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The Significance of Artificial Intelligence in Business and Accounting: A Bibliometric Analysis

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ABSTRACT

This article has explored the significance of artificial intelligence in business management and accounting over a period of 15 years from "2008 to 2022". Artificial Intelligence is an emerging field of study for students and it is playing a pivotal role in the courses of business management and accounting. This article guides the students in using new innovations, techniques, methods, software's etc. which are extremely helpful for our daily tasks. A scientometric approach is used to analyse the statistical-historical study of Artificial Intelligence in the field of business and accounting. The data is taken from the renowned and important data base "Scopus". A study sample comprises 1608 documents covers the field of Business management and Accounting. Secondary documents were 440,652 with the keyword "Artificial Intelligence". To find out the quality results, this study uses different statistical software's like R-tool, R-Package, Bibliometrix, VOSviewer, and Biblioshiny. The findings show the result of top countries that have worked on artificial intelligence. USA has the top rank in all over the world in research work with the publication of 88,679. USA, China, UK, India and Germany are the top five most prominent and struggling countries that have worked on the keyword "artificial intelligence" respectively.

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1. Introduction

John McCarthy formerly used the term "artificial intelligence" in 1956 during a cross-disciplinary research meeting at Dartmouth (McCarthy, Minsky, Rochester, & Shannon, 2018).. He defined artificial intelligence that, a computer system that behave and think in a rational manner, much like human beings (Kok, Boers, Kosters, Van der Putten, & Poel, 2009). His research team generated the idea of "thinking machines," which combined cybernetics, automata theory, and complicated information processing. Artificial intelligence (AI) is a key technological development that is generating a lot of buzz because of its amazing potential (Khalid et al., 2022). Managers can benefit from artificial intelligence (AI) by properly entrusting AI with making management decisions (Feuerriegel, Shrestha, von Krogh, & Zhang, 2022). In the age of artificial intelligence, societies now rely on big data, social media, knowledge management, and data science to survive and to achieve sustainability goals (A. M. Musleh Al-Sartawi, K. Hussainey, & A. Razzaque, 2022). According to the EY 2020 Global Tax and Transformation Survey, average tax teams used up to 70% of their time on tasks that AI could do in a very short amount of time. To address this challenge, several organizations use robotic process automation and AI. Advanced degrees in accounting reduce the amount of time required to perform time-consuming but ultimately simple procedures that are tiresome, repetitive, and require a lot of labour. The history of promises, dreams, and demonstrations is entwined with the development of artificial intelligence (AI) (Buchanan, 2005).

Critical task can be executed easily in Artificial Intelligence (Agarwal, Jain, Sinha, & Dhir, 2020; Pandl, Thiebes, Schmidt-Kraepelin, & Sunyaev, 2020). The fourth Industrial Revolution's integration of developing technologies is facilitated by AI, which is the primary engine of commercial and industrial progress (IR 4.0)(Goodell, Kumar, Lim, & Pattnaik, 2021; Lim, 2020; Zhang, Chen, Chen, & Chong, 2021) like blockchain (Ehrenberg & King, 2020) crypto currency (X. Li & Whinston, 2020) cloud computing (Hsu, 2022) and internet of things (Iot) (Ghaleb, da Costa, & Zou, 2022). AI decreases human error and enhances quality. More than 70% of people who believe AI will alter data-driven insights are leaders in accounting, finance, and consulting services. Artificial Intelligence helps to minimize the frauds in business organizations. The word "business" means all human activities that occurred for earning. According to Lewis H. Haney, any human activity that produces or acquires wealth through the purchasing and selling process can be referred to as a business. It means in any business organization, the role of accounting and its principles exist. Importance of artificial intelligence cannot be neglected in any field of business e.g. Banking, Marketing, E-commerce, Stocks, Insurance (Ali, ur Rahman, & Anser, 2020; Sarwar, Ali, Bhatti, & ur Rehman, 2021; Shafique; Younas, Idrees, & ur Rahman; Zhu, Fang, Rahman, & Khan, 2023).

Accounting is based on these businesses because in every business sellers and buyers exist, they make transactions daily, weekly or monthly. For the recording of these transactions accounting books, journals, ledgers, trial balance etc. are necessary. AI makes the business transactions very easy. Accounting Software's e.g. SAP, Oracle NetSuite, Workia, Insight software, Sage Intact, CCH Tagetik Wolters Kluwer, FYI Soft Financial Reporting Software, Fresh books, Workday adaptive planning etc. all are based on AI. It takes very short time and less human power to solve and complete the task of business management and accounting. In the last decennium the call of artificial intelligence systems has increased rapidly. Pakistan is a developing country and many business processes can be improved with the assistance of artificial intelligence. Many countries have applied AI in new technological innovations and institutional workings and they have attained desired results but in Pakistan business growth is very slow due to less resources, corruption, inefficient and ineffective working style.

New technological system e.g. Big Data has already been started in Pakistan and this is also a main source and important factor in improving the business and management decisions. Other fields specially in accounting field Big data is providing a path for taking good decisions. It includes arithmetical and statistical large amount of data that is indeed helpful in management firms, professional bodies and businesses that are directly or indirectly engaged to increase the efficacy and usefulness of business in Pakistan. The main problem is that developing countries are not knowing the importance of artificial intelligence in the area of business and accounting as compare to developed countries. Many developing countries has lack of financial and technical skill problems. Just 1.6% work has done in this area that is not very much suitable for this field.

2. Literature Review

To determine the significance and part of "Artificial Intelligence" there are many researches and literatures that are available in different data bases and Journals e.g. Scopus. A study was conducted by the (K. H. U. Hassan, Sheikh, & Rahman, 2022) in which he showed the importance of accounting and auditing. The study investigated and gathered the pertinent literature on Artificial Intelligence in Accounting and Auditing that was written from 1992 to 2020. The key value of this study was that it familiarizes accounting professionals with the AI phenomena without getting bogged down in the intricate technical details of AI-technologies. According to(Fares, Butt, & Lee, 2022).

AI use in the investment area is also the part of business and accounting. This study examined 44 articles through a systematic approach. AI was directly and indirectly involved in the banking sector and key areas of banking sector. Literature research were Customers, Strategy and Process. The finding of these key areas was benefited for marketing, bankers and customers that's adopt the functions of AI e.g. online banking services, ATM (Automated Teller Machine), online Credit facilities etc. Digital Innovation, Retails banking, Customer journey map were the key-words of this research. The study also provided future research directions. The fourth industrial revolution was being ushered by two disruptive technologies, namely AI and blockchain. The main purpose of this literature was, how people benefit from e-commerce technology in the presence of AI. This study covered four main thematic groups that were

directing on the resource chain, healthcare, safe transactions and the last one is finance and accounting.

This study settles with 10 application areas in the field of commerce and accounting that can benefits from these types of technologies. Main key words of this literature was AI, Block chain, Fourth Industrial Revolution (IR 4.0) integration and trend (Kumar, Lim, Sivarajah, & Kaur, 2023). Another study regarding big records and artificial intelligence in the field of accounting and auditing was conducted by the (Agustí & Orta-Pérez, 2022). This study cleared the main points of AI and big data using co-word and bibliographic coupling methods. The main goal of this study was to increase and broaden our understanding of this field of study to explain the publications, and to identify the major journals and authors involved in this research. A Bibliometric study was conducted on AI in e-commerce, focusing on the new tools and techniques that was used to enhance the business in this competitive market. The author examined the 4435 documents in which 229 documents were printed in the best International Standard (IS) journals.

The finding of this study was China base-institutions (leading in this research area) that contributed a lot to enhance the ability of business in the online platforms. The first analysis of study on artificial intelligence in e-commerce was presented by (Bawack, Wamba, Carillo, & Akter, 2022). The aim of this study was to act as a source of AI in business and accounting and all other fields. This article conducted the Bibliometric analysis with the help of "Bibliometric R-Package" and "Biblioshiny", a shiny application basically is a "web-interface" which is used for developing and putting together the concepts, map structure, trend topic, topic dendrogram, word treemap, Sankey diagram and word growth dynamics. The core principle and aim of this research item was to offer the Bibliometric analysis by using statistical-historical approach with the provision of importance and part of artificial intelligence in business and accounting.

In the context of Pakistan there were different studies that had conducted by different researchers of this field. AI being effectively employed in Pakistan to monitor and stop fraud, tax evasion, ineptitude, and the identification of possible threats. Businesses, for instance, use individual data and attitudes to spot trends and spot suspected accounting and business operations. Big data has recently gained popularity in both business and accounting in Pakistan. There has been a considerable change in the way technology is applied in finance during the past ten years. This shift is mostly attributable to big record, artificial intelligence (AI), machine learning, and "blockchain technologies", which have all made significant strides in this area. This is a result of the quick global adoption of fiscal technology, big data, cloud computing, blockchain, and artificial intelligence. These technologies are rapidly developing in Pakistan and are already being used all over the world (Y. Khan, 2022).

AI has impacted many spheres of life, and due to its growing importance in business decision-making, it is now a necessary tool for all large organizations worldwide. The use of AI has also increased business process transparency, particularly when it comes to financial disclosure (Mohammad et al., 2020). To increase the effectiveness of the economy, business, and other sectors, nations worldwide are concentrating more on the improvement of their technology sector. Pakistan is in a list of developing countries and struggling to improve the efficiency of its technology sector through applying artificial intelligence. Pakistan is also preparing for industrial growth in the wake of the fourth industrialized revolution. The software development industry's provision of freelance services has also improved (K. Hassan, 2020).

The implementation of big data analytics employing cutting-edge technologies in businesses and organizations has been connected to a number of advantages, including increased sustainability for the environment and society(Sadiq, Rehman, & Nasir, 2021). A study conducted in Pakistan and the primary objective of the study was to gain a comprehensive understanding of the existing and potential applications of artificial intelligence in promotion in order to make references to Pakistani business-to-consumer companies using the data and insights gathered from marketing managers in the trade sector. The finding of the study was businesses that incorporate technology into their operations have an advantage over rivals that stick with more conventional methods of operation (Rana & Haq, 2022).

Table 1: Summary of the Recent Literature of Artificial Intelligence specially in Context of Pakistan

S. No.	Topic	Author's Name	Variables	Data Collection / Theory Base/ Literature	Findings
1.	"Predicting Risk through Artificial Intelligence Based on Machine Learning" Algorithms: A Case of Pakistani Nonfinancial Firms	(Khalid et al., 2022)	Artificial Intelligence Debt to asset ratio Equity Ratio"	2006-2020/ Pakistan	AI techniques can correctly predict risk with least error value. It is valuable for the business and accounting in predicting risk.
2.	"The role of Artificial Intelligence networks in sustainable supply chain finance for food and drink industry"	(Olan, Liu, Suklan, Jayawickrama, & Arakpogun, 2022)	Artificial Intelligence Sustainable Supply chain finance	Supported previous Literature	The findings of this study point to the potential assistances of supply chain systems powered by AI technology as a long-term source of funding for the food and beverage supply chain.
3.	"Business Innovation based on artificial intelligence and Blockchain technology"	(Wang, Li, Lu, & Cheng, 2022)	Business Innovation, Artificial Intelligence, and Blockchain Technology	Few Respondents of two business sectors for qualitative analytical evidence	The findings show that digital transformation is frequently regarded as essential and benefits business innovation initiatives.
4.	"The role of artificial intelligence in sustainable finance"	(A. M. A. Musleh Al-Sartawi, K. Hussainey, & A. Razzaque, 2022)	Artificial Intelligence Sustainable Finance	Support recent relevant literature	This research expands our understanding of the importance of AI applications and models, sustainable investments, and the usefulness of AI beyond its application as a tool for problem-solving.
5.	"The impact of artificial intelligence (AI) finance on financing constraints of non-SOE firms in emerging markets"	(Shao, Lou, Wang, Mao, & Ye, 2022)	Financing Constraints, (Cash) Cash Flows (CF), AI Finance, Firm Size, Changes in short loan, Changes in net, working capital, Firm Growth, Expend (Capital Expenditure), Apply Grant (Number of Patients).	"Non-SOE Listed Companies in China. (2011 to 2018)	The finding shows emergence of AI finance can free non-SOE businesses from their financial limitations. We further show that this benefit is stronger for smaller businesses, businesses with greater levels of innovation, and businesses located in developing nations.
6.	The use of Artificial Intelligence in the context of Business to Consumers Firms in Pakistan	(Rana & Haq, 2022)	Artificial Intelligence "Business to Consumers Firms"	The main information for this study came from qualitative methods, such as in-depth interviews.	Businesses that incorporate technology into their operations have an advantage over rivals that stick with more conventional methods of operation.

Following are the research queries of this study;

- What are the main publications and citation trends of Artificial Intelligence in the world?
- Who are the main authors and their citations on artificial intelligence in area of business and accounting?
- What is the annual progress of documents and which countries are contributing continuously in boosting the research on artificial intelligence?
- What are the future research directions of artificial intelligence?

The approach, data, and inquiry design are presented in Section 3 of the remaining text of this work. Section 4 presents the findings from the bibliometric analysis, and displays the graphical investigation. Section 5 offerings the argument built on the analysis findings, the study's limits, its practical significances, and its coming research directions. In last, Section 6 offerings the inference.

3. Methodology

3.1. Data Organization and Sampling

Academic research is increasingly using bibliometric analysis to assess the calibre, influence, and importance of authors, journals, and institutions in a certain field of study (N. R. Hassan & Loebbecke, 2017). We started by choosing the relevant record and choosing keywords, grounded on an extensive study of literature, in accordance with the greatest procedures for performing a Organized Literature Review (OLR) (Bilal, Shah, Rahman, & Jehangir, 2022; K. H. U. Hassan et al., 2022; K. S. Khan, Kunz, Kleijnen, & Antes, 2003; M. A. Khan et al., 2022; D. Li et al., 2022; Tranfield, Denyer, & Smart, 2003; Xiao & Watson, 2019).

Study papers were gathered from Scopus. This is the well-known data base that is used for bibliometric analysis. The purpose of choosing this database was to enable access to scholarly literature and to complement one another (Mongeon & Paul-Hus, 2016) additionally, this was the primary stage in safeguarding the addition of papers of great calibre (Harzing & Alakangas, 2016). Data available on renowned "SCOPUS" website for bibliometric analysis is from 2008 and we have conducted our latest research at this topic from "2008 to 2022". The keywords "Artificial Intelligence" or "Machine Learning" or "Deep Learning" or "Neural Networks" and "Intelligent System" were used to locate the title, abstract, and keyword. Based on previous literature reviews, the key phrases were chosen with the intention of addressing numerous business functions, with a particular focus on the business (Borges, Laurindo, Spínola, Gonçalves, & Mattos, 2021; Loureiro, Guerreiro, & Tussyadiah, 2021; Verma, Sharma, Deb, & Maitra, 2021) 434,754 papers were returned using the initial search criteria. Following a restriction on these papers to "English," "object only" publishing, and a topic area strainer of "Business Managing and accounting," 1608 papers were ultimately found. The major part in research on artificial intelligence was taken by the United State of America with the publication of 88,679. China documents were 76838, United Kingdom 29,492, India 28,178, Germany 23,758, France 17632, Italy 16971 and Japan documents were 16,602 in AI research. Two works will be considered to be bibliographically attached if they both quote one or more works in common. The term "bibliographic coupling" refers to the relationship that develops when two works cite a third work in their bibliographies. Co-citation is the process of randomly quoting two texts from another by a third text.

3.2. Research Design

In this study most popular software VOSviewer and R-Package (Biblioshiny) were used for reliable results. In these we can take results in the table form and graphical representation is also available in this software to clarify the authentic and more reliable results as compared to other software. For this study of Artificial Intelligence, the research work was designed and at the first stage we obtained 434,754 documents with the keyword "artificial Intelligence". To refine the results, we limit to the year from "2008 to 2022" and found 332,485 documents as you can see in the Table 1. For further refining the results we Limit to the word "English" and found 324,098 documents. At last, we limit only to all open access papers, articles, Journals in the issue area of "Business administration and Accounting". Obtained results were 1608 documents. These were our primary documents for this study. For this purpose, Scopus data base was used.

Table 2: Lists the Selection Criteria for Papers from Scopus

Sr.	Finding Points	Records
1	Papers containing the term "Artificial Intelligence" in the name, abstract, and main words	434,754
2	Boundary to year 2008 to 2022	332,485
3	Boundary to Language: English	324,098
4	Main Sources (Limit to all open access with Articles and Journals that covered the area and subject of Business Management and Accounting)	1608

We have applied the conservative full counting system to build bibliometric linkages. We usage a different types of techniques and four major stages to analyse the orientations:

Figure 1

Stage. 1 History	Breakdown the background/history of the fundamental concept present in Artificial Intelligence printed through titles, keywords and abstracts.
Stage. 2 Co citation Analysis	Profile of the top bases and references for artificial intelligence that have also been co-cited.
Stage. 3 Co-Authorship Study	Study of the systems created by international co authorship cooperation on the artificial intelligence discussion.
Stage. 4 Intellectual, Information and Theoretical Structure	Building bibliometric networks based on co-citation analysis (to assess knowledge or conceptual structures) has made use of bibliometric markers of relatedness.

4. Data Assessment with Key Results

4.1. Writer Citation Analysis

Fig 1.a shows the top authors research on Artificial Intelligence. Novais, P. was the first author in the field of artificial intelligence with 158 highest documents publication. Tao, Da., Shen, D., Abdul Raheem, A., Coraachado, J.M., Parade, H., Mesler, R., Togelius, J., Tambae, M., and Hassanien, A.E. with the publication of 146, 131, 122, 120, 118, 113, 110, 108, 105 respectively. Fig 1 b displays the busiest authors research in the previous decade from 2012 to 2022 specially covered the focus zone of AI in business administration and accounting. The scope of node represents the number of objects in a specific year. Table #2, however, lists the top twenty authors with documents, citations and citations per article in the subject zone of business management and accounting.

Figure 2: a

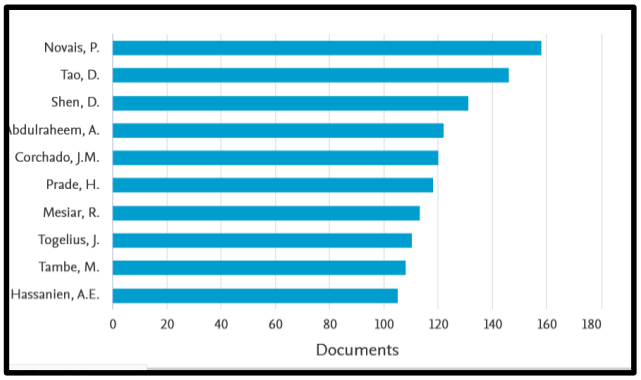
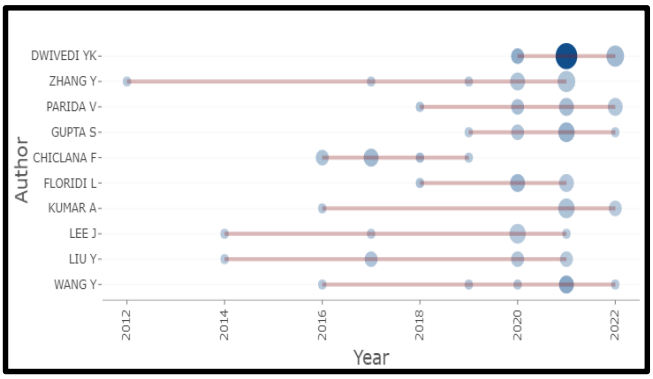


Figure 2: b



According to analysis, Table 2, shows the most famous authors are Dwivedi, Y.K. with 15 printed articles after that Zhang, Y. and Parida, V. 11 and 9 printed articles. Additionally, making a big contribution to publication is Gupta S. with 8 articles after that Chiclana, F. with 7 and Floridi, L. with 7 printed research documents. The researchers with greatest number of citations are Dwivedi, Y.K and 969 citations after that Chiclana, F. with 904 citations Lu, J. with 605 and Zhang, G. with 600 citations. Buhalis, D., Floridi, L. and Kumar V. are also leading authors with 432, 416 and 402 citations respectively. The authors Chiclana, F., Zhang, G., and Lu, J., with 129.143, 120, and 100.833 citations each, have the most citations per article. The most well-known author who has contributed to Artificial Intelligence for decision creating in the age of big records advancement dare, study agenda, and multidisciplinary perspective on emerging challenges and opportunities is Dwivedi, Y.K. Most Prominent Authors in research on Artificial Intelligence are portrayed in Figure 2a and 2b.

Table 3: Top Twenty Authors in research on Artificial Intelligence in Business Management and Accounting

Author's Name	Articles	Rank	Citations	Rank	Cit./Article	Rank
Dwivedi Y.K.	15	1	969	1	64.6	6
Zhang Y.	11	2	204	13	18.545	17
Parida V.	9	3	385	8	42.7	11
Gupta S.	8	4	241	12	30.125	13
Chiclana F.	7	5	904	2	129.143	1
Floridi L.	7	6	416	6	59.429	7
Wang Y.	7	7	352	9	50.286	9
Liu Y.	7	8	194	14	27.714	14
Kumar A.	7	9	136	16	19.429	16
Lu J.	6	10	605	3	100.833	3
Kumar V.	6	11	402	7	67	5
Taddeo M.	6	12	307	10	51.166	8
Wang X.	6	13	87	18	14.5	18
Liu J.	6	14	35	20	5.833	20
Zhang G.	5	15	600	4	120	2
Buhalis D.	5	16	432	5	86.4	4
Lauras M.	5	17	247	11	49.4	10
Wincent J.	5	18	192	15	38.4	12
Paschen J.	5	19	105	17	21	15
Chen Y.	5	20	42	19	8.4	19

4.2. Analysis by Year

Although artificial intelligence research began in 1960 with the publication of a single article, it continued intermittently during this time, and until 1983 the quantity of issued articles was quite small. The number of studies began to increase in the year 2000, and research on artificial intelligence notably began to increase quickly during the 2008 global financial crisis.

Figure 3a

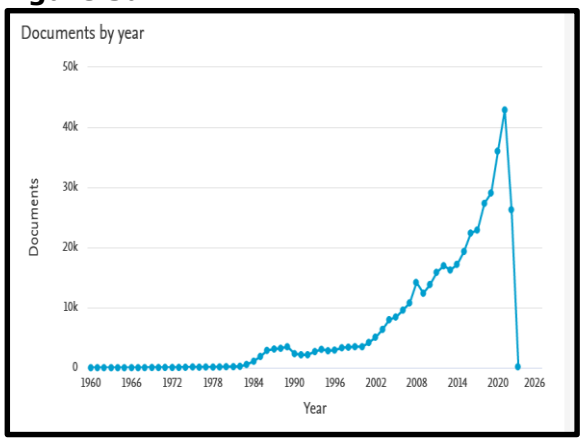


Figure 3b

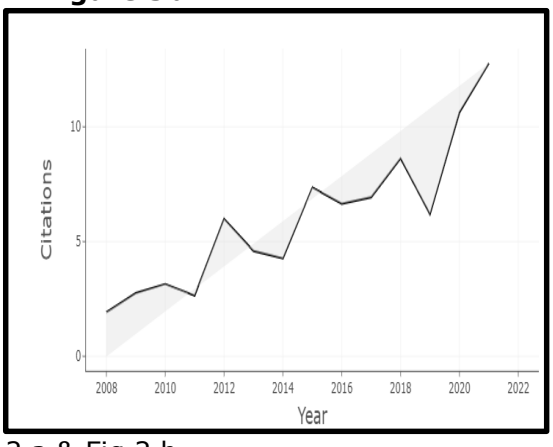


Fig 2 a & Fig 2 b

Figure 3a depicts the annual progress advancements, and from 2010 a large increase is visible. In 2021 the articles were published 42,899. A rapid decrease was observed from 2021 to 2022 with fluctuation 16,605 articles in a year. Fig 3b shows citations growth annually from the time period 2008 to 2022 as selected for the research on AI. This picture also covers the subject area on artificial intelligence in business and accounting. The citations upraised at almost

a high quantity from 8000 to 14000 in the period of 2019 to 2022. Annual trend of published documents & citations is portrayed in figure 3a and 3b.

4.3 Development of Research in Artificial Intelligence

Study on "Artificial Intelligence" was started in 1960 with the publication of one article. From 1960's to 1983 number of publications document was limited. The main development in research of AI was stared in 2000. In this study we collected the data over a period of 15 years since "2008 to 2022". Table 3 shows main information regarding research development in the study of artificial intelligence in "Business management & Accounting". In this tenure the number of source journals, books were 425. Annual growth rate was 29.45% and average citation per document was 18.66%. The last step of table 4. provide the information of international co-authorship % that was 34.14% in the time frame of "2008 to 2022".

Table 4: Presents the Research Development from "2008 To 2022"

Description	Results
Documents found	1608
Bases (Papers, Files, etc.)	425
Yearly Progress Rate %	29.45
Article Normal Stage	2.61
Normal citations each doc	18.66
References	92774
DOCUMENTS TYPE	
Key-words Plus (ID)	5434
Author's Keywords (DE)	5213
WRITERS	
Writers	4574
Writers of single-authored docs	205
WRITERS COOPERATION	
Single-authored docs	217
Co-Authors per Doc	3.26
Universal co-authorship %	34.14

Figure 4

4.4 Analysis by Source/Journal

Scholars may differentiate top papers and their overall concentration and output in the study arena by conducting literature reviews to observe the overall effectiveness of the related publication of the associated topic. A journal co-citation occurs when two journals are cited in the same work. When two journals are cited in one publication, it is known as a paper co-citation. This exercise replicates the association and dispersion of knowledge bases. Annual tendency of the top papers from the Scopus record is shown in Figure 3.a. Source progress during a 15-year period, from "2008 to 2022," is shown in Figure 3.b of the Social Sciences Citation Index (SSCI) web of science record. The density map for the most prestigious business and accounting publications that publish artificial intelligence research is displayed in Figure 4. The scope of the node signifies the regularity of journals. As shown in Fig. 4 & Table 4 the top most important, effective and notable journals in artificial intelligence research contain Knowledge-Base systems published 109 documents, followed by International Journal of Recent Technology and Engineering with 102 significant publications, Decision Support Systems 49 publications, Technological Forecasting and Social Change published 44 articles, Big Data and Cognitive

Computing, Journal of Cleaner Production and Science Engineering Ethics published 40 and 33 and 30 articles respectively significantly enhancing the work of research on artificial intelligence. "Science mapping density map" Figure 5a and 5b (yearly trend of top journals).

Figure 5a

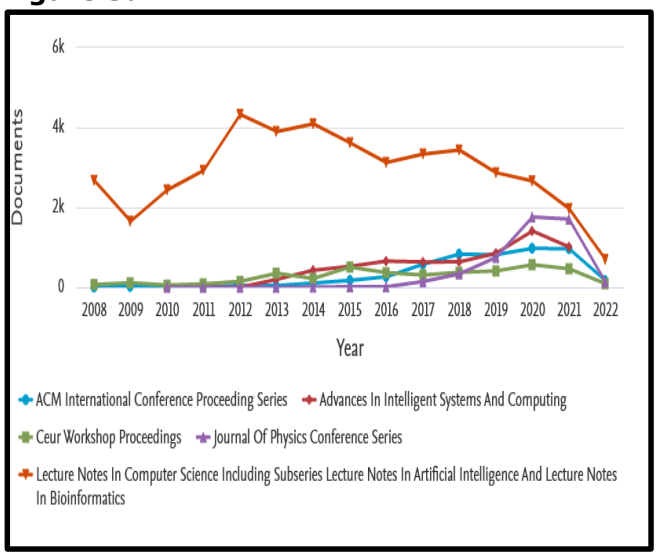


Figure 5b

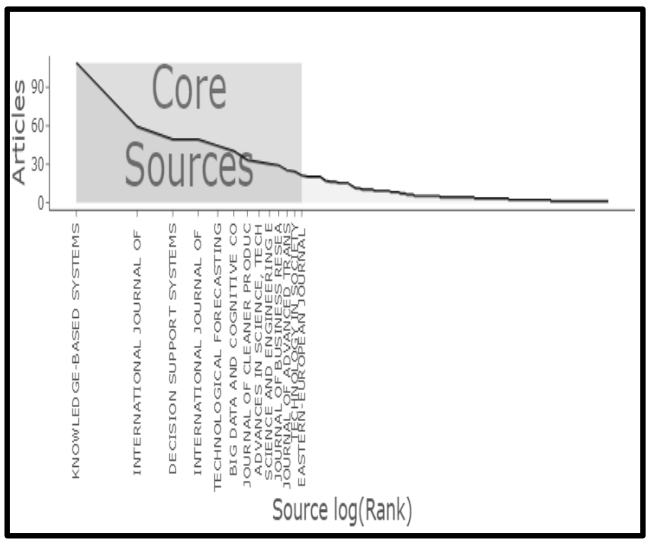
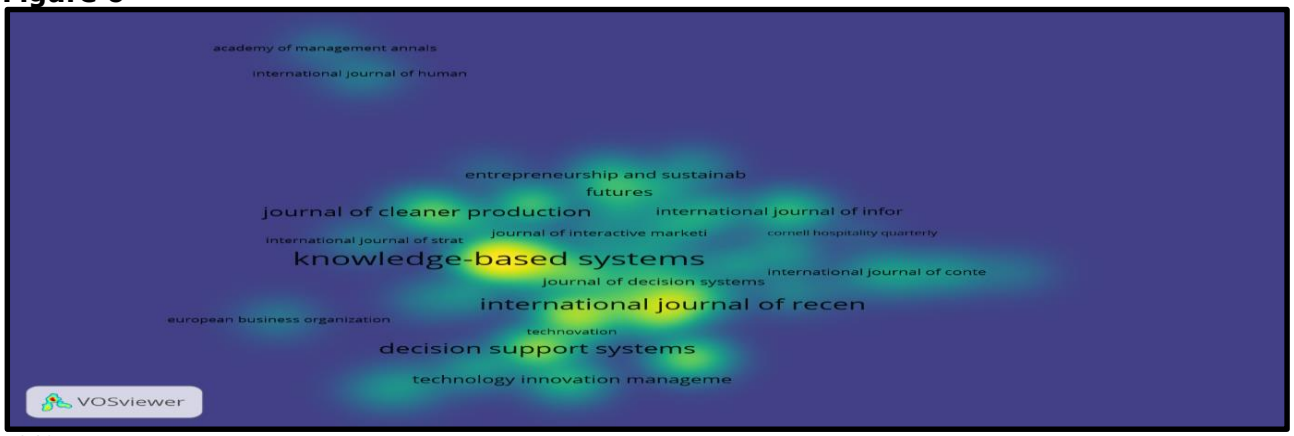


Table 5: Lists the Top 20 Journals for Artificial Intelligence Research Paper Publishing

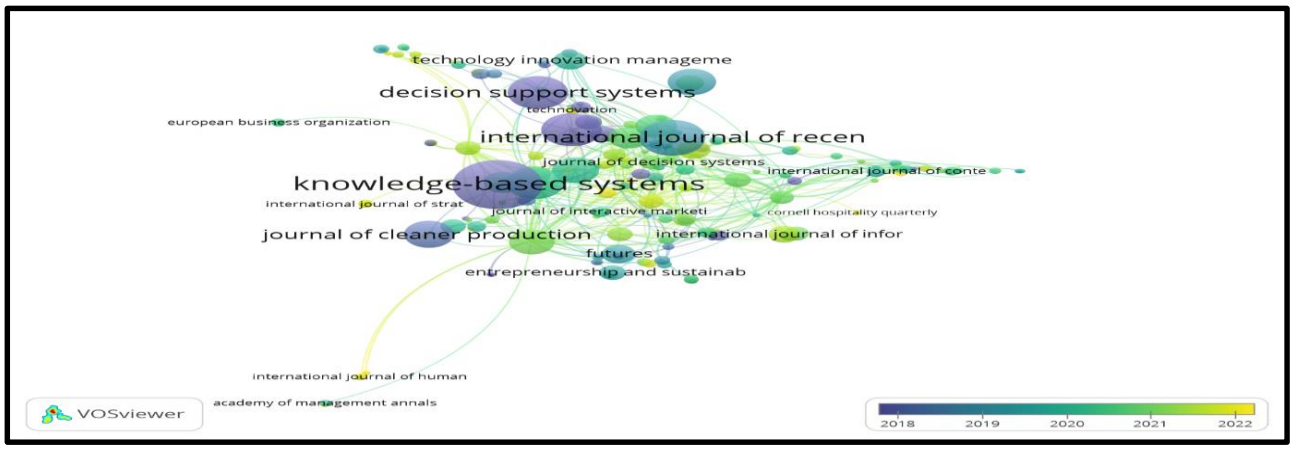
Journals	Articles	R	Citations	R	Cit./Article	R
Knowledge-Based Systems	109	1	3567	1	32.725	4
Advances In Science, Technology and Engineering Systems	31	8	94	19	3.032	19
Big Data and Cognitive Computing	40	6	156	16	3.9	18
Computer Law and Security Review	20	15	240	13	12	14
Decision Support Systems	49	3	2152	2	43.918	2
Electronic Markets	15	19	273	11	18.2	9
Futures	16	18	138	17	8.625	16
Ieee Transactions on Engineering Management	15	20	79	20	5.27	17
International Journal of Information Management	20	13	1527	3	76.35	1
International Journal of Production Research	49	4	1115	5	22.755	8
International Journal of Recent Technology and Engineering	59	2	102	18	1.728	20
Journal of Advanced Transportation	25	11	267	12	10.68	15
Journal of Business Research	29	10	755	8	26.034	5
Journal of Civil Engineering and Management	20	14	282	10	14.1	11
Journal of Cleaner Production	33	7	1280	4	38.787	3
Journal of Self-Governance and Management Economics	17	16	239	14	14.058	12
Journal of The Operational Research Society	16	17	237	15	14.813	10
Science And Engineering Ethics	30	9	759	7	25.3	6
Technological Forecasting & Social Change	44	5	1108	6	25.182	7
Technology In Society	24	12	300	9	12.5	13

Figure 6



Overlay visualization map make it abundantly clear that the journals of Knowledge-Based Systems and "International Journal of Recent Technology & Engineering" are foremost experts and most well-known in the field, followed by Decision Support Systems, Technological Forecasting, and Social Change**.**

Figure 7: Overly Visualization Journal Map



4.5 Analysis by Country

The most productive nation, with 327 publications published, is the United Kingdom with 10,451 citations in research on artificial intelligence in "Business and Accounting" in the period from 2008 to 2022.

Figure 8a

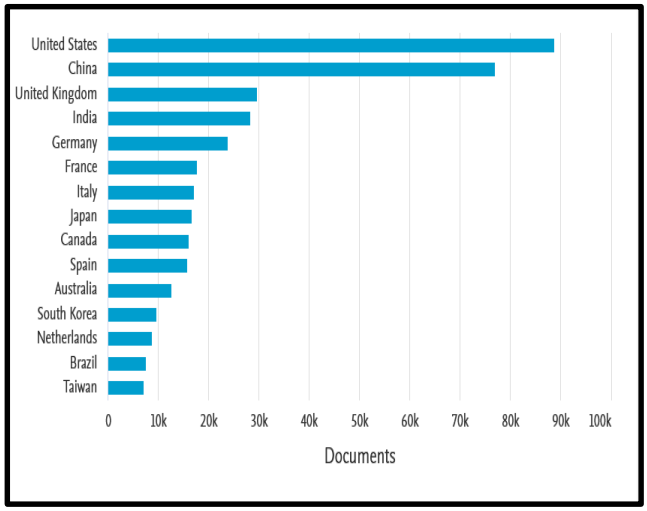
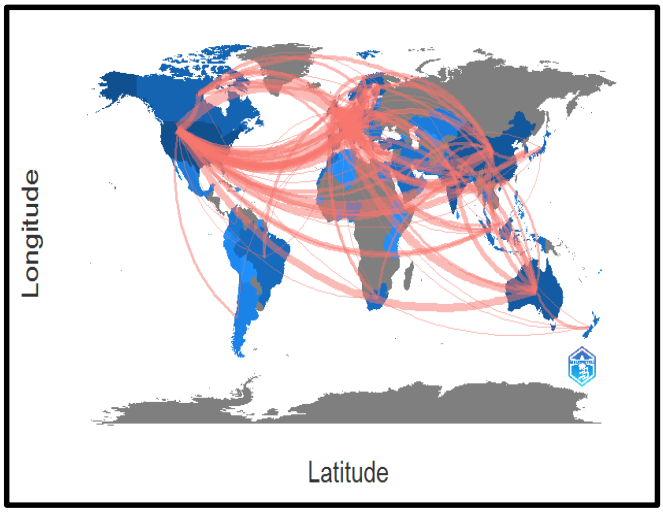


Figure 8b



It is followed by (USA) United State of America with publishing 276 articles and 8415 citations, Germany and China published 119 articles but the citations of Germany are 3146 that are greater than the citations of China with 2725. India, Spain, Netherlands, Australia, France and Italy are also the most prominent countries and includes in top 10 list of the publication with 118, 98, 97, 96, 80 and 77 articles respectively. Table 5 shows the top 20 countries list that are contributing in research on artificial intelligence in business and accounting. These countries also enhancing the opportunities to achieve the goals that are directly and indirectly linked with artificial intelligence in business and accounting in very efficient and effective manners.

Figure 8a shows the overall performance of Top 15 countries in publication the articles on AI. This study provides the help to see the growth and knowledge research not only in AI but also in AI in business and accounting. Figure 8b displays the global collaborative network. The global network of nations conducting research on artificial intelligence in accounting and business is substantially expanding. It's interested to see what kinds of collaborations the nations with the most publications have had. The network grid displays the key connections between the USA,

the UK, and Germany. Asian countries e.g. China and India are also the important part on research AI.

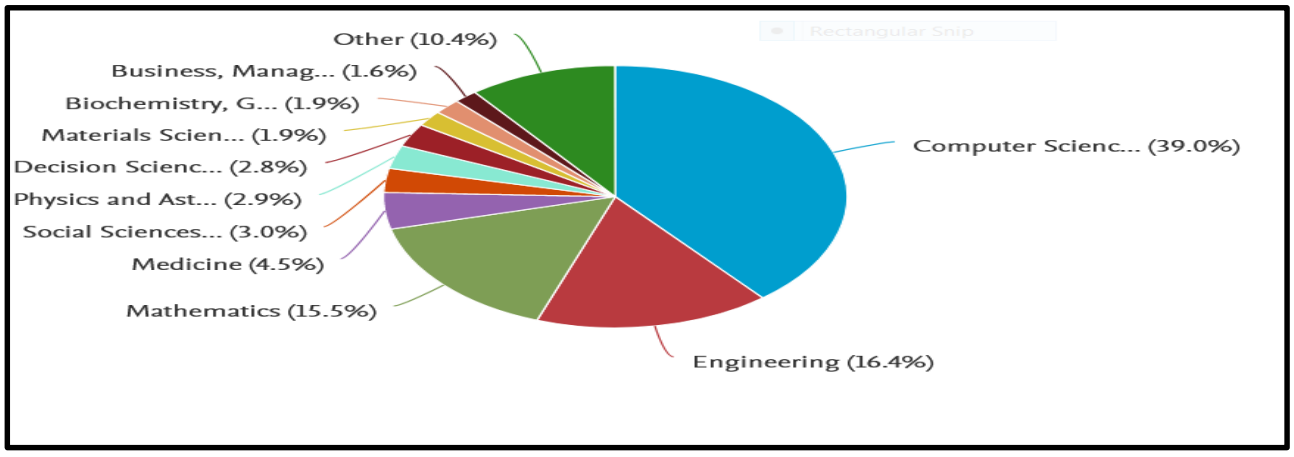
Table 6: Top 20 Countries (Citations Score and Amount of Published Documents)

Country	Documents	R	Citations	R	Cit./Article	R
Australia	96	8	3184	4	33.166	3
Austria	31	20	791	15	25.516	8
Canada	48	14	772	16	16.083	16
China	119	4	2725	6	22.899	11
Finland	59	12	1201	12	20.356	12
France	80	9	2505	7	31.313	5
Germany	119	3	3146	5	26.437	7
India	118	5	1938	10	16.424	14
Ireland	33	19	533	18	16.152	15
Italy	77	10	1204	11	15.636	17
Netherlands	97	7	3294	3	33.959	1
Norway	42	16	826	14	19.666	13
Poland	56	13	537	17	9.589	19
Russian Federation	35	18	254	20	7.257	20
South Korea	42	17	518	19	12.333	18
Spain	98	6	2368	8	24.163	10
Sweden	61	11	2061	9	33.786	2
Switzerland	47	15	1187	13	25.255	9
United Kingdom	327	1	10451	1	31.960	4
United States	276	2	8415	2	30.489	6

4.6 Systematic Synopsis of Field

Earlier we dive into a detailed summary, it's important to note that while traditional research on artificial intelligence can be classified as falling under the categories of Business Management and Accounting, Finance, Computer Science, Mathematics, Engineering, Biochemistry, Social Sciences, economics, additionally, it has been used in several transdisciplinary contexts. The subject areas where documents on artificial intelligence are released are shown in Figure 9. The majority of articles, which is not surprising, may be positioned into the research area "Computer Science" with 305,569 articles (39.0%) "Engineering" with 128,780 documents (16.4%) "Mathematics" with 121,547 documents (15.5%), "Medicine" with 35,310 documents (4.5%), "Social Sciences" with 23,150 documents (3.0%), and "Physics and Astronomy" with 22,654 documents (2.9%). However, there is other AI research in less well-known fields, such as "Decision Sciences" with 22,319 articles (2.8%) "Material Sciences" with 15,010 documents (1.9%) "Biochemistry, Genetic" with 163 documents (1.9%) "Business, Management and Accounting" with 149 documents (1.6%) and other subject ratio is (10.4%) with documents.

Figure 9: Top10 most common research areas in research on artificial intelligence



4.7 Analysis by Organizations

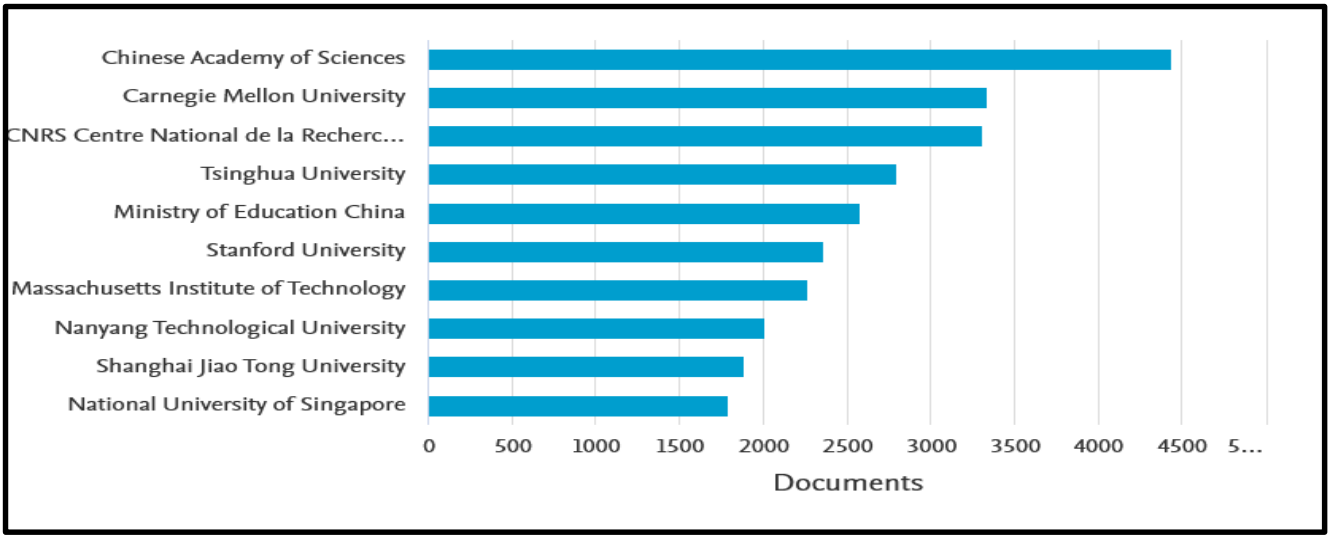
This study also reveals the results of organizations that are continuously struggling and working in the research on artificial intelligence. The top major organization is Lough borough University, United Kingdom with 06 documents, after that Aston University, Birmingham, UK with 05 documents and Hanken School of Economics, Finland, with 05 articles, De Montfort University

02, Leicester UK 01, University of Zilina 01, Slovakia, The University of Verona in Italy "Institute of Technology and Business in Ceske Budejovice, Czech Republic" and London Metropolitan University, and Chinese Academy of Sciences, Beijing with 04 articles each and De Montfort University, UK with 03 articles. The top five universities that have highest rank in the number of citations in study of AI are the De Montfort University with 727 citations, Faculty of Technology De Montfort University with 170 citations, Alan Turning Institute, British Library, UK and Oxford University with 117 citations each and fifth top rank university in number of citations is Aston University, UK with 114 citations. The top 4 institutions, as determined by the number of citations per publication are Faculty of Technology, De Montfort University, with 181.75% citations per article, followed by De Montfort University, UK with 56.67% citations per article, Alan Turning Institute, British Library and Oxford University with 39% citations per article each. (For further detail see Table No. 6)

Table 7: Top 20 Most Common Organizations in Research on AI In Business and Accounting

Organizations	Articles	R	Citations	R	Cit./Article	R
Alan Turing Institute, British Library, UK	3	11	117	3	39	3
Aston University, Birmingham, UK	5	2	114	5	22.8	8
Chinese Academy Of Sciences, Beijing, China	4	9	9	18	2.25	18
De Montfort University, Leicester, UK	3	10	170	2	56.67	2
Faculty of Technology De Montfort University, Leicester, UK	4	4	727	1	181.75	1
University of Verona, Verona, Italy	4	7	50	14	12.5	14
University of Zilina, Slovakia	4	5	73	10	18.25	11
London Metropolitan University, London	4	8	13	17	3.25	17
Hanken School of Economics, Finland	5	3	44	15	8.8	15
University of Reading, Reading, UK	3	13	73	9	24.33	7
University Dade Nova De Lisboa, Portugal	3	20	5	20	1.67	20
University of Oxford, UK	3	12	117	4	39	4
Loughborough University, UK	6	1	92	6	15.33	12
The Alan Turing Institute, London, United Kingdom	3	14	75	8	25	6
The Cognitive Labour Institute, New York	3	17	63	12	21	10
The Institute of Smart Big Data Analytics, New York	3	16	67	11	22.33	9
The Institute of Technology And Business In Ceske Budejovice, Czech Republic	4	6	53	13	13.25	13
The University of Melbourne, Australia	3	18	18	16	6	16
University of Groningen, Netherlands	3	15	91	7	30.33	5
Warsaw University Of Technology, Poland	3	19	6	19	2	19

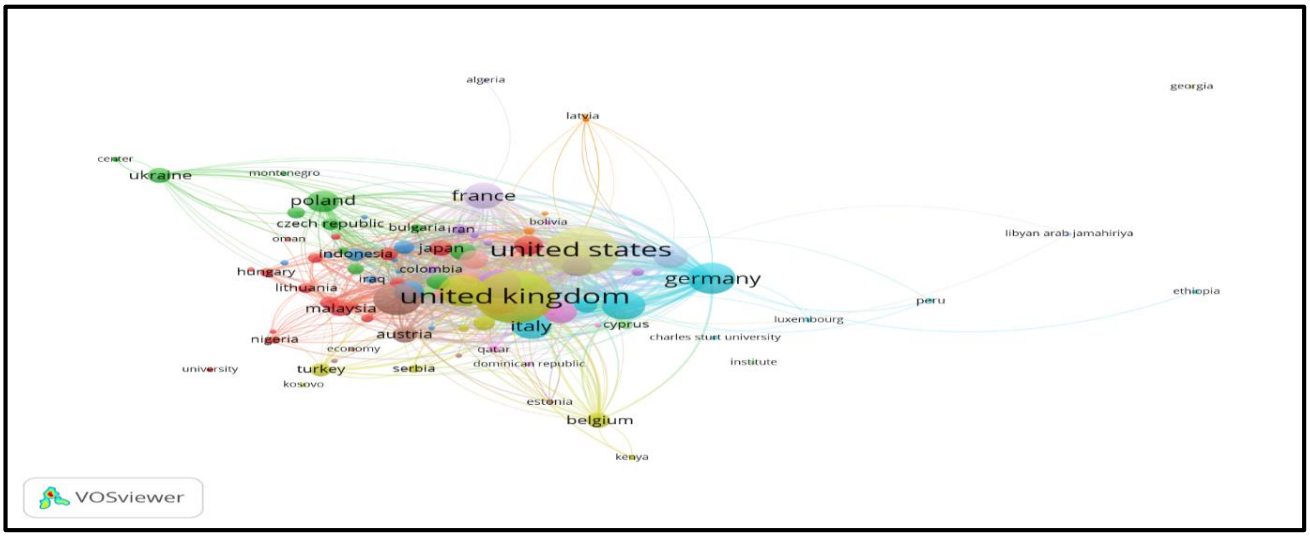
Figure 10: Top 10 Organization in Research on Artificial Intelligence



4.8 Science Mapping Inquiry

In this segment, "science mapping analysis" is carried out with the aid of bibliometric data. This analysis is very important as compared to all other analysis. This is very innovative data counting technique as compared to other techniques as it allows very informative and sophisticated report. This analysis' primary goal is to provide a geographical picture of artificial intelligence dynamics and the relationships between various scientific actors and features (Small, 1997). This strategy matches "scientometric performance indicators" (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2012) by attaining a broad picture through graphic mapping of the major methodical players printing study in the arena of artificial intelligence in "Business management and accounting". "VOSviewer software" (Van Eck & Waltman, 2010) which conceptualized the bibliometric statistics through bibliographic connection (Kessler, 1965) co-occurrence of keywords and the study of co-citation, is used to conduct the scientific mapping analysis in this study (Small, 1997). When two papers that have been printed in a journal cite the similar third paper, or when there is a significant amount of bibliographic relationship through additional papers, this referred to as "bibliographic coupling". The maximum output is demonstrated through bibliographic connection, which demonstrates relationships between the studies (Hafiza et al., 2022; McCarthy et al., 2018; Shahid et al., 2022; Shahzadi, Ali, Ghafoor, & Rahman, 2023; Zulfiqar et al., 2022). The co-citations show the maximum frequently cited research and the relationships that develop when dual published articles are cited by a third one. By noticing the size, symmetry, and importance of observable arrangements, we can understand scientific maps.

Figure 11: Cluster of Nations Reviewing on Artificial Intelligence (Colour Figure Online)



First of all, this analysis starts with science mapping clusters of nations reviewing on artificial intelligence in business and accounting. Authorship configurations were used to study the networks across the different nations. In Figure 10, there are nine clusters with various sizes and colours of nodes that include (green, yellow, blue, pink, red, orange, blue and light brown). In these clusters there are total 57 countries that are strongly and less strongly connected in working on artificial intelligence. These regional/national clusters represent the collaborative network. The node size specifies the comparative variance in publication frequency.

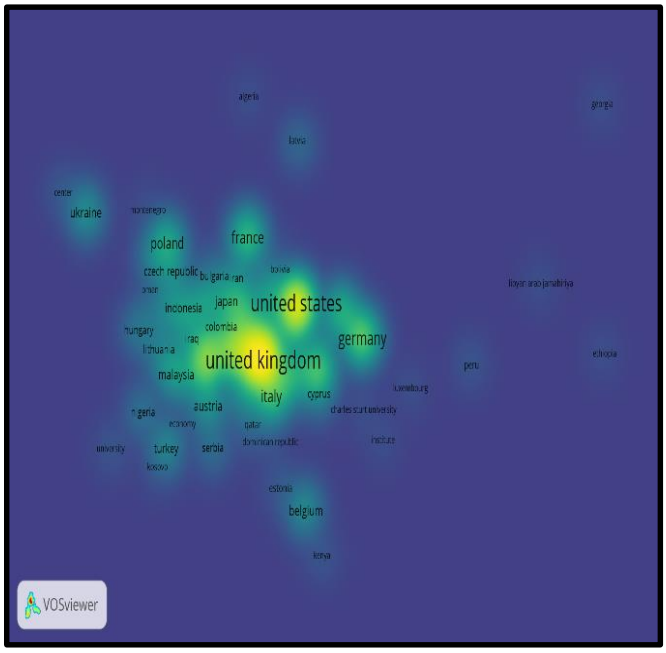
Amongst the countries with strong connection, the first cluster includes China, Israel, Japan, Malaysia, Mexico, New Zealand, Qatar, Romania, Russian Federation, Saudi Arabia, South Korea and Viet. The United Kingdom has a robust network with Australia, Indonesia, Italy, Jordan, Kazakhstan, Poland, Portugal, Slovakia and Ukraine between others. The third cluster of nations includes the United States, which has strong ties to a number of other nations including Austria, Colombia, Egypt, Norway, Sweden, Finland, and Hong Kong. Germany has a strong connection to the fourth cluster with Bulgaria, Cyprus, Czech Republic, Greece, Singapore and Switzerland among others. France is strongly associated with countries like Hungary, Iran, Lithuania, South Africa, and Turkey in the fifth cluster. Whereas India has an association linkage with Denmark, Pakistan, Taiwan and United Arab Emirates in the six cluster. The Canada has collaboration with Bangladesh, Brazil, and Ireland among other. If we discuss the eight cluster of science mapping analysis Spain has also strong collaboration with Belgium, Slovenia, and Netherland. The last

cluster in which just one country includes those efforts on exploring the study on AI is Thailand. The density map in blue printed color Figure 11 depicts the regional distribution of all artificial intelligence research in detail.

The top research producing nations in research on artificial intelligence specially covers the subject area of business and accounting as major performers are UK, US, Germany, China, Spain, Netherlands, Australia, France, India, and Italy. In Figure 11, a geographic representation of national scientific output is added to the same. This picture is taken through Biblioshiny software for the clear representation. The dark blue tint represents a country's vast volume of documents, while the light blue colour illustrates the great progress being made in many nations' artificial intelligence research. The result also shows that different areas are still not participating in the scientific discussion.

Journal co-citation study is second crucial component of science mapping. The findings are shown in Fig. 13a, which includes 39 sources/journals, seven clusters, and networks of citations and co-citations that show the relations. The major and greatest recognizable network of Journal of Artificial Intelligence is present in each cluster, and there are a sizable number of nodes in it. Journals with high citation include Journal of Cleaner Production, Knowledge Based Systems, Decision Support Systems, International Journal of Information Management, and International Journal of Production Research.

Figure 12: A Map of Country Densities Used in Artificial Intelligence Research



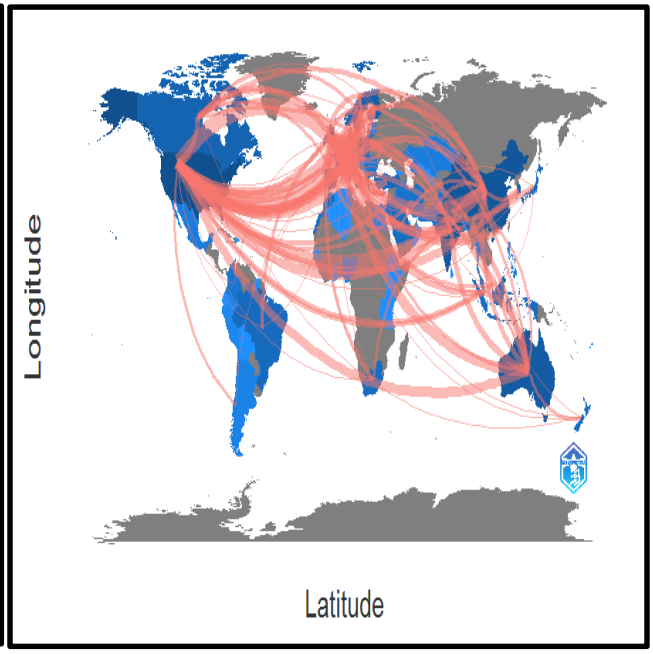


Figure 13a

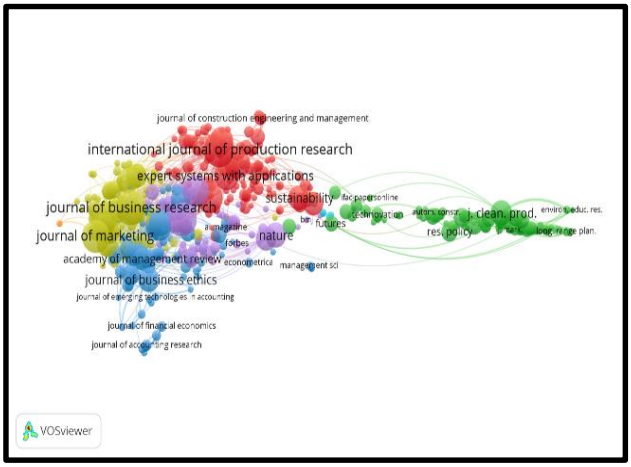
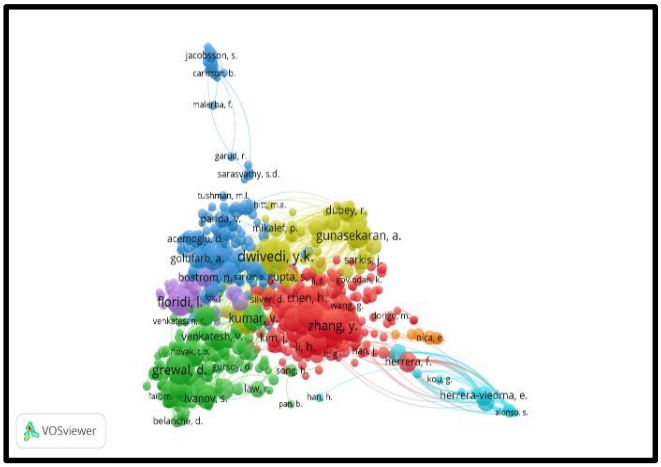


Figure 13b



Notably, the majority of the journals are in the field of Information Technology, Civil Engineering, Business Research, Economics and Technological estimating and societal change. These Journal names and their work emphasis the production of publications and citations of AI Journals. The global picture of journals and advancement from 2008 to 2022 is shown in Figure 12a and Table 4. In this section, science mapping also covers the significance of top leading author's citation study. The results shown in Figure 12b, are relatively same i.e. Table 2. Despite the fact that this graph focuses on the most often cited authors and places further emphasis on author networking ties, numerous important insights may be gained from looking at the graph. Considering the node size in light of the findings we see that Dwivedi Y.K, Zhang Y. Parida V. Gupta S. Chiclana F. and Florida L. take up a central stage having the strong and large network, preceded by (Awan, Rahman, Ali, & Zafar, 2023; Chaudhary, Nasir, ur Rahman, & Sheikh, 2023; Dawood, ur Rehman, Majeed, & Idress, 2023; Hafiza et al., 2022; Shahid et al., 2022; Shahzadi et al., 2023; Zahra, Nasir, Rahman, & Idress, 2023). The most prolific and well-known authors contribute significantly to the research network by setting the parameters for information run and relations. These writers are top rank authors in citation and publications of articles on artificial intelligence in journals. The graph (Fig. 12 b) has a strong "Homophily effect" because few nodes are incredibly near to one another. The idea of Homophily is that "closeness begets" (McPherson, Smith-Lovin, & Cook, 2001). "Homophily effect" happens when actors debate the same subject or a topic of shared interest in setting similar to simulated room. According to Jiang, Ritchie, and Benckendorff (2019)"fundamental disciplinary or thematic similarities typically demarcates Homophily" in bibliometric networks.

4.9 Key Co-occurrence Study

To categorize subsequent themes of artificial intelligence study from 2008 to 2022 the key co-occurrence analysis is used. It is very easy to understand that what are main keywords that were used in this study to explore the research on artificial intelligence in "Business and Accounting". The authors assign keywords according to their publication of articles. VOSviewer overlay visualization science mapping analysis is used to measure the importance of co-occurrence of keywords. Figure 13a shows the most prominent keyword co-occurrences. While Figure 13b represents words cloud using the Biblioshiny and Figure 14. displays a words treemap. In first Figure 13a there are total 07 clusters and each cluster has a different keyword co-occurrence. In first cluster 66 items includes e.g. algorithm, artificial intelligence technology, artificial neural network, bibliometric analysis, decision trees, computer version, deep learning, e-learning, learning system, machine learning, monitoring, online system etc. These are the main keywords with the green circle and present in the main centre of picture. Word clouds, also known as tag clouds, are visual graphs that show the symmetry of the existence of specific words in documents. In the grid, the term with the higher frequency also appears more frequently, and vice versa. In the word cloud the main keywords are decision supporting system, decision making, learning system and machine learning from the period 2008 to 2022. Figure 15 also shows the top 15 keyword occurrences. Several recently developed high-frequency key words are notable for helping researchers in the field of artificial intelligence identify prospective new research areas (e.g., decision support system with 185 publications of article, decision making with 179 article publication, learning system, machine learning, Knowledge based system, Forecasting, robotics, data mining, decision theory, software engineering, learning algorithms, innovation, supply chain and sustainable development).

Figure 14a & 14b

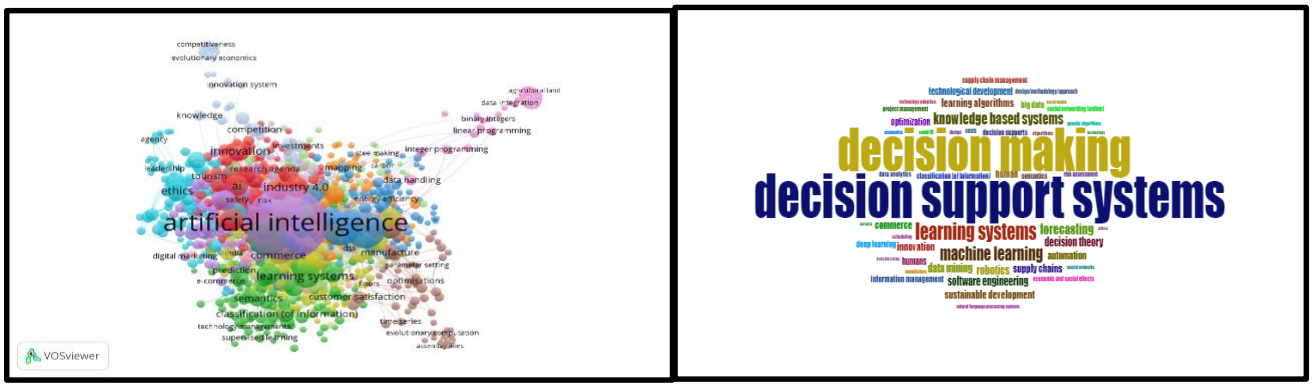


Figure 15

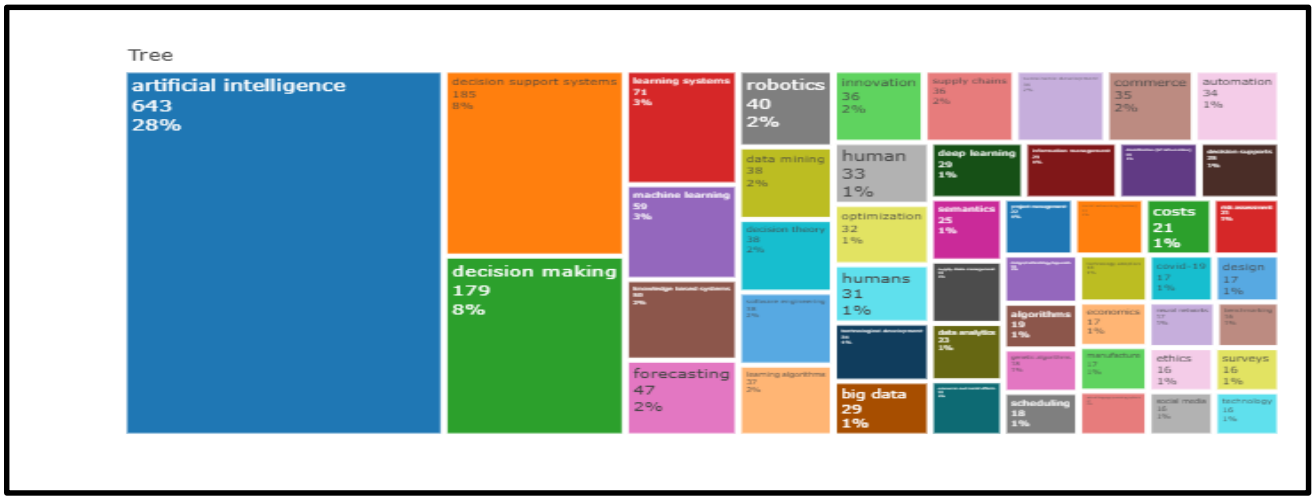
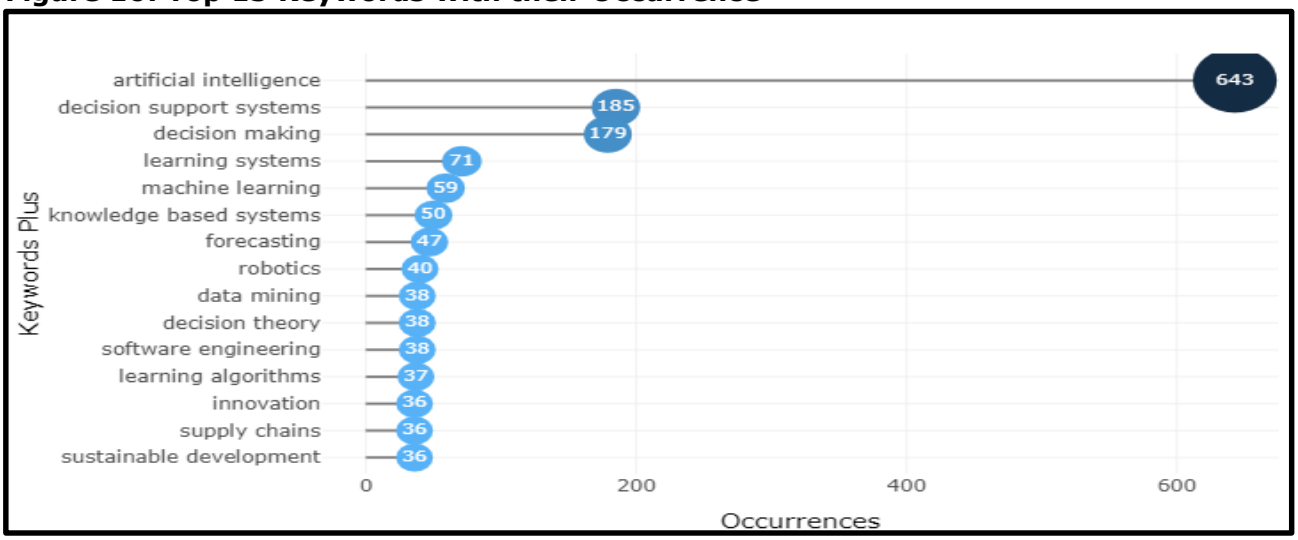


Figure 16: Top 15 Keywords with their Occurrence



4.10. Conceptual Structure Mapping

To represent the conceptual structure of the framework, we used word co-occurrence. Using a conceptual structure map produced by dimensionality reduction, we conducted a multiple correspondence analysis (MCA) on the keywords (Demiroz & Haase, 2019; Ilyas, Banaras, Javaid, & Rahman, 2023; K. S. Khan et al., 2003; Ullah, ur Rahman, & Rehman, 2023; Usman, Balsalobre-Lorente, Jahanger, & Ahmad, 2023). The conceptual structure can be used to create a variety of mapping types, including factorial maps of the most cited papers, conceptual structure maps, and documents factorial maps. One important cluster is depicted in light pink colour on the conceptual structure map of artificial intelligence study over a 15-year period in Figure 17. The resultant conceptual structure map categorizes into four parts. The group in light pink color reserved most keywords (e.g. deep learning, data mining, learning systems, process systems, innovation, decision theory, technology adoption). These are directly concerned with robotics and human ethics. Robotics can work in business and accounting with help of human signals. The conceptual structure map has two sides. The first one is x-axis that is in the position of horizontal and second one is y-axis in the vertical position. The dimensions of vertical position are 21.59% and horizontal position shows 31.39%.

A three-field scheme, often known as a "Sankey diagram", was also utilized in this section. The main purpose of this diagram is to reveal and asses the "flow" between authors, source, and key-words. Fig 16.a represents the strong relationship between them. The main keyword, source and authors that have strong relation in this three-field plot are Dewivdi Y.K., Duan Y., Edwards J. S., that have mostly work on artificial intelligence for decision making in the era of big records progress.

Figure 18b represents the growth cumulative occurrences over the period of 15 years from 2008 to 2022. The most effective and efficient growth is in the session from 2015 to 2022. We see the graph that clearly reflects the significance study fronts or "hotspots" in study on artificial intelligence in business and accounting. In the period of Covid-19 mostly worked has done by the usage of artificial intelligence. Online businesses e-commerce work, financial and accounting work all are dependent on artificial intelligence.

The findings of a cluster analysis that was done revealed the similarity and dissimilarity between the objects categorized by a dendrogram. Dendrogram also called Distance Tree. The hierarchical clustering shown in figure 17 establishes the connection amongst the keywords and the ranked order. The vertical axis reveals the disciplines of the pooled themes, while the horizontal axis reflects the differences between the clusters. Vertical lines and cuts in the picture simplify the analysis and comprehension of the various clusters. According to (Andrews, 2003; Awan et al., 2023; Fatima, Jamshed, Tariq, & Rahman, 2023; Shahzadi et al., 2023) the dendrogram goal is to assess the expected number of clusters rather than attempting to determine the ideal degree of linkage between clusters. Hierarchical clustering of the main areas of study for artificial intelligence in business and accounting is displayed in (Fig. 17). The distance tree has five main strands, with the most advancement and divides, as can be seen. These strands are also divided into eight sub strands. With the help of Dendrogram we can interpret the different arears of interest and their connections. The fifth block is the one with most divisions and progress. If we see the 4th block, this study defines the different areas of interest like automation, development, innovation, energy adoption. This fourth block is strongly connected with the fifth block and generates the different sub blocks. Innovation has direct connected with the cost, economics, algorithms, manufacture, benchmarking block. First block is a very small block in which human is connected with robotics and ethics. In second block systems is connected with the algorithms, information, semantics, data mining.

Figure 17: Conceptual Structure Map

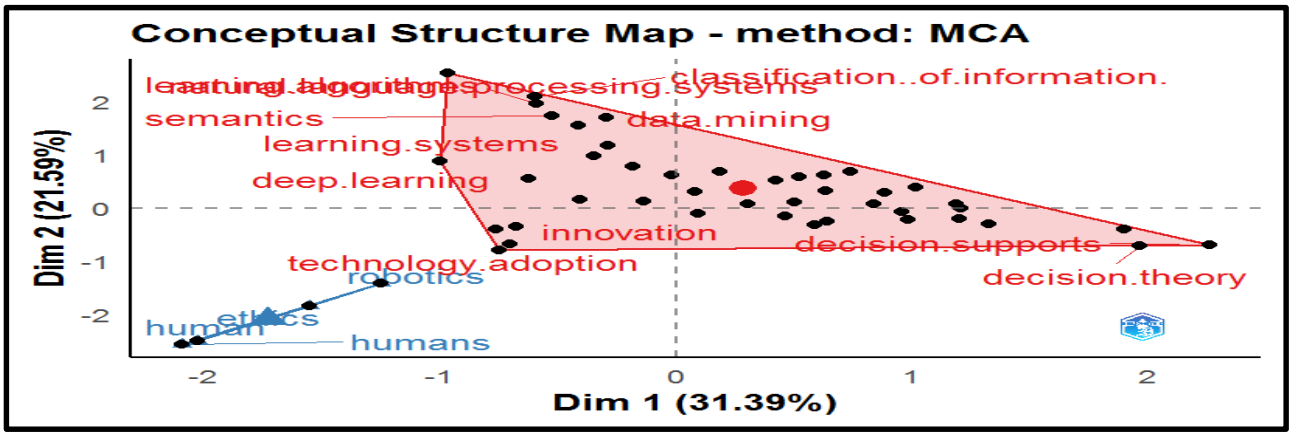


Figure 18: Displays the Sankey Diagram and Word Growth

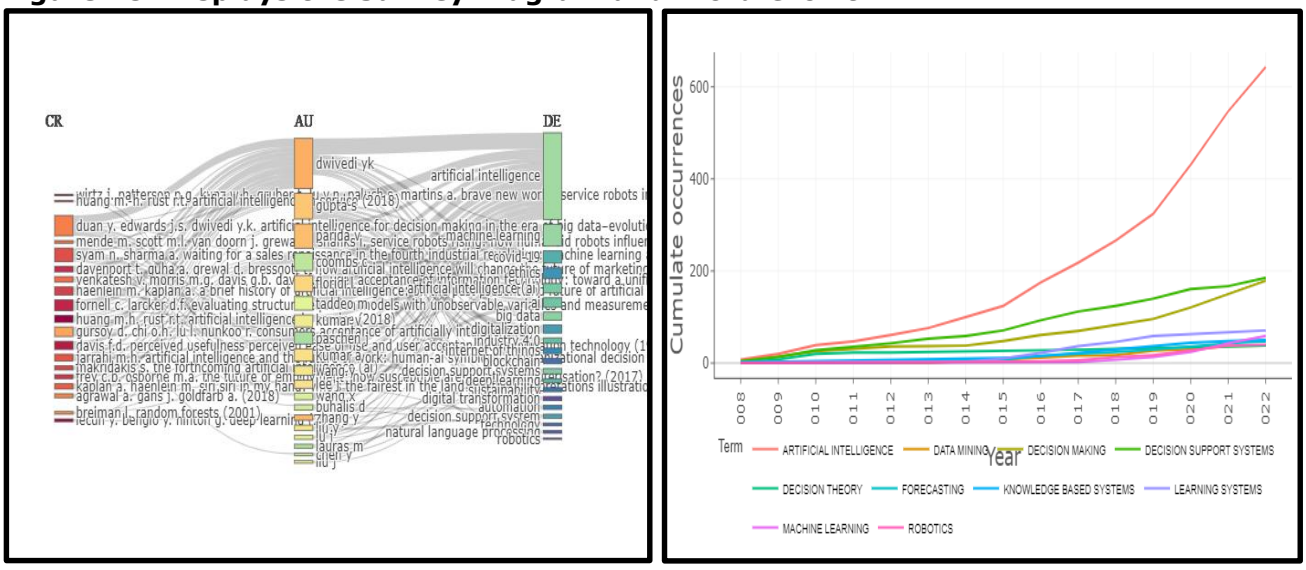
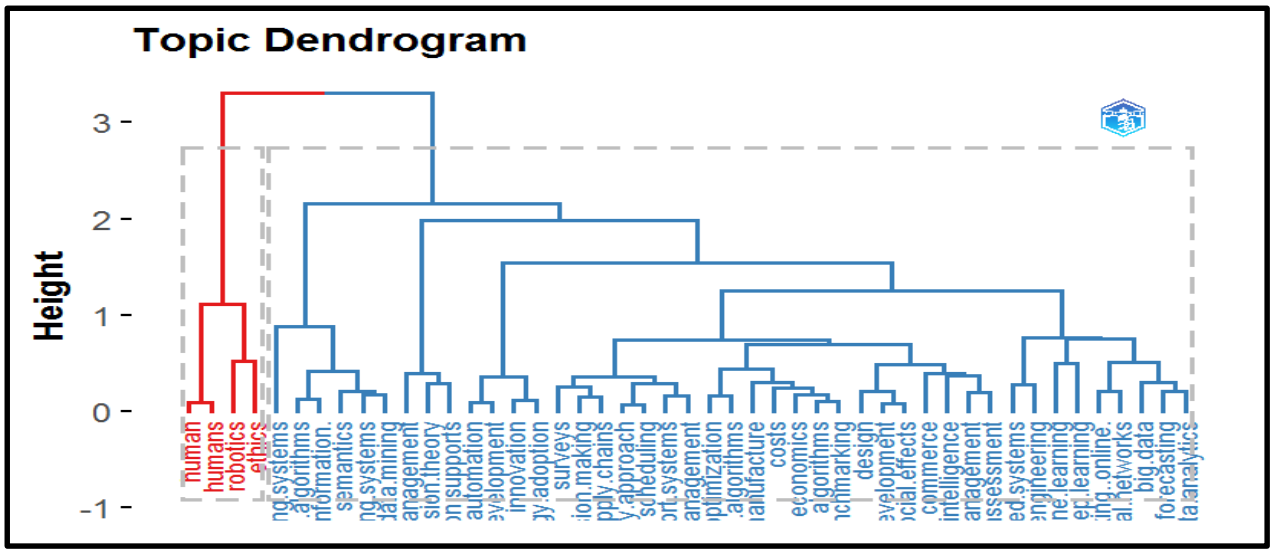


Figure 19: Topic Dendrogram (Source and Authors elaboration using Biblioshiny)



4.11 Limitations and Future Research Directions

We are aware that this study has significant gaps that could be filled by more research. First of all, Scopus was the only source of documents that we used for our analysis. There are different sources like Thomson Reuters Web of sciences (WOS) that can also be used for the research purposes for the future perspectives. Despite its breadth and authority, this decision might have resulted in a skewed perception of the literature. We also took into account that only English-language contributions were accepted and that important documents in other languages might have been missed. This study uses a data over a period of 15 years from 2008 to 2022. The study can also be conducted for the previous 20 to 25 years of data that can be more significant and helpful for the researchers, businessman, professional bodies & accountants, investors, banking companies etc.

5. Discussion

Research on artificial intelligence was conducted in several times according to the demand with solid routes. This study aids and directs academics, working in the area of artificial intelligence as they observe the underlying dynamics using a notable model. With the help of bibliometric investigation, we were capable to explain the difference in the top leading authors, top sources/journals, top leading organizations and universities, most common keywords and finally top rank countries by tracing and illustrating the growth of the field. For this determination, we used the data over the period of 15 years from 2008 to 2022. Onward from 2015 the progress of AI is increasing rapidly that continuously increase the business of organizations and accounting firms, because of less human power and less chances of errors. For data, we used Scopus data base that is biggest and well known data base for the secondary data. Different types of analysis were conducted to find out the significance importance and part of Artificial intelligence in the zone of business management and accounting. 39.00% work on artificial intelligence in the field of Computer Science and 1.6% work was done in business management and accounting. There is very much need to improve the work of this field. In financial reporting, artificial intelligence (AI) tools can examine vast amounts of data to find patterns and trends that humans might not be able to see.

6. Conclusion

Artificial Intelligence is totally a machine learning process. Anything that has taken by the human efforts in the last decades will be turned totally in the process of artificial intelligence. In this research we observed different software that are using to enhance the capabilities of human efforts. In last two decades all the work was done by book keeping, different types of ledgers were maintained but the results failed due to human errors. Accountants and auditors will see a renaissance in the next decades, with the greatest prospects for people entering the profession to spur innovation and advancement (Accounting Today, 2017). In this study we can conclude that the publications, citations, research documents on artificial intelligence are not increasing rapidly but these are beneficial for the economic development, business management and

accounting practices. This study has explored not only the term "Artificial Intelligence" but also the importance and role of AI in subject field of business management and accounting. AI won't replace accounts workers in the field of accounting; instead, it will change the emphasis (Greenman, 2017). In addition to exposing improbable perspectives for investigating quantitative methods and the research environment, bibliometric tools and procedures also help to distinguish its categories in published reviews. With the help of this study, business management and accounting, individuals and organizations will respond quickly to changes on customer demand and they will be able to create new methods and techniques of artificial intelligence. This will automatically shorten the time and energy of human power. We have tried to fill this study gap in our study by providing the science mapping techniques, multiples correspondence analysis of artificial intelligence field. In future we can conduct study at the challenges that are creating problems in the progress of artificial intelligence in the area of business and accounting. This research study is helpful for the new researchers who have joined the field of business management and accounting. Accounting professionals may be able to use this to pinpoint areas where financial performance could be enhanced, resulting in better decision-making.

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