Redefining insurance through technology: Achievements and perspectives in Insurtech

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A B S T R A C T

The digital revolution has been shaking up the financial sector for some time now. This is also happening in the insurance industry, which has remained unchanged for a long time. Insurtech is a phenomenon that uses new technologies to revolutionize the traditional insurance business, and it deserves to be explored in depth to understand its risks and potential. This study examines the academic literature on Insurtech through a bibliometric analysis and a systematic review, which allowed us to identify the main contributors to the topic, the main research clusters and future research directions. The results show a growing trend in scientific production on Insurtech and a strong focus on the implications of artificial intelligence and blockchain on the insurance sector. Furthermore, the analysis highlighted a strong collaboration between information technology and economics disciplines and the need for an interdisciplinary approach to understand the Insurtech phenomenon fully.

1. Introduction

The digital revolution and the advent of new technologies such as machine learning (ML) and big data have been shaking up the traditional financial industry for some time now. In recent years, the rise of Fintech, characterized by the integration of technology into financial services, has resulted not only in increased process automation but also in a significant restructuring of the financial services value chain. This transformation has given rise to new participants and innovative business models (Puschmann, 2017; Liu et al., 2020). So far, the main technological developments in the financial sector have concerned lending and financial advising, digital payment solutions, i.e. purely banking services revolutionized by Fintech companies operating with lower costs (Vives, 2017). The entry into the intermediation market of these new players has led banks to adopt a proactive behavior, leading to numerous Bank-Fintech partnerships (Temelkov, 2018). In recent times, this digitalization process has also involved the insurance sector. This sector has seen little change in the last 300 years due to its heavily regulated nature and the high profitability of incumbents (Yan et al., 2018). However, the entry into the market of tech giants such as Amazon and Google, with their vast data resources (Egfjord and Sund, 2020), and of tech startups, has cornered the insurance industry, creating new opportunities of change in the old insurance Business (Seekings, 2017; Cortis et al., 2019).

The application of technology to the traditional insurance business takes the name of *Insurtech*, a new term born from the merger of *Insurance* and *Technology*. Initially, this term indicated a simple data analysis process; however, disruptive technologies have

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revolutionized its meaning and broadened its purposes (Cao et al., 2020). Today, the Insurtech phenomenon is conceptualized as the use of technology, by traditional and non-traditional market players to provide data-driven and customer-oriented solutions, improve the marketing and distribution of insurance products, improve underwriting stages and risk management and innovate traditional insurance business models (Xu and Zweifel, 2020). Information technology helps reduce costs, improve efficiencies, and provide customers with personalized, more value-added, convenient, and easier-to-use services (Palmié et al., 2020).

Although Insurtech is often presented as "the branch of Fintech dedicated to the insurance sector" (Gómez and Pineda, 2023), in recent years, there has been a progressive detachment in which Insurtech is increasingly assuming its autonomous value (Cao et al., 2020).

Today, Insurtech aims to use artificial intelligence (AI), big data, blockchain and the Internet of Things (IoT) to improve the insurance ecosystem and overcome the sector's weaknesses (Gupta et al., 2022; Patel et al., 2022). This is done by introducing changes in the development of insurance products, and improving efficiency and savings (Cortis et al., 2019; Cao et al., 2020).

Insurtech also offers individual, tailored and personalized solutions to life's risks using data analytics, sensors, wearables and cell phone data (Yan et al., 2018). Wearable devices (e.g., Apple watch) allow health insurers and life insurance companies to obtain a series of biometric information on physical activity, cardiovascular measures, sleep quality data, and tobetter understand the actual risks associated with the insured. In the case of car insurance, telematics allows the real-time transmission of a large amount of information, enabling the insurer to estimate the probability of claims more precisely, avoiding making approximations that lead low-risk individuals to leave the insured pool. This occurs through technological devices that transmit real-time information on driving style, mileage, speed and so on (Barbara et al., 2017). Furthermore, new technologies allow insurers to implement pay-as-you-drive or pay-how-you-drive auto insurance and dynamic underwriting (Alfiero et al., 2022), which will enable the replacement of an annual or one-time premium payment with continuous adaptive pricing systems (Cortis et al., 2019).

The advent of big data and technology can help the traditional insurance business mediate its two most critical challenges: moral hazard and adverse selection (Liu et al., 2020). Furthermore, policyholders have the possibility of obtaining rates that are more suited to their needs and more personalized, thus freeing themselves from some disadvantages that traditional risk pooling entails: policyholders previously trapped in pools have the possibility of freeing themselves from their characteristics such as age and demonstrate their value as capable, low-risk drivers (Cortis et al., 2019). Another important consideration concerns the possible impact of Insurtech on sustainability. Insurtech's digital solutions promote energy efficiency and carbon reduction in the insurance industry. Insurtech can encourage sustainability by designing specific insurance products that cover risks related to environmental or social phenomena. Furthermore, technology applied to the financial sector is recognized as a factor capable of promoting the sustainable development goals of the United Nations, promoting the process of financial inclusion and guaranteeing greater social equity (Cosma and Rimo, 2023).

In 2017, the Insurtech sector received funding totalling $2.3 billion. These investments have been concentrated mainly in the United States, while it is even less developed in Europe and China, where however some expanding startups have made a public listing (Cao et al., 2020). In 2018, the global turnover of the Insurtech market was $532.7 million, attracting investments from numerous private equity firms and major global players such as Google Ventures, Amazon, Softbank and Salesforce (Thakor, 2020). However, global investment in Insurtech has seen mixed trends in recent years. Indeed, after recording growth in investments from 2017 to 2020, global investments in insurance technology have seen a sharp reduction in the last two years, which could reflect a decline in investor attention in light of the post-IPO performance that several Insurtech startups have experimented in recent years (KPMG, 2022).

The Insurtech phenomenon is relatively new, and innovation has always generated uncertainty, especially when applied to the insurance sector, which has had few shocking changes in its history. Furthermore, its recent development has not allowed for great in-depth studies in the literature. Although studies that explain its characteristics, evolution and impact are available, analytical works that elaborate on its potential and deepen its associated risks are scarce (Paul and Sadath, 2021). According to Herrmann and Masawi (2022), the academic literature significantly lacks sufficient representation of the insurance sector, and as highlighted by Zarifis and Cheng (2022), it is good that Insurtech receives more attention and carves out its research segment, exactly as it happened with Fintech. All these considerations make the topic worthy of further study.

In light of this, bibliometric analysis has been conducted, which allows us to understand how research on the Insurtech phenomenon is developing. In particular, we want to analyze how new technologies are revolutionizing the insurance world and if traditional insurance companies are trying to interact with new technological solutions to keep up with the times.

The bibliometric methodology uses bibliographic data to evaluate, through quantitative techniques, the scientific production in a given research area, identify trends, identify the main contributors, and build a future research agenda. With our analysis, we intend to answer the following research questions:

RQ1: How is scientific research on Insurtech developing?
RQ2: What are the most important studies on the topic?
RQ3: Who are the main contributors?
RQ4: What are the main research trends on the topic?
RQ5: What are the possible future developments?

Our results suggest how Insurtech research can be strengthened along different perspectives, managerial, regulatory and technical, and we show how researchers can benefit from a multidisciplinary approach. Finally, our review helps scholars better understand what we currently know about Insurtech and the interrelationships between the various components, recognizing existing gaps in the research and identifying potential approaches to address the most pressing gaps.

The article is structured as follows. Section 2 presents a description of the sample analyzed and the methodology used. Section 3 is dedicated to performance analysis to identify the main contributors and the most relevant studies. Section 4 is dedicated to the network

analysis instrumental in identifying knowledge clusters within the main topic. Section 5 discusses the thematic clusters through a systematic literature review. Section 6 evaluates research trends and future directions. Finally, the last section is dedicated to the conclusions.

2. Methodology

To analyze the scientific literature on Insurtech, we used the bibliometric methodology, in accordance with the most current research trends (Migliavacca et al., 2023; Sureka et al., 2022; Kumar et al., 2021). This methodology does not suffer from the biases related to the sample selection process that traditional systematic reviews suffer from, allows for the use of a quantitative and qualitative approach at the same time (Fernandes et al., 2022), allows for the identification of clusters of knowledge in a specific research area and, lastly, it allows researchers to have an overview of an entire field of study (Mukherjee et al., 2022). The various steps conducted in the analysis are summarized in Fig. 1.

The bibliographic data used to carry out the review on the Insurtech phenomenon were extracted from the Scopus database (Pana, 2022; Cosma et al., 2023), since it is one of the most used databases in financial research (Goodell et al., 2021). The research concerned all scientific studies that contained a reference to Insurtech or the application of Fintech to the insurance branch. This choice derives from the fact that Insurtech represents the application of Fintech to the insurance sector, which has only assumed its own independence in recent years (Gómez and Pineda, 2023; Cao et al., 2020; Thakor, 2020). To achieve this goal, the terms used in the search string were "insurtech" OR "insurance technology" OR "insurance technologies" OR "fintech and insurance" OR "financial technology and insurance" OR "financial technologies and insurance." These terms were searched in the studies' title, abstract, or keywords.

The initial research phase yielded a sample of 304 studies. Therefore, a screening was carried out, which led to the inclusion of only the studies published in English, and the exclusion of the studies published in 2023, as they still need more citations for their authenticity (Khan, 2022). This phase produced a sample of 287 documents. An exclusion of articles inconsistent with our research objectives based on their abstract was carried out, as they were not focused on Fintech or the insurance sector. This phase led to the exclusion of 96 studies. The last phase involved the integral reading of the individual studies and excluding those not aligned with the research objective. After this last phase, the final sample consisted of 156 studies published from 2016 to 2022 out of 113 sources, including academic journals, books, and conference proceedings. Using bibliographic data relating to scientific dissemination gives a complete picture of scientific production in a given discipline (Butler and Visser, 2006; Glänzel et al., 2006; Godin, 1998).

Bibliographic data were analyzed using the VosViewer software (van Eck and Waltman, 2010) and the Bibliometrix R package (Aria and Cuccurullo, 2017). These tools were used to conduct performance analysis of scholars in Insurtech research and content analysis. Performance analysis uses the number of publications and citations as the basic unit of analysis (Migliavacca et al., 2023). Analyzing these two proxies of scientific productivity and research influence allows us to understand the volume and impact of research in a given scientific field. In particular, the performance analysis conducted with Bibliometrix allowed us to answer the first three research questions (RQ1, RQ2, RQ3), identifying the main contributors to the topic (sources, authors, countries and organizations), the most relevant studies and the publication and citation trends (Chiaramonte et al., 2022; Goodell et al., 2023). On the other hand, content analysis allows you to examine the content of the scientific studies being reviewed and to qualitatively systematize knowledge in a
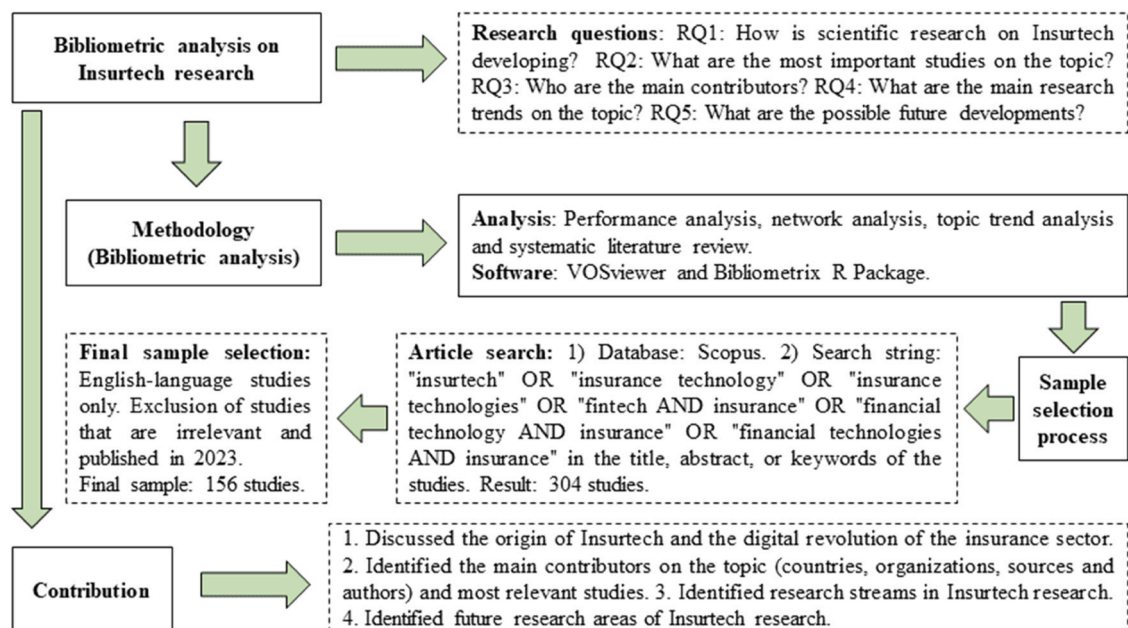

Fig. 1. Methodology flowchart (Adapted from Bajwa et al., 2022).

specific scientific field (Potter and Levine-Donnerstein, 1999). In particular, the network analysis identified the relationships between the studies present in the sample through the author's keywords and allowed us to answer the fourth research question (RQ4), through the identification of the main research streams in Insurtech research.(Callon et al., 1983; Donthu et al., 2021; Galletta et al., 2022). A systematic review of the articles then allowed us to delve deeper into the content of each research stream that emerged from the network analysis. After that, to identify the development trends in Insurtech research, a topic trend analysis was carried out on the author's keywords (Boubaker et al., 2022). Finally, through content analysis of the studies in the sample (Bahoo et al., 2020), we constructed a future research agenda composed of possible research developments attributable to the scientific areas of business management, marketing, IT and regulatory structure. This allowed us to answer the final research question (RQ5).

3. Performance analysis

3.1. Publication pattern and most cited studies

Fig. 2 describes the composition of the sample under analysis. Most of the studies analyzed consisted of scientific articles (69 out of 156). The sample in question also sees a large presence of conference proceedings (46). According to some studies, for emerging disciplines, conference proceedings assume even greater importance than articles in the process of knowledge transmission (Butler, 2008; Visser and Moed, 2005). The third type of document most present in the sample is the book chapter (29). Other forms of scientific dissemination, such as books, reviews and editorial material, are residual.

Fig. 3 highlights the recent development of the literature on technology applied to the insurance sector and on the Insurtech concept. The first study on the subject belongs to 2016, when the article entitled "Fintech and Insurance: Against the odds" was published in The Economist. The article highlighted how, until 2016, many investors had poured billions of dollars into Fintech startups specializing in payments, loans and brokerage but not in the insurance field. This was mainly due to two obstacles:

1. Regulation: Health insurance, especially American health insurance, is heavily regulated, requiring insurers to get numerous state approvals before offering policies. Overcoming the regulatory obstacle, therefore, is costly and time-consuming.
2. Capital: Fintech companies usually receive funding from venture capitalists to cover operating expenses, such as salaries, information systems, and employee benefits. However, these loans are not intended to support a large balance sheet, which may be required to provide insurance services. Many fintech companies avoid holding risky assets for an extended period of time. Instead, they act as intermediaries between different parties, such as lenders and borrowers, investors and investments, or between sender and recipient of money. However, this model is not as suitable for providing insurance services. Unless a fintech firm focuses solely on being an intermediary or broker, it will take on some risks and need to meet the capital requirements required to bear those risks.

Adding to these hurdles is the fact that customers will not buy insurance policies unless they are confident that the issuing company will be able to honor claims when they file a claim. However, a startup, by its nature of being a fledgling, does not have an established reputation that could help bolster customer confidence in the firm's ability to handle claims.

Despite these obstacles, the article in The Economist highlighted the presence of some startups offering innovative solutions, such as insurance on peer-to-peer platforms or pay-per-use insurance.[1] After 2016, the topic developed rapidly and attracted the attention of several academics, recording an increasing publication trend.

Table 1 lists the most cited studies within the sample. Citation counting is a commonly used method to measure the impact of research in the scientific community and facilitates the recognition of influential documents within a specific area (Ding and Cronin, 2011). From this analysis, it appears that the most cited article on the subject is that of Thakor (2020), entitled "Fintech and banking: what do we know?". This study represents a review of the literature on the various innovations of the Fintech phenomenon, in which the recent development of the Insurtech phenomenon is highlighted. The second most cited article is that of Gatteschi et al. (2018), "To Blockchain or Not to Blockchain: That Is the Question", in which the advantages and disadvantages of blockchain technology are analyzed using the insurance sector as a case study. The third most cited article is that of Gimpel et al. (2018), "Understanding Fintech start-ups – a taxonomy of consumer-oriented service offerings". The article classifies 227 Fintech startups and then proposes a taxonomy of their non-functional characteristics that abstracts from the specific function of Fintech startups for consumers and focuses on interaction, data and monetization perspectives. The top 5 of the most cited articles also include that of Raikwar et al. (2018) and Stoekli et al. (2018). In the first, "A Blockchain Framework for Insurance Processes", an efficient approach based on blockchain technology is designed to process insurance-related transactions. The second inductively builds an Insurtech innovation model using the grounded theory method.

3.2. Most influential countries and organizations

Table 2 displays the leading 10 countries with the highest count of published studies. The country with the highest number of citations is India, with 16 documents, followed by the United Kingdom (15) and China (13). However, the most cited countries are the United States, with 323 citations, and Italy, with 240 citations. Then follow India (170) and Germany (145). These results are in line

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[1] https://www.economist.com/finance-and-economics/2016/01/28/against-the-odds
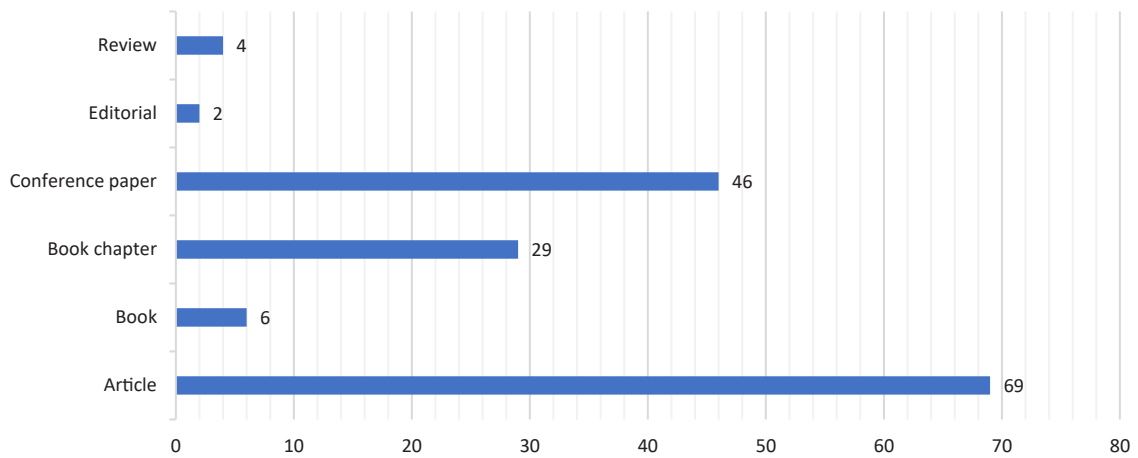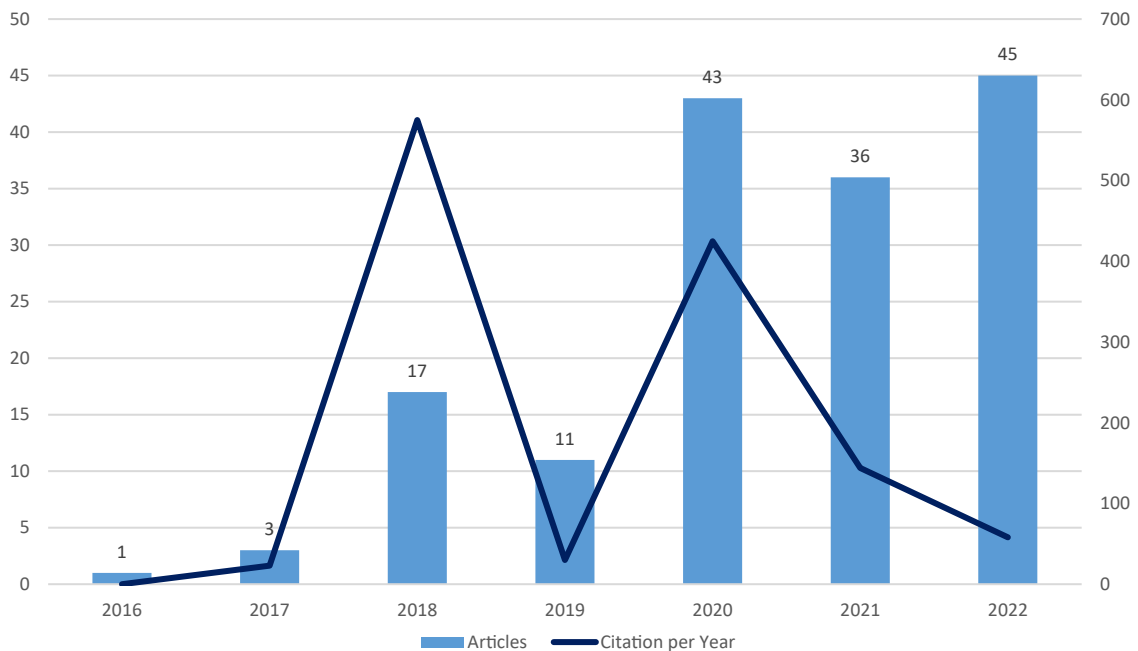
Fig. 2. Sample composition.

Fig. 3. Publication and citation pattern.

with studies that designate many of these countries as the best places where Fintech innovations find the most space. Indeed, the United States is characterized by a robust Fintech ecosystem, and the United Kingdom is considered one of the best hubs for tech startups.[2] India is characterized by a highly diversified economy and a steadily growing Fintech market, with more than two thousand Fintech startups as of early 2023.[3] Finally, the development of Fintech startups in China is driven by a favorable regulatory system, which supports technology companies and is increasingly favoring the development of Internet finance (McKinsey and Company, 2016). Italy and Germany play a key role in the ranking, in terms of number of publications and citations. At a European level, Germany was the second country in terms of Fintech transaction volume in 2018 (PWC, 2019). Italy, despite having lower volumes, is characterized by a very vast Fintech ecosystem, characterized by startups active in numerous fields, such as lending, money management, trading, Insurtech and Regtech (Izzo et al., 2022).

Table 3 shows the organizations that have contributed the most to the Insurtech literature. The institution with the most papers is the Birla Institute of Technology & Science of Dubai, which has contributed three papers to the literature and accumulated only six

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Table 1

Most cited studies.

Title	Authors	Source	Year	TC
Fintech and banking: What do we know?	Thakor, AV	Journal of Financial Intermediation	2020	211
To Blockchain or Not to Blockchain: That Is the Question	Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C., Santamaria, V.	IT Professional	2018	148
Understanding Fintech start-ups – a taxonomy of consumer-oriented service offerings	Gimpel, H., Rau, D., Röglinger, M.	Electronic markets	2018	115
A Blockchain Framework for Insurance Processes	Raikwar, M., Mazumdar, S., Ruj, S., Sen Gupta, S., Chattopadhyay, A., Lam, K.-Y.	2018 9th IFIP International Conference on New Technologies, Mobility and Security, NTMS 2018 – Proceedings. 2018-January, pp. 1–4	2018	82
Exploring characteristics and transformational capabilities of Insurtech innovations to understand insurance value creation in a digital world	Stoeckli, E., Dremel, C., Uebernickel, F.	Electronic markets	2018	62
Application of machine learning and data visualization techniques for decision support in the insurance sector	Rawat, S., Rawat, A., Kumar, D., Sabitha, AS	International Journal of Information Management Data Insights	2021	37
Technology and the insurance industry: Re-configuring the competitive landscape (Book)	Cappiello, A.	Technology and the Insurance Industry: Re-configuring the Competitive Landscape pp. 1–119	2018	25
Insurtech and Fintech: Banking and Insurance Enablement (Book Chapter)	Yan, TC, Schulte, P., Lee Kuo Chuen, D.	Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1: Cryptocurrency, Fintech, Insurtech, and Regulation pp. 249–281	2018	25
Big data platform architecture under the background of financial technology—in the insurance industry as an example	Liu, Y., Peng, J., Yu, Z.	ACM International Conference Proceeding Series. pp. 31–35	2018	24
How green Fintech can alleviate the impact of climate change—The case of Switzerland	Puschmann, T., Hoffmann, CH, Khmarskyi, V.	Sustainability (Switzerland)	2020	23
VaR and market value of Fintech companies: an analysis and evidence from global data	Najaf, K., Schinckus, C., Liew, CY	Managerial Finance	2020	23
Reimagining health data exchange: An application programming interface-enabled roadmap for India	Balsari, S., Fortenko, A., Blaya, JA, Gropper, A., Jayaram, M., Matthan, R., Sahasranam, R., Shankar, M., Sarbadhikari, S., Bierer, B., Mandl, K., Mehendale, S., Khanna, T.	Journal of Medical Internet Research	2018	23
Who, or what, is Insurtech personalizing?: persons, prices and the historical classifications of risk	McFall, L., Moor, L.	Distinction	2018	23
Blockchain and insurance: a review for operations and regulation	Brophy, R.	Journal of Financial Regulation and Compliance	2020	22
From pool to profile: Social consequences of algorithmic prediction in insurance	Cevolini A, Esposito E.	Big Data and Society	2020	20

TC= Total Citations.

Table 2

Most influential countries.

Country	Documents	Citations
India	16	170
United Kingdom	15	75
China	13	84
United States	13	323
Italy	12	240
Russian Federation	11	9
Germany	8	145
Singapore	8	140
Switzerland	7	92
Ukraine	7	31

citations. In contrast, the Olin Business School of Washington University (United States) and the European Corporate Governance Institute (Belgium) obtained 211 citations, with only one paper published on the topic. In second place for number of citations we find the Polytechnic University of Turin (Italy), with 148 citations.

Table 3

Most influential organizations.

Organization	Documents	Citations
Bits Pilani, Dubai Campus, Dubai, United Arab Emirates	3	6
Singapore University of Social Sciences, Singapore	2	38
School Of Management, Polytechnic Of Milan, Milan, Italy	2	8
The University of Malta, Msida, Malta	2	6
Ahlia University, Bahrain	2	4
Amity Business School, Amity University, Greater Noida, India	2	3
Chitkara Business School, Chitkara University, Punjab, India	2	2
College Of Islamic Studies, Hamad Bin Khalifa University, Doha, Qatar	2	1
School Of Accounting And Finance, Asia Pacific University Of Technology And Innovation (Apu), Kuala Lumpur, Malaysia	2	1
ECGI, Belgium	1	211
Olin Business School, Washington University In St. Louis, United States, United States	1	211
Polytechnic University of Turin, Italy	1	148

3.3. Most impactful sources

Table 4 provides the analysis of the most cited and prolific sources in the field of Insurtech. The analysis reveals how books and conference proceedings provide a significant contribution. The most cited source is *the Journal of Financial Intermediation*, whose 211 citations are linked to a single research article, namely Thakor (2020). Other most cited sources include *Electronic Markets*, *IT Professional*, the Proceedings of the *2018 9th Ifip International Conference on new technologies, Mobility And Security* and *the Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1: Cryptocurrency, Fintech, Insurtech, and Regulation*. Among the most productive sources on the subject, we find The Acm International Conference Proceeding Series (7 publications), Aida Europe Research Series On Insurance Law And Regulation (7 publications), Lecture Notes In Networks And Systems (6 publications), Geneva Papers On Risk And Insurance: Issues And Practice (5 publications) and Sustainability (Switzerland) (3 publications). The results demonstrate how the attention to the Insurtech theme comes not only from finance journals but also from IT and electronics journals, thus emphasizing the need for a multidisciplinary approach for a total understanding of the phenomenon.

3.4. Most influential authors

Table 5 presents the most relevant authors in the research field. The recent development of Insurtech has not allowed some authors to specialize in a particular way in this field. The authors with the highest publication count boast only three publications, and they are Venkamaraju Chakravaram, Sunitha Ratnakaram, Nitin Simha Vihari and Gagan Kukreja. The most cited authors are Anjan V. Thakor,

Table 4

Most impactful sources.

Most cited sources		Most prolific sources	
Source	TC	Source	TP
Journal of Financial Intermediation	211	Acm International Conference Proceeding Series	7
Electronic markets	177	Aida Europe Research Series on Insurance Law and Regulation	7
IT Professional	148	Lecture Notes in Networks and Systems	6
2018 9th Ifip International Conference on New Technologies, Mobility and Security, Ntms 2018 - Proceedings	82	Geneva papers on risk and insurance: issues and practice	5
Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1: Cryptocurrency, Fintech, Insurtech, and Regulation	38	Sustainability (Switzerland)	3
Sustainability (Switzerland)	37	Risks	3
International Journal of Information Management Data Insights	37	Innovative Strategies for Implementing Fintech in Banking	3
Big Data and Society	31	Fintech, Digital Currency and the Future of Islamic Finance: Strategic, Regulatory and Adoption Issues in the Gulf Cooperation Council	3
Acm International Conference Proceeding Series	26	electronic markets	2
Technology and the Insurance Industry: Re-Configuring the Competitive Landscape	25	Handbook ff Blockchain, Digital Finance, and Inclusion, Volume 1: Cryptocurrency, Fintech, Insurtech, and Regulation	2
Geneva papers on risk and insurance: issues and practice	23	Big Data and Society	2
Distinction	23	Insurance Markets and Companies	2
Journal of Medical Internet Research	23	Technological forecasting and social change	2
Managerial Finance	23	Journal of Risk and Financial Management	2
Journal of Financial Regulation and Compliance	22	European Business Law Review	2
Insurance Markets and Companies	20	Investment Management and Financial Innovations	2
Technological forecasting and social change	20	Risk Management and Insurance Review	2
Proceeding - 2018 20th Ieee International Conference on Business Informatics, Cbi 2018	19	Advances in Intelligent Systems and Computing	2
Maastricht Journal of European and Comparative Law	17	Big Data: A Game Changer for Insurance Industry	2

TC= Total Citations. TP= Total Publications.

Valentina Gatteschi, Fabrizio Lamberti, Claudio Demartini, Chiara Pranteda and Víctor Santamaría.

4. Network analysis

VOSViewer 1.6.18 software was used to conduct the network analyzes in the present study (Panetta et al., 2023). Using the VOS mapping technique, this software allows you to map the keywords of documents using co-occurrence data (Van Eck et al., 2010). These maps, therefore, allow the identification of knowledge clusters within a large research field.

4.1. Co-occurrence of keywords

To investigate the structure of the Insurtech literature, the co-occurrence of the authors' keywords was analyzed, making it possible to identify the keywords most often used in the sample articles. In particular, this analysis assumes that there is likely to be a connection between the concepts related to those words (Donthu et al., 2021). The VOSViewer text-mining algorithm creates keyword maps: each keyword is represented by a circle whose size depends on its more or less frequent presence in the authors' keywords of the sample studies. The distance between the keywords represents a proxy of their correlation (Laudano et al., 2018). Finally, different colours are used to cluster keywords.

A first preliminary analysis reveals that the most occurring authors' keywords are: Insurtech (58), Insurance sector (48), Fintech (43), Blockchain (23), Risk management (14), Artificial Intelligence (13), Smart contracts (10) and Big data (10). The co-occurrence analysis of the keywords reveals four clusters of knowledge, summarized in Table 6.

The co-occurrence analysis is graphically represented in Fig. 4, through a *network diagram*. The diagram makes it possible to distinguish four search clusters, each made up of numerous keywords connected by multiple lines, which indicate the words that frequently appear together in the sample documents. The four knowledge clusters can be described as follows:

- First cluster (red): studies analyzing the impact of digitization in the traditional financial sector and proposing solutions based on big data and the Internet of Things (IoT) to revolutionize insurance services.
- Second cluster (green): studies analyzing the application of the two main Fintech innovations, ML and AI, in the insurance sector and in the banking sector, with particular case studies dedicated to life insurance and health insurance.
- Third cluster (blue): studies evaluating the impact of digitization in the insurance sector from the point of view of Risk Management.
- Fourth cluster (yellow): studies evaluating the possible applications of blockchain and smart contracts in the insurance sector.

A *density analysis* was also carried out to better understand how the scientific debate about Insurtech developed (Fig. 5). This type of analysis evaluates the centrality of the topics through a heat map that does not consider interconnections between words and temporal dynamics (Pizzi et al., 2021).

The analysis allows us to highlight how much of the Insurtech debate is still firmly anchored to the main Fintech research line from which Insurtech descends. Although its independence is being established in the literature, in fact, numerous studies still address the Insurtech theme in generic studies that analyze Fintech, Insurtech and Regtech or bring insurance technologies back to the more general Fintech phenomenon (Bittini et al., 2022; Merello et al., 2022, Cao et al., 2021). The heat map highlights the development of an

Table 5
Most cited and most prolific authors.

Most cited authors		Most prolific authors	
Author	TC	Author	TP
Thakor A.V.	211	Chakravaram V.	3
Demartini C.	148	Ratnakaram S.	3
Gatteschi V.	148	Vihari N.S.	3
Lamberti F.	148	Kukreya G.	3
Pranteda C.	148	Lee Kuo Chuen D.	2
Santa Maria V.	148	Marano P.	2
Gimpel H.	115	Hoffmann C.H.	2
Rau D.	115	Mcfall L.	2
Roglinger M.	115	Xu X.	2
Chattopadhyay A.	82	Deipenbrock G.	2
Lam K.Y.	82	Grassi L.	2
Mazumdar S.	82	Lanfranchi D.	2
Raikwar M.	82	Tereszkiewicz P.	2
Ruj S.	82	Meskini F.Z.	2
Sen Gupta S.	82	Gupta R.	2
Dremel C.	62	Arshed N.	2
Stoeckli E.	62	Grima S.	2
Uebernickel F.	62	Saeed M.	2
Lee Kuo Chuen D.	38	Alam N.	2

TC= Total Citations. TP= Total Publications.

Table 6
Analysis of keywords.

Cluster 1 (Red): The impact of digitization on the traditional insurance sector			Clusters 2 (Green): Applications of artificial intelligence and machine learning in insurance			Cluster 3 (Blue): Risk management of digital insurance			Cluster 4 (Yellow): Blockchain and smart contracts in the new insurance scenario		
Keywords	OC	LS	Keywords	OC	LS	Keywords	OC	LS	Keywords	OC	LS
Insurtech	58	177	Fintech	43	139	Risk Management	14	44	Blockchains	23	92
Insurance Sector	48	145	Artificial Intelligence	13	53	Business Models	6	23	Smart Contracts	10	39
Big Data	10	42	Machine Learning	8	38	Insurance Distribution Directive	4	14	Cryptocurrencies	6	27
Technologies	8	38	Banking	6	28	Insurance Distribution	3	14	Smart Insurance	4	15
Digitization	11	29	Financial Services	6	27	Peer-To-Peer Insurance	5	13	Regulation	3	13
Innovation	7	28	Finance	6	23	Digital Insurance	4	12	Bitcoins	2	13
IoT Insurance	5	18	Regtech	4	20	Personalization	2	10	Takaful	3	11
Digital Transformation	4	16	Deep Learning	2	15	Robo-Advisors	2	10	Online Trading	2	10
Digital Technologies	4	14	Financial Engineering	3	12	Car Sharing	2	9	Multi-Agent-Based Modeling	2	9
Covid-19	3	13	Data Science	2	11	Crowdfunding	2	9	Insurance Contracts	2	6
Innovation Framework	2	11	Digital	2	10	Decentralization	2	9	Financial Institutions	2	3
Disruptive Technology	3	10	Intelligent Systems	2	10	Solvency Ii Directive	2	9			
Digital Intermediaries	2	9	Information Technology	4	9	Sharing Economy	2	5			
Ecosystem	2	9	Sustainability	3	8						
Insurance Technologies	4	8	Health Insurance	3	7						
Financial Markets	3	8	Climate Change	2	6						
Competition	2	8	Services	2	5						
Hyper Ledger	2	8	Life Insurance	2	2						
Investment	2	8									
Telematics	3	7									
Claim Analysis	2	7									
Cloud Computing	2	7									
Data Mining	2	7									

OC=Occurrences; LS=Link strength.

intense debate on the managerial implications deriving from applying new technologies to the insurance sector. Finally, another focal issue seems to concern the blockchain application in insurance services: the growth of online insurance smart contracts can reduce stipulation times and fraudulent phenomena.

5. Discussion of thematic clusters

5.1. Insurtech and Fintech: artificial intelligence for the financial sector (Green cluster)

In the last ten years, AI and ML have represented the watchwords of a new revolution that has affected all existing businesses (Rawat et al., 2021). This is especially true for the financial services world, where more and more Fintech and Insurtech startups cooperate or compete with the traditional financial sector. Although these two phenomena are slowly separating, various academics have analyzed them jointly (Najaf et al., 2020; Bittini et al., 2022), especially during the first periods of diffusion, when Insurtech was considered only a branch of Fintech (Thakor, 2020). Gimpel et al., for example, proposed in 2018 (i.e. at the dawn of Insurtech research) a classification of the various Fintech services, including insurance services (Gimpel et al., 2018). Furthermore, the authors proposed a distinction between Fintech, i.e. the application of digital technologies to financial services, and Fintech start-ups, i.e. newly established companies offering financial services based on Fintech. Other authors, however, try to conceptualize the terms Fintech and Insurtech, defining them as "innovations introduced by one or more *traditional* or *non-traditional market operators* that exploit information technology to provide specific solutions for the financial sector" (Stoeckli et al., 2018).

The main common feature of Fintech and Insurtech lies in the proposition of more efficient services in terms of cost and performance (Xu and Zweifel, 2020), more convenient and more personalized but which entails some scepticism about the reliability and reduction of human interaction dictated by the expansion of chatbots and virtual assistants (Zarifis et al., 2021).

Zarifis and Cheng (2022) investigated the factors that mainly influence consumer confidence in Fintech and Insurtech, two sectors revolutionizing the relationship with the consumer, to the detriment of human interaction. Their trust model highlights that general consumer trust in AI strongly determines trust in Fintech and Insurtech. In the last decade, in particular, there has been a growing acceptance of technology by individuals. As underlined by Merello et al.(2022), however, digital users are driven not only by
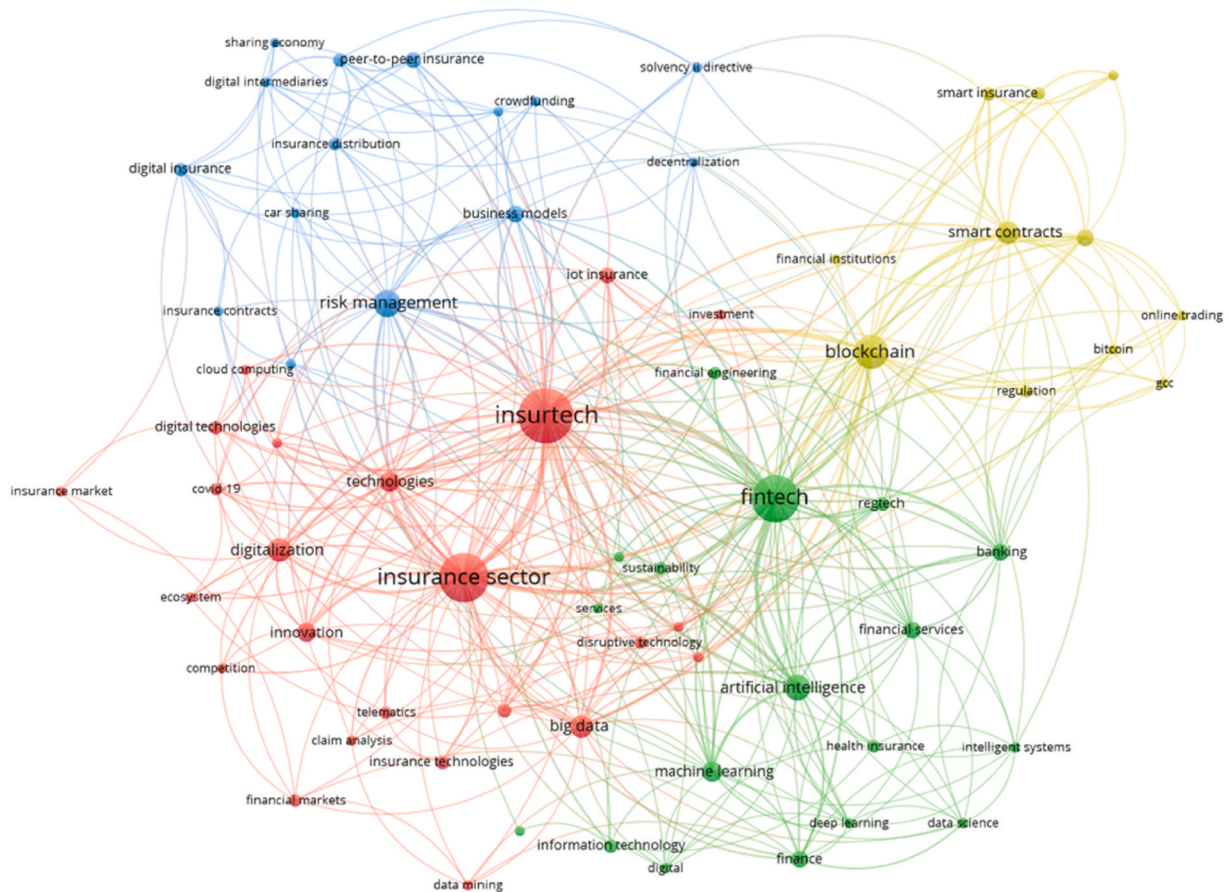
Fig. 4. Network diagram of the co-occurrence of keywords.

utilitarian factors but also by hedonistic factors, including the sustainability factor. Fintech is recognized by the United Nations as an innovation capable of facilitating the achievement of the Sustainable Development Goals, for example by digitizing the payment of wages and promoting financial inclusion (SDG 8) or by encouraging the granting of micro-mortgages for people living in disadvantaged (SDG 11).[4] Merello et al. (2022) have investigated the relationship between Fintech and sustainability, highlighting a positive relationship between market value and disclosure of CSR information by Fintech/Insurtech startups. Bittini et al. (2022) emphasized that the increasing request for Fintech/Insurtech services by other companies, particularly in the realm of business-to-business (B2B) operations, can be linked to the heightened prevalence of sustainability departments within Spanish Fintech/Insurtech firms.

On the other hand, Gupta et al. (2022) investigated the factors that influence the adoption of AI in the insurance sector, distinguishing between environmental, organizational and technological factors. In particular, it was found that the support of top management, greater financial readiness of the firm, market dynamics (understood as the transformation of competitive and complex markets), better regulatory support and stronger competitive pressure positively influence significantly the adoption of AI in the insurance industry (Gupta et al., 2022).

Several academics describe the possible applications of AI in the insurance business. According to Herrmann and Masawi (2022), "AI-based insurance applications are emerging for fraud detection, personalized recommendation of products (incl. cross-selling), underwriting, risk and compliance, cybersecurity, product development, and operational efficiency". AI can help in identifying anomalies and potential fraud in the claims or to propose personalized pricing by exploiting customers' behavioral data. (Mullins et al., 2021). Telematic technologies make it possible to develop pay-as-you-drive solutions to replace periodic premiums in the case of car insurance or on-demand insurance for low-severity risks and with short-term coverage (Standaert and Muylle, 2022). Aitken (2022) presented some prospects for using Fintech applied to microinsurance for managing climate risk, i.e., all those risks associated with natural catastrophes. These experiments use remote sensing 'earth observation' technologies to formulate climate risk indices.

Rawat et al. (2021) described some concrete applications of ML and AI in the insurance sector. Random Forest, Neural Networks (NN) and Probabilistic Neural Networks (PNN) techniques can be used for claim rrediction; Non-parametric ML model can be used for Claim Reserving; Adaptive Neuro-Fuzzy Inference Systems (ANFIS) can be used for Portfolio Insurance Strategy; deep learning models
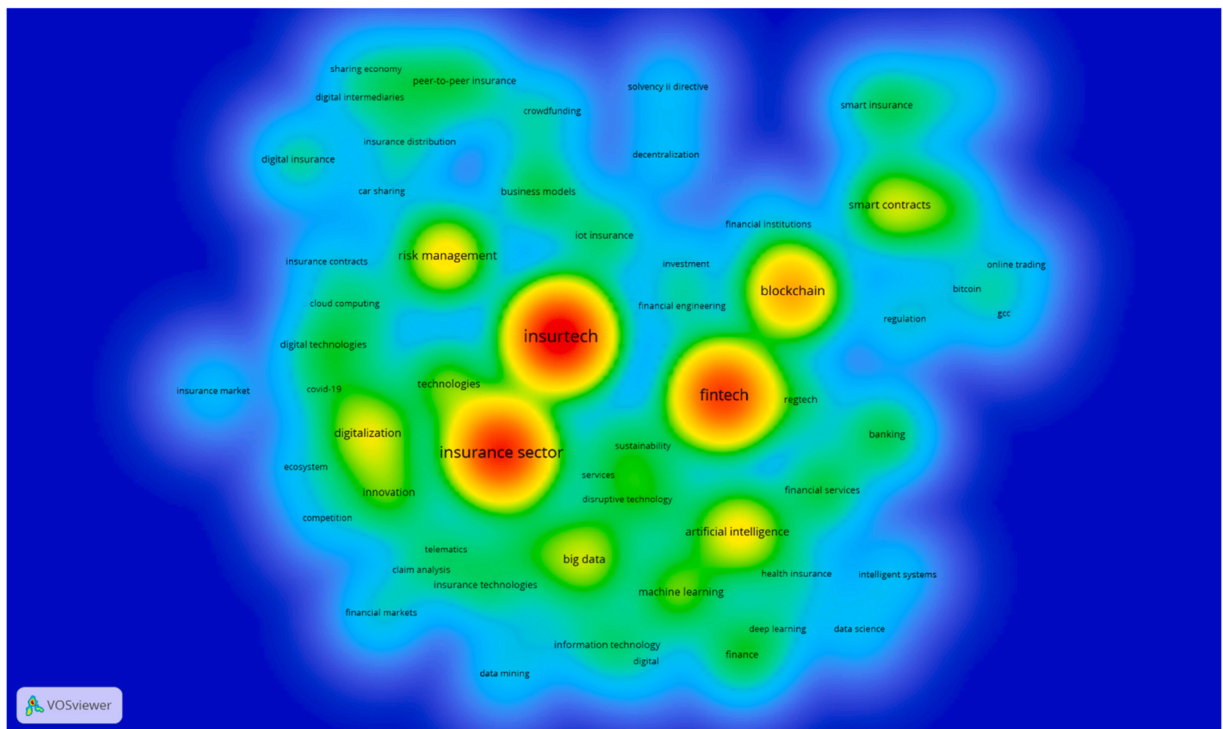

Fig. 5. Density analysis of keywords.

can be used for Auto-Insurance Fraud Detection, etc. (Rawat et al., 2021). The authors also propose supervised ML algorithms to perform complaint analysis in two case studies related to health and travel insurance.

5.2. The impact of digitization in the traditional insurance sector (Red cluster)

In researching Insurtech, various academics have examined, from a sectoral point of view, the consequences deriving from the penetration of new disruptive technologies in the insurance sector. This attention derives from the fact that, as Yan et al. (2018) highlighted, the insurance sector has experienced stagnation for about 300 years, characterized by few innovations and little change. This has frequently resulted in insurance companies being unable to meet market needs, leading to bad user experiences for end customers. However, the development of Insurtech has brought about some upheavals in the insurance sector. According to Cao et al. (2020), Insurtech has affected the insurance market mainly in the distribution channel and market demand. The Internet has revolutionized sales processes, increased competition and reduced the prices of insurance products. At the same time, there has been an increase in demand for increasingly personalized and 'on-demand' products. These new products are now the new focus of the insurance industry (Cao et al., 2020).

The emergence of new digital products and contracts will likely lead to the emergence of new insurable risks, such as those related to small market changes in non-traded or illiquid assets (Thakor, 2020), or risks related to physical health, which become insurable thanks to new medical technologies, wearable devices and the use of big data in health insurance (Lanfranchi and Grassi, 2022).

In this context, historical insurance companies are trying to become digital leaders by revolutionizing their business models; however, the services offered by emerging start-ups that focus on flexibility, customer centricity and simplicity challenge the market resistance of incumbents (Stoeckli et al., 2018). Ostrowska (2021) describes the business models of some innovative Insurtech startups: Lemonade is an insurance-licensed digital insurer offering homeowner and renter insurance powered by AI and behavioral economics; Friendurance and Teambrulla, on the contrary, are peer-to-peer insurance platforms aimed simply at intermediation. The irruption of these companies into the insurance market sometimes leads incumbent operators to establish strategic partnerships with Insurtech startups or participate in incubator programs or ventures to keep up with the times and ensure business continuity (Rawat et al., 2021).

Stoeckli et al. (2018) in their study propose a model to understand the impact of Insurtech on insurance value creation and the structure of the insurance industry. According to the model proposed by the authors, Insurtech innovations impact Digital and Data-Driven Infrastructure Operations, the provision and development of insurance services, and customer attraction/monitoring/selection activities. At the sector level, however, the main impact of Insurtech is determined by the rise of new digital intermediaries (Stoeckli et al., 2018). Lanfranchi and Grassi (2022) examined the innovation initiatives of the most crucial global insurance companies during the COVID period, identifying their underlying motivations, which can be translated into the logic of Adaptation, Expansion, Reaction and Aggression. In particular, insurance companies have innovated to manage their customers more

effectively/efficiently and to address new emerging risks.

Sosa and Montes (2022) investigated how Insurtech is transforming the insurance industry at the level of *Process Innovation*, *Product Innovation* and *Combined Product and Process Innovation*. Indeed, Insurtech innovations make it possible to process data accurately, adapt insurance product offerings, and facilitate the creation of new products and also allow insurance transactions to be conducted in a totally digital environment. These innovations lead to an increase in the sales volumes of policies and the optimization of the results of marketing campaigns (Sosa and Montes, 2022).

5.3. Blockchain and smart contracts in the new insurance scenario (Yellow cluster)

A large body of Insurtech literature focuses on blockchain's implications in the insurance business. This technology was initially conceived to record cryptocurrency transactions immutably; however, additional application scenarios have developed recently (Cao et al., 2021). The blockchain enables the creation of a digital ledger, irrevocable and shared by many peers, and can facilitate the recording of transactions, ensure that data is shared and easily verifiable (Ahmad and Saxena, 2022). Applying blockchain to the insurance industry can be particularly useful when there is a need to reduce operational costs in the value chain, produce a secure and reliable shared record for all stakeholders, or eliminate intermediaries in the value transfer/exchange process (Popovic et al., 2020). Raikwar et al. (2018) have designed a distributed platform with blockchain to support the execution of transactions in insurance processes: the advantages are attributable to the reduction of transaction processing and payment settlement times and greater general security.

Gatteschi et al. (2018) have proposed several possible benefits of applying blockchain to the insurance sector. These advantages are mainly based on the use of smart contracts. Smart contracts are scripts stored on the blockchain that regulate the rights and obligations between two or more parties and are automatically executed when certain conditions are met (Zgraggen, 2019). The automatic execution capability of smart contracts could facilitate the processing of claims and automatically initiate refunds upon certain events (Gatteschi et al., 2018). Brophy (2020) highlighted some cases where blockchain has already been implemented to facilitate some insurance activities: AIG adopted blockchain for policies underwritten internationally; AXA adopted smart contracts for airline flight delay policies. Further applications are related to the used car market: El-Switi and Qatawneh (2021) describe various blockchain-based applications that, through data provided by insurance companies and maintenance shops, help prevent fraud in the used car market.

Such blockchain applications are leading regulators to examine their potential and possible uses and are implementing sandboxes to test their strength, feasibility and rigor (Brophy, 2020).

5.4. Risk management of digital insurance (Blue cluster)

In the context of Insurtech research, several studies investigate the aspect linked to the risks deriving from introducing new digital technologies in insurance companies' operations and the role these technologies can have in better managing typical insurance risks (Wang, 2021). According to Njegomir and Bojanić (2021), the new consumer-centric approach of digital technologies allows insurers to understand the habits better, and therefore the practical risks, of policyholders; big data analytics and digital technologies make it easier to predict, understand, and visualize disasters and manage claims. As a result, digital technologies enable more accurate risk assessments and insurance premium calculations through the processing of extensive sets of Big Data (Njegomir and Bojanic, 2021). Shah et al. (2018) highlighted how technologies applied to the insurance sector can be essential in managing catastrophic risk at the individual, corporate and governmental levels. In agricultural risks, in particular, online insurance against the risks of earthquakes, tropical storms and floods has become widespread.

At the same time, the introduction of new technologies in the insurance sector involves emerging risks that are difficult to manage, such as possible reputational problems deriving from the mismanagement of sensitive data and the malfunctioning of increasingly complex IT systems (Leong and Chen, 2020). Mullins et al., (2021), in describing some applications of ML and big data in the insurance sector, describe the corresponding risks associated with them: the diffusion of robo-advisory and virtual chatbots lead to the exclusion of customers with poor technological knowledge; of automated complaint resolution is subject to algorithmic bias resulting from data used to calibrate AI algorithms; AI fraud detection can be characterized by algorithmic biases capable of making false allegations of fraud (Mullins et al., 2021). The diffusion of on-demand insurance on ever smaller risks and ever shorter durations makes it more difficult for insurers to pool risks, since these risks are constantly changing and getting smaller and smaller (Zeier Röschmann et al., 2022).

The advent of new technologies, therefore, places an obligation on insurers to consider these new risks linked to ethical issues and to provide customers with greater data protection to avoid losses, and regulatory sanctions but above all, to maintain customers' trust. (Njegomir and Bojanic, 2021). Furthermore, the challenges extend to regulators and supervisors, who, while facilitating the insurance sector's adoption of innovations, must carefully weigh the risks related to fairness, non-discrimination, and the repurposing of consumer data for additional commercial benefits (Mullins et al., 2021).

Applying the blockchain to the insurance business also entails some risks described by Popovic et al. (2020) related to high adoption costs, security issues arising from the underlying cryptography and consensus mechanisms, and doubts related to the legal status of smart contracts.

Another issue covered in the literature is risk management in Peer to peer (P2P) decentralized insurance models. In these models, unlike centralized models, the risks do not belong to a single insurer but are distributed among a pool of participants. Each participant is both insurer and insured. P2P insurance models are operated through platforms similar to crowdfunding platforms, which allow

people to pool their resources to compensate each other for losses and reduce the cost of insurance. The business models of these platforms are built on star-tree graphs: the platforms act as a central node where all risks are sorted and redistributed among peers (Abdikerimova and Feng, 2022).

Further risks are connected to new technologies' new commercial distribution mechanisms. These risks can be translated into mis-selling practices, reduction in business quality, policyholder abandonment behavior (Bravo, 2021). To date, traditional distribution, characterized by direct sales through insurance agents, brokers and independent financial advisors, is going through a revolution characterized by more innovative and efficient techniques based on robo-advisory, chatbots, and in-app sales. Disruptive innovation leads to risks such as the deterioration of the reputation of some traditional intermediaries due to uncompetitive services or prices, excessively high commissions compared to web-based services, and the cannibalization of traditional distribution channels by new digital channels (Bravo, 2021).

6. Research trends and future directions

6.1. Topic trend analysis

Following Goodell et al. (2023) and Boubaker et al. (2023), we performed a topic trend analysis to identify thematic progress in Insurtech. Fig. 6 shows the progression of themes. The bubbles represent the median years in which the different keywords were most used, while the lines on which the bubbles are positioned represent the period (in years) of respective keyword usage (Goodell et al., 2023).

The analysis shows that the most common words in the initial period of development of Insurtech literature were "digital finance", "financial technologies", "services", and "bitcoin". This describes a situation in which Insurtech was treated in vague and nuanced contexts without a specific focus on the benefits the technology could guarantee to the traditional insurance business.

Subsequently, from 2019 to 2020, studies focused on specific technology applications to the insurance sector began to spread in the scientific literature. Among the most widespread words in this period, we find "smart contracts", "smart insurance", and "peer-to-peer insurance", words that, for the first time, describe a practical implication of technology in the insurance sector.

It is interesting to note how the word "Insurtech" is used predominantly starting from 2019, together with the words "Fintech" and "digitalization". These words saw widespread use between 2019 and 2022. This reflects that the Insurtech phenomenon has begun to assume its independence and is no longer associated, more generally, with digital finance and other digital phenomena such as Bitcoin. In the same period, studies analyzing the use of the blockchain in insurance services found a strong diffusion.

Finally, between 2021 and 2022, the words "big data", "artificial intelligence" and digital technologies spread, together with "insurance industry", synonymous with the fact that the literature is analyzing how the technologies of the moment can revolutionize the insurance industry.

6.2. Future research directions in a multidisciplinary perspective

The last objective of our analysis consists of constructing a research agenda that can help academics deepen and broaden their knowledge of the Insurtech theme. Reading the studies in the sample made it possible to identify future research directions connected
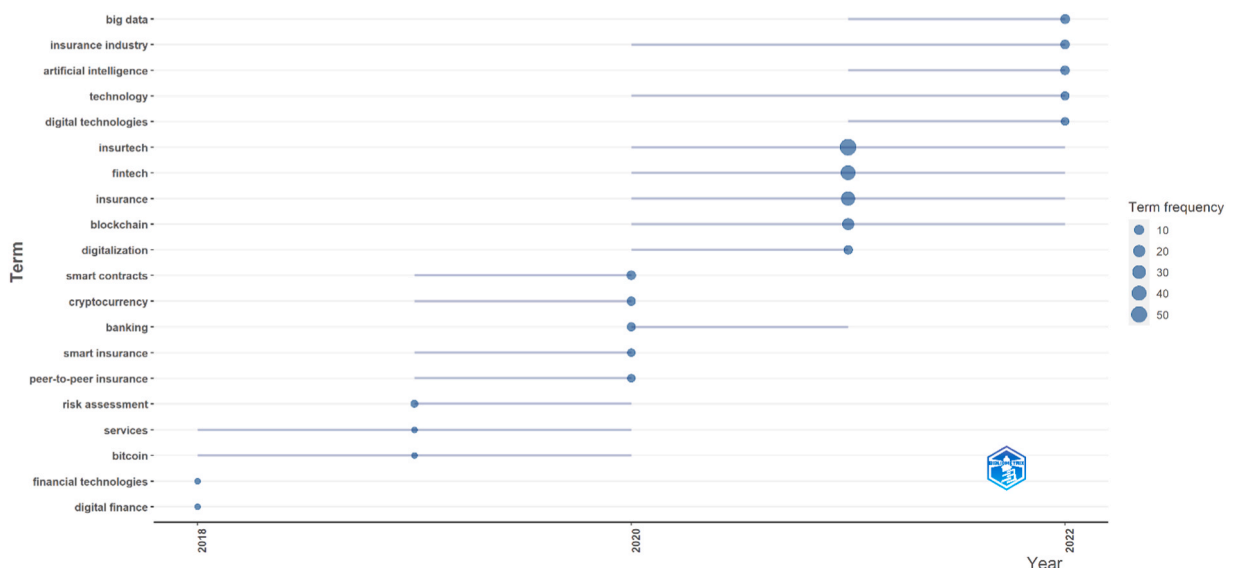

Fig. 6. Topic trend analysis. word minimum frequency=2; Number of words per year=5.

to the various knowledge clusters identified with the bibliometric analysis (Table 7).

The research questions extrapolated from the articles belonging to the four knowledge clusters can be traced back to different scientific areas and addressing them can allow a better understanding of the Insurtech phenomenon from the points of view of business management, marketing, IT and regulatory structure.

From the point of view of business management, future research can investigate the determinants of the success or failure of Insurtech startups and analyze the benefits of Insurtech innovations in terms of financial inclusion. Looking instead at the impact of Insurtech innovations on the traditional insurance sector, future research has the opportunity to investigate the success and failure factors of cooperation between financial institutions and Insurtech startups and to analyse, through case studies, the applicability of the blockchain and smart contracts in the insurance sector. Furthermore, it would be interesting to compare traditional insurance risk management mechanisms and traditional insurance risk sharing of p2p insurance (Abdikerimova and Feng, 2022). Finally, redefining insurance through technology is vital in light of its connection to economic, environmental and social issues. For example, Insurtech's digital solutions promote energy efficiency and carbon reduction in the insurance industry. It can encourage sustainability by designing specific insurance products that cover risks related to environmental or social phenomena. Looking at this phenomenon from the perspective of sustainability, future research can highlight the contribution of Insurtechs to achieving the SDGs and provide a comprehensive assessment of the green Fintech/Insurtech literature (Puschmann et al., 2020).

Marketing-oriented research can make an essential contribution by analyzing the customers' perceived value of insurance technology and evaluating how emerging new technologies enable the active involvement of customers in the creation of new insurance products.

From a regulatory point of view, studies are certainly needed to conduct an in-depth evaluation of smart contracts at a legal level. Furthermore, future research could evaluate the effectiveness of the existing European insurance legislation in promoting innovations in the traditional insurance sector while protecting the rights of policyholders (Ostrowska, 2021), highlighting its limitations and possible improvements.

From a more technical and IT point of view, future research could conduct an in-depth evaluation of the advantages and disadvantages of the various frameworks (Ethereum or Hyperledger) that can be used to implement blockchain solutions and evaluate their efficiency and scalability.

From a transversal reading of the sample studies, the need for an interdisciplinary approach emerged to fully understand the Insurtech phenomenon and its implications for the insurance industry. This suggests that future research should involve experts from different disciplines, including computer science, economics, finance and law, to delve into the phenomenon holistically (Zarifis and Cheng, 2022). Finally, while Insurtech presents significant opportunities for the insurance industry, numerous challenges exist, such as handling sensitive customer data, cyber security and regulatory compliance. Future research should continue to address these challenges and seek innovative solutions.

7. Conclusions

Our study, through a bibliometric and systematic review, made it possible to systematize research on Insurtech, identifying the most important contributors on the subject, the main clusters of knowledge and the trends that have been recorded in scientific research and providing possible future research areas for academics active on the topic.

Although Insurtech research is relatively recent, scientific production experienced significant growth from 2016 to 2022, recording a growing trend. Several studies on the subject have also had a substantial impact on the scientific community, such as the studies by Thakor (2020), Gatteschi et al. (2018), and Gimpel et al. (2018), which emerge by the number of total citations. Similarly, the United States, Italy, India, and Germany are the countries whose research had the strongest impact on the community in terms of citations. Furthermore, the analysis of the sources revealed that the most attentive Journals on the subject are finance (e.g. Journal of Financial Intermediation) and electronics/IT (e.g. Electronic Markets, IT Professional), thus emphasizing the need for a multidisciplinary approach for a total understanding of the phenomenon.

According to the network analysis, Insurtech research is structured into four sub-clusters of knowledge concerning the application of AI in insurance services, the impact of Insurtech on the traditional insurance sector, the use of blockchain and smart contracts in insurance and the risk management of digital insurance. The transversal reading of the studies relating to these clusters has also made it possible to identify future research questions that are useful for interested researchers. Furthermore, the topic trend analysis allows us to say that research on Insurtech is becoming increasingly specialized and focused on frontier issues such as big data, artificial intelligence and digital technologies.

Our review has important practical and theoretical implications. On the theoretical side, the need for Insurtech research to assume its autonomy emerges from this review. Although Insurtech has its definition and certain fields of application, the density analysis shows that insurance technology is still considered a branch of the more generic fintech. From a practical perspective, this review has important implications for policymakers, who are called upon to safely and prudently manage the process of innovation that has the potential to transform an industry, insurance, that has seen little change in the past 300 years. In particular, new technologies pose new challenges related to commercial distribution mechanisms, customer privacy and the legal status of smart contracts, as well as risks of fairness, non-discrimination and how consumer data is recycled for other commercial gains. Addressing these challenges is critical to the effective de-ageing of the insurance industry, and the role of policymakers is crucial. The review presents implications for traditional insurance companies, which may establish partnerships with innovative AI-based startups to facilitate fraud identification and insurance product placement, deal more efficiently with claims handling, or innovate their range of products for sale. At the same time, we also present implications for nascent startups in insurance technology and approaching regulatory and capital hurdles specific

Table 7
Future research directions.

Clusters	Future research areas	Main references
Artificial intelligence in Insurtech	• Differences and similarities between Fintech and Insurtech startups. • Analysis of the determinants of the success of Insurtech startups. • Customer perception of insurance technology in terms of perceived value. • Analysis of how green Insurtech startups can contribute to achieving the SDGs. • Analysis of the relationship between business model and sustainability profile of Fintech/Insurtech startups. • Analysis of the business model of Insurtech startups based on the type of innovation.	Zarifis and Cheng (2022), Rawat et al. (2021), Puschmann et al. (2020), Merello et al., (2022), Sosa and Montes (2022)
The impact of digitization on the traditional insurance sector	• Comparison of performance indicators between insurers who have already embraced digital technologies and traditional insurers. • Evaluation of the benefits for society of innovations introduced by insurance companies. • Evaluation of the persistence of innovations in traditional insurance. • Evaluate how technology enables customer engagement in creating new insurance products. • Analysis of the impact of Insurtech on the insurance value chain. • Success and failure factors of cooperation between Insurtechs and financial institutions.	Njegomir and Bojanić (2021), Lanfranchi and Grassi (2022), Tanninen (2020), Sosa and Montes (2022), Ruhland and Wiese (2022)
Blockchain and smart contracts	• Analysis of case studies related to the application of the blockchain in the insurance sector to study the validity and feasibility of this technology. • More research is required on the scalability and efficiency of Blockchain. • Evaluation of the advantages and disadvantages of the various frameworks that can be used to implement blockchain solutions (e.g. Ethereum vs Hyperledger). • In-depth assessment of the regulatory aspects of smart contracts.	Brophy (2020), Zgraggen (2019)
Risk management of digital insurance	• Comparison between risk management mechanisms of traditional insurance and risk sharing of p2p insurance. • Study how regulators should respond to the rise of Insurtechs.	Abdikerimova and Feng (2022), Ostrowska (2021)

to Insurtech startups for the first time. Insurtech startups that are already established, on the other hand, can understand which customer characteristics favor the penetration of AI- or ML-based services or which factors favor the adoption of insurance technology in the traditional insurance industry.

Clearly, this study has some limitations. A first limitation stems from using Scopus as the database from which to extract articles for analysis, excluding potentially relevant articles indexed in other databases such as Web of Science. Another common limitation of bibliometric studies stems from the choice of the search string, which defines the sample of extracted studies and thus inevitably impacts the review results.

Our analysis shows that Insurtech represents a new frontier for the insurance industry, potentially transforming how insurance services are delivered and managed. However, there are challenges in managing sensitive customer data, IT security and regulatory compliance. Continuous research and innovation in this field can yield significant results and benefits for industry and consumers.

CRediT authorship contribution statement

Simona Cosma: Conceptualization, Supervision, Validation, Writing – original draft. **Giuseppe Rimo:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft.

Declaration of Competing Interest

None.

Data availability

No data was used for the research described in the article.

References

Abdikerimova, S., Feng, R., 2022. Peer-to-peer multi-risk insurance and mutual aid. Eur. J. Oper. Res. 299 (2), 735–749.

Ahmad, S., & Saxena, C. (2022, November). Internet of Things and Blockchain Technologies in the Insurance Sector. In 2022 3rd International Conference on Computing, Analytics and Networks (ICAN) (pp. 1-6). IEEE.

Aitken, R., 2022. Mediating and mapping climate risk: micro-insurance and earth observation. J. Cult. Econ. 15 (4), 468–487.

Alfiero, S., Battisti, E., Hadjielias, E., 2022. Black box technology, usage-based insurance, and prediction of purchase behavior: evidence from the auto insurance sector. Technol. Forecast. Soc. Change 183, 121896.

Aria, M., Cuccurullo, C., 2017. Bibliometrix: an R-tool for comprehensive science mapping analysis. J. Inform. 11 (4), 959–975.

Bahoo, S., Alon, I., Paltrinieri, A., 2020. Corruption in international business: a review and research agenda. Int. Bus. Rev. 29 (4), 101660.

Bajwa, I.A., Ur Rehman, S., Iqbal, A., Anwer, Z., Ashiq, M., Khan, M.A., 2022. Past, present and future of FinTech research: a bibliometric analysis. SAGE Open 12 (4), 21582440221131242.

Barbara, C., Cortis, D., Perotti, R., Sammut, C., Vella, A., 2017. The european insurance industry: a PEST analysis. Int. J. Financ. Stud. 5 (2), 14.

Bittini, J.S., Rambaud, S.C., Pascual, J.L., Moro-Visconti, R., 2022. Business models and sustainability plans in the Fintech, Insurtech, and PropTech industry: evidence from Spain. Sustainability 14 (19), 12088.

Boubaker, S., Goodell, J.W., Kumar, S., Sureka, R., 2022. COVID-19 and finance scholarship: a systematic and bibliometric analysis. Intern. Rev. Finan. Anal., 102458

Bravo, J.M., 2021. IDD and distribution risk management. Insur. Distrib. Dir. 349.

Brophy, R., 2020. Blockchain and insurance: a review for operations and regulation. J. Financ. Regul. Compliance 28 (2), 215–234.

Butler, L., 2008. ICT assessment: moving beyond journal outputs. Scientometrics 74 (1), 39–55.

Butler, L., Visser, M.S., 2006. Extending citation analysis to non-source items. Scientometrics 66 (2), 327–343.

Callon, M., Courtial, J.-P., Turner, W.A., Bauin, S., 1983. From translations to problematic networks: an introduction to co-word analysis. Inf. (Int. Soc. Sci. Counc.) 22 (2), 191–235.

Cao, L., Yang, Q., Yu, P.S., 2021. Data science and AI in Fintech: an overview. Int. J. Data Sci. Anal. 12, 81–99.

Cao, S., Lyu, H., Xu, X., 2020. Insurtech development: evidence from Chinese media reports. Technol. Forecast. Soc. Change 161, 120277.

Chiaramonte, L., Dreassi, A., Piserà, S., Khan, A., 2022. Mergers and acquisitions in the financial industry: a bibliometric review and future research directions. Res. Int. Bus. Financ., 101837

Cortis, D., Debattista, J., Debono, J., Farrell, M., 2019. Insurtech. Disrupting Financ.: Fintech Strategy 21st Century 71–84.

Cosma, S., Rimo, G., 2023. Fintech, Financial inclusion, and social challenges: the role of financial technology in social inequality. Fintech Sustain.: How Financ. Technol. Can. Help Address Today'S. Environ. Soc. Chall. 107–128.

Cosma, S., Rimo, G., Torluccio, G., 2023. Knowledge mapping of model risk in banking. Intern. Rev. Finan. Anal., 102800

Ding, Y., Cronin, B., 2011. Popular and/or prestigious? Measures of scholarly esteem. Inf. Process. Manag. 47 (1), 80–96.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., Lim, W.M., 2021. How to conduct a bibliometric analysis: an overview and guidelines. J. Bus. Res. 133, 285–296.

Egfjord, K.F.H., Sund, K.J., 2020. Do you see what I see? How differing perceptions of the environment can hinder radical business model innovation. Technol. Forecast. Soc. Change 150, 119787.

El-Switi, S., Qatawneh, M., 2021. Application of blockchain technology in used vehicle market: A review (July). 2021 International Conference on Information Technology (ICIT). IEEE, pp. 49–54 (July).

Fernandes, C., Ferreira, J.J., Veiga, P.M., Kraus, S., Dabić, M., 2022. Digital entrepreneurship platforms: mapping the field and looking towards a holistic approach. Technol. Soc. 70, 101979.

Galletta, S., Mazzù, S., Naciti, V., 2022. A bibliometric analysis of ESG performance in the banking industry: From the current status to future directions. Res. Int. Bus. Financ. 62, 101684.

Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C., Santamaria, V., 2018. To blockchain or not to blockchain: that is the question. It Prof. 20 (2), 62–74.

Gimpel, H., Rau, D., Röglinger, M., 2018. Understanding Fintech start-ups–a taxonomy of consumer-oriented service offerings. Electron. Mark. 28, 245–264.

Glänzel, W., Schlemmer, B., Schubert, A., Thijs, B., 2006. Proceedings literature as additional data source for bibliometric analysis. Scientometrics 68 (3), 457–473.

Godin, B., 1998. Measuring knowledge flows between countries: the use of scientific meeting data. Scientometrics 42, 313–323.

Gómez, I.S., Pineda, Ó.M., 2023. What is an InsurTech? A scientific approach for defining the term. Risk Manag. Insur. Rev. 26 (2), 125–173.

Goodell, J.W., Kumar, S., Lim, W.M., Pattnaik, D., 2021. Artificial intelligence and machine learning in finance: Identifying foundations, themes, and research clusters from bibliometric analysis. J. Behav. Exp. Financ. 32, 100577.

Goodell, J.W., Kumar, S., Lahmo, O., Pandey, N., 2023. A bibliometric analysis of cultural finance. International Review of Financial. Analysis 85, 102442.

Gupta, S., Ghardallou, W., Pandey, D.K., Sahu, G.P., 2022. Artificial intelligence adoption in the insurance industry: Evidence using the technology–organization–environment framework. Res. Int. Bus. Financ. 63, 101757.

Herrmann, H., Masawi, B., 2022. Three and a half decades of artificial intelligence in banking, financial services, and insurance: a systematic evolutionary review. Strateg. Change 31 (6), 549–569.

Izzo, F., Tomnyuk, V., Lombardo, R., 2022. 4.0 digital transition and human capital: Evidence from the Italian Fintech market. Int. J. Manpow. 43 (4), 910–925.

Khan, M.A., 2022. ESG disclosure and Firm performance: a bibliometric and meta analysis. Res. Int. Bus. Financ. 61, 101668.

KPMG (2022). Pulse of Fintech H2'22. Global analysis of Fintech investments. Available at: https://kpmg.com/xx/en/home/industries/financial-services/pulse-of-Fintech.html.

Kumar, S., Pandey, N., Lim, W.M., Chatterjee, A.N., Pandey, N., 2021. What do we know about transfer pricing? Insights from bibliometric analysis. J. Bus. Res. 134, 275–287.

Lanfranchi, D., Grassi, L., 2022. Examining insurance companies' use of technology for innovation. Geneva Pap. Risk Insur. -Issues Pract. 47 (3), 520–537.

Laudano, M.C., Marzi, G., Caputo, A., 2018. A decade of the International Journal of Entrepreneurship and Small Business: a bibliometric analysis. Int. J. Entrep. Small Bus. 33 (2), 289–314.

Leong, Y.Y., Chen, Y.C., 2020. Cyber risk cost and management in IoT devices-linked health insurance. The. Geneva Pap. Risk Insur. -Issues Pract. 45, 737–759.

Liu, J., Li, X., Wang, S., 2020. What have we learnt from 10 years of fintech research? A scientometric analysis. Technol. Forecast. Soc. Change 155, 120022.

McKinsey & Company (2016). What's next for China's booming Fintech sector?. Avalaible at: https://www.mckinsey.com/~/media/mckinsey/industries/financial%20services/our%20insights/what%20next%20for%20chinas%20booming%20Fintech%20sector/whats-next-for-chinas -booming-Fintech-sector.pdf.

Merello, P., Barberá, A., De la Poza, E., 2022. Is the sustainability profile of Fintech companies a key driver of their value? Technol. Forecast. Soc. Change 174, 121290.

Migliavacca, M., Goodell, J.W., Paltrinieri, A., 2023. A bibliometric review of portfolio diversification literature. Int. Rev. Financ. Anal., 102836

Mukherjee, D., Lim, W.M., Kumar, S., Donthu, N., 2022. Guidelines for advancing theory and practice through bibliometric research. J. Bus. Res. 148, 101–115.

Mullins, M., Holland, C.P., Cunneen, M., 2021. Creating ethics guidelines for artificial intelligence and big data analytics customers: The case of the consumer European insurance market. Patterns 2 (10), 100362.

Najaf, K., Schinckus, C., Yoong, L.C., 2020. VaR and market value of Fintech companies: an analysis and evidence from global data. Manag. Financ. 47 (7), 915–936.

Njegomir, V., Bojanic, T., 2021. Disruptive technologies in the operation of the insurance industry. Teh. čki Vjesn. 28 (5), 1797–1805.

Ostrowska, M., 2021. Regulation of Insurtech: Is the Principle of Proportionality an Answer? Risks 9 (10), 185.

Palmié, M., Wincent, J., Parida, V., Caglar, U., 2020. The evolution of the financial technology ecosystem: An introduction and agenda for future research on disruptive innovations in ecosystems. Technol. Forecast. Soc. Change 151, 119779.

Pana, E., 2022. A bibliometric review of liquidity creation. Res. Int. Bus. Financ., 101841

Panetta, I.C., Leo, S., Delle Foglie, A., 2023. The development of digital payments–Past, present, and future–From the literature. Res. Int. Bus. Financ. 64, 101855.

Patel, R., Migliavacca, M., Oriani, M.E., 2022. Blockchain in banking and finance: a bibliometric review. Res. Int. Bus. Financ. 62, 101718.

Paul, L.R., Sadath, L., 2021. A systematic analysis on Fintech and its applications (February). 2021 Int. Conf. Innov. Pract. Technol. Manag. (ICIPTM) 131–136.

Pizzi, S., Venturelli, A., Variale, M., Macario, G.P., 2021. Assessing the impacts of digital transformation on internal auditing: a bibliometric analysis. Technol. Soc. 67, 101738.

Popovic, D., Avis, C., Byrne, M., Cheung, C., Donovan, M., Flynn, Y., Shah, J., 2020. Understanding blockchain for insurance use cases. Br. Actuar. J. 25, e12.

Potter, W.J., Levine-Donnerstein, D., 1999. Rethinking validity and reliability in content analysis. J. Appl. Commun. Res. 27, 258–284.

Puschmann, T., 2017. Fintech. Bus. Inf. Syst. Eng. 59, 69–76.

Puschmann, T., Hoffmann, C.H., Khmarskyi, V., 2020. How green Fintech can alleviate the impact of climate change—the case of Switzerland. Sustainability 12 (24), 10691.

PWC (2019), "Piccole FinTech crescono", available at: ⟨https://www.pwc.com/it/it/publications/assets/docs/PwC-FinTech.pdf⟩.

Raikwar, M., Mazumdar, S., Ruj, S., Gupta, S.S., Chattopadhyay, A., Lam, K.Y., 2018. A blockchain framework for insurance processes (February). 2018 9th IFIP Int. Conf. N. Technol., Mobil. Secur. (NTMS) 1–4.

Rawat, S., Rawat, A., Kumar, D., Sabitha, A.S., 2021. Application of machine learning and data visualization techniques for decision support in the insurance sector. Int. J. Inf. Manag. Data Insights 1 (2), 100012.

Ruhland, P., Wiese, F., 2023. FinTechs and the financial industry: partnerships for success. J. Bus. Strategy 44 (4), 228–237.

Seekings, C. (2017). Amazon set to shake-up UK insurance. The Actuary.

Shah, H.C., Dong, W., Stojanovski, P., Chen, A., 2018. Evolution of seismic risk management for insurance over the past 30 years. Earthq. Eng. Eng. Vib. 17, 11–18.

Sosa, I., Montes, O., 2022. Understanding the Insurtech dynamics in the transformation of the insurance sector. Risk Manag. Insur. Rev. 25 (1), 35–68.

Standaert, W., Muylle, S., 2022. Framework for open insurance strategy: insights from a European study. The. Geneva Pap. Risk Insur. -Issues Pract. 47 (3), 643–668.

Stoeckli, E., Dremel, C., Uebernickel, F., 2018. Exploring characteristics and transformational capabilities of Insurtech innovations to understand insurance value creation in a digital world. Electron. Mark. 28, 287–305.

Sureka, R., Kumar, S., Colombage, S., Abedin, M.Z., 2022. Five decades of research on capital budgeting–A systematic review and future research agenda. Res. Int. Bus. Financ. 60, 101609.

Tanninen, M., 2020. Contested technology: social scientific perspectives of behaviour-based insurance. Big Data Soc. 7 (2), 2053951720942536.

Temelkov, Z., 2018. Fintech firms opportunity or threat for banks?. International journal of information. Bus. Manag. 10 (1), 137–143.

Thakor, A.V., 2020. Fintech and banking: what do we know? J. Financ. Inter. 41, 100833.

Van Eck, N., Waltman, L., 2010. Survey software: VOSviewer, a computer program for bibliometric mapping. scientometrics 84 (2), 523–538.

Van Eck, N.J., Waltman, L., Dekker, R., Van Den Berg, J., 2010. A comparison of two techniques for bibliometric mapping: multidimensional scaling and VOS. J. Am. Soc. Inf. Sci. Technol. 61 (12), 2405–2416.

Visser, M.S., Moed, H.F., 2005. Developing bibliometric indicators of research performance in computer science. Proceedings of the 10th international conference of the international society for scientometrics and informetrics. Karolinska University Press,, Stockholm, pp. 275–279.

Vives, X., 2017. The impact of Fintech on banking. Eur. Econ. 2, 97–105.

Wang, Q., 2021. The Impact of Insurtech on Chinese insurance industry. Procedia Comput. Sci. 187, 30–35.

Xu, X., Zweifel, P., 2020. A framework for the evaluation of Insurtech. Risk Manag. Insur. Rev. 23 (4), 305–329.

Yan, T.C., Schulte, P., Chuen, D.L.K., 2018. Insurtech and Fintech: banking and insurance enablement. Handb. Block, Digit. Financ., Incl. Volume 1, 249–281.

Zarifis, A., Cheng, X., 2022. A model of trust in Fintech and trust in Insurtech: How Artificial Intelligence and the context influence it. J. Behav. Exp. Financ. 36, 100739.

Zarifis, A., Kawalek, P., Azadegan, A., 2021. Evaluating if trust and personal information privacy concerns are barriers to using health insurance that explicitly utilizes AI. J. Internet Commer. 20 (1), 66–83.

Zeier Röschmann, A., Erny, M., Wagner, J., 2022. On the (future) role of on-demand insurance: market landscape, business model and customer perception. Geneva Pap. Risk Insur. -Issues Pract. 47 (3), 603–642.

Zgraggen, R.R., 2019. Smart insurance contracts based on virtual currency: legal sources and chosen issues (July). Proc. 1st Int. Electron. Commun. Conf. (pp 99–102.