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Integration of Artificial Intelligence Tools in Libraries 2012-2023: A Bibliometric Assessment

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Abstract:
This article investigates the integration of Artificial Intelligence (AI) tools in libraries between 2012 and 2023. Employing a bibliometric approach, it analyzes 4,523 publications from Scopus database, revealing rising publication trends, prevalent document types (primarily conference papers and articles), and key contributors. The findings reveal conference papers and articles as the primary publication formats, reflecting the dynamic nature of the field. Notably, the highest publication volumes occurred in 2022 and 2023. This trend shows an evolving role of AI in libraries and emphasizes the importance of librarians acquiring skills to effectively collaborate with AI tools.

Keywords: Artificial Intelligence, Bibliometric Analysis, AI Integration, Emerging Tools

1. Introduction

Developments in information and communication technologies (ICTs) have had a strong impact on several sectors. The increasing application of technologies like Artificial Intelligence (AI) is evident in every area of life. Such emerging technologies offer new approaches and tools that drive change in the fields of medicine and health, education, finance, agriculture, industry, security and many other sectors, including libraries and information institutions (Borgohain, Bhardwaj and Verma, 2022; Gupta & Gupta, 2023. Relatedly, Haenlein and Kaplan (2019) perceive that AI is increasingly being used in the business environment and public conversation due to the rise of Big Data and improvements in computing power. Okunlaya, Abdullah and Alias (2021) opine that organisations that explore the usage of emerging technologies like AI will flourish while those that do not explore technologies have no future.

Artificial intelligence is changing the current role of libraries within the digital society (Jha, 2023; Yoon, Andrews & Ward, 2022). Libraries are service organizations where individuals, organizations and societies can access substantial quantities of information Lutaaya 2004; Lutaaya 1999). In Gul and Bano (2019)'s view, with the use of AI, the way libraries process, organize, disseminate and store information has reached new paradigms. Artificial intelligence technology has the potential to streamline library operations, improve user experiences, and enhance the value of library services (Halburagi and Mukarambi, 2023).

Factors for the rise of AI applications in the library include increased amount of information available online, wide-spread adoption of mobile phones with Internet connectivity, rise of the net-generation, a population of young people that are growing up in constant contact with digital media, and the need to

find information fast and easily. In addition, the COVID epidemic also accelerated the shift to remote access and digital platforms since libraries continued providing services remotely (Okunlaya, Abdullah and Alias, 2021; Pence, 2022). Referring to Ranganathan's fifth law of Library science, Gul and Bano (2019) states that libraries constantly change with user needs, the changing technological environment and the extensive growth of data. They highlight the increased need for dynamism in library services to validate the library's existence in the twenty-first century digital world that is the smart people, smart libraries and smart services.

Gul and Bano (2019) contemplate that the intrusion of AI in libraries could offer many potential positive enhancements into many library functions. In technical services of the library like categorization and cataloguing and metadata processes; in library management tasks like staffing, security and decision-making, in referencing and information service and information literacy, and in other user services like RFID scanning, digital storage and tracking, peer-to-peer lending and inter library loan, shelf reading and inventory management (Gul & Bano, 2019; Gupta & Gupta, 2023. It can also be used in recommender systems that help users discover new library resources based on their interests and past usage patterns. In addition, AI can also be utilised for Natural Language Processing (NLP) to automatically tag, categorize, and summarize library resources, in image recognition; and for digital assistants that can help library staff automate routine tasks such as scheduling appointments, responding to user inquiries and registering library users. In addition, AI can be applied for library marketing and content creation, to perform searches of library resources and monitoring quality of material in the collection Halburagi and Mukarambi, 2023; Harisanty...etal, 2022; Andrews and Ward, 2022;)

With AI, a library can foster innovative library service delivery, promote research and can allow library resources to be virtually reimagined Abdullah and Alias, 2021). Furthermore, using AI in the library reduces the need for several human resources and lengthy bureaucracy which facilitates data analysis and aids decision-making (Harisanty...etal, 2022).

Nevertheless, even though AI shows potential to offer new opportunities and perspectives for librarians, AI might have brought numerous concerns for librarians and library operations. Jha (2023) mentions its threat to job security and technological difficulties. Also, Okunlaya, Abdullah and Alias (2021) argue that librarians fear that the use of robots in libraries will create job loss. According to Halburagi and Mukarambi (2023), the successful implementation of AI technology in a library requires careful planning, significant investment, and ongoing support from experts in the field. Halburagi and Mukarambi (2023) mention requirements needed for successful AI integration such as robust AI Infrastructure, expertise in AI development, training, data privacy and security. Similarly, Harisanty...etal (2022) argues that AI cannot be done without the librarians' expertise, which includes both professional abilities and soft skills. Therefore, Librarians must be knowledgeable about IT applications and development in libraries and should be knowledgeable about AI tools and technology, data analytics competence, library management, user behaviour and system design.

The study applied a bibliometric assessment approach to critically appraise the published literature on use of AI in library services. The study applies both quantitative and qualitative aspects to analyse published literature on the subject.

Objectives of The Study

1. To examine the year-wise Growth of publications on integration of artificial intelligence tools in libraries between 2012-2023.

2. To identify the most productive and most prolific authors on integration of artificial intelligence tools in libraries between 2012-2023 publications.
3. To study subject facets and types of publications on integration of artificial intelligence tools in libraries between 2012-2023.
4. To establish the geographical areas, funding sources and institution wise affiliation of literature published on integration of artificial intelligence tools in libraries between 2012-2023.

2. Literature Review

2.1 Artificial Intelligence in Libraries

Okunlaya, Abdullah and Alias (2021) described AI as the capability a system has to correct and interpret external data, learn from such data, and use it to achieve specific goals and responsibilities through simple adaptation in the same way, Gupta and Gupta (2023) cited the ISO/IEC definition of AI as an interdisciplinary field dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning.

Artificial intelligence in library services eases access to reliable information and serves as a useful tool for the natural integration of readers and libraries and has enabled the transfer of information in multiple environments (Ajani, Adeyinka, Salawu and Abdullahi, 2022; Jha, 2023. Additionally, AI enables resource discovery since it helps to analyse data, create metadata, and provides new ways of interacting with information, thus enabling libraries to provide services beyond traditional (Cox, Pinfield and Rutter, 2019; Wheatley and Sandy, 2020; Yoon, Andrews and Ward, 2022). Adeyinka, Salawu and Abdullahi (2022) concur that AI has made libraries smarter, enhancing staff job capacities, meeting customer demands, and bridging the knowledge gap. Harisanty...etal (2022) opine that the AI era requires library professionals to be flexible and to be able to adapt to new technology rather than refuse to accept AI.

In addition, Gupta and Gupta (2023); Lutaaya and Hoskins (2019); Lutaaya and Hoskins (2015) and Lutaaya (2014) suggested that librarians use their soft skills, such as creativity and problem-solving, to gain practical experience with the technologies, develop the skills necessary to choose the most useful ones from a wide range of options, share their experiences with their peers, and support their successful adoption.

According to Mallikarjuna (2024), AI tools present a transformative prospect for both academic and public libraries. AI-powered automation can streamline repetitive tasks like cataloguing and inventory management, freeing up librarians highly skilled information specialists to focus on more strategic endeavours. Artificial intelligence enables librarians to curate personalized learning journeys, creating targeted recommendations and educational pathways that foster deeper engagement with the library's resources (Rahmani, 2023). They can also provide expert research assistance, guiding patrons through complex information landscapes and uncovering hidden gems within the library's collection. Freed from administrative burdens, librarians can champion digital literacy, empowering patrons to fully utilize information technology and navigate the ever-evolving online world with confidence.

While AI tools hold great promise for libraries (Rahmani, 2023), integrating them presents significant hurdles (Tundrea, 2020). One major concern is algorithmic bias. According to Kumar (2024), AI tools are trained on skewed data that can reflect biases in search results and recommendations, potentially limiting user access to diverse information. Libraries must be vigilant in ensuring the data used to train AI tools is fair and representative. Another critical challenge in integrating AI tools in libraries is the issue of data security. Libraries handle sensitive user information, and integrating AI necessitates robust security

measures to safeguard this data from breaches or misuse (Gupta and Gupta, 2023; Tundrea, 2020). Furthermore, Lutaaya and Hoskins (2015) affirm the costly nature of implementing and maintaining AI services. Therefore, libraries must allocate resources for technology, training programs, and ongoing support for AI tools, posing potential budgetary challenges for parent institutions.

According to Akinyemi & Omolabake (2023), the digital divide presents another challenge in integrating AI in libraries. AI-powered library services risk exacerbating existing disparities in access to technology and digital literacy. Libraries need strategies to bridge this gap and ensure equitable access to AI tools for all patrons. Librarians themselves may also need to develop new skillsets to work effectively alongside AI.

2.2 Bibliometric Approach

Bibliometric is a computational tool for quantitatively analyzing academic papers on a particular subject using mathematical methods (Chen, Dubin, and Kim, 2014). Bibliometric examines at measures including the number of publications written on a given topic, the patterns of literature production, the most prolific source titles, the most occupied countries, organizations, and authors, and the most quoted articles to research the properties of literature production. According to Malone and Burke (2016), the use of bibliometric tools is extremely significant for research in which librarians are required to give research support services to researchers. A bibliometric study has been one of the important topics of works in the literature. Therefore, bibliometric analysis is one of the significant ways to find the knowledge map easily as pointed out by (Lutaaya 2022).

2.3 Bibliometric Analysis

Lutaaya and Namale 2023 investigated Data management in libraries between the 2003 and 2022 and 17, 373 documents were retrieved as indexed by Scopus. It was discovered that Wiffen, P.N from the United Kingdom was the utmost fruitful writer with 22 documents with an H-index of 69 whereas Buchbinder, Rachelle was the most prolific writer with 98,918 mentions and an H- index of 109.

Chahrour et al. (2020) conducted a study on bibliometric analysis of COVID-19 research activity. The researchers retrieved 564 articles from the PubMed and WHO databases. These publications come from 39 nations, accounting for 24% of the overall number of countries affected. With 377 publications, China was the country that published the most (67percent). With 434 initial publications, Asian countries led the way in continental research operations (77 percent). Lutaaya (2020) conducted a bibliometric study analyzing publications of Ndejje University staff. The study focused on all documents published by Ndejje University staff between 2009-2018 as indexed by Scopus. This query yielded a total of 23 documents for further analysis. The study revealed that there was little research done in Ndejje University. Rugumayo A. I was the most productive author with 3 publications.

The findings further exposed that majority of the publications retrieved were in form of journal articles, review, Chapter, conference, Review, book, Editorial and note. This indicated that most scholarly publications were journal articles as pointed out by (Lutaaya 2022). Lutaaya (2023) studied ICT applications in libraries, a bibliometric assessment. The study revealed the top 10 countries that published about ICT applications in libraries. The study indicated that India had the highest number of publications 214 (27.36%) followed by Nigeria with 209 (26.73%) publications and United States of America with 74 (9.46%) documents. South Africa had 58 (7.42%) publications, Pakistan had 52 (6.64%), Italy had 41 (5.25%) while Malaysia had 39 (4.99%) publications followed by United Kingdom with 38 (4.86%), Spain had 30 (3.84%) and lastly Ghana with 27 (3.45%) publications.

Conferring to Scopus, 4,523 documents had been published on AI and libraries between (2012-2023) implying that many works on AI had already been done. However, a bibliometric assessment on the integration of AI tools in libraries are absent in the literature hence need for the study.

3. Methodology

A bibliometric survey on integration of artificial intelligence tools in libraries between 2012-2023 was conducted from Scopus database and 4,523 publications were retrieved. The period between 2012-2023 was preferred since it ranges in the latest 12 years. Scopus database was chosen since it is the top exploration podium researchers use in discovering, exploring, and distributing data in different disciplines like humanities, social sciences, arts and sciences as discovered by (Lutaaya and Namale, 2023).

Bibliometric is an evolving drive zone of exploration and is an established portion of information research and a quantitative method to the depiction of documents. Bibliometric has grown up out of a level with which no information provider equipped with outmoded abilities and approaches could keep abreast (Lutaaya 2022).

3.1 Research Design.

Research design is the plan the researcher used to carry out the study in answering all questions to the study(Dubey & Kothari, 2022a). The study applied a descriptive study design with majorly a quantitative approach supported by qualitative approach.

3.2 Data Collection

This bibliometric study preferred the query option of "title" for searching the most relevant documents in the Scopus database. All documents related to AI and libraries indexed in Scopus 2012 to 2023 were retrieved giving results of 4,523 documents. All documents retrieved were taken into account irrespective of the type of document. The different types of documents considered were conference papers, articles, reviews, chapters Books, Note, Editorials, Erratum and Retraction among others. In addition, the search was done by the joint search option with (DOCUMENTS).

3.3 Data Analysis

Data was analysed basing on year-wise Growth of publications on integration of artificial intelligence tools in libraries between 2012-2023; Numerous bibliometric facets of each publication were explored. These included most productive and prolific authors; subject facets and types of publications on integration of artificial intelligence tools in libraries. The geographical areas, funding sources and institution wise affiliation on integration of artificial intelligence tools in libraries were described. Data was transferred into Microsoft Excel after extraction for statistical analysis and evaluation of several bibliometric pointers, such as top-cited papers, most productive countries, institution, and journals sources.

4. Analysis and Distribution

Table 1: Year Wise Distribution of Publications

SN	Year	N0. Of Publication	Cumulative Documents	%	
1	2023	769	769	17.0	
2	2022	773	1,542	17.1	
3	2021	597	2,139	13.2	
4	2020	441	2,580	13.2	
5	2019	355	2,935	7.85	

6	2018	307	3,242	6.8	
7	2017	260	3,502	5.7	
8	2016	263	3,765	5.8	
9	2015	229	3,994	5.1	
10	2014	188	4,182	4.2	
11	2013	168	4,350	3.7	
12	2012	173	4523	3.8	

Table 1 above presents number of publication retrieved on integration of artificial intelligence tools in libraries between 2012 to 2023. Out of the 4523 publications retrieved from Scopus data base, it was displayed that both years 2023 and 2022 had most publications of 769(17.0%) and 773(17.1%) respectively. These were followed by the year 2021 with 597 (13.2%) publications, 2020 had 441(13.2%), 2019 with 355 (8.0%) while 2018 registered 307 (6.8%) publications. The rest of the years produced less than 300 publications on integration of artificial intelligence tools in libraries between 2012 and 2023 each.

Publications produced on integration of artificial intelligence tools in libraries between 2012 and 2023 were in different formats/types as confirmed in Table 2 below.

Table 2: Types of Publications

SN	Types Of Publications	Number Of Publications	Cumulative Publications	%
1	Conference Paper	2210	2210	48.9
2	Article	1522	2,689	33.7
3	Review	479	3,168	10.6
4	Book Chapter	112	3,280	2.5
5	Conference Review	75	3,355	1.7
6	Book	67	3,422	1.5
7	Note	27	3,449	0.6
8	Editorial	11	3,460	0.2
9	Erratum	6	3466	0.1
10	Retracted	6	3,472	0.1

It was clearly revealed that most publications retrieved from Scopus database on integration of artificial intelligence tools in libraries between 2012 and 2023 were conference papers with 2210 publications with a percentage of 48.9. These were followed by articles, reviews and book chapters with 1522 (33.7%), 479 (10.6%) and 112 (2.5%) publications each respectively. Books were 67 (1.5%) while Note were 27 (0.6%). It was further revealed that editorials had 11 (0.2%) while erratum and retracted produced only 6(0.1%) publications each.

Geographical Distribution of Publications

Geographical distribution of publications on integration of artificial intelligence tools in libraries between 2012-2023 from Scopus are as illustrated in Table 3 below.

Table 3: Geographical Distribution of Publications

SN	COUNTRY	NO. DOCUMENTS	%	RANK
1	United States of America	948	21.0	1
2	China	781	17.3	2
3	India	419	9.3	3
4	Germany	281	6.2	4
5	United Kingdom	280	6.2	5
6	Italy	194	4.3	6
7	Spain	161	3.6	7
8	Canada	156	3.4	8
9	France	123	2.7	9
10	Australia	119	2.6	10
11	South Korea	98	2.2	11
12	Russian Federation	94	2.1	12
13	Japan	92	2.0	13
14	Netherlands	87	1.9	14
15	Brazil	83	1.8	15

As illustrated in Table 3 above, it was specified that United States of America had most publications on integration of artificial intelligence tools in libraries between 2012-2023 of 948 (21.0%) followed by China with 781 (17.3%) publications. India was in third position with 419 publications (9.3%), followed by Germany with 281(6.2%), United Kingdom 280 (6.2%). Italy, Spain, Canada, France and Australia had 194(4.3%), 161(3.6%), 156(3.4%), 123(2.7%) and119(2.6%) publications each respectively. The rest of the countries had less than 100 publications some of these included: South Korea with 98(2.2%), Russian Federation had 94(2.1%), Japan registered 92(2.0%), Netherlands recorded 87(1.9%) publications while Brazil logged 83 (1.8%) publications. The remaining countries projected less than 83 publications each.

Different institutions published publications on integration of artificial intelligence tools in libraries between 2012-2023 as indicated in Table 4 below.

Table 4: Institution Wise Distribution of Publications

SN	**Name Of Institution**	**No. Of Documents**	**Cumulative Documents**	**%**
1	Chinese Academy of science SNRS center National Del	44	44	1.1
2	Recherché Scientifique	30	74	0.7
3	Imperial College London	26	100	0.6
4	Stanford University	25	125	0.6
5	University of Chinese academy of Sciences	24	149	0.5
6	Ministry of education of the people's republic of China	23	172	0.5
7	University of Toronto	21	193	0.5

8	Peking University	21	213	0.5
9	University of California Berkeley	20	233	0.4
10	Tsinghua University	20	253	0.4

Table 8 above, displayed institutional wise distribution of publications published on AI intelligence tools in libraries between 2012-2023. Out of 4523 publication retrieved, Chinese academy of science SNRS center National Del had most publications 44 (1.1%) trailed by Recherché Scientifique with 30 (0.7%), Imperial College London had 26 (0.6%) publications while Stanford University registered 25 (0.6%) publications. Ministry of education of the people's republic of China recorded 23 (0.5%) publications; the University of Toronto and Peking University both documented 21(0.5%) publications each while University of California Berkeley and Tsinghua University enumerated 20 (0.4%) publications on integration of artificial intelligence tools in libraries between 2012-2023 as indexed by Scopus.

Ten Top Most Productive Authors

Table 5 below divulges the 10 top most productive authors in publishing about the AI intelligence tools in libraries between 2012-2023.

Table 5: 10 Top Most Productive Authors

SN	Author's Name	Country	No. Of Documents	Overall Documents	Citation	%	H-Index	Grants
1	Urban, Josef	Czech Republic	13	122	2,342	0.29	26	0
2	Househ, M		9	325	30,244	0.20	51	0
3	Kalis Zyk, C		8	106	1,449	0.18	20	1
4	Schneider, Gisbert	Switzerland	8	436	22,224	0.I8	69	9
5	Crawford, B	Chile	7	349	2,679	0.15	25	0
6	Ferman dez, P	USA	7	51	160	0.15	7	0
7	Fox, A. Edward	USA	7	368	6,058	0.15	35	4
8	Khanagar, S.	Saudi Arabia	7	52	574	0.15	11	0
9	Soto, R	Chile	7	318	2,584	0.15	25	0
10	Abd-Alrazaq. A	Quatar	6	72	1,744	1.13	17	0

It was disclosed that Urban, Josef from the Czech Republic was the most productive author on integration of artificial intelligence tools in libraries between 2012-2023 with 13 (0.29%) publications and 2,342 citations. He had 122 over all publications with an H-Index of 26. Urban, Josef was followed by Househ, M with 9 publications relating to integration of AI tools in libraries between 2012-2023. It was further revealed that Househ, M had 30,244 citations with a total number of 325 overall publications and an H-Index of 51. Kalis Zyk, C and Schneider, Gisbert were in the 3rd position with 8 (0.18%) publications on integration of AI tools in libraries between 2012-2023 each. Kalis Zyk, C and Schneider, Gisbert had 106 and 436 overall publications each with 1,449 and 22,224 citations respectively and an H-Index of 20 and 69 correspondingly. The rest of the authors registered less than 8 publications each. Considering the

publications on integration of AI tools in libraries between 2012-2023 conferring to Scopus, the most prolific author was Househ, M with 30,244 citations while Urban, Josef was the most productive author with 13 publications.

Table 6 below, unveils the co-authorship of publications on integration of AI tools in libraries between 2012-2023 consulting Scopus database.

Table 6: C0-Authorship

SN	Author	1st Author	N0. Documents	Average Citation	Co-Author	Single Authorship	Last Author
1	Urban, J	4%	80	27	25%	0%	71%
2	Househ, M	7%	19	20	54%	2%	37%
3	Kaliszyk. C	42%	35	17	24%	1%	33%
4	Schneidev, A	5%	9	19	28%	5%	62%
5	Crawford, B	35%	92	10	62%	0%	3%
6	Farnander, P	5%	2	2	50%	87%	3%
7	Fox, A. Edward	13%	10	1	23%	7%	56%
8	Khanagar, S.B	45%	19	20	53%	0%	2%
9	Soto, R	27%	75	6	63%	0%	10%
10	Abd-alrazaq	46%	24	50	50%	0%	4%

Considering co-authorship, it was exposed that Crawford, B had 92 co-authored publications on integration of AI tools in libraries between 2012-2023 referring to Scopus database. Crawford, B was followed by Urban, J with 80 co-authored publications. Soto, R recorded 75 publications, Kaliszyk. C listed 35 publications while Abd-alrazaq registered 24 co-authored publications. The rest of the authors enumerated less than 20 co-authored publications each.

Furthermore, Table 6, uncovered the percentage rate of being the first author in regard to co-authorship publishing. Abd-alrazaq had the biggest percentage of 46 as the first author, followed by Khanagar, S.B with 45%, Kaliszyk. C recorded 42% and Crawford, B registered 35% while the rest of the authors itemised a percentage rate of less than 30 co-authored publications each.

Further still, Table 6 revealed persons that published as single authors. The single authors included the following: Farnander, P who registered 87% under single authorship publishing, Fox, A. Edward recorded 7%, Schneidev, A logged 5%, Househ, M had 2% while Kaliszyk. C listed 1% as a single author. The rest of the authors never published any publication as single authors.

Table 7 below discloses the subject areas that published about integration of artificial intelligence tools in libraries between 2012-2023.

Table 7: Subject Area

SN	**Subject**	**No. Publications**	**Cumulative Publications**	**%**
1	Computer Science	2942	2942	34.6
2	Engineering	1090	4032	12.8
3	Mathematics	1055	5087	12.4

4	Medicine	643	5730	7.6
5	Social Sciences	490	5220	5.8
6	Decision Sciences	301	6521	3.5
7	Physics and Astronomy	295	5816	3.5
8	Biochemistry, Genetics and molecular Biology	286	6102	3.4
9	Material Science	195	6297	2.3
10	Chemistry	168	6465	2.0

It was proved that computer science had the biggest number of publications 2942 (34.6%) on AI tools in libraries between 2012-2023 as indexed by Scopus. Followed by Engineering with 1090 (12.8%) and Mathematics with 1055 (12.4%) publication. Medicine had 643 12(7.6%) while Social sciences registered 490 (5.8%) publications. It was noted that Decision sciences, Physics and Astronomy, Biochemistry, Genetics and molecular Biology, Material Science and Chemistry recorded 301(3.5%), 295 (3.5%), 286 (3.4%), 195 (2.3%) and 168 (2.0%) correspondingly.

Table 8 below indicated the document sources in which publications on artificial intelligence tools in libraries between 2012-2023 as indexed by Scopus where published.

Table 8: Document by Source

SN	Source	No. Documents	Cite Score	SNIP	SJR
1	Lecture notes in computer science including subseries lecture notes in artificial intelligence and lecture notes in Bioinformatics	533	2.2	0.542	0.320
2	Acm International conference proceeding series	88	1.1	0.229	0.209
3	Ceur workshop proceedings	84	1.1	0.223	0.202
4	Journal of physics conference series	77	1.0	0.260	0.183
5	Communication in computer and information science	71	1.0	0.241	0.194
6	Advances in intelligent systems and computing	58	0.9	0.291	0.215
7	Library Hi Technews	55	1.8	0.935	0.49
8	IEEE Access	31	9.0	1.422	0.926
9	Lecture notes in network and systems	31	0.190	0.190	0.151
10	Journal of medical internet research	29	12.1	2.162	1.992

Lecture notes in computer science including subseries lecture notes in AI and lecture notes in Bioinformatics was ranked the top most journal in which publications on AI tools in libraries between 2012-2023 where published as indexed by Scopus. The same journal registered 533 publications with a Cite Score of 2.2; 0.542 SNIP and a SJR of 0.320. This was followed by Ceur workshop proceedings; Journal of physics conference series; Communication in computer and information science; Advances in

intelligent systems and computing; Library Hi Technews with 88, 84,77, 71, 58 and 55 publications on artificial intelligence tools in libraries between 2012-2023 as indexed by Scopus each respectively. IEEE access and Lecture notes in network and systems both had 31 publications each while Journal of medical internet research had only 29 publications published on AI tools in libraries between 2012-2023.

Table 9 below exposed funding sponsors of publications on artificial intelligence tools in libraries between 2012-2023.

Table 9: Documents by Funding Sponsors

SN	Documents	No. Documents	Cumulative Publications	%
1	National natural foundation of China	172	172	3.80
2	National science foundation	127	299	2.81
3	Horizon 2020 framework programme	118	417	2.60
4	European commission	77	494	1.70
5	National institute of health	68	562	1.50
6	European regional development fund	44	606	1.06
7	U.S. Department of energy	44	650	1.06
8	Engineering and physical sciences research council	37	687	0.82
9	Seventh framework programme	37	724	0.82
10	National key research and development program of China	34	758	0.75

Following Table 9 above, it was designated that National natural foundation of China funded most publications on AI tools in libraries between 2012-2023 referring to Scopus database with 172 (3.8%) publications followed by National science foundation listing 127 (2.81%) publications and Horizon 2020 framework programme stating 118 (2.60%). European commission; National institute of health; European regional development fund; U.S. Department of energy; Engineering and physical sciences research council; seventh framework programme and National key research and development program of China registered 77(1.70%), 68 (1.50%), 44 (1.06%), 44 (1.06%), 37 (0.82%), 37(0.82%) and 34 (0.75%) singly.

Limitation

Investigation was centred on Scopus database assortment between published documents in the year 2012-2023 leaving out supplementary records from other databases and years.

Policy Implications

The investigation concentrated on publications indexed by Scopus data base only, this suggests that some publications were not scrutinised. Therefore, authors should be encouraged by policy makers to publish with journals that are indexed by Scopus database since it the biggest database. This will improve the visibility of the participating authors and their institutions hence improved citations of the publications.

Conclusion

The study publicised 4523 publications distributed on AI tools in libraries between 2012-2023 as indexed by Scopus. It was revealed that different authors published about AI tools in libraries. These included:

Urban, Josef; Househ, M; KalisZyk C; Schneider. A; Crawford, B; Farnander, P among others. The most productive and most prolific authors on integration of AI tools in libraries between 2012-2023 were identified as Urban, Josef and Househ, M singly.

These authors were affiliated to various institutions including: Chinese Academy of science SNRS center National Del, Recherche Scientifique, Imperial College London, Stanford University, Ministry of education of the people's republic of China; the University of Toronto, Peking University, University of California Berkeley and Tsinghua University among others.

The investigation further revealed the subject facets on integration of AI tools in libraries between 2012-2023 as Computer science, Engineering, Mathematics, Medicine, social sciences, decision sciences, Physics and Astronomy, Biochemistry, Genetics and molecular Biology, Material Science and Chemistry etc. While the types of publications in which AI publications replicated included: conference papers, articles, reviews, book chapters Books, Note, Editorials, Erratum and Retracted publications.

The geographical areas that published about the integration of AI tools in libraries between 2012-2023 were exposed as United States of America, China, India, Germany, United Kingdom, Italy, Spain, Canada, France, Australia, South Korea, Russian Federation, Japan, Netherlands, Brazil and so forth.

The funding institutions were also identified as: National natural foundation of China, National science foundation, Horizon 2020 framework programme, European commission; National institute of health; European regional development fund; U.S. Department of energy; Engineering and physical sciences research council; seventh framework programme and National key research and development program of China.

Journals that published publications about integration of AI tools in libraries between 2012-2023 were publicised as: Lecture notes in computer science including subseries lecture notes in artificial intelligence and lecture notes in Bioinformatics, Ceur workshop proceedings; Journal of physics conference series; Communication in computer and information science; Advances in intelligent systems and computing; Library Hi Technews, IEEE Access, Lecture notes in network and systems and Journal of medical internet research among others.

Future Research Direction

Future research track can concentrate on the systematic literature review on artificial intelligence and libraries related papers. Systematic reviews are a fresh style in global progress exploration that has the probable to advance and encourage evidence-based and policymaking research particularly in spaces where the indication base is vigorous and well-developed. When the ideas of systematic appraisals are used with care, systematic appraisals provide a separate benefit above normal literature appraisals (Mallett et al., 2012).

Forthcoming investigation could still cover Scopus database but concentrating on more or different years other than 2012-2023. Imminent studies can also be carried out grounding on other data bases like google scholar and Web of science, LISA and LISTA among others.

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