

# VIRTUAL HORIZONS: A BIBLIOMETRIC EXPLORATION OF METAVERSE LIBRARIES

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**Abstract:** This study examines the emerging domain of metaverse libraries through a bibliometric lens, using Scopus and Web of Science data analysed via Biblioshiny of metaverse libraries, provides a thorough bibliometric examination of the subject. Through the creation of immersive, accessible, and engaging environments, the metaverse—a communal virtual realm enhanced by technologies like virtual reality (VR) and augmented reality (AR)—is completely changing the way that libraries provide their services. This study uses bibliometric techniques to evaluate the growth and influence of academic research in this field by examining important research hotspots, major contributors, and trends. The study uses data from Scopus and Web of Science to identify growth patterns, significant institutions, and leading countries in this discipline. The findings show a substantial growth in publications after 2022, with a significant concentration of research efforts in select journals and institutes. The analysis also emphasizes the importance of important phrases like "metaverse," "virtual reality," and "digital libraries" and provides insights into worldwide collaborative networks. This study intends to influence future research and inform the growth of virtual libraries.

**Keywords:** Augmented Reality, Bibliometric Analysis, International Collaboration, Library Science, Metaverse Libraries, Virtual Reality

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## 1.0 Introduction to Metaverse Library

The surfacing of the metaverse, has collectively significant impact on various aspects of society, it has communal of virtual shared space including the area of of library science. Metaverse libraries have unmatched chances to reinvent the conventional library experience by commercializing technologies like virtual reality (VR) and augmented reality (AR). These virtual libraries offer realistic settings where users can engage with digital collections and take part in educational activities from any place, with the goal of improving user engagement, accessibility, and resource management. The metaverse concept has received significant interest in recent years, owing to breakthroughs in VR, AR, and blockchain technology. Libraries, as centers of knowledge and community participation, are investigating how to incorporate new technologies to better serve their clients. Library science is one of several disciplines that will be significantly impacted by the paradigm shift brought about by the creation of the metaverse, a huge network of connected virtual worlds. The idea of the Metaverse library has started to take shape as libraries look into how to include immersive technology like augmented reality (AR) and virtual reality (VR). Improved accessibility, interactive learning settings, and worldwide connectivity are some of the ways that these virtual libraries promise to transform traditional library services.

## 2.0 Significance of Bibliometric Study in Metaverse Libraries

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**Mr. Vikrant Dubey, Ms. Manisha Joshia and Prof. Shilpi Verma: Virtual Horizons: A Bibliometric Exploration Of Metaverse Libraries**

Bibliometric studies lay out useful insights into the evolution and effect of academic research by examining publishing trends, citation patterns, and the contributions of key authors and organizations. In the context of Metaverse libraries, a bibliometric approach enables us to carefully analyze the present level of study, identify important themes and influential publications, and chart the evolving field.

This study aims to conduct a comprehensive bibliometric analysis of research related to Metaverse libraries. The focus of this analysis is to identify key contributors, detect trends in research output, and highlight important areas of attention and research shortages by looking at academic publications and citation data. Comprehending these processes is essential for directing upcoming studies, influencing practice, and influencing the evolution of virtual libraries. Through this exploration, we hope to shed further light on the development of the area of Metaverse libraries and give useful information for scholars, practitioners, and policymakers who are interested in the nexus between library science and virtual environments.

This study employed a bibliometric analysis to examine current trends and identify potential areas for future research.

**2.1 Limitations of the study:** This study has various limitations that should be recognized. For starters, the analysis is limited to papers available in Scopus and Web of Science, which may exclude significant research indexed in other databases. Furthermore, the emphasis on English, Chinese, and Italian publications may overlook important contributions published in other languages. The study also depends on bibliometric data, which may not adequately capture the qualitative impact and new trends in the subject. Finally, while the study identifies key patterns and contributions, it does not go into the exact content and quality of individual studies, which could provide more information about the field's development and obstacles.

### 3.0 Objectives

The following objectives guide the study:

1. To identify and evaluate the global research trends, leading contributors, and publication growth in the domain of metaverse libraries using bibliometric indicators such as publication frequency, h-index, and citation analysis.
2. To analyze the thematic structure and intellectual landscape of metaverse library research through keyword co-occurrence, hotspot mapping, and co-authorship network analysis.
3. To investigate the practical implications and potential of integrating immersive technologies (VR, AR) in library systems by synthesizing bibliometric findings into actionable recommendations for researchers and policymakers.

### 4.0 Research Methodology

This study uses bibliometric tools to examine research articles in the field of metaverse libraries, with the goal of identifying existing trends and potential topics for future research. Bibliometric analysis is the quantitative examination of bibliographic data to identify research patterns (Lu et al., 2021). This methodology, developed in the field of library and information science, has grown in popularity in recent decades (Merigo & Yang, 2017). Bibliometric analyses have been published in a variety of disciplines, including tourism (Leong et al., 2020), social science (Nasir et al., 2020), economics (Bahoo et al., 2021), finance (Goyal & Kumar, 2021), marketing (Gao et al., 2021), library science (Ahamad et al., 2018), environmental science (Guan et al., 2019), psychology (Setiawan, 2022), and management (Rao & Shukla, 2022).

**4.1 Source of Data:** An initial step in bibliometric analysis involves selecting and extracting data from a suitable database. The data source must be relevant and reliable (Rueda et al., 2007). Various databases are available for this purpose, including Scopus, Web of Science, ERIC, PubMed, IEEE Xplore, JSTOR, Directory of Open Access Journals, Elsevier, and Google Scholar. Scopus and Web of Science were selected as the data sources to extract research papers for this paper. The search term "Metaverse Library" was used to retrieve the relevant publications. This study includes publications up to July 2024.

Scopus provides a comprehensive collection of scholarly literature, statistics, and analytical tools that help users stay educated and competitive. The database contains about 94 million records, 29,200 active serial titles, and over 330,000 books. Because of its vast coverage, the researcher considered the Scopus database. Scopus is a

well-known indexing database for scientific publications (Kipper et al., 2020). It includes detailed information about study areas, authors, publication dates, affiliations, countries, keywords, citations, and journal information (Meho & Yang, 2007; Falagas et al., 2008).

The Web of Science platform encompasses Over 225 million records (journals, books, and proceedings), 63 million patent families (over 115 million patents), and over 14 million data sets.

The standards and keywords used in data searches are critical since they have a significant impact on the outcomes (Khan and Mukhtar, 2020). The researcher used the "Metaverse Library" keyword to retrieve information from Scopus and Web of Science. The search only included papers and reviews in science, engineering, social science, arts, humanities, business management, and accounting. Only articles written in English, Chinese, or Italian were examined. A total of 130 papers were discovered, with 93 coming from the Scopus database and 37 from Web of Science. The researcher next went over each article's title, authors, and abstracts, deleting any duplicates. A total of 113 publications were eventually included for examination.

The data was examined with the R program's Biblioshiny. This tool looks into the relationships between authors, affiliations, publications, countries, and popular keywords (Hoppen & de Souza Vanz, 2016). Furthermore, Biblioshiny investigates the relationships between co-authors, affiliations' geographic regions, and co-citation coupling (Khan & Mukhtar, 2020).

**5.0 Data Analysis**

The study included research published until July 2024, and the first piece was written in 2013. Table 1 summarizes the data utilized for bibliometric study. As shown in Table 1, 113 documents from 75 sources, including journals, books, and conferences, were found.

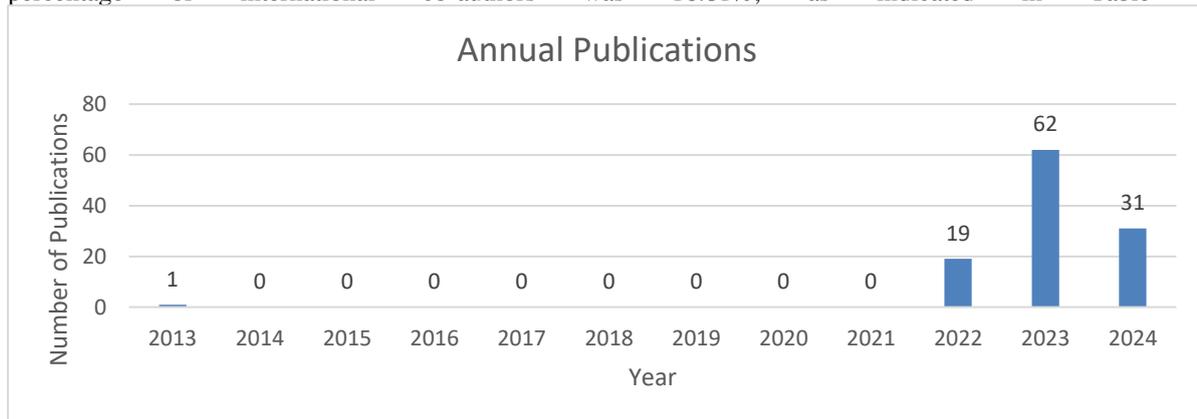
**Table 1:** Overview of Data

Description	Results
<b>MAIN INFORMATION ABOUT DATA</b>	
Timespan	Till July 2024
Sources (Journals, Books, etc)	75
Documents	113
Annual Growth Rate %	36.64%
Document Average Age	0.982
Average citations per doc	2.558
<b>DOCUMENT CONTENTS</b>	
Keywords Plus (ID)	459
Author's Keywords (DE)	380
<b>AUTHORS</b>	
Authors	330
Authors of single-authored docs	19
<b>AUTHORS COLLABORATION</b>	
Single-authored docs	25
Co-Authors per Doc	3.76
International co-authorships %	16.81
<b>DOCUMENT TYPES</b>	
Article	53
article; early access	2
article; retracted publication	1
Book	2
book chapter	9
book review	3
conference paper	23
conference review	3
Editorial	1
Note	3
proceedings paper	3

Review	9
review; early access	1

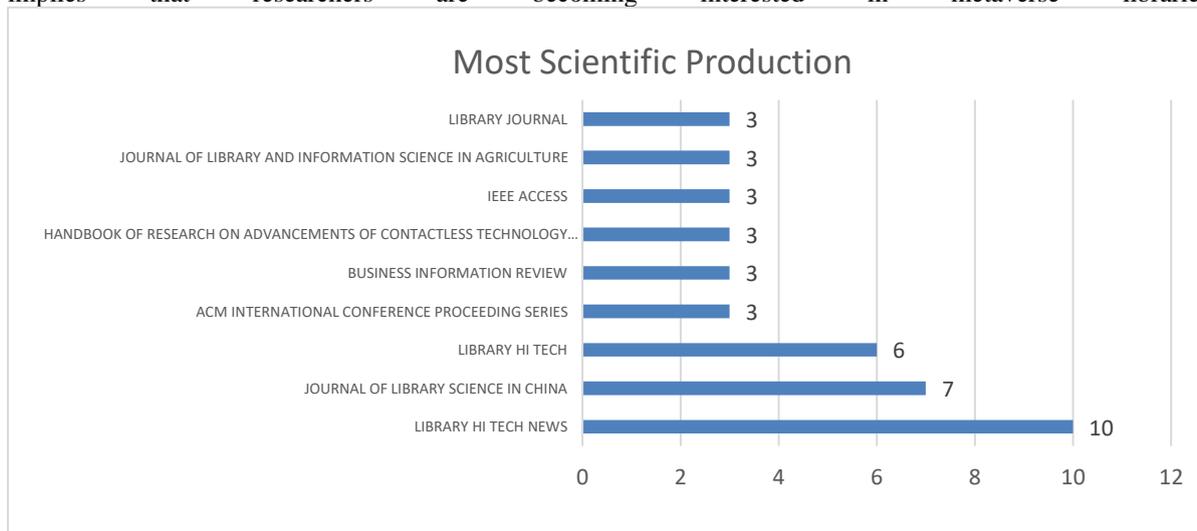
Table 1 shows that the annual growth rate percentage was found to be 36.64%. The average age was 0.982, whereas the average number of citations per document was 2.558. The total of 113 materials that were obtained can be split down as follows: 53 articles, 2 early access articles, 1 retracted publication article, 2 books, 9 book chapters, 3 book reviews, 23 conference papers, 3 conference reviews, 1 editorial, 3 notes, 9 reviews, and 1 early access review.

Keywords are divided into two categories: author keywords, which are provided by the writers, and keyword plus, which is generated automatically by the software. This investigation found 380 author keywords and 459 keywords plus phrases. It was also discovered that 330 authors have contributed to papers in the related topic, with 19 of them being single authored. The average number of co-authors was 3.76 per document. The percentage of international co-authors was 16.81%, as indicated in Table 1.



**Figure 1:** Annual Publication on Metaverse Library

Figure 1 depicts the growing popularity of research into the "Metaverse Library" topic. Over 99.11% of all articles were discovered between 2022 and 2024, demonstrating that interest in metaverse libraries increased after 2021. The majority of these articles (around 54%) were published in 2023. By July 2024, 27.43% of papers had been discovered; in 2022, 16.81% of research publications were documented, and just 0.88% of research publications were published in 2013, resulting in only one research paper. This increased tendency implies that researchers are becoming interested in metaverse libraries.



**Figure 2:** Top 10 most Scientific Production

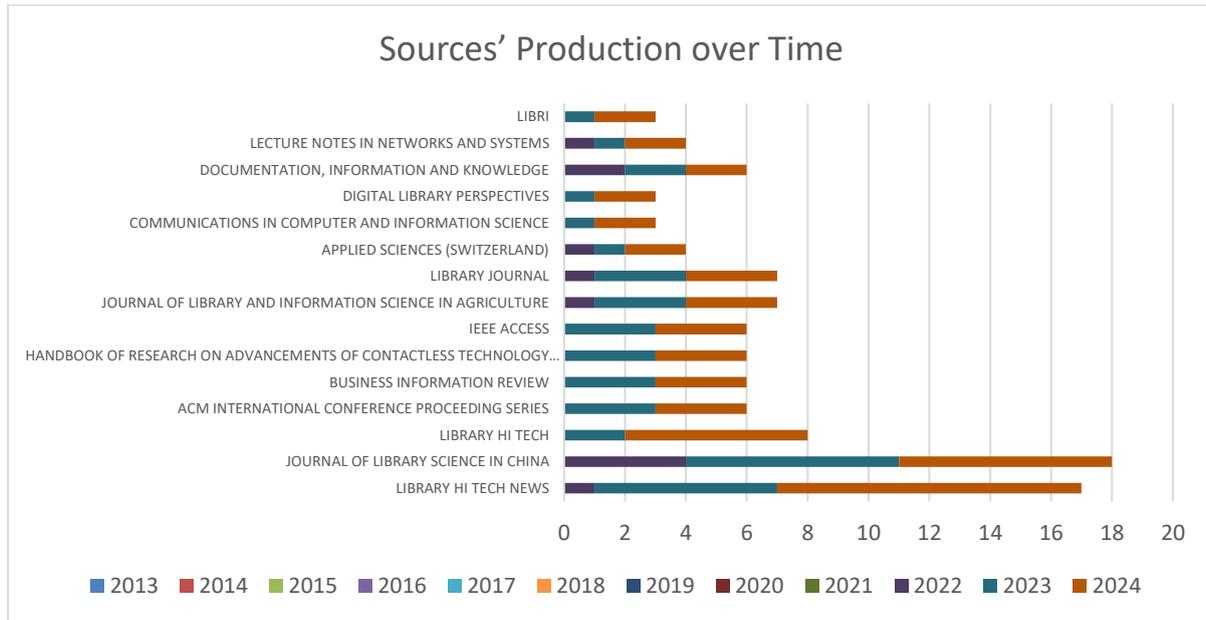


Figure 2.1: Sources' Production over Time

Figure 2.1 demonstrates that the production of Library Hi tech news increased fast in 2024, with 10 publications out of a total of 17. However, the Journal of Library Science in China has released 18 documents as of July 2024, which exceeds the entire number of publications in Library Hi tech news. Library Hi-tech published 8 documents until 2024, and others followed suit.

5.1 Authors' Analysis

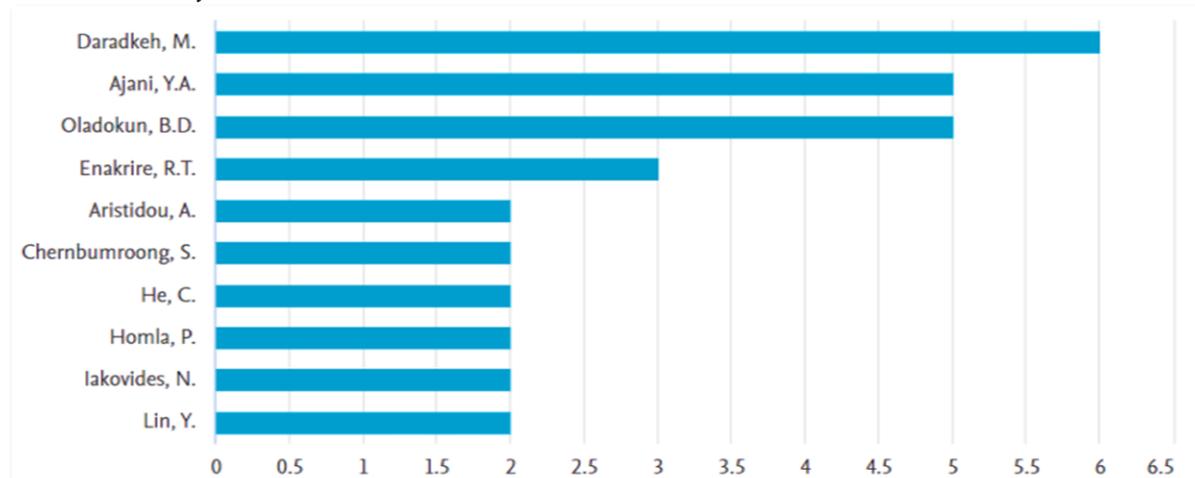


Figure 3: Most Prolific Authors in the Metaverse Library

Figure 3 illustrates the top ten authors; the most published authors and articles were analyzed using bibliometric data. Figure 4 depicts the list of top authors in the metaverse library based on Scopus and Web of Science-indexed articles until July 2023. The top three authors, Daradkeh M, Anjani Y A, and Oladokun B D wrote almost 14% of the articles.

5.1 Source Impact Analysis

Table 2: Source Impact

Element	h-index	g-index	m-index
IEEE ACCESS	3	3	1.5
JOURNAL OF LIBRARY SCIENCE IN CHINA	3	3	1

LIBRARY HI-TECH	3	6	1.5
LIBRARY HI TECH NEWS	3	7	1
2022 IEEE INTERNATIONAL WORKSHOP ON METROLOGY FOR EXTENDED REALITY, ARTIFICIAL INTELLIGENCE AND NEURAL ENGINEERING, METROXRINE 2022 - PROCEEDINGS	1	1	0.333
2022 INTERNATIONAL CONFERENCE ON INTERACTIVE MEDIA, SMART SYSTEMS AND EMERGING TECHNOLOGIES, IMET 2022 - PROCEEDINGS	1	1	0.333
ADVANCES IN SCIENCE AND TECHNOLOGY	1	1	0.5
APPLICATIONS OF NEUROMARKETING IN THE METAVERSE	1	1	0.5
APPLIED SCIENCES (SWITZERLAND)	1	2	0.333
BRAIN SCIENCES	1	1	1

After analysis of Table 2, we found the following conclusions:

- a. Top Performers: The best performer was Library Hi Tech, which had an h-index of 3, a g-index of 6, and an m-index of 1.5. This reflects a higher level of influence and production, particularly given the g-index, which indicates a large number of highly referenced papers. The second-best performer was Library Hi Tech News, which has an h-index of 3, a g-index of 7, and an m-index of 1. This implies a significant influence with a high number of citations.
- b. High Productivity and Impact: IEEE Access and the Journal of Library Science in China have an h-index of three. IEEE Access has a slightly higher m-index of 1.5 than the Journal of Library Science in China, indicating a larger yearly impact for IEEE Access.
- c. Moderate Performers: Applied Sciences (Switzerland) has a g-index of 2, indicating that it has at least some highly cited articles, but its h-index and m-index are significantly lower.
- d. Lower Impact: The 2022 IEEE International Workshop proceedings and the 2022 International Conference on Interactive Media have low h-index and g-index values, with m-indexes indicating very low annual impact.
- e. Specialized Publications: Advances in Science and Technology and Applications of Neuromarketing in the Metaverse have moderate m-indexes of 0.5, indicating some consistent impact over time, but their h-index and g-index values are low.

Library Hi Tech and Library Hi Tech News are the leading sources of impact and productivity in the Metaverse Library field based on the provided data.

**5.2 Keyword analysis:** A keyword analysis seeks to find the most commonly used phrases and terms in article titles, abstracts, and keywords. Figure 4 shows an analysis of the top 50 terms. It shows the ten most frequently used keywords: metaverses (frequency 32), virtual reality (frequency 21), digital libraries (frequency 16), augmented reality (frequency 13), libraries (frequency 5), blockchain (frequency 4), learning systems (frequency 4), library services (frequency 4), students (frequency 4), and virtual worlds (frequency 4). The keyword metaverse Library became popular once it was included in the Scopus and Web of Science database search parameters.



**5.4 Affiliation analysis**

The most significant affiliation is determined by the institution's article productivity. Table 3 lists the top ten most relevant institutions from among 113 papers. Table 3 shows that Chiang Mai University is the most prolific contributor, publishing 12 articles and accounting for 10.61% of the total publications in the Metaverse Library collection. Following closely, the University of Ilorin has published seven publications, accounting for 6.19% of the total. Zhejiang Normal University also contributes a major contribution with 6 papers, accounting for 5.30% of the total documents.

**Table 3:** Most Relevant Affiliations

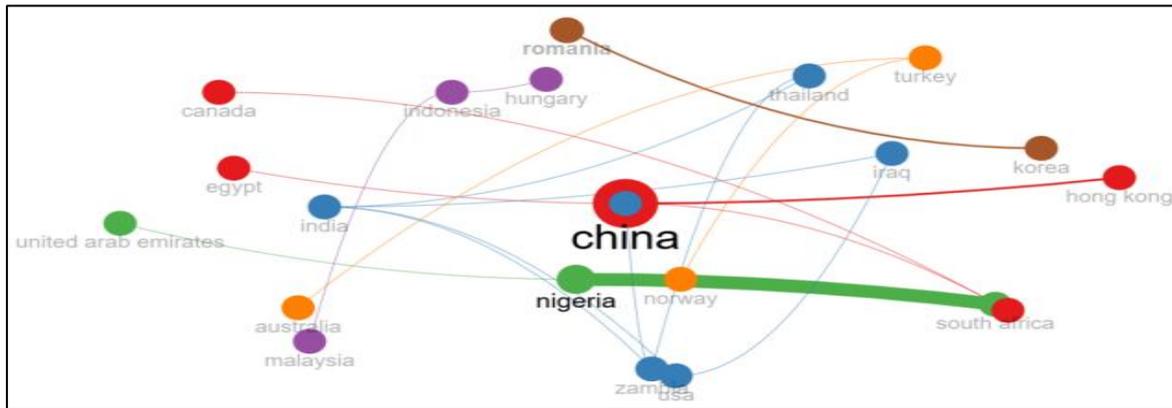
Affiliation	Articles	Percentage (%)
CHIANG MAI UNIVERSITY	12	10.61
UNIVERSITY OF ILORIN	7	6.19
ZHEJIANG NORMAL UNIVERSITY	6	5.30
LIÈGE	5	4.42
NANJING UNIVERSITY	5	4.42
UNIVERSITY OF SOUTH AFRICA	5	4.42
ZHENGZHOU UNIVERSITY OF AERONAUTICS	5	4.42
FEDERAL UNIVERSITY OF TECHNOLOGY	4	3.54
PEKING UNION MEDICAL COLLEGE	4	3.54
POLITECNICO DI TORINO	4	3.54

**5.4 Countries collaboration analysis**

To improve international collaboration, a country collaboration network is being established. This study used the biblioshiny program, with the requisite number of edges set to 2 and the number of nodes set to 50 to represent the top 50 participating countries. According to the data, just 22 countries took part in at least two collaborations. Figure 6 depicts the six clusters generated, with the top two being red and blue.

After analysing Figure 6, Some Key Findings as follows:

- a. Top Collaborating Countries: The study determined that the top five nations based on Page Rank and proximity measures were Egypt, China, Canada, Hong Kong, and the United Kingdom. These nations' prominent positions in the network of collaborations demonstrate their considerable clout and influence in the international scientific community.
- b. Clusters:
- c. Red Cluster: Dominated by key players such as China and the United Kingdom, this cluster highlights strong collaboration ties within these nations.  
 Blue Cluster: Includes significant contributors like Canada and Hong Kong, showcasing their vital role in fostering international research partnerships.
- d. Network Structure: The network structure, depicted in Figure 7, reflects the interconnectedness of these top collaborating countries. The size and color of the nodes represent the frequency and strength of collaborations, with larger nodes indicating higher levels of participation and influence.



**Figure 6:** Countries collaboration analysis

The analysis of the country collaboration network emphasizes how important some nations are to the world of research. Significant international cooperation was made possible by the emergence of China, Canada, Hong Kong, the United Kingdom, and Egypt as key hubs. Strong regional and global links are necessary to advance research and innovation, as evidenced by the establishment of various clusters. Strategies to improve international research partnerships and advance scientific advancement and knowledge exchange can be devised by comprehending these collaboration patterns.

### 6.0 Conclusion

The bibliometric analysis reported in this study highlights the dynamic and ever-changing character of research in metaverse libraries. The findings show a large increase in scholarly output beginning in 2022, reflecting increased interest and investment in this creative sector. Key institutions including Chiang Mai University and the University of Ilorin have emerged as major providers. At the same time, nations such as China, Canada, Hong Kong, the United Kingdom, and Egypt are recognized as key actors in the global collaborative network. The analysis of keywords and co-occurrence patterns indicates major research hotspots as well as the interconnection of key concepts like the metaverse, virtual reality, and digital libraries. These insights offer a valuable framework for understanding current trends and guiding future research directions in the realm of virtual libraries.

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