DESIDOC Journal of Library & Information Technology, Vol. 43, No. 5, September 2023, pp. 354-363, DOI : 10.14429/djlit.43.5.19002

Mapping and Visualisation of Global Research Output on Military Stealth Technology

Ramesh B. Kuri[1], Sandip Majumdar[2], Kunwar Singh[3] and Ayush Kumar Patel[4*]

[1]*Department of Library and Information Science, Rani Channamma University, Belagavi - 591 156, India*
[2]*Department of Library and Information Science, University of Gour Banga, Malda, West Bengal - 732 103, India*
[3]*Faculty of Library and Information Science, School of Social Sciences, IGNOU, New Delhi - 110 068, India*
[4]*Department of Library and Information Science, Banaras Hindu University, Varanasi - 221 005, Uttar Pradesh, India*
[*]*E- mail: ayush.kumarvns2012@gmail.com*

ABSTRACT

Military stealth technology is crucial in modern combat, allowing military vehicles to be more survivable and less detectable. The primary objective of this study is to map and visualise the global research output on military stealth technology in order to acquire insights into the research landscape, identify relevant trends, and facilitate informed decision-making. This study was mainly focused on the mapping and visualisation of global research output on military stealth technology. For conducting the study, data was collected from the Scopus database covering the period from 2001-2021. A total of 299 articles with 1764 citations were found during the search. The majority of papers (74.25 %) were published in a multi-authored mode. The overall collaborative index was 2.84. Professors Zhang X and Zhang Y of China were named top contributors, each with seven papers and 139 and 121 citations, respectively. China leads the list of contributing countries, with 108 papers and 731 citations, followed by the United States (51), India (19), the United Kingdom (12), and South Korea (7). As per keyword analysis, "military applications," "radar," and "military vehicles" were the biggest hotspots. The findings revealed that Asian countries are increasingly dominating their western counterparts in global research publications on stealth technology. This scientometric analysis contributes to a better understanding of how countries are implementing new technologies for military assets. Furthermore, it may assist scientists in identifying core areas of interest and future research directions in the field, as well as library professionals in selecting appropriate resources.

Keywords: Military stealth technology; Research output; Scientometrics study; Visualisation; Collaborative coefficient; Mapping; Collaboration; Innovation; Decision support

1. INTRODUCTION

Stealth technology has transformed modern combat, allowing military aircraft, ships, and ground units to operate with reduced detectability and enhanced survivability. The global pursuit of breakthroughs in military stealth technology has resulted in a broad and diversified body of research done by scientists, engineers, and defence organisations worldwide. Mapping and visualisation approaches have evolved as effective tools for gaining insights into this vast research environment and comprehending the global distribution of knowledge in this discipline. With the rapid development of radar technology in the 1930s and 1940s, radar was widely used to detect, locate, track, warn, and destroy enemy combat assets such as aircraft, ships, and automobiles. Indeed, detection by enemy radar systems became a nation's military think tank's top priority. Complex and ever-changing international geopolitics require a nation's armed forces to be agile, well-prepared, and technologically updated so that the nation's sovereignty is never jeopardised. During a conflict, a country's plan is to decrease the loss of war assets by using advanced technology like stealth technology. This includes technology used on military aircraft, ships and missiles to make them more difficult to detect by radar, infrared, and other methods.[1] It is being viewed as the technology of future warfare. Efforts are on to incorporate stealth features in war fighting assets for a decisive advantage of one country over another.[2] Many countries are doing top-secret research on stealth technology, which is a big deal. Because of its significance, scientists are analysing published research on the topic from all over the world. This study assesses the quality of research in military stealth technology using various metrics, such as collaboration level (DC), collaboration coefficient

Received : 27 March 2023, Revised : 26 June 2023
Accepted : 26 July 2023, Online published : 26 October 2023

(CC), and collaboration index (CI). The analysis includes aspects such as author collaboration, authorship patterns, and citation analysis.

2. REVIEW OF LITERATURE

The invention, improvements, applications, and difficulties of military stealth technology are frequently discussed in detail. The literature reviews must cover the following topics: historical evolution, stealth platforms, stealth technologies and methods, detection and defenses, and potential future uses. When researchers looked for information on "military stealth technology" as a general concept, they did not find much. However, when they searched for specific subtopics such as graphene, high-entropy ceramics, nanoparticles, military operations, and robotics, they found a few studies using bibliometrics.

Rajgoli and Laxminarsaiah[3] conducted a study on spacecraft technology from 2001-2011. Collaborative research was found in 18.15 % of articles with an average correlation coefficient of 0.87. It is believed that many authors depend on factors such as the nature of the research, financial support, the topic under investigation, and the lack of communication between researchers. Aydogdu[4] *et al.* carried out a bibliometric analysis of nanotechnology and its use in the Turkish defense industry. They found that the most promising applications were stealth materials, protective clothing, military force management, nano-weapons, sensor networks, efficiency, and friend or foe recognition.

Peng[5] *et al.* in their bibliometric analysis of graphene research papers from 1991 to 2010. They found that research in this area has grown significantly in the past five years, with the United States, China and Japan being the top countries. Collaboration is common, with two to five authors per paper. In recent years, research on high-entropy ceramics has received much attention due to their excellent environmental stability and energy conservation. A bibliometric analysis of 3177 articles covering a period between 2000-2020 by Hu[6] *et al.* found that China leads energy ceramics research followed by the United States and India.

Xi'an Jiaotong University has extensive publications and a high h-index, and J.W. Zhai is a well-known author. The most popular journals in this field are "Journal Ceramics International, Journal of Materials Science-Materials in Electronics and Journal of Alloys and Composites". Saritas and Burmaoglu[7] analysed how energy is used in military operations and made recommendations for future military research and development. It has been discovered that drones and robots can use cognitive and communication tools to outperform humans in certain tasks.

Gupta & Dhawan[8] analysed Indian publications in robotics research from 2007-2016 using bibliometric indicators. They found that the quality of research was insufficient and advised the Indian government and industry to focus on increasing research and partnering with foreign companies and start-ups to help develop the robotics research industry in India.

3. STATEMENT OF THE PROBLEM

Military stealth technology has seen tremendous research and development activities around the world, resulting in a huge and diversified body of knowledge. There is, nevertheless, a need to gather insights into the global distribution of research output and to identify major trends and knowledge clusters within this sector. The issue addressed in this paper is the lack of a complete awareness of the global research landscape on military stealth technology, as well as the lack of adequate methods to visualise and analyse this vast body of knowledge.

4. SCOPE OF THE STUDY

Mapping and visualisation of worldwide research output on military stealth technology cover a number of critical aspects linked to research output and visualisation in the field of military stealth technology. The study focuses on research output, mapping and visualisation, data analysis, geographical distribution, cooperation and knowledge networks, impact and influence, decision support and strategic insights, and so on.

5. OBJECTIVES OF THE STUDY

The main objectives of this study are to:

- Analyse the global research trends on military stealth technology;
- Find the authorship pattern and the nature of collaboration;
- Identify the most prolific authors and productive countries;
- Determine the most preferred source of publication and highly cited publications;
- Examine the keyword co-occurrence network.

6. METHODOLOGY

The Scopus database was used to obtain data for thisstudy.[9] Scopus, an international multidisciplinary bibliographic database, was the target database for the search for relevant datasets.

6.1 Data Collection

The keywords used are "military stealth technology" for the years 2001 to 2021. On January 4, 2022, a search was conducted using the string "TITLE-ABS-KEY (military AND stealth AND technology) AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2001)) AND (LIMIT-TO (PUBSTAGE, "final''))", which resulted in the retrieval of 299 bibliographic records. These records were downloaded as a .csv file.

6.2 Data Analysis

The downloaded data were used with the following scientometric indicators to understand and quantify the dynamics of the collaborative nature of research in military stealth technology:

Collaboration Index (CI):

The CI is applied to calculate the average number of authors per publication and is calculated as formula suggested by Lawani[10]:

$$CI = \frac{\sum_{j=1}^{k} j f_j}{N}$$

where CI = Collaboration index, j = Authorship, fj= Number of j - authored research papers, N= the total Number of research papers, K = the most significant Number of authors per paper. Although simple to compute, it is difficult to understand as a degree because it has no upper limit. Further, it assigns single-authored publications with no collaboration a non-zero weight.

Degree of Collaboration (DC):

The DC metric measures the ratio of collaborative scientific articles within a specific field over the total number of scientific articles published within the same period. The formula suggested by Subramanyam[11] was used in this analysis:

$$DC = \frac{Nm}{Nm + Ns}$$

where DC = Degree of collaboration, Nm = number of multi-authored papers, and Ns = Number of single papers.

Collaboration Coefficient (CC):

The CC is the ratio between the average number of authors in a publication and the proportion of articles with multiple authors. The following formulae as proposed by Ajiferuke, Burell & Tague[12] was used here:

$$CC = 1 - \frac{\sum_{j=1}^{k} \left(\frac{1}{j}\right) f_j}{N}$$

where, CC = Collaboration coefficient, j = Authorship, f_j = Number of j - authored research papers, N = the total number of research papers; K = the most significant number of authors per paper. The collaboration coefficient ranges from 0 to 1, with 0 indicating single-authored papers.

6.3 Software Used for Visualisation of Results

To visually explore research trends in military stealth technology, the study utilised VOSviewer version 1.6.16, a data visualisation tool developed by (Nees Jan van Eck and Ludo Waltman). In addition, the study employed Biblioshiny, a web app included in an open-source tool called bibliometrix, created by Massimo Aria from the University of Naples Federico, for quantitative research in scientometrics.

7. RESULTS

7.1 Publication Trends in Global Research on Military Stealth Technology

Figure 1 illustrates the development of research in military stealth technology over the course of 21 years. The figure indicates that the field was in its early stages prior to 2004, with an annual publication rate of less than 5 papers per year. However, in 2004, the number of published papers experienced a significant increase, with 22 articles, which is five times more than in 2003. The rapid development of radar-related techniques led to the urgent need for stealth technology to reduce the radar echo of objects and enhance the survivability of military assets on the battlefield.[13,14] The literature on military stealth technology published after 2004 does not show a steady increase, although it reached 25 in 2019 and 34 in 2020. The figure also indicates that the expanding curve shows no sign of saturation.

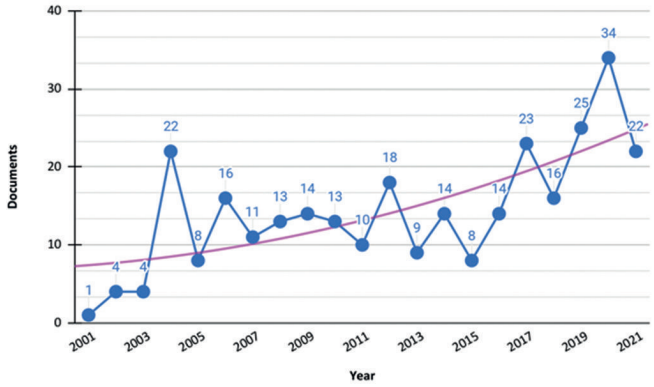

Figure 1. Growth of military stealth technology research.

7.2 Authorship Pattern and Collaborative Measures

According to Table 1, the majority (74.25 %) of publications in military stealth technology were produced through collaborative efforts, demonstrating a preference for working together rather than independently. Additionally, the study period saw a rise in DC (from 0.00 in 2001 to 1.00 in 2021), CI (from 1 in 2001 to 4.55 in 2021), and CC (from 0.00 in 2001 to 0.77 in 2021), indicating a trend towards collaborative research over time. The average CI of 2.84 during the study period indicates a good collaboration rate among authors. However, if the collection consists solely of single-authored publications, CI, DC, and CC are all equal to zero.

7.3 Top 10 Most Prolific Authors

During the period from 2001 to 2021, 785 authors were identified as contributors to research on military stealth technology. However, only 32 of these authors had published at least 3 articles on the topic. Table 2 presents a list of the most productive and prolific authors in this field. Notably, Professor Xuetong Zhang, affiliated with the Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences (CAS), Suzhou, China, was found to have the highest research output, having authored 7 papers and amassed a total of 139 citations. He is followed by Yi Zhang, affiliated with AB Life Bio Big Data Institute, Wuhan, China, with 7 research papers and 121 citations, and then L Yang, affiliated with the Naval University of Engineering, Wuhan, China, with 6 papers and 26 citations. The first three leading authors are from China, indicating the country's military stealth technology research dominance.

Table 1. Authorship pattern and measures of research collaboration

Year	Authorship pattern					TP	CI	DC	CC
	Single author	Two authors	Three authors	Four authors	Five and above				
2001	1	0	0	0	0	1	1.00	0.00	0.00
2002	1	1	1	0	1	4	2.75	0.75	0.49
2003	2	1	0	1	0	4	2.00	0.50	0.31
2004	7	5	4	1	5	22	2.64	0.68	0.45
2005	4	0	1	0	3	8	2.75	0.50	0.38
2006	12	0	1	1	2	16	1.81	0.25	0.19
2007	3	2	2	2	2	11	2.82	0.72	0.49
2008	5	3	4	1	0	13	2.08	0.62	0.38
2009	3	3	1	3	4	14	3.14	0.79	0.54
2010	6	4	2	1	0	13	1.85	0.54	0.31
2011	4	3	1	1	1	10	2.20	0.60	0.37
2012	5	3	7	1	2	18	2.56	0.72	0.47
2013	2	1	0	5	1	9	3.22	0.78	0.56
2014	4	2	3	3	2	14	2.79	0.71	0.48
2015	1	0	2	1	4	8	3.86	0.89	0.66
2016	2	1	3	4	4	14	3.50	0.86	0.62
2017	8	3	2	5	5	23	2.83	0.65	0.46
2018	3	1	2	2	8	16	3.69	0.81	0.61
2019	3	2	6	6	8	25	3.56	0.88	0.64
2020	1	5	4	6	18	34	4.03	0.97	0.71
2021	0	0	3	4	15	22	4.55	1.00	0.77
Total	77	40	49	48	85	299	59.62	14.21	9.92

[Note* TP=Total Papers, CI=Collaborative Index, DC=Degree of Collaboration, CC=Collaborative Coefficient]

Table 2. Top 10 most prolific authors

Author	Affiliation	Papers	Citations	% of 299	Citations per paper
Zhang, X.	Suzhou Institute of Nano-tech and Nano-bionics, Suzhou, China	7	139	2.34%	19.86
Zhang, Y.	ABLifeBioBigData Institute, Wuhan, China	7	121	2.34%	17.29
Yang, L.	Naval University of Engineering, Wuhan, China	6	26	2.01%	4.33
Wang, X.	State Key Laboratory of Organic–Inorganic Composites, China	6	9	2.01%	1.5
Li, Y.	Xi'AnJiaotong University, Xi'an, China	6	9	2.01%	1.5
Tripak, J. A.	All Saints Academy, Columbus, United States	6	0	2.01%	0
Zhang, Z.	Nankai University, Tianjin, China	5	62	1.67%	12.4
Wang, J.	Wuhan University of Technology, Wuhan, China	5	39	1.67%	7.8
Liu, X.	Zhengzhou University, Zhengzhou, China	5	12	1.67%	2.4
Zhang, J.	Lanzhou University, Lanzhou, China	5	11	1.67%	2.2

****Note: Source data (https://www.scopus.com)**

7.4 Co-authorship Network Analysis

Scientific collaboration often involves co-authorship, which is a highly visible and extensively studied form of collaboration within the scientific community.[15] Utilising co-authorship network analysis can help identify an author's average publication and active years related to a particular subject of study.[16] Figure 2 shows a co-authorship network of authors and co-authors using VOSviewer. The nodes' sizes in a network diagram are indicative of their relative frequency, whereas the links' widths denote the intensity of the connection between authors. In other words, the bigger the node, the more frequently it appears in the network, and the wider the link, the stronger the association between the authors. Yellow nodes represent authors who are actively researching military stealth technology, including Chen, J., Li, G., Li, Z., and Yang, Y. On the other hand, purple nodes represent authors, who are not currently publishing research on military stealth technology, such as Yuan, J.-T., Yang, L., Chen, X., and Lou, G.

(51 & 341), India (19 & 219), and the United Kingdom (12 & 231). Chinese authors dominated stealth technology research with 36.12 % of the papers, and their contribution exceeded 48.64 % when considering only the top 10 countries. Figure 3 illustrates a map demonstrating country co-authorship, using a sample size of 299 papers. The map highlights three countries, namely, China, the United States of America, and India, which form the most prominent cluster in terms of co-authorship, comprising 59.53 % of all the publications analysed. In other words, these three countries are the most active collaborators in terms of co-authorship, with a significant contribution to the total publications analysed. The lines connecting the spots on the map indicate the co-authorship between countries, and the distance between clusters shows the strength of co-authorship and their level of collaboration in military stealth technology research. This provides insight into international cooperation in the field.

Military stealth technology research is among the most secretive state-funded research and closely guarded projects.

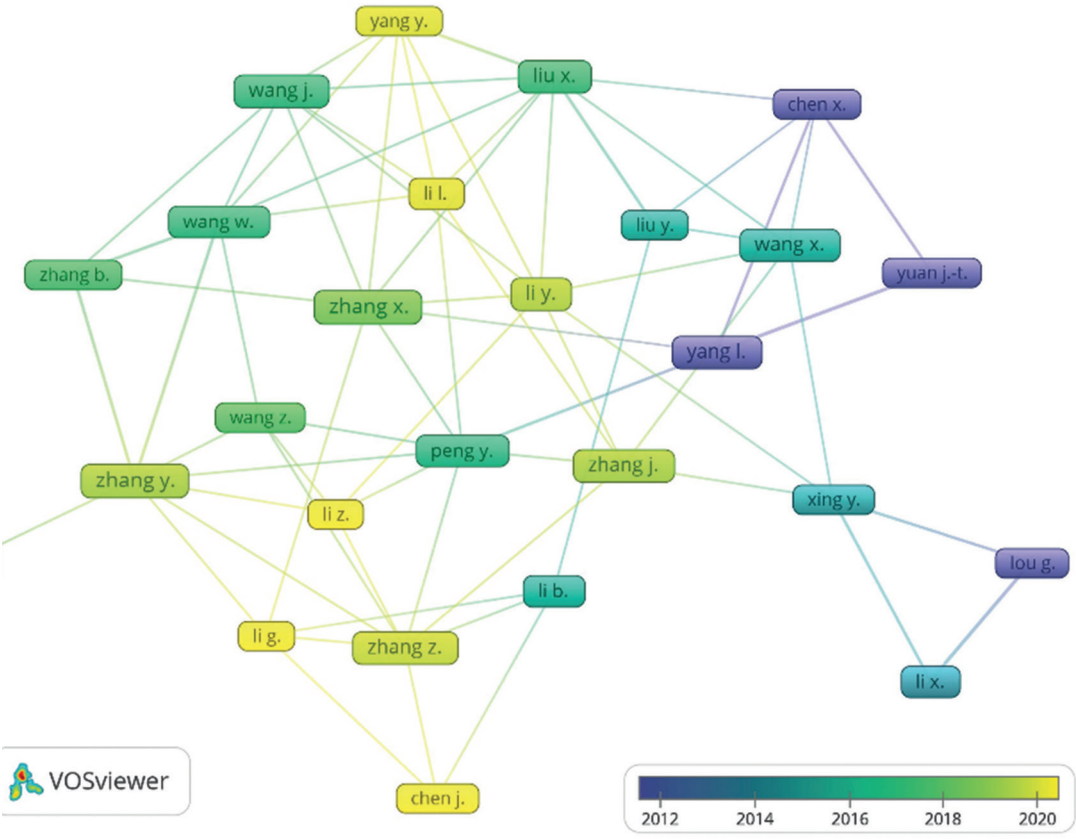

Figure 2. Co-authorship network of authors.

7.5 Geographical Distribution of Papers

Research in military stealth technology is global, with authors from 37 countries contributing to the 299 papers studied. Table 3 shows the 10 countries that have published the most papers in the field of research. The top 10 countries contributed 74.25 % of all papers, with China leading in both number of publications (108) and citations (731), followed by the United States

Hence, most research results are likely to be classified in nature. This could explain the sparse distribution of co-authorship among authors from different countries.

7.6 Top 10 Highly Cited Publications

The citation of papers is an effective way to measure the impact of authors, journals, and papers. Table 4 presents the top 10 papers with the highest number of

Table 3. Top 10 countries with the most papers on military stealth technology research

Country	Papers	5 of 299	Citations
China	108	36.12%	731
United States	51	17.06%	341
India	19	6.35%	219
United Kingdom	12	4.01%	231
South Korea	7	2.34%	25
Sweden	6	2.01%	8
Poland	5	1.67%	105
Italy	5	1.67%	60
Turkey	5	1.67%	10
Israel	4	1.34%	24

7.7 Three-field Plot Analysis of Author, Country, and Affiliations

Figure 4 displays a three-field plot of the top 20 authors, countries, and affiliations in military stealth technology research from 2001-2021. The left, middle, and right fields represent authors, countries, and affiliations respectively. It was observed that in a particular field, there were significant author contributions from China and the USA. Additionally, the statement identifies specific institutions, such as Nankai University, Zaozhuang University, Tianjin University's College of Precision Instrument and Opto-Electronics Engineering, the Naval University of Engineering at Beijing Institute of Technology, that made major contributions. In summa ment highlights the notable contributions of both countries and specific

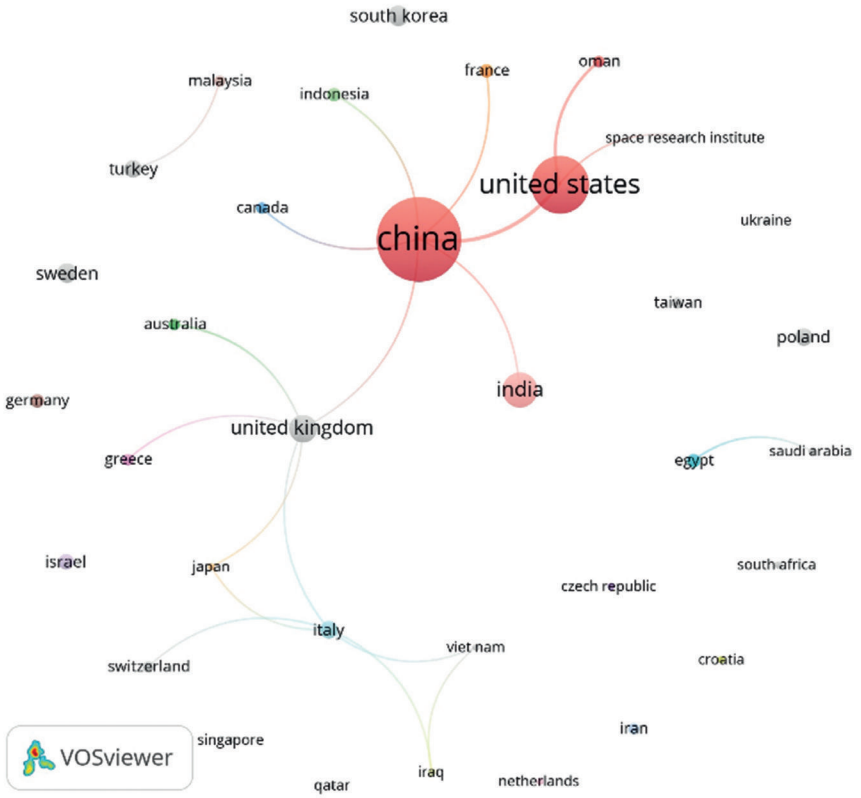

Figure 3. Co-authorship by country.

citations in the field of military stealth technology. The paper titled "Nanofibrous Kevlar aerogel films and their phase-change composites for highly effective infrared stealth" has received the most citations, with a count of 121. In essence, the analysis of paper citations allows the determination of highly influential papers, and this table identifies the top 10 highly cited papers in the field of military stealth technology, with the mentioned paper receiving the highest number of citations. Researchers may include the most cited publications as references to address the knowledge gap and justify their research. This also gives a fair idea about the direction researches in the domain are heading towards.

institutions in the field. In the figure, the size of the block represents the associational link between each element. In the left field, Zhang, X, Zhang, Y, Zhang, Z, Li, Y, and Zhang, J are all strongly associated with China. Nankai University and Zaozhuang University are strongly related to China, a highly associated country. The second-most affiliated country, the United States of America, had close ties to both the University of California and the United States Naval Academy.

7.8 Keyword Analysis

Keywords are words and phrases that capture an academic paper's essence and hint at closely related

Table 4. Top 10 highly cited publications

Title	Authors	Year	Source title	Citations
Nanofibrous kevlar aerogel films and their phase-change composites for highly efficient infrared stealth	Lyu J., Liu Z., Wu X., Li G., Fang D., Zhang X.	2019	ACS Nano	121
Integrated review of stealth technology and its role in airpower	Rao G.A., Mahulikar S.P.	2002	Aeronautical Journal	111
Multifunctional broadband microwave absorption of flexible graphene composites	Zhang K.-L., Zhang J.-Y., Hou Z.-L., Bi S., Zhao Q.-L.	2019	Carbon	105
Graphene-based Materials toward microwave and terahertz absorbing stealth technologies	Chen H., Ma W., Huang Z., Zhang Y., Huang Y., Chen Y.	2019	Advanced Optical Materials	95
New antistatic charge and electromagnetic shie lding effectiveness from conductive epoxy resin/ plasticised carbon black composites	Aal N.A., El-Tantawy F., Al-Hajry A., Bououdina M.	2008	Polymer Composites	70
From blackness to invisibility – carbon nanotubes role in the attenuation of and shielding from radio waves for stealth technology	Kolanowska A., Janas D., Herman A.P., Jędrysiak R.G., Giżewski T., Boncel S.	2018	Carbon	63
A survey of stealth malware attacks, mitigation measures, and steps toward autonomous open world solutions	Rudd E.M., Rozsa A., Günther M., Boult T.E.	2017	IEEE Communications Surveys and Tutorials	61
Polymer matrix composites as broadband radar absorbing structures for stealth aircrafts	Jayalakshmi C.G., Inamdar A., Anand A., Kandasubramanian B.	2019	Journal of Applied Polymer Science	51
Infrared invisibility stickers inspired by cephalopods	Phan L., Ordinario D.D., Karshalev E., Walkup Iv W.G., Shenk M.A., Gorodetsky A.A.	2015	Journal of Materials Chemistry C	46
Stealth technology for wind turbines	Pinto J., Matthews J.C.G., Sarno G.C.	2010	IET Radar, Sonar, and Navigation	43

**Note: Source data (https://www.scopus.com)

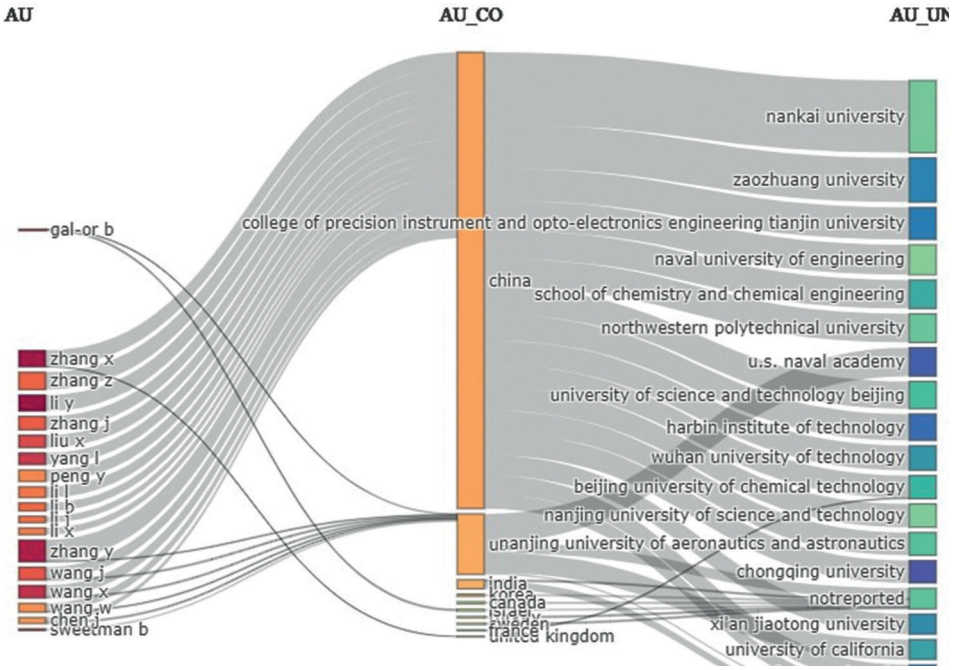

Figure 4. Three field plots for the top 20 most influential authors, countries, and affiliations.

topics, which serve as a literature summary and describe a study's focus area.[17-18] 3105 keywords were extracted from 299 papers. Figure 5 depicts a map that divides the keywords into six clusters namely Stealth technology (yellow cluster), military applications (dark blue cluster), military vehicles (red cluster), electromagnetic waves (purple cluster), microwaves (green cluster), and stealth (light blue cluster). 589 terms appeared twice, for a prevalence of 18.97 %. Another 98 keywords appeared more than five times, accounting for 3.11 %, whereas 28 keywords appeared more than 10 times, and only six keywords appeared more than 20 times, accounting for 0.19 %. The keywords "stealth technology", "military applications", "radar", "military vehicles", "electromagnetic wave", and "meta materials" appeared more than 20 times. The keyword "stealth technology" occurs 130 times, making it the most frequently used word to represent the main subject content of the studied papers, followed by "military applications" (56 occurrences) and "radar" (32 occurrences). This map also shows that stealth technologies, military applications, and vehicles appear to be the most active research areas and hints at new research possibilities that may emerge soon.

7.9 Top Most Preferred Sources

A close scan of the bibliographic details of 299 research papers revealed the scattering of the military stealth technology-related literature across research articles (50.84 %), conference papers (29.77 %), reviews (13.04 %), short surveys (2.68 %), book chapters (1.67 %), boo dy has F-22 and F-35 stealth fighter jets, B-2 stealth bombers, and several stealth ships. The Advanced Medium Combat Aircraft (AMCA) programme is still in the detailed design stage and has a long way to go to catch up to the Chinese initiative, despite India trying to catch up by placing itself in third place after the USA in terms of the total number of papers (19) published. Turkey and Japan are other countries in this forum. In the world of military stealth technology research, secrecy and competition are the norm. This scientometric study reveals fascinating insights into authorship patterns and journal selection in this highly specialised field. It seems that researchers are moving away from general defense journals and opting for more specific subject-specific journals. Group research is dominating solo research, which may be due to the need for sophisticated laboratory setups that require significant funding and sponsorship. and as for collaborative authorship across

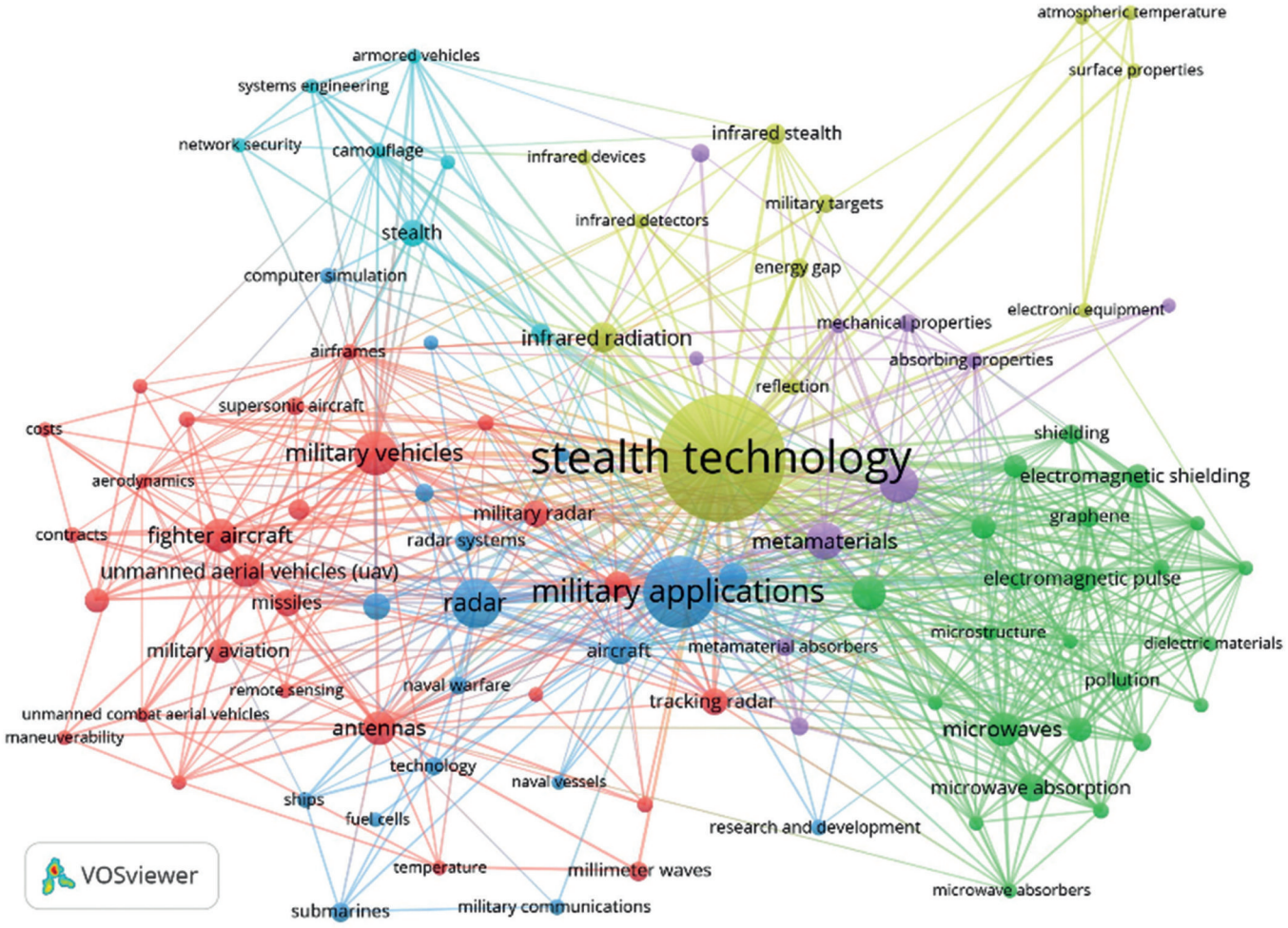

Figure 5. Keyword trends.

Table 5. Top most preferred sources

Name of the journal	Number of papers published			Total	Rank
	2001-2007	2008-2014	2015-2021		
Air Force Magazine	3	4	3	10	1
Aviation Week and Space Technology	4	6	0	10	1
Jane's Defence Weekly	7	1	0	8	2
Infrared and Laser Engineering	0	6	1	7	3
International Journal of Turbo and Jet Engines	0	3	3	6	4
Jane's International Defence Review	6	0	0	6	4
Carbon	0	0	4	4	5
Optical Technique	4	0	0	4	5
Acta Aeronautica Et AstronauticaSinica	0	2	2	4	5
Acta PhysicaSinica	0	1	3	4	5
Systems Engineering And Electronics	0	2	2	4	5

countries, it's rare to find, indicating the fiercely competitive nature of the research. After all, any significant breakthrough could mean a significant advantage in military applications.

8. DISCUSSION

This scientometric study highlights China's exceptional rise as a leading nation in military stealth technology research and application. The statistical analysis reveals China's significant investment of human capital and monetary power in this sector, resulting in a remarkable impact. Be it the highest number of citations accrued by an article (121), total research output in terms of published papers (108), total citations (731), or affiliations, the footprint of China is very much visible. The long and arduous journey from a nation of opium eaters to a country of cutting-edge research on stealth technology is now challenging the hegemony of the USA in this domain. The result is the birth of the Chengdu J-20, Mighty Dragon, a twinjet all-weather stealth fighter aircraft for the Chinese Air Force and many stealth ships for the Chinese Navy. The USA already has F-22 and F-35 stealth fighter jets, B-2 stealth bombers, and several stealth ships. The Advanced Medium Combat Aircraft (AMCA) programme is still in the detailed design stage and has a long way to go to catch up to the Chinese initiative, despite India trying to catch up by placing itself in third place after the USA in terms of the total number of papers (19) published. Turkey and Japan are other countries in this forum. In the world of military stealth technology research, secrecy and competition are the norm. This scientometric study reveals fascinating insights into authorship patterns and journal selection in this highly specialised field. It seems that researchers are moving away from general defense journals and opting for more specific subject-specific journals. Group research is dominating solo research, which may be due to the need for sophisticated laboratory setups that require significant funding and sponsorship. and as for collaborative authorship across countries, it's rare to find, indicating the fiercely competitive nature of the research. After all, any significant breakthrough could mean a significant advantage in military applications.

9. CONCLUSION

The key findings of the study could have practical ramifications for military organisations, defense contractors, and governments. The study assists stakeholders in making informed decisions about financing, resource allocation, and strategic planning related to military stealth technology by identifying significant research centers, emerging trends, and potential gaps in knowledge. The competition among nations in military research is an ever-evolving phenomenon, and this stu dy serves as a testament to this fact. The results of this study may not be indicative of future trends, as countries can shift their focus towards research in a particular field. However, this work provides valuable insights for researchers who seek to publish their research in potential journals. Additionally, this study can aid countries in reviewing their position and performance in R&D on stealth technology, which could lead to fruitful collaborations across borders. As technology continues to advance, the need for military stealth technology will remain, and this study serves as a guide for countries to stay ahead of the curve.

REFERENCES

1. Jha, B. & Aswale, M. Mechanical aspects in stealth technology: Review. *Int. J. Eng. Tech. Res.*, 2016, **4**(4), 21-27.
2. Kumar, S.; Mishra, S. & Gupta, S. Stealth Technology: The fight against radar. *Int. J. Adv. Elect. Com.*

Sci., 2014, **1**(2), 44-49.
3. Rajgoli, I.U. & Laxminarsaiah, A. Authorship pattern and collaborative research in the field of spacecraft technology. *Elect. Lib.*, 2015, **33**(4), 625-642. Doi: 10.1108/EL-12-2013-0210.
4. Aydogdu, A.; Burmaoglu, S.; Saritas, O. & Cakir, S.A. Nanotechnology road mapping study for the Turkish defence industry. *Foresight,* 2017, **19**(4), 354-375. Doi: 10.1108/FS-06-2017-0020.
5. Peng, H.L.; Gui-Fang, W.; Yong, W.; Jia, L.; Qing, L. & Fei-cheng, M. Bibliometric trend analysis on global graphene research. *Scientometrics*, 2011, **88**(2), 399–419. Doi: 10.1007/s11192-011-0386-x.
6. Hu, H.; Liu, A.; Wan, Y. & Jing, Y. Energy storage ceramics: a bibliometric review of literature. *Materials*, 2021, **14**, 3605. Doi: 1.3390/ma14133605.
7. Saritas, O. & Burmaoglu, S. Future of sustainable military operations under emerging energy and security considerations. *Tech. Forec. Soci. Chan.*, 2016, **102**, 331–343. Doi: 10.1016/j.techfore.2015.08.010
8. Gupta, B.M. & Dhawan, S.M. Robotics research in India: A scientometric assessment of Indian publications output during 2007-16. *J. Scient. Res.*, 2018, **7**(2), 84-93. Doi: 10.5530/jscires.7.2.14.
9. Scopus. (n.d.). Scopus preview. Retrieved from https://www.scopus.com (Accessed on 4 January 2022)
10. Lawani, S.M. Some bibliometric correlates of quality in scientometric research. *Scientometrics*, 1986, **9**(1&2), 13-25. Doi: 10.1007/bf02016604.
11. Subramanyam, K. Bibliometric studies of research collaboration: A review. *J. Inf. Sci.*, 1983, **6**(1), 33-38. Doi: 10.1177/016555158300600.
12. Ajiferuke, I.; Burell, Q. & Tague, J. Collaborative coefficient: A single measure of the degree of collaboration in research. *Scientometrics*, 1988, **14**(5), 421-433. Doi: 10.1007/bf02017100.
13. Chen, H.; Ma, W.; Huang, Z.; Zhang, Y.; Huang, Y. & Chen, Y. Graphene-based materials toward microwave and terahertz absorbing stealth technologies. *Adva. Opti. Mate.*, 2019, **7**(8), 1-16. Doi: 10.1002/adom.201801318.
14. Knott, E.F.; Schaeffer, J.F. & Tulley, M.T. Radar cross-section. *Sci. Tech. Publishing, Raleigh, NC*, 2004.
15. Glänzel, W. & Schubert, A. Analysing scientific networks through co-authorship. *In* Handbook of quantitative science and technology research, Springer, Dordrecht, 2004, 257-276.
16. George, T.T.; Obilana, A.O.; Oyenihi, A.B. & Rautenbach, F.G. Moringa oleifera through the years: A bibliometric analysis of scientific research (2000-2020). *S. Afr. J. Bot.*, 2021, **141**, 12-24. Doi: 10.1016/j.sajb.2021.04.025.
17. Patel, A.K.; Singh, K.; Parida, D.K. & Patel, A.K. Visualisation of global research output on disruptive innovation in health care. *J. Hosp. Libra.*, 2022, **22**(4), 311-325. Doi: 10.1080/15323269.2022.2124802.
18. Wang, R.L.; Hsu, T.F. & Hu, C.Z. A bibliometric study of research topics and sustainability of packaging in the greater China region. *Sustainability*, 2021, **13**(10), 1-19. Doi: 10.3390/su13105384.

CONTRIBUTORS

Dr Ramesh B. Kuri is working as Assistant Professor in the Department of Library and Information Science at Rani Channamma University, Belagavi, Karnataka. His areas of interest are Library automation, Academic library system, Scientometrics studies, and Information storage and retrieval. As a key contributor, he drafted an abstract of this study and contributed to introduction to the concept, data analysis, and copyediting.

Mr Sandip Majumdar is working as Assistant Professor in the Department of Library and Information Science, University of Gour Banga, Malda, West Bengal. He has seven years of experience in LIS field. His areas of interest are: Knowledge organisation, Bibliometric and Scientometric studies, Social implications of information.
As a major contributor, he conceived the idea of this scientometric study and contributed in literature review, wrote most preferred sources as well as discussion and conclusion sections.

Dr Kunwar Singh is working as Professor in the Faculty of Library and Information Science, School of Social Sciences, IGNOU, New Delhi. Before joining to IGNOU, he has worked in various organisations such as Banaras Hindu University, Utkal University and India Institute of Technology Madras, Chennai on various capacities. His areas of interest include: Information needs, Library automation, Scientometrics, and Bibliometrics.
He has worked on methodology part, reviewed this article, and also provided time to time support whenever it was required.

Mr Ayush Kumar Patel is a Junior Research Fellow in the Department of Library and Information Science, Banaras Hindu University, Varanasi, U.P. He has completed BSc in Physics (Hons.) and MLISc Degree from Banaras Hindu University. His research interests include: Scientometrics, Bibliometrics, Data mining, and Text mining.
His contribution to the current study was: Data analysis and computational analysis through two major software (VOSviewer and Biblioshiny), and writing part of the article.