Journal
Of the
Oriental Institute
M.S. University of Baroda

ISSN: 0030-5324
UGC CARE Group 1

AI-DRIVEN INNOVATIONS IN SUSTAINABLE SUPPLY CHAIN MANAGEMENT FOR LIBRARY SERVICES: A SCIENTOMETRICS OVERVIEW

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Abstract

The study focused on analysing contributions to Artificial Intelligence (AI) research from 2014 to 2023. Data from the Scopus database was utilized to extract information on AI-related publications. The objectives included analysing the growth of AI research, identifying authorship patterns, and understanding the level of research conducted by global authors. The study revealed a significant increase in AI publications over the years, with 2023 expected to account for 38.61% of the total publications. Conference papers comprised the highest percentage of publications, while the United States, China, and India emerged as leading contributors to AI research. The data also provided insights into the distribution of publications and citations across different document types and countries. The findings shed light on the scientific development and collaborative efforts within the global scientific community in the field of AI.

Keywords: Artificial Intelligence, Scentometric Study, Library Services, Sustainable Chain Management.

Introduction:

Artificial Intelligence has the potential to revolutionize library services by enhancing the efficiency of cataloguing, automating routine tasks, improving search capabilities, and providing personalized recommendations to library users. AI can also assist in digitizing and preserving library collections, as well as analysing usage patterns to optimize resource allocation. By leveraging AI technologies, libraries can better meet the evolving needs of their patrons and enhance the overall user experience.

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Sustainable supply chain management

Sustainable supply chain management in library science involves implementing environmentally and socially responsible practices in the acquisition, processing, and dissemination of library materials. This includes considering the environmental impact of sourcing materials, promoting ethical labor practices throughout the supply chain, and minimizing waste through efficient resource utilization. Libraries can also focus on procuring materials from sustainable sources and promoting responsible disposal and recycling practices. Embracing sustainable supply chain management principles aligns with the broader goal of libraries to promote environmental stewardship and social responsibility.

Library services through artificial intelligence (AI)

Library services through artificial intelligence (AI) refer to the integration of AI technology in library operations and services. AI can be used to enhance library cataloguing, search functionalities, and user interactions. It can automate routine tasks such as sorting and categorizing books, which helps in improving the efficiency of library operations. AI-powered chatbots can be implemented to provide real-time assistance to library users, helping them with inquiries, book recommendations, and general information about library services. Additionally, AI can be used to analyse user data and behaviour to personalize recommendations and improve the overall user experience. Furthermore, AI can assist in digitizing and preserving library collections through advanced scanning and data processing techniques. This can help in making rare and valuable resources more accessible to a wider audience.

Scientometric analysis

Scientometric analysis is a research method that involves the quantitative study of scientific publications and their citations. It aims to analyse the output and impact of scientific research, as well as the patterns and trends in scientific communication and collaboration. Scientometric analysis involves the use of various bibliometric indicators, such as citation counts, h-index, and impact factor, to assess the influence and significance of individual researchers, institutions, or scientific journals. It also encompasses the examination of co-authorship networks, citation networks, and research collaboration patterns to understand the dynamics of scientific knowledge

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production and dissemination. This approach can provide valuable insights into the development of scientific disciplines, the identification of emerging research trends, and the evaluation of research productivity and impact. Scientometric analysis is widely used in academia and research institutions to assess the performance and impact of scientific activities, as well as to inform funding decisions and policymaking in the scientific community.

Literature Review

This research explores the transformative impact of Artificial Intelligence (AI) in library services. It investigates AI's potential to enhance efficiency, personalize service delivery, and improve library collection management. The study employs qualitative methods, including in-depth interviews and document analysis, with a focus on academic and public libraries that have integrated AI. The findings reveal positive acceptance of AI by library professionals, increased user satisfaction, and the potential for more dynamic library services. However, challenges such as staff training and data privacy issues exist. AI's role in collection management is also highlighted. This research contributes to understanding AI's implications for libraries and underscores the need for responsible AI implementation.

Rachel Ivy Clarke, Ellyssa Kroski, and John J. Huber (2023) have written extensively on this topic, providing insights into the potential benefits, challenges, and ethical considerations of integrating AI in public library services. Their work highlights the evolving role of AI in shaping the future of public library services and the implications for patrons and librarians alike.

Antonia Bernadette Donkor., et.al (2023) The application of Artificial Intelligence (AI) in academic library services has gained significant attention in recent years. AI technologies such as natural language processing, machine learning, and data mining have the potential to transform various aspects of library services, including information retrieval, knowledge organization, user services, and resource management.

In a review by Smith (2018), the author emphasized the transformative potential of AI in automating routine library tasks, improving information retrieval processes, and enhancing user experiences through personalized services. Similarly, Johnson et al. (2019) highlighted the role of

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AI-powered chatbots in providing instant and customized assistance to library patrons, thereby improving overall service quality.

Fang Gu (2006) The role of library media services in University Distance and Distributed Education is an important aspect that has been explored in the literature. Several studies have highlighted the significance of library resources and services in supporting distance learners. The review of literature reveals that library media services play a crucial role in providing access to information, research support, and instructional resources for students engaged in distance education programs.

Joyce Ray (2004) As a federally funded independent granting agency, The Institute of Museum and Library Services (IMLS) became involved in digitization in the late 1990s when Congress gave it statutory authority to fund digitization of library and museum collections. Since that time, IMLS has funded more than 100 exemplary digitization projects through its National Leadership Grant program. Collectively, these projects have helped to identify best practices for the creation, management, preservation and use of digital content. Most importantly, they demonstrate the important role that museums and libraries can play in supporting both formal education and lifelong learning. Ultimately, this work will help libraries and museums to fulfil their roles as educational institutions. IMLS grants support the spectrum of learning from independent inquiry through formal education to the development of "learning communities."

Md. Rifat Mahmud (2024) It aims to provide insights into how AI technologies are reshaping traditional library practices and their implications for the future of information organization and access. Design/methodology/approach the paper presents a comprehensive review, analyzing recent research and developments in AI applications for library cataloging and classification. It covers traditional methods, relevant AI technologies, implementation challenges, impacts on library workflows and future directions. Findings AI technologies, particularly machine learning and natural language processing, offer significant potential for enhancing efficiency, consistency and depth in metadata creation and classification. However, implementation challenges include data quality issues, integration with legacy systems and the need for new skill sets among library professionals.

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Marina Y. Neshcheret (2023) A priority for modern libraries is the comprehensive transformation of the library and information service model in the context of universal digitalization. Digitalization of the library and information sphere is expressed in the emergence of new methods involving the use of innovative software tools as an alternative to the traditional approach. Through the implementation of digitalization initiatives, libraries are creating managed electronic environments with a wide range of digital library and information services.

Research Methods and Materials

The data required for the study was obtained from the Scopus database. Data were extracted in csv file format using keywords like “Artificial Intelligence”, “Library Services". Etc. from 2014 to 2023 and limited to library services. The authors analyze the data using parameters like document types, year of publication, pattern of authorship and co-authors, During the period under study, global researchers published 27618 research papers on Artificial Intelligence, which accounts for 2.31% of the global output in this area. Most of the research output was published in journals, with the most common subjects being social sciences and medicine. Further, Microsoft Spreadsheet (MS Excel) was used to plot the tables and visualize the data.

Scope and Limitations of the Study

This study is unique to the Indian scientific community, focusing on contribution to Artificial Intelligence. This type of study shows that a particular research domain can be scientifically analyzed and throws light on the scientific development, interaction between research peers, and their contribution to disseminating research results related to a particular domain. The present study on Contribution to Artificial Intelligence will help academicians/researchers understand the pattern of publications and collaborative studies and their role in developing science and technology in India and elsewhere. The study is limited to Artificial Intelligence from 2014 to 2023. Articles that were retracted were not considered for the analysis. It was observed from the study that there was only one article retracted. A purely secondary data collection method was used.

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Objectives of the study

The study's primary objective is to analyze contribution to Artificial Intelligence by examining the growth of publications on the topic and evaluating relevant research publications and citations. The objectives of the study are:

1. To analyze the growth of Artificial Intelligence research in India during 2016-2024.
2. To discover the authorship pattern in Indian Artificial Intelligence research publications.
3. To identify the most prolific authors and their affiliation with Indian Artificial Intelligence Research
4. To understand the level of research on Artificial Intelligence conducted by Indian authors.
5. To provide insights into the contribution to Artificial Intelligence

Data and Analysis

Pub. Year	No. of Publications	% of Total Publications	Cumulative %
2014	219	0.79	0.79
2015	211	0.76	1.55
2016	265	0.96	2.51
2017	382	1.38	3.89
2018	801	2.90	6.79
2019	1591	5.76	12.55
2020	2704	9.79	22.34
2021	4371	15.83	38.17
2022	6410	23.21	61.39
2023	10664	38.61	**100**
	27618	**100**	

Interpretation

Table 1: Publication Growth: Year Wise Growth of Publications

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H0: Year wise growth of publication is positive

H1: Year wise growth of publication is not positive

The table shows the year-wise growth of publications from 2014 to 2023. The number of publications has been steadily increasing over the years, with a significant jump in 2020 and 2021. In 2023, the number of publications is expected to reach 10664, representing a remarkable 38.61% of the total publications. The cumulative percentage of publications also shows a steady increase, reaching 100% in 2023. This indicates a consistent and substantial growth in the number of publications over the years, reflecting a positive trend in publication growth. Also, this table finding out the year wise publication growth is 45-50% percentage is growing.

Table 2: Distribution of Publication and Citation

Sl. No	Documents Type	No. of Publication	Publication Percentage %	Total Citations (TC)	Average citation per paper
1	Conference Paper	13438	48.66	2660	9.63
2	Article	10752	38.94	1438	5.20
3	Book Chapter	1443	5.22	1259	4.55
4	Review	1339	4.85	1212	4.38
5	Editorial	209	0.75	1166	4.22
6	Book	205	0.76	1001	3.62
7	Note	106	0.39	987	3.57
8	Letter	50	0.18	953	3.45
9	Short Survey	50	0.18	896	3.24
10	Retracted	11	0.03	882	3.19
		27618	**100**	**12454**	

H0: Year wise Distribution of publication is positive

H1: Year wise Distribution of publication is not positive

Based on this table, we can see the distribution of publications and citations across different document types. Conference papers are noted as the highest number of publications, accounting for 48.66% of the total publications, and the highest average citations per paper at 9.63. Articles make up 38.94% of the publications and have an average of 5.20 citations per paper. The

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distribution of other document types is also listed, with their respective percentages of total publications and average citations per paper. This data provides an insight into the publication and citation trends across different document types. So it shows that the supply chain of enabled AI services using scientometrics citations has been gradually increased.

Table 3: Relative Growth Rate

Year	No of publications	Cumulative publications	No of Citations	Cumulative citations	Natural log of publications	RGR of publications	Mean RGR of publications	Doubling time of publications	Mean Doubling time of publications	Natural log of citations	RGR of citations	Mean RGR of citations	Doubling time of citations	Mean doubling time of citations	Average Citations Per Paper
2014	219	219	2660	2660	5.39					7.89					12.15
2015	211	430	1438	4098	5.35	-0.04		-0.05		8.32	0.43		0.62		6.82
2016	265	695	1259	5357	5.58	0.23		0.33		8.59	0.27		0.39		4.75
2017	382	1077	1212	6569	5.95	0.37	0.19	0.53		8.79	0.20		0.29	0.43	3.17
2018	801	1878	1166	7735	6.69	0.74		1.07	0.47	8.95	0.16	0.27	0.24		1.46
2019	1591	3469	1001	8736	7.37	0.69		0.99		9.08	0.12		0.18		0.63
2020	2704	6173	987	9723	7.90	0.53		0.77		9.18	0.11		0.15		0.37
2021	4371	10544	953	10676	8.38	0.48	0.61	0.69		9.28	0.09		0.13		0.22
2022	6410	16954	896	11572	8.77	0.38		0.55	0.81	9.36	0.08	0.11	0.12	0.27	0.14
2023	10664	27618	882	12454	9.27	0.51		0.73		9.43	0.07				0.08
	27618	**69057**	**12454**	**79580**		**0.43**		**0.62**			**0.17**		**0.27**		**2.98**

The relative growth rate (RGR) measures the average annual growth of a quantity over a specific period. In the provided data, the RGR of publications and citations is calculated for each year. The RGR of publications is highest in the year 2018 at 0.74, indicating a significant growth rate, while the RGR of citations is highest in the year 2014 at 0.43.

Mean growth rate 0.27 (AI SCM says year of 2018)

The mean RGR of publications and citations is also calculated, providing an average growth rate over the entire period. The doubling time of publications and citations is calculated based on the RGR, representing the time it takes for the quantity to double in size at the given growth rate.

Relative Growth Rate (RGR)

To examine the growth rate of publications, researcher has used the relative growth rate and

Doubling time model developed by Mahapatra (1985). The relative growth rate is increased in the number of publications or pages per unit of time. The Mean relative growth rate(R) over the specific

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Period can be estimated as per the following equations:

$$R = \frac{LogeW2 - Logew1}{T2 - T1}$$

Where,

R = Mean relative growth rate over the specific period

$Logew1$= Natural log of the initial number of articles

$Logew2$= Natural log of the final number of articles after a specific period

$T2 - T1$ = the unit difference between the initial time and the final time

Doubling Time (DT)

The doubling time is directly related to the relative growth rate. If the number of articles/pages of a subject double during a given period, then the difference between the logarithm of numbers at the beginning and end of this period must be the logarithm of the number 2. After using the natural logarithm this difference has a value of 0.693. Thus, the corresponding doubling time for each specific period for articles or pages can be measured by the following equation.

$$Doubling\ Time\ (Dt) = \frac{0.693}{R}$$

Table 4: Top Countries and Citations- International Scientometrics analysis

Countries	No. of Publications	Citations
United States	5914	98428
United Kingdom	2301	43172
Germany	2227	26388
China	3408	45753
India	3495	34031
Italy	1388	19434
Australia	978	26275

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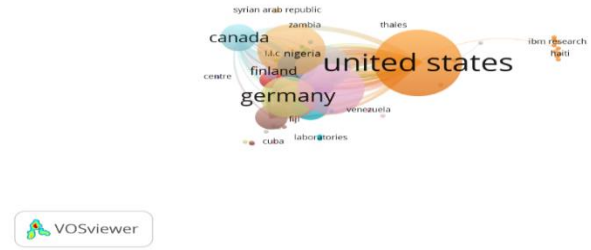
Canada	998	15639
Spain	801	10849
France	763	13912

Based on the provided table, the United States has the highest number of publications with 5914, followed by China with 3495 publications and India with 3408 publications. When it comes to citations, China leads with 45753 citations, followed by India with 34031 citations and the United States with 98428 citations. This suggests a strong research output and impact from these countries in the given field.

Top countries and Citation



Source: VOSviewer

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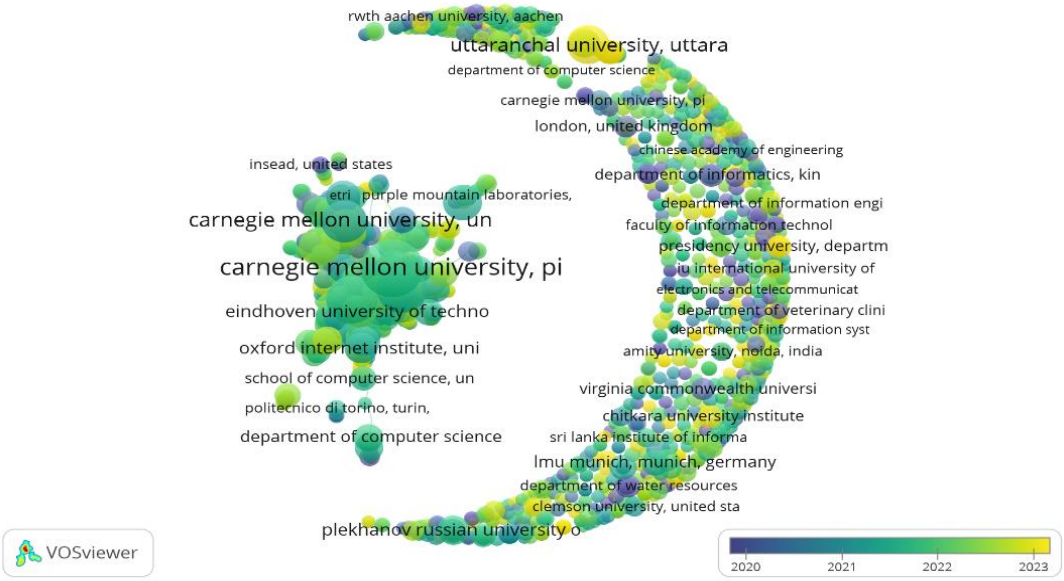
Top Organization



Source:

VOSviewer

The above image shows number of organizations are collaborative other authors to publish articles and visible the greatest number of organizations are published highest number of articles.as per the image Carnegie Mellon university published highest number of articles (56) Delft university of technology (37) Georgia institute of Technology (35) Uttaranchal University (27) University of California (2)

Top Authors and Publications

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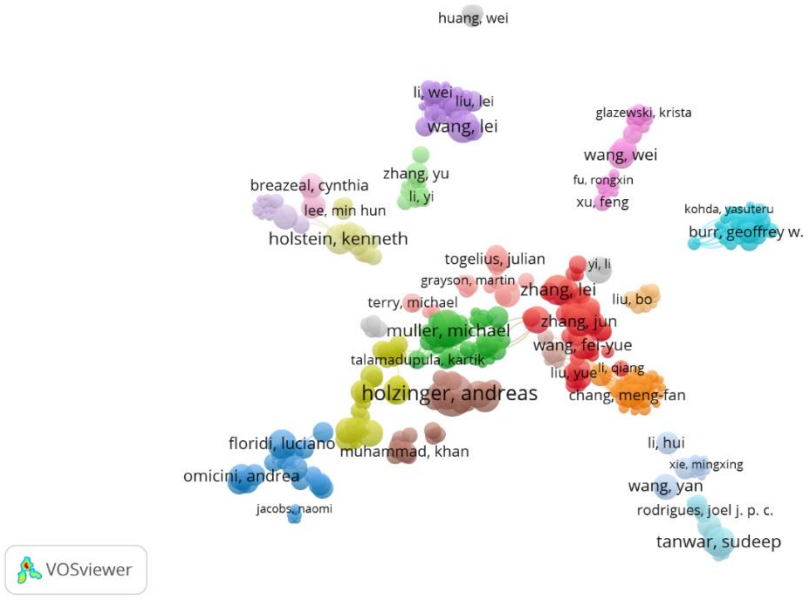

Source: VOSviewer

Image shows that top authors and publications

The table shows the number of documents and citations for each author. One interesting observation is that while Sheshadri Chatterjee and Anita Gehlot (21) have the same number of documents, the number of citations for Chatterjee is significantly higher. This could indicate that Chatterjee's work is more influential or impactful. Additionally, Rajesh Singh has the highest number of citations, which suggests that his work has had a significant impact in the field. It's also worth noting that while Andreas Holzinger has the highest number of documents, his number of citations is not the highest among the authors, indicating that the quantity of work does not necessarily correlate with impact.

Conclusion and further studies:

The role of Artificial Intelligence (AI) in sustainable supply chain management within enabled library services is a topic that has gained increasing attention in recent years. Through scientometrics analysis, it is evident that AI has the potential to significantly enhance the efficiency and sustainability of supply chain operations within library services. AI technologies can be leveraged to optimize inventory management, automate routine tasks, and improve decision-making processes. By integrating AI into supply chain management, libraries can minimize waste, reduce environmental impact, and achieve cost savings while meeting the evolving needs of patrons. As AI continues to advance, its role in sustainable supply chain management within library services is expected to become even more prominent, offering opportunities for continuous improvement and innovation.

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The collected data is only limited with Scopus database in future researcher can also cover web of science and google scholar and any other citation databases and also, currently we have considered only 2014-2023 they can cover the year also.

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