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1

A Framework-Based Evaluation of Bibliometric Analysis Tools: An Up-To-Date Review

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Abstract

The rapid growth of scholarly publications across the disciplines has made bibliometric analysis crucial for evaluating research output, trends, influence, and gaps. Various developers have created a range of bibliometric software tools that differ in utility, user accessibility, and analytical depth to enable such analysis. Nevertheless, selecting the most appropriate equipment for certain research goals still presents challenges for scientists, particularly in view of the different technical competencies and the different benefits and drawbacks of every instrument. The present paper closes this gap by methodically comparing three widely used bibliometric tools-VOSviewer, Bibliometrix/Biblioshiny, and biblioMagika. These instruments fit different categories: Excel-based, user-friendly utilities; R-based analytical suites; and sophisticated network visualization platforms. Unlike earlier research, this paper portrays biblioMagika as a practical and underexplored tool in scholarly discussion. Every tool's interface, analytical capacity, data

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management, pre-processing tools, and fit for different user types are rigorously evaluated using a ten-dimensional comparison framework. This work offers a thorough and easily available assessment to support librarians, researchers, and information workers in selecting appropriate techniques for bibliometric studies, therefore improving informed and effective procedures of research assessment.

Keywords: *Bibliometric tools, bibliometric analysis, comparative framework, tool selection, analytical software*

Introduction

Human knowledge is expanding rapidly and enormously, es pecially in the 21st century. A study published in Nature in 2021 estimated that the overall growth rate of scientific publications is approximately 4.10%, resulting in a doubling period of about 17.3 years (Bornmann et al., 2021). In the medical domain, Dr. Ian Chuang, Chief Medical Officer at Elsevier, remarks in "The Dynamism of Clinical Knowledge" that the doubling time for medical research, estimated at 50 years in 1950, accelerated significantly to just 73 days by 2020 (Chuang, 2020). An American architect, systems theorist, author, and futurist, Buckminster Fuller, first prominently introduced the concept of the "doubling of human knowledge" in his 1981 book titled "Critical Path" (Fuller, 1981). Every domain has its growth speed, and human knowledge within each field advances rapidly whenever the situation demands. Nevertheless, it is widely acknowledged that overall, human knowledge is increasing at an extraordinary rate.

To quantify and analyze this ever-expanding knowledge, bibliometrics plays a crucial role. Bibliometrics is the application of statistical and mathematical methods to quantify documented scholarly communication and provide insights into the characteristics and evolution of a field (Moral-Muñoz et al., 2020). Before Alan Pritchard coined and introduced the term "bibliometrics" in 1969, E. Wyndham Hulme used the term "statistical bibliography" in 1922 in a report on his study of journal entries. Prior to Hulme, Cole and Eales conducted the first bibliometric study in 1917, referring to their research as a "statistical analysis of the literature" (Ikpaahindi, 1985).

Presently, numerous academic and scholarly databases are managing the bibliographical records of the published documents of human knowledge (Gusenbauer, 2019). Examples of some leading and popular scholarly databases are Scopus, Web of Science, PubMed, Dimensions.

ai, Cochrane Library, IEEE Xplore, and Google Scholar. These databases index millions of bibliographical details for published scholarly communication and other metadata, such as authors' affiliations with institutions, publishing venues, funding sources, and citations (Gusenbauer, 2022). Records available on these databases help researchers to perform quantitative analysis and science mapping using bibliometric tools and techniques.

In response to the growing number of records in databases, searchers across various disciplines have attempted to evaluate the literature in their fields in terms of productivity (Kushwaha et al., 2024), research trends (Basumatary et al., 2023), collaboration (Aksnes et al., 2019), research gaps, and underexplored areas (He et al., 2019). In doing so, researchers have employed various open-source, proprietary, and commercially available bibliometric and scientific mapping tools on the Internet. With this variety of bibliometric tools now available, ranging from statistical environments to GUI-based user-friendly visual platforms, researchers are often faced with the challenge of selecting the most appropriate tool for their specific analytical goals and technical skill level, as not all researchers are sound in programming skills.

However, these varieties of tools have their strengths, limitations, challenges, use cases, and learning curves. A major question that arises is, 'What tool should a researcher choose?' And the answer depends on several factors, like researchers' technical proficiency, analytical goals, and visualization needs. To support informed decision-making, this study develops and applies a structured comparative framework to evaluate three widely used science mapping bibliometric analysis tools: VOSviewer, Bibliometrix/Biblioshiny, and biblioMagika. The goal is to help researchers make informed choices in bibliometric tool selection by evaluating the tools across critical dimensions such as user interface, analytical capabilities, scalability, data compatibility, and visualization features.

Review of Literature

The growing use of bibliometric analysis across fields has led to the creation of many software programs with different strengths and technological needs. Over the years, scholars have compared these tools and proposed frameworks to help researchers match tool capabilities with analytical goals. A foundational study by Cobo et al. (2011) analyzed science mapping tools based on network types, preprocessing

options, and bibliometric techniques. They found that VOSviewer was most promising for showing co-authorship and co-occurrence networks, whereas SciMAT offered substantial preprocessing and longitudinal analysis. However, they only examined a few network-oriented technologies and ignored user experience and learning curves. Mor al-Muñoz et al. (2020) reviewed software solutions for bibliometric and scientometric analysis, building on previous work. They categorized performance analysis tools, scientific mapping software, and Bibliometrix programming libraries. They named Bibliometrix/Biblioshiny one of the most comprehensive open-source bibliometric statistical analysis systems and praised VOSviewer for network visualizations. Their assessment did not include Excel-based or descriptive analytic tools like biblioMagika, limiting its coverage of non-technical tools. Ozturk et al. (2024) underline the need for realistic and clear tool comparison approaches in bibliometric research. They said current studies focused too much on tool output without addressing how it supports research design, theory formulation, or literature synthesis. Lim and Kumar (2024) advocated for a sensemaking viewpoint in bibliometrics, emphasizing that tool selection should take into account both technical aspects and the user's ability to interpret and apply results. As more researchers without coding backgrounds use bibliometric methods, Bales et al. (2020) and Marzi et al. (2025) stressed the need for usability-focused frameworks that balance analytical depth with interface intuitiveness. Despite this emphasis, most evaluations have focused on technically advanced tools, neglecting lightweight, non-code plat forms utilized in practical research. There is no formal comparative comparison of biblioMagika in the available literature. BiblioMagika, developed by Aidi Ahmi, is a macro-enabled Excel utility with simple, template-driven workflows for Scopus and Web of Science data analysis. Its simplicity and detailed output have made it popular among practitioners and early-career researchers. Peer-reviewed scientific literature has not critically examined it, despite its use in Scopus-indexed publications. This paper fills that gap by evaluating VOSviewer, Bibliometrix/Biblioshiny, and biblioMagika side-by-side utilizing a technical and user-centered methodology. The present study balances depth with accessibility, providing useful insights for researchers of all skill levels, unlike previous studies that focused on high-level functionality or complex analytical tools. It provides a comparative perspective that includes underrepresented tools and addresses the growing demand

for inclusive, functional evaluations to assist bibliometric research decision-making.

Methodology

To offer a focused yet insightful comparison, this study selected three widely used bibliometric analysis tools: VOSviewer, Bibliometrix/Biblioshiny, and biblioMagika. The selection relied on their accessibility, popularity, practical application, and diversity of features. While biblioMagika was relatively new and less well-known compared to the other two tools, both of which were commonly cited in bibliometric research, it gained attention and appeared increasingly in analyses published in reputable Scopus-indexed journals. However, no prior study had formally evaluated it in scholarly literature, which positioned this study as a novel contribution to the field of bibliometric tool assessment.

All three tools were freely available, which makes them easy to access and use. They represented distinct categories: VOSviewer served as a powerful network visualization tool, Biblioshiny is a shiny app providing a web interface for Bibliometrix, a set of tools for quantitative research, and biblioMagika offered a lightweight, Excel-based environment focused on descriptive statistics. This mix enabled a balanced comparison across platforms with differing strengths and user expectations. The comparative evaluation framework was constructed by synthesizing criteria from previous review studies and tool evaluation frameworks proposed by Cobo et al. (2011), Moral-Muñoz et al. (2020), Donthu et al. (2021), Öztürk et al. (2024), and Marzi et al. (2025). Ten core dimensions were defined to guide the evaluation, ensuring both functional and user-centered perspectives. This framework balances technical depth and user experience, aiming to support both novice and experienced users in tool selec tion. Each tool was evaluated independently using the framework described above. Evaluation criteria were derived from a combination of first-hand usage and exploration of each tool, review of official documentation and tutorials, and academic literature and user forums.

Brief introduction to selected tools under study

VOSviewer: VOSviewer is a Java-based software tool for construc

ing and visualizing bibliometric networks and maps (Van Eck & Waltman, 2010). It was developed by Nees Jan Van Eck and Ludo Waltman of Leiden University (Netherlands) in 2009. It is open-source software distributed under MIT License. Networks and maps on VOSviewer are constructed using data on journals, authors, or individual articles retrieved from scholarly databases and built via citation, bibliographic coupling, co-citation, or co-authorship relationships (Figure 1). VOSviewer also has text mining capabilities, which allow users to create and display co-occurrence networks of key phrases taken from scientific literature.

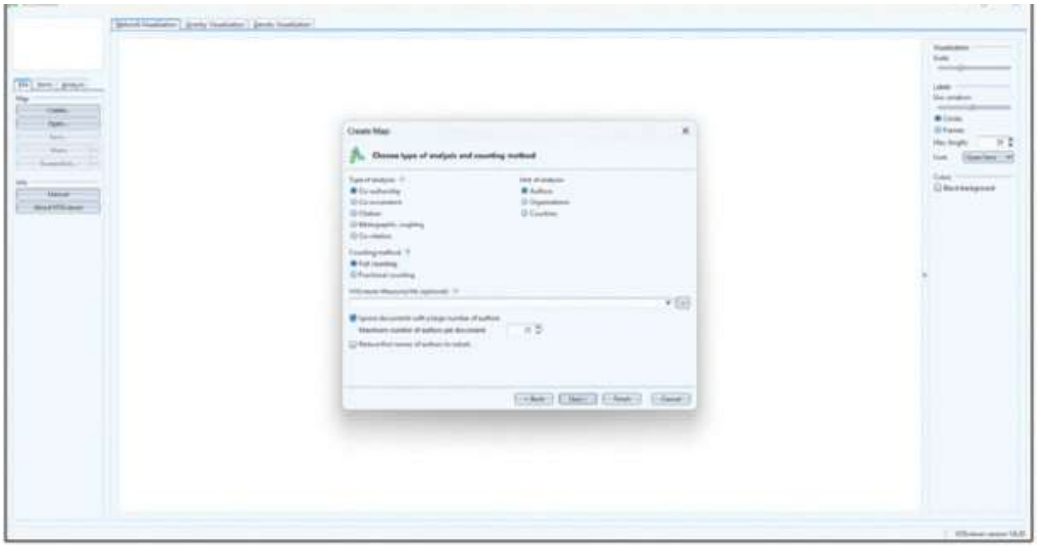

Figure-1: Map and network creation window of VOSviewer, displaying options for the type of analysis, unit of analysis, and counting method filter.

Bibliometrix/Biblioshiny: Bibliometrix is an R-based library package to perform science mapping analysis via RStudio. It is available under multiple licenses; however, the RStudio Desktop edition is open source and is distributed under GNU Affero General Public License, version 3. It was developed by Massimo Aria and Corrado Cuccurullo of the University of Naples Federico II (Italy) in 2017. Biblioshiny is 'bibliometrix for no coders.' It is a web-based GUI application for performing various performances and science mapping analyses that require no programming skills (Aria & Cuccurullo, 2017). It can be run on any latest web browser (Figure 2). However, it needs to run via the RStudio IDE and installing it for the first time requires basic commands. It can be used on systems running Windows, Linux, or macOS.

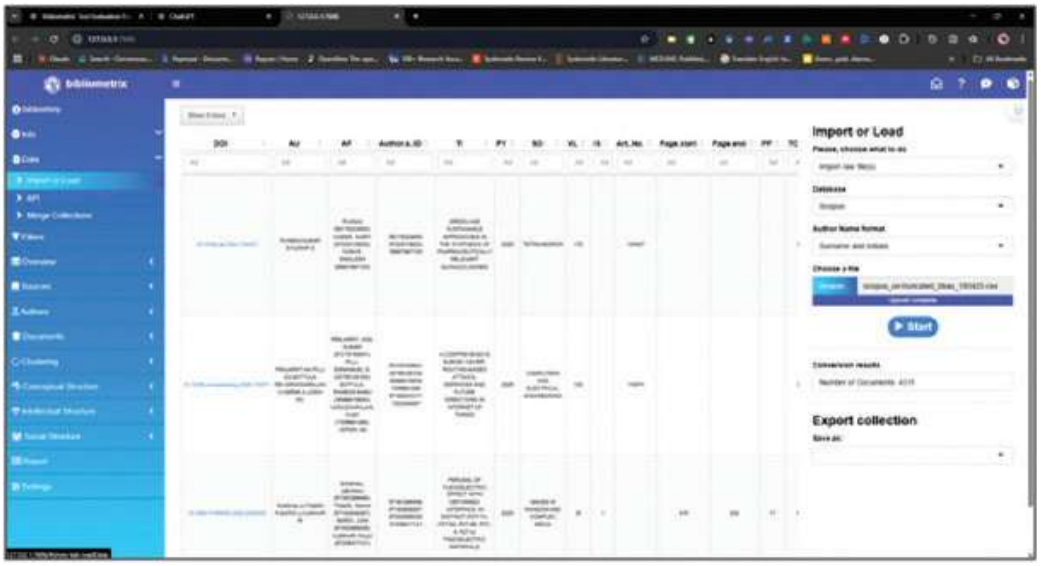

Figure-2: Biblioshiny app running on chrome browser, displaying import and load options (right) and filters and other options for running analysis and creating visualization (left)

biblioMagika: biblioMagika® is an Excel-based tool designed for conducting bibliometric analysis, with a focus on assessing publication productivity and evaluating scholarly impact (Ahmi, 2024). It provides various calculations, including total publications (TP), contributing authors (NCA), cited publications (NCP), total citations (TC), average citations per publication (C/P), average citations per cited publication (C/CP), h-index, g-index, m-index, citations sum within the h-core, cumulative total publications, and additional metrics (Figure 3). This analysis can be conducted across multiple factors, including publica tion year, source titles, authors, affiliations, and countries. It was developed by Aidi Ahmi of the Universiti Utara Malaysia (Malaysia) in 2023. It is freely available but is a proprietary tool. It runs only on MS-Excel with the latest versions, like 2021 or 365.

General information about all three selected bibliometric tools is presented in Table 1.

Figure-3: Home tab of biblioMagika running on MS-Excel 365 edition, displaying its main menu for performing various bibliometric analysis, and its unique data cleaning tools

Table-1: General information of the selected bibliometric tools

Sr. No.	Characteristics	VOSviewer	Bibliometrix/ Biblioshiny	biblioMagika
1	**Developer Name(s)**	Nees Jan Van Eck & Ludo Waltman	Massimo Aria and Corrado Cuccurullo	Aidi Ahmi
2	**Affiliating Institution**	Leiden University (The Netherlands)	University of Naples Federico II (Italy)	Universiti Utara Malaysia (Malaysia)
3	**Initial Release Year**	2009	2017	2023
4	**Latest version & Year**	1.6.20 (October 2023)	4.3.3 (March 2025)	2.10 (April 2025)
5	**Type**	Java based GUI tool (Desktop)	R package with Shiny GUI (Web based)	MS-Excel based tool (Desktop)
6	**Source nature**	Open Source	Open Source	Free to use but Proprietary
7	**Supported O**	Windows, macOS, Linux	Windows, macOS, Linux (via RStudio)	Windows, macOS (via MS-Excel only) and Office version 2021 or 365
8	**Link**	https://www.vosviewer.com/	https://www.bibliometrix.org/home/	https://biblioMagika.com/

Table-2: Structured Comparative Analytical Framework

Sr. No.	Evaluation Dimensions	VOSviewer	Bibliometrix/ Biblioshiny	biblioMagika
1	Supported Databases	WoS, Scopus, Dimensions, Lens, PubMed	WoS, Scopus, OpenAlex, Dimensions, Lens, PubMed, Cochrane Library	Scopus, WoS (Excel format)
	Supported APIs	OpenAlex, Crossref, Europe PMC, Semantic Scholar, OCC, COCI, WikiData	PubMed, Dimensions, OpenAlex	None
2	Supported Input Formats	RIS, CSV, TXT	XLSX, CSV, TXT	CSV, XLSX
	Supported Export Formats	BMP, EMF, GIF, JPG, PNG, SVG, PDF, SWF, TIFF	PNG, XLSX	XLSX, JPEG, JPG, PNG, other Excel export files.
3	Preproces ing Capabilities	Basic filtering	Deduplication, time slicing, advanced filtering, Synonyms, Stop words	Data cleaning and harmonization, identifying missing data
4	Analytical Capabilities	Science mapping analysis	Performance analysis and Science mapping analysis	Performance Analysis
5	Visualization Types	Network, Overlay, and Density Maps	Multiple visualizations (tables, network, charts, graphs, strategic diagrams, maps)	Line, Bar and Pie Charts, Dynamic bubble chart, Frequency tables

6	Customization Options	Low	Moderate in Biblioshiny and High in bibliometrix (via R customization)	Moderate (Dashboard-driven Keyword Customization)
7	Ease of Use	Beginner-friendly	Moderate (easy via GUI, advanced in R)	Very easy to use
8	Documentation and Tutorials	Manuals, videos, website FAQs	Comprehensive documentation and community support	Paid user guide PDF for download, Paid workshop and Bootcamps
9	Scalability and Performance	Handles large datasets efficiently	Slows down with very large datasets in Shiny GUI, pe forms best with high computing power system using coding via bibliometrix library	Best for small to mid-size datasets
10	Unique Features	Excellent for network visualizations and cluster analysis	Merge collections of different databases, Thematic evolution and Factorial analysis, Clustering, Historiograph	Excellent for data cleaning and harmonization, MS-Excel based, Compatible with VOSviewer and Biblioshiny

Structured Comparative Evaluation of Bibliometric Tools Based on Ten Core Dimensions

A detailed, structured, and evaluative comparison of the three selected bibliometric tools across ten core dimensions is presented in Table 2, followed by their descriptive analysis below.

Supported Databases and APIs

Bibliometric tools' support for many databases and APIs affect their use and significance in research. As the most comprehensive and versatile in this dimension, Bibliometrix/Biblioshiny supports Web of

Science (WoS), Scopus, OpenAlex, Dimensions, Lens, PubMed, and the Cochrane Library. It also enables API-based data harvesting from PubMed, Dimensions, and OpenAlex for speedier, automated, and real-time data integration for sophisticated users doing large-scale or cross-disciplinary reviews. VOSviewer supports WoS, Scopus, Dimensions, Lens, PubMed, and more APIs, including OpenAlex, Crossref, Europe PMC, Semantic Scholar, OCC, COCI, and WikiData. It is powerful enough to visualize data from curated exporters, open citation ecosystems, and linked data resources. biblioMagika only supports Excel-exported Scopus and WoS datasets and does not integrate APIs. While this limits its application to offline and manually prepared datasets, it is useful for targeted datasets and predefined or centralized data collecting. This dimension shows that Bibliometrix and VOSviewer excel in data-intensive or multi-source projects, while biblioMagika excels at simpler operations.

Supported Input and Export Formats

Interoperability with databases, other software, and publication workflows depends on input and export file types. VOSviewer supports RIS, CSV, and TXT files, three popular formats for exporting bibliographic data from Scopus, WoS, and PubMed. It supports bitmap (BMP), vector (SVG), image (PNG, JPG, GIF), and document (PDF, TIFF) export file types. It is suitable for creating high-quality images for academic publishing. Bibliometrix/Biblioshiny supports XLSX, CSV, and TXT files, making database outputs easy to convert. Despite its limited export options, PNG and XLSX are sufficient for internal analysis and basic presentation but may require additional processing for publication-ready visuals. As an Excel-based program, biblioMagika supports CSV and XLSX inputs, matching Scopus and WoS Excel exports. JPEG, PNG, JPG, and other Excel-native formats can be exported. These are good for presentations and quick reports, although VOSviewer has better export options. However, biblioMagika provides a seamless workflow for Microsoft Office users. In this dimension, VOSviewer leads for input processing and export quality, Bibliometrix for analytical format compatibility, and biblioMagika for Excel ecosystem simplicity and familiarity.

Preprocessing Capabilities

To arrange, clean, and assess bibliographic data, bibliometric analysis depends on extensive preprocessing. biblioMagika benefits from combining strong preprocessing capabilities with an easily available Excel-based interface. For author names, affiliations, keywords, and more, it streamlines synonym merging, data harmonizing, and metadata refining by interacting with OpenRefine. Bibliometrix/biblioshiny offers strong preprocessing capabilities like deduplication, temporal slicing, filtering, and term unification. It may be challenging for non-technical users, although it shines in analytical depth and automation. VOSviewer just applies crude filtering and external preprocessing. It shows nice co-authorship and citation networks but requires data purification. Before visualization, researchers preprocess their VOSviewer datasets using biblioMagika or Bibliometrix. Hence, in this dimension biblioMagika has an upper hand.

Analytical Capabilities

Analytical capabilities define the range and depth of insights produced by bibliometric instruments. In this regard, Bibliometrix/Biblioshiny provides the most complete capability, supporting science mapping analysis as well as performance analysis. This dual capability lets researchers investigate intellectual structures using co-citation, co-word, and thematic evolution studies in addition to evaluating productivity measures like author output, publication trends, and source impact. Its broad methodological range qualifies it for exploratory as well as explanatory bibliometric research. Conversely, VOSviewer concentrates just on science mapping analysis and emphasizes visualizing bibliometric networks, including co-authorship, co-citation, bibliographic coupling, and keyword co-occurrence. Though it does not offer performance analysis (such as h-index tracking or annual publication trends), its value resides in its capacity to generate highly interpretable and visually appealing maps, which are often very vital for network-driven research. Conversely, biblioMagika is more concerned with performance analysis; however, its powers go beyond mere measurements. Reflecting its dashboard capabilities, it provides publishing trend analysis by year, source, author, institution, and country, as well as keyword frequency analysis, Lotka's Law, and identification of highly cited works. Particularly for users without programming abili-

ty, these built-in analytical choices make biblioMagika a useful tool for institutional bibliometric evaluations and literature reviews.

Visualization Types

A cornerstone of bibliometric analysis, visualization helps scientists more naturally understand trends, correlations, and patterns. VOSviewer Science mapping is popular for its effective network-based visualizations, like network maps, overlay maps, and density maps, which are great for exploring co-authorships, keyword connections, and citation links, and it is favored for its flexible and detailed visual results. Though rather less specialized in network aesthetics, bibliometrix/biblioshiny provides a wide spectrum of visualization techniques, including charts, graphs, tables, strategic diagrams, and several kinds of bibliometric maps. Covering a wide range of bibliometric goals, these choices are appropriate for both descriptive and inferential pr sentations. Though Excel-based, biblioMagika offers an unexpectedly useful visualizing arsenal, including line charts, bar and pie charts, dynamic bubble charts, and frequency tables. Particularly for presentations or institutional reporting, these are quite helpful for synthesizing distribution patterns, productivity measures, and publication trends.

Customization Options

Customizing considerably helps align bibliometric data with research goals, formatting limits, and institutional requirements. Bibliometrix/Biblioshiny gives the most customization of the three tools. The core Bibliometrix R package lets R programmers customize display parameters and analytic filters, whereas Biblioshiny, the GUI, offers limited built-in customization. Label, layout, color scheme, data filters, and possibly new analytical methods are included. VOSviewer allows only minor visual customization, such as node size, color gradients, and clustering resolution. Lack of analytical reasoning or interface behavior modifying limits complex usage situations. Though not script-based, biblioMagika enables modest customizing with its dashboard controls. Especially, it lets users use interactive Excel tools to do keyword cleaning, merging, and filtering, thereby streamlining user-driven data improvement. Although not as broad as code-based customizing, this method provides users with looking for simply, point-and-click editing for data harmonization and output presentation some practical flexibility. Bibliometrix leads in extensibility over-

all; biblioMagika in accessibility; VOSviewer stays tuned for quick, consistent visual output with little user configuration.

Ease of Use and Documentation & Tutorial Support

A user's whole experience with bibliometric tools is much influenced by the availability of documentation and tutorials as well as their ease of use. In this regard, biblioMagika stands out as the most user-friendly instrument since it provides a quite simple Excel-based interface that is understandable even for first-time users. But the support materials, user manuals and training boot camps are monetized and accessible via paid options, which can restrict access for institutions or budget-conscious consumers. VOSviewer, by contrast, combines a beginner-friendly interface with free and reliable documentation, including user manuals, video tutorials, and FAQs on its official website. This makes it ideal for newcomers who want to quickly produce network visualizations without complex setup or configuration. While it lacks depth in analysis compared to its counterparts, its simplicity is its strength for rapid visual exploration. Bibliometrix/Biblioshiny offers dual experience: the Biblioshiny web interface is moderately easy to use, while the Bibliometrix R package demands coding proficiency. However, this complexity is well-balanced by the extensive and freely available support ecosystem, which includes detailed vignettes, GitHub repositories, academic papers, video tutorials, and a vibrant user community. For users willing to invest time in learning, it pro vides a rewarding, scalable analytical environment.

Scalability and Performance

Scalability and performance are crucial factors for big bibliomet ric datasets, especially in literature reviews and research mapping over extended timeframes. VOSviewer excels in this area since it is geared to handle huge datasets without sacrificing responsiveness. Its lightweight Java-based architecture speeds visual rendering and data parsing even with tens of thousands of records, making it perfect for large-scale scientometric studies. Bibliometrix/Biblioshiny performs inconsistently. Shiny GUI slows down with huge datasets, which can hinder workflow during heavy analysis. However, the Bibliometrix R package works well with high-performance computing systems and can process big datasets in code. Scalability is available, but only technically competent users can employ R scripting and computer resourc-

es properly. biblioMagika prefers small to mid-sized datasets. Because it uses Microsoft Excel, its performance may be restricted by spreadsheet size and computing power.

Unique Features

Each bibliometric tool offers features tailored to analytical priorities and user profiles. Network visualizations and cluster analysis make VOSviewer a popular choice for science mapping. It creates stunning, analytically rich co-authorship, co-citation, and keyword co-occurrence maps. The built-in clustering algorithms reveal field-specific thematic groups and intellectual structures, creating clear visual narratives desired in scholarly communication. However, Bibliometrix/Biblioshiny excels in analytical depth and integrated workflows. It lets users integrate datasets from disparate databases, which is useful for systematic reviews and multidisciplinary investigations. It also offers topic evolution analysis, factorial analysis, and historiographic mapping, which go beyond bibliometric indicators to reveal study fields' temporal growth and cognitive structure. On the other hand, Excel-based simplicity and compatibility give biblioMagika advantages. It excels in data cleaning and harmonization, preparing for VOSviewer or Biblioshiny analysis. Its interface lets users find, fix, and normalize metadata errors before exporting clean datasets to more advanced tools. For researchers without technical backgrounds or who want quick descriptive insights with exportable data, biblioMagika is essential.

Conclusion

In response to the expanding complexity and size of bibliometric research, this paper detailed a structured comparison of three popular bibliometric tools: VOSviewer, Bibliometrix/Biblioshiny, and biblioMagika. The study applied a ten-dimensional evaluative framework to account for researchers' technical capabilities, analytical goals, and visualization needs, therefore offering a balanced, feature-oriented approach. VOSviewer excelled in network visualization, Bibliometrix in analytical depth and flexibility, and biblioMagika in pre-processing efficiency and user accessibility, showing that no single tool is superior. Instead, their usefulness depends on the user's goals, skills, and analysis scale. BiblioMagika, a tool not before thoroughly investigated in scholarly comparisons, is a crucial contribution of this paper. Its Excel-based environment, OpenRefine integration, and VOSviewer and

Biblioshiny compatibility make it useful for novice researchers and resource-constrained researchers. This comparative approach assists researchers, librarians, and information professionals in selecting bibliometric methodologies that align with their research plan, thereby enhancing methodological rigor, transparency, and impact. Future search could incorporate new or commercial platforms to enhance the bibliometric environment, test tool interoperability in real-time procedures, and provide user input.

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