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Artículo Académico

ANALYSIS OF INTELLIGENCE AND NATIONAL SECURITY IN LATIN AMERICA: BIBLIOMETRIC ANALYSIS

ANÁLISIS DE INTELIGENCIA Y SEGURIDAD NACIONAL EN AMÉRICA LATINA: ANÁLISIS BIBLIOMÉTRICO

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Abstract
Intelligence analysis (IA) consists of the collection, processing and analysis of classified information with the objective of identifying and preventing national security (NS) threats. NS encompasses a wide range of concerns related to sovereignty, homeland defense, and prevention of internal and external threats. While the use of IA in NS is valuable, it may have limitations by focusing on specific aspects and restricting addressing broader needs to ensure NS. This reveals a gap in the comprehensive understanding of the challenges and threats to a country, as the specific focus of IA does not encompass the broad vision needed in the NS. In this regard, bibliometric research was developed in which 416 articles from the Scopus and WOS database were analyzed using the WOSviewer and Biblioshiny tools. It was found that among the most cited authors were Schultze Ulrike and Choo Kim-Knag. In addition, among the most cited sources were the journal Information Visualization and Intelligence and National Security. Also, among the most frequently used keywords were "Intelligent Analysis" and "Artificial Intelligence". It was concluded that the study of AI is in development, the concern of which integrates artificial intelligence and cyber-attack threats.

Códigos JEL: F51, F52

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Resumen

El análisis de inteligencia (IA) consiste en la recopilación, procesamiento y análisis de información clasificada con el objetivo de identificar y prevenir amenazas a la seguridad nacional (SN). La NS abarca una amplia gama de preocupaciones relacionadas con la soberanía, la defensa nacional y la prevención de amenazas internas y externas. Si bien el uso de la AI en la SN es valioso, puede tener limitaciones al centrarse en aspectos específicos y restringir el abordaje de necesidades más amplias para garantizar la SN. Esto revela una brecha en la comprensión integral de los desafíos y amenazas de un país, ya que el enfoque específico de la AI no abarca la visión amplia que necesita la Sociedad Nacional. En este sentido, se desarrolló una investigación bibliométrica en la que se analizaron 416 artículos de la base de datos Scopus y WOS mediante las herramientas WOSviewer y Biblioshiny. Se encontró que entre los autores más citados se encontraban Schultze Ulrike y Choo Kim-Knag. Además, entre las fuentes más citadas se encuentran la revista Information Visualization and Intelligence and National Security. Además, entre las palabras clave más utilizadas se encuentran "Análisis inteligente" e "Inteligencia artificial". Se concluyó que está en desarrollo el estudio de la IA, cuya preocupación integra la inteligencia artificial y las amenazas de ciberataques.

INTRODUCTION

The definition of security and defense are closely related and complementary due to the fact that the former evokes a condition of trust and a feeling of being free from risks, threats and dangers, while the latter refers to the different measures, whether military or not, that protect people from those risks, dangers and threats (Marrin, 2007, 2017). In this way, security advocates guaranteeing individual freedom collectively and defense provides protection and conservation, counting on a capacity to respond to threats, so that the community feels safe (Vargas, 2008). These concepts are then integrated and inherent to the survival and development of society, even more so when nations base their social and political structure on the ability to respond and defend themselves against threats, dangers and risks that may arise against the people of such nations (De Vergara, 2009), as well as their goods and interests, which is why it becomes a relevant issue in terms of the strategic and political direction of a country's lines of defense.

Thus, SN refers to a broad spectrum that involves concerns associated with sovereignty, defense of the territory, prevention of internal and external threats, among other interests of a country (Blum & Paté-Cornell, 2016; Mandel & Tetlock, 2018). While IA is about a procedure that starts with the collection, processing and analysis of information in secret with the purpose of warning threats and ensuring NS (Phythian, 2017). The integration of these concepts is fundamental for the survival and improvement of societal development, especially when nations base their social and political structure on their ability to respond to and defend themselves from threats, dangers and risks (De Vergara, 2009). This includes the search for guarantees of protection of individual citizens, as well as the set of public goods and national interests, which becomes a relevant issue for the conduct of defense. However, while the use of IA as an element for NS is useful, it can also be limiting to the extent that it presents a narrow focus (Marrin, 2011, 2017), which restricts the spectrum of broad needs fundamental to ensuring NS (Devanny et al., 2018; Mandel & Irwin, 2021).

Therefore, this study employs a bibliometric analysis procedure of 416 articles on IA and Latin American SN. Compared to traditional literature

reviews, in the bibliometric approach, massive amounts of scientific data, such as citation counts, keyword occurrences (instead of scholars) occupy a central place. In this regard, a bibliometric analysis complements traditional literature checks because it serves as a more objective and less biased analytical approach to reveal the current and evolving nuances of a specific discipline (Baumgartner & Pieters, 2003).

In particular, a bibliometric approach is suitable to better understand the field of IA and SN, framed in Latin America. First, it allows the discovery of the intellectual structure of these domains by identifying influential authors, countries, institutions, potential collaborations and networking patterns. Second, it facilitates the detection of dominant research themes by identifying clusters within a field. Third, a bibliometric approach dealing with 22 years of academic research on NS in Latin America provides essential information on the evolution of the literature and sheds light on mature and emerging areas of the field. Finally, it also reveals the current status, relevant topics and their development in this field of study.

This bibliometric analysis on NS and IA in Latin America is the first comprehensive systematic quantitative approach to the NS domain, which seeks to answer the following questions:

RQ1. Who or which are the most dominant authors, articles, journals, organizations and countries that have contributed to IA and NS research in Latin America?

RQ2. What are the current topics of IA and NS research in Latin America? How can these topics be further developed? Has their prevalence changed over time?

What are the main keywords in IA and NS research and how have they changed over time?

What are the future avenues for research in Latin American IA and NS?

METHODOLOGY

The development of this study was carried out following the guidelines and recommendations for bibliometric analysis of Donthu et al. (2021), which corresponds to the following five stages.

The first stage consists of the selection of the database. Different databases are available for conducting a bibliometric analysis, such as Scopus, Web of Science (WoS) and PubMed. However, according to AlRyalat et al. (2019), PubMed focuses on biomedical and life sciences research, whereas WoS and Scopus focus on multidisciplinary research. In consideration of the scientific focus of these databases, it was decided to use the first two, which are associated with Scopus and Clarivate, respectively. This is because they are two of the databases that are most widely recognized by researchers from different disciplines.

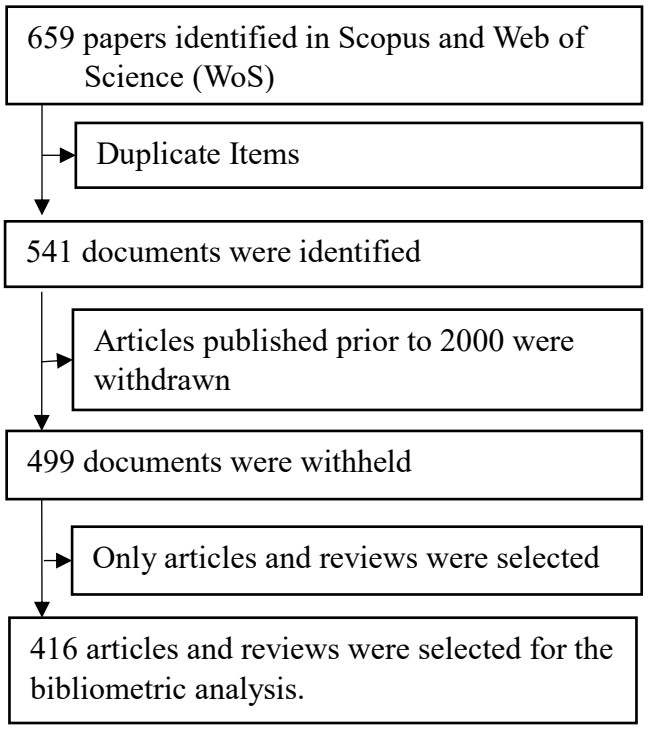
The second stage corresponds to the creation of the literature search formula or equation. In this stage, the IA and NS literature was analyzed preliminarily, which facilitated the generation of a search formula that allowed the largest number of scientific records related to one or both variables to be obtained. The search fields "title, abstracts and keywords" were used and the Boolean operators "AND/OR" were applied to the identified keywords. This allowed the following final search formula to be applied: TITLE-ABS-KEY ("Latin*Ameri*" and "nation* security*" or "Intelligence* Analy*"). The * is used as a wildcard in order to retrieve as many articles as possible.

The third stage is data collection and retrieval. The above search formula initially yielded 659 documents between both Scopus and Web of Science databases (Figure 1), when the articles were pooled, duplicates were discarded, resulting in 541 articles, then articles that have not been published from 2000 to 2023 were discarded resulting in 499. Next, only articles and reviews (also known as "certified knowledge") were selected as recommended by (Ramos-Rodríguez & Ruíz-Navarro, 2004). Therefore, all other papers, such as conference papers, books and

book chapters, were excluded, resulting in a final set of 416 articles. Duplicates were extracted.

In the fourth stage, the analysis is carried out. As highlighted by Donthu et al. (2021), both principal and enrichment analyses were performed for the present study. Performance analysis and scientific mapping analyses were performed as main analyses, while visualization techniques were applied in enrichment analyses (Donthu et al., 2021). The study used Biblioshiny and VOSviewer for the analysis. The broad set of bibliometric techniques offered by the Biblioshiny tool, just the VOSviewer network visualization tool, which allows bibliometric scholars to complement, leverage the strengths and overcome the limitations of each (Donthu et al., 2021; Moral-Muñoz et al., 2020). Because of this advantage, recent bibliometric studies have adopted the combination of both tools (Abhishek & Srivastava, 2021; Srivastava & Sivaramakrishnan, 2021).

FIGURE 1
Steps taken to compile and select the literature



VOSviewer was used in this study to identify the most cited documents, authors, sources and organizations and to perform a bibliographic linkage. Biblioshiny was used to obtain the annual scientific production graph, the geographical distribution of the top five countries, the impact of the author, the impact of the source and the most cited local sources in the domain. Then different keyword analyses were run to obtain the top 25 keywords, which were analyzed using tree diagram, word growth analysis, trend themes and thematic maps. Finally, a three-field graph was generated to visualize the interaction between countries, keywords and journals in the domain.

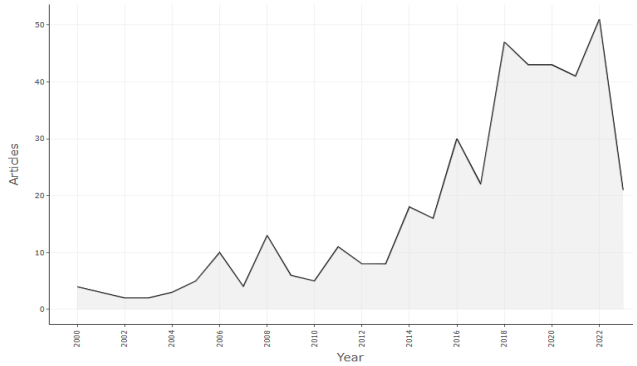
As a fifth step, a bibliographic linkage was performed using VOSviewer to identify the various evolving themes or clusters in the domain, either by identifying current topics or future research directions. According to Donthu et al. (2021), scholars should use this analysis to obtain the evolving themes and developments in the domain. Later, the result of keyword analysis, cluster and content analysis were used to propose future research directions not yet examined in each topic.

RESULTS

Results of performance analysis and citations

The annual production of 416 papers from 2000 to 2023 is presented in Figure 2, with an annual growth rate of 7.48%. These 416 papers are published in 236 journals, with 16.6 mean citations per paper and 16297 references. These documents include 405 articles and 11 reviews. From the graph, it can be seen that the scientific production of research related to IA and NS has increased at an accelerated rate, with greater emphasis from 2013, until reaching its maximum peak in 2022. This could indicate that throughout the study period the interest of researchers in IA and NS topics increased, probably due to the advancement of technology applied to the NS case. This is evidenced by examples such as the application of artificial intelligence (AI) as a complementary tool to the limitations of IA (Parra-Martinez et al., 2023; Qi et al., 2022).

FIGURE 2
Annual production of scientific articles on IA and NS, period 2000 – 2023



An article-by-article analysis resulted in 416 articles (220 linked) with a minimum of 4 citations. Table 1 presents the 10 most cited papers. The paper by Picard et al. (2001) entitled "Towards emotional intelligence of machines: analysis of affective physiological state" is the most cited paper with a total number of 1255. This article presents and compares multiple algorithms for feature-based recognition of emotional state from a dataset. The second most cited article (236 citations) is by Stasko et al. (2007), in which they developed a visual analytic system called Jigsaw that visually represents documents and their entities in order to help analysts examine them more efficiently and develop theories about possible actions more quickly. In third place is the article by Schultze (2000) with a total of 233 citations and focuses on the work of producing information objects, a central activity in knowledge work. These results show the most relevant articles regarding the study of IA and NS are mainly related to the search for improvements in the efficiency and objectivity of IA activities, as well as contributing to the acceleration of the work of human analysts.

TABLE 1
Most cited articles

N	Author/ Year	Title	Citations	Links
1	Picard et al. (2001)	Toward machine emotional intelligence: analysis of affective physiological state	1255	0
2	Stasko et al. (2007)	Jigsaw: Supporting Investigative Analysis through Interactive Visualization	236	8
3	Schultze (2000)	A Confessional Account of an Ethnography about Knowledge Work	233	1
4	Schultze y Boland (2000)	Knowledge management technology and the reproduction of knowledge work practices	157	1
5	Buhalis y Leung (2018)	Smart hospitality—Interconnectivity and interoperability towards an ecosystem	153	0
6	Quick y Choo (2014)	Impacts of increasing volume of digital forensic data: A survey and future research challenges	141	3
7	Singh-Manoux et al. (2005)	Effects of Physical Activity on Cognitive Functioning in Middle Age: Evidence From the Whitehall II Prospective Cohort Study	111	0
8	Serin et al. (2020)	Review of tool condition monitoring in machining and opportunities for deep learning	107	0
9	Koschade (2006)	A Social Network Analysis of Jemaah Islamiyah: The Applications to Counterterrorism and Intelligence	103	1
10	Bose (2008)	Competitive intelligence process and tools for intelligence analysis	103	0

The analysis by author revealed 92 authors who have at least two papers with at least three citations. The list of the ten most cited authors is shown in Table 2. Schultze, Ulrike is the most influential author with three papers and 390 citations, followed by Choo, Kim-Kwang Raymond (5 papers, 294 citations), Quick, Darren (five papers, 294 citations) and Stasko, John (five papers, 287 citations). Note that in comparison from Table 1, Schultze ranks first as one of the most relevant authors on IA and SN topics even though his paper with the highest relevance ranks third. It can also be observed that Pikard and Stasko, who occupy the first positions in the list, do not occupy the first positions as authors with the highest number of citations. Only Stasko ranks fourth on the list, so despite not being cited slightly less, his article has achieved a higher level of recognition in IA and SN topics.

TABLE 2
Most cited authors

N	Author	Documents	Citatations	Links
1	Schultze, Ulrike	2	390	0
2	Choo, Kim-Kwang Raymond	5	294	16
3	Quick, Darren	5	294	16
4	Stasko, John	5	287	40
5	Goerd, Carsten	4	283	39
6	Mandel, David	16	268	300
7	Liu, Zhicheng	3	257	35
8	Tetlock, Philip	6	188	159
9	Dhami, Mandeep	11	129	182
10	Mellers, Barbara	3	126	74

The "author impact analysis" performed in Biblioshiny revealed that Mandel, D., is in the first position with an h-index of 10, followed by Tetlock with an index of 6 and in third place is Choo, Kim-Kwang Raymond with an index of 5. In fact, Mendel is in the sixth position of the most cited authors and none of his articles is in the top ten of the most cited. However, despite this, the h-index positions him as the author with the highest level of impact. Similarly, the authors of Picard, Stasko and Schultze were the authors with the most cited articles, but this does not necessarily imply a higher level of impact. In fact, only Stasko is listed in the author impact analysis, although he is ranked seventh (see Table 3).

TABLE 3
Author impact analysis

Autor	H - index	G - Index	M - index	TC	NP
Mandel, David	10	16	1.000	268	16
Tetlock, Philip	6	6	0.462	188	6
Choo, Kim-Kwang Raymond	5	5	0.500	294	5
Dhami, Mandeep	5	11	0.556	129	11
Quick, Darren	5	5	0.500	294	5
Goerg, Carsten	4	4	0.250	283	4
Stasko, John	4	5	0.250	287	5
Barnes, Alan	3	3	0.300	110	3
Kang, Youn-ah	3	3	0.231	36	3
Karvetski, Christopher W.	3	3	0.500	28	3

Note. TC: Total Citation and NP: Number of publications.

Next, a source analysis was performed, resulting in 29 journals with at least three papers and three citations. The ten sources with the highest number of citations in the domain can be seen in Table 4, while Table 5 shows the result of the source impact analysis. Among the most cited sources, the journal Information Visualization stood out as the leader in the discipline with 6 papers and 367 citations (Table 4), followed by Intelligence and National Security (53 papers, 337 citations) and Studies in Conflict & Terrorism (3 papers and 152 citations). However, as shown in Table 5, none of these journals are among those with the highest impact. This would indicate that although there are journals that were cited more frequently, they do not necessarily have the greatest amount of high-quality research or scientific impact. Since these indicators focus mainly on the quantity of citations, the quality of these citations is ignored, which would explain the lack of presence of the most cited journals among those with the highest impact.

TABLE 4
Most cited sources

N	Source	Documents	Citations	Links
1	Information Visualization	6	367	9
2	Intelligence and National Security	53	337	41
3	Studies in Conflict & Terrorism	3	152	1
4	Expert Systems with Applications	4	115	0
5	PLOS One	5	114	1
6	Risk Analysis	4	104	17
7	Human Factors	3	86	4
8	International Journal of Human	4	75	3
9	Intelligence	3	75	0
10	American Psychologist	3	72	20

TABLE 5
Journals with the greatest impact

Journals	H - index	G - Index	M – index	TC	NP
Armed Forces & Society	2	2	0.057	49	2
International Journal of Communication	2	2	0.200	25	2
Journal of Chinese Political Science	2	2	0.400	6	2
Latin American Perspectives	2	2	0.118	10	2
Latin American Politics and Society	2	2	0.182	14	2
American Ethnologist	1	1	0.034	36	1
Canadian Journal of Political Science	1	1	0.031	5	1
Crime Law and Social Change	1	1	0.143	1	1
Diplomatic History	1	1	0.077	10	1
Energies	1	1	0.333	5	1

Note. TC: Total Citation, NP: Number of publications and AIP: Year of start of publication.

An analysis by organizations was then performed resulting in 54 institutions with a minimum of three published papers and three citations. The ten most influential organizations in the domain are listed in Table 6. The University of Pennsylvania, Georgia Institute of Technology, which are located in the United States, occupy the top two positions of the most influential organizations with a total of 10 and 4 published papers, as well as 282 and 281 citations, respectively. University College London of the United Kingdom and Defence Research & Development Canada emerged as the top institutions, ranking third and fourth, respectively. Finally, the results of the analysis by country also showed that 53 of them have at least three documents and three citations. The most influential country was the United States, with 175 papers and 4235 citations; the United Kingdom ranked second with 69 papers and 1130 citations, followed by China (66 papers, 463 citations) and Canada (32 papers, 461 citations).

TABLE 6
Most influential organizations

N	Source	Documents	Citations	Links
1	University of Pennsylvania	10	282	128
2	Georgia Institute of Technology	4	281	14
3	University College London	5	261	1
4	Defence Research & Development Canada	12	166	162
5	Middlesex University	17	158	143
6	Pittsburgh University	6	150	3
7	York University	5	142	106
8	George Mason University	8	133	12
9	Harvard University	4	97	17
10	Sichuan University	5	92	2

Science mapping and visualization results

Figure 3 presents the 15 most prominent keywords. As can be seen in the figure, the word Latin America is the most used word, and the concept of security is placed with the following

words "Intelligent Analysis", "Artificial Intelligence", "Community Intelligence", "threat intelligence" are some of the most popular keywords in the domain. On the other hand, in the tree diagram (Figure 4) which is evident that "Intelligent Analysis" has 27% of occurrences, while the keywords "Intelligence" and "Artificial Intelligence", have 8% and 6% of occurrences, respectively. Based on these results, it can be seen that the term IA is the predominant term in the results of the analysis. In addition, this term is associated with a set of similar elements, but involving technology issues, whether AI, forecasting, visual analytics, data mining, among others. This gives intuition that the research, whose topic of interest is focused on IA, has also expanded its field of study to those new tools of technological acceleration and large amounts of data. Thus, these new tools are used to improve information processing as well as the decisions that need to be made efficiently in terms of IA. Note also that, although to a lesser extent, the term NS or related terms are also often mentioned in this field of study, making the application of AI to NS one of the current topics of interest for various scientific fields of IA.

FIGURE 3
Most used keywords

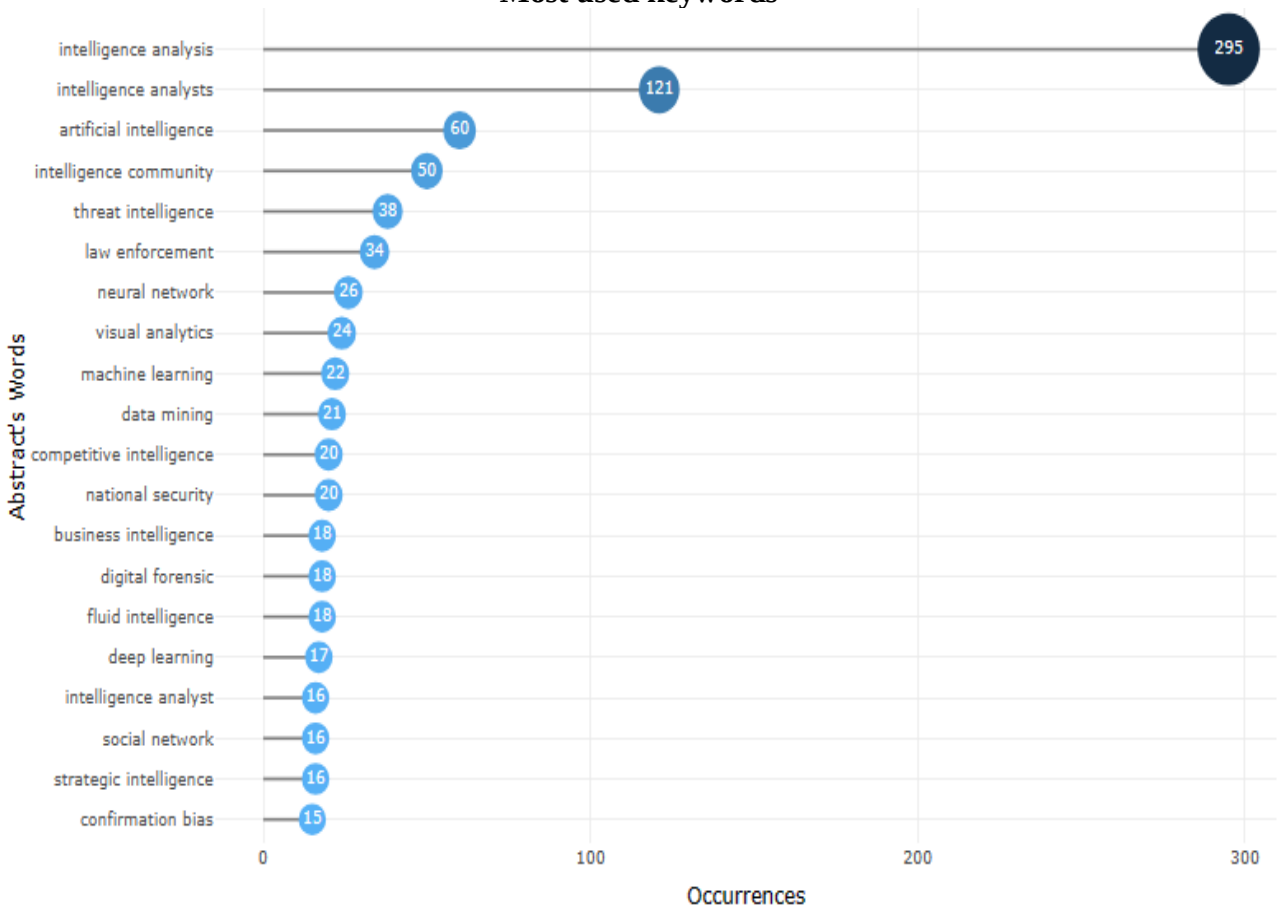
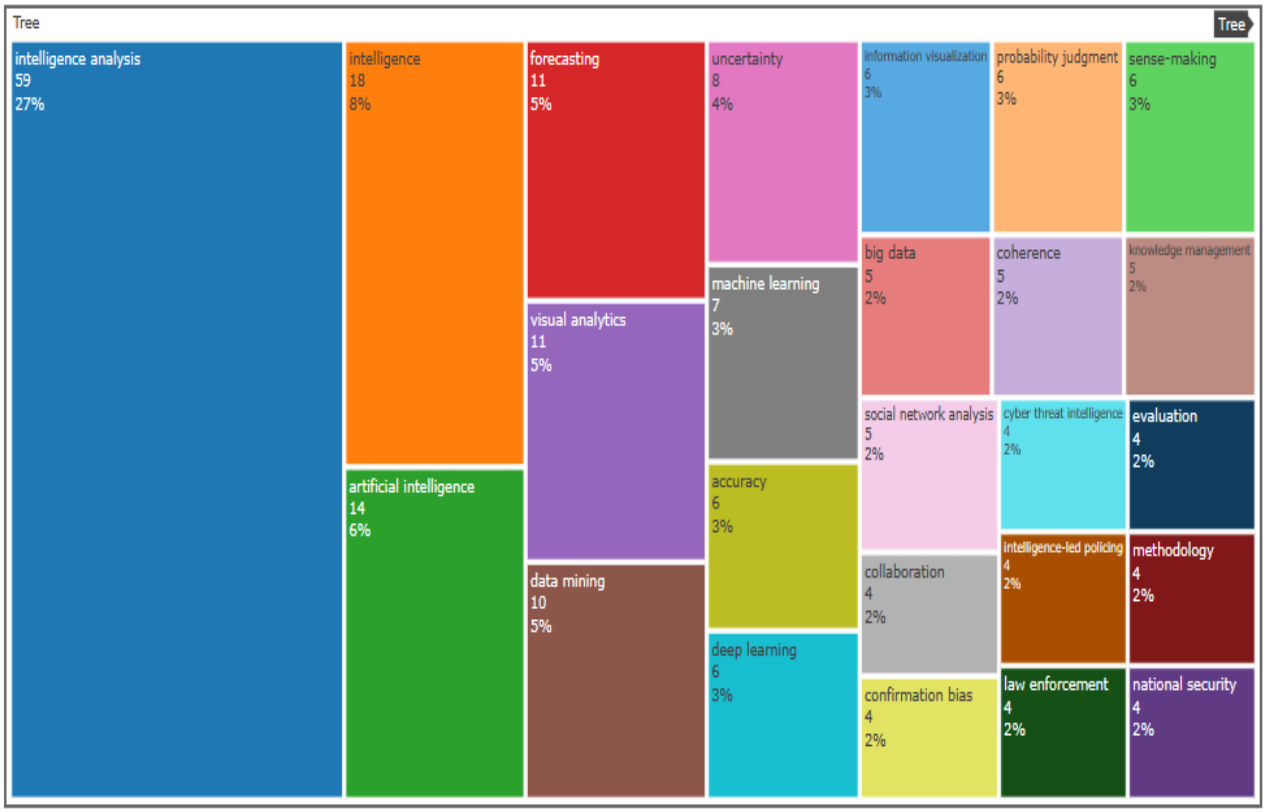
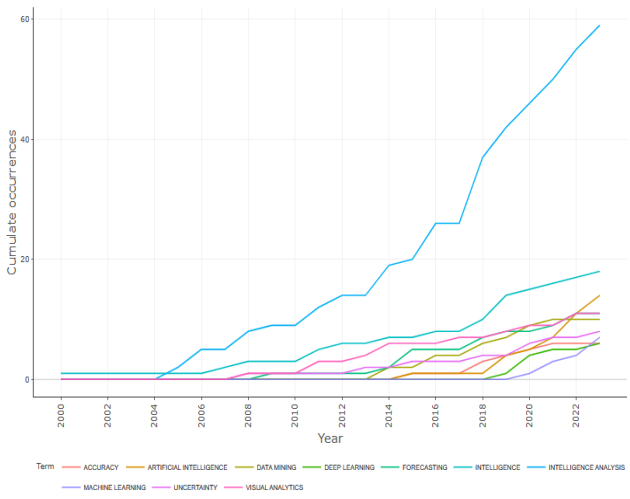


FIGURE 4
Keyword tree diagram



Interestingly, the figure shows that keywords such as "Intelligent Analysis" and "Artificial Intelligence" are growing in usage, as well as words such as forecasting, visual intelligence as words that are closely related to the concept of IA. It is still visualized that they use constructs from general NS fields, but terminology such as "uncertainty" is increasingly being adjusted. In addition, it is observed that the growth in the use of terms such as AI has increased with greater acceleration since 2010, which is consistent with the previous reasoning of the application of new technologies of analysis of large amounts of data to IA and NS.

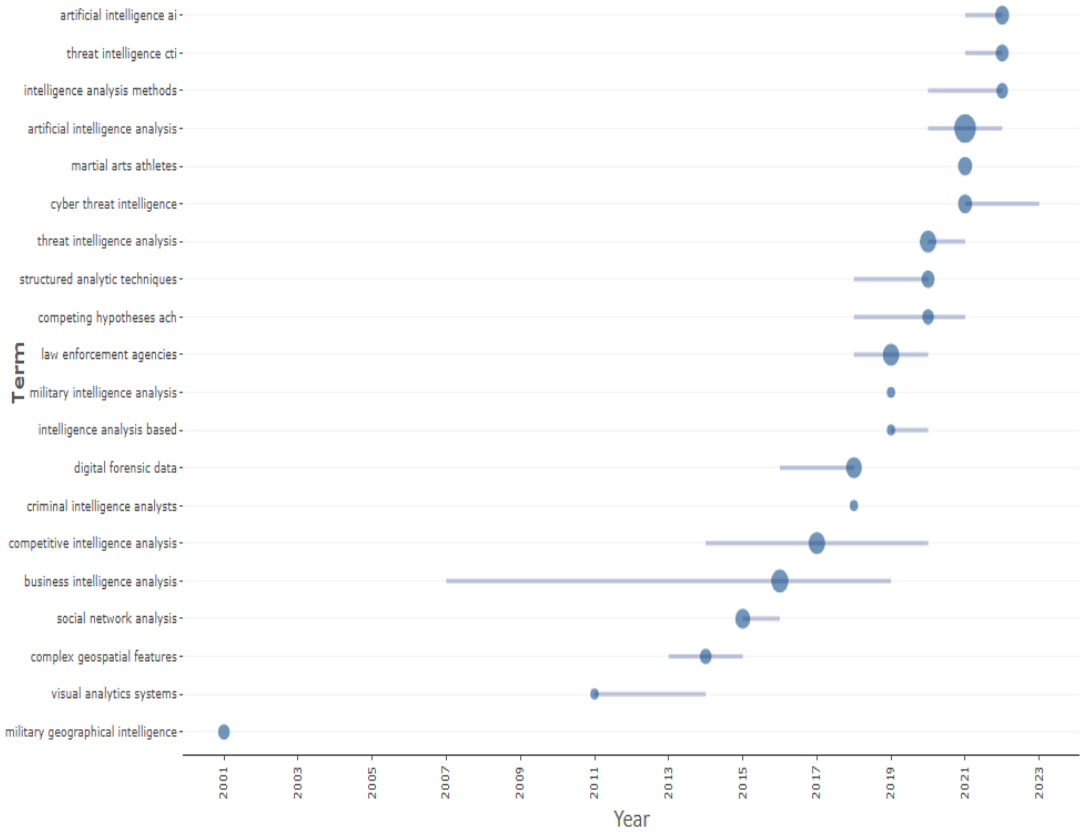
FIGURE 5
Word Growth Chart



Next, a trending topic analysis was performed to understand the top three trending keywords in the domain over the last decade. "Author keywords" was set as the field of analysis and the minimum word frequency was set to five. A

similar trend to the word growth graph (Figure 6) can also be observed here. In the latest wave of research (five years: 2018-2023), the use of keywords has been driven by the recent and increasing focus on NS and IA application. The development of research has led to the evolution of the following terms: 'Artificial Intelligence', 'Threat Intelligence', 'Artificial Intelligence Analysis'. In addition, the growing presence of AI for NS analysis is predominant among the analysis groups, as can be seen in the topic of "artificial intelligence analysis".

FIGURE 6
Thematic trend chart



In addition, a thematic map analysis was performed to obtain the emerging themes in the domain (Figure 7). The analysis was performed with 350 author keywords and a minimum cluster frequency of 10 (per thousand documents), resulting in eight clusters on the map. The larger the circle, the greater the number of keywords appearing in their respective cluster (Cobo et al., 2011). "Brand value" emerged as the second most prominent cluster, with 18 separate keywords and 338 cumulative appearances, followed by "brand", which has 14 separate keywords with 182 cumulative frequencies.

The dimensions of centrality and map density were used as criteria for measuring importance. Centrality refers to the "intensity of links with other clusters" (Callon et al., 1991, p. 164), indicating the importance of a topic in a specific domain. On the other hand, density denotes the intensity of the linkage between words belonging to each cluster (Callon et al., 1991, p. 165), measuring the ability of the theme to sustain and develop over time (Callon et al., 1991; Cobo et al., 2011).

Also, it can be visualized that the "Artificial Intelligence" cluster is a "driving theme" in the

domain, as it belongs to the quadrant that has high density and centrality (Figure 7). It implies that this theme is well connected with other themes in the domain and the keywords belonging to this cluster are closely linked to each other. Some of the main keywords that are included in this cluster are "Intelligence Community", "Visual Analysis", "Intelligence Agencies". In contrast, the "Field Intelligence" cluster appears in the quadrant with low density and low centrality, and this topic can be considered a declining topic in the domain (Cobo et al., 2011). It is also evident that the "Cognitive Ability" cluster has a relatively higher density, while "Digital Forensics" has the lowest density. This can be further validated by looking at the keywords that appear in these clusters.

FIGURE 7
Thematic map graphic

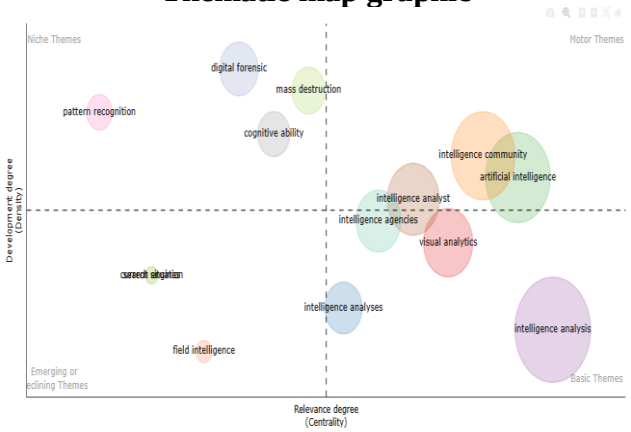
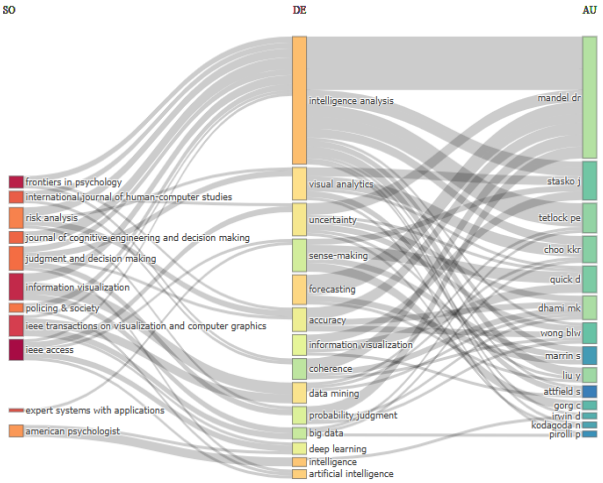


Figure 8, also known as a three-field figure that considers country, keywords and journal, is based on Sankey diagrams, in which larger boxes represent more occurrences (Riehmann et al., 2005). In this case, it is evident that UK academics (e.g., Mandel y Irwin (2021)) use keywords such as "Intelligence Analysis" and "Visual Analytics" more frequently, while keywords such as "Uncertainty" and "Sense making" are more popular among US academics. When examining journal keywords, in addition to "Intelligent Analysis", the keyword "Visual Analytics" is preferred in Information Visualization and Judgment and Decision Making. These results reveal that there are significant differences in their research focus, with a greater emphasis on IA and visualization in the UK, and a greater focus on uncertainty and decision making in the US.

FIGURE 8
Three-field diagram



DISCUSSION AND FUTURE RESEARCH QUESTIONS

The results found show the evolution of the study of IA and NS, as well as the dynamics of the related topics. Evidently, the recurrence and predominance of the term IA is logical, given that together with the term NS they are the terms of study. In contrast, the existence of a relationship between the use of the term IA and AI is consistent given that it shares the term intelligence, but also because in recent years AI has been studied in various thematic fields, including NS (Moran et al., 2023; Qi et al., 2022). The implications and risks associated with the use of AI have been considered as tools for the defense and security of nation states, which is widely documented (Moran et al., 2023; Robles & Mallinson, 2023; Romero, 2019). It is intuited that this would be a reason that explains the acceleration of scientific production related to IA, which also allows it to sustain itself as a thematic trend of study with high density and centrality.

In addition to them, the concern for cybersecurity and the advancement of technologies may be another reason associated with the increase in scientific production on IA and NS issues. In different nations of the Latin American region, there has been a substantial increase in threats and challenges associated with the field of security, such as organized crime, drug

trafficking, terrorism, among others (Estévez, 2022; Jasso, 2017; Ugarte, 2016). Authors of various researches have focused on the study and detection of cybercrime using IA (Parra-Martinez et al., 2023; Qi et al., 2022; Vogel et al., 2021). The use of AI in IA is relevant in that it enables the fast and efficient realization of large amounts of data that can be complex in human analysts (Vogel et al., 2021). This advantage can be exploited as a tool for IA applied to various SN-related areas (Parra-Martinez et al., 2023), although it is also possible that its use may have implications that impair the objectivity and quality of IA (Vogel et al., 2021). Therefore, it is reasonable that the terms IA and AI are related and predominant as themes in NS related trends.

In this regard, it is recommended that greater attention be paid to the intersection between NS and IA. It is essential to continue developing NS education programs at a global level, as cyber-attacks and threats affect all organizations, regardless of their composition, size or geographical location. The relevance of this issue has increased in recent years due to the lack of prioritization of security by some organizations, which exposes them to serious consequences. It is crucial to understand the importance of security at all stages of an organization's planning and operation, since neglecting this aspect can have negative repercussions in economic terms and in the protection of assets and people. It is necessary to keep up to date because new forms of attacks are constantly emerging. Therefore, an additional research opportunity is to update and characterize the different types of existing attacks, developing effective defense methods against them. Automatic methods have also been developed to detect anomalies in systems and alert about possible cyberattacks in real time. These methods are useful for preventing threats. NS and cybersecurity are constantly evolving fields, so it is essential to keep abreast of the latest trends and techniques to address present and future challenges.

CONCLUSIONS

This study is the first bibliometric analysis of 23 years of NS research and the IA. The quantitative assessment contributes in a first approach or study that dealt with the topic of NS, therefore, the study provides a holistic perspective of a quantitative nature that encompasses both the past and present of NS research, while projecting considerations for the future in this area of study. The overall conclusion is that the IA field is still growing exponentially and has moved from an embryonic stage to a growth stage as it integrates with the concepts of AI and cyber-attacks. The first wave of NS research was based on Security research in general. However, recent times have seen a growing research focus on leveraging AI for the purpose of boosting efficiency in IA-related decision-making processes.

This study is useful for both novice and experienced researchers in NS development and IA. In reading the paper, it is clear which are the top journals, seminal articles, and content topics in these domains, along with emerging and declining trends. In addition, the clusters identified provide a panoramic view of the domains and, at the same time, point to intriguing avenues for future research. All of this should provide a fruitful foundation for the next wave of NS research.

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