



Unveiling the Future of Insurance: A Bibliometric Study of Digital Transformation over the Last Decade

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Abstract: The contemporary landscape of the insurance industry has been drastically changed alongside the introduction of state-of-the-art technologies like Artificial Intelligence (AI), machine learning, big data, blockchain, and InsurTech. The present study traces the evolution of digital transformation in this sector through a bibliometric analysis of data published between 2015 and 2024 and indexed in the Scopus database. The dataset, consisted of 972 articles, could help identify publication trends, thematic focus areas, and collaborative networks. The findings suggested a rapidly expanding literature base with increasing scientific production in recent years due to the accelerated adoption of technology within the sector. The US, China, and India emerged as the dominant countries in their contribution to publications; in addition to their substantial influence in the field due to active national research programs. International co-authorship occupied around one-quarter of the publications, which demonstrated collaboration among global researchers in this topic. This article filled the existing research gap by examining the correlation between digital transformation and insurance with a bibliometric analysis, while drafting policy documents revealed more topics for discussion and patterns for collaboration. Valuable guidance was provided to policymakers and industrial stakeholders to identify the key strengths in the field with the emergence of AI applications and blockchain technology; furthermore, emphasis was placed in the areas for further research and concerted efforts.

Keywords: Digital transformation; Insurance industry; Bibliometric analysis; InsurTech; Artificial intelligence applications; Blockchain technology

JEL Classification: G22; I13

1. Introduction

Experts predict that insurance companies will leverage technological progress through Artificial Intelligence (AI) and Big Data innovations to drive their operations (Bednarz & Manwaring, 2022). The combination of these technologies serves as the foundation for this transformation. The latest technological developments in insurance operations create new possibilities to deliver customer-focused services together with automated underwriting systems and improved claims processing (Cosma & Rimo, 2024).

The insurance sector experiences a rising wave of InsurTech which represents the progression of innovative technology that leads to a more adaptable and data-centric industrial operation (Stoeckli et al., 2018). The insurance sector undergoes a critical transformation through InsurTech to establish new business approaches that prioritize automated solutions and tailored services alongside immediate service delivery (Zarifis & Cheng, 2022).

The COVID-19 pandemic accelerated digital transformation among the insurance organizations because firms require pioneering technological solutions to sustain operations while connecting with customers during the fast-changing environment. According to Pauch & Bera (2022), the pandemic triggered the insurance organizations to adopt digital resources for operation maintenance and to improve client interactions during the social distancing period.

The adoption of digital channel has guided the strategic direction of the industry to implement enduring digital transformations for their operations. In this light, scholars employed bibliometric analysis as their fundamental tool to study publication patterns and key theoretical developments of the insurance sector while understanding its operational evolution.

Researchers employing bibliometric techniques could analyze the impact of influential studies on the field, detect new research directions, and track research topics on insurance development. For instance, Agrawal & Kumar (2025) performed a bibliometric study to examine public health insurance coverage for older populations. By using VOSviewer software, the authors evaluated co-authorship networks and keyword co-occurrence patterns; they showed that the United States led this research area through international partnerships. The authors chose long-term care and public health insurance of senior citizens as their focus of study while identifying depression among the elderly as their most preferred reference to demonstrate the interdisciplinary connections found in health insurance research. Yavaş & Güngör (2025) conducted a bibliometric study to examine research patterns and collaborative efforts in healthcare-related corporate governance. The authors analyzed 168 relevant articles from the Bibliometrix package which came from Scopus and Web of Science.

The research cooperated with top writers and dominant nations to generate a visual representation of international collaboration patterns. Major research topics including hospital governance, healthcare accountability, and stakeholder engagement were highlighted. The findings in this study established essential knowledge which served as a strategic foundation to enhance healthcare system governance worldwide.

Zheng et al. (2025) implemented bibliometric evaluations with systematic reviews to assess the purchasing patterns of health insurance. Their research discovered vital trends in the consumption behaviors of clients, market regulations as well as cultural and financial aspects that affect insurance marketplaces. The focus of research has shifted toward emerging markets, although the United States and China remain the two primary research contributors.

Suwanmalai & Zaby (2024) conducted a twenty-year bibliometric analysis to identify three fundamental intellectual schools in research related to insurance risks, including risk management and mathematical models alongside actuarial science. The study advocated that artificial intelligence serves as a developing tool to analyze extensive datasets and its application leads to enhanced strategies in respect of insurance risk management.

Jiang et al. (2024) performed a bibliometric evaluation regarding the Australian National Disability Insurance Scheme (NDIS) to examine the trends of research from previous ten years. Their analysis showed that research on disability insurance currently focuses on customized treatment approaches along with the integration of digital technology. The findings offered constructive direction to policymakers who aim to enhance care through digital transformation, according to Jiang et al. (2024).

Cosma & Rimo (2024) conducted a bibliometric analysis to prove that the new generation of InsurTech driven by AI and blockchain could bring forth a historically great disruption to traditional insurance institutions. The research concluded that the interdisciplinary approach of InsurTech represents a confluence of economic and information technology. The rise of publications about InsurTech and newly established research clusters are featured in this paper. Another bibliometric investigation was found in the research by Kumar & Kumar (2024); Data Envelopment Analysis (DEA) was used to measure insurance performance. The authors reviewed more than 400 academic papers from 2010 to 2023 to determine important patterns found in AI and machine learning (ML) applications. The research suggested that insurance companies are adopting digital transformation through the use of AI to evaluate performance metrics, mainly for customer-focused and sustainability-related assessments. The study detected a regional performance gap found between developed markets like North America and Europe, which excelled in efficiency, and emerging markets such as Asia and Africa.

Taneja et al. (2025) analyzed the potential opportunities and risks of deepfake technology in the fields of insurance and other businesses. The paper explored how deepfake technology affected the levels of trust between organizations and their customers, even though it did not adopt a bibliometric research methodology. The paper critiqued the legitimacy of insurance dealings and statements that demanded an overhaul of ethical principles and risk control approaches for insurance organizations to counter digital risks.

Duta & Romo (2024) emphasized in their paper that Blockchain fostered improved trust, transparency, and operational efficiency within the insurance industry. Although the technology has its competitive advantages, its implementation is hindered by regulatory frameworks and integration into existing systems. Further investigation is indispensable to address this research gap while exploring efficient Blockchain integration strategies for the insurance industry. Using machine learning techniques like Random Forest and Multiple Linear Regression, Seyam (2025) aimed to determine factors affecting the adoption of InsurTech in Saudi Arabia. The study found that the scale of the company, along with its profitability and capital sufficiency, significantly affected the use of InsurTech; indeed, there was a greater tendency for smaller companies to implement such technologies. The implementation of InsurTech should synchronize with the digital transformation priorities of a country, for instance Vision 2030 goals of Saudi Arabia, in order to foster innovation in the insurance industry.

Saidat et al. (2023) directed their attention to the impact of Big Data on the growth of the digital insurance sector in the context of Dubai, UAE. Data analytics had a significant relationship with the advancement of digital

insurance systems, although full realization was hindered by some regulatory challenges. The research showed that traditional legal structures were inadequate and required modification to facilitate the use of InsurTech and Big Data.

Poorhadi Poshtiri et al. (2023) examined the need for innovative insurance systems to deal with the risks posed by new technologies, in particular FinTech start-ups. The study showcased the acceleration of digital adoption during the pandemic alongside the urgency for innovative frameworks to manage emerging digital risks. The investigation by Stano (2022) explored the use of Internet of Things (IoT), AI, and machine learning in the vehicle insurance sector for improving the assessment of damage and boosting the efficiency of claims processing. Together, these technologies enabled insurance companies to achieve better accuracy while lowering their operational expenses.

Harishbhai Tilala et al. (2024) investigated the impact of Big Data on Chinese digital insurance platforms to show data-driven solutions that could enhance both decision processes and customer satisfaction. The technological progress confronted major obstacles in the form of data privacy risks, together with infrastructural requirements, which prevented broad digital implementation in the insurance industry.

Several studies explored the ethical and regulatory considerations surrounding emerging technologies in the insurance sector. Harishbhai Tilala et al. (2024) reviewed the applications of AI and machine learning (ML) in healthcare with an emphasis on privacy, data security, bias in algorithms, and transparency. They highlighted the clinical validation as well as the professional ethical responsibility which guaranteed the equitable deployment of technologies and proper advocacy for patients' best interests. Even though their research was centered on healthcare, it urged the insurance industry to deal with ethical questions arising from the growing adoption of AI technologies in underwriting, claims processing, and fraud evaluation. Similarly, Lanfranchi & Grassi (2021) studied the impact of new technologies, such as AI, blockchain, and smart contracts on data compliance and reviewed the roles of RegTech in compliance and risk management of the public and private entities. Their study placed equal importance on mitigating risks from cybersecurity and algorithmic bias to ensure fairness and trust. These issues paralleled those raised in the study by Chatzara (2020) on the global regulatory issues resulting from the rise of FinTech and InsurTech. Chatzara (2020) centred on the absence of international regulatory structures to determine the areas for regulation in the insurance value chain and identified the limits of national framework. All these authors highlighted the ongoing efforts of international organizations like Financial Stability Board (FSB), Organization for Economic Cooperation and Development (OECD), and International Association of Insurance Supervisors (IAIS) to foster innovation while ensuring regulatory clarity in the adoption of emerging technologies in the insurance industry. These studies reinforced the importance of proposing ethical AI governance and stringent regulatory systems to support digital transformation in the sector.

Digital technologies have expanded significantly throughout the insurance sector, but there has been relatively little in-depth academic research published in this area. Most studies concentrated on single technological innovations instead of analyzing the collaboration of these technologies to propel strategic and operational changes in insurance companies (Herrmann & Masawi, 2022; Mall et al., 2023). Research available today showed geographical bias because it mainly studied developed economies yet failed to explain digital transformation processes within insurance sectors of various global regions (Mall et al., 2023). More studies need to be conducted to ascertain the effects of global digital transformation in the insurance industry.

The current research addressed the essential gap through a systematic examination of how digital transformation impacted insurance companies. The investigation covered three important themes concerning the insurance sector, including the relationship between main authors and institutions or countries influencing the field, future research directions and top influential papers from the past ten years. Scopus stood as the main data platform for this research, which selected 972 articles from 2015 to 2024 for analysis. The scientific landscape of digital transformation in insurance underwent mapping through a bibliometric approach, which delivered quantitative analysis of publication trends together with key contributors and thematic development in the field.

The core question guiding this study is: What insights can academic publications indexed in the Scopus database which has recorded the trends, scientific perspectives, and impact of digital transformation on insurance companies over the past decade?

To address this overarching question, the study explored the following sub-questions:

Q1: What are the prevailing trends in scientific research on digital transformation in the insurance industry?

Q2: Who are the leading authors, institutions, and countries contributing to this field?

Q3: What are the most cited papers, and what themes do they explore?

Q4: How are keywords associated with digital transformation and insurance companies clustered, and what insights do these clusters offer in respect of the emerging research trends?

These questions triggered a comprehensive bibliometric analysis in this study to examine the evolving role of digital technologies in the insurance sector and the findings contributed significantly to both the academic literature and the practical applications of digital transformation. Policymakers, researchers, and industry practitioners benefitted from the insights derived from this study, as they navigated the ongoing digital transformation and responded to emerging technological disruptions with more effective strategies.

The main contribution of this study lied in its holistic approach to understanding the complex interplay between digital technologies and insurance practices. Unlike existing studies that focused on specific technologies or geographic regions, this research took a global perspective to analyze the cumulative impact of various digital tools and technologies in the insurance industry. By doing so, it aimed to shed light on the broader trend of digital transformation that was reshaping the sector.

Furthermore, this study addressed an important research gap by providing a data-driven overview of the academic contributions in this field, particularly from an international perspective. This global approach was valuable in linking research on developed economies and the rapidly growing markets, where digital transformation was gaining momentum, yet still in its infancy. The technical roadmap for performing this bibliometric analysis was illustrated in Figure 1.

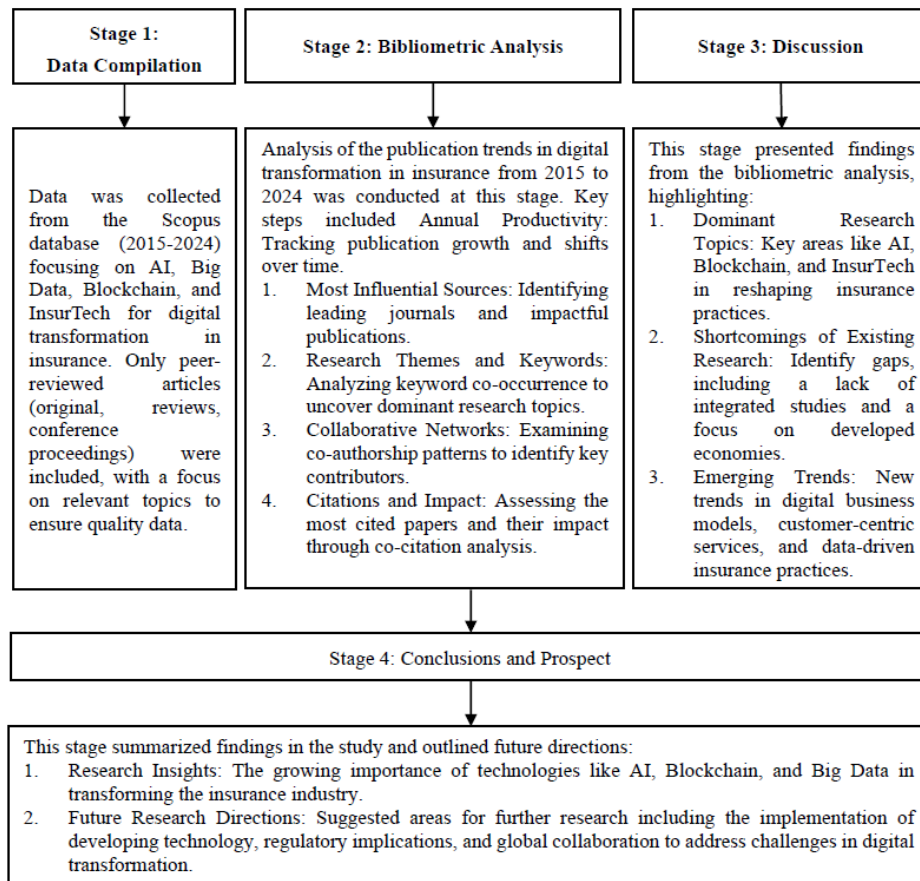


Figure 1. Technical road map

Source: Compiled with authors

The subsequent sections of this work are organized as follows: Section 2 explains the process and briefly describes the procedures of data collection, filtering criteria, and bibliometric techniques utilized for performance, intellectual, and conceptual analysis. Section 3 summarizes the findings, including important metrics, publishing patterns, and network visualizations. Section 4 explores the policy implications of the findings, areas for future work, and industrial practices. Section 6 summarizes major results, acknowledges limitations, and suggests recommendations for further study on the topic.

2. Methodology

2.1 Data Collection

The research used bibliometric methods to analyze the progress and main directions of digital transformation in insurance from 2015 up to 2024. Researchers used Scopus as their data source because it provided extensive scientific literature with Digital Object Identifier (DOI) indexing, which guaranteed access to both core and peripheral scientific content (Martín-Martín et al., 2018). The research used bibliometric analysis as its main approach because it enabled scientific field mapping through numerical evaluation of publication numbers, citation

counts, and thematic patterns (Donthu et al., 2020).

2.1.1 Search strategy and formulation of queries

The search strategy combined keywords from two thematic groups (Table 1):

- Digital transformation terms (e.g. “digital transformation”, “AI adoption”, “blockchain technology”, “InsurTech”).
- Insurance sector terms (e.g., “insurance company”, “health insurance”, “risk management”).

The Boolean search syntax applied in Scopus was: TITLE-ABS-KEY ((“digital transformation” OR “digitalization” OR “digitization” OR “digital strategy” OR “digital technologies” OR “digital innovation” OR “technology adoption” OR “technological change” OR “IT transformation” OR “IT adoption” OR “digital business models” OR “digital disruption” OR “digital economy” OR “artificial intelligence” OR “AI adoption” OR “machine learning” OR “big data analytics” OR “blockchain technology” OR “cloud computing” OR “Internet of Things” OR “IoT” OR “robotic process automation” OR “RPA” OR “InsurTech” OR “FinTech” OR “cybersecurity in insurance”) AND (“insurance company” OR “insurance industry” OR “insurance firms” OR “insurance sector” OR “insurance market” OR “insurance services” OR “health insurance” OR “life insurance” OR “property insurance” OR “auto insurance” OR “reinsurance” OR “risk management in insurance” OR “digital insurance” OR “online insurance” OR “cyber insurance” OR “insurance technology” OR “insurance innovation” OR “insurance business models”)).

The search was performed in the fields of Title, Abstract, and Keywords to capture the most relevant articles.

Table 1. Keywords included

Set 1: Digital Transformation Terms	Set 2: Insurance Sector Terms
Digital transformation	Insurance company
Digitalization	Insurance industry
Digitization	Insurance firms
Digital strategy	Insurance sector
Digital technologies	Insurance services
Digital innovation	Health insurance
Technology adoption	Life insurance
Technological change	Property insurance
IT transformation	Auto insurance
IT adoption	Reinsurance
Digital business models	Risk management in insurance
Digital disruption	Digital insurance
Digital economy	Online insurance
Artificial intelligence	Cyber insurance
AI adoption	Insurance technology
Machine learning	Insurance innovation
Big data analytics	
Blockchain technology	
Cloud computing	
Internet of Things (IoT)	
Robotic Process Automation (RPA)	Insurance business models
InsurTech	
FinTech	
Cybersecurity in insurance	

Source: Author (Scopus database)

The search query was executed on 19 March 2025, and yielded 4,462 initial documents. The query was framed to ensure the inclusion of a wide range of digital transformation technologies and their application within the insurance domain, without restricting the dataset to specific technologies or business model typologies.

2.2 Data Processing and Filtering

The bibliometric analysis was adhered to a robust four-stage filtration protocol in alignment with PRISMA guidelines (Figure 2). The process began with an initial set of 4,462 records retrieved from Scopus (with no duplicates), followed by a clear inclusion threshold that restricted the dataset to six multidisciplinary subject areas: Computer Science, Business, Engineering, Economics, Decision Sciences, and Social Sciences. This step reduced the dataset to 2,500 records. A subsequent filter limited the corpus to English-language publications to ensure consistency and avoid interpretative fragmentation, yielding 2,448 records. The assessment of eligibility prioritized peer-reviewed journal articles, applying rigorous inclusion criteria that specifically targeted empirical studies related to digital transformation in the insurance sector, such as AI-driven underwriting systems and

blockchain-based claims automation.

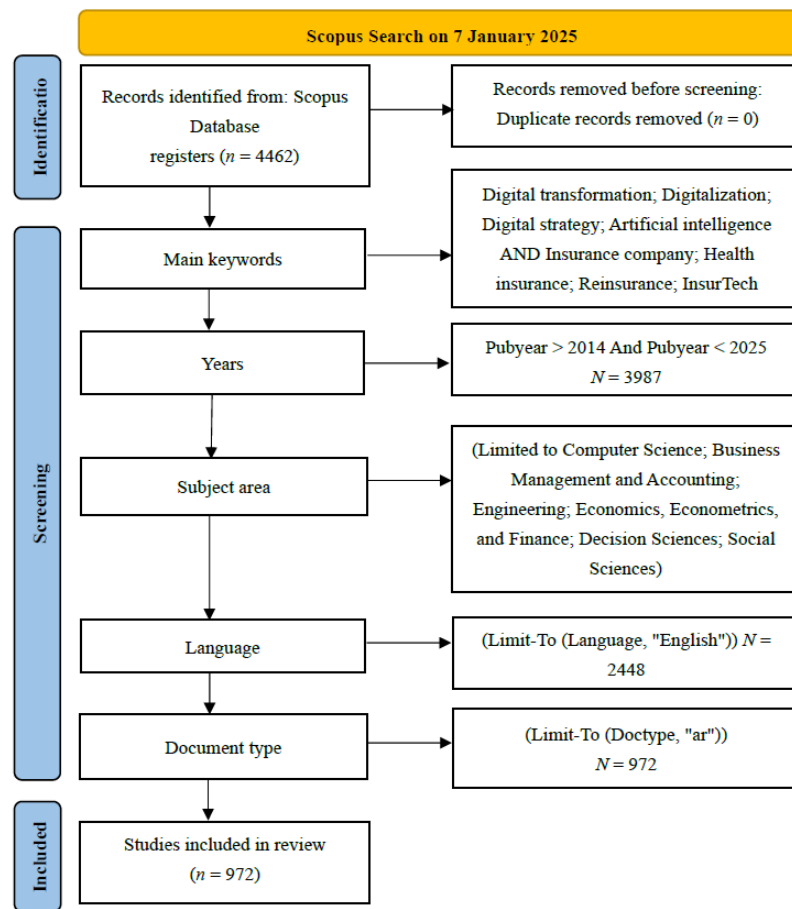


Figure 2. Analytic research PRISMA framework
Source: Compiled with authors based on Scopus output

Peer-reviewed articles were preferred due to their higher academic quality, as they underwent a stringent evaluation process by field experts, ensuring the credibility, accuracy, and scholarly rigor of the research. Non-empirical research, FinTech studies, and grey literature including industry reports and white papers, were excluded. While this decision ensured academic rigor and reproducibility, it implied sacrificing insights into emerging InsurTech innovations found in grey literature.

The final dataset consisted of 972 articles, with acknowledged limitations such as potential geographical bias, though this was partially mitigated by the global coverage of Scopus (Martín-Martín et al., 2018), and the exclusion of perspectives from the rapidly evolving industry.

2.3 Bibliometric Tools and Framework for Analysis

This analysis utilized RStudio (version 4.4.3) together with the Bibliometrix R package through the Biblioshiny web interface and VOSviewer (version 1.6.20.0). This software enabled detailed bibliometric performance evaluation and scientific mapping through its statistical and graphical features (Aria & Cuccurullo, 2017). Performance analysis consisted of determining yearly scientific output and influence of sources, as well as identifying leading researchers, national productivity metrics, and collaborative network structures. Additionally, Microsoft Excel was employed to organize, structure, and refine the exported bibliometric data, particularly from the Bibliometrix-generated Comma Separated Values (CSV) files, enabling systematic quality control and category reclassification when needed. Together, these tools and methods created a robust framework to identify the key themes, gaps, and future directions for research in digital transformation applicable to the insurance industry.

2.4 Bibliometric Metrics

Several bibliometric metrics established the foundation for the analysis of digital transformation in the insurance

sector. The study began with a general overview of the dataset using key metadata statistics, such as the total number of articles, sources, authors, and collaboration indices. An analysis of the scientific trend was performed through the annual scientific production metric and the average citations per year, hence providing insights into the field's evolution between 2015 and 2024. The analysis also identified the most cited papers and the ten most relevant authors, offering a view of intellectual leadership in the domain. The study conducted an in-depth analysis of local authors' influence and measured their productivity and impact within the dataset while applying Bradford's Law to identify those core journals driving research in the field.

The investigation focused on institutional contributions through an analysis of the ten most productive affiliations in the field. The study examined the geographic patterns by monitoring countries which produced publications across time while mapping international partnerships to show transnational research dynamics. Researchers obtained conceptual insights through keyword co-occurrence networks that revealed both dominant themes and emerging research areas. The research domain was structured intellectually through treemap visualizations and mapping techniques, which summarized relationships between keywords, authors, sources, and countries.

Keyword co-occurrence networks employed the standardized workflow of Bibliometrix with empirically validated thresholds: minimum cluster frequency was set to 5 occurrences (5.14 per 1,000 documents, rounded for our 972-document corpus) to balance thematic relevance and noise reduction. The top 250 words by relevance were clustered using the Walktrap algorithm (community repulsion = 0), generating groups labeled by the 3 most significant terms per cluster (label size = 0.3). This configuration was confirmed via sensitivity testing: frequencies < 5 produced fragmentation, while > 10 excluded emerging themes, aligning with bibliometric best practices for robust cluster formation.

3. Results

3.1 Overview of the Main Bibliometric Data

As mentioned earlier, this paper used a detailed bibliometric performance evaluation and scientific mapping through its statistical and graphical features. For instance, Table 2 demonstrates that this research has 972 articles between 2015 and 2024, sourced from 498 different outlets, including journals and books. The documents in the dataset had an average age of 3.46 years, indicating a relatively recent body of literature. The 34.82% annual growth rate revealed a substantial increase in the number of publications over the period for analysis.

The academic recognition of these works was notable, as each document had been cited for an average of 17.21 times. The collection included 4,472 Keywords Plus (ID) and 3,055 Author's Keywords (DE), demonstrating a broad thematic diversity across the research. Regarding the collaboration of authors, the dataset includes 3,105 authors, with an average of 3.64 co-authors per document. This highlighted a tendency for collaborative research and very few single-authored documents.

International co-authorship was present in 25.82% of the papers, reflecting a strong trend of global collaboration. This suggested an increasing level of international cooperation in research on digital transformation and insurance companies.

Table 2. Bibliometric analysis data

Description	Results
Timespan	2015: 2024
Sources (Journals, Books, etc.)	498
Single-authored Docs	92
References	42764
Keywords Plus (ID)	4472
International Co-authorships %	25.82
Documents	972
Document Types	Article
Document Average Age	3.46
Co-Authors per Doc	3.64
Average Citations per Doc	17.21
Authors of Single-authored Docs	88
Authors	3105
Author's Keywords (DE)	3055
Article	972
Annual Growth Rate %	34.82

Source: Compiled with authors based on Bibliometrix output

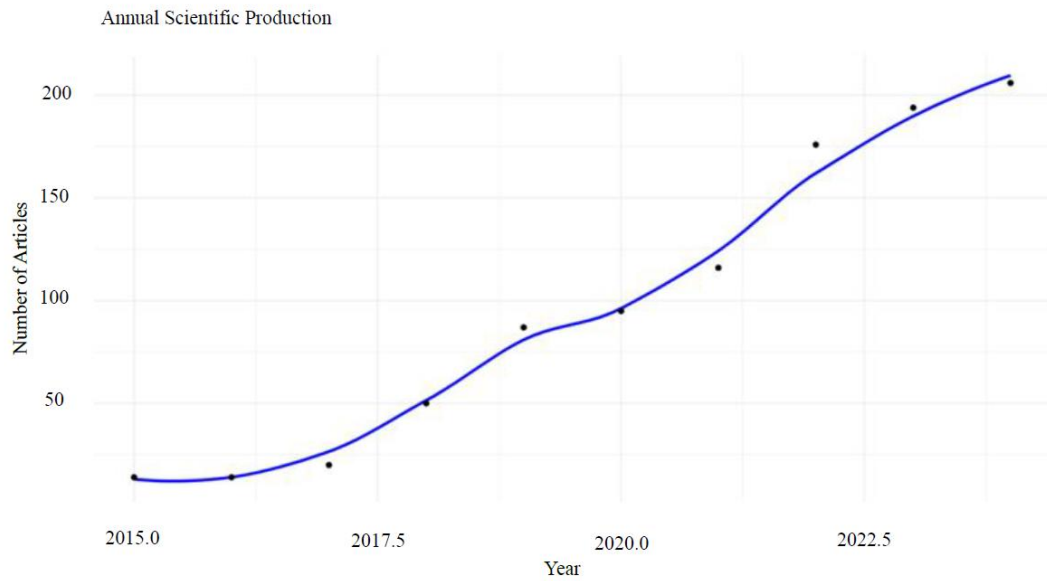


Figure 3. Annual scientific production

Source: Compiled with authors based on Bibliometrix output

Based on the analysis of annual scientific production from 2015 to 2024 presented in Figure 3, research on digital transformation and insurance companies has experienced significant and consistent growth. The number of publications has climbed from just 14 articles in 2015 to 206 articles in 2024, indicating a nearly fifteen-fold rise over a decade. The early years between 2015 and 2017 showed a relatively low and stable output, suggesting the novelty of the topic. A notable acceleration occurred between 2018 and 2020, with publications rising from 20 to 95, reflecting growing academic interest and increasing relevance of digital technologies in the insurance sector. The trend continued with a sharp rise between 2021 and 2022 and it was likely influenced by the global digital shift during the COVID-19 pandemic. The pandemic drastically increased reliance on digital tools and remote services, which in turn boosted the volume of research in InsurTech, AI, blockchain, and RegTech. These changes were likely key drivers behind the sharp expansion of publications during this period. With the incorporation of these annotations, the interpretation of data became more convincing in explaining the relationship between research trends in digital transformation and external events such as the pandemic.

Although the growth rate began to stabilize in 2023 and 2024, the continued increase in output suggested that the field was entering a mature phase, characterized by more focused and specialized research. Overall, the high compound annual growth rate of approximately 31.9% underscored the dynamic and expanding nature of this research area, making it a timely and relevant focus for bibliometric analysis.

Mean TC per Art (Mean Total Citations per Article): This measures the average number of citations each article has received. Eq. (1) shows the method of calculation:

$$\text{Mean TC per Art} = \frac{\text{Total Citations (TC)}}{(\text{Number of Articles})N} \quad (1)$$

Mean TC per Year (Mean Total Citations per Year): This measures the average number of citations per year. It calculates the total citations over the number of years the articles have been published. Eq. (2) shows the method of calculation:

$$\text{Mean TC per Year} = \frac{\text{Total Citations (TC)}}{\text{Citable years}} \quad (2)$$

where, Eq. (3):

$$\text{Citable Years} = \text{Current Year} - \text{First Year of Publication} \quad (3)$$

Table 3 illustrates the evolution of Average Citations Per Year (Mean TC per Year) from 2015 to 2024, offering an explicit idea of how citation impact has shifted across the decade. In the initial years between 2015 and 2018,

the field demonstrated relatively strong citation performance, with MeanTCperYear values fluctuating between 5.06 and 6.88. The peak occurred in 2018, with an average of 6.88 citations per year, reflecting the high impact and visibility of publications during that period, despite a moderate publication volume ($N = 50$).

Table 3. Average citation per year

Year	Mean TC per Art	N	Mean TC per Year	Citable Years
2015	57.14	14	5.19	11
2016	30.43	14	3.04	10
2017	45.50	20	5.06	9
2018	55.02	50	6.88	8
2019	29.95	87	4.28	7
2020	29.35	95	4.89	6
2021	17.83	116	3.57	5
2022	12.60	176	3.15	4
2023	8.99	194	3.00	3
2024	2.02	206	1.01	2

Source: Compiled with authors based on Bibliometrix output

This suggested that early contributions to the intersection of digital transformation and insurance companies attracted substantial scholarly attention.

From 2019 to 2020, a gradual decline was observed, with “Mean TC per Year” values dropped to 4.28 in 2019 and 4.89 in 2020, despite a rise in the number of publications. The citation performance remained relatively moderate during this time, indicating a possible saturation in the novelty of topics or the beginning of increased competition within the domain.

The most significant downward trend was evident in the period from 2021 to 2024. “Mean TC per Year” steadily fell from 3.57 in 2021 to just 1.01 in 2024, marking a steep decline in citation impact. This trend aligned with the sharp increase in the volumes of publications from 116 in 2021 to 206 in 2024, implying that the growing number of studies may have led to citation dispersion and reduced per-article visibility.

Recent publications typically required more time to accumulate citations and this partly explained the low figures for 2023 and 2024. However, the consistent decline in the recent years might reflect broader shifts in citation behavior, changes in research quality or focus, and an increasingly crowded publication landscape.

3.2 Sources with the Most Contributions

The analysis in Table 4 identifies the most influential research on digital transformation in insurance. These sources revealed the important trends in the development of research of this field as some journals had particularly significant impacts. For example, *Geneva Papers on Risk and Insurance: Issues and Practice* has led with 604 total citations, an h-index of 11, and 15 publications since 2015. This strong citation performance underscores its central role in driving scholarly conversations around insurance and risk-related digital innovation. Its research is highly impactful and has had tangible effects on both policy and the industry when it comes to digitally transforming insurance. On the other hand, *IEEE Access* excels in the low publication latency ratio, with 23 publications and 486 citations. With an h-index of 11, it has represented a sound scientific impact in a short period since 2020. The journal, being the gravity of digital transformation, is oriented to technology-based publishing, in particular communications technology and its potential applications in the field of blockchain and AI. The rapid ascension of *IEEE Access* indicates that high-quality, high-yield, open-access journals are considered to be critical for the rapid dissemination of the most advanced technologies. This is in line with the major trend of open-access journals as major contributors to speed up the access to knowledge for research.

The Journal of Big Data, which has had 484 citations and 13 papers published since 2018, shows a narrower and niche contribution to the area of big data technologies in insurance with an h-index of 10, which suggests steady, but intentional and useful contributions to the area, and more importantly, a narrower and deeper focus of the influence exerted by big data on digital transformation in insurance activities. Few published papers suggest a relatively smaller scale of the journal and a decrease in contributions is closer in size to its focus on data analytics. Analytics and big data are playing transformational roles in the insurance process to improve performance and operability. While the other journals have more of a broad focus, these three examples show some of the different ways to approach digital transformation in the insurance space. While *Geneva Papers* focuses on broad risk and insurance issues, *IEEE Access* emphasizes technological innovation, and *The Journal of Big Data* narrows in on the data-centric aspects of digital change. Together, these journals highlight different facets of digital transformation, underscoring how various research streams are converging to shape the future of the insurance industry.

Table 4. Most impactful and prolific sources

Source	h_index	TC rank	g_index	m_index	TC	NP	PY_start
<i>Geneva Papers on Risk and Insurance: Issues and Practice</i>	11	1	15	1.000	604	15	2015
<i>IEEE Aaccess</i>	11	2	22	1.833	486	23	2020
<i>Journal of Big Data</i>	10	3	13	1.250	484	13	2018
<i>Sustainability (Switzerland)</i>	10	4	18	1.000	370	18	2016
<i>Decision Support Systems</i>	8	5	8	0.889	533	8	2017
<i>Expert Systems with Applications</i>	8	6	15	0.727	316	15	2015
<i>Journal of Biomedical Informatics</i>	8	7	10	0.727	447	10	2015
<i>Risks</i>	7	8	18	0.875	336	30	2018
<i>Applied Sciences (Switzerland)</i>	6	9	14	0.857	205	14	2019
<i>Insurance Markets and Companies</i>	6	10	10	1.000	114	15	2020

Source: Compiled with authors based on Bibliometrix output

Notes: Total Citation Rank (TC Rank); g-index; m-index; Total Citations (TC); Number of Publications (NP); Publication Year Start (PY Start)

The h-index is highest at h such that the researcher has h articles that have each been mentioned a minimum of h times. Eq. (4) shows the method of calculation:

$$h - \text{index} = \max(h) \text{ where } h \text{ papers have } h \text{ or more citations} \quad (4)$$

The TC rank is a rank that orders papers (or authors) based on the total number of citations. Eq. (5) shows the method of calculation:

$$TC = \sum \text{Citations of all papers} \quad (5)$$

The g-index refers to the highest number of publications with at least g^2 citations. Eq. (6) shows the method of calculation:

$$g - \text{index} = \max(g) \text{ where } \sum_{i=1}^g \text{citations of top } g \text{ papers} \geq g^2 \quad (6)$$

The m-index is the h-index divided by the number of years since the researcher started publishing. Eq. (7) shows the method of calculation:

$$m - \text{index} = \frac{h - \text{index}}{(\text{years since first publication})} \quad (7)$$

Number of Publications is the total number of papers published by a researcher or in a specific dataset. Eq. (8) shows the method of calculation:

$$NP = \text{Total number of papers published} \quad (8)$$

Publication Year Start is the year when the researcher started publishing their first paper. Eq. (9) shows the method of calculation:

$$PY_{\text{start}} = \text{Year of the first publication} \quad (9)$$

Figure 4, depicting “Production of Different Sources over Time”, reveals a dynamic evolution in scholarly output across six key journals from 2015 to 2024. “*RISKS*” dominates the trajectory, surging from 0 publications in 2015 to 30 in 2024; there is a sharp acceleration post-2019 and it is likely driven by global crises such as pandemics and climate risks that amplified the demand for risk-related research. “*IEEE Access*” emerged abruptly in 2020 and rose rapidly to 23 publications by 2024, reflecting its role as a high-volume, open-access platform catering to interdisciplinary engineering and applied sciences. “*Sustainability (Switzerland)*” grows steadily from 1 publication in 2016 to 19 in 2024, mirroring sustained global interest in sustainability. Meanwhile, “*Expert Systems with Applications*” and “*Geneva Papers on Risk and Insurance: Issues and Practice*” exhibit gradual and

consistent growth to reach double output by 2024; each suggests enduring relevance in AI applications and insurance scholarship respectively. “*Insurance Markets and Companies*” has been absent until 2020 but matched other sources by 2024 with 15 publications, signaling a delayed but aggressive entry in the field with potential to tie with emerging demands for regulatory or market-driven research. A striking convergence of output lined by 2024 and four sources clustered between 15 and 23 publications, highlighting a diversified research landscape and reducing reliance on a single dominant journal. This trend may reflect interdisciplinary overlap (e.g., AI in risk modeling and sustainability in insurance) or indexing shifts favoring newer platforms. However, data in 2024 should be interpreted cautiously due to potential partial-year indexing artifacts. Overall, the figure underscores a transformative shift from monocentric (RISKS-dominated) to polycentric dissemination of research which is driven by global challenges, open-access momentum, and interdisciplinary innovation.

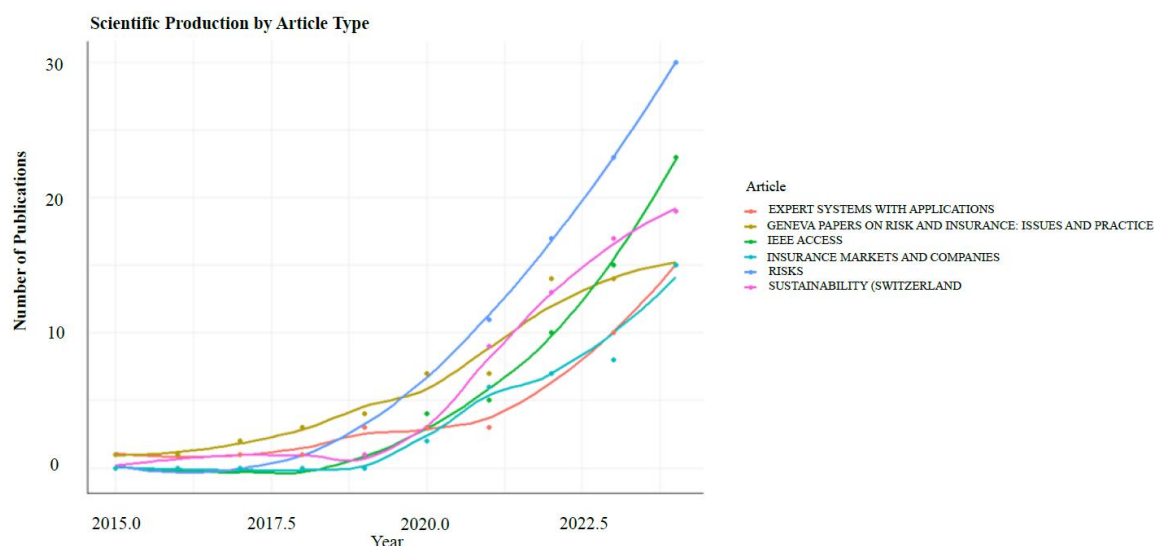


Figure 4. Production of different sources over time
Source: Compiled with authors based on Bibliometrix output

3.3 Distribution of Impact and Collaboration of Countries

The global research landscape as depicted by corresponding authors’ affiliations highlights a mix of dominant contributors and collaboration patterns (Figure 5 and Table 5). The United States stands as the leading country with 154 publications, accounting for 15.8% of the total. Among these, 122 are single-country publications (SCPs) whereas 32 are multiple-country publications (MCPs), indicating a rate of 20.8% international collaboration. This reflects the robust scientific productivity of the US as supported by both strong domestic capacity and consistent engagement in international networks.

Research output from China stands at 106 articles, while 68 of these are single-country publications and 38 are multiple-country publications, leading to an MCP ratio of 35.8%. The substantial percentage demonstrates the advancing position of China as both publication leader and research partnership driver across global networks, hence demonstrating its involvement in joint projects.

Table 5. Most contributing countries

Country	Articles	Articles %	SCP	MCP	MCP %
USA	154	15.8	122	32	20.8
China	106	10.9	68	38	35.8
India	85	8.7	68	17	20.0
Germany	42	4.3	39	3	7.1
Korea	24	2.5	19	5	20.8
United Kingdom	24	2.5	12	12	50.0
France	23	2.4	8	15	65.2
Italy	22	2.3	17	5	22.7
Australia	19	2.0	13	6	31.6
Spain	19	2.0	19	0	0.0

Source: Compiled with authors based on Bibliometrix output

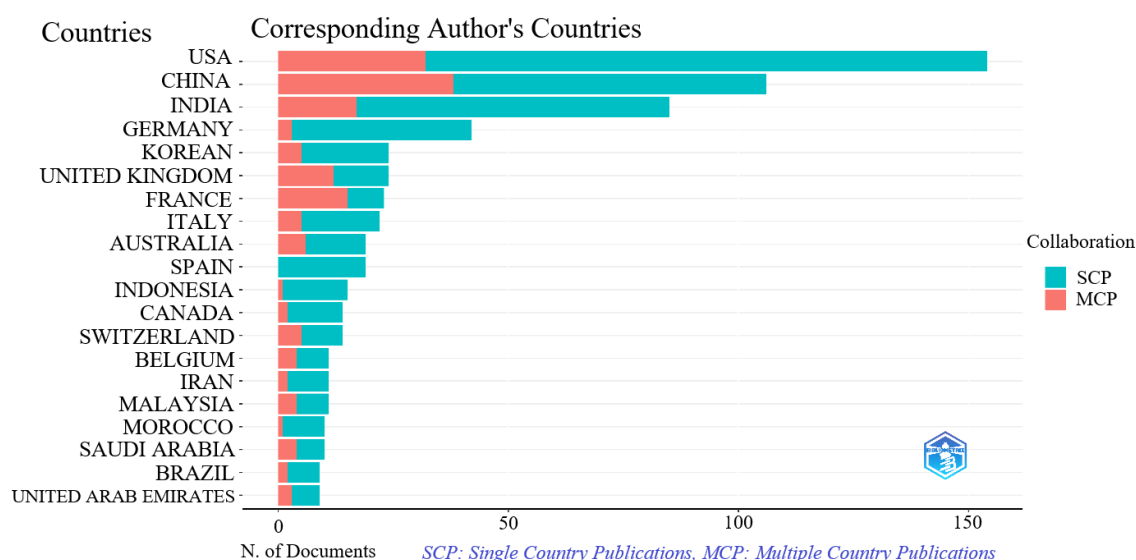


Figure 5. Citations of authors by countries
Source: Compiled with authors based on Bibliometrix output

India produces 85 academic publications; among these works, 68 are SCPs whereas 17 are MCPs which lead to a collaboration ratio of 20%. Through this analysis, India shows a pattern similar to the US by depending on national capacity and maintaining consistent connections with international research collaborators.

3.3.1. Patterns among leading European and Asian contributors

A total of 42 publications come from Germany, which shows a strong bias against its national research output and produces 39 SCPs alongside just 3 MCPs which results in a rate of 7.1% international collaboration. Research priorities in Germany focus mainly on national scientific work. The patterns of research publications suggested by the United Kingdom and France show substantial differences between each other. The two countries generate an equivalent total number of publications at 24 and 23 but both maintain high levels of international collaboration. The United Kingdom divides its research publications equally between SCPs and MCPs and each accounts for the same distribution of 50%. Out of the total 23 publications, France produces only 8 SCPs which result in an exceptionally high collaboration rate of 65.2%. The statistics of research emphasize the active involvement of these two countries in worldwide scientific networks.

3.3.2. Observation of mid-level contributors

The scientific output from Korea and Italy demonstrates a desirable equilibrium between SCPs and MCPs. The 24 publications from Korea consist of 19 SCPs and 5 MCPs; collaborated works in this country account for 20.8% of the total published works. Italy published 22 scientific papers, including 17 SCPs and 5 MCPs, to achieve a collaboration rate of 22.7%. The 19 publications from Australia demonstrate a moderate level of collaboration with 31.6% of MCPs, and this suggests its increasing international participation in the science arena. Spain serves as an intriguing example because its entire set of 19 articles represents SCPs based solely on national research, hence excluding any international partnerships. The findings suggest a powerful research culture that operates exclusively within domestic boundaries.

3.3.3. Strategic implications and insights

As reflected from the study, different nations choose their own appropriate tactics to publish scientific works. Research output from the USA together with China and India remains substantial, yet their percentages of collaboration are at a moderate level since they could prioritize their national research capabilities. Worldwide scientific networks recognize France and the UK because they maintain strong collaborative relationships with researchers from different countries. Research data show that the scientific contribution of a nation depends on both its research quantity and its collaborative involvement with other countries.

These insights assist policymakers and institutions in optimizing international partnerships and enhancing global reach and impact of their research communities.

SCPs (Single Country Publications): Publications that are authored by researchers from a single country, i.e., the entire research team or authorship originates from one country.

MCPs (Multiple Country Publications): Publications that are authored by researchers from multiple countries. This typically indicates international collaboration.

3.4. Most Influential Papers

Table 6 summarizes the most impactful articles in the field of digital transformation in the insurance sector with an emphasis on blockchain and AI. The article by Chen et al. (2019) ranks first with a total of 420 citations and a normalized total citations (TC) of 14.02, and represents a significant contribution to literature towards an understanding of how blockchain could facilitate privacy-protected data sharing. Significant citation rate of Chen et al. (2019), with an average of 60 per year, illustrates its continuing relevance in the subject of data security in insurance, but most importantly, it suggests that blockchain is essential to digital transformation for the insurance industry in digitally-enabled safe transactions and data integrity. In this light, blockchain is considered critical to the reorganization of the future insurance industry.

Table 6. Most influential papers

Paper	Title	DOI	Total Citations	TC Rank	TC per Year	Normalized TC
Chen et al. (2019), <i>Future Gener. Comput. Syst.</i>	Blockchain-Based searchable encryption for electronic health record sharing	10.1016/j.future.2019.01.018	420	1	60.00	14.02
Shneiderman (2020), <i>ACM Trans. Interact. Intell. Syst.</i>	Bridging the gap between ethics and practice: Guidelines for reliable, safe, and trustworthy human-centered AI systems	10.1145/3419764	366	2	61.00	12.47
Wang & Song (2018), <i>J. Med. Syst.</i>	Secure cloud-based HER system using attribute-based cryptosystem and blockchain	10.1007/s10916-018-0994-6	314	3	39.25	5.71
Wang & Xu (2018), <i>Decis. Support Syst.</i>	Leveraging deep learning with LDA-based text analytics to detect automobile insurance fraud	10.1016/j.dss.2017.11.001	252	4	31.50	4.58
Radanović & Likić (2018), <i>Appl. Health Econ. Health Policy</i>	Opportunities for use of blockchain technology in medicine	10.1007/s40258-018-0412-8	248	5	31.00	4.51
Hussien et al. (2019), <i>J. Med. Syst.</i>	A systematic review for enabling of develop a blockchain technology in healthcare application: Taxonomy, substantially analysis, motivations, challenges, recommendations and future direction	10.1007/s10916-019-1445-8	191	6	27.29	6.38
Eling & Lehmann (2017), <i>Geneva Pap. Risk Insur. Issues Pract.</i>	The impact of digitalization on the insurance value chain and the insurability of risks	10.1057/s41288-017-0073-0	185	7	23.13	3.36
Zhou et al. (2018), <i>J. Med. Syst.</i>	MISore: A blockchain-based medical insurance storage system	10.1007/s10916-018-0996-4	184	8	23.00	3.34
Stubbs et al. (2015), <i>J. Biomed. Inform.</i>	Automated systems for the de-identification of longitudinal clinical narratives: Overview of 2014 i2b2/UTHealth shared task track 1	10.1016/j.jbi.2015.06.007	180	9	16.36	3.15
Gatteschi et al. (2018), <i>IT Prof.</i>	To blockchain or not to blockchain: That is the question	10.1109/MITP.2018.021921652	164	10	20.50	2.98

Source: Compiled with authors based on Bibliometrix output

Shneiderman (2020), ranked second, addressed the ethical issues of using AI as these constitute an area typically ignored by technical studies. The paper has been cited 366 times with a normalized TC of 12.47 and raises the need to ensure trustworthy AI systems in the insurance industry, especially for applications such as underwriting and claims decisions, where algorithmic decisions directly impact consumers. This paper identifies the increasing need for regulatory frameworks that incorporate fairness and accountability, mirroring themes from our

bibliometric analysis and emphasizing the scarcity of literature related to ethical AI Governance in insurance.

Table 7. Historiographic evolution of manuscripts

Paper	Title	Author Keywords	DOI	Year	LCS	GCS
Derikx et al. (2016), <i>Electron. Mark.</i>	Can privacy concerns for insurance of connected cars be compensated?	Connected cars; E-mobility; Insurance; Internet-of-things; Mobile Services; Privacy	10.1007/S12525-015-0211-0	2016	6	63
Riikkinen et al. (2018), <i>Int. J. Bank Mark.</i>	Using artificial intelligence to create value in insurance	Artificial intelligence; Chatbot customer value; Insurance; Reverse use of customer data; Service logic; Value creation	10.1108/Ijbm-01-2017-0015	2018	16	162
Stoeckli et al. (2018), <i>Electron. Mark.</i>	Exploring characteristics and transformational capabilities of InsurTech innovations to understand insurance value creation in a digital world	Digitalization; Fintech; Insurance; Insurance IT innovations; InsurTech	10.1007/S12525-018-0304-7	2018	25	117
Eling & Lehmann (2017), <i>Geneva Pap. Risk Insur. Issues Pract.</i>	The impact of digitalization on the insurance value chain and the insurability of risks	Digitalization; Innovation; Insurability; Technology; Value chain	10.1057/S41288-017-0073-0	2018	36	185
McFall & Moor (2018), <i>Distinktion J. Soc. Theory</i>	Who, or what, is InsurTech personalizing: Persons, prices and the historical classifications of risk	Data; Insurance; InsurTech; Personhood; Price; Tracking	10.1080/1600910x.2018.1503609	2018	6	39
Bohnert et al. (2018), <i>Geneva Pap. Risk Insur. Issues Pract.</i>	Digital agendas in the insurance industry: The importance of comprehensive approaches	Corpus linguistics; Digitalization; Firm characteristics; Shareholder value	10.1057/S41288-018-0109-0	2019	21	64
Xu & Zweifel (2020), <i>Risk Manag. Insur. Rev.</i>	A framework for the evaluation of Insurtech		10.1111/Rmir.12161	2020	6	17
Eckert & Osterrieder (2020), <i>ZVersWiss</i>	How digitalization affects insurance companies: Overview and use cases of digital technologies		10.1007/S12297-020-00475-9	2020	9	45
Grima et al. (2020), <i>Geneva Pap. Risk Insur. Issues Pract.</i>	A steep framework analysis of the key factors impacting the use of blockchain technology in the insurance industry	Blockchain technology; Distributed ledger technology (Dlt); Insurance markets; Risk management; Steep	10.1057/S41288-020-00162-X	2020	10	77
Lanfranchi & Grassi (2021), <i>Geneva Pap. Risk Insur. Issues Pract.</i>	Examining insurance companies' use of technology for innovation	Business model; Covid-19; Fintech; Innovation framework; Insurance; InsurTech; Risk; Technology	10.1057/S41288-021-00258-Y	2022	10	26

Source: Compiled with authors based on Bibliometrix output

Notes: DOI: Digital object identifier; LCS: Local citation score; GCS: Global citation score

The third-ranked paper, Wang & Song (2018), which has 314 citations and a normalized TC of 5.71, discussed the intersection of blockchain and cloud-based Electronic Health Record (EHR) system in healthcare and exhibited particular pertinence to digital health insurance application. The blockchain-enabled systems discussed in this paper aligned with the broader trend in the insurance industry towards integrating blockchain into data storage and risk management. Similarly, Radanović & Likić (2018), and Hussien et al. (2019) explored the potential of blockchain in healthcare and reinforced the security and transparency provided by blockchain for managing insurance data and improving trust in digital transactions.

One notable observation from Table 6 is the relatively low citation count for Eling & Lehmann (2017), with 185 citations, despite its significant focus on the digitalization of the insurance value chain and its effects on risk

insurability. The paper, while not as widely cited as others, offers valuable insights into the impact of emerging technologies like blockchain and AI on the transformation of core insurance operations. Analysis of Eling & Lehmann underscored how digital technologies are not just tools for improving operational efficiency but also for rethinking the fundamental nature of risks in insurance. This paper shed light on the need for research on digital risks and regulatory adaptation, which is currently underexplored.

Total citation counts become normalized through adjustments that consider the duration of publication and the different fields or types of research. Eq. (10) shows the method of calculation:

$$\text{Normalized TC} = \frac{\text{TC}}{\text{Citable Years}} \quad (10)$$

Table 7 presents a historiographic evaluation of the digital transformation in an insurance company, illustrating distinct shifts in research topics encompassing four main periods.

Between 2016 and 2017, the initial phase established the foundation by examining privacy and technological problems that affected insurance services delivered through connected vehicles and mobile platforms. Derikx et al. (2016) analyzed privacy problems connected to automotive connectivity systems to determine their effects on the insurance sector while investigating early IoT risks.

The period between 2018 and 2019 saw an expansion of research which focused on artificial intelligence (AI), InsurTech developments, and digitalization effects on insurance value chains. Researchers like Riikkinen et al. (2018) and Stoeckli et al. (2018) established the foundations for AI customer value analysis and InsurTech innovation transformation, respectively. Eling & Lehmann (2017) conducted a crucial study about the effects of digital technologies on insurance value chains and risk insurability to identify insurance technology disruption as a key research topic.

The years following 2020 have seen growing recognition of blockchain technology, together with sophisticated digital systems. Grima et al. (2020) conducted an in-depth STEEP examination to demonstrate the impact of blockchain on risk management as well as insurance markets through distributed ledger technology. Scholars Xu & Zweifel (2020) and Eckert & Osterrieder (2020) studied the implementation of digital technology that concentrated on the innovation frameworks and practical applications carried out by insurance companies.

The latest research from 2021 onwards, including Lanfranchi & Grassi (2021), stressed complete technology implementation as a reaction to changes in business models and the external impact of COVID-19. The study explored the collaboration of Fintech, InsurTech, and innovation frameworks while highlighting the requisite for a complete digital transformation in insurance.

Future research should emphasize the implementation of blockchain to facilitate effective insurance operations for a higher level of security and transparency, along with enhanced operational efficiency. The ongoing investigation of AI-based personalization, together with data governance, would continue to solve upcoming regulatory and ethical problems encountered in digital insurance ecosystems.

3.5 Thematic Map Analysis

As illustrated in Figure 6, the study focused primarily on “health insurance” because this term represented 9% of the examined keywords and demonstrated its importance at the healthcare-technology interface. The term “machine learning” took up 6% and showed the rising significance of artificial intelligence for improving healthcare insurance systems and decision frameworks. The term “Insurance” emerged 6%, indicating a broad interest in the research on this study domain of the insurance industry.

The subject of “human” represented a substantial portion at 6% of the research, highlighting the human components and population groups studied in health insurance. The combination of “artificial intelligence” with “health care” made up of 3% of the research because they both contributed to improving medical services and insurance frameworks. Interest in security and ethical issues concerning the protection of patients and data handling was testified by the focus on risk assessment at 3% and privacy at 1%.

Emerging technologies such as blockchain and the Internet of Things (IoT) accounted for 2% each, indicating new approaches to data management and connectivity in healthcare insurance systems. The methodological keywords “machine learning”, “learning systems and forecasting”, together with “decision trees” all suggested a robust foundation for predictive analytics and algorithm-driven insights at 1–2% prevalence.

The analysis showed specific terms like “fraud detection”, “diagnosis”, “data privacy”, and “insurance claims” appeared less often but emphasized improvements in health insurance in terms of accuracy, security and operational performance.

The treemap illustrates a wide-ranging research environment that connects health insurance to machine learning, together with artificial intelligence and new technology developments for enhancing healthcare management and risk assessment, and data protection. According to the visual distribution, the paper establishes technological integration together with predictive modeling as fundamental elements that drive upcoming progress in studies

about health insurance.

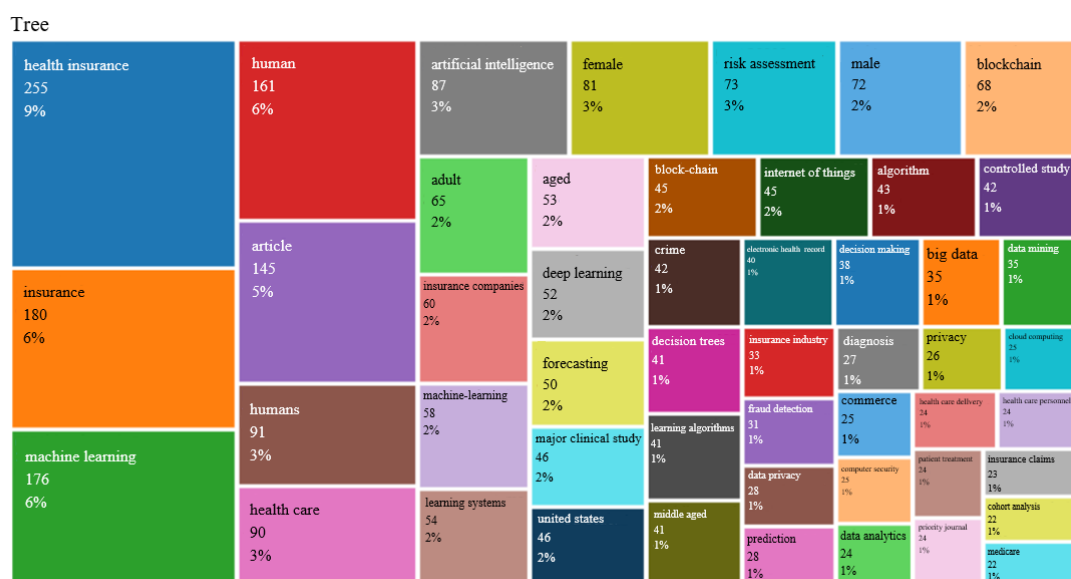


Figure 6. Treemap of the top 50 keywords plus

Source: Compiled with authors based on Bibliometrix output

Note: The size of each cube represents the frequency of the corresponding keyword, with larger cubes indicating a higher frequency. The percentages of the total frequency for each keyword are displayed in the respective cubes.

The thematic map shown in Figure 7 highlights the key thematic areas driving digital transformation in the insurance sector. The map is organized according to two axes: Development Degree (Vertical Axis) measures the level of development or exploration of each theme in the field. The higher positions indicate more developed themes. Relevance Degree (Horizontal Axis) reflects the relevancy of each theme to the current research, with themes positioned further to the right being more relevant.

There are clear distinctions between Motor, Basic, Niche, and Emerging or Declining Themes. The Motor Themes quadrant, dominated by machine learning, big data, deep learning, and artificial intelligence, underscores the growing importance of AI-driven solutions and data analytics in insurance operation, particularly in enhancing efficiency and risk management. The Basic Themes quadrant, featuring terms such as insurance, InsurTech, blockchain, and cloud computing, stresses the foundational role of these technologies in both InsurTech and healthcare insurance and puts data privacy, security, and operational efficiency in the agenda for future studies.

In the Niche Themes quadrant, specialized terms like claims prediction and Covid-19 pandemic signal emerging research areas in predictive analytics and decision-making tools. Emerging or Declining Themes, such as digital health, digital technology, and health care, reflect the growing interest in innovative insurance models driven by digital transformation. The map illustrates the interdisciplinary convergence between healthcare digitization, FinTech, and RegTech, exhibiting the reshaping power of digital transformation in the performance of InsurTech with innovations brought forth by AI, blockchain, and IoT.

This thematic distribution reveals a dual focus in the current research: one was driven by technological innovations such as AI and blockchain whereas the other was grounded in insurance policy and risk management, with an emphasis on cybersecurity and data privacy. While technological advancement implies major breakthroughs, foundational themes such as insurance systems, risk prediction, and cybersecurity remain central to the field.

The three-field Sankey chart illustrated in Figure 8 offers a comprehensive visualization of the relationships among Keywords, Authors, and Sources within the field of data-driven insurance and financial technologies. The rectangular nodes in the chart represent the frequency of occurrences for each entity, while the width of the connecting lines indicates the strength of association between them. Among the keywords, “big data” and “machine learning” emerge as the most prominent, reflecting their central role in the research landscape. Other significant keywords such as “fraud detection”, “artificial intelligence”, “blockchain technology”, “insurance”, and “InsurTech” also feature prominently, while terms like “deep learning,” “cloud computing,” “health insurance,” and “life insurance” pop up less frequently, suggesting their status as emerging or niche topics.

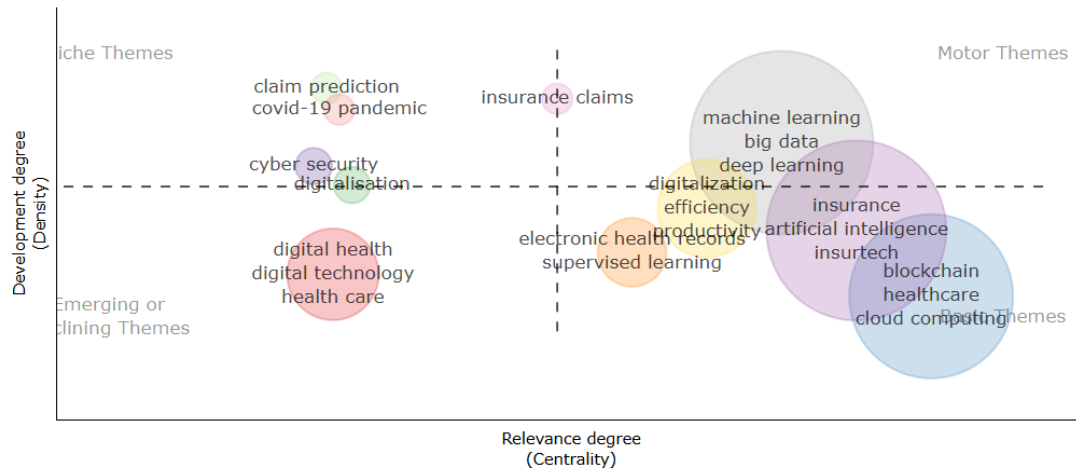


Figure 7. Thematic map of digital transformation in insurance
Source: Compiled with authors based on Bibliometrix output

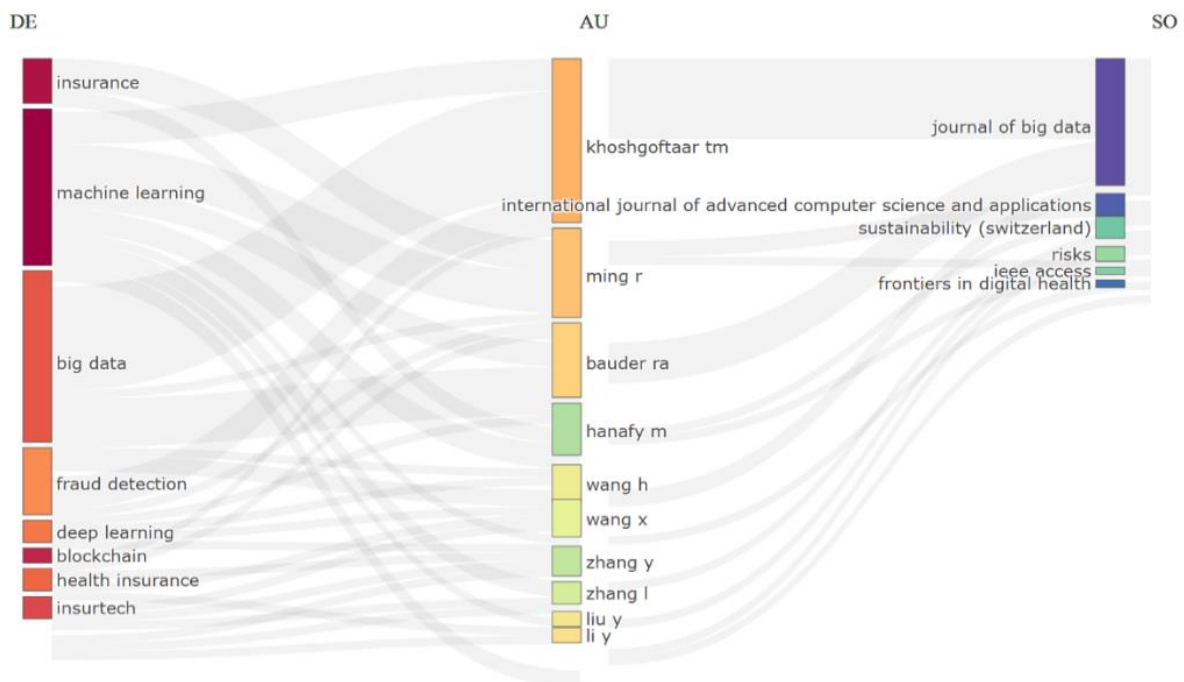


Figure 8. Three-field plot: Keywords, authors, and sources
Source: Compiled with authors based on Bibliometrix output

In the author dimension, “khoshgoftaar tm” stands out as a leading figure, with strong connections to both key topics and major journals. Other influential authors such as “ming r”, “bauder ra”, and “hanafy m” bridge multiple research themes and publication outlets, shaping the direction of the field. On the source side, *The Journal of Big Data* is the most significant publication, closely linked to both leading authors and the most important keywords. Other notable sources include “Sustainability (Switzerland)”, “IEEE Access”, and “Frontiers in Digital Health”, with further contributions expected from “Risks”.

The chart indicates that researchers focused largely on “big data” and “machine learning” with a strong relationship to “*The Journal of Big Data*”; as such, these topics are paramount in the research ecosystem. Fraud detection and blockchain are closely associated, therefore, their active contributions to insurance technology and financial analytics could be detected. “Khoshgoftaar tm” and “ming r” are identified as influential authors with powerful links to various keywords and multiple sources, thus growing in importance in the field. The diagram projects a research setting that emphasizes teamwork and dynamic workflow with advanced data analytics and machine learning applications in the insurance and financial settings. The field shows its intention for continuing

technological advancement through “big data” as a keyword, “machine learning” as both keyword and influential authors, as well as “*The Journal of Big Data*” as central publication. The field sheds light on its fast development through the supporting keywords and multiple publication outlets as it examines areas like fraud detection, blockchain, and digital transformation. As can be seen from the diagram, international researchers specializing in different fields collaborate to develop data-driven insurance and financial technologies that could aptly match the analysis approach of a certain model.

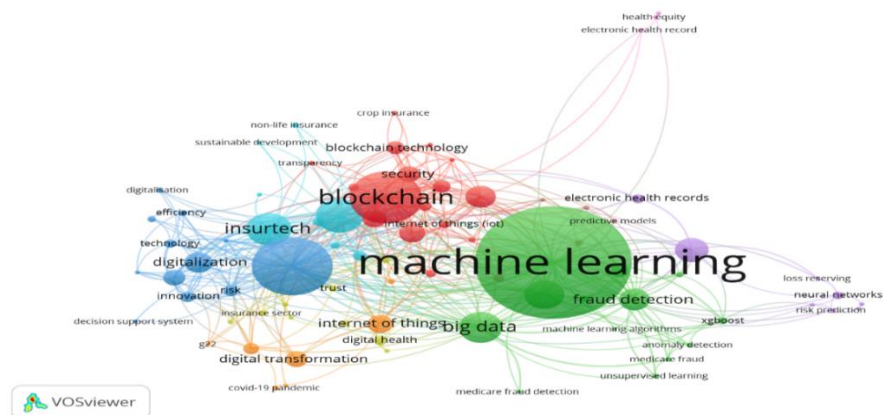


Figure 9. Cross-disciplinary insights into digital transformation in insurance
Source: Compiled with authors based on Vos Viewer output

Figure 9 is the network map on Digital Transformation in Insurance. It reveals important cross-disciplinary connections among InsurTech, FinTech, and healthcare digitization, particularly in the areas of machine learning, blockchain, and big data. The map shows nine clusters and a total of 435 links, with machine learning emerging as the central theme in the study. This demonstrates the rising influences within fraud detection, risk prediction, predictive modelling and scenarios in respect of not only insurance, but also healthcare, especially their application to diagnostic devices and personalized care routines. The blockchain cluster demonstrates a behavioral relationship across both InsurTech and RegTech, with a focus on security, privacy, and trust issues that are confronted across sectors. A focus on Internet of Things (IoT) and electronic health records helps to illustrate the relationship of digitization in healthcare and InsurTech while also demonstrating the relationships and synergies between the insurance and healthcare sectors. Overall, the interconnectedness of technology adoption in the insurance and healthcare sectors could be further explored; the need for a broader, cross-disciplinary approach could enrich innovative breakthrough in either sector, such that AI in healthcare could have direct applications and challenges in InsurTech and FinTech. Given the growing role of RegTech in both sectors, future studies could benefit from exploring the impact of these technologies on regulatory compliance, data privacy, and operational efficiency. A comprehensive overview of digital transformation could offer interdisciplinary insights into changes driven by technologies across the insurance, finance, and healthcare sectors.

4. Discussion

This study reveals key discoveries from the application of evolving digital transformation, say machine learning, blockchain, and InsurTech technologies, in insurance businesses; for instance, to reshape insurance business models and customer service approaches. This aligns with Cosma & Rimo (2024), who emphasized the transformative role of these technologies in propelling operational efficiencies and innovation in the sector. However, an unexpected and critical finding from our dataset is the low visibility of leadership, organizational change, and ethical governance themes in the literature, despite their recognized importance in achieving successful digital transformation in other sectors. This gap particularly deserves attention, given that technological adoption alone does not guarantee success; the organizational and cultural adaptation essential for integrating such technologies are worth examining in the context of insurance. The greatest tendency of technology-related conversations may result in neglecting these salient organizational considerations. Future studies to simultaneously combine these variables for developing a broader understanding of digital transformation in the insurance industry would be a feasible topic.

Even though our results are mostly consistent with previous studies like Mall et al. (2023) which identified AI, blockchain, and big data as core areas for achieving digital transformation, there are some notable differences. First, Mall et al. (2023) primarily focused on technological evolution in isolation whereas the current study connected technological evolution with the regulatory, governance, and organizational aspects of digital

transformation of actors in the insurance sector. Moreover, blockchain as a significant facilitator was associated with trust and transparency for the execution of insurance operations, as described by Kaur et al. (2023), but the regulatory environment and ethical perspective would affect the determining factors to incorporate blockchain into the other elements of the regulatory framework. Nevertheless, while earlier studies tend to emphasize the technical benefits of blockchain, the present study has suggested that regulatory compliance and ethical governance would be indispensable to the functions performed by blockchain technology in the insurance sector, as these aspects could determine its uptake and ultimately its effectiveness. Though serving as a contrast to previous studies, a more even-handed perspective from which technological evolution, especially digital interface technologies, could be set in a wider context of organizational and ethical aspects for a more sustainable and conscientious approach to digital transformation.

Several new research questions that earlier studies did not fully prescribe but have been identified are highlighted in the present investigation; these include the intersection of machine learning and regulatory compliance in insurance to cater for the increasing demand for automation and automated regulatory compliance in the marketplace. Built upon the findings of Pauch & Bera (2022) situated within pandemic-disruption digitalization, the current study stresses that new technologies should comply with the changing regulatory landscape. The emergent area of regulatory AI integration offers evidence of new possibilities for digital transformation to develop and evolve in insurance businesses.

Table 8. Rankings of global insurance market

Rank	Country	Total Premium Volume (USD bn) 2024	Global Market Share 2024 (%)	Total Premium Volume (USD bn) 2023	Global Market Share 2023 (%)	% Change 2024
1	United States	3,497	44.8%	3,233	44.4%	8.1%
2	China	792	10.2%	724	9.9%	9.4%
3	United Kingdom	485	6.2%	454	6.2%	6.8%
4	Japan	339	4.4%	363	5.0%	−6.6%
5	France	292	3.8%	264	3.6%	10.8%
6	Germany	266	3.4%	254	3.5%	5.0%
7	Canada	181	2.3%	172	2.4%	4.7%
8	Italy	180	2.3%	157	2.2%	14.6%
9	South Korea	176	2.3%	177	2.4%	−0.8%
10	India	141	1.8%	136	1.9%	4.0%

Source: (Swiss Re Institute, 2025)

The US and China are dominant in both research on insurance and global market share owing to their pioneering roles in shaping the digital transformation of the industry. These findings were validated by the *Swiss Re Sigma Report 2025*, which ranked the US and China as the top two countries in terms of global insurance market share, with the US holding 44.8% and China contributing 10.2% (Swiss Re Institute, 2025). Table 8 highlights the rankings of the global insurance market, showcasing the US and China at the top, and this aligns with our bibliometric analysis in which the UK and France appear prominently in both our research output analysis and premium volume rankings. The UK, contributing 50% of its publications to international collaborations, and France, with a collaboration rate of 65.2%, are ranked third and fifth in market share, respectively. Additionally, countries like Germany, Italy, and South Korea show moderate contributions to both market size and research output, consistent with our findings about their focus of national research. India, ranked 10th in premiums, mirrors our bibliometric analysis and shows a gradual increase in contributions to both research output and digital transformation in insurance. The alignment between the bibliometric results and *Swiss Re Sigma Report* underscores the structure of global insurance market and the growing influence of emerging markets in digital innovation and research collaboration.

The dominance of these countries is not coincidental but caused by the combined forces of large insurance markets, robust government support, increasing access, and sophisticated approach to technology infrastructures. In the US, for example, MetLife has been the leader in applying AI in claims processing, while startups like Lemonade, have creatively employed AI and big data to deliver more personalized insurance policies (Boguslawski et al., 2025). The US also benefits from a great venture capital ecosystem that has fed InsurTech growth and provides easier access for new entrants and innovation. In China, the government is seriously pushing toward digitalization and this has had a positive overall effect on the development of both AI and blockchain technologies for insurance purposes. One of the largest insurance companies in China, Ping An, uses AI to process over 100 million claims each year (Lee & Oh, 2020; Ping An Insurance Group Company of China, 2022). It could be argued that this technology adoption is heavily influenced by the regulatory environment in China. By providing

a loose yet sound regulatory environment, China has become a significant leader in digital insurance research.

The position of India is unique in its own right but equally valuable. Given its large, under-insured population and strong push for financial inclusion, India is proving to be a fertile ground for mobile-enabled insurance schemes. Insurers such as Bajaj Allianz and HDFC Life have positioned themselves to lead the integration of AI-based chatbots and blockchain into their businesses, particularly for customer service and claims management (Anandraj et al., 2024; Gupta, 2025). The government has made strides towards the promotion of digital literacy, creating opportunities for the growth of InsurTech in India.

Despite the global nature of digital transformation, the low level of international collaboration at 25.82% suggests that national agendas, supported by strong domestic programs and technological investments, may hinder cross-border cooperation.

To strengthen the theoretical contribution of this study, the findings highlight how AI enhances personalized insurance products and claims management, and how blockchain improves data security and claims processing. This corresponds to the technological aspect of Vial's framework, which posits that technological advances drive change. The organizational readiness identified in this study, such as the investment in infrastructure and employee training as discussed in the cases of Allianz and AXA, connects to the organizational pillar of Vial's framework. In addition, the regulatory concerns about data privacy and GDPR compliance in AXA relate to the environmental aspect of Vial's framework and the environmental context of the Technology-Organization-Environment (TOE) model, which examined the external pressures to impel the adoption of technology. The results of the paper, especially blockchain adoption and the security of data, demonstrate the regulatory and operational contexts in which insurers could operationalize digital technologies.

Moreover, the socio-technical systems theory (Bostrom & Heinen, 1977) provides an added benefit to understand the relationships among technology, people, and organizations, when considering the impacts of digital transformation in insurance. The results of this investigation suggest that the focus of the insurance industry has been primarily on technological innovations, such as AI and blockchain. While the bibliometric analysis indicates a lack of emphasis on organizational governance and ethics, it informs a salient socio-technical gap in the research. To this end, technologies are commonly examined without considering the human/organizational contextual factors for integrating the technologies successfully. The theory confirms that technology could not enact changes: technology should go alongside organizational changes such as investments in infrastructure and employee training, if they are to be implemented without obstacles. Emerging attention to AI and blockchain adoption in key countries like the USA, China, and India could be the proof.

The theory of dynamic capabilities from Teece et al. (1997) helped further understand the response of insurance companies to new technologies. The bibliometric analysis showed that there was increasing research on new technologies such as AI implementation, primarily for underwriting and claims management, as firms are improving their capabilities for incorporating this technology into their knowledge and routine. Evidence in the earlier sections of the paper suggests that firms like MetLife and AXA are utilizing AI and blockchain technology not only for AI implementation but also for reconfiguration of their businesses via improving client-facing experiences and automating claims processing. This is a reflection of dynamic capabilities theory, with which firms could consistently transform their technology to sustain their competitive advantages and operational effectiveness in a changing digital environment.

Lastly, institutional theory (DiMaggio & Powell, 1983) provided a useful lens to discuss the varying and inequitable pace of digital transformation across international regions. The bibliometric findings showed that there was a significant regional disparity with the highest volume of publications and technological adoption in China, followed by the United States, and then India. This aligned with the institutional theory premise in which external pressures, in this case, regulations, standards, and market expectations, produced differential digital adoption rates.

In comparing the results from our paper with the insights derived from non-Scopus studies, several key trends emerge. Akhil (2022), focusing on the emerging technologies in the insurance industry with data from Web of Science, corroborated the findings that big data analytics, AI, and blockchain were dominant technologies driving digital transformation. The study analyzed 1,674 articles (1,323 from healthcare and 351 from insurance), emphasizing a surge in publications post-2016. Similarly, Pandey & Rarhi (2021), analyzing IEEE and PubMed databases with 666 healthcare documents and 173 insurance-related papers, highlighted blockchain and AI as transformative technologies, concurring with the trend found in the current research.

In contrast, Eletter (2024), analyzing data from 125 articles on blockchain in the insurance sector from Web of Science, revealed a concentration of research in developed countries like China, India, and the USA and mirrored the findings about regional dominance in North America and Asia. Their research highlighted that blockchain technology was still in its early stage in insurance and so scalability and security could be the challenges for this emerging technology.

Finally, Al-Bedwawi et al. (2024) conducted a bibliometric analysis using Scopus and Dimensions to examine InsurTech, noting a rise in research on machine learning and AI for insurance; for instance, fraud detection and claims processing. The growth in publications is reflected in both the bibliometric findings and the surge in scholarly output post-2016. This aligns with the current study, which shows a rise of interest in AI and big data

analytics in insurance business models. Table 9 summarizes a comparison of these non-Scopus studies with the findings in this paper.

Table 9. Comparison of findings from non-Scopus studies and the Bibliometric analysis

Study	Database	Number of Articles Processed	Methodology	Technologies Highlighted	Major Findings
Akhil (2022)	Web of Science (WoS)	1,674 (1,323 healthcare, 351 insurance)	Bibliometric analysis and network visualization	Big data, AI, Blockchain, Mobile technology	Similarities: Confirms the growing role of AI and big data in insurance; blockchain emerges as a key technology. Discrepancies: Focuses on both healthcare and insurance, while the current study is exclusively on insurance.
Pandey & Rarhi (2021)	IEEE, PubMed	666 (healthcare), 173 (insurance)	Bibliometric analysis	Blockchain, AI, Chatbots, Telematics	Similarities: Highlights blockchain and AI as transformative technologies in insurance. Discrepancies: Chatbots and telematics not emphasized in the current study, which focuses more on InsurTech and data-driven technologies.
Eletter (2024)	Web of Science	125 documents	Bibliometric analysis	Blockchain, Insurance technology	Similarities: Reinforces blockchain as a central technology in the insurance sector. Discrepancies: Limited focus on the broad range of technologies covered in the current study (e.g., big data, AI).
Al-Bedwawi et al. (2024)	Scopus, Dimensions	680 InsurTech	Bibliometric analysis	AI, Machine learning, Big data	Similarities: Aligns with the findings on AI, machine learning, and big data in InsurTech. Discrepancies: Focuses on InsurTech specifically, while the current study includes a broader scope of digital technologies in insurance.
Current Paper (Bibliometric analysis)	Scopus	972 articles	Bibliometric analysis, keyword analysis	AI, Blockchain, Big data, InsurTech, Smart contracts	Similarities: Identifies AI, big data, and blockchain as dominant technologies in digital transformation in insurance. Discrepancies: N/A (findings from the current study are compared with previous studies).

Source: Compiled with the authors

This study supports digital transformation frameworks, for example Vial (2019), by highlighting the dual role of technology and organizational design in reshaping insurance through AI and blockchain.

Our findings suggest that future research should integrate human, ethical, and governance aspects alongside technological advancements in digital transformation. To enhance the practical implications of digital transformation for insurers, the strategic adoption of emerging technologies such as AI, blockchain, and big data analytics is essential. For instance, Lemonade, an InsurTech company, implemented AI to automate claims management and personalize insurance products, resulting in improved operational efficiency and customer satisfaction (World Bank Group, 2018). In a similar fashion, Swiss Re Institute implemented blockchain technology to secure data and assist in reducing fraud. Technology therefore demonstrates its potential of transparency in the future insurance industry. As technology becomes mainstream and normalized, successful implementation requires investment in the infrastructure and training programs. Allianz Commercial (2025) struggled with the integration of blockchain, so they worked with startups to develop their employees' digital

competencies. Notably, AXA worked to focus on getting General Data Protection Regulation (GDPR) compliance in order to align its AI plan with an appropriate strategy that adheres to privacy regulations as part of gaining consumer trust. Finally, MetLife has partnered with blockchain startups to improve claims processing with smart contracts, highlighting the importance of flexibility in a business model to meet changing consumer expectations (McKinsey & Company, 2017).

This paper contributes to the above practical aspects by providing a full review of technological trends and operation that insurers have to deal with in digitalization, so as to provide methodologies for mitigating these changes. In addition, recent regulatory momentum, including the GDPR, the AI Act, and insurance sandbox initiatives, has formed the core of research for future direction of digitalization in the insurance industry. The GDPR imposes rigorous data privacy obligations, which have become critical given the amount of AI and big data that insurers start using for their underwriting and claims automation processes (European Commission, 2016). The current research highlights the increasing importance of data protection, privacy, and transparency for AI systems, and signals a significant priority for insurers, namely, to comply with the GDPR and build trust with clients, along with establishing a regulatory framework.

The AI Act presents a wide-ranging regulation regime for high-risk AI systems, including systems used in the insurance industry, to ensure ethical use, transparency, and accountability of AI technologies in decision-making processes regarding areas like pricing and claims (European Commission, 2021). This regulatory development aligns with our findings of increasing use of AI across the industry, and the emergence of new concerns over fairness and transparency of AI algorithms. Additionally, insurance sandbox projects are controlled environments that enable insurers to test digital innovation while ensuring that technologies, like blockchain and InsurTech, adhere to regulatory requirements before the implementation of the technology at scale (Financial Conduct Authority, 2022). This study shows the importance of sandbox projects to allow safe experimentation and assist insurers in navigating complex regulations.

While artificial intelligence (AI) and blockchain have attracted attention to their potential for enhancing the efficiency of insurance, the broader societal and economic impacts they might have, particularly in regions that are underserved, receive less attention. Research shows that much of the work taking place in developed countries like the United States, China, and India creates an evident and growing digital gap and potentially weakens emerging economies. While AI use for underwriting and claims processing may lead to reduced costs, it may lead to job losses in markets lacking adequate digital training infrastructures. It could also threaten job opportunities in areas like data administration and data governance even though sufficient investment is made to upskill the workforce. While the blockchain is associated with transparency and consumer trust, particularly in cases of fraud and automation of claims payment, the evolution and increasing reliance on AI for decision-making raise important questions about fairness and accountability to be addressed in the literature. If unregulated, these technologies may reinforce inequities and diminish trust in digital insurance products. Consequently, a call for research is warranted to consider diversity in geography, labor market impact, and ethical governance of these technologies, in order to enhance distribution of value in AI and blockchain and to ensure the equity and transparency of digital transformation in insurance.

The study establishes itself as a significant strength by analyzing digital transformation in the insurance sector through a comprehensive and wide-scale bibliometric investigation. This study used RStudio software environment for statistical computing and graphics, and Bibliometrix of R to process 972 articles published during the past decade. It establishes a solid foundation for identifying trends, mapping intellectual structure, and revealing important thematic areas in the fast-changing field. The study integrates bibliometric performance metrics with social mapping approaches to provide a thorough analysis of research patterns and valuable insights into the growth of literature concerning digital transformation. The research helps enrich existing academic knowledge by responding to unaddressed issues about interdisciplinarity in digital transformation through the integration of technological, organizational, and governance perspectives. The study presents a remarkable capability to detect emerging research areas and establishes itself as a vital reference for future investigations about digital transformation within insurance operations.

This bibliometric research advances knowledge about digital transformation in the insurance field through its analysis of technological aspects, organizational features, and regulatory factors. The study traces trends, sources, and emergent themes that direct future research while responding to demands for an integrated framework to promote technological progress with ethical considerations. The study provides ready academic knowledge and practical guidance to industry professionals and policymakers who tackle the development of insurance industry amid digital disruption nowadays.

5. Conclusions

This research analyzed the digital transformation in the operation of insurance businesses through a bibliometric study, which explored key industrial changes and trends between 2015 and 2024. The study created a research map to identify key sources and authors while examining global partnerships in InsurTech and AI as well as

machine learning and blockchain to enhance the operation of the insurance industry. The study used publication trend analysis together with thematic area evaluation to offer strategic guidance for upcoming research and policy development towards digital transformation.

The insurance industry has experienced an extended duration of enhanced understanding about digital transformation since 2020. The research field of digital transformation receives major publication volume and impact from three countries, including the United States, China, and India. The three leading journals *IEEE Access* along with *The Journal of Big Data* and *Sustainability (Switzerland)* demonstrate a strong influence on technological innovation and insurance applications within the sector. Collaboration among countries, particularly between Brazil, Russia, India, China, South Africa (BRICS) nations and European counterparts, has been evident, with approximately 25.82% of publications featuring international co-authorship. The research field has evolved from a focus on technological tools to an increasing emphasis on the integration of these tools into business models and the broader strategic landscape of insurance companies.

This study adds to the academic literature by providing a comprehensive bibliometric analysis of the field. The findings underscore the importance of advancing digital technologies such as AI, blockchain, and InsurTech, to advocate substantial changes in the operation and service delivery of insurance companies. The research highlights the imperative for continuous investment in digital infrastructure and encourages further global collaboration to foster innovation and improve operational efficiencies. For policymakers and industry leaders, the study offers practical insights into the area for concerted efforts, be it in strengthening regulatory frameworks, facilitating industry partnerships, or supporting technological adoption across different markets. The analysis of global collaboration patterns reveals that a more inclusive and multi-national approach could deal with challenges that extend beyond regional boundaries, such as cybersecurity, data privacy, and regulatory harmonization.

However, this study is not without limitations. While the Scopus database provides a robust source of high-quality, peer-reviewed publications, it does not include research from non-indexed journals or regional repositories. This may exclude valuable insights from emerging or niche markets. The bibliometric analysis, though powerful for mapping trends and identifying research hotspots, could capture neither the practical and real-world impact of digital transformation initiatives nor the socio-economic effects of these technological shifts. Future studies could benefit from qualitative research, such as expert interviews, focus groups and case studies, to complement the quantitative findings and unravel the practical challenges, organizational barriers and successes in adopting new technologies. By combining quantitative bibliometric analysis with qualitative insights, future research could provide a full picture of the dynamics and impact of digital transformation in the insurance sector. This study addresses the following research questions:

Q1: What are the prevailing trends in scientific research on digital transformation in the insurance industry? The study highlights a significant rise in publications on AI, blockchain, and InsurTech, especially post-2020.

Q2: Who are the leading authors, institutions, and countries contributing to this field? The United States, China, and India dominate the research, with major contributions from journals like *IEEE Access* and *The Journal of Big Data*.

Q3: What are the most cited papers and what themes do they explore? Key themes include AI-driven underwriting, blockchain for claims automation, and regulatory issues surrounding data privacy.

Q4: How are keywords associated with digital transformation and insurance companies clustered, and what insights do these clusters offer about emerging research trends? Keywords cluster around AI, blockchain, and data privacy, highlighting emerging themes in the digital shift of the industry.

Future research should aim to explore the broader policy implications for the insurance sector, particularly focusing on the challenges and opportunities emerged from digital transformation in developing economies. Additionally, environmental impact assessments and the integration of economic modeling and life cycle analysis would provide a thorough understanding of digital transformation initiatives in the insurance industry and their sustainability in the long run.

Scholars should critically examine the rationale behind the limited international collaboration and explore strategies to foster more inclusive and cross-disciplinary partnerships. In particular, there is an opportunity to bridge gaps between developed and emerging markets, where the adoption of InsurTech and digital transformation may follow different trajectories. Such an approach could provide a more nuanced understanding of the global dynamics in digital transformation and encourage a unified perspective on these technological advancements.

Further studies should delve into specific insurance sub-sectors, such as health, life, and auto insurance, to understand the impact of digital technologies on their business models and operational structures. Research on the regulatory, governance, and ethical implications of adopting AI and blockchain in insurance is also crucial in face of the maturity and pervasiveness of these technologies. Examining the role of leadership and organizational culture in facilitating digital transformation would help clarify the human factors that play a significant role in achieving technology integration.

In addition to the technological advancement identified in this study, organizational barriers, such as legacy systems, workforce resistance, and scarcity of digital skills, should be overcome to ensure successful implementation of digital transformation. Legacy systems often create major obstacles and require extensive

investment and time to modernize and replace outdated infrastructure, hence hindering the integration of AI and blockchain technologies. Moreover, workforce resistance stems from cultural challenges and skills shortages when employees hesitate to embrace new technologies due to unfamiliarity or fears of job displacement. To tackle this difficulty, insurers should prioritize investments in upskilling programs and foster a culture that embraces innovation and change management strategies. Further, the risk-averse mindset prevalent in the insurance industry complicates the use of emerging technologies like Generative AI. This resistance is inextricably intertwined with concerns about regulatory ambiguity and reputational risks associated with new technologies. Insurers should focus on strategic investments that bridge these gaps, i.e., to ensure employees are not only equipped with the technical knowledge but also be psychologically prepared to navigate the organizational change towards effective digital solutions. Overcoming these barriers would enable insurers to fully leverage AI and blockchain for improving efficiency and customer satisfaction, as well as maintaining sustainable growth in a foreseeable tech-driven market.

Author Contributions

Conceptualization, B.W. and S.D.; methodology, S.D.; software, B.W.; validation, S.D.; formal analysis, B.W.; resources, S.D.; writing—original draft preparation, B.W.; writing—review and editing, S.D.; visualization, B.W.; supervision, S.D.; All authors have read and agreed to the published version of the manuscript.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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