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# ARTIFICIAL INTELLIGENCE IN HEALTH CARE INDUSTRY: A BIBLIOMETRIC ANALYSIS

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**Abstract**
The present work highlights current research trends in AI in insurance in recent years, focusing on unlocking innovation and efficiency, and exploring future research directions, through bibliometric analysis and assessment of the scientific literature on AI in insurance. The study finds research growth over time within this research ground, with major attention on health insurance and the healthcare domain. Presented countries that most contribute to research on AI in insurance are the USA, UK, and India. Similarly, significant contributing sources, authors, and articles in the research field. It reveals major themes such as Artificial Intelligence, human, insurance, machine learning, and health insurance. The findings of the study facilitate future research with the main emphasis on the application of Artificial intelligence technologies in definite insurance markets including Life insurance, auto insurance, and compensation insurance either at the national level, regional level, or sub-regional, and possibly research themes.

**Keywords**
Artificial intelligence (AI), Insurance, Technology, bibliometric analysis, scientific literature, R package, and Vos Viewer.

## 1. Introduction

Artificial intelligence (AI) has appeared as the utmost impactful technology across various industries, including insurance, and it has unlocked a world of opportunities for all industries with its dynamic technological skills and abilities. It had a great effect on the insurance market and has completely changed the insurance industry, transforming traditional insurance activities such as risk assessment, claim processing, customer assistance, and underwriting policies, enabling insurers all over the world to adopt AI-powered solutions and achieve exceptional efficiency and sustainable development. AI can change the insurance industry through proactive techniques that mimic human cognitive processes(Rao & Tirumalaiah, 2024). This shift will improve decision-making, productivity, cost-efficiency, and customer experiences by affecting agents, clients, financial intermediaries, insurers, and service providers through the optimum use of the latest technology. The dependency of the insurance sector on AI technologies is a major focus and aim of this research

Industry 4.0, with its multi-faceted technologies, provides a range of benefits and has been transforming industrial and economic activities to grow globally (Rai et al., 2021). and insurance services have been an important component of all other sectors, (Meindl et al., 2021). In recent years, the insurance sector has joined the digitalization revolution. This industry has

not altered much in the past 300 years due to its completely regulated environment and the extreme productivity of the participants(Yan et al., 2018). Customer involvement has historically been poor in the insurance sector and interacts less with insurers than with any other industry(Morgan Stanley and Boston Consulting Group, 2014).

Globally Many insurers have restricted interaction with the end consumers because a significant amount of their business is carried out with brokers and agents. Insurance was traditionally associated with lots of paperwork, time-consuming documentation, filing complicated claims, and waiting a long time for claim settlement. But with their massive data capabilities, tech titans like Google and Amazon have entered the market.(Egfjord & Sund, 2020), and tech startups have surrounded the insurance industry, creating a bunch of opportunities for change in traditional insurance business practices (Seekings, 2017);(Cortis et al., 2019). With the need for time-consuming processes, to avoid lots of paperwork and to remain competitive, it has become a mandate for the insurance industry to adopt the use of the latest technologies including artificial intelligence, big data, predictive analytics, blockchain, machine learning, the Internet of Things, and robotics for process automation. The automation process introduced by AI in insurance has restored consumer confidence in insurance companies. As a result of these discoveries, insurance companies are promoting sustainable growth, reducing challenges and fraud, automating all business processes to cut expenses, and the insurance industry's increasing reliance on applying advanced and sophisticated technologies like big data, AI, and Machine Learning.

Artificial Intelligence (AI), is transforming the insurance segment Globally, India is not an exception to this digital transformation. The insurance sector in India has traditionally depended mostly on manual processes, mainly documentation, and claim processing, and lengthy turnaround times for policy settlement. However, due to the use and integration of fully equipped technologies such as artificial intelligence (AI), insurers are conducting business operations differently. According to(Accenture, 2020), insurers may now automate these procedures, which can lower expenses, minimize errors, shorten the time needed for important insurance activities like claim processing and settlement, and enhance customer service, (PwC, 2021). Insurance companies can provide today more individualized products,(KPMG, 2019), spot and stop insurance fraud,(McKinsey & Company, 2021), and make more appropriate decisions thanks to AI-powered technologies and their applications transforming the insurance sector in India,(EY, 2020).

Artificial Intelligence efforts towards customer service are prominent, Chatbots and virtual assistants offer endless support for handling customer inquiries around the clock and provide guidance to the users, especially policy particulars and claim process requirements. This permits human resources in the sector to address complex tasks, provide better customer service, and also improve customer satisfaction. Additionally, AI plays a key role in risk valuation and management by investigating massive amounts of data from many sources, AI and ML algorithms can forecast risks more accurately(McKinsey & Company, 2021), permitting insurers to value their products more competitively and manage their clusters more effectively. Predictive analytics models assist insurers to detect fraudulent events and ensure that claims are processed fairly and efficiently. The employment of digital technologies in the insurance sector is determined by regulatory compliance requirements. Artificial Intelligence systems can aid insurers in implementing regulatory standards and ensuring that all measures

are followed accurately, by automating compliance checks,(Deloitte, 2022).

## 2. Literature Review

Early in 2010 (Kelley & Wang, 2021), the term "InsurTech" was coined, it had become extensively used by 2015 and was a global Google trend by 2022 (Shamsuddin et al., 2023). According to (Cao et al., 2020), the application of modern technologies to the traditional insurance business revised the name Insurtech, a new term that arrived from the integration of insurance and technology. With the latest technologies, including artificial intelligence (AI), the insurance sector is transforming a part of the global business trend (Lasi et al., 2014). This digital transition has surprised the insurance industry's sustainable performance, according to (Cosma & Rimo, 2024)

(Gupta et al., 2022) and (Patel et al., 2022) investigated that insurance technology is a recent marvel that applies the latest digital knowledge to adjust traditional insurance practices, and it is worthy to be explored in detail to understand its risks and probable. Today, insurance technology intends to use artificial intelligence, big data, blockchain, and (IoT) to progress the insurance environment and overcome the sector's vulnerabilities. This results in the design and development of new insurance plans, and improves efficiency (Cortis et al., 2019)(Cortis et al., 2019). Underwriting is a major challenge for the insurance industry because it heavily requires clients' data sets and human involvement. Therefore, the chances of human errors are high. In the late 19th century in Canada, an automated underwriting expert system was developed(Pilote & Fillion, 1991), Later, ML and other statistical techniques like fuzzy logic and NLP were successfully applied to complete the underwriter's automation (Aggour et al., 2006).

Big data assists insurers in more accurately pricing policies because it provides more data. By providing them with effective and efficient consumer knowledge, it can help increase operational efficiency. This could result in reduced costs and better customer service (Hassani et al., 2020). The insurance sector is revolutionized by using big data, providing various benefits ranging from underwriting to contentious customer support and satisfaction. Machine learning and AI are frequently applied in the industry to analyze their data. These advanced technologies can assist insurance companies improve the quality of services through automation (Ellili et al., 2023).

Artificial Intelligence originated with a 1955 Dartmouth Summer Research Project Proposal that aimed to allow machines to mimic human intelligence and do complicated jobs (McCarthy et al., 2006). AI refers to the advancement of computers from being simply an instrument that can simulate human intelligence to the attainment of intellectual and self-learning processes. By Incorporating artificial intelligence, ML and DL techniques become promising areas of the modern technological revolution (Huang et al., 2020).

The term machine learning (ML) refers to a vast field that focuses on using data and methods automatically without explicit programming According to (Herrmann, 2023), industrial operations have been transformed by the widespread expansion and use of AI and ML technologies in current years (Goodell et al., 2021). (Alnaser et al., 2023) state that this kind of application of AI and ML to boost customer experience, reduce risk, and increase operational efficiency is not exclusive to the insurance industry. The underwriting process in the insurance industry is a major application of machine learning (Bee et al., 2021). To automate business processes, make better decisions to enhance customer experiences, and detect fraud, artificial

intelligence, and ML have recently joined with insurance industry (Pattnaik et al., 2024). AI and ML algorithms can examine massive amounts of datasets to assess the degree of risk associated with different policies(Akakpo et al., 2019). AI can also be used to prospect potential customers to offer modernized insurance plans, including life cover, health, property, agriculture, and reinsurance (Simester et al., 2019).

A variety of ML algorithms, decision trees, SVN, artificial neural networks (ANN), and other algorithms have been used to predict whether customers would churn in many industries, including insurance (Vafeiadis et al., 2015). For the customer lifetime value prediction, various ML algorithms were developed, such as classification and regression trees (CART), SVM, additive regression, K-Star Method, multilayer perceptron, and wavelet neural networks (Rathi & Ravi, 2017), probit, regression, and Naïve used to predict the CLV that helps to understand the customers' attitude and performance to successfully keep their policies (Verhoef & Donkers, 2001). For recommending appropriate offers for each specific client, recommendation engines play a crucial role(Jing et al., 2018), and chatbots are the most revolutionary discoveries of AI that help lots of customers solve their inquiries through online chats or messages (Riikkinen et al., 2018).

## 3. METHODOLOGY

The present study uses a method of bibliometric analysis to inspect the role and importance of artificial intelligence in the area of insurance and investigates its potential applications for the insurance sector transformation to rebuild the traditional business into a digitalized one, also analyzes the effectiveness of the newborn technologies with a focus on unlocking innovation and efficiency, integration of bibliometric and literature review allows us to complete understanding of the title "Artificial Intelligence in Insurance" and to address the limitations. To determine the role and significance of emerging technologies like artificial intelligence in the expansion of the insurance sector and the level to which the research area has grown, an evaluation method named "Bibliometric analysis" was used. It is a method intended to use purposefully analyze the data, and connect and visualize periodicals and other contributions related to the topic. (Nobanee, 2021)(Donthu et al., 2021),(Migliavacca et al., 2023); (Boubaker et al., 2022).

For this study, the Scopus database was used to build the search question and gather the required datasets for the stated analysis. Since it is one of the most valuable and reliable databases in scientific research (Goodell et al., 2021), a leading source of abstract and citation databases of extreme publications, including journals and articles, (Nobanee, 2021), using this database, we can obtain a well-structured collection of research papers and articles that are focused mainly on the insurance industry's effective use of artificial intelligence (AI).

On 5th June 2024, a query was established and posted in the Scopus database to extract and examine required data sets, As presented in **Figure-1**, the refining process presents the search process for the main query, including the presence of the keywords "Insurance Technology," "AI," "Artificial Intelligence," and "Insurance" in the titles, and abstracts of the database documents. The search initially provided 2352 documents, and then the criteria of the query were modified to documents published within the last seven years (2017–2024). And further screened by applying subject area and document type, and the query was filtered again by confining the articles made in English only, this resulted in a decrease in the number of papers

from a count of 2352 to 393. Furthermore, the last query is well thought-out to be inclusively open-access documents, and the final output results of 244 documents extracted from the database to conduct bibliometric analysis, (Cosma & Rimo, 2024). Further, the research papers are segregated into conceptual, application & use cases, and technological advancements for the latest insights and a more comprehensive understanding of the title "Artificial Intelligence in Insurance" by conducting a literature review and Analyzing bibliographic data by using the Vos Viewer software (Van Eck & Waltman, 2010), and the Bibliometric R package (Aria & Cuccurullo, 2017), were applied to conduct performance analysis and science mapping (Donthu et al., 2021).

The quantity of publications and citations is the main unit of analysis used in performance analysis (Migliavacca et al., 2023). Examining these proxies of publication output and research effect might help determine the research trend and significance in a given scientific field. Particularly, the performance study and science mapping were conducted with Bibliometric data, both are permissible for us to address the two research questions (RQ1, RQ3,), detecting the major suppliers to the research in the area of artificial intelligence in insurance by most contributing sources, impactful authors, countries, and organizations), the most impactful research studies through the publications and citation trends (Chiaramonte et al., 2022); (Migliavacca et al., 2023). On the other hand, the scientific literature of existing articles allows us to examine the advancements in the scientific studies being reviewed to qualitatively draft knowledge in a specific field (Potter & Levine-Donnerstein, 1999) and allow us to address our second investigation (RQ2), through the documentation of the major research streams in artificial intelligence and insurance research. (Donthu et al., 2021); (Holland & Kavuri, 2021). After the keyword analysis, cluster analysis using the author's keyword co-occurrences network was directed to determine the development trends in artificial intelligence in the insurance domain (Boubaker et al., 2022). Lastly, we drafted future research directions, including potential research titles related to the scientific fields of artificial intelligence and insurance, (Bahoo et al., 2020).

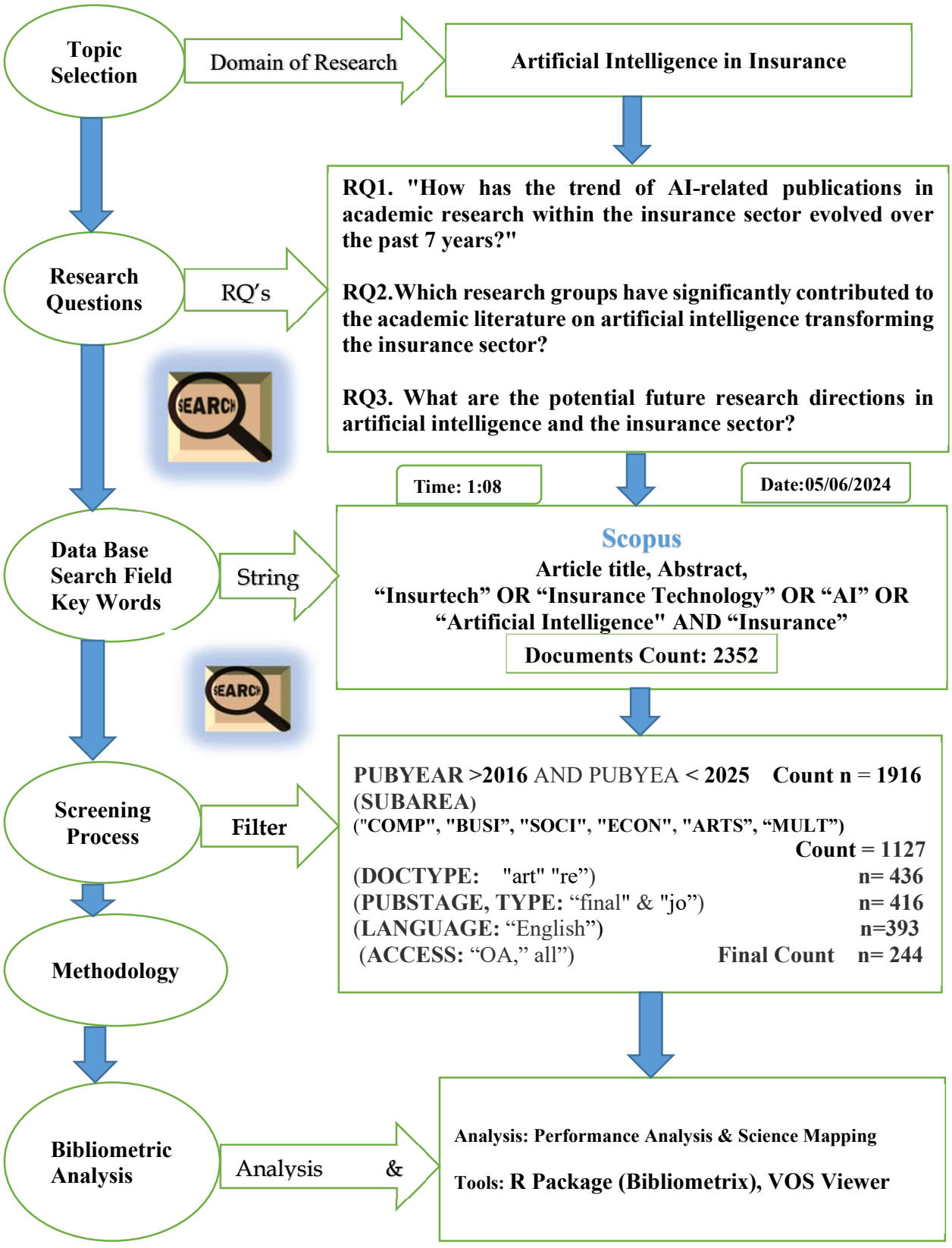


**Fig .1. Research Flow Chart (Authors Contribution)**

## 4. RESULTS AND DISCUSSION

### 4.1 Main Information

After refining all 2352 documents, a total of 244 documents with a period of 7 years between 2017 and 2024—were found using the keywords artificial intelligence and insurance, insurance technology, insurance, and AI that were extracted from the Scopus database. The data exhibited that out of the 244 research papers, there were 219 articles and 25 review papers. A yearly publication growth rate of 52.28% is established by the data provided. A total of 918 authors, including 29 single authors, contributed to the papers presented by 162 sources. The remaining articles presented by multiple-author papers also had an average citation score of @17.6% including all keywords, an international co-authorship of @28.8%, and an average co-author per document of @4(3.96).

Using the Scopus data, we analyze the bibliometric features of publication annual growth, major contributing countries, publication sources, subject area-wise trend, countries' productivity over time, most influential authors, top impactful articles, and citation analysis and keyword analysis followed by keyword co-occurrence analysis. The progress is presented in terms of frequency and growth rate form. We use R Package (Bibliometrics'), and VOS viewer to map the co-occurrence of the keywords and report citation analysis as citation metrics by presenting top cited articles on artificial intelligence in insurance.

The results presented include publication trends by year, subject area, countries' contributions, publication sources, authors' scientific production, and most cited articles that can answer our first two (RQ1, RQ2,) research questions, cluster analysis(keyword co-occurrence ) and current stream documentation based on the determined keywords (keyword analysis), provides valuable insights into artificial intelligence in insurance and its significance, contribution to transforming the insurance sector, their applications and advancements focusing on unlocking innovation and efficiency and explores future research directions for answering our research questions (RQ3)

### 4.2 Basic Bibliometric Analysis

A performance analysis, which is exclusive to AI in Insurance research in this publication, was incorporated into the study to show the efficacy of a particular research area. This study also identifies the most significant publications, contributors, connections, publishing patterns, and countries. The equipment used for the research analysis is shown in **Figure 1**.

#### 4.2.1 Publication Trend by Year

The number of publications on artificial intelligence and insurance technology did not increase significantly until the industry gained traction in 2017, there was only one study on the topic for several years (Shamsuddin et al., 2023). After that, the application of the latest technologies during the COVID-19 pandemic expressively changed the pace of the insurance business. As a result, insurance markets in progress for executing new business permanence plans to preserve the supply of major functions, emphasizing the delivery of digitalized services (OECD, 2020); (OECD, 2021), this is the major milestone for the insurance sector to adopt AI technologies for the enhancement of business operations, and that resulted in tremendous progress in the insurance sector as well as scientific publications in the field from 2019 onwards

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### 4.2.2 Annual Publications on AI in Insurance

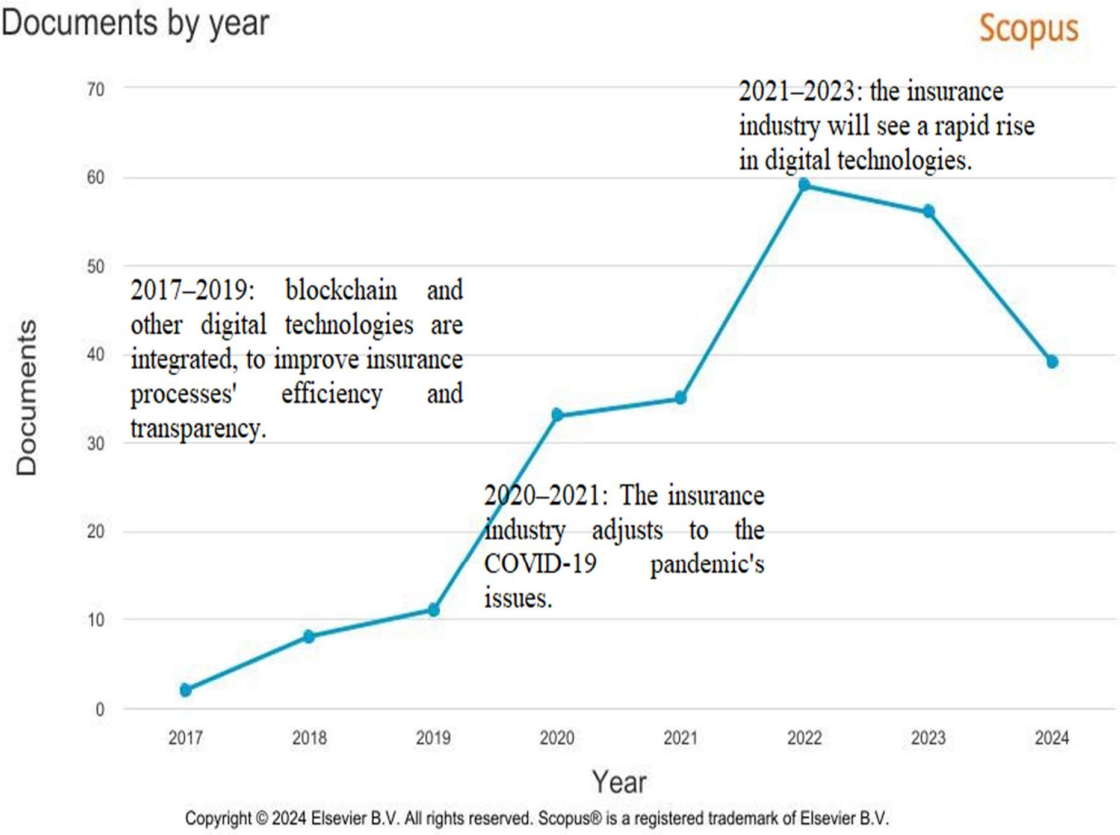



**Figure 2**

### 4.2.3 Publications by Year and Annual Growth Rate

| Year | No of Publications | Percentage (N=244) | Cumulative Percentage% | Growth Rate % |
|---|---|---|---|---|
| 2017 | 2 | 0.82% | 0.82% | 0.00% |
| 2018 | 8 | 3.3% | 4.12% | 302.44% |
| 2019 | 11 | 4.5% | 8.62% | 36.36% |
| 2020 | 33 | 13.5% | 22.12% | 200.0% |
| 2021 | 35 | 14.2% | 36.32% | 5.18% |
| 2022 | 59 | 24.3% | 60.62% | 71.13% |
| 2023 | 57 | 23.4% | 84.02% | -3.70 |
| 2024 | 39 | 15.9% | 99.92% | -32.05(so far) |
| Total | 244 | 100% | 100% | |

**Table 1**

Figure 2 and Table 1, summarize the number of publications over time and present the greater research progress with the number and growth rate in the articles published on Artificial intelligence and insurance. The number of documents increased steadily year by year and reported the highest number of (59) research publications in the year 2022 and a little bit of correction in the number in the year 2023 and reached 39 articles so far in 2024. The quantity

is projected to increase by the end of 2024 and 2025 as the Industrial Revolution 4. O gains widespread traction and 5. O advancements in artificial intelligence and its applications in various sectors including insurance.

**4.2.4 Top 10 Countries by Publications on AI in Insurance Over Time**

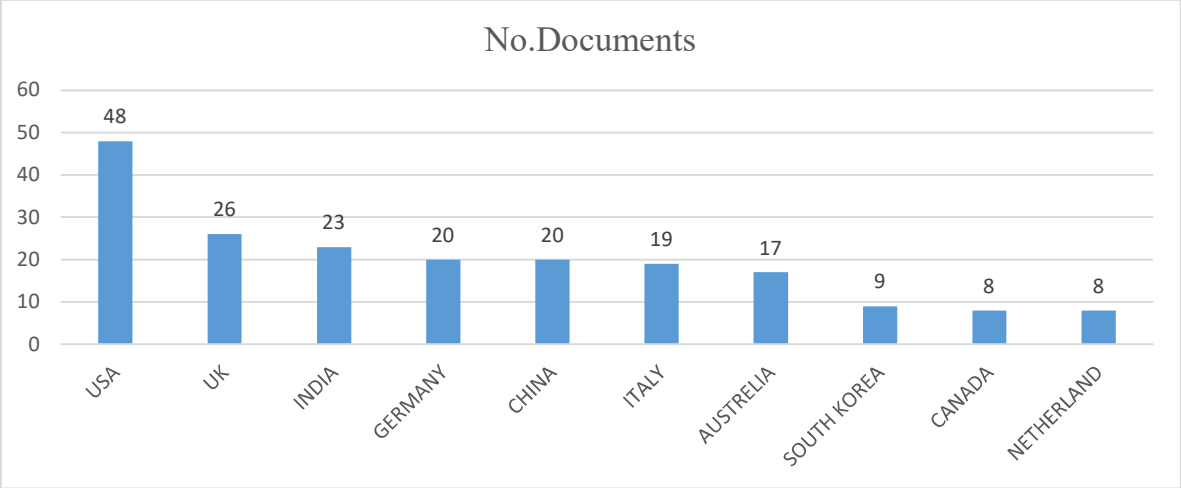



**Figure 3**

Figure 3 represents the top 10 territories' contribution in terms of the number of research papers on artificial intelligence in insurance over time. It compares the document counts for various countries based on the information arrived.

The USA occupies the first position, producing the highest document count of 48 publications, the UK with 26 publications followed by India with 23 articles, similarly, Germany and China equally produced 20 articles, while Canada and Netherlands have lower research article count, The USA took a leading position by contributing a greater number of articles in the field, followed by the UK. India is also a leading country with several publications and collaborations focusing on AI technologies and their applications in the field of insurance to transform the insurance industry to compete and enhance sufficiency through digitalization and the latest technologies for their insurance business operations. The top research publications indicate potential research work tracks in the USA, UK, India, and Germany followed by China in the field. To forward research production and collaboration, countries with smaller output of research articles could focus on collective research funding, encouraging research partnerships, and enhancing research structure. Additionally, encouraging international research collaborations and contributions to global research initiatives could help to improve their research production and importance on a global scale.

### 4.2.5 Publication Pattern by Subject Area (%)

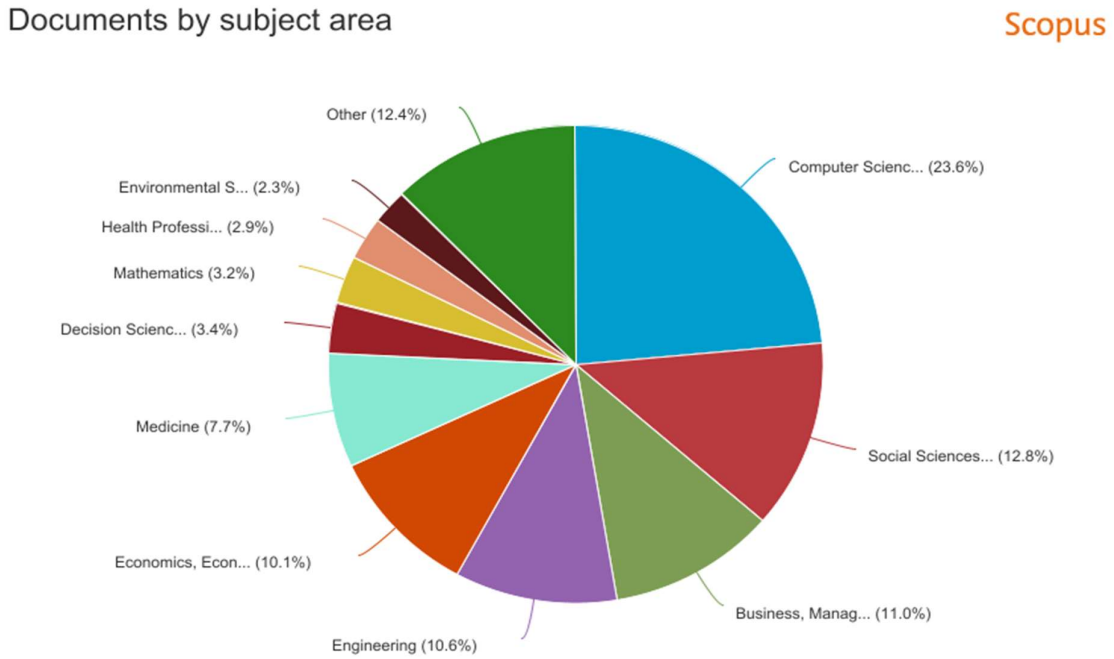



**Figure 4**

Figure 4 presents the subject area-wise distribution of publications and informs that computer science is the most represented field in publishing articles on AI in the insurance sector with (23.6%) producing 58 articles, followed by social sciences with 12.8% an article counts of 31 and business management occupies by 11% with 27 articles. Engineering forms 10.6%, Economics has a share of around 10.1% and medicine confines only about 7.7%. Document representation for health professions, mathematics, decision science, and environmental sciences are lower.

The high percentage of documents in computer science aligns with the increasing importance of advanced technologies like artificial intelligence, machine learning, and NLP and other digital innovations in the field of the insurance sector in various aspects like client data management, algorithm development for insurance pricing (underwriting) majorly, risk management, and preventing insurance fraud. At the same time, the representation of social sciences informs that research work in the insurance sector helps to understand customer behaviors, policy claim processing, and assisting customer support through AI-enabled Chatbots, Business Management signifies that research publications on AI in the insurance sector help to develop organizational strategies, enhance business operations, and prompt decision-making.

### 4.2.6 Top 5 countries by publications on AI over time

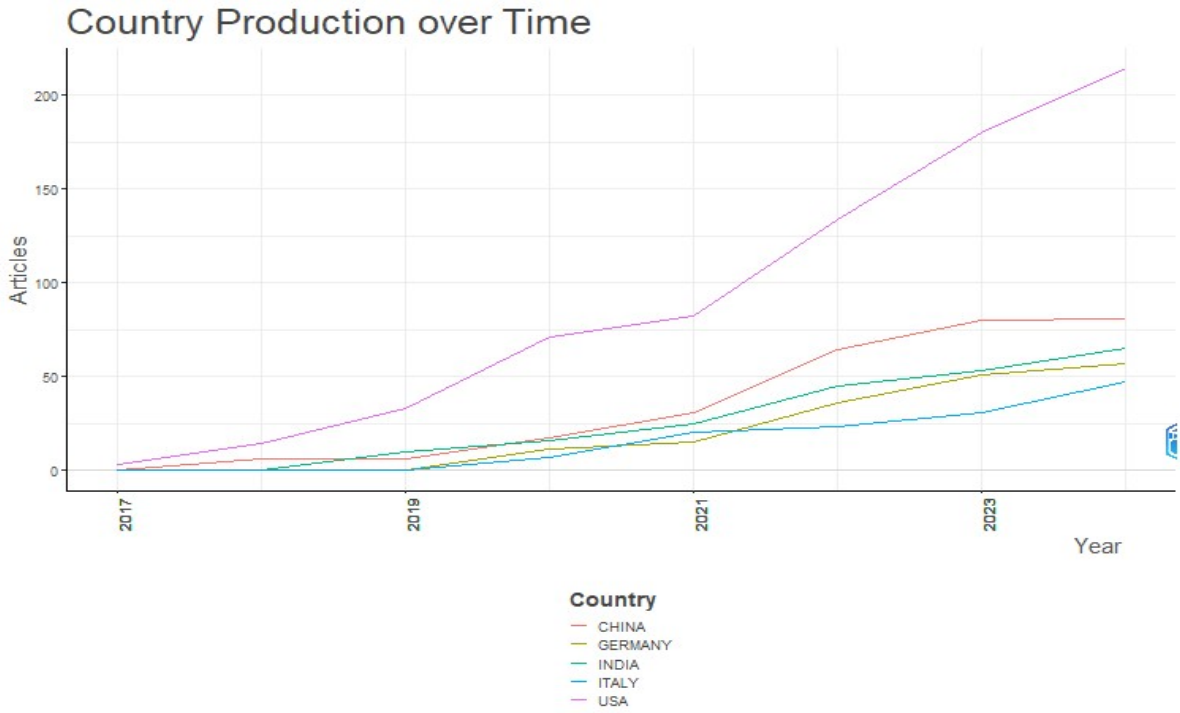



**Figure 5**

### 4.2.7 Most Contributing Countries on AI in Insurance (based on timeline)

| Country | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | TPAI | PAI&I | (n=244) | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| USA | 3 | 14 | 33 | 71 | 82 | 134 | 180 | 214 | 731 | 48 | 19.7 % | **1** |
| CHINA | 0 | 6 | 6 | 17 | 31 | 64 | 80 | 81 | 285 | 20 | 8.2 % | **2** |
| INDIA | 0 | 0 | 10 | 16 | 25 | 45 | 53 | 65 | 214 | 23 | 9.4 % | **3** |
| GERMANY | 0 | 0 | 0 | 11 | 15 | 36 | 51 | 57 | 170 | 20 | 8.2 % | **4** |
| ITALY | 0 | 0 | 0 | 7 | 20 | 23 | 31 | 47 | 128 | 19 | 7.8 % | **5** |

***Note**: TPAI=Total Number of publications on AI, PAI&I=Publications on AI in Insurance

**Table 2**

Figure 5 and Table 2 present the number of research articles produced on artificial intelligence and its contribution to the insurance sector over time. The first 5 countries including the United States of America, China, and India are the leading countries by publishing the greatest number of publications in the field and capturing the first three ranks in a row. India took the lead over China in the research area with the rising importance of AI in the insurance sector followed by Germany and Italy published 20 and 19 articles over time. The top 5 countries contributed 130 articles @53.3% out of 244, indicating greater research focus and progress on artificial intelligence in the insurance sector. An increased number of articles show the growing importance of emerging technologies in the field for optimizing business operations in the global insurance business.

### 4.3 Advanced Bibliometric Analysis

#### 4.3.1 Top 10 Contributing Sources

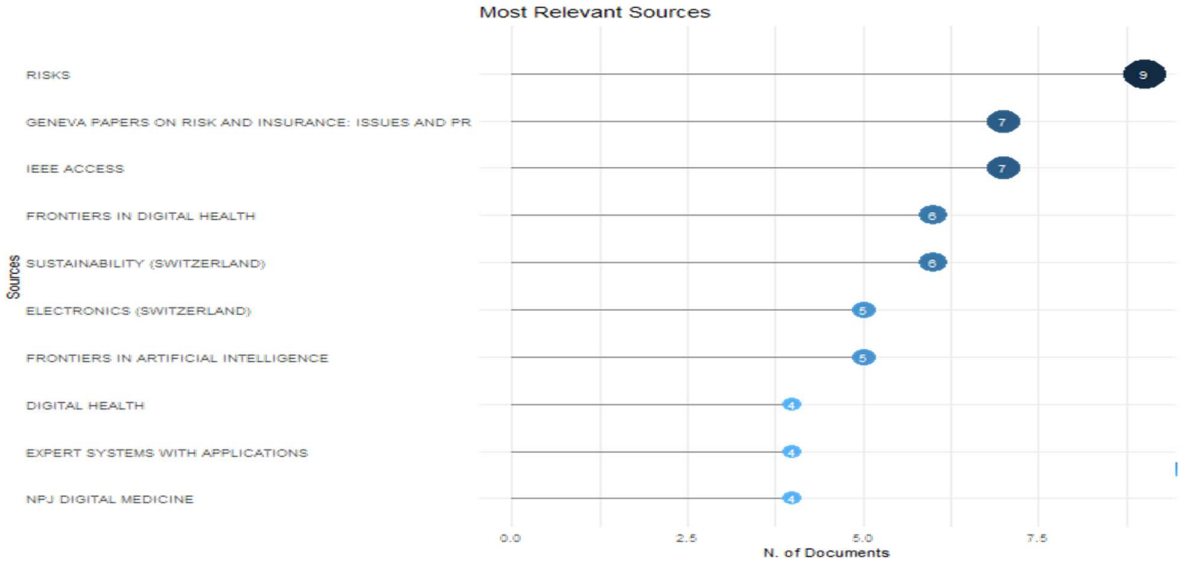



**Figure 6**

#### 4.3.2 Most Contributing sources of scientific works on AI in insurance

| Sources | TP | CP | TC | CD | AC | g | h | m | Rank |
|---|---|---|---|---|---|---|---|---|---|
| RISKS | 9 | 9 | 107 | 11.9 | 15.3 | 5 | 7 | 1 | **1** |
| GENEVA PAPERS ON RISK AND INSURANCE | 7 | 16 | 80 | 11.4 | 11.4 | 5 | 8 | 1 | **2** |
| IEEE ACCESS | 7 | 23 | 103 | 14.7 | 14.7 | 5 | 6 | 1 | **3** |
| FRONTIERS IN DIGITAL HEALTH | 6 | 29 | 20 | 3.3 | 2.9 | 4 | 4 | 1 | **4** |
| SUSTAINABILITY (SWITZERLAND) | 6 | 35 | 135 | 22.5 | 19.3 | 4 | 7 | 0.8 | **5** |
| ELECTRONICS (SWITZERLAND) | 5 | 40 | 192 | 38.4 | 27.4 | 3 | 3 | 0.6 | **6** |
| FRONTIERS IN ARTIFICIAL INTELLIGENCE | 5 | 45 | 176 | 35.2 | 25.1 | 3 | 4 | 0.5 | **7** |
| DIGITAL HEALTH | 4 | 49 | 52 | 13 | 7.4 | 3 | 5 | 1 | **8** |
| EXPERT SYSTEMS WITH APPLICATIONS | 4 | 53 | 54 | 13.5 | 7.7 | 3 | 3 | 0.6 | **9** |
| NPJ DIGITAL MEDICINE | 4 | 57 | 187 | 46.8 | 26.7 | 3 | 4 | 1 | **10** |

***Note**: Ranks were given based on source production (Bradford Law), TP=Total Publications, CP= Cumulative Publications, TC=Total Citations, CD=Citations per document, AC= Annual Citations g=g-index, h-h-index, and m=m-index

**Table 3**

A total of 162 sources contributed 244 articles on AI in insurance out of 127 sources contributed by single articles, 17 sources produced two articles and 6 sources produced 3 documents, the highest number of documents 9 were made by the Journal of RISKS and stands as a leading one, Geneva Papers on Risk and Insurance and IEE Access contributed equally with the7 documents between 2017 and 2024. The top 10 sources contributed 57 publications @23.36% of total documents (244), indicating more active and productive research in the field of artificial intelligence in insurance.

A higher level of research output results potentially a greater impact on the field by focusing on emerging research trends and areas of interest and contributing diverse applications of AI in insurance, like Big data, ML, NLP, and blockchain technology to fraud prevention, risk assessment, claim processing, and operational efficiency improvements are at the forefront of new developments shaping the overall knowledge landscape and likely to attract funding and support for further research initiatives with considerable publication count, citations, index factors, and collaborative efforts towards the increasing global interest discovering the connection of Artificial Intelligence in the insurance industry.

### 4.3.3 Most Productive Authors

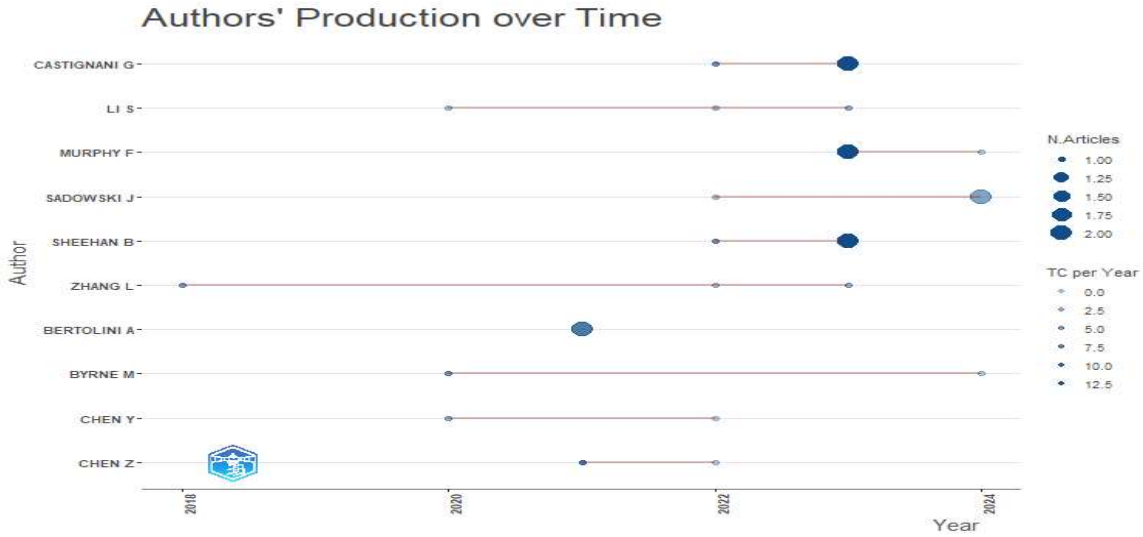



**Figure 7**

### 4.3.4 Most influential authors by number of publications and citations

| Author's | AY | PAY | TC | CD | h | i-10 | Rank |
|---|---|---|---|---|---|---|---|
| CASTIGNANI G | 2 | 3 | 41 | 13.7 | 19 | 34 | **1** |
| LI S | 3 | 3 | 11 | 3.7 | 87 | 270 | **2** |
| MURPHY F | 2 | 3 | 26 | 8.7 | 28 | 60 | **3** |
| SADOWSKI J | 3 | 3 | 6 | 2.0 | 6 | 1 | **4** |
| SHEEHAN B | 2 | 3 | 41 | 13.7 | 14 | 17 | **5** |
| ZHANG L | 6 | 3 | 33 | 11.0 | 59 | 87 | **6** |
| BERTOLINI A | 1 | 2 | 33 | 16.5 | 16 | 21 | **7** |
| BYRNE M | 5 | 2 | 24 | 12.0 | 36 | 66 | **8** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CHEN Y | 3 | 2 | 12 | 6.0 | 148 | 926 | **9** |
| CHEN Z | 2 | 2 | 34 | 17 | 12 | 12 | **10** |

***Note**: AY= Active Years, PAY=Productivity per active Year, TC=Total Citations, CD= Citations per document, and h-h-index and i-10 index.

**Table 4**

Figure 7 and Table 4 state the most influential authors and their publication contributions to the research area globally. 918 authors published 244 articles on AI in insurance, which contained 29 single-authored documents and 35 authors produced 2 articles in a row. The first 6 authors subsidized 3 articles over time, and the balance of 137 research articles were made by multiple authors. with an overall average citation score per document @17.6% including international co-authorship @28.8%.

The author's h-index and i-10 index factors represent an impactful research publication in the area of the increasing trend of artificial intelligence in the insurance sector globally, and its potential applications to move forward and enhance the performance of the insurance sector worldwide.

### 4.3.5 Top 10 Countries by Citations

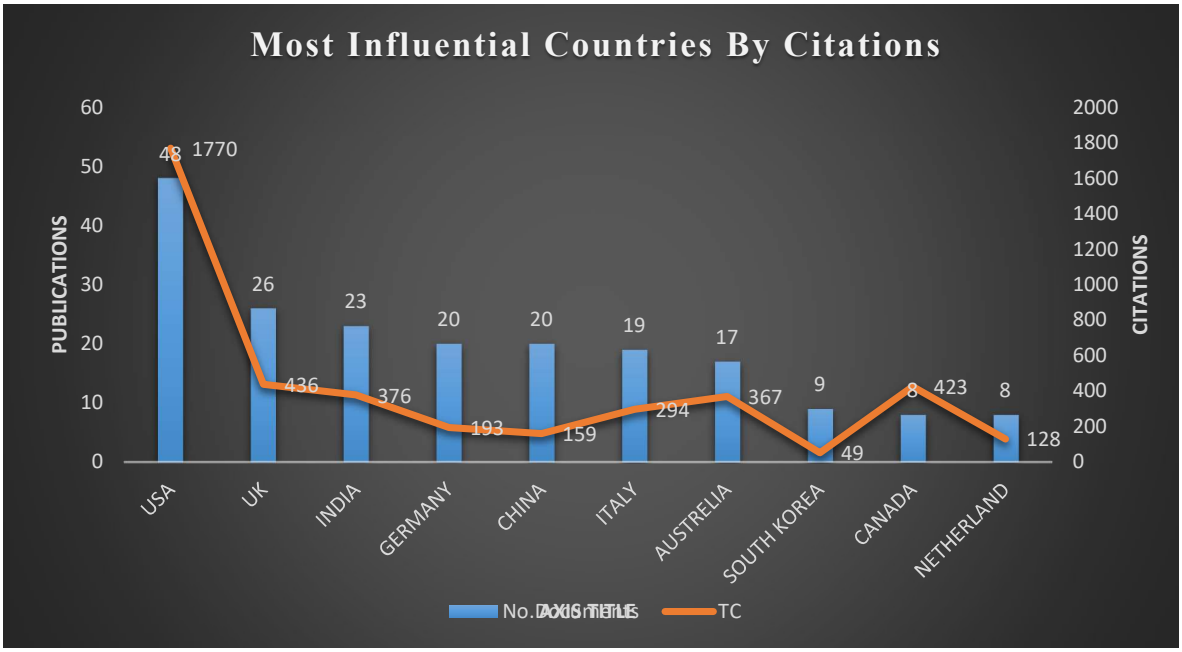



**Figure 8**

### 4.3.6 Top 10 Countries by Citations and Collaboration Network

| Country | NA | TC | CPA | CC Network | Rank |
|---|---|---|---|---|---|
| USA | 48 | 1770 | 36.87 | 22 | **1** |
| UK | 26 | 436 | 16.77 | 15 | **2** |
| INDIA | 23 | 376 | 16.35 | 6 | **3** |
| GERMANY | 20 | 193 | 9.65 | 9 | **4** |
| CHINA | 20 | 159 | 7.95 | 14 | **5** |

| | | | | | |
|---|---|---|---|---|---|
| ITALY | 19 | 294 | 15.47 | 5 | **6** |
| AUSTRALIA | 17 | 367 | 21.58 | 7 | **7** |
| SOUTH KOREA | 9 | 49 | 5.44 | 3 | **8** |
| CANADA | 8 | 423 | 52.87 | 6 | **9** |
| NETHERLAND | 8 | 128 | 16 | 3 | **10** |

***Note:** NA= Number of Research Articles, TC=Total Citations. CPA= Citations per Article, CC=Countries Collaboration

**Table 5**

Figure 8 and Table 5 show the contributions made by various countries in terms of research publication size along with citations in the present research area. The country United States of America contributes the most with a total number of publications of 48 with 22 countries collaborating globally, followed by the UK with 26, collaborating with 15 countries, respectively leading the pack. India picked 3rd position in the world with 23 documents output with a 6 countries collaboration like Australia, Ireland, and France, less collaboration with the United States, etc., which means that there is greater room for research in the country, Germany and China have occupied 4$^{th}$ with 14 countries collaboration and 5$^{th}$ places with an equal number of articles of 20 followed by Italy and Australia also contributed majorly whereas other countries produced with single digit articles inline.

The Cite Score indicates the number of researchers/authors who cited the articles frequently in the area to get insights and for further research. The higher Cite Score indicates that the articles have a greater impact on the research field. United States of America secured higher citations in number (1770) with great research progress, the UK, and Canada captured 2$^{nd}$ and 3$^{rd}$ places and India took 4$^{th}$ position with 376 citations by producing impactful publications in the research area.

### 4.3.7 Top Cited Research Articles on AI in Insurance

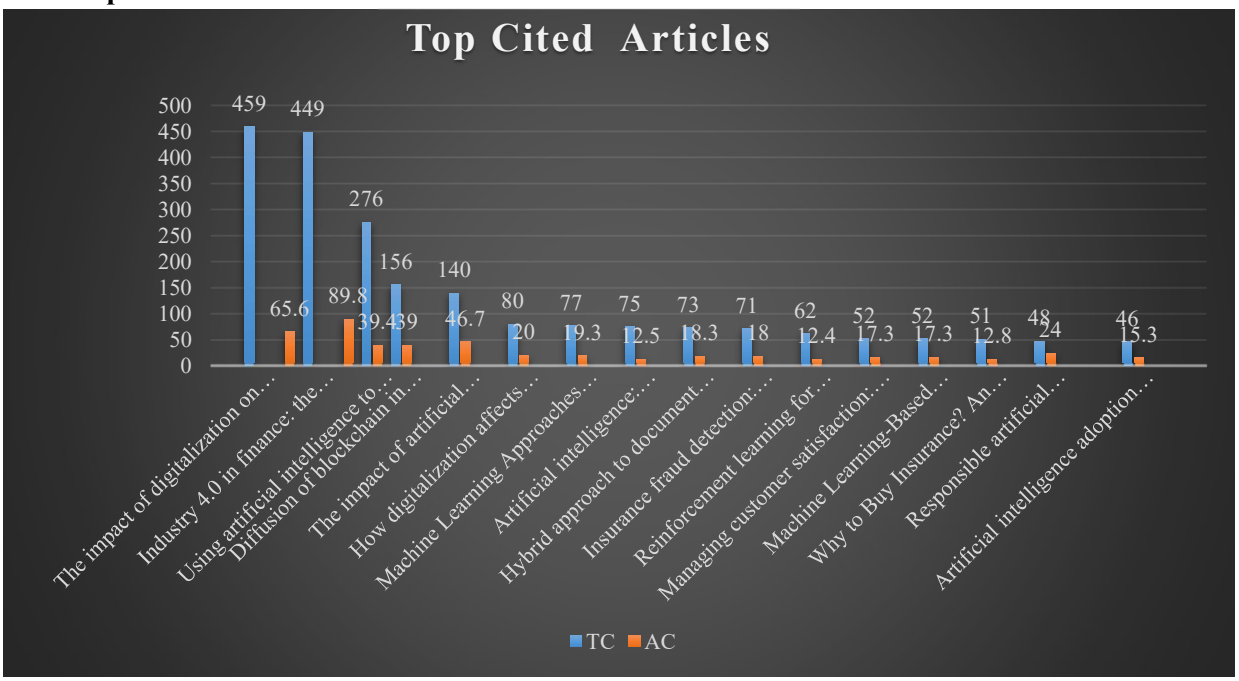



**Figure 9**

### 4.3.8 Most Impactful Articles (Ranked by citations and journal ranking)

| Author | Article Title | Year | TC | AC | SJR | Author's Index | |
|---|---|---|---|---|---|---|---|
| | | | | | | h | i-10 |
| M Eling | The impact of digitalization on the insurance value chain and the insurability of risks | 2018 | 459 | 65.6 | Q1 | 47 | 105 |
| D Mhalanga | Industry 4.0 in finance: the impact of artificial intelligence (ai) on digital financial inclusion | 2020 | 449 | 89.8 | Q2 | 27 | 43 |
| M Riikkinen | Using artificial intelligence to create value in insurance | 2018 | 276 | 39.4 | Q1 | 4 | 2 |
| AK Kar | Diffusion of blockchain in insurance industry: An analysis through the review of academic and trade literature | 2021 | 156 | 39 | Q1 | 50 | 21 |
| C Eckert | How digitalization affects insurance companies: overview and use cases of digital technologies | 2020 | 80 | 20 | Q3 | 9 | 8 |
| | Machine Learning Approaches | | 77 | 19.3 | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mohamed H | for Auto Insurance Big Data | 2021 | | | Q2 | 6 | 6 |
| KH Kelly | Artificial intelligence: Implications for social inflation and insurance | 2018 | 75 | 12.5 | Q3 | 13 | 18 |
| A Guha | Hybrid approach to document anomaly detection: an application to facilitate RPA in title insurance | 2021 | 73 | 18.3 | Q1 | 6 | 5 |
| F Aslam | Insurance fraud detection: Evidence from artificial intelligence and machine learning | 2022 | 71 | 18 | Q1 | 19 | 33 |
| E Krasheninnikova | Reinforcement learning for pricing strategy optimization in the insurance industry | 2019 | 62 | 12.4 | Q1 | 11 | 5 |
| C Eckert | Managing customer satisfaction: digital applications for insurance companies | 2022 | 52 | 17.3 | Q1 | 9 | 8 |
| Keshav Kaushik | Machine Learning-Based Regression Framework to Predict Health Insurance Premiums | 2022 | 52 | 17.3 | Q2 | 17 | 25 |
| A Gramegna | Why to Buy Insurance? An Explainable Artificial Intelligence Approach | 2020 | 51 | 12.8 | Q2 | 4 | 3 |
| M Johnson | Responsible artificial intelligence in healthcare: Predicting and preventing insurance claim denials for economic and social wellbeing | 2023 | 48 | 24 | Q1 | 10 | 10 |
| S Gupta | Artificial intelligence adoption in the insurance industry: Evidence using the technology–organization–environment framework | 2022 | 46 | 15.3 | Q1 | 4 | 3 |

***Note:** TC=Total Citations, AC= Annual citations per document, SJR= Scimago Journal Rank

**Table 6**

According to Figure 9 and Table 6, the top 15 most impactful articles on artificial intelligence in the insurance sector in terms of citation number. It is noticed that the document of (M Eling., 2018) titled "The Impact of Digitalization on the Insurance Value Chain and the Insurability of Risks" is the most influential and impactful research article with a maximum of 459 citations and 65.6 citations annually, with the author with the highest h (47) and i-10(105) index is also high among the presented articles and authors, followed by "Industry 4.0 in finance: the impact of artificial intelligence (ai) on digital financial inclusion"(449) made by D Mhlanga, 2020 and "Using artificial intelligence to create value in insurance"(276) by M Riikkinen, 2018 occupied

top three positions by securing highest number of citations individually.
Additionally, the rest of the articles scored a massive number of 843 citations in total. To assess the quality and impact of articles and authors we used the cite score and journal ranking along with the author's index factors. It reveals that the articles are the most impactful by comparing citations, and index, 90% of the articles are published in Q1 and Q2 ranked journals.

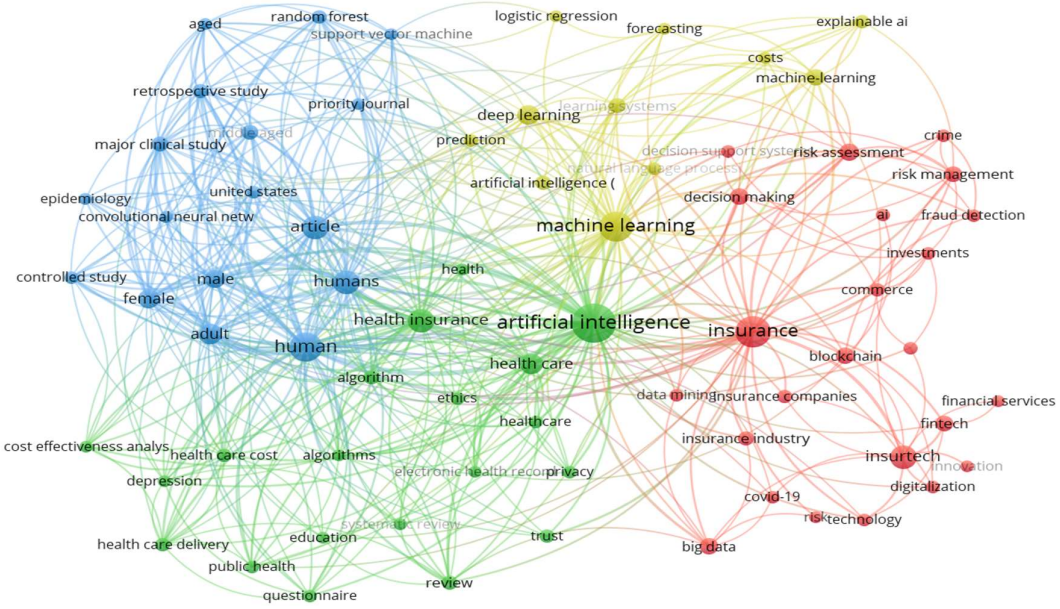
**5. Keyword Analysis**


**Word Cloud**
**Figure 10**

In academic research, keywords serve as the fundamental unit of observation and identification of the various disciplines of study(Zhan et al., 2018). When analyzing the knowledge structure of scientific areas using bibliometric analysis, keywords offer quick access to scientific works and are very successful.(Vargas-Quesada et al., 2017); (Zhan et al., 2018). According to (Chandra et al., 2022) word cloud analysis is applied to sort out the main themes of AI in insurance research.

The top terms found in the research documents are shown in **Figure 10**. The main areas of study in the literature include artificial intelligence with the highest occurrence of 73, humans 50, and insurance with 48. The other keywords with a similar number of occurrences like machine learning, health insurance, and deep learning. The association between keywords in a set of research papers is shown with word cloud mapping and keyword occurrences through the mapping of related co-words.

## 6. Cluster Analysis




**Co-occurrence to All keywords**

**Figure 11**

In bibliometrics, the keyword co-occurrence method has been frequently used to assist researchers in understanding the areas of most interest for their work (Ding et al., 2001). Four clusters with various thematic ties have been developed **(Fig. 11)**. We used the minimal number of keyword occurrences of five to arrange the keywords into theme clusters—72 of the 1445 keywords that were discovered satisfied the threshold. We determined the connection strength between 72 keywords and the keywords that had the best-performing keywords were chosen.

A keyword is represented with a node, the larger the node the more research work and citations it has. A link connecting two nodes specifies the co-occurrence of two terms; the thicker the line, the more the keywords appear together. According to (Pattnaik et al., 2024), the size of nodes represents the degree of occurrence whereas the intensity of the link between nodes represents the degree of co-occurrence. Figure 11 presents a total of 72 items the top four terms with the highest total link strength (TLS) and occurrence ratio (OR) are artificial intelligence (OR = 106; TLS = 467), human (OR = 48; TLS = 376), insurance (OR = 61; TLS = 222), machine learning (OR = 55; TLS = 273).

*Cluster 1(**Red Color**)*—Transformation of insurance sector: the digital revolution and its inferences for insurance services—containing 21 themes advocates that the insurance sector is a narrowly examined area. The rise of insurtech has carried a new trend of research chances, as demonstrated by research lessons that concentrated on the impact of digital technologies on the traditional insurance business. These studies have tested the challenges of the insurance sector, like client data mining, fraud detection, risk assessment, and Mitigating Risk, COVID-19, along with how insurtech and fintech startups are offering solutions by introducing innovative products and services to offer customer support, service quality, and satisfaction.

*Cluster 2(**Green Color**)*—Explored the Role of Artificial Intelligence in the Insurance Industry: The major focus on health insurance, electronic healthcare records, healthcare costs, healthcare delivery, and public health —comprising 24 themes suggests that scientific research

has concentrated on the role of digital revolution, artificial intelligence, and how automation process offers better services, loyalty, and value creation towards health insurance and healthcare sector to deliver better customer service and improving health care performance.

*Cluster 3(**Blue Color**)* — Investigations into Artificial Intelligence and its applications on humans have reached a diversity of study designs and themes, including controlled studies, epidemiology, retrospective studies, and major clinical studies. These investigations encompass 17 themes that exposed a complete understanding of AI's impact on the healthcare sector including Diagnostic Accuracy, Treatment Optimization, Patient Monitoring, Clinical Outcomes, Cost Efficiency, Personalized Medicine, and Telemedicine.

*Cluster 4*(**Lemon yellow color**)—AI and Machine learning applications in the insurance sector: It reveals the role of ML and Deep learning—covering 10 themes advocates that the impact of artificial intelligence, deep learning, blockchain, and advancements in AI and ML techniques in the insurance sector has gained significant attention in recent years. Research studies addressed on use of these recent technologies to forecast insurance fraud, assess risks correctly, and manage by advancing innovative insurance services.

## 7. Research Trends and Future Directions

The current study Artificial Intelligence in Insurance Explores the Role of Artificial Intelligence (AI) in the Insurance Industry, majorly focusing on health insurance and electronic healthcare, identifies 24 themes where academic research has concentrated on how digital transformation, AI, and automation improve customer service, loyalty, and value creation in health insurance and health care (Cluster-2). Additionally, the study highlights 17 themes from various study designs, such as controlled studies, epidemiology, and major clinical studies, representing AI's comprehensive impact on healthcare. The Themes include diagnostic accuracy, treatment optimization, clinical outcomes, cost efficiency personalized medicine (Cluster-3).

The provided insights for future research were made since a research gap was found, especially in the cluster analysis, the keyword co-occurrences that are not present customer service, customer support, personalized policies, and emerging risks like cyber-attacks clime adjustment, and reinsurance, marks unexplored aspects of the research study. Regardless of the rising number of research studies, when it comes to Deep Learning and insurance, explainable AI and insurance, Blockchain technology, and insurance are still growing, and some research is pending on this side to explore more. The possibility of future research aids is vital to support the research area, establishing a strong foundation and more practical knowledge, and pooling evolving data and evidence. Investigators attracted to insurance and technology are stimulated to study how to direct private and public insurers on the usage of AI tools. Scholars can put their all energies into progress in the field that could help insurers optimally utilize their technological environment and data resources. Machine Learning algorithms for image recognition (especially properties like buildings, machinery, crops, and vehicle damages) speech recognition, client behaviors, and personalized support and service.

Deep learning technologies to lever complex tasks like insurance Underwriting, Fraud Detection, risk assessment, and claim processing. Explainable Artificial Intelligence for customer communication, and policy recommendations, consequently, researchers should work investigating the application of Artificial intelligence technologies in definite insurance areas like motor insurance, life, Crops, and compensation either at the national level, local, or

regional level. For example, the likely future titles are to explore the progress of the insurance sector in an emerging country like India, as a case study, and how these latest technologies can be employed to progress it, application of AI Technologies for customer service and support, application of AI Technologies to offer personalized policies, client's education and how they bridge the gap between insurers and clients.

## 8. Conclusions

Our results establish the substantial attention that academics have given to this subject, demonstrating the wide range of academic interest that it has attracted, essential to understand the dynamic trends and patterns noticed in the literature to obtain important insights into the signs of progress, difficulties, and future possibilities of this quickly changing field. Examining publishing trends, RQ1 found that the quantity of publications on AI in the insurance industry has significantly increased over the past seven years. The vast volume of literature may be divided into categories by carefully examining the theme research groups RQ2, which have significantly transformed the insurance industry. Our RQ3 finds considerable research gaps that offer opportunities for future research studies.

**With the acceptance and application of AI technologies, the insurance sector has gained several advances that transformed insurance pricing, claim processing, and risk assessment. Moreover, our output reveals the considerable influence of AI technologies in improving the accuracy, speed, claim process, and efficiency of customer services in the insurance industry. Robust AI technologies are becoming more important as the insurance sector grows more digitalized and the number of online insurance policies increases globally. On the other hand, automation and artificial intelligence have many advantages but also many difficulties. Together, countries, policymakers, and organizations to test these matters and make sure that the fruits of automation and artificial intelligence are maximized while limiting any adverse effects. Given the complex and dynamic nature of automation and artificial intelligence, as well as the effects they have on society, a careful and nuanced approach is required. The ultimate objective is to make these technologies' potential to enhance lives while minimizing the possible extent of risks.**

**Our review paper hail from the following limitations. Firstly, all research articles used in the examination were extracted exclusively from the Scopus database, as it is the furthermost reliable database for researchers and scholars. Therefore, all publications made by the other databases were not considered in this study. Another constraint for the study is that the datasets used for the bibliometric study were limited to the title, abstract, keywords, subject area, and language and within the specific time and field. Therefore, this research might be enhanced even further in the future by growing the databases utilized to gather the data.**

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