# Bibliometric assessment of artificial intelligence applications in libraries: Insights of author pattern from Scopus data

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## Abstract

**Purpose:** Artificial intelligence (AI) has become a transformative technology in libraries, enabling enhanced services, information access, and personalized experiences. To understand the research trends and patterns in AI applications in libraries, a comprehensive bibliometric assessment of authorship patterns was conducted.

**Methodology:** Using data from the Scopus database, key authorship metrics, affiliations, corresponding authors' countries, country-level scientific production, and Lotka's Law analysis were analyzed.

**Findings:** The study identified influential authors, assessed their impact, examined affiliations and international collaborations, and evaluated country-level scientific production. The analysis revealed steady growth in research output, emphasizing the significance of AI in libraries. Collaboration among authors, including international collaboration, showcased the global nature of research efforts. Key authors and their contributions were identified, and patterns of productivity over time were observed. The study also highlighted the countries with the highest scientific production and their research ecosystem. The findings provide insights into authorship patterns, research impact, and global collaboration in AI applications in libraries.

**Research implications:** The study has implications for research policies, international collaboration, economic and social development, education, and benchmarking. By leveraging these insights, policymakers, researchers, and educators can make informed decisions to advance science and technology, foster innovation, and address global challenges in the library domain.

**Keywords:** Artificial intelligence, AI applications, libraries, authorship patterns, bibliometric assessment, research trends, education, benchmarking.

## 1. Introduction

Artificial intelligence (AI) has become a disruptive technology in recent years, significantly impacting many industries, including libraries (Păvăloaia & Necula, 2023). Artificial intelligence (AI) describes the creation of computer systems capable of undertaking tasks that typically require human intelligence, such as comprehending natural language, spotting patterns, and making judgment calls (Perifanis & Kitsios, 2023). The organization, accessibility, and delivery of information to users could all be revolutionized by the incorporation of AI in libraries (Winkler & Kiszl, 2022). The value of AI in libraries comes from its capacity to improve and automate various library tasks (Okunlaya, et al., 2022). Information retrieval is one of the major fields where AI has had a significant impact (Smith, 1976). Traditional search methods frequently rely on keyword matching, which has drawbacks regarding how well they can retrieve pertinent data. On the other hand, AI-powered search algorithms use machine learning and natural language processing techniques to comprehend user queries, examine content, and provide more precise and individualized search results (Bashir et al., 2021) (Ahn & Brusilovsky, 2013). This enhances the user experience and enables quicker and more accurate information discovery (Xu et al., 2021). Additionally, libraries can use AI to implement clever recommendation systems (Portugal et al., 2018). AI algorithms can recommend relevant resources, books, articles, or other materials that are suited to the needs and interests of specific users by examining user preferences, behavior, and previous interactions (Zhang et al., 2021) (Perifanis & Kitsios, 2023). These tailored suggestions increase users' engagement with library resources by introducing them to new information and sources they might have missed. AI also makes it easier for libraries to manage their knowledge (Taherdoost & Madanchian, 2023). AI can automatically extract and categorize information from massive amounts of text using techniques like text mining and semantic analysis, making it more straightforward for librarians to manage and organize resources (Hemmatian & Sohrabi, 2019a). AI-powered systems can automate processes like metadata generation, classification, and indexing to save librarians valuable time and effort (Saccucci & Salaba, 2021). AI also has the potential to enhance library user services (Okunlaya, 2022). For instance, AI-powered chatbots can offer users immediate and interactive support by responding to frequently asked questions, directing them through library services, and recommending resources based on their queries (Adam et al., 2021). These chatbots simulate human-like conversations and are accessible around the clock to provide users with ongoing support (Adamopoulou & Moussiades, 2020). Finally, AI can help with library resource management (Elfatih et al., 2022). AI algorithms can assist libraries in optimizing collection development, identifying popular or underutilized resources, and making data-driven decisions about resource allocation and acquisition by examining usage patterns and user behavior (Crawford & Syme, 2018; Cresswell et al., 2020). Incorporating AI into libraries has enormous potential to transform library services, improve user experiences, and

increase operational effectiveness (Engel et al., 2022). Libraries can adapt to the changing information landscape and better serve their users in the digital age by utilizing AI technologies (Cox & Mazumdar, 2022).

A quantitative approach called bibliometrics is used to evaluate and quantify different elements of scholarly publications, such as the number of publications, citations, and collaborations. It offers insightful information about research patterns, trends, and effects in a particular field or discipline. Bibliometric analysis is fundamental in assessing scholarly output and impact because it allows researchers and institutions to gauge the influence and visibility of research contributions (Academy, 2017; Agarwal et al., 2016; Byl et al., 2016; Donthu et al., 2021; Ellegaard & Wallin, 2015). Bibliometric analysis can be used to pinpoint significant research trends, patterns of collaboration, and influential authors or institutions in the context of AI research in libraries. Bibliometric analysis enables researchers and institutions to evaluate the quantity and quality of scholarly output in a specific field. It offers an unbiased assessment of the productivity of research, including the quantity of publications, citations, and citation impact. Researchers can assess the influence and notoriety of particular publications, authors, or institutions by examining bibliometric indicators. This evaluation is essential to comprehend the research landscape, we are identifying significant contributions to the field and identifying the most effective and influential institutions or researchers in AI in libraries.

### 1.1 Research trends

Bibliometric analysis looks at publication patterns over time to find research trends. Researchers can spot periods of heightened AI research activity in libraries by examining publication counts and growth rates. Furthermore, bibliometric analysis enables researchers to investigate both new areas of research as well as the development of research themes over time (Hwang & Tu, 2021). Researchers, practitioners, and policymakers can use this information better to understand the changing landscape of AI research in libraries. Bibliometric analysis enables the detection of field-specific research trends (Guo et al., 2020).

### 1.2 Assessing impact and influence

Quantitative indicators are provided by bibliometrics to assess the impact and influence of research outputs. Researchers can identify highly cited articles, significant authors, and preeminent institutions by looking at citation counts and other bibliometric metrics. This evaluation aids in identifying the most significant research contributions and clarifies how libraries' AI research affects the larger scholarly community (Patcas et al., 2019). Authors and institutions that influence artificial intelligence can be found through bibliometric analysis. Researchers can assess the influence and impact of specific researchers or research groups by looking at citation counts, h-index, and other bibliometric indicators. This data aids in the identification of experts, thought leaders, and potential collaborators for researchers and institutions. It also helps with

performance benchmarking and evaluation of academic institutions and researchers engaged in AI research in libraries (Abrishami & Aliakbary, 2019). Facilitating collaboration and networking: Identifying and analyzing collaboration patterns in the field of AI in libraries is made possible by bibliometric analysis. Collaboration is a crucial component of scientific research. Researchers can find the authors, organizations, and nations that collaborate best by looking at co-authorship networks (Chopade et al., 2018). Understanding the flow of information, the development of research networks, and the effect of collaborative efforts on furthering AI research in libraries are all made possible through collaboration analysis. It also makes it easier for researchers and institutions to find potential collaborators and research partners (Darko et al., 2020).

### 1.3 Informing research and practice

Bibliometric analysis provides valuable insights that can inform both research and practice. By identifying research gaps and areas of high research activity, researchers can focus their efforts on areas that require further investigation or have the potential for impact (Gao & Ding, 2022). Practitioners can also benefit from understanding the current state of AI research in libraries to inform their decision-making processes and adapt their services to emerging trends. Research and practice can be informed by bibliometric analysis, which offers insightful data that is useful for both. Researchers can concentrate their efforts on areas that need additional research or have the potential to impact by identifying research gaps and regions of high research activity (Bennett et al., 2012). Supporting evidence-based decision making: Bibliometric analysis provides objective and quantitative evidence that can support decision making at institutional or policy levels. By analyzing publication and citation patterns, institutions and policymakers can assess the research strengths and weaknesses in AI research in libraries, allocate resources effectively, and develop strategies to promote innovation and collaboration (Newman & Mintrom, 2023). Research and practice can be informed by bibliometric analysis, which offers insightful data that is useful for both. Researchers can concentrate their efforts on areas that need additional research or have the potential to impact by identifying research gaps and regions of high research activity. To guide their decision-making processes and modify their services to fit emerging trends, practitioners can also gain an advantage from understanding the current state of AI research in libraries (Muhlroth & Grottke, 2022).

### 1.4 Purpose

The purpose of this review paper is to conduct a bibliometric assessment of AI applications in libraries, focusing on authorship patterns. By analyzing data from Scopus, a comprehensive scholarly database, we aim to provide insights into the patterns of authorship, the impact of authors, relevant affiliations, corresponding authors' countries, country-level scientific production, Lotka's Law analysis, and the most cited countries in the field of AI applications in libraries. This paper seeks to

contribute to existing literature by shedding light on the authorship landscape and providing a comprehensive overview of the research trends and patterns in this domain.

Through this review, the aim is to:

- Identify the influential authors and their contributions to AI research in libraries.
- Analyze the impact and productivity of authors based on their publication and citation metrics.
- Examine the production and trends of affiliations in the field of AI applications in libraries.
- Investigate the distribution of corresponding authors' countries and its implications on international collaborations.
- Assess the country-level scientific production and its evolution over time.
- Apply Lotka's Law to understand authorship patterns and research productivity.
- Identify the most cited countries in AI research in libraries and analyze their citation impact.

By examining these aspects, we aim to provide a comprehensive understanding of the authorship patterns and their implications in AI applications in libraries. The findings of this review will not only contribute to the scholarly literature but also provide valuable insights for researchers, library professionals, and policymakers in shaping future directions and collaborations in this field.

## 2. Research review

Due to its potential to change a variety of library functions and services, artificial intelligence (AI) has drawn a lot of attention in the field of library science. The overview of AI methods frequently used in libraries, This section covers the discussion of AI-driven library services and the advantages and drawbacks of AI adoption in libraries.

Information retrieval, document classification, and sentiment analysis are made more accessible by natural language processing (NLP), which enables computers to comprehend and analyze human language. The accuracy of searches has been increased, metadata generation has been automated, and user interaction with library systems has been improved using NLP techniques, such as text mining and text analytics (Hemmatian & Sohrabi, 2019b). Without explicit programming, systems can learn from data and make predictions or decisions thanks to machine learning (ML) algorithms. In several contexts, ML is used in libraries, including user profiling, recommendation engines, and collection management. ML algorithms analyze user behavior and preferences to make personalized recommendations and allocate resources as efficiently as possible (Venkatachalam & Ray, 2022). Extracting knowledge or patterns from sizable datasets is known as data mining. Data mining

techniques are employed in library science to forecast future demand for library services and to unearth hidden patterns in user behavior and resource usage. The decisions libraries make regarding resource management, user services, and collection development are aided by these insights (Nugroho et al., 2023a).

Artificial Intelligence (AI) has emerged as a transformative technology with applications across various domains. Its potential to revolutionize industries and enhance decision-making processes has attracted significant attention from researchers worldwide. This literature review aims to provide an overview of recent research articles that discuss the application of AI in different fields, including libraries, education, and smart cities. The review will highlight key findings, methodologies, and trends observed in these studies.

Borgohain et al. (2022) conducted a scientometric analysis to map the literature on the application of AI in libraries (AAIL). The study revealed a growing interest in utilizing AI technologies in library settings. Researchers employed various AI techniques, such as machine learning and natural language processing, to improve information retrieval, recommendation systems, and user experience in libraries. The findings of this study provide valuable insights into the emerging trends and future directions for incorporating AI in library services.

Chang & Huang (2012) investigated the evolution of interdisciplinarity in the field of Library and Information Science (LIS) using bibliometric methods. The study examined co-citation, bibliographic coupling, and co-occurrence of keywords to identify interdisciplinary research trends. The findings indicated a gradual increase in interdisciplinary collaborations within LIS, highlighting the integration of diverse disciplines, such as computer science and social sciences, to address complex information challenges. This research contributes to understanding the evolving landscape of LIS and the importance of interdisciplinary approaches in the field.

Chen et al. (2023) conducted a knowledge mapping study to explore the research landscape of AI in education. The authors reviewed literature to identify key themes, research gaps, and influential studies in this domain. The findings indicated a wide range of applications, including intelligent tutoring systems, personalized learning, and educational data mining. The study provides a comprehensive overview of the research trends, highlighting the potential of AI to transform educational practices and improve learning outcomes.

Gupta et al. (2022) performed a bibliometric analysis to examine the intersection of AI and smart cities. The study explored the growth of research publications in this area, identifying key authors, institutions, and influential articles. The findings revealed a significant increase in research related to AI and smart cities, emphasizing the integration of AI technologies to enhance urban planning, transportation, energy management, and public services. This analysis contributes to understanding the

current state of AI applications in building sustainable and intelligent urban environments.

Nugroho et al. (2023b) investigated the shift in research trends related to AI in library repositories during the coronavirus pandemic. The study analyzed articles published before and during the pandemic to identify changes in research focus and methodologies. The findings revealed a shift towards research on AI-enabled virtual services, remote access to information resources, and digital preservation during the pandemic. This study highlights the adaptability of libraries in leveraging AI technologies to meet changing user needs during crisis situations.

## 3. Methods

In order to conduct the bibliometric analysis of authorship patterns in AI applications in libraries, data was retrieved from the Scopus database. The search query used was "(TITLE-ABS-KEY (ai OR artificial AND intelligence) AND TITLE-ABS-KEY (librar* OR librarianship))". The search was performed on March 23, 2023. The initial search yielded a total of 5,660 document results. To ensure the relevance and focus of the study, inclusion and exclusion criteria were applied. The inclusion criteria consisted of articles that focused on AI in libraries or librarianship, were published in the English language, and were published between the years 2018 and 2022. The document types considered for inclusion were conference papers (CP) and articles (AR). On the other hand, articles not related to AI applications in libraries or published in languages other than English were excluded. After applying these criteria, a subset of 1,878 documents was selected from the initial search results. These documents represent the most relevant articles for analyzing authorship patterns in the field of AI applications in libraries. To visualize and analyze the selected data, bibliometric analysis techniques were employed using tools such as biblioshiny and R packages. Biblioshiny is a web-based application that allows for interactive bibliometric analysis and visualization. R packages provide various functions and tools for performing bibliometric analysis, including co-authorship analysis and citation analysis. The final sample for this study consists of 252 documents, which were selected from the subset of 1,878 articles based on further evaluation and screening. These documents will serve as the basis for conducting bibliometric analysis to gain insights into the authorship patterns and trends in the field of AI applications in libraries.

# 4. Data visualization

## 4.1 Main information

Table 1 provided data of artificial intelligence (AI) applications in libraries yields significant insights. Spanning from 2018 to 2022, the dataset includes 252 documents from 146 sources.

**Table 1: Main Information**

| Description | Results |
|---|---|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 2018:2022 |
| Sources (Journals, Books, etc.) | 146 |
| Documents | 252 |
| Annual Growth Rate % | 1.23 |
| Document Average Age | 2.88 |
| Average citations per doc | 6.679 |
| References | 7241 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 1508 |
| Author's Keywords (DE) | 740 |
| AUTHORS | |
| Authors | 684 |
| Authors of single-authored docs | 56 |
| AUTHORS COLLABORATION | |
| Single-authored docs | 58 |
| Co-Authors per Doc | 2.94 |
| International co-authorships % | 16.27 |
| DOCUMENT TYPES | |
| article | 106 |
| conference paper | 144 |
| erratum | 1 |
| review | 1 |

The analysis reveals an average annual growth rate of 1.23%, indicating a steady increase in research output in this field over the five-year period. This suggests a sustained interest in exploring AI applications within library contexts, reflecting the growing significance of AI in this domain. The average age of the documents is 2.88 years, implying that the majority of the research is recent. This indicates a focus on current developments and trends in AI applications in libraries, showcasing the timeliness of the research. The average citations per document are 6.679, indicating a

notable level of impact and recognition within the scholarly community. The high citation count signifies that the research in this area has garnered attention and has been influential in shaping the discourse around AI in library applications. The dataset encompasses a significant number of keywords, with 1,508 unique Keywords Plus (ID) and 740 unique Author's Keywords (DE). This breadth of keywords demonstrates the diverse aspects and areas of focus within the field of AI applications in libraries. Collaboration among authors is evident, with an average of 2.94 co-authors per document. Furthermore, approximately 16.27% of the collaborations are international, highlighting the global nature of research efforts in this domain. In summary, the bibliometric analysis of the AI applications in library research reveals a growing interest in the field, with recent publications that have had a significant impact within the scholarly community. The analysis highlights the collaborative and international nature of the research, as well as the diverse range of keywords used to explore various facets of AI in library applications.

### 4.2 Most relevant authors

Table 2 provides information about the most relevant authors based on the number of articles they have published and the fractionalized representation of their articles. Let's analyze the results. The author "ASEMI A" stands out with the highest number of articles, with a total of 10 publications. This suggests that Asemi A has been actively contributing to the field and has a significant presence in the research community. The next most prolific author is "CHAKRAVARTY R" with 4 articles, indicating a notable contribution to the field, although not as extensive as Asemi A. "FOX EA" and "LI J" tie for the third position with 3 articles each. They have made substantial contributions, but their presence is slightly less compared to the top two authors. Similarly, "LIU J" and "WANG Y" also have 3 articles each, indicating their significant contributions to the field. Among the authors with 2 articles, "AJANI YA," "AL-AAMRI JH," "ALI MY," and "AMMAR N" have made noteworthy contributions, although their presence is relatively less compared to the top authors. The fractionalized representation indicates the average number of articles per year for each author. It provides a measure of their productivity over time. Asemi A has an average of 4.67 articles per year, which is the highest among all authors, indicating consistent and sustained productivity. In summary, the analysis of the most relevant authors reveals a diverse group of contributors with varying levels of publication output. Asemi A stands out as the most prolific author, followed by Chakravarty R. The fractionalized representation provides an additional perspective, highlighting the average productivity of each author over the specified period.

Table 2: Most relevant authors

| Authors | Articles | Articles Fractionalized |
|---|---|---|
| ASEMI A | 10 | 4.67 |
| CHAKRAVARTY R | 4 | 2.00 |
| FOX EA | 3 | 1.75 |
| LI J | 3 | 1.70 |
| LIU J | 3 | 1.00 |
| WANG Y | 3 | 2.33 |
| AJANI YA | 2 | 0.75 |
| AL-AAMRI JH | 2 | 1.00 |
| ALI MY | 2 | 0.67 |
| AMMAR N | 2 | 0.45 |

## 4.3 Author production over time

Analyzing the document production of authors over time provides insights into their publication trends and impact on figure 1. One notable example is the author "Asemi A," who has exhibited consistent publication activity.

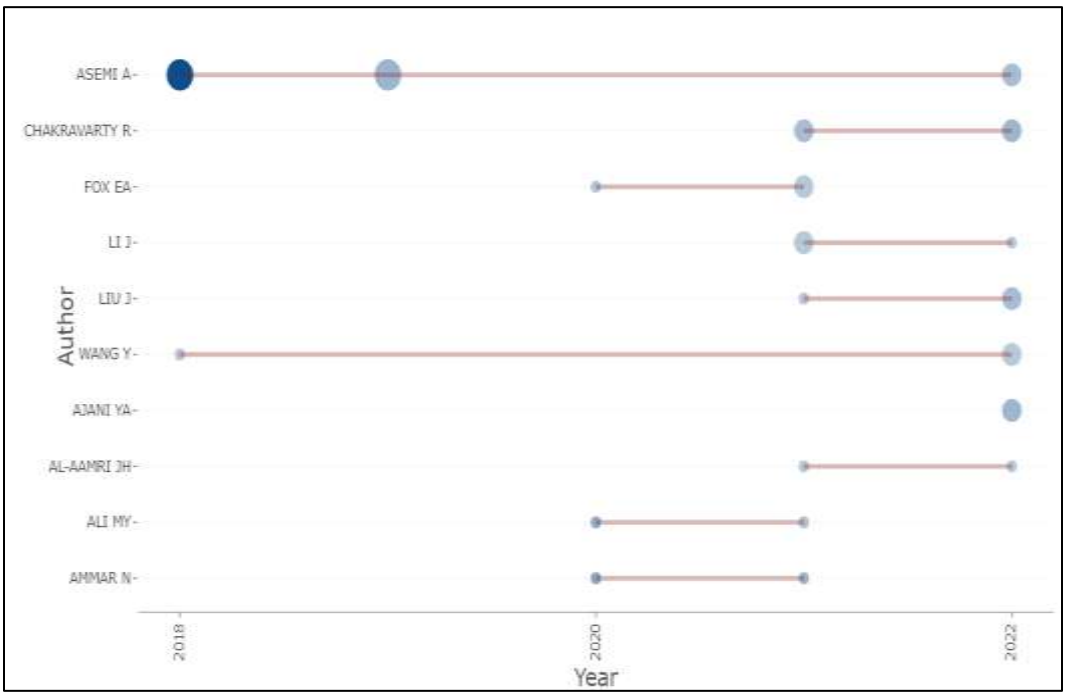


Figure 1: Author production over time

In 2018, Asemi A published four articles, followed by another four in 2019. This high level of productivity demonstrates a strong commitment to research and knowledge dissemination. However, in 2022, their publication frequency decreased to two articles. Despite this decline, Asemi A has amassed a significant total citation count of 60, indicating the impact and influence of their work within the research community. The citation rate per year varies across the years, with 10 citations per year in 2018, 1.6 citations per year in 2019, and one citation per year in 2022. This suggests that their earlier publications have garnered more attention and recognition over time. Another author worth mentioning is "Ammar N," whose publication activity and citation impact have also been noteworthy. In 2020, Ammar N published an article that received 11 citations, resulting in a citation rate of 2.75 per year. This demonstrates the high quality and relevance of their research. In 2021, Ammar N published another article, which garnered five citations, resulting in a citation rate of 1.667 per year. While the citation count decreased compared to the previous year, their work continues to receive significant attention. These consistent publication efforts and impactful research output contribute to establishing Ammar N as a reputable and influential researcher. On the other hand, there are authors who have published fewer articles and received relatively fewer citations. For instance, "AL-AAMRI JH" published one article in both 2021 and 2022, but did not receive any citations for their work. This suggests a need for further investigation into the potential factors influencing the visibility and impact of their research. Similarly, "LI J" and "LIU J" published multiple articles in 2021 and 2022 but did not receive any citations, indicating a potential gap in the dissemination or relevance of their research. Overall, analyzing the production of authors over time provides valuable insights into their research productivity, impact, and potential areas for improvement. It highlights the significance of both publication frequency and citation impact in evaluating the contributions of researchers to their respective fields.

## 4.4 Author impact

The provided data presents several authors along with their corresponding impact metrics in table 3. One commonly used measure of author impact is the h-index, which reflects both the number of publications and the number of citations received by an author's work. Additionally, the g-index and m-index provide alternative perspectives on author impact by considering the distribution of citations among an author's publications. Among the listed authors, Asemi A stands out with an h-index of 4, indicating that they have published at least four articles that have each received four or more citations. Asemi A's total citation count (TC) is 70, suggesting that their work has garnered significant attention within the research community.

Table 3: Author impact

| Element | h_index | g_index | m_index | TC | NP | PY_start |
|---|---|---|---|---|---|---|
| ASEMI A | 4 | 8 | 0.667 | 70 | 10 | 2018 |
| ALI MY | 2 | 2 | 0.5 | 12 | 2 | 2020 |
| AMMAR N | 2 | 2 | 0.5 | 16 | 2 | 2020 |
| ANDREWS JE | 2 | 2 | 0.667 | 21 | 2 | 2021 |
| BHATTI R | 2 | 2 | 0.5 | 12 | 2 | 2020 |
| CHAKRAVARTY R | 2 | 2 | 0.667 | 6 | 4 | 2021 |
| DAVIS RL | 2 | 2 | 0.5 | 16 | 2 | 2020 |
| DIVAYANA DGH | 2 | 2 | 0.4 | 5 | 2 | 2019 |
| NAEEM SB | 2 | 2 | 0.5 | 12 | 2 | 2020 |
| SHABAN-NEJAD A | 2 | 2 | 0.5 | 16 | 2 | 2020 |

With a career starting in 2018, Asemi A has maintained a consistent publication rate of 10 articles (NP) per year, which demonstrates their sustained productivity. Other authors, such as Ali MY, Ammar N, and Chakravarty R, have an h-index of 2, indicating a lower but still respectable level of impact. Their total citation counts range from 6 to 16, suggesting that their work has received moderate recognition. It is worth noting that Chakravarty R has published four articles per year, which contributes to their higher NP value of 4. The m-index, representing the ratio of an author's TC to their NP, provides insights into the average impact per publication. A higher m-index indicates that an author's work tends to receive more citations on average. In the given dataset, Asemi A has the highest m-index of 0.667, indicating that their publications have a relatively high impact per article. Overall, these impact metrics offer a quantitative perspective on the scholarly influence of the listed authors. It is important to consider these metrics alongside other qualitative factors when evaluating the overall impact and contributions of researchers in their respective fields.

## 4.5 Most relevant affiliation

The table 4 provided data presents a list of affiliations along with the number of articles published by authors affiliated with each institution. This information can give insights into the most relevant affiliations in terms of research output and activity.Among the listed affiliations, Health Education England and Panjab University stand out with five articles each. These I nstitutions have demonstrated a consistent level of research productivity, suggesting a strong focus on scholarly contributions. The University of Wyoming, Higher Education Institute of Safahan, Universitas Pendidikan Ganesha, and the University of Isfahan have also published four articles each, indicating a significant research presence.

Table 4: Most relevant affiliation

| Affiliation | Articles |
|---|---|
| Health Education England | 5 |
| Panjab University | 5 |
| Higher Education Institute of Safahan | 4 |
| Universitas Pendidikan Ganesha | 4 |
| University of Isfahan | 4 |
| University of Wyoming | 4 |
| Chiang Mai University | 3 |
| Department of Computer Science | 3 |
| Inha Univ. | 3 |
| Wuhan University of Technology | 3 |

While the number of articles alone does not necessarily indicate the quality or impact of the research conducted, it does provide a glimpse into the level of research activity within these institutions. It suggests that researchers affiliated with these institutions have been actively contributing to the academic community through their publications. It is worth noting that Chiang Mai University, the Department of Computer Science, Inha University, and the Library of Wuhan University of Technology have each published three articles. These institutions also exhibit notable research output and engagement within their respective fields. Overall, this information highlights the affiliations that have produced a higher number of articles, indicating their relevance and involvement in research activities. It is important to consider other factors, such as the quality and impact of the research conducted, in order to fully assess the significance of these affiliations within their respective domains.

## 4.6 Affiliation production over time

The figure 2 provided data showcases the publication production of different affiliations over time. This information sheds light on the research output and activity of specific institutions. The Higher Education Institute of Safahan and the University of Isfahan have maintained a consistent level of publication production throughout the years. Both institutions have published four articles annually from 2018 to 2022. This indicates a sustained commitment to research and knowledge dissemination. The University of Wyoming also demonstrates a similar pattern, with four articles published each year during the same period. In contrast, affiliations like Universitas Pendidikan Ganesha and Panjab University show variations in their publication output over the years. Universitas Pendidikan Ganesha had no publications in 2018, but gradually increased its output to four articles by 2021 and 2022. Panjab University, on the other hand, had no publications in 2018 and 2019 but experienced a surge in productivity with three articles in 2021 and five articles in 2022. Health Education

England did not have any publications in the given years, suggesting a potential gap in research output or a focus on other forms of knowledge dissemination. Overall, the data illustrates the publication trends of different affiliations over time, highlighting their engagement in research and scholarly activities. The consistency in publication production by some institutions indicates a strong research culture, while the variations observed in others could be attributed to various factors such as changes in research priorities, resource allocation, or other institutional considerations.

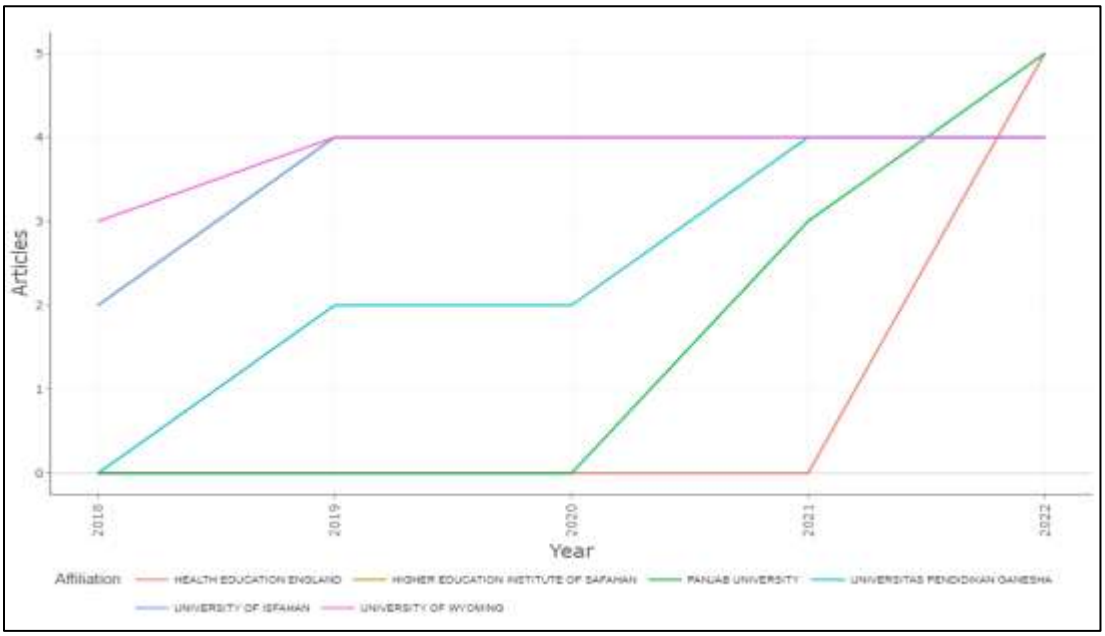


Figure 2: Affiliation production over time

## 4.7 Corresponding author's country

The figure 3 data provided showcases the distribution of corresponding authors by country in terms of their publication frequency and corresponding authorship ratios. The analysis offers insights into the countries with the highest representation as corresponding authors and their relative contribution to the scholarly literature. China emerges as the country with the highest number of corresponding authors, with 27 articles and a corresponding authorship ratio of 0.107. This indicates that approximately 10% of the articles have a corresponding author from China. The United States follows closely behind with 20 articles and a slightly higher corresponding authorship ratio of 0.079, suggesting a higher frequency of corresponding authorship compared to China. India has 16 articles, making it the third most prolific country in terms of corresponding authorship. However, it is worth noting that India has a corresponding authorship ratio of 0, indicating that all articles from Indian authors have multiple corresponding authors or no corresponding author

listed. Germany, Indonesia, Iran, France, Italy, and Korea also contribute significantly to the corresponding authorship pool, each having multiple articles and varying corresponding authorship ratios. These countries demonstrate a notable presence in international scholarly collaborations and knowledge dissemination. Other countries such as Poland, Portugal, the United Kingdom, Australia, Canada, and several others have a smaller but still noteworthy contribution to corresponding authorship. Overall, the data showcases the global distribution of corresponding authors and their involvement in scholarly publications. The dominance of China and the United States in terms of publication frequency and corresponding authorship ratio highlights their strong research output and influence in the academic community. However, it is important to consider that the data provided represents a specific set of articles and may not capture the entire landscape of corresponding authorship across all disciplines and research areas.

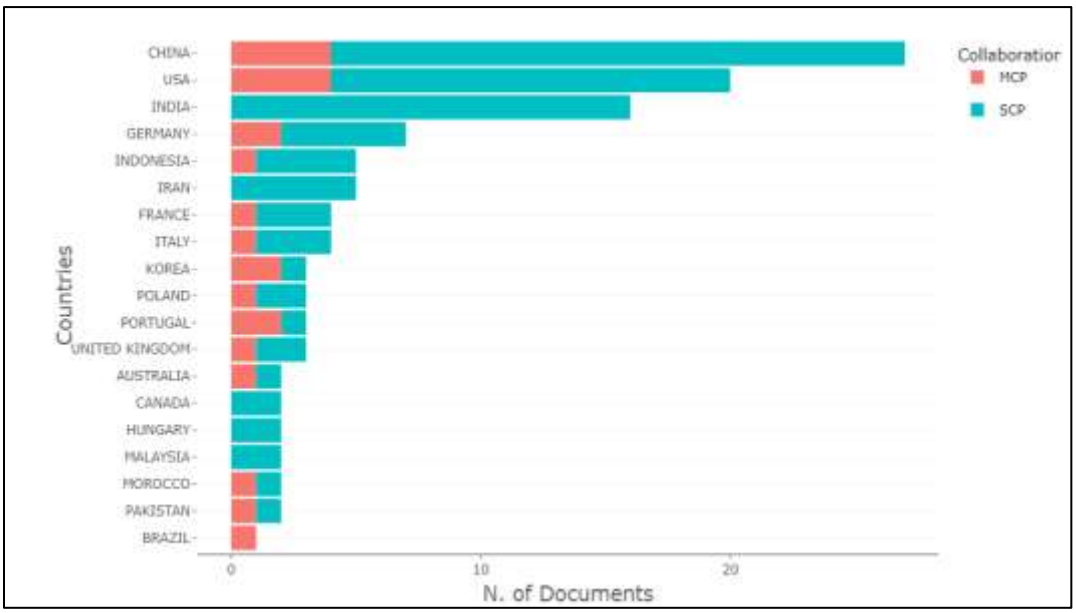


**Figure 3: Corresponding author's country**

## 4.8 Country scientific production

The figure 4 data provided offers insights into the scientific production of various countries by showcasing the frequency of publications in each region. The analysis provides a snapshot of the research output across different countries, highlighting their contributions to the global scientific community. China and the United States emerge as the two leading countries in terms of scientific production, with 74 and 72 publications, respectively. This demonstrates their significant research output and influence in the academic landscape. India follows closely behind with 40 publications, indicating a strong presence in scientific research. Germany, the United Kingdom, and

Canada also demonstrate notable scientific production with 17, 16, and 14 publications, respectively. These countries have well-established research ecosystems and contribute substantially to the generation of new knowledge.

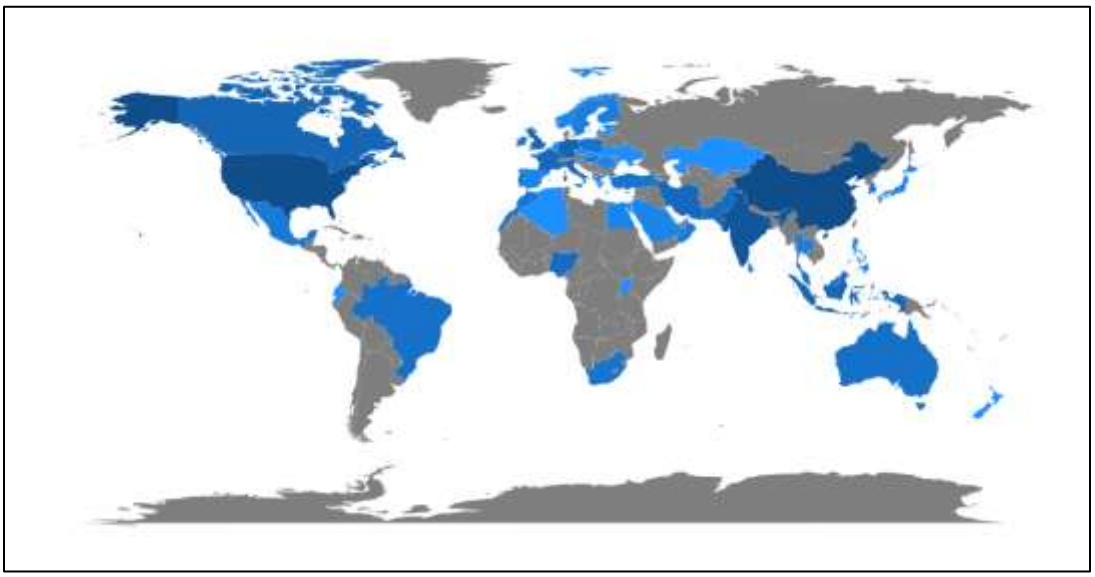

**Figure 4: Country scientific production**

Other countries such as Indonesia, Italy, France, Iran, Pakistan, Nigeria, Australia, Brazil, Malaysia, Portugal, Poland, South Africa, Turkey, Hungary, Ireland, and several others also contribute to the scientific production. While their publication frequencies may be comparatively lower, they still play a valuable role in expanding the global scientific knowledge base. The diverse range of countries represented in the data highlights the global nature of scientific research and collaboration. Countries from various regions, including Europe, Asia, Africa, and the Americas, are actively engaged in producing new scientific knowledge. It is important to note that the data provided represents a specific set of publications and may not encompass the entire scientific production of each country. Additionally, the frequency of publications does not necessarily indicate the quality or impact of the research conducted. Overall, the data underscores the global distribution of scientific production, demonstrating the contributions of different countries to advancing knowledge and fostering scientific advancements.

## 4.9 Country production over time

The figure 5 provided data showcases the scientific production of four countries, namely China, Germany, India, and the United Kingdom, over a five-year period. It offers insights into the number of articles published by each country each year, highlighting their research output and trends over time.

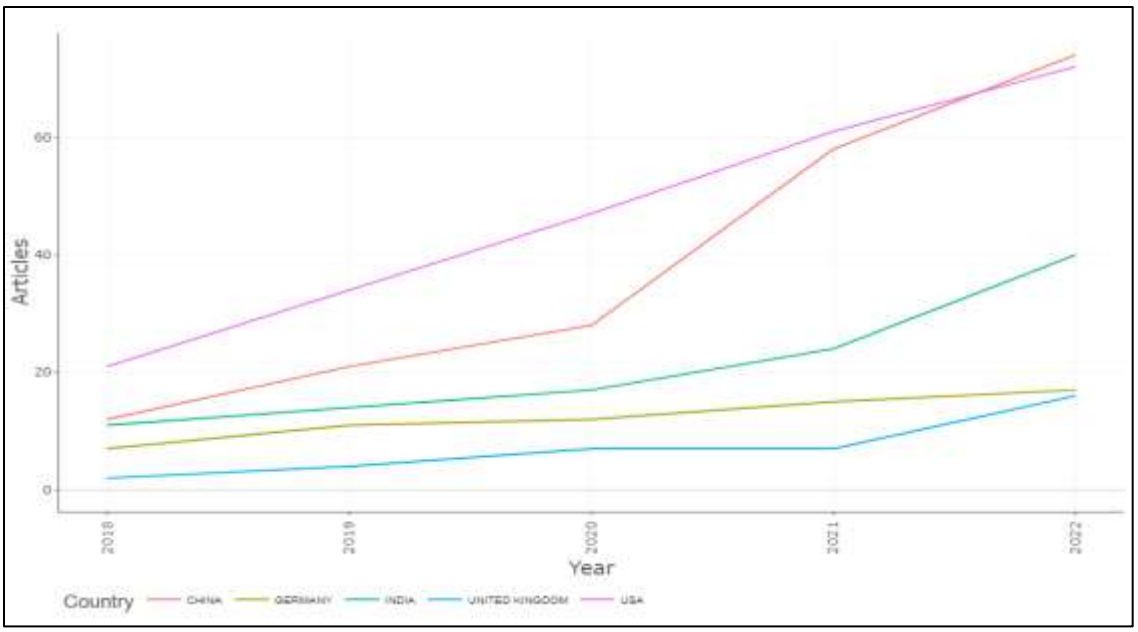


**Figure 5: Country production over time**

China demonstrates a substantial increase in scientific production over the years, with a notable growth trajectory. Starting from 12 articles in 2018, the number rises to 74 articles in 2022, showcasing a significant expansion in research output. This trend indicates China's commitment to scientific advancement and its growing influence in the global research landscape. Germany exhibits a consistent level of scientific production over the five-year period. With 7 articles in 2018 and 17 articles in 2022, Germany maintains a steady contribution to the scientific community. While the growth may not be as dramatic as that of China, it still reflects a consistent commitment to research and innovation. India, similar to China, displays a notable increase in scientific production over the years. Starting from 11 articles in 2018, the country reaches a peak of 40 articles in 2022, showcasing a significant upward trend. India's research output highlights its growing presence in various scientific disciplines and its increasing contribution to global knowledge. The United Kingdom demonstrates a more modest but steady growth in scientific production. With 2 articles in 2018 and 16 articles in 2022, the country consistently contributes to the research community. The United Kingdom's research output shows its commitment to scientific excellence and its continued involvement in generating new knowledge. Overall, the data reflects the dynamic nature of scientific production in these countries. China stands out with its remarkable growth, while Germany, India, and the United Kingdom maintain consistent contributions. The trends observed indicate the countries' dedication to scientific research and their active participation in advancing knowledge across various disciplines.

## 4.10 Most cited countries

In table 5, upon analyzing the provided data on total citations (TC) and average article citations, it is evident that Slovakia stands out as the most cited country. With a remarkable total citation count of 313, Slovakian publications have received substantial attention and recognition within the dataset. Furthermore, the average article citations for Slovakia also match the total citation count at an impressive 313.00, suggesting a consistently high impact for each published article from Slovakian authors. The prominence of Slovakia in terms of citation counts could signify the quality and significance of research originating from the country. It indicates that the work of Slovakian researchers has made notable contributions and garnered attention within their respective fields. This remarkable performance showcases Slovakia's research excellence and the impact of its scientific output. Following Slovakia, the United States holds the second position in terms of total citations, with a count of 121. However, the average article citations for the United States are comparatively lower at 6.05, suggesting a more dispersed impact across a larger number of publications. China, with a total citation count of 93, demonstrates a lower citation count compared to Slovakia and the United States. The average article citations for China are 3.44, indicating a relatively modest impact per publication. Similarly, India has a total citation count of 78 and an average of 4.88 citations per article, signifying a moderate impact compared to other countries. Germany, with a total citation count of 54, shows a higher average of 7.71 citations per article.

Table 5: Most cited countries

| Country | TC | Average Article Citations |
|---|---|---|
| SLOVAKIA | 313 | 313.00 |
| USA | 121 | 6.05 |
| CHINA | 93 | 3.44 |
| INDIA | 78 | 4.88 |
| GERMANY | 54 | 7.71 |
| ITALY | 52 | 13.00 |
| UNITED KINGDOM | 48 | 16.00 |
| IRAN | 39 | 7.80 |
| PORTUGAL | 39 | 13.00 |
| BRAZIL | 37 | 37.00 |

This suggests that although the citation count is lower, German publications tend to have a more substantial impact on average. Italy, despite having a lower total citation count of 52, demonstrates a remarkable average of 13.00 citations per article. This

signifies that Italian publications tend to receive a higher number of citations on average, indicating a considerable impact for individual articles. The United Kingdom follows closely behind with a total citation count of 48, but its average article citations are the highest among the countries listed at 16.00. This suggests that publications from the United Kingdom receive a significant number of citations, showcasing the impact and influence of British research. Both Iran and Portugal have the same total citation count of 39. However, Portugal stands out with an average of 13.00 citations per article, while Iran has a slightly higher average of 7.80 citations per article. This indicates that Portuguese publications tend to have a more concentrated impact, whereas Iranian publications have a relatively dispersed impact. Lastly, Brazil has a lower total citation count of 37, but its average article citations are the highest among all the countries listed at 37.00. This indicates that although the citation count is relatively low, Brazilian publications tend to have a highly impactful nature. In summary, the analysis of the most cited countries reveals that Slovakia leads the way with a significantly higher total citation count and an impressive average citation per article. However, other countries such as the United States, Italy, the United Kingdom, Portugal, and Brazil also demonstrate notable citation counts and average article citations, showcasing the impact of their respective research outputs.

## 4.11 Lotka law

Lotka's Law, also known as the Inverse Square Law, is a mathematical principle that describes the distribution of author productivity in scientific research. According to Lotka's Law, the number of authors who have published a certain number of documents follows an inverse square relationship. In other words, the number of authors decreases exponentially as the number of documents they have written increases(Kawamura & Thomas, 1999; Kumar et al., 1998; Qiu et al., 2017; Sahu & Jena, 2022; Sudhier, 2013).

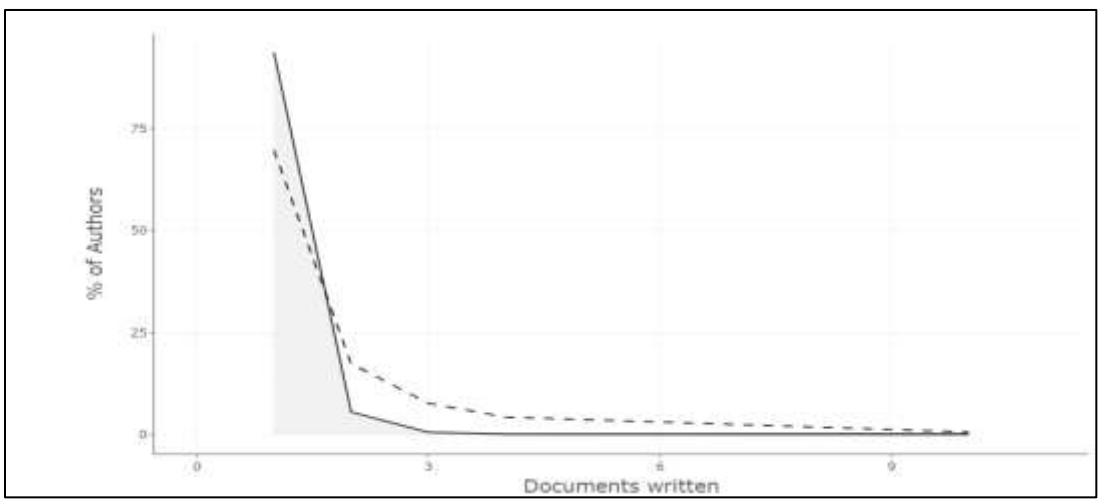


Figure 6: Lotka's law

Analyzing the data provided figure 6, we can observe that the majority of authors (93.6%) have only written one document, indicating a high level of dispersion in scientific publishing. Only a small proportion of authors (5.6%) have written two documents, followed by an even smaller fraction (0.6%) who have written three or four documents. There is also a negligible number of authors who have written ten documents. This distribution of author productivity aligns with Lotka's Law, which suggests that a small number of highly productive authors contribute to the majority of scientific output, while the majority of authors have lower levels of productivity. This observation is consistent with the Pareto principle or the "80/20 rule," where a small proportion of inputs (in this case, authors) generates the majority of outputs (publications). Understanding Lotka's Law helps us grasp the concentration of research output among a few prolific authors, highlighting the importance of recognizing and supporting these highly productive contributors. However, it also underscores the need for fostering a supportive environment that encourages more authors to participate in scientific publishing, as well as promoting collaboration among researchers to ensure a diverse and inclusive representation in scientific literature.

## 5. Discussion

The bibliometric assessment of artificial intelligence (AI) applications in libraries provides valuable insights into the research landscape in this field. The analysis of the provided data reveals several key findings. Firstly, the dataset includes 252 documents from 146 sources, spanning from 2018 to 2022. The average annual growth rate of 1.23% indicates a steady increase in research output, highlighting the sustained interest in exploring AI applications within library contexts. This reflects the growing significance of AI in the library domain. The average age of the documents is 2.88 years, indicating a focus on recent developments and trends in AI applications in libraries. This suggests that researchers are actively exploring current advancements and technologies in this field, emphasizing the timeliness of the research. The average citations per document are 6.679, signifying a notable level of impact and recognition within the scholarly community. The high citation count indicates that the research in AI applications in libraries has garnered attention and has been influential in shaping the discourse around this topic. The dataset encompasses a significant number of keywords, with 1,508 unique Keywords Plus (ID) and 740 unique Author's Keywords (DE). This breadth of keywords demonstrates the diverse aspects and areas of focus within the field of AI applications in libraries. Researchers are exploring various facets of AI in library applications, covering a wide range of topics and perspectives. Collaboration among authors is evident, with an average of 2.94 co-authors per document. Approximately 16.27% of the collaborations are international, highlighting the global nature of research efforts in this domain.

This international collaboration showcases the exchange of ideas and expertise across borders, contributing to the advancement of AI applications in libraries on a global

scale. Analyzing the most relevant authors, it is observed that "ASEMI A" stands out with the highest number of articles, followed by "CHAKRAVARTY R" with 4 articles. Other authors such as "FOX EA," "LI J," "LIU J," and "WANG Y" have also made significant contributions to the field. The fractionalized representation of articles per year provides insights into the average productivity of authors, with "ASEMI A" having the highest average articles per year at 4.67. Examining the production of authors over time reveals interesting patterns. "Asemi A" has exhibited consistent publication activity, while "Ammar N" has shown consistent publication efforts and impactful research output. However, there are authors who have published fewer articles and received relatively fewer citations, suggesting potential areas for improvement and further investigation. Assessing author impact, the h-index, g-index, and m-index provide different perspectives. "Asemi A" stands out with an h-index of 4 and a high m-index, indicating both the quantity and impact of their publications. Other authors, such as Ali MY, Ammar N, and Chakravarty R, also demonstrate respectable levels of impact.

The assessment of affiliations highlights institutions such as Health Education England and Panjab University as having a consistent level of research productivity. The University of Wyoming, Higher Education Institute of Safahan, Universitas Pendidikan Ganesha, and the University of Isfahan also contribute significantly to the research output in AI applications in libraries. The analysis of corresponding authors by country reveals China as the country with the highest number of corresponding authors, followed by the United States and India. This reflects the global distribution of research efforts in this field and emphasizes the involvement of multiple countries in scholarly collaborations. Examining the scientific production of different countries showcases China and the United States as the leading contributors, with notable research output. Germany, the United Kingdom, and Canada also demonstrate significant scientific production. Other countries, although with comparatively lower publication frequencies, contribute to the global. The trends observed indicate the countries' dedication to research and their efforts to advance scientific knowledge. It is important to note that the data provided represents a specific set of articles and may not capture the entire scientific production of these countries across all disciplines and research areas. It is worth mentioning that scientific production is influenced by various factors, including funding, research infrastructure, collaboration networks, and national research policies. The growth or stability of scientific production in a country can be attributed to these factors and the overall research ecosystem. China's significant increase in scientific production reflects its investment in research and development and its efforts to establish itself as a global scientific powerhouse. The country has made substantial investments in science and technology, leading to a rise in research output across various fields. Germany, known for its strong research institutions and scientific culture, maintains a steady level of scientific production. The country has a well-established research infrastructure, high-quality education system, and a tradition

of excellence in science and engineering. These factors contribute to Germany's consistent contribution to scientific knowledge. India's notable growth in scientific production reflects its focus on research and development as a means of economic and social progress. The country has made significant investments in science and technology, resulting in increased research output and the establishment of world-class research institutions. The United Kingdom's steady growth in scientific production showcases its longstanding tradition of scientific excellence. The country has a rich scientific heritage, with renowned universities and research institutions. Despite challenges such as changes in research funding and policies due to Brexit, the United Kingdom continues to maintain a strong presence in scientific research. It is important to highlight that scientific production is a global endeavor, with contributions from researchers and institutions from around the world. While the provided data focuses on specific countries, it is crucial to recognize the collective efforts of the global scientific community in advancing knowledge and fostering scientific progress. In conclusion, the data on country-wise scientific production highlights the contributions of China, Germany, India, and the United Kingdom to the global research landscape. These countries demonstrate varying levels of growth and stability in their research output, reflecting their commitment to scientific advancement. However, it is important to consider that the data represents a specific set of articles and may not capture the entire scientific production of these countries.

## 6. Implication of the study

The study on country-wise scientific production has several implications for research policies, international collaboration, economic and social development, education, and benchmarking. Firstly, the findings provide insights into the effectiveness of research and development (R&D) policies implemented by different countries. Governments and policymakers can evaluate the impact of their investments in science and technology and identify areas for improvement. This information can guide future funding decisions and policy adjustments to promote scientific productivity. Secondly, the study highlights the importance of global collaboration in scientific research. It demonstrates that scientific production is a collaborative effort across borders. Countries can leverage this information to identify potential areas for collaboration, foster international partnerships, and tap into collective expertise to address complex global challenges. Thirdly, scientific production is closely linked to a country's economic and social development. By analyzing the trends and growth patterns, policymakers can identify areas where increased research and development investment can drive innovation, stimulate economic growth, and address societal challenges. This knowledge can inform strategic decisions related to resource allocation, industry development, and technology transfer. Fourthly, the study emphasizes the role of science education and training in fostering scientific production. Countries can identify areas where investment in education, particularly in science, technology,

engineering, and mathematics (STEM) disciplines, can have a positive impact on research output. This insight can guide efforts to improve science education curricula, support STEM initiatives, and nurture a skilled scientific workforce. Additionally, the findings of the study provide a benchmark for countries to assess their scientific production relative to others. It can serve as a basis for competition, motivating countries to enhance their research capabilities and establish themselves as leaders in specific scientific fields. This can foster healthy competition, drive innovation, and raise the global scientific standard. In summary, the study's implications lie in informing research policies, promoting international collaboration, driving economic and social development, enhancing science education, and establishing benchmarks for scientific productivity. By considering these implications, countries can make informed decisions to advance science and technology, foster innovation, and address the challenges of our time.

## 7. Conclusion

In conclusion, the study on country-wise scientific production provides valuable insights into the landscape of global research and its implications for various aspects of society. The findings highlight the importance of research policies, international collaboration, economic and social development, education, and benchmarking in shaping the scientific productivity of countries. The study underscores the need for governments and policymakers to evaluate the effectiveness of their research and development policies and make informed decisions regarding future investments. It emphasizes the significance of global collaboration in scientific research and encourages countries to foster international partnerships to address global challenges collectively. Furthermore, the study highlights the close relationship between scientific production and a country's economic and social development. Policymakers can identify areas where increased investment in research and development can drive innovation, stimulate economic growth, and tackle societal issues effectively.

The study also emphasizes the importance of investing in science education and training to nurture a skilled scientific workforce and enhance research capabilities. By identifying areas for improvement and supporting STEM initiatives, countries can strengthen their scientific output. Lastly, the study provides a benchmark for countries to assess their scientific productivity and encourages healthy competition. By striving to improve research capabilities and establish themselves as leaders in specific scientific fields, countries can foster innovation and raise the global scientific standard. In conclusion, the implications of this study are far-reaching and offer valuable insights for policymakers, researchers, and educators. By considering these implications and taking appropriate actions, countries can advance science and technology, promote international collaboration, drive economic and social development, and ultimately address the challenges and opportunities of the ever-evolving global landscape.

## References


1. Abrishami, A., & Aliakbary, S. (2019). Predicting citation counts based on deep neural network learning techniques. *Journal of Informetrics*, *13*(2), 485–499. https://doi.org/10.1016/j.joi.2019.02.011
2. Academy, E. (2017, June 29). How to Evaluate Research Impact: Bibliometrics. Enago Academy. https://www.enago.com/academy/how-to-evaluate-research-impact-bibliometrics/
3. Adam, M., Wessel, M., & Benlian, A. (2021). AI-based chatbots in customer service and their effects on user compliance. *Electronic Markets*, *31*(2), 427–445. https://doi.org/10.1007/s12525-020-00414-7
4. Adamopoulou, E., & Moussiades, L. (2020). Chatbots: history, technology, and applications. *Machine Learning with Applications*, *2*, *100006*. https://doi.org/10.1016/j.mlwa.2020.100006
5. Agarwal, A., Durairajanayagam, D., Tatagari, S., Esteves, S. C., Harlev, A., Henkel, R., Roychoudhury, S., Homa, S., Puchalt, N. G., Ramasamy, R., Majzoub, A., Ly, K. D., Tvrda, E., Assidi, M., Kesari, K., Sharma, R., Banihani, S., Ko, E., Abu-Elmagd, M., … Bashiri, A. (2016). Bibliometrics: Tracking research impact by selecting the appropriate metrics. *Asian Journal of Andrology*, *18*(2), 296–309. https://doi.org/10.4103/1008-682X.171582
6. Ahn, J., & Brusilovsky, P. (2013). Adaptive visualization for exploratory information retrieval. *Information Processing & Management*, *49*(5), 1139–1164. https://doi.org/10.1016/j.ipm.2013.01.007
7. Bashir, M. F., Arshad, H., Javed, A. R., Kryvinska, N., & Band, S. S. (2021). Subjective Answers Evaluation Using Machine Learning and Natural Language Processing. *IEEE Access*, *9*. https://doi.org/10.1109/ACCESS.2021.3130902
8. Bennett, C. C., Doub, T. W., & Selove, R. (2012). EHRs connect research and practice: where predictive modeling, artificial intelligence, and clinical decision support intersect. *Health Policy and Technology*, *1*(2), 105–114. https://doi.org/10.1016/j.hlpt.2012.03.001
9. University of Waterloo Working Group on Bibliometrics, (Winter 2016) *White Paper on Bibliometrics, Measuring Research Outputs through Bibliometrics*, Waterloo, Ontario: University of Waterloo Prepared by
10. Lauren Byl, Jana Carson, Annamaria Feltracco, Susie Gooch, Shannon Gordon, Tim
11. Kenyon, Bruce Muirhead, Daniela Seskar-Hencic, Kathy MacDonald, Tamer Özsu, Peter
12. Stirling, of the University of Waterloo Working Group on BibliometricsChang, Y.-W., & Huang, M.-H. (2012). A study of the evolution of interdisciplinarity in library and information science: using three bibliometric methods. *Journal of the American Society for Information Science and Technology*, *63*(1), 22–33. https://doi.org/10.1002/asi.21649
13. Chankoson, T., Chen, F., Wang, Z., Wang, M., & Sukpasjaroen, K. (2023). Knowledge Mapping for the Study of Artificial Intelligence in Education Research: literature Reviews. *Journal of Intelligence Studies in Business*, *12*(3), 27–37. https://doi.org/10.37380/jisib.v12i3.896

14. Chopade, P., Khan, S. M., Stoeffler, K., Edwards, D., Rosen, Y., & von Davier, A. (2018, July). Framework for Effective Teamwork Assessment in Collaborative Learning and Problem Solving. In *TTW@ AIED* pp. 48-59.
15. Cox, A. M., & Mazumdar, S. (2024). Defining artificial intelligence for librarians. *Journal of librarianship and information science*, *56*(2), 330-340. https://doi.org/10.1177/09610006221142029
16. Crawford, S., & Syme, F. (2018). Enhancing Collection Development with Big Data Analytics. *Public Library Quarterly*, *37*(4), 387–393. https://doi.org/10.1080/01616846.2018.1514922
17. Cresswell, K*., Callaghan, M., Khan, S., Sheikh, Z., Mozaffar, H., & Sheikh, A. (2020). Investigating the use of data-driven artificial intelligence in computerised decision support systems for health and social care: a systematic review. Health Informatics Journal, 26(3), 2138–2147. https://doi.org/10.1177/1460458219900452*
18. Darko, A., Chan, A. P. C., Adabre, M. A., Edwards, D. J., Hosseini, M. R., & Ameyaw, E. E. (2020). Artificial intelligence in the AEC industry: scientometric analysis and visualization of research activities. *Automation in Construction*, *112*. https://doi.org/10.1016/j.autcon.2020.103081
19. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: an overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070
20. Elfatih, N. M., Hasan, M. K., Kamal, Z., Gupta, D., Saeed, R. A., Ali, E. S., & Hosain, Md. S. (2022). Internet of vehicle's resource management in 5G networks using AI technologies: current status and trends. *IET Communications*, *16*(5), 400–420. https://doi.org/10.1049/cmu2.12315
21. Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: how great is the impact? *Scientometrics*, *105*(3), 1809–1831. https://doi.org/10.1007/s11192-015-1645-z
22. Engel, R., Fernandez, P., Ruiz-Cortes, A., Megahed, A., & Ojeda-Perez, J. (2022). SLA-aware operational efficiency in AI-enabled service chains: challenges ahead. *Information Systems and E-Business Management*, *20*(1), 199–221. https://doi.org/10.1007/s10257-022-00551-w
23. Gao, H., & Ding, X. (2022). The research landscape on the artificial intelligence: a bibliometric analysis of recent 20 years. *Multimedia Tools and Applications*, *81*(9), 12973–13001. https://doi.org/10.1007/s11042-022-12208-4
24. Guo, Y., Hao, Z., Zhao, S., Gong, J., & Yang, F. (2020). Artificial Intelligence in Health Care: bibliometric Analysis. *Journal of Medical Internet Research*, *22*(7), e18228. https://doi.org/10.2196/18228
25. Gupta, A., Gupta, S., Memoria, M., Kumar, R., Kumar, S., Singh, D., ... & Ansari, N. (2022, 26-27 May). Artificial intelligence and Smart Cities: a bibliometric analysis. In *2022 international conference on machine learning, big data, cloud and parallel computing (COM-IT-CON). 1*, 540-544. IEEE.
26. Hemmatian, F., & Sohrabi, M. K. (2019a). A survey on classification techniques for opinion mining and sentiment analysis. *Artificial Intelligence Review*, *52*(3), 1495–1545. https://doi.org/10.1007/s10462-017-9599-6

27. Hemmatian, F., & Sohrabi, M. K. (2019b). A survey on classification techniques for opinion mining and sentiment analysis. *Artificial Intelligence Review*, *52*(3), 1495–1545. https://doi.org/10.1007/s10462-017-9599-6
28. Hwang, G.-J., & Tu, Y.-F. (2021). Roles and Research Trends of Artificial Intelligence in Mathematics Education: a Bibliometric Mapping Analysis and Systematic Review. *Mathematics*, *9*(6), 584. https://doi.org/10.3390/math9060584
29. Kawamura, C. D. L. Thomas, Y. Kawag, M. (1999). Lotka's law and the pattern of scientific productivity in the dental science literature. *Medical Informatics and the Internet in Medicine*, *24*(4), 309–315. https://doi.org/10.1080/146392399298320
30. Kumar, S., Sharma, P., & Garg, K. C. (1998). Lotka's law and institutional productivity. *Information Processing & Management*, *34*(6), 775–783. https://doi.org/10.1016/S0306-4573(98)00027-2
31. Muhlroth, C., & Grottke, M. (2022). Artificial Intelligence in Innovation: How to Spot Emerging Trends and Technologies. *IEEE Transactions on Engineering Management*, *69*(2), 493–510. https://doi.org/10.1109/TEM.2020.2989214
32. Newman, J., & Mintrom, M. (2023). Mapping the discourse on evidence-based policy, artificial intelligence, and the ethical practice of policy analysis. *Journal of European Public Policy*, *30*(9), 1839-1859. https://doi.org/10.1080/13501763.2023.2193223
33. Nugroho, P. A., Anna, N. E. V., & Ismail, N. (2023a). The shift in research trends related to artificial intelligence in library repositories during the coronavirus pandemic. *Library Hi Tech*. https://doi.org/10.1108/LHT-07-2022-0326
34. Nugroho, P. A., Anna, N. E. V., & Ismail, N. (2023b). The shift in research trends related to artificial intelligence in library repositories during the coronavirus pandemic. *Library Hi Tech*. https://doi.org/10.1108/LHT-07-2022-0326
35. Okunlaya, R. O., Syed, A. N., & Alias, R. A. (2022). Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education. *Library Hi Tech*. *40*(6), 1869–1892. https://doi.org/10.1108/LHT-07-2021-0242
36. Okunlaya, R. O., Syed Abdullah, N., & Alias, R. A. (2022). Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education. *Library Hi Tech*. *40*(6), 1869–1892. https://doi.org/10.1108/LHT-07-2021-0242
37. Patcas, R., Bernini, D. A. J., Volokitin, A., Agustsson, E., Rothe, R., & Timofte, R. (2019). Applying artificial intelligence to assess the impact of orthognathic treatment on facial attractiveness and estimated age. *International Journal of Oral and Maxillofacial Surgery*, *48*(1), 77–83. https://doi.org/10.1016/j.ijom.2018.07.010
38. Păvăloaia, V.-D., & Necula, S.-C. (2023). Artificial Intelligence as a Disruptive Technology—a Systematic Literature Review. *Electronics*, *12*(5), 1102. https://doi.org/10.3390/electronics12051102
39. Perifanis, N.-A., & Kitsios, F. (2023). Investigating the Influence of Artificial Intelligence on Business Value in the Digital Era of Strategy: a Literature Review. *Information*, *14*(2), 85. https://doi.org/10.3390/info14020085
40. Portugal, I., Alencar, P., & Cowan, D. (2018). The use of machine learning algorithms in recommender systems: a systematic review. *Expert Systems with Applications*, *97*, 205–227. https://doi.org/10.1016/j.eswa.2017.12.020

41. Qiu, J., Zhao, R., Yang, S., Dong, K. (2017). Author Distribution of Literature Information: Lotka's Law. In: *Informetrics*. Springer, Singapore. https://doi.org/10.1007/978-981-10-4032-0_6
42. Saccucci, C., & Salaba, A. (2021). Introduction to Artificial Intelligence (AI) and Automated Processes for Subject Access. *Cataloging & Classification Quarterly*, *59*(8), 699–701. https://doi.org/10.1080/01639374.2021.2022058
43. Sahu, A., & Jena, P. (2022). Lotka's law and author productivity pattern of research in law discipline. *Collection and Curation*, *41*(2), 62–73. https://doi.org/10.1108/CC-04-2021-0012
44. Smith, L. C. (1976). Artificial intelligence in information retrieval systems. *Information Processing & Management*, *12*(3), 189–222. https://doi.org/10.1016/0306-4573(76)90005-4
45. Sudhier, K. G. P. (2013). Lotka's Law and Pattern of Author Productivity in the Area of Physics Research. *DESIDOC Journal of Library & Information Technology*, *33*(6), 457–464. https://doi.org/10.14429/djlit.33.5477
46. Taherdoost, H., & Madanchian, M. (2023). Artificial Intelligence and Knowledge Management: impacts, Benefits, and Implementation. *Computers*, *12*(4), 72. https://doi.org/10.3390/computers12040072
47. Venkatachalam, P., & Ray, S. (2022). How do context-aware artificial intelligence algorithms used in fitness recommender systems? A literature review and research agenda. *International Journal of Information Management Data Insights*, *2*(2), 100139. https://doi.org/10.1016/j.jjimei.2022.100139
48. Winkler, B., & Kiszl, P. (2022). Views of Academic Library Directors on Artificial Intelligence: a Representative Survey in Hungary. *New Review of Academic Librarianship*, *28*(3), 256–278. https://doi.org/10.1080/13614533.2021.1930076
49. Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., Liu, X., Wu, Y., Dong, F., Qiu, C.-W., Qiu, J., Hua, K., Su, W., Wu, J., Xu, H., Han, Y., Fu, C., Yin, Z., Liu, M., … Zhang, J. (2021). Artificial intelligence: a powerful paradigm for scientific research. *The Innovation*, *2*(4), 100179. https://doi.org/10.1016/j.xinn.2021.100179
50. Zhang, Q., Lu, J., & Jin, Y. (2021). Artificial intelligence in recommender systems. *Complex & Intelligent Systems*, *7*(1), 439–457. https://doi.org/10.1007/s40747-020-00212-w

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