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A Scientometric Analysis of Global Trends in Research Data Management Practices

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Abstract - **Aim: Research Data Management (RDM) has developed as a critical field of scholarly attention in response to the rising significance of data-intensive research, open art initiatives, and the evolving demands of data stewardship.**

Methodology: This theoretical investigation presents an inclusive scientometric examination of global trends, patterns, and thematic developments in RDM research from 2015 to 2024. Drawing data from the Web of Science (WoS) and Scopus databases, this research employed quantitative techniques using tools, such as VOSviewer and Bibliometrics (R-package) to analyze publication volume, citation impact, co-authorship networks, country and institutional contributions, and keyword co-occurrence mapping.

Result: The results indicate a substantial increase in RDM-related publications, particularly after 2015, which is aligned with the proliferation of FAIR data principles and mandates by funding bodies. Thematic clustering revealed key focus areas, including data-sharing policies, metadata standards, digital curation, data repositories, and institutional strategies for research data services. Furthermore, the analysis highlights a shift toward interdisciplinary approaches, involving domains, such as data science, computer science, library science, and health sciences.

Conclusion: This scientometric evaluation provides a foundational understanding of the intellectual and collaborative structure of RDM research, offering actionable insights for researchers, data professionals, and policymakers aiming to enhance research data infrastructure and governance on a global scale.

Keywords: **Global Trends, Research, Data Management, Scientometric Analysis, Thematic Cluster, Bibliometrics**

I. INTRODUCTION

Effectual Research Data Management (RDM) is essential for effective investigation and is widely recognized as a best practice for researchers worldwide. RDM is the process of guiding researchers through the investigative information lifecycle that includes preparation, gathering, examination, publication, preservation, sharing, and reuse (Bhoi et al., 2023). Research data originates from unique investigation effects, publishing investigations, theses and dissertations, and other examination activities. RDM is growing more significant, as seen by the rise of information journals and citations. RDM focuses on data collection, best practices, infrastructure, and services for archiving, preserving, and reusing research data (Chawinga & Zinn, 2021; Helbig, 2016). This solution covers all aspects of data management such as storage, safety, protection, fulfillment, data excellence, and involvement. Researchers require convincing to share their data with institutional repositories due to issues, habits, beliefs, and attitudes toward data management and sharing (Singh et al., 2022). To establish information archives and data distributing policies that recognize investigation data produced at the institutional stage, institutes, and universities should collaborate with researchers and libraries to understand their perceptions and levels of awareness about RDM (Al-Jaradat, 2021; Helbig et al., 2015). RDM promotes open contact with exploration information through repositories, particularly for public-sponsored investigation. In research, sponsoring

organizations have implemented information organization and involvement strategies to ensure proper information management for administration-supported investigation (Masinde et al., 2021; Herres-Pawlis et al., 2022). Although various mandates and regulations have been adopted by recognized funding agencies and, more specifically, in certain rich nations, the guidelines, information administration measures, and transportation are trailing in the majority of poor countries (Chawinga & Zinn, 2020; Herres-Pawlis et al., 2020). Due to the deficiency of tactical plans by exploration sponsoring organizations, particularly the necessity for researchers to deposit data in repositories (Onorato et al., 2024). This is exacerbated by a need for supporting determination, resolve, and directives from the direction of investigation information organization that impedes the provision and execution of RDM packages in the popular nations and foundations (Huang et al., 2021; Johnston, 2019). The research aims to analyze global trends in RDM from 2015 to 2024 using scientometric methods. Drawing from Scopus and Web of Science (WoS), it employs Visualization of Similarities Viewer (VOSviewer) and bibliometric to examine publication trends, collaboration networks, and thematic focus areas, providing insights into the evolution of RDM practices and informing future research infrastructure and policy development (Khyade & Wanve, 2018; Anada, 2020; Alves et al., 2018; Amorim et al., 2015; Amorim et al., 2017; Johnston et al., 2018; Jones et al., 2020; Karimova et al., 2021).

II. Related Works

Li et al., (2021) utilized a scientometric technique to examine research trends in Grassland Remote Sensing (GRS) across 2,692 publications indexed in SCI-E from 1980 to 2020. Document analysis, keyword analysis, and co-citation analysis were used to investigate research fields, institutions, authors, and future directions (Mancilla eta l., 2019; Miksa et al., 2018; Miksa et al., 2019). The findings demonstrated a large increase in GRS publications, dominated by subjects in remote sensing, ecology, and environmental sciences, with key contributions from the Chinese Academy of Sciences and authors, such as Guo X.L. Limitations include reliance on a single database and the exclusion of non-English literature (Bishop et al., 2019; Donaldson & Knight, 2018; Parham eta l., 2016).

Gurcan et al., (2023) revealed patterns in business intelligence research over the last 20 years using topic modeling. It highlighted 36 major subjects, including Artificial Intelligence (AI), big data, and visualization, as well as a taxonomy map. While it provided useful insights for researchers, its disadvantage was its reliance on current literature, which resulted in neglecting developing or underrepresented topics. Thavorn et al., (2021; Read et al., 2020; Read et al., 2021) analyzed global coronavirus research collaboration and identified China and the United States as key contributors at national, organizational, and individual levels. Using scientometric methods and Vantage Point software. The findings demonstrated strategic Research and development (R & D) planning but were limited by reliance on a single database and the potential omission of broader global contributions (Bishop et al., 2020; Goben & Griffin, 2019).

Regina et al., (2023) leveraged VOSviewer to conduct a scientometric analysis of 3710 papers from 2000 to 2023 to investigate AI's involvement in building sustainability. The findings demonstrated consistent growth, the dominance of Machine Learning (ML), and tremendous AI potential in the economic governance and design phases. One limitation was the use of scopus-only statistics along with the exclusion of non-indexed or gray literature. Nawaz et al., (2023) performed a scientometric examination of building waste management research from 2013 to 2022, identifying active authors, nations, and significant research areas. It focused on trends in demolition, sustainability, and recycling. The research's drawback was its dependence on Scopus-indexed articles, which excluded crucial grey literature and other important research contributions (Bryant et al., 2017; Bryant et al., 2017; Schöpfel et al., 2020; Schöpfel et al., 2018; Searle et al., 2015; Searle et al., 2015).

Zhuang et al., (2022) examined worldwide research trends in Environmental Health Inequalities (EHI) from 1970 to 2020, utilizing 12,320 articles. The scientometric and content analysis found major topics and trends, indicating increased research effort, particularly in environmental fields. The paper presented a conceptual framework but it was constrained by its emphasis on a single database (Carlson et al., 2015; Goben & Raszewski, 2015; Simm et al., 2016; Tenopir et al., 2020; Tenopir et al., 2020; Teperek et al., 2017).

Umeokafor et al., (2022) provided a scientometric examination of building health and safety research in expanding nations over a 31-year period to identify trends, gaps, and future directions. The findings showed that certain nations, including China and South Africa, were growing, while others were underrepresented. It underlined the need to do qualitative research and explore Industry 4.0 in health and safety. Lv et al., (2021) examined intercropping research from 1992 to 2020 using the WoS database. It identified the leading authors, organizations, and nations, displaying four research clusters. Key findings included a rise in publications, with Lal 2004 being the most referenced work. Limitations include potential database biases and regional representation (Cox & Tam, 2018; Van Wyk, 2020).

Yang et al., (2021) used CiteSpace and VOSviewer to examine 3314 papers on urban floods published between 2006 and 2021. Climate change and urbanization have led to a shift away from hydrological processes toward municipal storm-water organization and low-influence growth, according to the findings. Limitations include reliance on current databases and the necessity for region-specific research. Li et al., (2022) utilized scientometric approaches to examine 17,153 smart home-related papers published between 2000 and 2021. The findings indicated sustained expansion, with research focusing on home automation, AI, the Internet of Things (IoT), energy management, and

healthcare. IoT was the dominating technology, but urban and social components were underexplored, restricting a full smart city approach (Cox et al., 2017; Van et al., 2020; Whitmire, 2015).

Current scientometric studies often rely on single databases and English-only sources, overlooking emerging topics and regional contributions. They lack interdisciplinary focus, advanced analytical methods, and actionable insights for policy. Most are purely quantitative, missing qualitative depth. These limitations highlighted the need for inclusive, multi-method approaches to better capture global research dynamics and inform practical applications (Donaldson, 2018; Whitmire et al., 2015).

III. METHODOLOGY

This research utilizes a scientometric examination to evaluate global trends in RDM from 2015 to 2024. Data was obtained from WoS and Scopus and then reduplicated. VOSviewer software was employed to map and visualize co-authorship prototypes across authors, institutions, and nations. Fig. 1 represents the methodological flow.

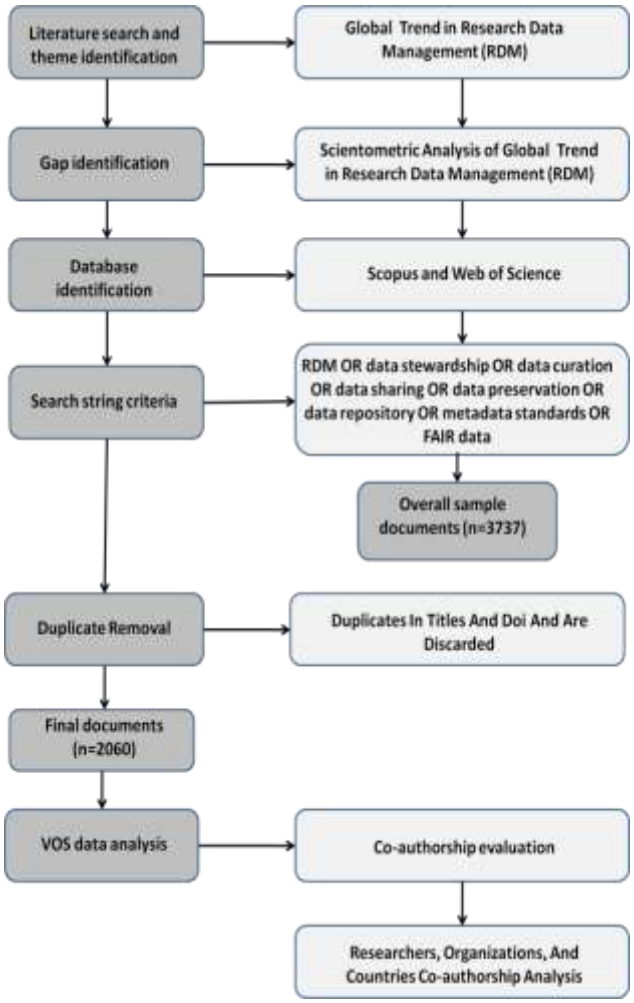

Fig. 1 Methodological Flow

Data Collection

This research examines global research on RDM during 2015-2024, using Scopus and WoS Core assortment datasets. Scopus and WoS databases yielded 1877 and 1860 publications, respectively, focusing on articles, conference papers/proceedings papers, book chapters, reviews, and editorials. The data was obtained on December 29, 2024.

This analysis included all forms of published materials. The following superior investigation inquiries are performed in every record to acquire the desired results:

The authors identified 7 titles that are available twice in diverse journals and are not measured duplicates. Out of a sum of 3737 merged data files (1860+ 1877=3737), 1477 (39.54%) are found to be duplicated in titles and DOIs and are discarded, leaving a sum of 2260 journals for this research. Few documents in the WoS gathered folder are categorized as both Article & Book Chapter and Article & Proceedings Paper but they are only regarded as Proceedings Paper and Book Chapter respectively.

Data Analysis

The research's scientometric analysis is conducted using VOSviewer in an R-package environment, freely available software. VOSviewer software is known for its responsive graphical representation, resulting in clear bibliometric maps. The software is useful for combining activity-yielding and relationship-indicator analysis, which is common in scientometric analyses. Thus, VOSviewer is used to create a network map of author co-authorship, organization/institutional co-authorship, and country co-authorship. The network maps provide insight into the research influence of RDM learning materials by highlighting productive authors, notable institutions, countries, and research trends. To create a clear network map, modify the visualization scale and size variation based on the required threshold. The threshold will be identified in each phase of the research. The size of a node determines its contribution, whereas relatedness is represented by lines. The color in co-authorship indicates similarity and association, whereas in co-occurrence, it represents the year of publication.

IV. RESULT

This section uses bibliometric data from Scopus and WoS to examine publication trends in RDM from 2015 to 2024. It includes an analysis of annual publication counts, percentage growth rates, and a combined dataset to identify broad trends. The section also discusses the distribution of document kinds, author productivity, institutional output, and national contributions.

Literature Growth

Table I displays global publications on research data management from 2015-2024. Annual percentage growth

rates for Scopus, WoS, and combined data files are 49.78%, 50.24%, and 60.47%, respectively. Fig. 2 displays the global growth patterns in research data management publications from 2015 to 2024 for Scopus, WoS, and merged files.

TABLE I RDM PUBLICATIONS

Year	WOS	Scopus	Merged documents
2015	200	140	235
2016	195	130	213
2017	210	160	269
2018	205	155	283
2019	220	165	277
2020	190	140	233
2021	175	120	199
2022	170	110	205
2023	165	105	201
2024	130	95	145
Total	1860	1877	2260

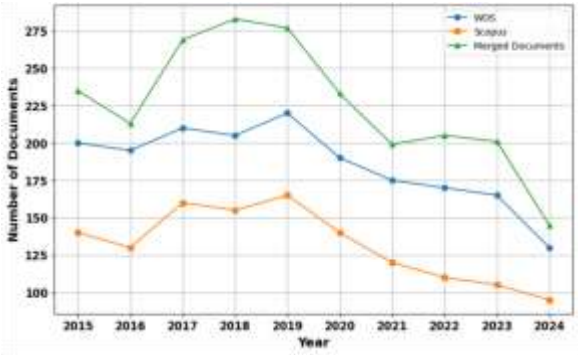

Fig. 2 Annual Literature Growth

WOS routinely shows larger document counts than Scopus, with a peak in 2019 and then a slow fall. Scopus likewise has a diminishing tendency, with its document count slowly dropping from 2019 to 2024. The combined number of papers follow this pattern, peaking at 277 in 2019 before declining sharply to 145 by 2024. This implies that the period from 2017 to 2019 witnessed the most research production, followed by a significant decrease in indexed papers across both databases. The pattern points to a probable shift in research activity, indexing priorities, or database coverage strategies over time.

Document Types

In academic research, categorizing publications into distinct document categories is critical for understanding the organization and concentration of scholarly output on a certain topic. Articles, conference papers, book chapters, reviews, and editorials are the most popular document types used in bibliometric analysis. Each of these sorts serves a certain purpose in the diffusion of knowledge. Analyzing the distribution and frequency of these document formats in studies of RDM reveals important information about the discipline's evolution, the focal areas of scholarly activity, and knowledge-sharing mechanisms within the academic community. Table II and Fig. 3 demonstrate the article kinds in the RDM research.

TABLE II DOCUMENT TYPES

Document types	Scopus	WOS	Merged
Article	820	610	2065
Conference paper	210	120	10
Book chapter	80	60	139
Review	85	80	32
Editorial	30	22	14
Total	1225	892	2260

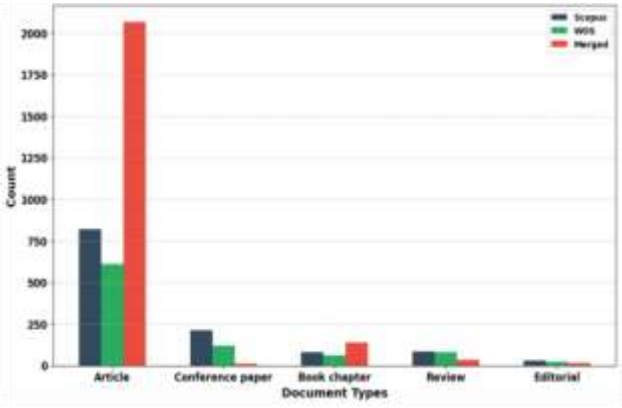

Fig. 3 Document Types

WOS routinely shows larger document counts than Scopus, with a peak in 2019 and then a slow fall. Scopus likewise has a diminishing tendency, with its document count slowly dropping from 2019 to 2024. The combined papers follow this pattern, peaking at 262 in 2019 and declining dramatically to 126 by 2024. This implies that the period from 2017 to 2019 witnessed the most research production, followed by a significant decrease in indexed papers across both databases. The pattern points to a probable shift in research activity, indexing priorities, or database coverage strategies over time.

Co-authorship Analysis

One of the most used scientometric examination functions is co-authorship mapping. A reliable technique is used to map and analyze co-authorship networks, identifying scientific relationships and behavioral trends. Co-authorship analysis reveals behavioral patterns across writers, researchers, organizations, and countries. The analysis identifies cooperation structures with renowned academics, areas of interest within the topic field, and network players' centrality. It also provides insight into future research possibilities. It acknowledges the contributions of organizations and governments in advancing research in a certain field. The research used co-authorship analysis to map the network of authors, organizations, and countries involved in global trends in RDM research collaborations. The co-authorship mapping uses a nominal threshold for author, organization,

and country categories. Eliminating authors, organizations, and nations with fewer articles improves readability and clarity in network visualizations. To choose the ideal threshold, multiple iterations are performed to identify the clearest visualizations. Articles having many authors, organizations, and nations are counted as a whole, rather than proportionally, to measure their effect through link strength. Eliminations and removals will be detailed in each area, with explanations provided.

- *Authorship Analysis*

It is a bibliometric technique that investigates the contributions, collaborations, and influence of individual authors on a certain research subject. It entails analyzing publication productivity, citation counts, and co-authorship networks to discover significant researchers and patterns of scholarly collaboration. This analysis also examines authorship patterns across time, regional and institutional ties, and subject areas of competence. Authorship analysis provides unique insights into a research field's intellectual structure and social dynamics to recognize outstanding contributors, create academic alliances, and drive research policy and strategy. Table III and Fig. 4 show the top 20 authors with the most publications across Scopus and WoS. Additionally, the table displays the writers' h-indexes.

TABLE III AUTHORSHIP ANALYSIS

Author	Number of publications
Ganshorn, H	17
Bishop, B	13
Whitmire, A.L	12
Goben, A	12
Donaldson, M	11
Schöpfel, J	11
Carlson, J	10
Riberiro, C	10
Bryant, R	10
Castro, J.A	10
Cox, A.M	10
Searle, S	10
Johnston, L.R	10
Herres-Pawlis, S	9
Miksa, T	9
Teperek, M	9
Jones, S	9
Tenopir, C	9
Helbig, K	9
Van Wyk, J	9

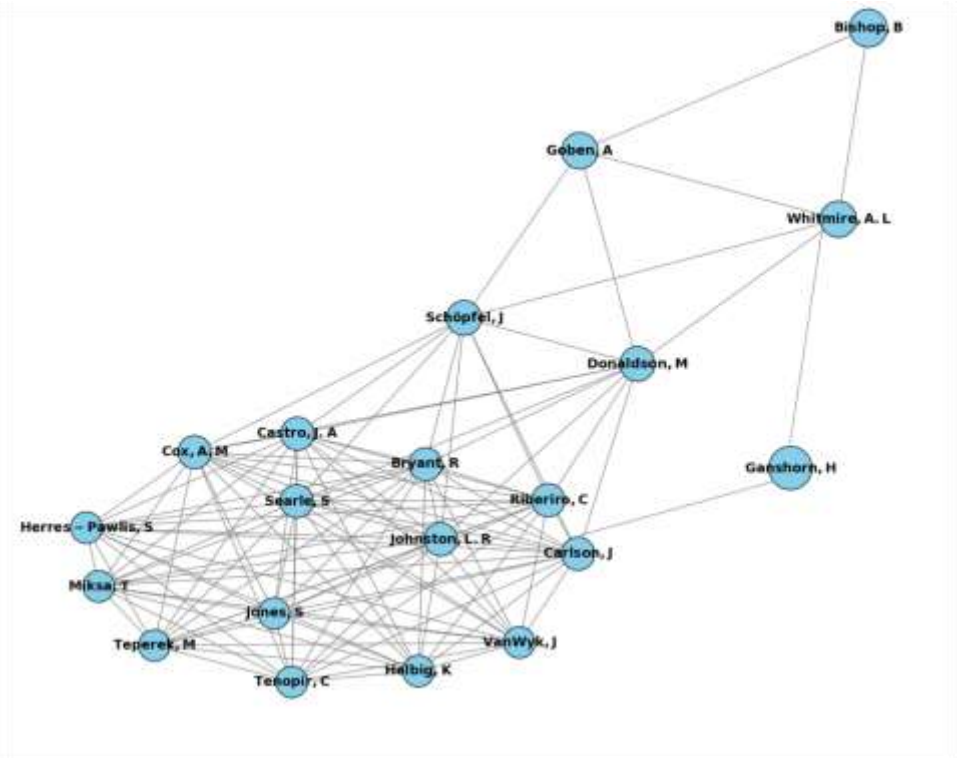

Fig. 4 Top Productive Authors

The research identified the top 20 contributors to RDM literature from 2015 to 2024, including prolific authors and those with considerable citation impact. The results show that Ganshorn, H is the most prolific author, with 17 publications, showing a leadership role in the research domain. Bishop, B (13 publications) is the second-highest contributor, followed by Whitmire, A.L and Goben, A, each with 12 publications. The majority of authors especially those with nine or ten publications form a core group of continuously active contributors, indicating a equal distribution of academic

production among peers. This trend reflects a collaborative and productive research environment in which a small number of key individuals may play central roles in publishing networks. The data also suggests avenues for further investigation into co-authorship patterns and theme study clusters among these writers.

- *Organisations/Institutions*

Affiliations	Documents
University of Illinois Urbana-champaign	10
Universidade do porto	10
University of Tennessee at Knoxville	10
Digital curation center	9
University of Sheffield	9
Technischeinformationsbibliothek (TIB)	8
National institutes of health	7
INESC TEC	7
Delft university of technology	7

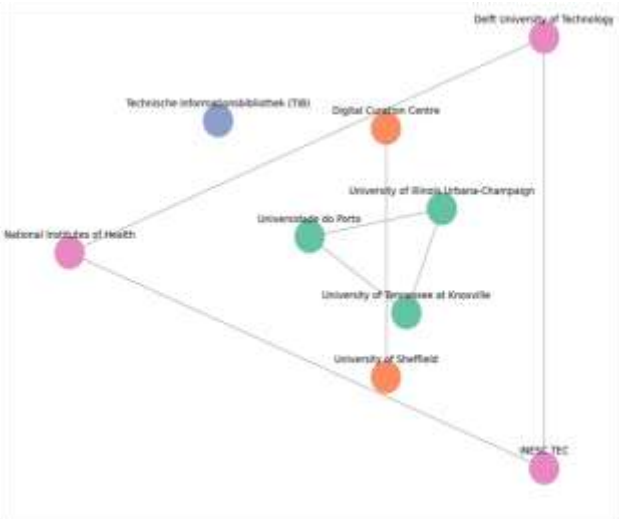

Fig. 5 Network Visualisation for Productive Institutions

A core cluster of the University of Illinois at Urbana-Champaign, Universidade do Porto, and the University of Tennessee at Knoxville demonstrates considerable reciprocal collaboration. Institutions such as the Digital Curation Centre and the University of Sheffield act as bridges, linking key collaborators to larger networks. Meanwhile, institutions such as the National Institutes of Health, Delft University of Technology, and INESC TEC look on the outside yet maintain important strategic relationships, implying specialized or high-level engagement. The Technische Informationsbibliothek (TIB) appears to be less linked, which might indicate theme or infrequent participation. Overall, the graph depicts a partly integrated yet strategically linked multinational research network, maybe centered on digital curation or research data management.

Table IV highlights the top 9 most productive institutions in the worldwide research context for global trends in RDM. The analysis identifies top-performing research organizations based on the number of journals and geographic location. Fig. 5 shows a network visualization map that identifies research collaboration within organizations with at least 15 papers per organization.

TABLE IV PRODUCTIVE INSTITUTIONS IN THE WORLDWIDE RESEARCH

- *Countries*

The analysis focused on the author's affiliated nation's technical invention in Scopus and WoS databases. Table V and Fig. 6 show the top 20 countries' contributions to worldwide research data management literature from 2015 to 2024.

TABLE V COUNTRIES ON SCIENTIFIC PRODUCTION

Countries	Documents
USA	510
Germany	213
Belgium	148
UK	102
Netherlands	67
Canada	66
Australia	56
Italy	49
China	44
France	36
Belgium	34
Spain	31
South Africa	30
Finland	30
Norway	30
Portugal	29
Austria	26
Brazil	26
Switzerland	24
India	21

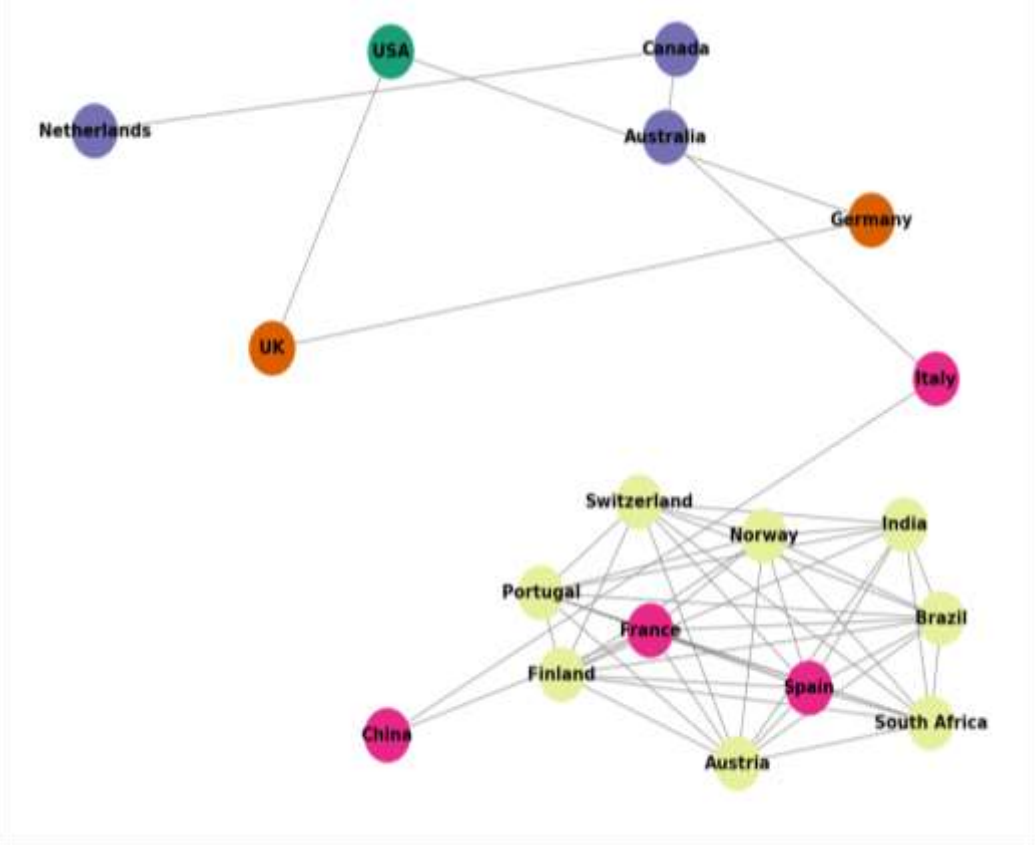

Fig. 6 Countries' Collaboration in Scopus and Wos

The graph shows two prominent clusters: one containing the USA, UK, Australia, Canada, and Germany, indicating strong transatlantic and Anglosphere research ties, and another denser cluster containing European and BRICS nations, such as France, Spain, China, Brazil, India, and South Africa, indicating significant cross-national collaboration within this group. Countries such as Switzerland, Portugal, and Norway appear to be closely integrated inside the European Union, indicating close regional research cooperation. The Netherlands and Italy connect both clusters, perhaps serving as bridges. Overall, the graphic depicts a global research network with a regional focus, where both transcontinental and intra-European collaboration is critical to scientific production.

Keyword Co-occurrence

Co-occurrence network diagrams assist in understanding the frequency with which terms appear in a certain situation. Co-occurrence analysis is useful for text-mining, determining the frequency of texts across time. Co-occurrence networks are mostly utilized to uncover research trends through keyword analysis in research. Table VI displays the top 15 most commonly used terms in RDM literature published internationally between 2015 and 2024. The keywords are shown from left to right. Fig. 7 shows the frequency and connection strength of terms from the bibliographic data, along with a timeframe. These graphics offer further insights regarding the Co-occurrences of each keyword and reflect the study emphasis across the chosen period.

TABLE VI MOST POPULAR KEYWORDS

Keywords	Frequency
Research data	344
Data Sharing	320
RDM	294
Data management plan	237
Open science	120
Best practice	105
Scholarly communication	105
Digital curation	97
Presentation	73
Stewardship	67
Data governance	65
Data access	52
discipline	46
Digital preservation	43
Survey data collection	42

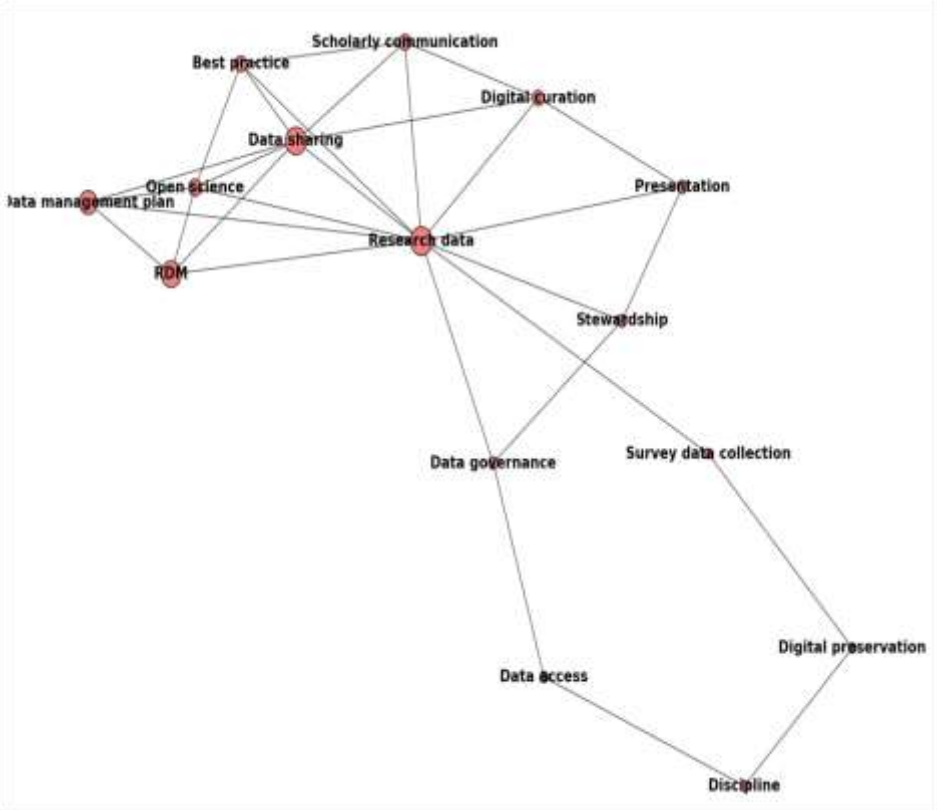

Fig. 7 Keyword Co-occurrence Network

The network visualization depicts the thematic structure of RDM using interconnected keywords. Research data emerges as the major node, demonstrating its fundamental relevance in the area. Core emphasis areas are indicated by strongly related phrases, such as data sharing, RDM, data management plan, and open science. Peripheral but related themes, such as Digital preservation, Survey data collection, and Discipline indicate expanding but less integrated issues. The obvious grouping and lack of overlapping labels improve interpretability, exposing a well-organized ecosystem of RDM research themes while also giving important insight into the conceptual links that shape the current scholarly debate.

V. DISCUSSION

This research investigated global developments in RDM over the last decade using secondary data. The number of publications on RDM has decreased dramatically and quadrupled in the past five years. According to the findings, the most dominating fields driving RDM research were computer science and library and information science, followed by science and technology, educational research, social sciences, and management. This increase reflects the growing importance of RDM techniques across a variety of fields, with a focus on cloud storage, open contact, and educational repositories, which have played a major role in RDM growth. Interestingly, despite its increasing research output in RDM-related publications. However, research indicated that RDM examinations were in their beginnings in developing countries, emphasizing the need for library professionals to enhance their abilities to face future data management difficulties. Furthermore, this research found that wealthy nations were setting the standard for RDM practices and examinations, while poorer countries must improve their RDM infrastructure. The research also found that social science investigators were more likely to allocate information than their counterparts in the life sciences. Key RDM areas mentioned include data sharing, RDM, data management plan, and open science. These findings emphasized the consequence of global association and the creation of standardized frameworks for improving RDM services, particularly in underrepresented regions.

VI. CONCLUSION

The research examined global trends in RDM during the previous decade, utilizing secondary data from Scopus and WoS. The data revealed a large decrease in RDM publications, notably in subjects, such as Computer Science and Library and Information Sciences. Notably, some countries were at the forefront of RDM research, with India exhibiting significant growth in the sector. RDM methods were increasingly focused on cloud storage, open contact, and institutional archives, which contributes to the advancement of global data management standards. Despite these advances, one weakness of this research was its heavy reliance on database searches, potentially overlooking non-indexed articles and regional studies that could offer a broader perspective on RDM. Furthermore, while the

research identified patterns in rich nations, it fell short of addressing the infrastructural issues that underdeveloped countries confront when adopting RDM services. Future research should focus on the impact of RDM techniques in developing countries, identify impediments to implementation, and propose methods to overcome these obstacles. Future research should also examine the long-term influence of cross-country collaborations on RDM's global advancement.

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