

Analyzing Bibliometric Visualization Tools for Research Evaluation and Visibility: A Comparative Study

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ABSTRACT

Today, research is more connected and data-focused than ever before. Tools that help visualize research data are becoming very important because they make it easier to study, compare, and share scientific work. This study looks closely at six popular tools used for this purpose: VOSviewer, CiteSpace, Bibliometrix, SciMAT, Gephi, and HistCite. The analysis covers papers listed in the Scopus database from 2017 to 2025. The main goal is to understand how widely these tools are used, what each does best, how often they are cited, and where in the world they are most popular. A total of 18,881 papers were reviewed, showing that the use of these visualization tools in research has grown fast, by almost 60% each year. Among all, VOSviewer leads the way, making up nearly half of all publications and more than 60% of citations. CiteSpace and Bibliometrix are also growing quickly, especially in recent years. The study also found that more research is now coming from Asia, mainly from China, India, and Indonesia, which together make up the largest share of this work. Many researchers now use more than one tool at the same time, especially VOSviewer and Bibliometrix, to get deeper insights. Citation data shows that these tools have changed how scientists explore knowledge, track how topics develop, and understand global research networks. Overall, this study shows that visualization tools not only help measure research performance but also make scientific information easier to understand and share worldwide. Looking ahead, the mix of visualization, artificial intelligence, and open-access data is expected to shape the next stage of research communication, making science more open, connected, and meaningful.

KEYWORDS: Bibliometric visualization, research evaluation, VOSviewer, CiteSpace, Bibliometrix, scientometrics, Scopus analysis.

1. INTRODUCTION

It is essential to make research visible in the present digital era, and it should be of good quality. Millions of articles are published every year, and scholars have trouble finding the appropriate audience and becoming popular, as well as getting cited. Being visible is no longer a question of numbers but also a question of quality of communication, sharing, publishing and being part of the larger academic fabric. To overcome this, scientists are relying more on

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bibliometric and scientometric tools. These methods methodically trace references, chart cooperation styles, and identify novel trends in fields. They assist researchers in understanding the impact of an individual paper, author, or journal on knowledge in the disciplines and demonstrate how various knowledge bases are connected to one another, indicate gaps, and suggest future research directions. Ellegaard (2018) notes that the technique can be biased in its structure and is not always sufficient to identify inter-disciplinary scholarship, which means that a more generalized mapping technique needs to be created. In the meantime, Donthu et al. (2021) highlight the importance of systematic and clear procedures that can generate rigorous and reproducible guidelines, which will enhance the reliability and usefulness of bibliometric evaluation.

Bibliometric studies have found use in a variety of fields. The authors revealed that the intellectual evolution of a field and its trends are demonstrated by mapping author networks throughout decades (Cisneros et al., 2018). It was shown that institutional-level analyses may reveal the regional strengths, the collaboration patterns, and emphasize university initiatives worldwide (Laengle et al., 2020). Long-term research, including that of Donthu, Kumar, and Pattnaik (2020) tracks the changes in journals and their focus over the years and provides information about the dynamics of scholarly communication. Hassan and Duarte (2024) warn that using citation counts only may overlook context, collaboration, and new trends, and thus, it is important to interpret carefully. Computers and software have increased the usefulness of these techniques. Dervis (2019) identified the benefits of open-source packages such as Bibliometrix, which facilitates reproducible analysis, whereas L., George, and Anisha (2022) discovered that these techniques were particularly effective in medical research to direct future collaborations and thematic mapping. Lyu, Liu, and Yao (2023) approached the issue historically, demonstrating the increasing diversity and interdisciplinarity of bibliometrics in the last 50 years. The article by Alsharif, Salleh, and Baharun (2020) depicted the importance of domain-specific mapping to detect research groups, new topics, and contributors of importance. Bibliometric research is a relatively new development in using visualization tools. Recent research has underscored the increasing role of technological innovations in bibliometric and library science studies. Nasir and Jana (2025) highlighted how emerging computational tools, such as those used in cloud-based applications, are transforming research mapping and bibliometric analysis within library contexts, reflecting a broader trend toward data-driven scholarly evaluation. VOSviewer, CiteSpace, Bibliometrix, SciMAT, HistCite, and Gephi are programs which can transform complex data into maps, graphs, and networks. Such visual presentations make it easier to comprehend relationships between authors, institutions, and research subjects, identify key trends, and enhance access to and impact of research. Turning abstract citation and co-authorship data into visual maps allows researchers to find top authors in a few seconds, play with collaboration networks, and discover thematic clusters that would not otherwise be evident. Therefore, bibliometric visualization is a useful instrument to quantify research output and enhance the global coverage of academic literature.

The present work, *Analyzing Bibliometric Visualization Tools for Research Evaluation and Visibility: A Comparative Study*, examines the use of these tools in research assessment, trend identification, and in the dissemination of knowledge. The paper provides reflections on how researchers can utilize these tools to promote not only visibility but also gain an insight into how scientific areas should be organized and to make better decisions in academia and policy by comparing the capabilities, features, and usability of the key visualization platforms.

Overall, it can be suggested that bibliometric visualization is gaining more importance in the context of modern research, wherein quality and visibility serve as catalysts of knowledge development and interdisciplinary work.

2. CONCEPT OF BIBLIOMETRIC VISUALIZATION TOOLS

Bibliometric visualization tools provide analytical and visual approaches to the vast, multifaceted world of scholarly communication. They transform numeric bibliometric information such as numbers of publications, citations, co-authorship relationships, and key-word frequencies into graphs that reveal latent patterns and connections in scholarly texts. By using visual maps, clusters, and networks, scientists can also trace the development of knowledge, identify powerful authors and journals, analyze thematic connections and identify new trends in various areas. Network graphics, data mining and statistical modeling are combined to transform raw bibliographic data into interactive, understandable visual output. This combination enhances learning and helps in strategic research planning, institutional benchmarking and evidence-based policy making. Simply put, these tools will connect raw data and discovery and allow scholars to go beyond numbers to the entire picture of scientific progress.

Over the years, several bibliometric visualization tools have appeared that have their own distinctive features and advantages. Popular ones are VOSviewer, CiteSpace, Bibliometrix, SciMAT, HistCite and Gephi, which have all advanced the field of bibliometric and scientometric analysis. VOSviewer is complimented with transparent cluster-based maps that reveal patterns of collaborations and citing. CiteSpace, however, is good at identifying new subjects, turning points, and citation bursts through its timelines analyses. Bibliometrix offers a complete range of science mapping and statistical analysis tools, which makes it very versatile in sophisticated research. SciMAT helps in making long term analysis of evolving themes in a study. These tools have proven invaluable by increasing the visibility of research, increasing transparency in research and enhancing our general understanding of scientific advancement by showing us how knowledge is created and disseminated.

Table 1: Comparative List of Bibliometrics Tools

Tool	Developed By	Birth Year	Key Functions	Strengths	Limitations
Bibliometrix	Aria & Cuccurullo (R language)	2017	Science mapping, performance analysis, network analysis	Open-source, integrates with R, customizable, statistical depth	Requires R knowledge (except GUI version), steep learning curve
SciMAT	Cobo et al. (Java)	2012	Science mapping, co-word analysis, strategic diagrams	Focus on longitudinal analysis, evolution of themes over time	Complex interface, limited updates
VOSviewer	Van Eck & Waltman, Leiden University (Java)	2009	Network visualization, co-citation, co-authorship, keyword mapping	Easy GUI, strong visualization, handles large datasets	Limited statistical functions, less customizable

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Gephi	Bastian, Heymann & Jacomy (Java, open-source)	2008	General network visualization & analysis	Very flexible, supports many network formats, strong visual customization	Not specific to bibliometrics, steep learning curve, data prep needed
CiteSpace	Chaomei Chen (Java)	2004	Co-citation analysis, burst detection, clustering, temporal analysis	Strong for trend detection, timeline & burst analysis, good clustering	Interface less user-friendly, requires practice
HistCite	Eugene Garfield & colleagues (Java/Windows)	2004	Citation history, historiographic mapping	Simple citation-based mapping, shows influence chains	Limited visualization, small datasets

3. OBJECTIVES OF THE STUDY

The main goal of this study is to look at how six popular bibliometric visualization tools – VOSviewer, CiteSpace, Bibliometrix, SciMAT, Gephi, and HistCite, have been used between 2017 and 2025 for research evaluation and improving research visibility. As more people rely on data-based methods to study scientific communication, this research aims to understand how these tools have changed bibliometric work, helped in mapping knowledge, and affected global research trends.

More specifically, the study will:

- i. Track how publications and the use of these visualization tools have grown from 2017 to 2025.
- ii. Compare how well these tools perform based on how often they are used, how many times they are cited, and how they are applied in collaborations.
- iii. Look at which countries use these tools the most and what regional patterns exist in bibliometric visualization studies.
- iv. Examine how these tools help make research more visible, encourage collaboration, and support the sharing of scientific knowledge.
- v. Highlight the most cited studies and the tools that have had the greatest influence on the development of bibliometric and scientometric research.

By meeting these goals, the study aims to give a clear view of how bibliometric visualization tools contribute to research evaluation and visibility, showing their increasing importance in shaping global scientific communication and scholarly impact.

4. METHODOLOGY

4.1 Research Design and Data Collection

The study employed a bibliometric approach to determine the value of visualization tools in bibliometric and scientometric research. Data was obtained by researchers on September 3, 2025, in the Scopus database. Scopus was selected as the central source due to being among the biggest and most reliable abstract and citation databases, providing a comprehensive and extensive dataset. The scope of the analysis was also restricted to the publications

between 2017 and 2025 to enable a fair comparison among the tools. This specific timeframe was chosen because Bibliometrix, a key tool under investigation, was introduced in 2017. By analyzing all six tools, VOSviewer, CiteSpace, Bibliometrix, SciMAT, Gephi, and HistCite, within a common timeframe, the study ensures comparability and captures recent developments and long-term trends in the use of these tools.

4.2 Search Strategy

The search strategy was designed to identify publications that explicitly mention the use of these visualization tools in the context of bibliometric, scientometric, or science mapping research. Advanced Search queries were executed in the Scopus database using the field code TITLE-ABS-KEY, which scans the titles, abstracts, and author keywords of publications. This approach facilitated the identification of highly relevant documents.

Separate queries were executed for each visualization tool to enable a tool-by-tool comparison. The detailed search query set, along with the corresponding number of retrieved documents, is summarized in Table 2. Each query was restricted to publications in English to maintain consistency in language.

Table 2: Search Query Set and Results

Query	Search Query (Scopus Advanced Search)	Results (Documents)
1	TITLE-ABS-KEY("VOSviewer") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	12983
2	TITLE-ABS-KEY("CiteSpace") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	7423
3	TITLE-ABS-KEY("Bibliometrix" OR "Biblioshiny") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	4649
4	TITLE-ABS-KEY("SciMAT") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	381
5	TITLE-ABS-KEY("Gephi") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	423
6	TITLE-ABS-KEY("HistCite") AND TITLE-ABS-KEY(bibliometric OR scientometric OR "science mapping" OR visualization) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English"))	358

5. DATA ANALYSIS

After retrieving the records, the documents were exported in CSV format. This allowed for the preservation of essential metadata fields, including the title, authors, abstract, keywords, source, and citation information.

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After removing duplicates and incomplete records (e.g., missing author information) we found 18881 unique values. The subsequent data analysis was conducted using a combination of specialized software tools and standard statistical software. Excel was used for descriptive statistics and data cleaning. For more advanced analysis and visualization, the data were processed using Bibliometrix (in R) and VOSviewer. These tools were specifically utilized to map co-authorship networks, keyword co-occurrence, and citation patterns, which are crucial for understanding the research landscape.

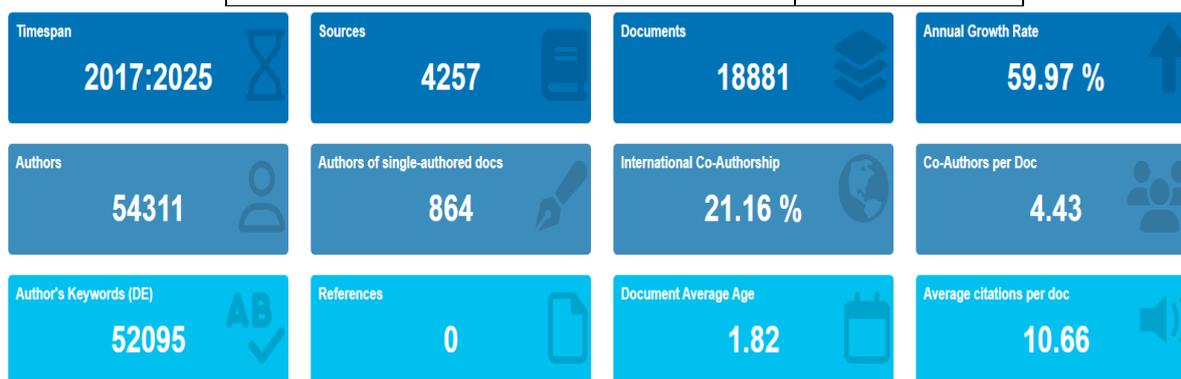
Main Information About Data

To gain a comprehensive understanding of the research landscape, the collected bibliometric data were organized and analyzed. The following table (Table 3) presents this data, highlighting the key variables relevant to the research objectives, including publication output, growth trends, document characteristics, authorship patterns, and collaboration measures. It provides a clear overview of the patterns observed and helps in understanding the distribution of responses across different categories. By summarizing the raw data in tabular form, it enables easier interpretation and comparison, thereby supporting the subsequent analysis and discussion. Table 3 outlines the main information about the data, while Figure 1 provides a concise summary in visual form.

Table 3: Main Information About Data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2017:2025
Sources (Journals, Books, Etc)	4257
Documents	18881
Annual Growth Rate %	59.97
Document Average Age	1.82
Average Citations Per Doc	10.66
DOCUMENT CONTENTS	
Keywords Plus (ID)	32613
Author's Keywords (DE)	52095
AUTHORS	
Authors	54311
Authors Of Single-Authored Docs	864
AUTHORS COLLABORATION	
Single-Authored Docs	1035
Co-Authors Per Doc	4.43
International Co-Authorships %	21.16
DOCUMENT TYPES	
Article	10340
Book	1
Book Chapter	460

Conference Paper	2210
Data Paper	5
Editorial	6
Erratum	21
Letter	44
Note	18
Retracted	13
Review	5746
Short Survey	17



Fig

1: Data Summary

5.2 Year-Wise Growth and Distribution

The Data given in Table 4 and Figure 2 indicates a consistent rise in the use of bibliometric tools from 2017 (115 publications) to a peak in 2024 (7,415), followed by a modest decline in 2025 (6,731). VOSviewer accounts for the largest share with 12,941 publications (49.5%), establishing itself as the most widely adopted tool. CiteSpace follows with 7,378 publications (28.3%), and together the two tools represent nearly 78% of total usage, underscoring their dominance in the field. Bibliometrix shows significant growth in recent years, contributing 4,634 publications (17.7%), particularly after 2020, which suggests its increasing acceptance among researchers. By contrast, SciMAT (380; 1.5%), Gephi (422; 1.6%), and HistCite (357; 1.4%) remain marginal with stagnant or declining use. Overall, the trend suggests a clear preference for advanced and user-friendly tools, with VOSviewer and CiteSpace maintaining leadership while Bibliometrix rapidly gains ground.

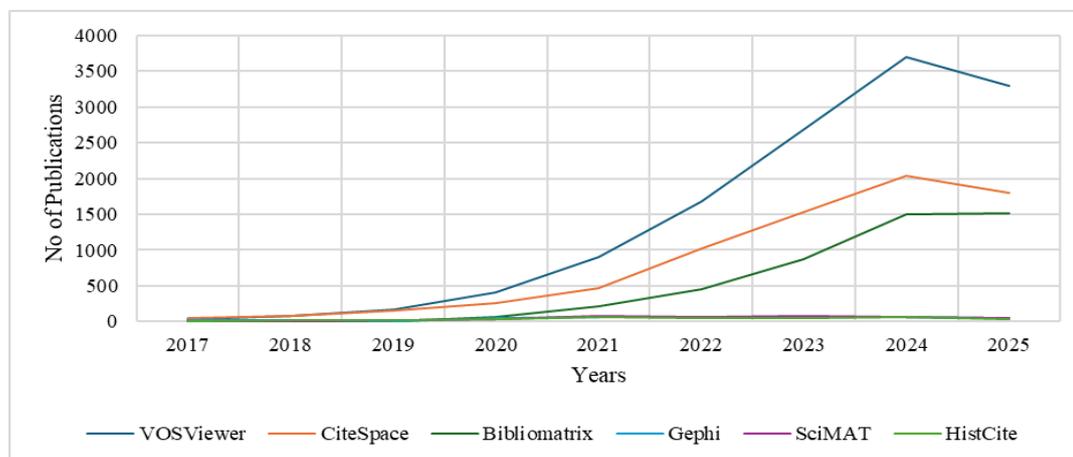


Fig 2: Year-Wise Growth of Publications on Visualization (2017–2025)

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Table 4: Usage of Visualization Tools (2017-2025)

Tools	2017	2018	2019	2020	2021	2022	2023	2024	2025	Grand Total
VOSViewer	38	79	170	402	901	1687	2680	3695	3289	12941
CiteSpace	49	73	151	255	474	1018	1532	2032	1794	7378
Bibliomatrix	1	3	9	59	215	455	872	1506	1514	4634
Gephi	16	19	1	54	61	70	60	64	50	395
SciMAT	2	11	15	39	72	62	77	58	44	380
HistCite	9	16	20	37	65	54	56	60	40	357
Grand Total	115	201	366	846	1788	3346	5277	7415	6731	26085

5.3 Single and Collaborative Use

Figure 3 shows some interesting differences in how they are used alone and in combination with other tools. VOSViewer is the most popular overall, used in 7,077 papers on its own (about 55%) and 5,864 papers with other tools (about 45%) (See Table 5). CiteSpace, on the other hand, is used more often in collaboration (4,074 papers, 55%) than on its own (3,304 papers, 45%). Bibliomatrix follows the same trend, with more collaborative use (2,878 papers, 62%) compared to single use (1,756 papers, 38%). Tools like Gephi and SciMAT are less common, but they are still used more individually (around 62% single vs. 38% collaborative for both). HistCite is quite different because it is rarely used alone (72 papers, 20%) but mostly in combination with other tools (285 papers, 80%). Overall, VOSViewer clearly leads in both single and collaborative use, while CiteSpace, Bibliomatrix, and HistCite are stronger in collaborative research.

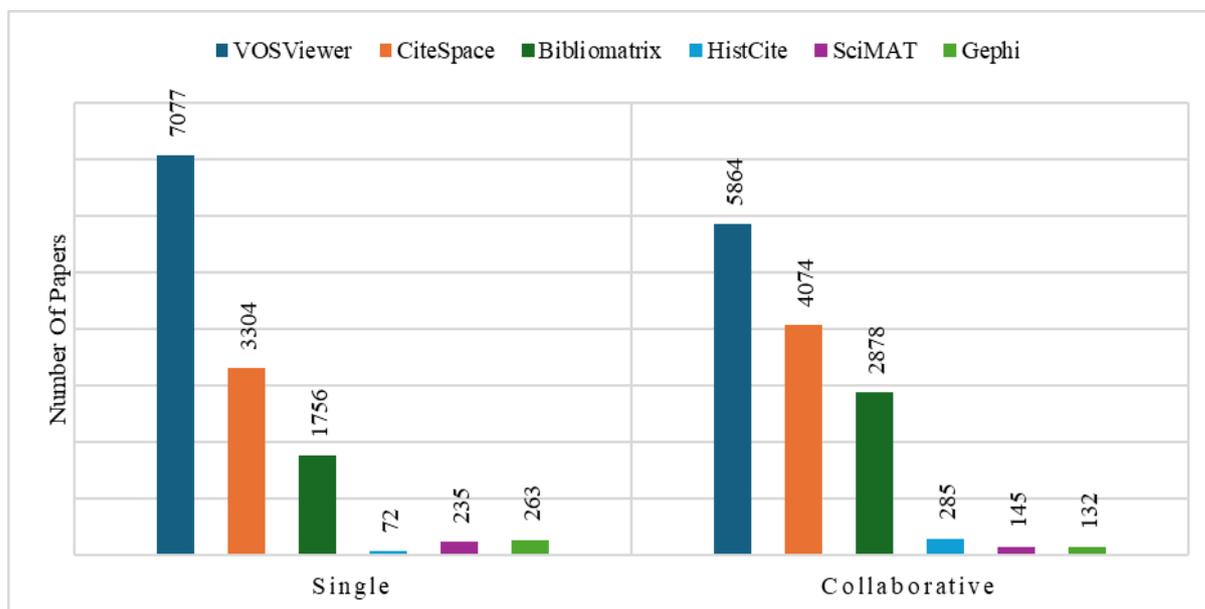


Table 5: Single vs Collaborative Use of Visualization Tools (2017-2025)

Tools	Single Usage	Collaborative Usage	Total
VOSViewer	7077	5864	12941
CiteSpace	3304	4074	7378
Bibliomatrix	1756	2878	4634

HistCite	72	285	357
SciMAT	235	145	380
Gephi	263	132	395
Total	12707	13378	26085

5.4 Geographic Distribution

The country-wise contribution from 2017 to 2025 shows an exceptional rise in bibliometric research, with China emerging as the clear global leader. Figure 4 presents the country-wise publication distribution and clearly highlights India’s strong global standing. Out of a total of 177,326 articles, China leads with 110,928 publications (nearly 63%), but India emerges as the second-highest contributor with 14,705 publications, accounting for over 8% of the total output and surpassing several advanced economies. Indonesia follows closely with 14,120 publications (~8%), while Malaysia (8,721; ~4.9%) and Brazil (7,025; ~4%) show moderate contributions. Spain (6,719; ~3.8%) and the USA (4,637; ~2.6%) rank below India, further emphasizing its research prominence. The lower tier, comprising Italy (3,680), Iran (3,544), and Turkey (3,247), collectively contributes less than India alone. Overall, the data visually depicted in Figure 4 underscores India’s growing influence and competitive edge in global research output.

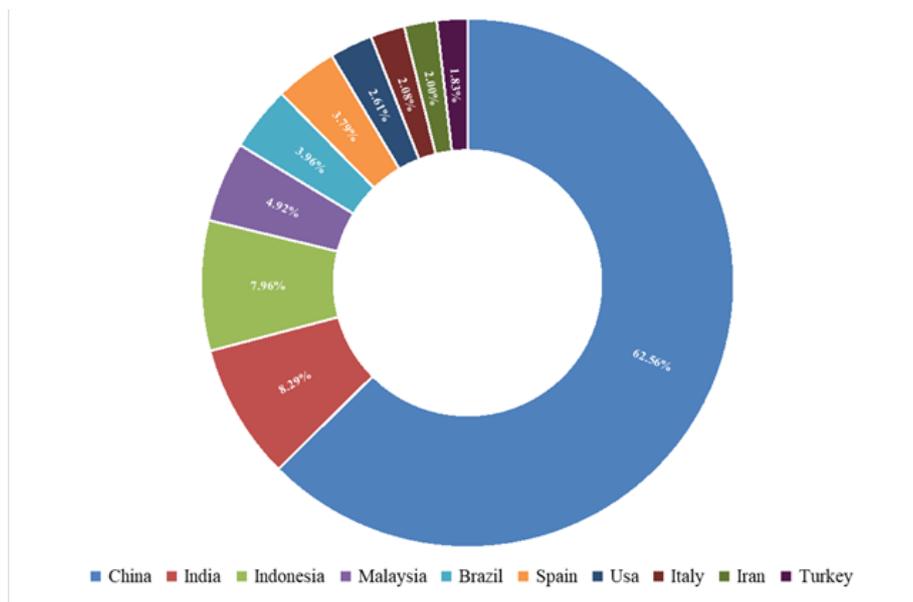


Fig 4: Geographic Distribution of Bibliometric Visualization Tools

Overall, the analysis highlights a geographic shift towards Asia, where China dominates decisively, and India and Indonesia are emerging as significant players. Western countries such as the USA, Italy, and Spain continue to contribute, but their growth is relatively modest compared to the exponential rise seen in Asian nations.

In Figure 5 you can see, China consistently dominates the citation landscape, accounting for around 65% in 2017 and maintaining over 60% share through 2025. India, Indonesia, and Malaysia show strong upward trends. India grows from about 2% in 2017 to nearly 9% in 2025, Indonesia rises from almost negligible to 11%, and Malaysia climbs from less than 2% to about 7%. Brazil, Spain, and the USA show modest but steady contributions, each holding 3–6% range across the years. Meanwhile, Iran, Italy, and Turkey remain relatively small players, contributing 1–3% each.

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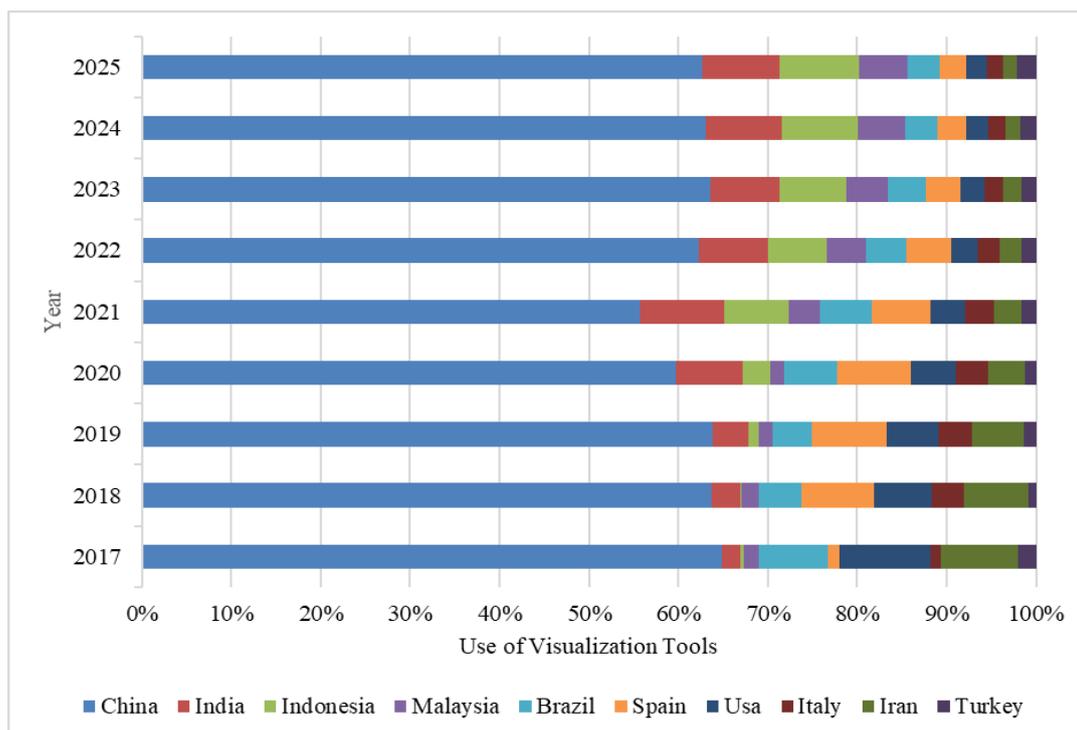


Fig 5: Country wise usage of Bibliometric Visualization Tools

Figure 6 illustrates the collaborative network of countries contributing to the research output. China clearly dominates the map, appearing at the center with the largest node, indicating the highest volume of publications and collaborations. India follows as one of the most prominent contributors, actively connected with multiple countries in the network. Indonesia and Malaysia also demonstrate strong participation, with noticeable linkages that reflect their growing involvement in global research. Other countries such as the United States, Spain, Brazil, and Italy appear as important secondary contributors, but their presence is comparatively smaller. Overall, the visualization highlights China's leading position, with India emerging as the next major hub, followed by other Asian and European nations showing substantial yet relatively moderate engagement.

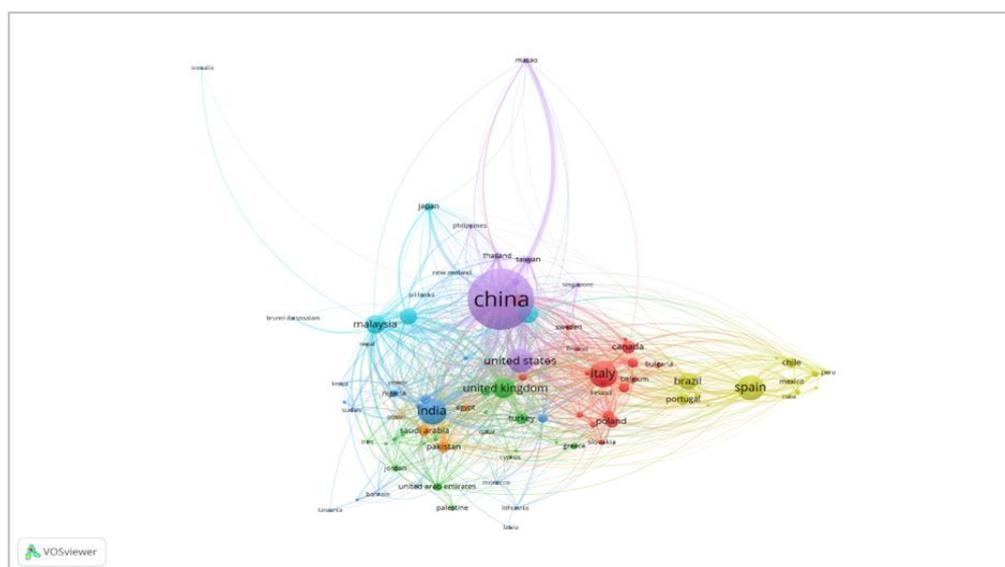


Fig 6: Network Visualization of Author's Countries

5.5 Citation Trends and Distribution

From 2017 to 2025, researchers cited these six tools a total of 201206 times. Table 6 shows that citations increased steadily year after year, reaching their peak in 2022 with 42,868 citations (21.3% of the total). After this peak, there was a noticeable drop, with only 3,214 citations in 2025.

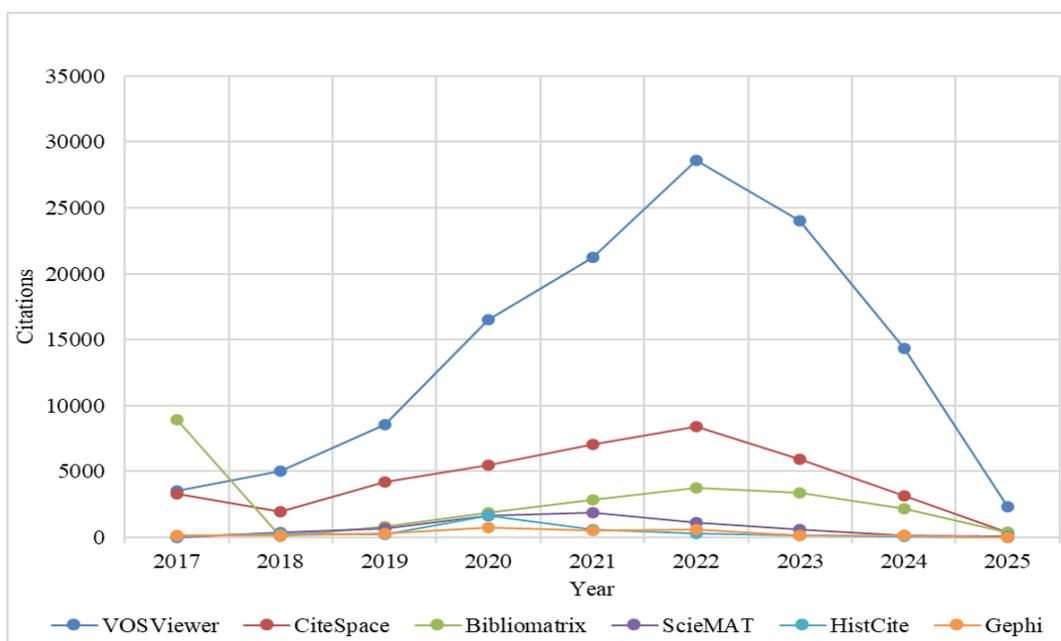


Fig 7: Citation Usage Trends of Visualization Tools (2017-2025)

Figure 7 shows that among all tools VOSviewer stood out as the clear leader, accounting for more than half of all citations (124,054; 61.6%). CiteSpace followed with 39,847 citations (19.8%), and Bibliomatrix with 24,370 (12.1%), while tools like ScieMAT (6,513), HistCite (3,483), and Gephi (2,939) were used much less frequently. Bibliomatrix had a strong start in 2017 but quickly leveled off, while VOSviewer and CiteSpace continued to dominate consistently. Overall, the pattern shows that researchers relied most heavily on VOSviewer and CiteSpace, that Bibliomatrix’s popularity was brief, and that citations after 2022 declined, likely because the tools had reached saturation or because newer platforms were beginning to take their place.

Table 6: Citations of Papers (2017-2025)

Tools	2017	2018	2019	2020	2021	2022	2023	2024	2025	Grand Total
VOSViewer	3506	5020	8537	16495	21223	28587	24011	14318	2357	124054
CiteSpace	3326	1955	4197	5451	7025	8428	5945	3134	386	39847
Bibliomatrix	8946	105	807	1901	2852	3793	3372	2216	378	24370
ScieMAT	22	344	713	1657	1849	1108	611	164	45	6513
HistCite	88	302	250	1655	619	324	165	74	6	3483
Gephi	169	121	325	764	544	628	177	169	42	2939
Grand Total	16057	7847	14829	27923	34112	42868	34281	20075	3214	201206

5.6 Three-Factor Plots: Country, Author, and Affiliation

The Three-Factor Plot (Figure 8) illustrates the relationships among countries, authors, and their affiliations, providing insight into global research contributions and collaborations. The analysis shows that China is the leading contributor, represented by authors such as Zhang, Wei (China Academy of Chinese Medical Sciences), Wang, Wei (Beijing University of Chinese Medicine), and Liu, Zhen (China Medical University, Shenyang). Indonesia is primarily represented by Purnomo, Agung from Universitas Pendidikan Indonesia, while Spain and Brazil are linked to Cobo, Manuel J. (China Academy of Chinese Medical Sciences).

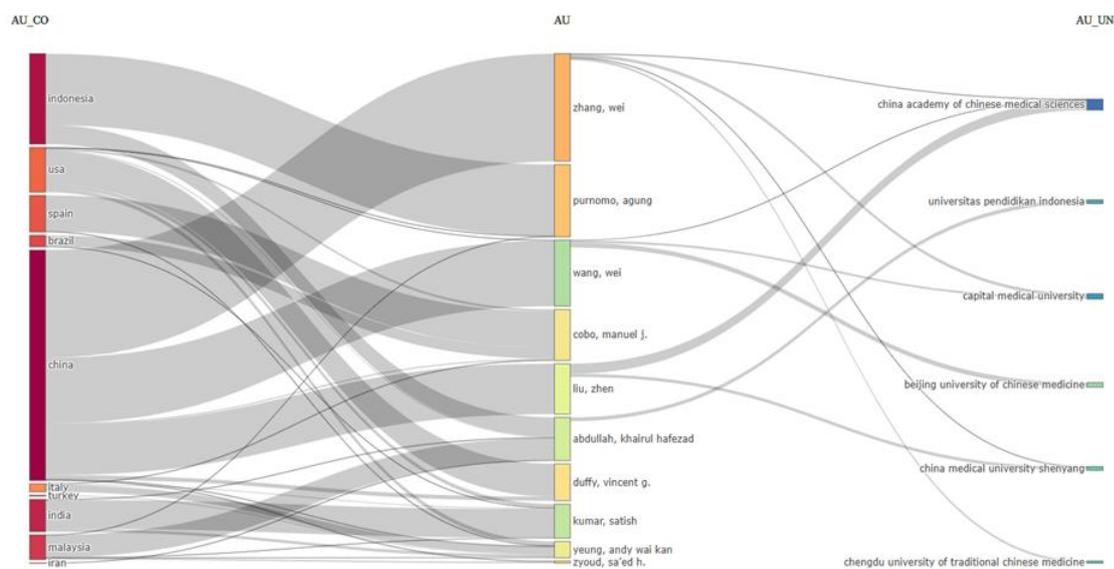


Fig 8: Three-field plot. AU_CO, author country; AU, author; AU_UN, author affiliation.

5.7 Top 10 Influential Papers Employing Visualization Tools

Here are the top 10 most-cited papers that use visualization tools. An analysis of these papers, published between 2017 and 2025, shows a clear preference for certain tools. VOSViewer is the most frequently used, appearing in 7 out of 10 papers, followed by Bibliometrix in 3 papers and CiteSpace in 2 papers. Tools such as SciMAT, HistCite, and Gephi appear less often and are typically used in combination with other tools. Several studies employ multiple tools, for example, VOSViewer with Gephi or Bibliometrix with SciMAT, demonstrating a trend of combining tools for more comprehensive bibliometric analyses. Overall, these findings highlight VOSViewer as the dominant tool, with others playing a complementary role.

Table 7: Top 10 Papers using Visualization Tools (2017-2025)

Rank	Year	Authors	Title	Citations	Tools
1	2017	M., Aria, Massimo; C., Cuccurullo, Corrado	bibliometrix: An R-tool for comprehensive science mapping analysis	8946	Bibliometrix
2	2017	N.J., Van Eck, Nees Jan; L., Waltman, Ludo	Citation-based clustering of publications using CitNetExplorer and VOSviewer	1823	VOSViewer

3	2017	C., Chen, Chaomei	Science Mapping: A Systematic Review of the Literature	1544	CiteSpace
4	2020	J.A., Moral-Munoz, Jose A.; E.E., Herrera-Viedma, Enrique Enrique; A., Santisteban-Espejo, Antonio; M.J., Cobo, Manuel J.	Software tools for conducting bibliometric analysis in science: An up-to-date review	1165	Bibliometrix + SciMAT + VOSViewer
5	2020	M.K., Linnenluecke, Martina K.; M., Marrone, Mauricio; A.K., Singh, Abhay Kumar	Conducting systematic literature reviews and bibliometric analyses	1031	Bibliometrix + HistCite
6	2019	R., Bardestani, Raouf; G.S., Patience, Gregory S.; S.C.F., Kaliaguine, Serge C.F.	Experimental methods in chemical engineering: specific surface area and pore size distribution measurements, BET, BJH, and DFT	860	VOSViewer
7	2020	N., Donthu, Naveen; S., Kumar, Satish; D., Pattnaik, Debidutta	Forty-five years of Journal of Business Research: A bibliometric analysis	667	Gephi + VOSViewer
8	2018	H., Liao, Huchang; M., Tang, Ming; L., Luo, Li; C., Li, Chunyang; F., Chiclana, Francisco; X., Xiao-Jun Zeng, Xiao-Jun	A bibliometric analysis and visualization of medical big data research	532	CiteSpace + VOSViewer
9	2019	S.A., Sarkodie, Samuel Asumadu; V., Strezov, Vladimir	A review on Environmental Kuznets Curve hypothesis using bibliometric and meta-analysis	488	VOSViewer
10	2020	M., Duque-Acevedo, Mónica; L.J., Belmonte-Ureña, Luis J.	Agricultural waste: Review of the evolution, approaches and perspectives on alternative uses	475	VOSViewer

5.8 Frequency of Tools used in Top 10 Highly Cited Papers

Among the top 10 most-cited papers, VOSViewer dominates with usage in 7 papers (70%), followed by Bibliometrix in 3 papers (30%) and CiteSpace in 2 papers (20%). SciMAT, HistCite, and Gephi are used only once each (10%) and typically alongside other tools (see Figure 9). Several studies employ multiple tools, for example, combining VOSViewer with Gephi or Bibliometrix with SciMAT, to enhance the analysis. This highlights that while VOSViewer is the preferred choice for bibliometric visualization, other tools are often used in a complementary manner.

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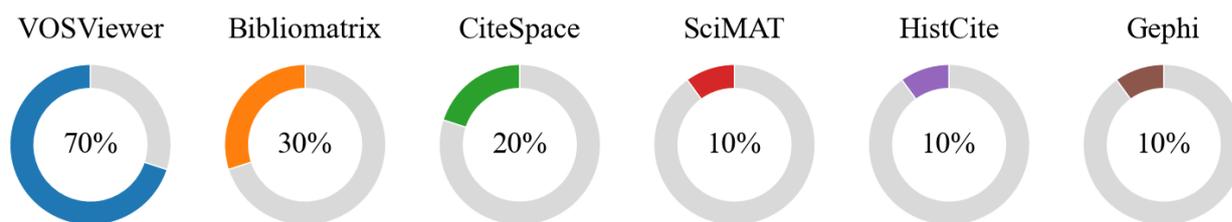


Fig 9: Frequency of Tools used in Top 10 Papers

5.9 Keyword Analysis: Word Cloud

To identify the most frequently occurring terms in the selected dataset, a word cloud visualization was generated (Figure 10). The visualization highlights the predominance of terms such as “bibliometric analysis,” “bibliometrics,” “VOSviewer,” “CiteSpace,” and “Web of Science.” These keywords indicate that bibliometric methods and visualization tools are central to the analyzed literature. The appearance of terms like “human,” “article,” and “review” reflects the broader research context in which these tools are applied.

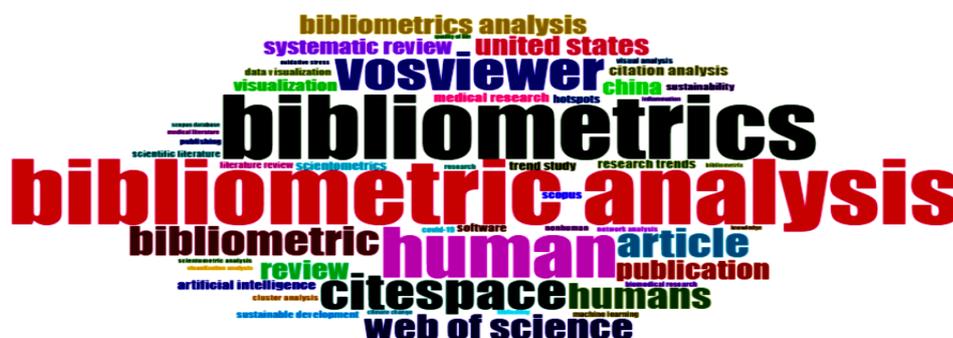


Fig 10: Word Cloud

DISCUSSION

Bibliometric and scientometric studies have made visualization tools important. They allow researchers to visualize complex data more readily in the form of maps, graphs, and network visuals. The application of such tools has increased dramatically between 2017 and 2025, particularly VOSviewer, CiteSpace, and Bibliomatrix. This expansion indicates the extent to which scientists depend on the use of visual analysis as a way of identifying trends, research relationships, and patterns of collaboration.

VOSviewer is the most prominent due to its plain interface and high capacity to process large volumes of data. It is user-friendly, and it generates clear visual maps, which is why it is popular with scholars of various disciplines. CiteSpace has also gained popularity; it identifies trends in research, citation bursts, and how topics develop over time. Bibliomatrix is a more recent tool and is rapidly expanding due to its comprehensive statistical analysis capabilities and compatibility with the R programming language, which is familiar to many researchers. On the contrary, such tools as SciMAT, Gephi, and HistCite are less frequently employed. They have a distinct objective: SciMAT to develop themes, Gephi to visualize large networks, and HistCite to trace the history of citations, yet they are not as user-friendly or updated as the most popular ones. Therefore, researchers are more likely to prefer such platforms that are easy, pleasant to the eye, and multicurative.

The geographical patterns are remarkable. As it can be analyzed, Asian countries, in particular, China, India, and Indonesia, are currently leading the application of visualization instruments in bibliometric studies. China takes the lead in terms of the number of publications, with India and Indonesia fast following. This means that there is increased participation in high-level bibliometric and scientometric research by more scholars in developing regions, which has increased the visibility of research worldwide.

VOSviewer has the highest number of citations, second by CiteSpace and Bibliometrix, which highlight their high impact. The slight decrease in citations beyond 2022 may serve as an indicator of new AI-based visualization platforms or maturity of current tools. On balance, the findings indicate that visualization tools do not only assist in data analysis but make the work of scientists more visible, approachable, and impressive.

CONCLUSION

This paper identifies visualization tools as critical to enhance research analysis and dissemination. They make complicated information easier and increase academic exposure. Among all the six tools analyzed, VOSviewer, CiteSpace, and Bibliometrix are the most popular due to their effectiveness, ease of use, and clarity of visuals. Others like the SciMAT, Gephi and HistCite are still useful but used in more special jobs.

The research also indicates the expansion of tool use over the world, especially in Asia-China and India, as researchers use modern ways of visualizing images more and more. This trend demonstrates how the world is moving towards more inclusive and data-driven research practices.

Visualization tools will become more robust in the future through the combination of artificial intelligence, big data, and interactive dashboards. This synergy will allow researchers to work faster, identify new trends in real-time, and create an even more open and connected scientific community. Concisely, visualization tools are defining the future of research through facilitating knowledge exploration, sharing, and comprehension. template.

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