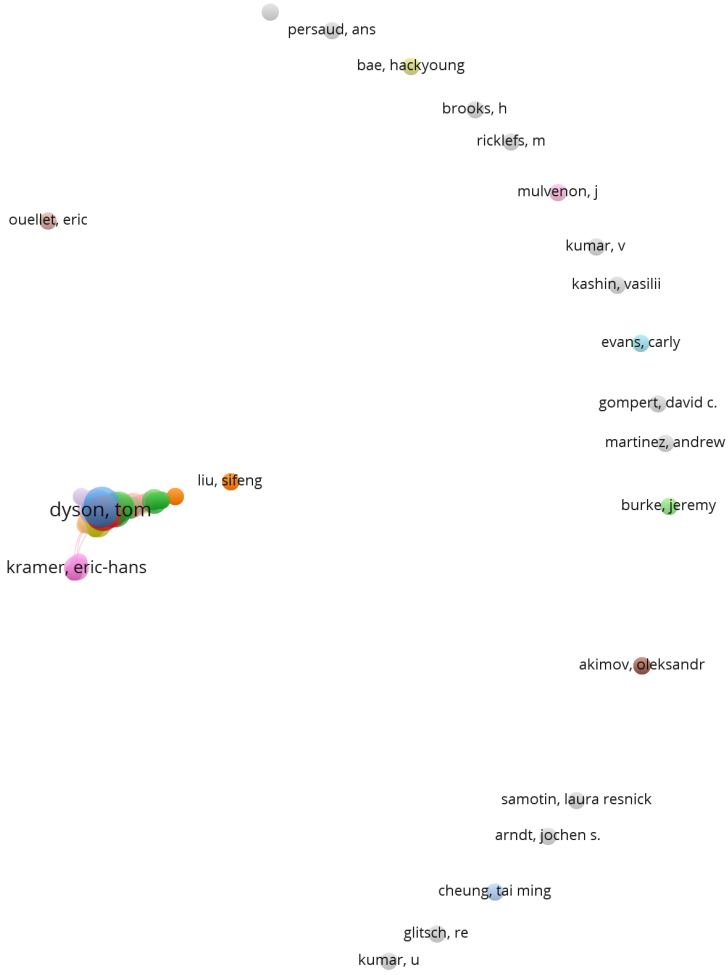
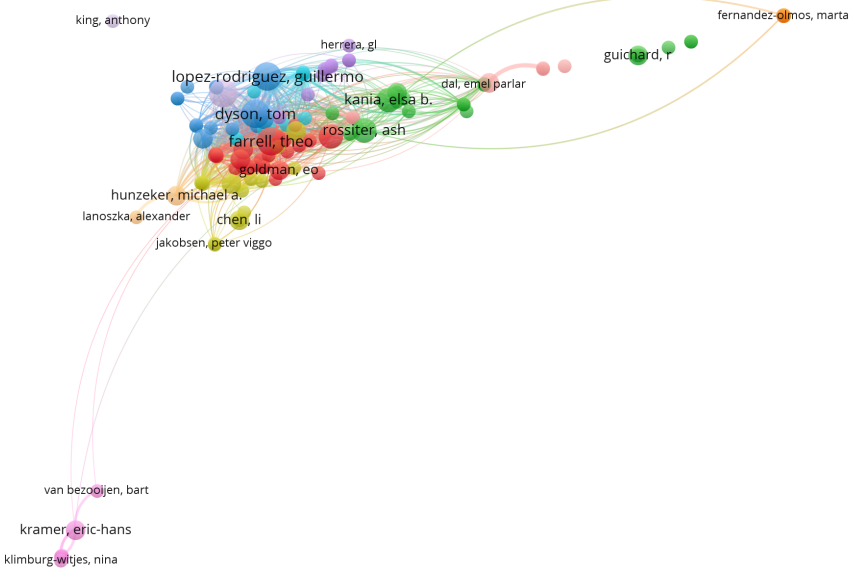


FIGURE 14. BIBLIOGRAPHIC COUPLING OF AUTHORS

FIGURE 15. MAIN CLUSTER OF THE BIBLIOGRAPHIC COUPLING OF AUTHORS



In the complete network visualization, seen in Figure 16, the main cluster is prominently centralized, showcasing a tightly knit group of institutions such as *King's College London*, *Netherlands Defence Academy*, and *Harvard University*. These organizations dominate the field, evidenced by their strong interconnections and central positioning. Their dense network reflects significant collaborative efforts, frequent cross-citation, and thematic overlaps in military innovation research. These institutions are key contributors to the intellectual development of the field, often serving as hubs for influential studies and interdisciplinary dialogue. Peripheral organizations, such as the *Atlantic Council* and *University of Illinois*, are situated at the outskirts of the network, with weaker connections to the main cluster. These institutions contribute to niche or tangential areas of military innovation, broadening the scope of research but maintaining less influence on the core discussions. Their placement underscores their specialized focus or limited engagement with the central themes that dominate the field. The zoomed-in view of the main cluster (see Figure 17) provides greater detail on the relationships between central institutions. *King's College London* emerges as a pivotal node, reflecting

its significant role in advancing military innovation scholarship. Institutions such as *Harvard University*, *Rand Corporation*, and the *Netherlands Defence Academy* are closely linked to King's College, forming a highly interconnected network. This central group is characterized by frequent collaboration and citation, indicating shared research priorities in areas like technological adaptation, strategic planning, and defense studies. Organizations such as *George Mason University* and *Collège of Europe* are also part of this core cluster but are positioned slightly toward the periphery, suggesting strong contributions to specific subfields while being less integrated into the overall network. The inclusion of entities like *DeepMind* highlights the increasing relevance of private and non-academic institutions in shaping discussions on artificial intelligence and other emerging technologies in military contexts.

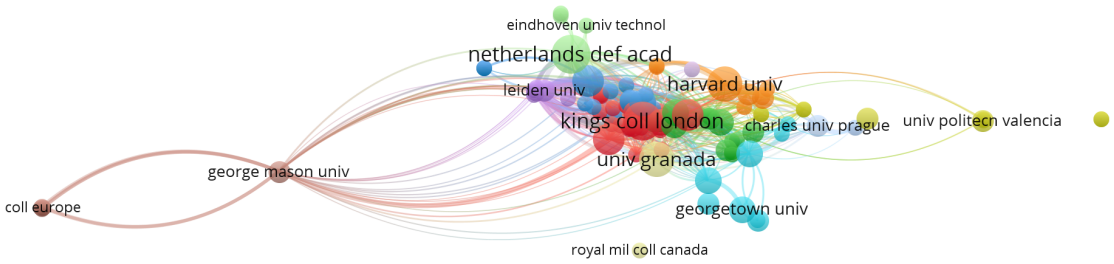
The central institutions, with their high levels of interconnectivity, act as the driving force behind major theoretical and practical advancements in military innovation research. Their influence reflects not only their academic output but also their capacity for fostering interdisciplinary collaboration. Peripheral organizations, while less central, play a complementary role by addressing emerging or niche topics. Their contributions often bring fresh perspectives or innovative approaches, expanding the boundaries of the field. For instance, the presence of private sector actors like *DeepMind* highlights the growing role of commercial technologies and dual-use innovations in shaping the future of warfare. The analysis of organizations reveals a well-defined intellectual landscape, with a strong central cluster of leading institutions surrounded by peripheral contributors. This structure reflects the field's interdisciplinary and collaborative nature, driven by a core group of influential organizations and enriched by the diverse contributions of more specialized institutions. The insights gained from this analysis highlight the importance

of both established academic hubs and emerging players in advancing the study of military innovation.

The fifth and final bibliographic coupling analysis surrounds the countries, highlighting a clear structure within the network, dominated by a central cluster with the United States at its core. This visualization seen in Figure 18 illustrates the geographic distribution of influence and collaboration within military innovation research, emphasizing the interconnectedness of global contributors.

FIGURE 16. BIBLIOGRAPHIC COUPLING OF ORGANIZATIONS

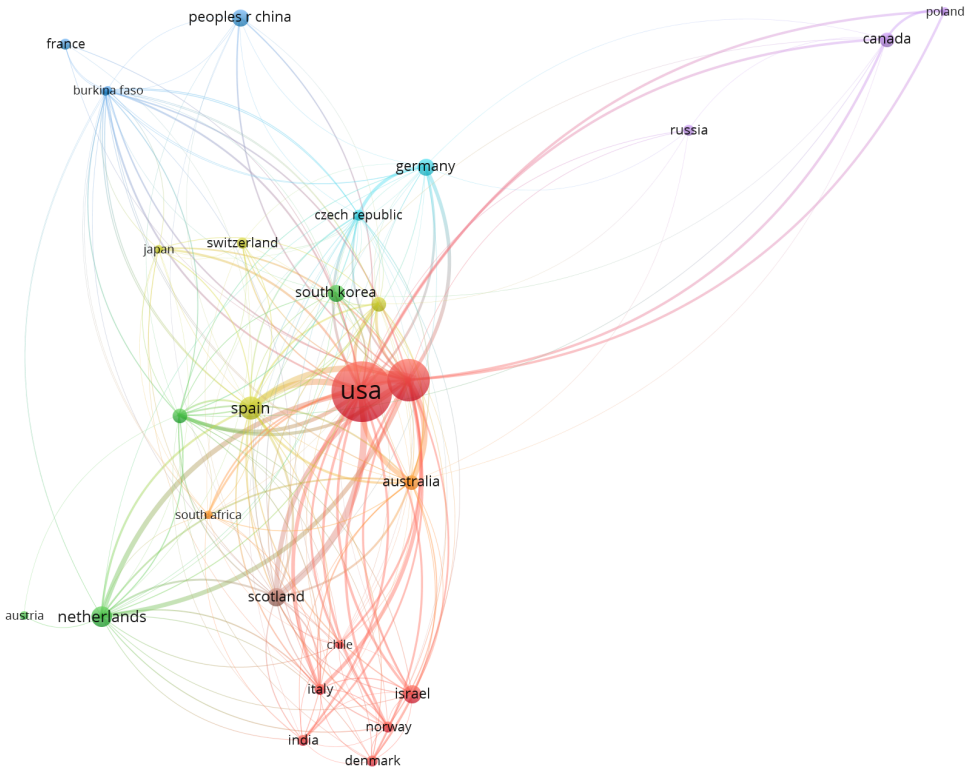
FIGURE 17. MAIN CLUSTER OF THE BIBLIOGRAPHIC COUPLING OF ORGANIZATIONS



At the heart of the network lies the United States, represented as the largest and most connected node. Its prominence reflects its substantial academic output and its role as a central hub for research collaboration. Strong connections extend from the United States to key partners such as Canada, England, and the Netherlands, highlighting frequent co-authorship, shared research priorities, and active intellectual exchange.

Canada stands out as a close collaborator, while England and the Netherlands contribute significantly through their cross-national research efforts. Peripheral countries, including Israel, South Korea, and Japan, maintain links to the central cluster but occupy more marginal positions. These nations often focus on specialized topics such as regional security, asymmetric warfare, or technological innovation, enriching the broader discourse with niche insights. Emerging contributors like South Africa, Austria, and Denmark add diversity by addressing underexplored topics and incorporating unique regional perspectives. Regional subgroups also emerge within the network. European countries like Germany, France, and the Netherlands form a tightly interconnected cluster, reflecting their focus on defense innovation and policy. Similarly, connections among South Korea, Japan, and China underscore the growing role of East Asian nations in advancing technological and strategic innovation, often driven by regional security concerns. The network reveals a hierarchical yet collaborative structure. The leadership of the United States, alongside strong ties to Canada, England, and the Netherlands, underscores the centrality of these nations in shaping the intellectual landscape. Simultaneously, the involvement of peripheral and emerging contributors highlights the field's global and interdisciplinary nature, with diverse perspectives enriching the discourse. The bibliographic coupling analysis illustrates a globally interconnected network, with the United States at its center. The strong collaborations among leading countries, complemented by contributions from peripheral and emerging players, emphasize the dynamic and inclusive character of military innovation research. This structure underscores the importance of fostering international partnerships and leveraging the strengths of both established and emerging contributors to address the evolving challenges in the field.

FIGURE 18. BIBLIOGRAPHIC COUPLING OF COUNTRIES



5. CONCLUSION

This dissertation set out to answer two primary research questions: (1) What is the thematic and disciplinary landscape within the military innovation literature, and how can it be defined through bibliometric indicators? (2) How has military innovation literature evolved in terms of research focus, influence, and collaboration? By providing a comprehensive bibliometric analysis of military innovation research, this dissertation offers valuable insights into its thematic evolution, intellectual structure, and collaboration networks. By analyzing a dataset of 151 articles published between 1975 and 2024, this study has mapped the core ideas that shape the field, identifying key contributors, institutions, and themes. The findings show that military innovation research is anchored in a strong intellectual core, with foundational works and seminal authors continuing to influence the discourse on technological adaptation, doctrinal change, and organizational learning. While the core theoretical concepts such as military innovation and military adaptation remain central, the field is also increasingly engaging with emerging topics like artificial intelligence, drones, and technological innovation. These shifts reflect the field's responsiveness to contemporary challenges in modern warfare and security. However, the analysis also reveals that the field is characterized by a Western-centric research collaboration network, with the United States, England, and Western European nations dominating the intellectual landscape. This concentration of research within Western institutions and countries highlights the need for broader inclusivity, both geographically and institutionally. Notably, research contributions from regions like Africa and Latin America are underrepresented, pointing to disparities in global research participation and the potential for a more diverse set of perspectives to enrich the field.

Despite the valuable insights offered by this study, several limitations must be acknowledged. First, the reliance on the Web of Science database, while providing robust metadata, may have inadvertently excluded relevant research indexed in other sources such as Scopus or Google Scholar. Additionally, the exclusion of non-English publications may have led to an underrepresentation of significant research from non-Anglophone regions, further solidifying the perception that this remains a predominantly Western-centric field. The inherent time lag in academic publishing and citation cycles presents another challenge, since emerging themes and recent intellectual shifts may not yet be fully visible within the dataset.

Yet, this study, for all its analytical ambition, offers a static portrait of the military innovation literature – a moment frozen in time, capturing its intellectual architecture as it stands. Future research might enrich the picture by expanding the dataset to incorporate additional bibliographic sources and non-English publications, thus fostering a more inclusive and globally representative view of military innovation. Beyond bibliometric methods, qualitative approaches, such as expert interviews or case studies of military institutions, could offer deeper insight into how innovation unfolds in practice. Furthermore, a more dynamic analysis of the literature could illuminate the field's intellectual evolution, distinguishing between enduring themes and emerging frontiers. This might be achieved by contrasting the earliest 75-80% of works with the most recent 20-25%, or by segmenting the literature into thirds to observe the gradual transformation of dominant ideas. Such an approach would allow for a richer, more nuanced understanding of how military innovation scholarship has progressed, revealing not only where it has been but where it is inexorably headed.

Ultimately, to better reflect the complexities of modern warfare and security, the field should consider embracing broader international collaboration, drawing in perspectives beyond the traditional centers of military research. The study of innovation, after all, should itself be innovative – constantly adapting, expanding, and challenging the contours of its own intellectual boundaries.

REFERENCES

Allison, G. (2017). *Destined for War: Can America and China Escape Thucydides's Trap?* Houghton Mifflin Harcourt.

Avant, D.D. (1993). The Institutional Sources of Military Doctrine – Hegemons in Peripheral Wars, *International Studies Quarterly*, 37(4), pp. 409–30.

Avant, D.D. (1994). *Political Institutions and Military Change: Lessons from Peripheral Wars*. Ithaca, NY: Cornell University Press.

Beard, E. (1976). *Developing the ICBM: A Study in Bureaucratic Politics*. New York: Columbia University Press.

Bellamy III, W. (2014). *Aircraft Wire and Cable: Doing More with Less.* Avionics.

Broadus, R. N. (1987). *Toward a definition of "bibliometrics".* Scientometrics, 12(5–6), pp. 373–379.

Builder, C.H. (1989). *The Masks of War: American Military Styles in Strategy and Analysis*. Baltimore, MD: Johns Hopkins University Press.

Burke, L.M. II, (2020). Methodologies and Models in Military Innovation Studies. *International Journal of Military History and Historiography,* 40, pp.110–134.

Caviggioli, F. and Ughetto, E., (2018). A bibliometric analysis of the research dealing with the impact of Additive Manufacturing on industry, business and society. *International Journal of Production Economics*. doi:10.1016/j.ijpe.2018.11.022

Cote, O.R. (1998). The Politics of Innovative Military Doctrine: The U.S. Navy and Fleet Ballistic Missiles. PhD diss., Massachusetts Institute of Technology.

Crenshaw, M. (2011). *Introduction: Definitions, Approaches, Responses, and Trajectories*, Explaining Terrorism: Causes, Processes, and Consequences. Oxford and New York: Routledge, p. 6.

Dolnik, A. (2007) *Understanding Terrorist Innovation: Technology, Tactics and Global Trends*. Routledge.

Donthu, N., Kumar, S. and Pandey, N. (2020) A retrospective evaluation of Marketing Intelligence and Planning: 1983–2019, *Marketing Intelligence and Planning*. doi:10.1108/MIP-02-2020-0066.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N. and Lim, W.M. (2021) How to conduct a bibliometric analysis: An overview and guidelines, *Journal of Business Research*, 133, pp. 285–296. doi:10.1016/j.jbusres.2021.04.070.

Farrell, T.G. (1998). Culture and Military Power, *Review of International Studies*, 24(3), pp. 407–16.

Farrell, T.G. (2001). *Transnational norms and military adaptation: International influences on the British army in Northern Ireland*. European Journal of International Relations, 7(1), pp. 63–102.

Farrell, T.G. (2008). The dynamics of British military transformation. *International Affairs,* 84(4), pp. 777–807.

Farrell, T.G. (2010). Improving in war: Military adaptation and the British in Helmand Province, Afghanistan, 2006–2009. *Journal of Strategic Studies,* 33(4), pp. 567–594.

Farrell, T.G., Osinga, F. and Russell, J. (2013). *Military Adaptation in Afghanistan*. Stanford, CA: Stanford University Press.

Farrell, T.G. and Terriff, T. (2002). *The Sources of Military Change: Culture, Politics, Technology*. T. Farrell & T. Terriff, eds., Boulder, CO: Lynne Rienner, p. 6.

Foley, R.T. (2012) A case study in horizontal military innovation: The German Army, 1916–1918, *Journal of Strategic Studies*, 35(6), pp. 799–827. doi:10.1080/01402390.2012.669737.

Friedberg, A. (2000). *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy*. Princeton, NJ: Princeton University Press.

Giese, J.F. (1999). *Military Innovation: Sources of Change for United States Special Operations Forces*. MA thesis, US Naval Postgraduate School, Monterey, CA.

Gilli, A. and Gilli, M. (2016). The diffusion of drone warfare? Industrial, organizational, and infrastructural constraints. *Security Studies*, 25(1), pp. 50–84.

Goldman, E. O. and Andres, R. B. (1999). Systemic effects of military innovation and diffusion. *Security Studies*, 8(4), pp. 79–125.

Griffin, S. (2017) Military innovation studies: Multidisciplinary or lacking discipline?, *Journal of Strategic Studies*, 40(1–2), pp. 196–224. doi:10.1080/01402390.2016.1196358.

Grissom, A. (2006). *The future of military innovation studies. Journal of Strategic Studies*, 29(5), pp. 905–934.

Hoffman, B. (2002). Rethinking terrorism and counterterrorism since 9/11, *Studies in Conflict and Terrorism*, 25(5), pp. 303–316. doi:10.1080/105761002901223.

Horowitz, M.C. (2010). *The Diffusion of Military Power: Causes and Consequences for International Politics*. Princeton University Press.

Horowitz, M.C. and Pindyck, S. (2021). *What is a Military Innovation and Why it Matters*. Journal of Strategic Studies, 46(1), pp. 85–114.

International Studies Association. (2024). *About ISA*. Available at: https://www.isanet.org/ISA/About-ISA (Accessed: December 10th, 2024)

King's College London (n.d.) *Department of War Studies events*. Available at: https://www.kcl.ac.uk/warstudies/events (Accessed: December 10th, 2024).

Kunertova, D. (2023) The war in Ukraine shows the game-changing effect of drones depends on the game, *Bulletin of the Atomic Scientists*, 79(2), pp. 95–102. doi:10.1080/00963402.2023.2178180.

Legro, J.W. (1996). *Culture and preferences in the International Two-step*. International Organization 90: 118-37

Lock-Pullan, R. (2005). *US Intervention Policy and Army Innovation: From Vietnam to Iraq*. London: Routledge.

Mahnken, T.G. (2002). *Uncovering Ways of War: U.S. Intelligence and Foreign Military Innovation, 1918–1941*. Cornell university press.

Mahnken, T.G. (2011). *China's anti-access strategy in historical and theoretical perspective*. Journal of Strategic Studies, 34(3), pp.299-323.

Marcus, R.D. (2014). 'Military Innovation and Tactical Adaptation in the Israel–Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF', *Journal of Strategic Studies*. doi: 10.1080/01402390.2014.923767.

Marquis, S.L. (1997). *Unconventional Warfare: Rebuilding US Special Operations Forces*. Washington DC: Brookings.

Martín-Martín, A., Orduna-Malea, E., Thelwall, M. and Delgado López-Cózar, E. (2018). *Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories*, Journal of Informetrics, 12, pp. 1160–1177. doi:10.1016/j.joi.2018.09.002.

Mearsheimer, J.J. (2001) *The Tragedy of Great Power Politics*. New York: W.W. Norton & Company, 2014.

Moghadam, A. (2013) *How Al Qaeda Innovates.* Security Studies, 22(3), pp. 466–497. doi:10.1080/09636412.2013.816123.

Morrow, J.D. (1993). *Arms versus Allies: Trade-Offs in the Search for Security*. International Organization, 47(2), pp. 207–208, 213–217.

Munich Security Conference (n.d.) *About the MSC*. Available at: https://securityconference.org/en/about-us/about-the-msc/ (Accessed: December 10th, 2024).

Parent, J. M. and Rosato, S. (2015). *Balancing in neorealism*. International Security, 40(2), pp. 51–86.

Posen, B.R. (1984). *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*. Ithaca, NY: Cornell University Press.

Pritchard, A. (1969) *Statistical bibliography or bibliometrics?,* Journal of Documentation, 25(4), pp. 348–349.

RAND Corporation (2024). *About RAND*. Available at: https://www.rand.org/about.html (Accessed: December 10th, 2024).

Raska, M. (2020) The sixth RMA wave: Disruption in Military Affairs?, *Journal of Strategic Studies*. doi:10.1080/01402390.2020.1848818.

Ratcliffe, S. (2017). *Oxford Essential Quotations* (5th ed.). Oxford University Press. eISBN: 9780191843730.

Rosen, S. P. (1988). *New ways of war: Understanding military innovation. International Security*, 13(1), pp. 134–168.

Rosen, S.P. (1991). *Winning the Next War: Innovation and the Modern Military*. Cornell University Press,

Saunders, M., Lewis, P. and Thornhill, A. (2009) *Research Methods for Business Students*. Pearson Education.

Sapolsky, H.M. (1972). *Polaris System Development: Bureaucratic and Programmatic Success in Government*. Cambridge, MA: Harvard University Press.

Seuring, S., Müller, M., Westhaus, M. and Morana, R. (2005) Conducting a literature review — The example of sustainability in supply chains, *Research*

Methodologies in Supply Chain Management, pp. 91–106. doi:10.1007/3-7908-1636-1_7.

Schroeder, P.W. (1994). Historical Reality vs. Neo-realist Theory. *International Security*, 19(1), pp. 108–148.

Schumpeter, J.A. (1942). *Capitalism, Socialism and Democracy*. Vol. 36, Harper & Row, New York.

Terriff, T. (2006). Innovate or die: Organizational culture and the origins of maneuver warfare in the United States Marine Corps, *Journal of Strategic Studies*, 29(3), pp. 475-503. doi:10.1080/01402390600765892.

Thucydides. (n.d.). *The Peloponnesian War.* Translated by R. Crawley. Available at: https://www.gutenberg.org/files/7142/7142-h/7142-h.htm (Accessed: November 15th, 2024)

Wallin, J.A. (2005) *Bibliometric methods: Pitfalls and possibilities,* Basic and Clinical Pharmacology and Toxicology, 97(5), pp. 261–275.

Waltz, N.K. (1979). *Theory of International Politics,* New York: McGraw-Hill.

Waltz, K.N. (1997). *Evaluating Theories*, American Political Science Review, 91(4), p. 915.

APPENDICES

Appendix 1. List of the 151 publications included in the bibliometric analysis dataset.

Author(s)	Year	Title
Grissom, A	2006	*The future of military innovation studies*
Farrell, T	2010	*Improving in War: Military Adaptation and the British in Helmand Province, Afghanistan, 2006-2009*
ROSEN, SP	1988	*NEW WAYS OF WAR - UNDERSTANDING MILITARY INNOVATION*
Agoston, G	2014	*Firearms and Military Adaptation: The Ottomans and the European Military Revolution, 1450-1800*
Goldman, EO; Andres, RB	1999	*Systemic effects of military innovation and diffusion*
Farrell, T	2008	*The dynamics of British military transformation*
Mahnken, TG	2011	*China's Anti-Access Strategy in Historical and Theoretical Perspective*
Catignani, S	2012	*'Getting COIN' at the Tactical Level in Afghanistan: Reassessing Counter-Insurgency Adaptation in the British Army*
Moghadam, A	2013	*How Al Qaeda Innovates*
Jensen, BM; Whyte, C; Cuomo, S	2020	*Algorithms at War: The Promise, Peril, and Limits of Artificial Intelligence*
Bellais, R; Guichard, R	2006	*Defense innovation, technology transfers and public policy*
Kollars, NA	2015	*War's Horizon: Soldier-Led Adaptation in Iraq and Vietnam*
Marcus, RD	2015	*Military Innovation and Tactical Adaptation in the Israel-Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF*
Goldman, EO	2006	*Cultural foundations of military diffusion*
Foley, RT	2012	*A Case Study in Horizontal Military Innovation: The German Army, 1916-1918*
Pretorius, J	2008	*The security imaginary: Explaining military isomorphism*
Griffin, S	2017	*Military Innovation Studies: Multidisciplinary or Lacking Discipline?1*
Beier, JM	2003	*Discriminating tastes: 'Smart' bombs, non-combatants, and notions of legitimacy in warfare*
Terriff, T	2006	*'Innovate or die': Organizational culture and the origins of Maneuver warfare in the United States Marine Corps*
Mukherjee, A	2017	*Fighting Separately: Jointness and Civil-Military Relations in India*
Haaland, TL	2016	*The Limits to Learning in Military Operations: Bottom-up Adaptation in the Norwegian Army in Northern Afghanistan, 2007-2012*
Kunertova, D	2023	*The war in Ukraine shows the game-changing effect of drones depends on the game*
Raska, M	2021	*The sixth RMA wave: Disruption in Military Affairs?*
Harkness, KA; Hunzeker, M	2015	*Military Maladaptation: Counterinsurgency and the Politics of Failure*
Lock-Pullan, R	2005	*How to rethink war: Conceptual innovation and AirLand battle doctrine*
Schmitt, O	2017	*French Military Adaptation in the Afghan War: Looking Inward or Outward?*

Kollars, N	2014	*Military Innovation's Dialectic: Gun Trucks and Rapid Acquisition*
King, A	2009	*The Special Air Service and the Concentration of Military Power*
Bury, P; Catignani, S	2019	*Future Reserves 2020, the British Army and the politics of military innovation during the Cameron era*
BROOKS, H	1975	*MILITARY INNOVATION SYSTEM AND QUALITATIVE ARMS-RACE*
Marcus, RD	2019	*Learning 'Under Fire': Israel's improvised military adaptation to Hamas tunnel warfare*
Kania, EB	2019	*Chinese Military Innovation in the AI Revolution*
Burke, J; Miller, AR	2018	*THE EFFECTS OF JOB RELOCATION ON SPOUSAL CAREERS: EVIDENCE FROM MILITARY CHANGE OF STATION MOVES*
Coticchia, F; Moro, FN	2016	*Learning From Others? Emulation and Change in the Italian Armed Forces Since 2001*
Bukkvoll, T	2015	*Military Innovation Under Authoritarian Government - the Case of Russian Special Operations Forces*
POOLE, E; BERNARD, JT	1992	*DEFENSE INNOVATION STOCK AND TOTAL FACTOR PRODUCTIVITY*
Rossiter, A; Cannon, BJ	2022	*Turkey's rise as a drone power: trial by fire*
Kania, EB	2021	*Artificial intelligence in China's revolution in military affairs*
Jakobsen, PV; Rynning, S	2019	*Denmark: happy to fight, will travel*
Herrera, GL	2004	*Inventing the railroad and rifle revolution: Information, military innovation and the rise of Germany*
Mahnken, TG	1999	*Uncovering foreign military innovation*
Horowitz, MC; Pindyck, S	2023	*What is a military innovation and why it matters*
Brummer, M	2022	*Innovation and Threats*
Dyson, T	2020	*A revolution in military learning? Cross-functional teams and knowledge transformation by lessons-learned processes*
Black, J	1998	*Military organisations and military change in historical perspective*
Farrell, T	2022	*Military adaptation and organisational convergence in war: Insurgents and international forces in Afghanistan*
Andrade, T	2015	*Cannibals with Cannons: The Sino-Portuguese Clashes of 1521-1522 and the Early Chinese Adoption of Western Guns*
Grauer, R	2015	*MODERATING DIFFUSION Military Bureaucratic Politics and the Implementation of German Doctrine in South America, 1885-1914*
Gholz, E; Sapolsky, HM	2021	*The defense innovation machine: Why the US will remain on the cutting edge*
Rosendorf, O	2021	*Predictors of support for a ban on killer robots: Preventive arms control as an anticipatory response to military innovation*
Haun, P	2020	*Peacetime military innovation through inter-service cooperation: The unique case of the US Air Force and Battlefield Air Interdiction*
Rossiter, A	2020	*Bots on the ground: an impending UGV revolution in military affairs?*
Berman, L	2012	*Capturing Contemporary Innovation: Studying IDF Innovation against Hamas and Hizballah*
Guichard, R	2005	*Suggested repositioning of defence R&D within the French system of innovation*

Chávez, K; Swed, O	2023	*Emulating underdogs: Tactical drones in the Russia-Ukraine war*
Kuo, K	2022	*Dangerous Changes: When Military Innovation Harms Combat Effectiveness*
Evron, Y	2021	*4IR technologies in the Israel Defence Forces: blurring traditional boundaries*
Neads, A	2020	*You're in the Army Now: The Politics of Cohesion During Military Integration in Sierra Leone*
Shortland, N; Sari, H; Nader, E	2019	*Recounting the Dead: An Analysis of ISAF Caused Civilian Casualties in Afghanistan*
Libaers, D	2009	*Industry relationships of DoD-funded academics and institutional changes in the US university system*
Angevine, RG	2005	*Innovation and experimentation in the US Navy: The UPTIDE antisubmarine warfare experiments, 1969-72*
Franck, RE	2004	*Innovation and the technology of conflict during the Napoleonic Revolution in Military Affairs*
Klimburg-Witjes, N	2024	*A Rocket to Protect? Sociotechnical Imaginaries of Strategic Autonomy in Controversies About the European Rocket Program*
Van Bezooijen, B; Kramer, EH	2015	*Mission Command in the Information Age: A Normal Accidents Perspective on Networked Military Operations*
Dyson, T	2011	*'Condemned forever to becoming and never to being'? The Weise Commission and German Military Isomorphism*
Ding, JF; Dafoe, A	2023	*Engines of power: Electricity, AI, and general-purpose, military transformations*
López-Rodríguez, G	2022	*Building military expeditionary culture: Spanish Army after international operations*
Stanley-Lockman, Z	2021	*From closed to open systems: How the US military services pursue innovation*
Jayaram, D	2020	*The Indian military and environmental affairs: an analysis through the lens of military change*
Broekhof, MP; Kitzen, MWM; Osinga, FPB	2022	*A Tale of Two Mosuls, The resurrection of the Iraqi armed forces and the military defeat of ISIS*
Neads, A	2019	*Improvise, adapt and fail to overcome? Capacity building, culture and exogenous change in Sierra Leone*
DeVore, MR	2021	*Armaments after autonomy: Military adaptation and the drive for domestic defence industries*
Dyson, T	2021	*The Challenge of Creating an Adaptive Bundeswehr*
Kollars, N	2017	*Genius and Mastery in Military Innovation*
Jordán, J	2017	*An explicative model of the processes of change in military organizations: the response of the United States after 9/11 as a case study*
Chen, L	2015	*From Civil War Victor to Cold War Guard: Positional Warfare in Korea and the Transformation of the Chinese People's Liberation Army, 1951-1953*
Callado-Muñoz, FJ; Fernández-Olmos, M; Ramírez-Alesón, M; Utrero-González, NM	2024	*Assessing the Impact of Military and Civilian R&D on Performance*
Lanoszka, A; Hunzeker, MA	2023	*Evaluating the Enhanced Forward Presence After Five Years*

Horowitz, MC; Kahn, L; Samotin, LR	2022	*A Force for the Future A High-Reward, Low-Risk Approach to AI Military Innovation*
Kuo, K	2021	*Military Innovation and Technological Determinism: British and US Ways of Carrier Warfare, 1919-1945*
Hunzeker, MA; Harkness, KA	2021	*Detecting the need for change: How the British Army adapted to warfare on the Western Front and in the Southern Cameroons*
Dyson, T	2020	*Unpacking military emulation: absorptive capacity and German counterinsurgency doctrine during ISAF*
Lee, C	2023	*The role of culture in military innovation studies: Lessons learned from the US Air Force's adoption of the Predator Drone, 1993-1997*
Raghavan, S	2018	*Military technological innovation in India: A tale of three projects*
Chen, L	2017	*Operational idealism: doctrine development of the Chinese People's Liberation Army under Soviet threat, 1969-1989*
Kollars, NA; Muller, RR; Santora, A	2016	*Learning to Fight and Fighting to Learn: Practitioners and the Role of Unit Publications in VIII Fighter Command 1943-1944*
Yuan, CQ; Liu, SF; Yang, YJ; Shen, Y	2016	*ON THE CONTRIBUTION OF DEFENSE INNOVATION TO CHINA'S ECONOMIC GROWTH*
Ouellet, E; Pahlavi, PC	2011	*Institutional Analysis and Irregular Warfare: A Case Study of the French Army in Algeria 1954-1960*
van der Maarel, S; Verweij, D; Kramer, EH; Molendijk, T	2023	*This Is Not What I Signed up for: Sociotechnical Imaginaries, Expectations, and Disillusionment in a Dutch Military Innovation Hub*
Rossiter, A	2023	*Hyping emerging military technology: probing the causes and consequences of excessive expectations*
Shklarsky, I; Shamir, E	2023	*Driving innovation in air power: the cold war's four generations of fighter jets*
Jenne, N	2024	*Narratives Around Civil-Military Cooperation: How Institutionalized Discourses Influence Learning in Peace Operations*
Schmid, J	2023	*Technological Emergence and Military Technology Innovation*
Oling, P; Rietjens, S; van Fenema, P; Schakel, JK	2022	*Towards a cultural perspective on the absorption of emerging technologies in military organizations*
Kania, EB	2021	*China's quest for quantum advantage-Strategic and defense innovation at a new frontier*
Hall, BN	2021	*The American Expeditionary Forces, Communications and the First World War: A Case Study in Inter-Allied Learning*
DeVore, MR	2020	*Reluctant innovators? Inter-organizational conflict and the U.S.S's route to becoming a drone power*
Martinez, A	2017	*Disciplinary Ordinances for English Armies and Military Change, 1385-1513*
KUMAR, V; PERSAUD, ANS; KUMAR, U	1994	*ON IMPROVING THE EFFICIENCY OF THE DEFENSE INNOVATION PROCESS - AN EMPIRICAL FRAMEWORK*
Dal, EP; Dipama, S	2024	*Assessing the Diffusion of Military Power Capacity of Middle Powers: The Case of Turkey*
Gompert, DC	2024	*Winning the US-China Technology Race*

Bae, H; Han, J	2024	*Capability for China's Intervention by Sea in the Total War on the Korean Peninsula in 2049-By Using Scenario Planning Methodology*
Wiltenburg, I; Gootzen, V	2024	*Military adaptation to combat mentoring: Belgium's Operational Mentoring and Liaison Team experience*
Ferdman, H; Filippova, V; Kozak, I; Pasichnyi, R; Lutsyshyn, A; Akimov, O	2024	*INNOVATION DEFENSE CLUSTERS - AN EFFECTIVE DRIVER OF DEFENSE AND NATIONAL SECURITY OF UKRAINE*
Kim, I	2023	*Reformist Cultural Inertia and Prospects for Defense Innovation 4.0 in South Korea*
Rosendorf, O; Smetana, M; Vranka, M	2024	*Algorithmic Aversion? Experimental Evidence on the Elasticity of Public Attitudes to Killer Robots*
Gannon, JA	2023	*Planes, Trains, and Armored Mobiles: Introducing a Dataset of the Global Distribution of Military Capabilities*
Yoo, K; Yun, DH	2023	*The Conceptual Framework of Korean Defense Innovation 4.0: Transition to High-Tech Army in the Era of 4IR*
López-Rodríguez, G	2022	*Cultural Factors and Processes of Military Change in the Spanish Army*
Haggard, S; Cheung, TM	2021	*North Korea's nuclear and missile programs: Foreign absorption and domestic innovation*
Kashin, V	2021	*Defense innovation in Russia in the 2010s*
Yoon, J	2021	*Issues and Prospects of AI Utilization in the Defense Field: Organizational Capability, Technology Maturity, Institutional Congruence*
Burke, LM	2020	*Methodologies and Models in Military Innovation Studies*
Korb, LJ; Evans, C	2017	*The third offset strategy: A misleading slogan*
Fernández-Quesada, MDH	2015	*THE MILITARY INNOVATION IN SPAIN IN THE XVIII. FELICE GAZZOLA, CONDE DE GAZOLA, AND THE REAL COLEGIO DE ARTILLERIA, SEGOVIA (1760-1780)*
Arndt, JS	2012	*The True Napoleon of the West: General Winfield Scott's Mexico City Campaign and the Origins of the U.S. Army's Combined-Arms Combat Division*
Gallart, JM	2008	*THE LINK BETWEEN CIVIL AND MILITARY INNOVATION: TOWARDS A NEW FRAMEWORK*
Tischer, A	2003	*Reform and military change in the Holy Roman Empire -: The Emperor Maximilian I (1493-1519) and the Reichskriegsreform*
Wang, BC; Mulvenon, J	2000	*China and the RMA*
MOLASGALLART, J	1995	*MISSILE SYSTEMS - FLEXIBLE MODULARITY AND INCREMENTAL TECHNOLOGICAL-CHANGE IN MILITARY PRODUCTION*
RICKLEFS, M	1990	*BALANCE AND MILITARY INNOVATION IN 17TH-CENTURY JAVA*
GLITSCH, RE	1981	*A RECORD OF CIVILIAN SEARCH FOR MILITARY INNOVATION*
de Waard, EJ; van der Vorm, M	2024	*Unpacking the learning dynamics of a military task force in Afghanistan from a project-based organising perspective*
Donlon, B	2024	*ADAMS CENTER 2023 COLD WAR ESSAY CONTEST WINNER Getting 'On the NATO Map': Marine Corps Innovation and Late Cold War Exercises, 1975-1978*

Bonvillian, WB	2024	*Operation warp speed: Harbinger of American industrial innovation policies*
Ploom, I; Kalvet, T; Küutt, R; Veinla, M; Tiits, M	2024	*Managing risks in public procurement of defense innovation: lessons from the development of an anti-armor mine in Estonia*
Ben-Ari, E	2024	*The art of military innovation: Lessons from the Israel Defense Forces*
Kuo, K	2024	*How to Think About Risks in US Military Innovation*
Gutiérrez, JMP	2024	*Santa Anna in Texas: from his formation with Arredondo to the Uprising of the Anglo-saxon settlers (1811-1836)*
Borges, L	2023	*Leading sectors and polarity change in the context of US-China competition: a process-based analysis of the origins of polarity shift*
Borges, L	2023	*Leading sectors and polarity change in the context of US-China competition: a process-based analysis of the origins of polarity shift*
Morgan-Owen, D; Fox, A; Gould, A	2024	*Sources of military change: Emulation, politics, and concept development in UK defence*
Smeets, M	2023	*The challenges of military adaptation to the cyber domain: a case study of the Netherlands*
Maltsev, V	2023	*The economics of military innovation under anarchy: The case of the Ukrainian Civil War of 1917-1921*
Neads, A; Farrell, T; Galbreath, DJ	2023	*Evolving towards military innovation: AI and the Australian Army*
Chang, YN	2023	*Anti-Tank Warfare of the Chinese People's Volunteer Army in the Korean War*
López-Rodríguez, G	2023	*Is the Spanish Army's Experimental Brigade 2035 a Result of Civil-military Relations? A Historical Overview (1923-2021)*
Wilson, PH	2023	*Of 'Master' and 'Grand Narratives' and Their Discontents: Early Modern European Military History*
Chung, Y; Dai, ST	2022	*The Fourth Industrial Revolution and China's Defense Innovation in Intelligent Systems*
Posner, A	2023	*Imagining total onslaught: South African military threat scenarios and doctrinal change, 1953-1975*
Moller, SB	2022	*Learning from losing: How defeat shapes coalition dynamics in wartime*
Dossi, S	2022	*Explaining Military Change in China: Reintroducing Civilian Intervention*
Neads, A	2021	*Rival principals and shrewd agents: Military assistance and the diffusion of warfare*
Lydin, NN	2021	*The Main Approaches to Chronological Problems of the Military Revolution Theory in Modern English-Language and Russian Studies*
Ru, SH	2020	*Forging a Pure Military Identity: The Rise of Jurchen Heritage in Northeast Asia (15th-17th Century)*
Campbell, P	2020	*Military Realism and Doctrinal Innovation in Kennedy's Army: A New Perspective on Military Innovation*
López-Rodríguez, G	2019	*Military innovation in the Spanish Army during the Moroccan War (1921-1927)*
Greenhalgh, E	2019	*The French Army on the Western Front*
Ijebor, C	2019	*The Role Of Artificial Intelligence In Facilitating Military Innovation*
Gholz, E	2014	*Military Innovation and the Prospects for Defense-Led Energy Innovation*
Hayworth, JR	2014	*Evolution or Revolution on the Battlefield? The Army of the Sambre and Meuse in 1794*