ARTICLE DOI 10. 52781/cmm.a132

Knowledge management in military affairs and defense: state of the art and trends based on a bibliometric study

Gestión del conocimiento en asuntos militares y de defensa: estado del arte y tendencias a partir de un estudio bibliométrico

Abstract: This bibliometric study investigates Knowledge Management in the Military and Defense Area. Using the Scopus database and the Prisma methodology (Jahan et al., 2016; Moher et al.; 2009), 961 articles were analyzed, of which 449 were selected for analysis using the Mendeley software and the R Bibliometrix platform (Aria; Cuccurullo, 2017). The results indicate the growing importance of knowledge management in this context, with emphasis on topics such as national security, digital transformation, simulation and risk management. Scientific production is diverse, involving different authors and institutions, and is disseminated mainly in academic events and journals in the areas of Business, Information Technology and Computing. The findings point to the relevance of knowledge management for improving military capabilities and strategic decision-making in an increasingly complex scenario.

Keywords: Knowledge Management. Knowledge transfer. Military affairs. Defense. Navy.

Resumen: Este estudio bibliométrico investiga la Gestión del Conocimiento en el Área Militar y de Defensa. Utilizando la base de datos Scopus y la metodología *Prisma* (Jahan et al., 2016; Moher et al.; 2009), se analizaron 961 artículos, de los cuales 449 fueron seleccionados para su análisis mediante el software Mendeley y la plataforma R *Bibliometrix* (Aria; Cuccurullo, 2017). Los resultados indican la creciente importancia de la gestión del conocimiento en este contexto, con énfasis en temas como la seguridad nacional, la transformación digital, la simulación y la gestión de riesgos. La producción científica es diversa, involucrando diferentes autores e instituciones, y se difunde principalmente en eventos académicos y revistas en las áreas de Negocios, Tecnología de la Información y Computación. Las conclusiones apuntan a la relevancia de la gestión del conocimiento para la mejora de las capacidades militares y la toma de decisiones estratégicas en un escenario cada vez más complejo.

Palabras clave: Gestión del conocimiento. Transferencia de conocimientos. Asuntos militares. Defensa. Naval.

Nikiforos Joannis Philyppis Junior
Universidade Federal do Rio de Janeiro.
Faculdade de Administração e Ciências Contábeis
Rio de Janeiro, RJ, Brasil
nikiforos@facc.ufrj.br

Adriano Lauro
Escola de Guerra Naval
Rio de Janeiro, RJ, Brasil
adlauro@gmail.com

Received: July 8, 2023
Accepted: June 24, 2024

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

1 INTRODUCTION

Knowledge, alongside "land, capital and labor," the main factors of production of the classical economy, has become a valuable asset in organizations not only as a value in itself, but also as a source of sustainable competitive advantage for organizations competing globally. Knowledge management (KM), although old as an activity, only became a discipline of academic study with the seminal work of Nonaka (1991), who reiterated the importance of managing both tacit and explicit knowledge in organizations. KM deals with acquiring, organizing, and transferring external and internal knowledge among employees to achieve organizations' results, preventing such knowledge from being lost over time.

In all spheres of the public sector, knowledge has become essential for effective management in pursuit of a nation's interests. In the context of the Armed Forces (AF) and Defense as a whole, in which there are many players, the challenge of managing information to accomplish missions becomes especially complex, both in the strategic dimension (national defense) and in the operational (defense planning) and tactical (military operations) spheres. Given its relevance, studying KM in the spheres of defense and military affairs is justifiable for both academia and public and private institutions that orbit the subject. Therefore, a more in-depth study of KM in military and defense matters is opportune for directing policies and strategies at the national level. Having this theme in mind, this research aims at conducting a bibliometric study to locate and identify articles that show the current state of the art of KM in military and defense affairs, describing the studied topics and discuss research trends worldwide.

This introduction presented the justification for the research and its objective. The second and third parts provide a brief review of concepts to define the terms: "knowledge management," "military affairs," and "defense." In the fourth part, the research methodology and the criteria used in this research are presented. In the fifth part, the data and graphical bibliometric analysis are shown with comments from the authors. Finally, there are final considerations and suggestions for future studies. The bibliography collected for this research follows.

2 MANAGEMENT AND TRANSFER OF KNOWLEDGE

Knowledge is the organization of available data (information) used to achieve the objectives of individuals or companies. It can be stored in the minds of people (tacit knowledge) or formally documented in any type of media or transfer process (explicit knowledge). The challenge of managing knowledge is not only in prospecting, capturing, and collecting knowledge, but also in organizing and allocating it to repositories and correctly disseminating it to organizations' employees. Although we live in an information society, useful knowledge is not always accessible to organizational agents. In addition, the loss of intellectual capital by key people, due to professionals leaving in search of better opportunities or retiring due to length of service is a reality that must be managed to avoid the loss of knowledge. This is how KM works (Husain; Ermine, 2021). For the sake of simplicity, it is defined as

> Knowledge management as a systematic and integrative process of coordinating organisation-wide activities of acquiring, creating, storing, sharing, diffusing, developing, and deploying knowledge by individuals and groups in pursuit of major organisational goals. It is the process through which organisations create and use their institutional and collective knowledge.(Kesavan, 2021, p. 13).

Nakamori (2020) currently advocates the emergence of a "science of knowledge," based on research in the area of KM, but tends towards research into creativity for innovation, i.e. knowledge must have the purpose of creating "new products" useful to organizations in for achieving their objectives. To understand how knowledge flows, the widely known Nonaka's SECI Model (1991) can be applied, (Figure 1), which advocates the diffusion of knowledge as a "spiral," using the processes of "dialog," "linking explicit knowledge," "learning by doing," and "building knowledge in the field" (Figure 2).

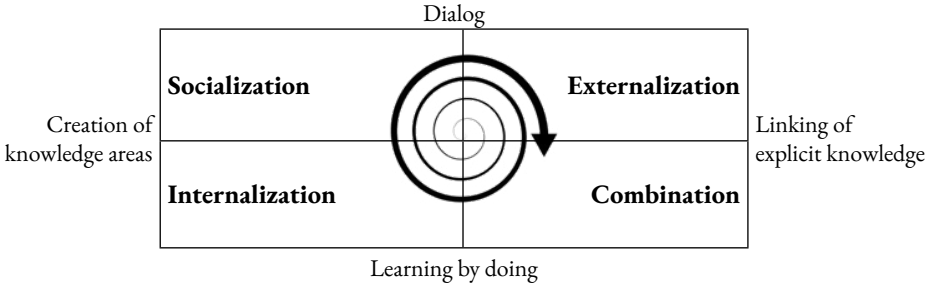
In short, KM is a set of processes and resources used to transform "private" knowledge, acquired and developed and stored in the minds of employees in organizations, into public knowledge, accessible to other productive agents in order to create and maintain competitive advantages and achieve defined objectives. There are various methods, tools, models, and concepts involved in this task. This article seeks to understand what the main contributions are in defense, military and related research. To this end, the next section defines the terms used to search for, research, and select articles in this area.

Figure 1 - SECI model - knowledge content created by the four modes

	Tacit knowledge to explicit knowledge	
Tacit knowledge to explicit knowledge	**Sympathized knowledge** (Socialization)	**Conceptual knowledge** (Externalization)
	Operational knowledge (Internalization)	**Systemic knowledge** (Combination)

Source: Adapted from Nonaka (1991).

Figure 2 - Spiral of Knowledge and approaches for disseminating knowledge



Source: Adapted from Nonaka (1991).

Another notable item in KM is the concept of knowledge transfer. Argote et al. (2000) and Costa Figueiredo et al. (2017) offer multiple interpretations to this term:

> Knowledge transfer in organizations is the process through which one unit (e.g., group, department, or division) is affected by the experience of another. This definition is similar to definitions of transfer at the individual level of analysis in cognitive psychology [...] Knowledge transfer in organizations manifests itself through changes in the knowledge or performance of the recipient units (Argote *et al.*, 2000, p. 151).

> Davenport and Prusak (1998) define knowledge transfer as the transmission, absorption and use of knowledge. Xiuping Chen and Jiaqiong Wang (2011) conceptualize it as an event in which one organization learns from the experience of another. According to these concepts, it can be observed that knowledge must be transferred between the two entities in such a way that they feel confident to use it and innovate whenever necessary (Figueiredo *et al.*, 2017, p. 12, our translation).

For knowledge transfer to effectively occur, an essential point to note is the change in the recipient's knowledge and/or performance. Knowledge can be added not only to people, but also to tasks, tools, and organizations, allowing various networks of people, functions and tools to achieve superior performance (Argote et al., 2000). Thus, any studies, tools, and processes that enable knowledge transfer are within the scope of this bibliometric research. Since these two definitions open up a broad spectrum of options, it is up to these authors to determine a cut-off point for the research, based on the interests described in the research objective. Section four defines the research methodology, selection criteria (inclusion and exclusion of texts), analysis process, tools, and results.

3 CONCEPT OF DEFENSE AND MILITARY AFFAIRS

National defense is not just equipping the Armed Forces with the necessary apparatus to act in conflicts, but "attitudes, measures and actions of the state [...] for the defense of the territory, sovereignty and national interests" (Brasil, 2015, our translation). The nation's interests involve the constant operation of military organizations in actions requiring administrative and operational activity. For example, coastal monitoring missions by the Navy or border patrols by the Army. To achieve this, the Armed Forces have complex processes involving the acquisition of consumer goods through bids and contracts, logistical planning, administrative processes in barracks, and other administrative facilities, among other tasks that span legal, bureaucratic-administrative, and technical-logistical domains. Although administrative processes are repetitive workflows, military missions move a huge range of very specific resources and assets over a limited period, a common characteristic of project management, which are not always executed as planned. Shortages of parts and fuel, improper allocation of military

personnel, budget authorization in public spheres, among other complexities. They are not uncommon and involve a variety of factors, resources and procedures at different hierarchical levels. The set of these various actions can be referred to as "military affairs." According to the Rand Corporation (*n. d.*):

> Military affairs comprise a range of topics from military personnel and veterans to equipment and facilities—as well as the methods, doctrines, organizational concepts, and technologies that support the military's strategic or tactical goals (Rand Corporation, [n.d.]).

Since this definition is quite broad, it is necessary to specify cuts for this research, focusing on the need to develop knowledge that leverages the mission of the Armed Forces and Defense as a whole. The term "defense" is even broader, as it not only seeks to dissuade or neutralize an enemy action but include illegal and unethical activities that can cause damage to the nation, whether in its sovereignty or in the economic, political or internal public security spheres. To guide this research, the definition contained in the Glossary of the Armed Forces published by the Ministry of Defense (2015) is used:

> DEFENCE - 1) Act or set of acts carried out to obtain, safeguard or restore the condition recognized as security. 2) Neutralization or deterrence of hostile actions aimed at affecting the security of a military organization or sensitive point, through the rational use of appropriate means, distributed according to planning, duly controlled and commanded. 3. Reaction against any actual or imminent attack or aggression (Brasil, 2015, p. 84, our translation).

Although such definitions are wide-ranging, in this research we have taken as important points the notion that military affairs encompass "a variety of topics, from military personnel and veterans to equipment and facilities, as well as methods, doctrines, organizational concepts and technologies" (Rand Corporation, [n.d.]). Defence encompasses "neutralization or deterrence of hostile actions [...] by the rational employment of appropriate means, distributed according to planning, duly controlled and commanded" (Brasil, 2015, our translation). The intersection of these definitions allows the research to cover a variety of areas such as public policy, strategic studies, administration and engineering, as well as humanities, and dialogue with a wide range of studies, theoretical essays and case studies in quantitative and qualitative research.

4 METHODOLOGY, PROCEDURES, AND TOOLS FOR DATA COLLECTION AND ANALYSIS

4.1 *Selection Strategy*

This research followed the search criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method (Moher et al., 2009), illustrating the results of the

literature review and the article selection process. PRISMA is a methodology created to provide robustness and validity to literature reviews and meta-analyses. Initially developed with a focus on medical sciences, it gained popularity in other areas of knowledge, as it audits the quality of reviews with an extensive list of quality checkpoints. For this reason, it is currently adopted by many journals as the standard methodology for systematic reviews (Moher et al., 2009). The scope of analysis in this research was defined between 1991 and December 2021, in the Scopus database. The terms used and the Boolean rules were ("knowledge management" OR "knowledge transfer" OR "knowledge sharing") in conjunction (Boolean AND) with ("military" OR "defence" OR "defense" OR "navy" OR "naval"). The search returned 961 items, which were evaluated one by one, starting with the titles, to exclude irrelevant topics and articles. From this initial screening, 603 articles remained.

4.2 *Selection criteria (inclusion and exclusion)*

After removing irrelevant journals and articles, the author reviewed the remaining ones individually, starting with a more detailed analysis of abstracts, keywords, and key terms from each author, journal, and/or database. The dataset was then refined with inclusion and exclusion criteria. One inclusion criterion was inserting articles on knowledge transfer in which the term "shipbuilding" appeared as the focus of the study. Although shipbuilding is not exclusively military or defense-related, the close relationship between shipbuilding companies and Navy military projects makes them strategic to the scope of defense in this research.

The first exclusion criterion involved articles in the fields of health and medicine, even in military environments, to focus on the defense aspect itself, while ensuring not to exclude studies involving biological warfare. The second exclusion criterion involved articles on hardware or software technology of a general application, in which the keywords military, defence, defense, naval, and navy appeared more as a lure for the "breadth of utility" of the technology, process, tool, or research; without being the actual focus of the work. The third criterion was identical to the second but applied to generic information technology and information science articles, such as a technical article on Radio Frequency Identification (RFID) technology, with applications in multiple sectors. The last exclusion criterion referred to articles whose primary topic was crises and disasters, even when military actions and organizations were involved, as the focus of knowledge transfer in these cases is the resolution of the effects of a crisis the population, which constitutes a temporary endeavor.

4.3 *Data extraction and treatment*

Selection criteria studies were reviewed by the authors, who extracted and analyzed the following indicators: (1) main information on the data (number of articles, source, keywords assigned by the system and by the authors, average citations per article, number of authors, author appearances, authors per article, single authorship, authors of multi-author

articles, article per author, co-authors per article, collaboration index); (2) most cited and relevant sources; (3) most cited topics and keywords, and topic evolution; (4) most cited authors and countries; and (5) density and relevance analysis of topics. The reference file and its metadata were saved in BibTex format and exported to a selected folder in Mendeley Desktop software, version 1.19.8. The R Bibliometrix package was used to generate bibliometric indicators and analysis figures.

5 DATA OUTPUT AND ANALYSIS OF RESULTS

5.1 *Main information on data*

The result of the selection was a set of 449 different documents, with a 90% predominance of conference papers (232) and journal articles (174), pointing to a growing stage of research discussion in the area. This hypothesis is reinforced by the relationship between the number of authors (1042) and their occurrence (1204), which showed a low concentration of authors on the topic (1.15 occurrences per author). Only 28% of the documents are single-authored and the index of authors per document and co-authorship per document are 2.32 and 2.68 respectively (less than three authors), showing little collaboration (index 2.88). The proximity of these indicators suggests numerous publications within the same institutes, probably between supervisors and students in postgraduate programs or colleagues in the same department or research area. The low rate of articles per author (0.43) suggests sporadic *ad hoc* research from these programs and projects. Table 1 shows some descriptive statistics, other information, and a summary of our own considerations.

5.2 *Most cited and most relevant sources*

Table 2 summarizes the most relevant and most cited sources. The 20 most cited sources are all journals, while among the 20 most relevant sources there are only four journals, which suggests a possible concentration of research on exploratory studies, case studies and conceptual discussion articles, which are more widely accepted at academic events. Regarding the most cited sources, the majority are management journals with a wide range of topics and subjects, such as Organization Science, Harvard Business Review, and Strategic Management Journal, in 2nd, 3rd, and 4th place respectively, with 253 articles. In 1st place was the Journal of Knowledge Management with 189 articles. Six journals are from the area of KM, Information Systems and Information Management: Journal of Knowledge Management, MIS Quarterly, Journal of Management Information Systems, Expert Systems with Applications, Communications of the ACM, and International Journal of Information Management. The concentration of relevance in academic events with the majority published in management journals covering a wide range of subjects gives further clues as to the stage of evolution of the topic itself.

Table 1 - Basic information and statistics on the data, with observations from the authors

Description of data	Results	Observations
Basic information on the data		Knowledge management has been consolidating since 1991, but the first article within the research objective only appeared seven years later, with a mean of 18.7 articles per year between these dates.
Time period	1998:2021	
Sources (journals, books, conferences, etc.)	327	
Documents	449	
Mean years since publication date	11.3	Documents are cited sparsely, with a mean of citations per year of less than 1 and a mean of 6.78 citations per year over the period. The mean of productivity is 18.7 articles per year, with a mean of 26 references per article.
Mean citations per document	6.78	
Mean citations per document per year	0.53	
References (total)	11,986	
Types of documents		More than 90% of the production is concentrated in conference articles (51.6%) and journal articles (38.7%), indicating a phase of debate on the related research topics. The low production in book chapters and books indicates that there is still little consensus, which suggests that the number of literature reviews (16) is almost equal to the chapters and is much greater than books on the subject.
Conference paper	232	
Journal article	174	
Book chapter	18	
Review	16	
Book	5	
Note	2	
Editorial	1	
Short survey	1	
Content of documents		The number of keywords extracted from the titles of the articles, by Scopus' Keyword Plus, is 2.38 times greater. This difference may disperse research in the classification of articles.
Keywords Plus (ID)	2,683	
Keywords from authors	1,125	
Authors		
Authors' appearance	1,204	Although the number of authors appearing in total is greater than the number of authors in the selection, the ratio between appearance and author is 1.15, i.e., the production is not concentrated in several authors.
Number of authors	1,042	
Authors of co-authored documents	926	
Authors of single-authored documents	116	
Collaboration from authors		Only 28% of documents have single authorship and the collaboration rates (2.88) very close to the rates of co-authorship per document. Authorship per document suggest that there are still dispersed research efforts, probably within organizations among their members in specific actions, such as research in postgraduate programs, which can be inferred by the low rate of documents per author (0.43).
Documents with single authorship	127	
Collaboration index	2.88	
Coauthors per document	2.68	
Authors per document	2.32	
Documents per author	0.43	

Source: The authors (2023).

Table 2 - Most cited (left) and most relevant (right) sources, in decreasing order of articles

Fontes mais citadas	Artigos	Fontes mais relevantes	Artigos
JOURNAL OF KNOWLEDGE MANAGEMENT	189	PROCEEDINGS OF THE EUROPEAN CONFERENCE ON KNOWLEDGE MANAGEMENT ECKM	19
ORGANIZATION SCIENCE	109	JOURNAL OF KNOWLEDGE MANAGEMENT	11
HARVARD BUSINESS REVIEW	75	LECTURE NOTES IN COMPUTER SCIENCE	10
STRATEGIC MANAGEMENT JOURNAL	69	PROCEEDINGS OF SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING	10
MIS QUARTERLY	61	JOURNAL OF INFORMATION AND KNOWLEDGE MANAGEMENT	7
ACADEMY OF MANAGEMENT REVIEW	52	PROCEEDINGS OF THE ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES	6
MANAGEMENT SCIENCE	48	VINE	6
ADMINISTRATIVE SCIENCE QUARTERLY	46	AUTOTESTCON (PROCEEDINGS)	5
ACADEMY OF MANAGEMENT JOURNAL	41	IEEE AEROSPACE CONFERENCE PROCEEDINGS	5
CALIFORNIA MANAGEMENT REVIEW	37	CEUR WORKSHOP PROCEEDINGS	4
RESEARCH POLICY	37	ENCYCLOPEDIA OF KNOWLEDGE MANAGEMENT	4
JOURNAL OF MANAGEMENT INFORMATION SYSTEMS	34	PROCEEDINGS - IEEE MILITARY COMMUNICATIONS CONFERENCE MILCOM	4
SLOAN MANAGEMENT REVIEW	34	22ND ANNUAL INCOSE 2012 AND THE 8TH BIENNIAL EUSEC 2012	3
EXPERT SYSTEMS WITH APPLICATIONS	33	EXPERT SYSTEMS WITH APPLICATIONS	3
INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT	32	PROCEEDINGS OF THE INTERNATIONAL ASTRONAUTICAL CONGRESS IAC	3
JOURNAL OF MANAGEMENT STUDIES	30	2013 MILITARY COMMUNICATIONS AND INFORMATION SYSTEMS CONFERENCE MCC 2013	2
JOURNAL OF APPLIED PSYCHOLOGY	26	29TH ANNUAL NATIONAL CONFERENCE OF THE AMERICAN SOCIETY FOR ENGINEERING MANAGEMENT 20	2
LASSILA	26	62ND INTERNATIONAL ASTRONAUTICAL CONGRESS 2011 IAC 2011	2
COMMUNICATIONS OF THE ACM	25	ACADEMY OF MANAGEMENT 2005 ANNUAL MEETING: A NEW VISION OF MANAGEMENT IN THE 21ST CENTU	2
INTERNATIONAL JOURNAL OF INFORMATION MANAGEM	25	ADVANCED SCIENCES AND TECHNOLOGIES FOR SECURITY APPLICATIONS	2
Legendas: Fonte vermelha = periódicos Fonte azul = congressos, conferências, encontros etc. Fonte preta = livro ou capítulo de livro	A fonte que se repete em ambas as listas é o *Journal of Knowledge Management* (marcado em amarelo). No âmbito de fontes mais citadas, todas são periódicos genéricos o que pode denotar que a pesquisa em Gestão de Conhecimento para Assuntos Militares e Defesa ainda não esteja tão solidificada a ponto de chamar a atenção dos pesquisadores para periódicos da área OU ainda não tenha periódicos relevantes. Das 20 fontes mais relevantes, somente quatro são periódicos, sugerindo que a pesquisa na área ainda está na fase de estudos exploratórios.		

Source: The authors (2023).

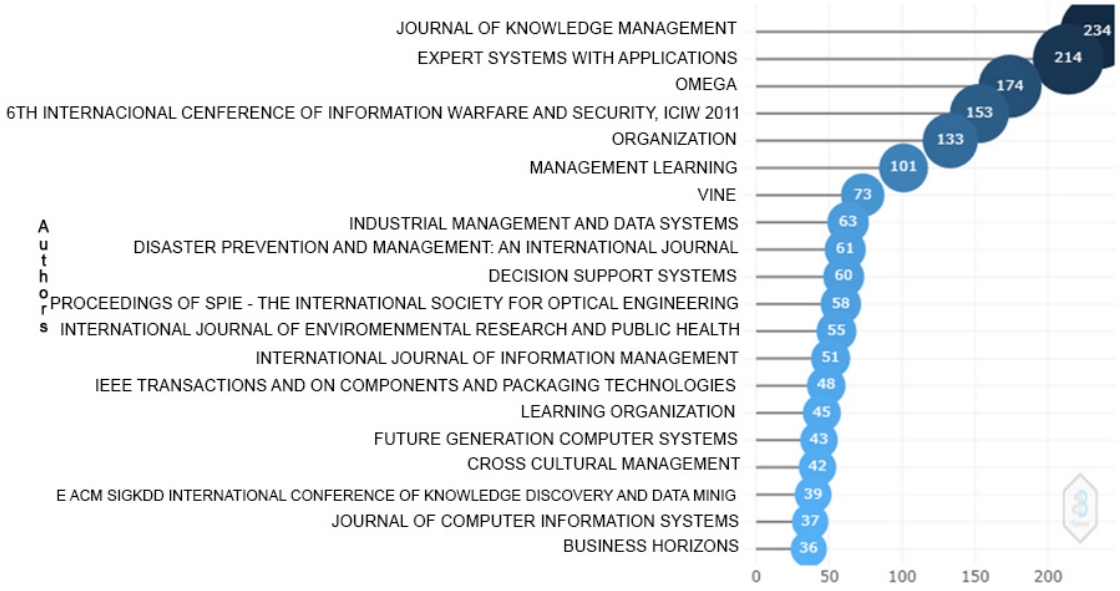
Another measure to look at is the total number of citations per source, with 448 authors concentrated in the Journal of Knowledge Management and Expert Systems with Applications. Two other sources are Omega, a journal in Management area with high impact factor, accounting for 174 authors; and the 6th International Conference in Informational Warfare and Security of 2011, with 153 authors. This indicator shows sources with the greatest scientific impact and academic strength. The other journals on the list are not specific to military or defense matters, but are divided into business, information and the like (Figure 3).

5.3 *Most cited topics and keywords and their evolution*

Table 3 summarizes the 50 most used keywords. Among the 407 words that appear, the search terms "knowledge management," "knowledge sharing," "knowledge transfer", and "military" are also counted. Excluding these terms for analytic purposes, 245 words are among the most repeated, with "ontology" (6.1%), "knowledge" (5.7%), "organizational learning" (4.5%), and "collaboration" (4.1%) being the most frequent. The presence of the other key terms (42 in all) varied between 3.3% and 1.2%, suggesting a dispersion of topics in military KM, also the result of the low concentration of research as shown in the indicators of author per document and document per author.

Although the most cited words are relevant, Figure 4 shows the productivity of these terms over the years, concentrating on groups of up to five terms per year. Taking the year 2012 as the midpoint of the defined period, the last ten terms that include "knowledge management," "ontology," "learning," "simulation," and "knowledge innovation" appear by 2017. Among the emerging subjects from 2019 to 2021, there are "digital transformation," "national security," "risk management," and "serious games." The intersection among these concepts could point to an interesting future in research and projects aimed toward military learning with an emphasis on dealing with national security risks through first-person digital games and simulations.

Figure 3 - Local impact of the source by Total Citation Index, in descending order.



Source: The authors (2023).

Table 3 - Most frequent key terms with individual and cumulative percentage

Keywords	Frequency	Percentage frequency	Cumulative percentage frequency	Keywords	Frequency	Percentage frequency	Cumulative percentage frequency
knowledge management	113	NC	NA	atom	4	1.6%	63.4%
knowledge sharing	23	NC	NA	big data	4	1.6%	65.0%
ontology	15	6.1%	6.1%	crisis management	4	1.6%	66.6%
knowledge	14	5.7%	11.8%	enterprise architecture	4	1.6%	68.2%
military	14	NC	NA	epistemology	4	1.6%	69.8%
knowledge transfer	12	NC	NA	information	4	1.6%	71.4%
organizational learning	11	4.5%	16.3%	information exchange	4	1.6%	73.0%
collaboration	10	4.1%	20.4%	information systems	4	1.6%	74.6%
case study	8	3.3%	23.7%	information technology	4	1.6%	76.2%

(to be continued)

Table 3 - Continuation

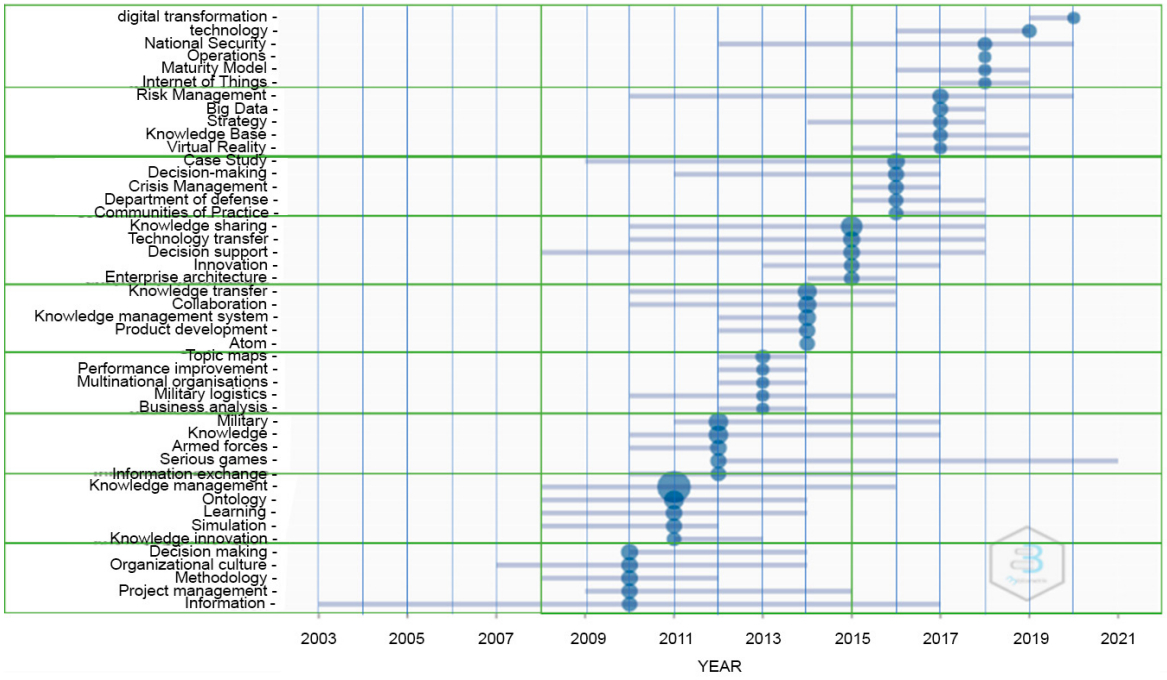
Keywords	Frequency	Percentage frequency	Cumulative percentage frequency	Keywords	Frequency	Percentage frequency	Cumulative percentage frequency
knowledge management system	8	3.3%	27.0%	innovation	4	1.6%	77.8%
decision making	7	2.9%	29.9%	knowledge creation	4	1.6%	79.4%
technology transfer	7	2.9%	32.8%	knowledge management systems	4	1.6%	81.0%
armed forces	6	2.5%	35.3%	leadership	4	1.6%	82.6%
command and control	6	2.5%	37.8%	learning organizations	4	1.6%	84.2%
decision support	6	2.5%	40.3%	management	4	1.6%	85.8%
learning	6	2.5%	42.8%	military university	4	1.6%	87.4%
methodology	6	2.5%	45.3%	tacit knowledge	4	1.6%	89.0%
organizational culture	6	2.5%	47.8%	visualization	4	1.6%	90.6%
decision-making	5	2.0%	49.8%	web services	4	1.6%	92.2%
product development	5	2.0%	51.8%	aerospace and defense industry	3	1.3%	93.5%
project management	5	2.0%	53.8%	artificial intelligence	3	1.3%	94.8%
risk management	5	2.0%	55.8%	cloud computing	3	1.3%	96.1%
semantic web	5	2.0%	57.8%	communities of practice	3	1.3%	97.4%
serious games	5	2.0%	59.8%	competitive advantage	3	1.3%	98.7%
simulation	5	2.0%	61.8%	complexity	3	1.3%	100.0%
				Total	245	100%	-------

Legends:

Red font = key research terms. Extracted from analysis.	NC = not computed
Gray background = groups terms with the same number of occurrences.	NA = not applicable

Source: The authors (2023).

Figura 4 - Trend Topics arranged in groups of up to five of the most relevant items, in chronological order.



Source: The authors (2023).

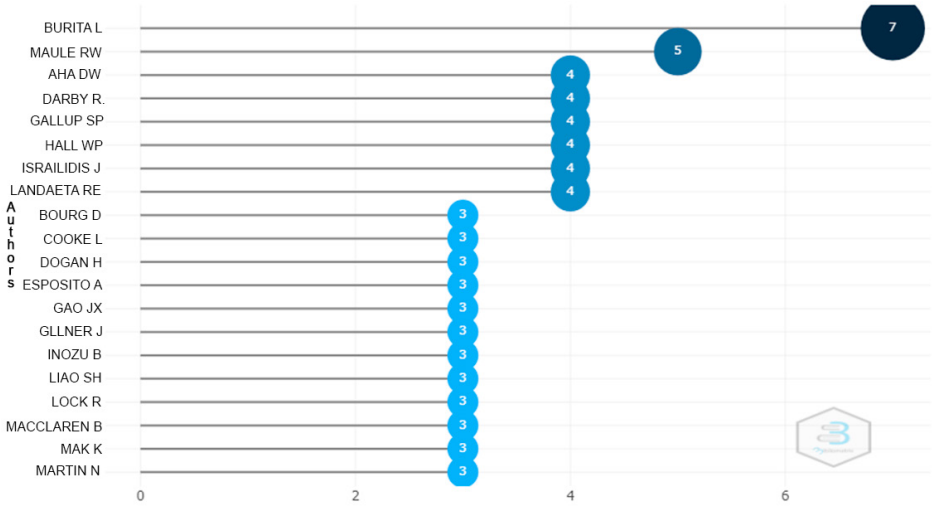
5.4 *Most cited authors and countries*

Figure 5 summarizes authors with up to three cited papers. This graph shows that production is not concentrated in a few authors and that those who produce the most have links with military institutes that define continuity not only in productivity, but also in maintaining emphasis in their studies. Examples include Ladislav Buřita, from the Univerzita obrany v Brne in the Czech Republic, with the highest productivity and publications in the area from 2010 to 2015, using the Czech Armed Forces as a case study in his articles. The topics chosen were knowledge modeling, ontology, collaborative society, and studies of knowledge management systems. He used case studies in teaching and research at military universities and in the Czech army. The second author with the most work is Randy Williams Maule, from the Naval Postgraduate School in Monterey, USA. This author has five works, including the organization of the Encyclopedia of Knowledge Management and a specific chapter on military KM in the same encyclopedia, as well as studies on ontology, codification, and KM systems in the military environment.

Figure 6 lists the main authors, showing their periods of production and indicates other authors with more recent and/or continuous production. Israilidis, Landaeta, Gao, Gllner, Mak, and Martin shows the most frequent and recent productions (2018–2021). Taking 2010 as the median for the period, only Landaeta, Gllner, and Mak present extensive continuity. The average years of contribution by the top 20 authors is 5.7 years, over a 20-year time span plotted on the graph. This distribution also suggests research in special projects and/or studies in postgraduate programs.

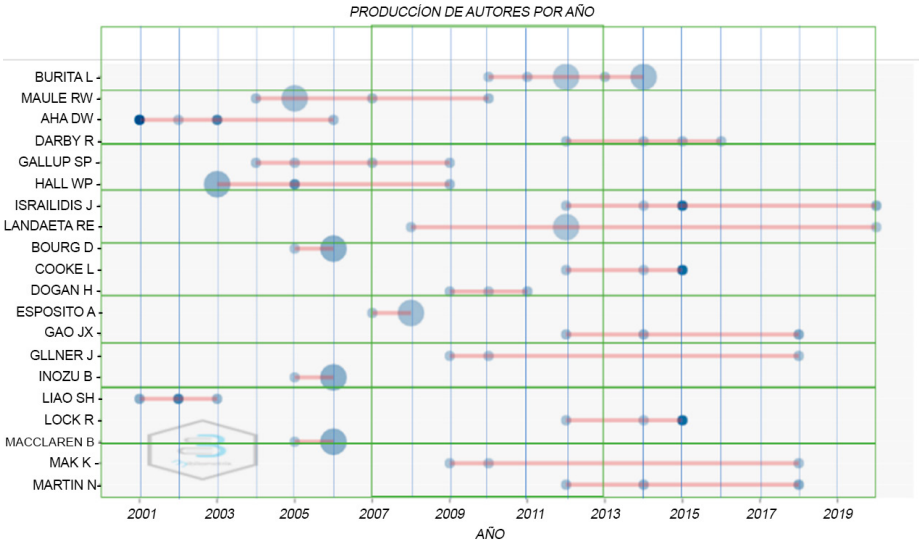
Finally, when analyzing production by country, the USA and the UK stand out as having the highest number of citations (1161 and 498, respectively), followed closely by Australia (227), China (138), Canada (60), and France (47), as can be seen in Figure 7. Separating the top 20 countries into ten deciles (every two) and plotting a weighted average (of 236.5 articles), only the US, the UK and Australia appear as countries with a relevant contribution, very much in line with the interests of these nations in projecting military power, not only on their borders, but globally. Considering the participation of countries, among the five continents, Europe and Oceania present greater participation by area than the Americas, Africa, Asia, and the Middle East (Figure 8).

Figure 5 - Main authors by number of papers, in descending order



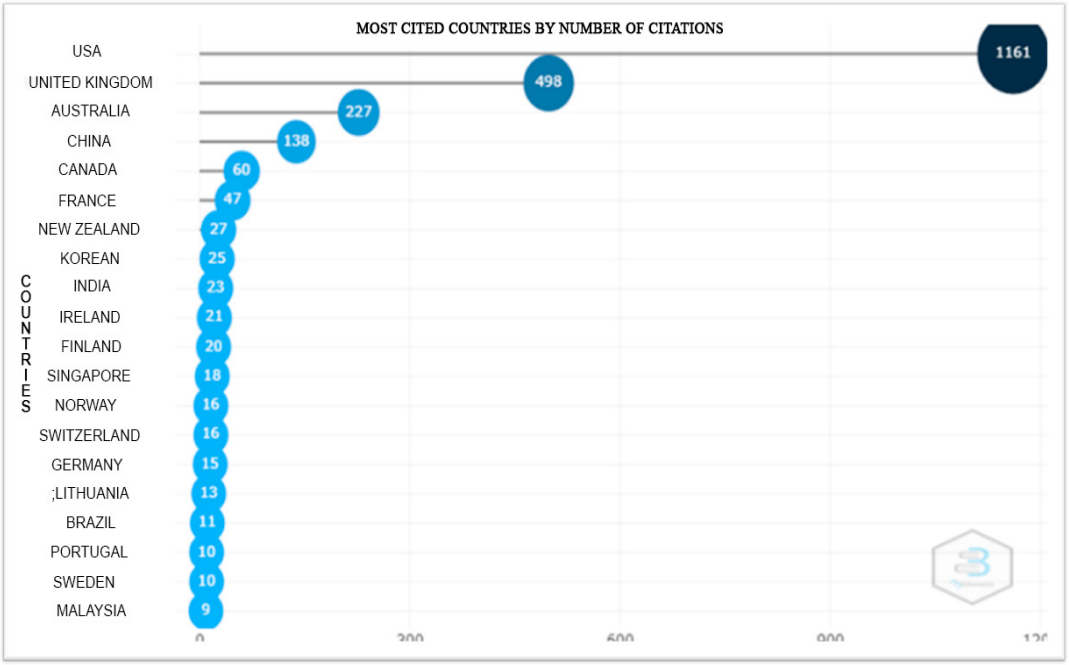
Source: The authors (2023).

Figure 6 - Main authors in descending order of contribution over the years.



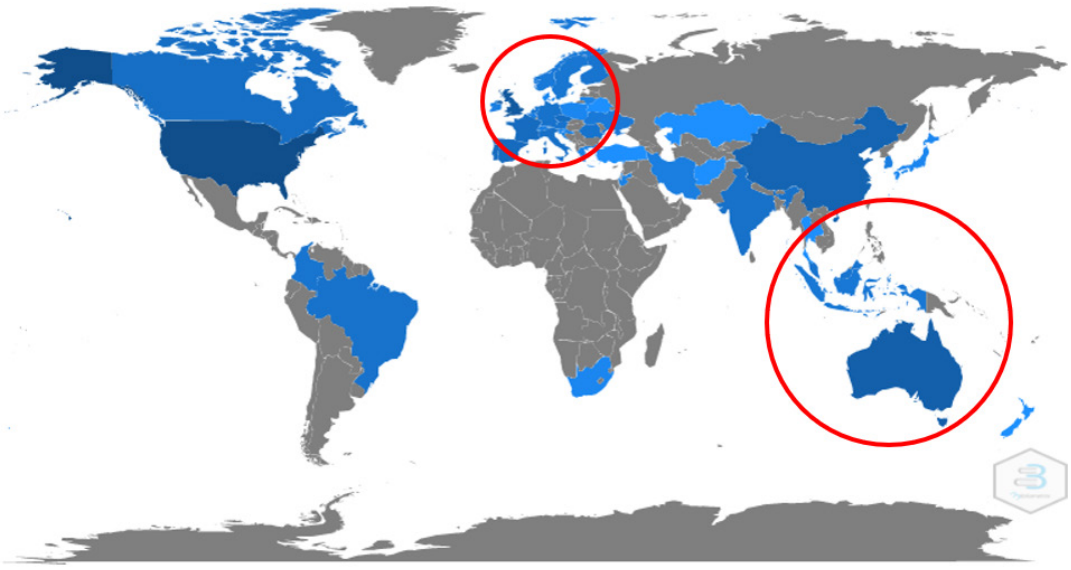
Source: The authors (2023).

Figure 7 - Most cited countries by number of citations



Source: The authors (2023).

Figure 8 - Most cited countries and continents by number of citations



Source: The authors (2021).

5.5 *Analysis of density and relevance of themes*

Another analysis that can be made using Figure 9 is the observation of key terms based on their relevance (centrality of the topic in current discussions, proportional to the size of the font) and development (growth, stability/stagnation or decline, graphically plotted by variation

between green, gray and blue, respectively). It can be seen that "knowledge management system," "army," and "knowledge sharing" are the most relevant, but declining themes. On the other hand, "technology transfer," "learning organizations," and "defense industry," although of low relevance, have grown in the collected base during the study period. On average, the relevance of the topics in the sample is low, ranging from 0.48 for "army" to 0.05 for words such as "aerospace industry" (decreasing), as well as "data envelopment analysis" and "decision support systems" (both increasing).

Figure 9 - Analysis of the 50 most cited keywords, by relevance and development

Source: The authors (2023).

6 FINAL CONSIDERATIONS

This bibliometric study shows the current state of the art of KM in military and defense affairs, making it possible to outline the topics studied and discuss research trends worldwide. The basic statistics of the collected sources and articles indicated that the field of research is very diverse, with a low concentration of authors and sources and with relevance not only in journals, but also in scientific and technical events in management, technology and information areas. Indicators of authorship, co-authorship, collaboration and articles per author are modest, showing that the area is not intellectually concentrated in a few research centers.

As for the most cited sources, management and technology journals stand out in terms of quantity, although the Journal of Knowledge Management (JKM) is in first place in number of articles. Among the most relevant sources, the same JKM appears again, but shares

space with events in engineering, information technology, and business, as well as four specific military/aeronautical events. Digital transformation, national security, operations, maturity models, and internet of things are among cited the most topics, and the most frequent keywords are ontology, knowledge, organizational learning, and collaboration. However, there is no predominance of words, which indicates the breadth of discussions in the area. The same goes for the most cited authors, with a single author leading only seven papers in the area. As far as geographical concentration is concerned, there is a predominance of US, British, and Australian publications, although Europe and Oceania, as continents, have a greater national share than the others ones. Lastly, the analysis of the density and relevance of topics shows low relevance due to the spreading of research across different subjects, and growth in subjects that are more widely discussed, such as digital transformation and internet of things, to the detriment of subjects that are better known in other areas of research.

The low number of authors per article and the low productivity of book chapters suggest that academic production comes mainly from sparse studies, such as case studies from master's and PhD research and military career training courses. The significant production in congresses lends strength to this hypothesis, since 51% are conference papers. The relevance of the research subject (military affairs and defense) is still incipient, and production is dispersed among conferences and journals, since only one out of the 20 most frequent sources (conference on military affairs) is specific to the topic.

The results suggest that researchers in postgraduate programs should not disregard publications in events, lesser-known authors and journals from other areas outside the military while conducting their research. They should not also disregard less cited authors, depending on the area of research due to the dispersion of topics. The survey of these articles and the analysis of terms (Figure 9) suggest that defense and military studies have focused on the topic of KM, with an emphasis on knowledge transfer and sharing, processes and management systems, although these topics seem to be declining. Another observation is the growth of studies on the defense sector (industry) as a whole, technology transfer and organizational learning. This suggests a shift in studies from technical-procedural to those more focused on the interaction between knowledge agents and the flow of knowledge through organizational exchanges, whether through technology acquisition or training and development.

However, the study's limitations must be highlighted. Firstly, the search in indexed databases does not consider reports from foundations, technological institutes, or reports from military organizations that may have relevant contributions to the analysis, potentially not considering important studies and authors. Another point is that this bibliometric study returned statistics and indices of the totality of production, leaving out the analysis of the quality of academic production and the classification of contributions in order to better understand research in this area. Therefore, future research should conduct a systematic literature review in order to understand and classify research findings, identifying the stage of maturity of each subject and the gaps that may arise in future relevant research.

REFERENCES

ARGOTE, L.; INGRAM, P. Knowledge Transfer: A Basis for Competitive Advantage in Firms. **Organizational Behavior and Human Decision Processes**, Amsterdam, v. 82, n. 1, p. 150-169, 2000. DOI: https://doi.org/10.1006/obhd.2000.2893

ARIA, M.; CUCCURULLO, C. bibliometrix: An R-tool for comprehensive science mapping analysis. **Journal of Informetrics**, Amsterdam, v. 11, n. 4, p. 959-975, 2017. DOI: https://doi.org/10.1016/j.joi.2017.08.007

BRASIL. MINISTÉRIO DA DEFESA. **Glossário das Forças Armadas**. Brasília, DF: Ministério da Defesa, 2015.

FIGUEIREDO, R. M. da C. **Transferência de Conhecimento: conceitos, estratégias e processos**. Brasília, DF: UnB, 2017. Available at: https://repositorio.unb.br/bitstream/10482/30503/3/RELATORIO_TransferenciaConhecimento.pdf. Access on: Oct. 1, 2020.

HUSAIN, S.; ERMINE, J.-L. Knowledge Management: Processes and Models. *In*: HUSAIN, S.; ERMINE, J.-L. **Knowledge Management Systems**: Concepts, Technologies and Practices. Bradford: Emerald, 2021.

JAHAN, N. *et al*. How to Conduct a Systematic Review: A Narrative Literature Review. **PubMed**, London, v. 8, n. 11, e864, 2016. DOI: https://doi.org/10.7759/cureus.864

KESAVAN, P. **Enablers of Organisational Learning, Knowledge Management, and Innovation**: Principles, Process, and Practice of Qualitative Data. Singapore: Springer Singapore, 2021. DOI: https://doi.org/10.1007/978-981-15-9793-0

MOHER, D. *et al*. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. **BMJ**, London, v. 6, n. 7, e1000097, 2009. Available at: http://www.bmj.com/content/339/bmj.b2535?tab=related#datasupp. Access on: Jan. 12, 2022.

NAKAMORI, Y. **Knowledge Construction Methodology**: Fusing Systems Thinking and Knowledge Management. Singapore: Springer Singapore, 2020. v. 20. *E-book*. Available at: http://link.springer.com/10.1007/978-981-13-9887-2. Access on: Jan. 12, 2022.

NONAKA, I. **The Knowledge-Creating Company**. Harvard Business Review, [*s. l.*], 1991. Available at: https://hbr.org/2007/07/the-knowledge-creating-company. Access on: Jan. 12, 2022.

RAND CORPORATION. Military Affairs. **Rand Corporation**, California, [s.d.]. Available at: https://www.rand.org/topics/military-affairs.html. Access on: Jan. 12, 2022.


ECEME