FINTECHS AND INNOVATIVE FINANCIAL INSTRUMENTS IN THE CONTEXT OF THE DIGITAL AGE

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Abstract. We are currently witnessing a reshaping of the financial system, as a result of the challenges and influencing factors generated by the digital era and the multi-crises of recent years, the extent of FinTechs (financial technology) being carefully evaluated and which include new innovative technologies aimed directly at optimizing financial processes and the automation of classic services for both corporate clients and physical personal financial services consumers. The digitization of financial institutions has determined that the attention on FinTechs is increasing, which is why with this paper we propose to contribute to the field of "digital finance" by identifying and presenting bibliometric analyses of the specialized scientific literature related to the topic Fintech. Our analysis is based on the metadata identified both in databases and in certain works from specialized journals, the data processing being through the VOSviewer and Biblioshiny software. The subject of Fintech is analysed both within the present paper, as a result of the fact that for the academic environment itself there is an interest in redefining financial models in the context of the digital age, but also a permanent involvement of us as researchers in future research works.
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UDC: 001.895:336

Introduction. The concept of Fintech can be found in scientific literature since the beginning of the 1900s, but the association between digital technologies and the financial industry can be said to have appeared after the 2010s, especially in the context of the definition of the transfer of financial services through technologies (Cai, 2018) The term Fintech is currently very well known, and is associated with a digital financial product (PwC, 2016). The acceleration moment is given on the one hand by the approval of the European Digitalization Strategy in 2018, as well as the approval in 2021 by the Commission of the plan towards Europe's Digital Decade. It is very evident that the acceleration of digitization has been reinforced by the outbreak of the COVID-19 pandemic.

In accordance with the works published by Deloitte (Deloitte, 2020), the pandemic led to a direct contribution to the development and emergence of new financial digital technologies in various sectors of activity, including traditional

ones. The year 2018 was the year in which more and more fintechs appeared, and the analysis based on the performance indicators of the Fintech company showed for the first time that the performance indicators of traditional institutions were exceeded, the pandemic making this gap even wider visible (Deloitte, 2020). According to Statistica (Statista, 2021), total investment in Fintech reached USD 33.9 billion by the first quarter of 2019. Additionally, nearly 75% of global consumers had some interaction with Fintech in 2019 (Statista, 2021), while (Deloitte, 2020) predicts that global revenues of Fintech companies will grow by 11.7% from 2019 to 2024.

This rapid growth of the Fintech industry was the date and result of the target segment addressed by this industry, namely the segment of the unbanked target group, which existing financial institutions, as a result of regulatory norms and financial prudence, do not include in the desired target group . Moreover, as a result of the digitization of financial services, the Fintech industry has optimized the financial costs for the services provided, making them more affordable in terms of costs. At the same time, innovation and new business models have allowed Fintech to spread throughout the industry and enter the customer segment of existing financial service providers. Therefore, Fintech is an excellent illustration of the disruptive innovation theory introduced by Clayton, M. Christensen in 1995 (Christensen & Euchner, 2015). According to this theory, disruptive innovation is a process that occurs when a small firm with limited resources enters the market by targeting customers neglected by incumbents. By doing so, the small firm adopts innovative solutions and gradually expands its customer base in existing businesses (Christensen & Euchner, 2015).

Similarly, Fintech is creating a customer-centric environment by disrupting the traditionalproduct orientation of existing banks (Siek & Sutanto, 2019). According to (Deloitte, 2021), Fintech has already set the stage for another successful industry disruption,
whereby 86% of financial institutions believe that Fintech threatens their various areas business (Lee & Shin, 2018). Furthermore, (Gomber et al., 2018) argue that drastically changes in financial services signal a looming financial revolution. technological innovation, process disruption and service transformation are the main driving forces behind such a revolution (Gomber et al., 2018). The recent rapid progress of the Metaverse leads to further technological and financial disruptions (Sahni & Lyne-Smith, 2022). Anticipating the growing academic interest in researching the financial disruption of the incumbent system through the rapid progress of Fintech, this paper aims to identify the scope, the main contributors and sources shaping Fintech research.

The paper presents a bibliometric analysis to address the topic of Fintech as a financially disruptive. Bibliometric analysis is a relatively new research method that has gained popularity in several academic fields, including finance. It is part of a larger the discipline of scientometrics, defined as the study of the quantitative features of science and scientific research (Biancone et al., 2020). Methodology of bibliometric analysis involves the processing of bibliometric data, such as sources of publications or documents, using quantitative techniques (Donthu et al., 2021).

From the number of academics publications is growing exponentially, evaluating the content of the relevant literature it became an extremely laborious process. The different visualization techniques allow us simplifying the review process of related academic literature (Borner et al., 2003). For for example, bibliometric analysis allows a better picture and understanding of a research theme by systematizing the relevant academic literature (Aria & Cuccurullo, 2017).

Consequently, the researcher can efficiently sort information through the visual map of published literature. Furthermore, this type of analysis allows for the easy identification of critical research trends and the most cited authors and papers in the broader framework group of academic publications on any given topic. Thus, bibliometric analysis helps in retrieving and classifying relevant information (Borner et al., 2003). Furthermore, several researchers (Shibata et al., 2008), (Van et al, 2010) discussed and demonstrated the significance of bibliometric analysis in determining emerging trends and themes of future research. The range of newly developed and specialized software enables convenience and efficient execution of bibliometric analysis. The bibliometrix open-source R package, used in this paper, allows data analysis to be performed and provides data visualization via different types of mapping (Aria & Cuccurullo, 2017). Provides various statistics and graphical techniques for analyzing existing academic literature; for example, the presentation of scientific collaboration units can be done by citation and co-citation analysis (Janik et al., 2020). VOSviewer is another software program that can help visualize the results of the lyometric analysis. This software works with different data sources and generates images that reflect data with various characteristics. The software organizes the data into clusters represented by nodes and connected lines (Janik et al., 2020). The clustering technique of VOSviewer is based on the local intelligent motion algorithm introduced by Waltman and Van Eck (Janik et al., 2020). This algorithm allows building connections networks based on selected data. Generated by software, author networks,citations and countries are shown as maps. This paper uses Biblioshiny (the web interface of the bibliometrix R package freely available online) (Aria & Cuccurullo, 2017) to generate figures and VOSviewer (version 1.6.16) (Van et al, 2010) for mapping presentations to perform a comprehensive bibliometric analysis.

The growing number of academic publications on the subject of Fintech has generated several bibliometric analyses. While some studies have covered Fintech literature in general (Wu, 2017), (Chen & Peng, 2019), (Sarhan, 2020), a growing number of bibliometric reviews focus on specific areas of Fintech, such as Fintech regulations (Lakhe & Kulkarni, 2020), crowdfunding (Martínez-Climent et al., 2018), (Buttice & Ughetto, 2021), Fintech and Islamic finance (Aysan and et al., 2022); (Abubakr & Aysan, 2022) and cryptocurrencies and blockchain (Firdaus et al., 2019), (Jiang et al., 2020), (Nasir et al., 2020), (Dosso & Aysan , 2022), (Aysan et al., 2021). However, to the authors' knowledge, the academic literature on Fintech as a financial disruptor has not been bibliometrically reviewed (Ndou, et al., 2022). Consequently, at the time of writing, this work is the first to present a bibliometric analysis on the given topic, contributing to the originality of the work. This paper attempts to fill this gap by exploring the existing literature on Fintech as a disruptor and transformator of the financial system operator. Through the analysis carried out on Biblioshiny and VOSviewer, the paper tries to answer the following

research questions: What is the academic purpose of literature on the given topic? Who are the main contributors to the given topic? What are the main trends in the given topic?. The authors believe that the topic of Fintech as a financial disruptor is an emerging but promising area of research, and this paper can be a good starting point in this endeavour. The paper is organized as follows. Section 2 discusses data collection and methodology. Section 3 presents the results of the bibliometric analysis, including an overview of existing literature, document types, trending words, and author impact assessment.

Methodology and data collection

Data collection. To perform the bibliometric analysis, the Scopus database was chosen, due to its academic reputation, as well as due to the multidisciplinary database of abstracts and citations. Scopus, part of the larger analytics and information company Elsevier, provides easy access to peer-reviewed academic publications, including books, journals and conferences.

Metadata used in this paper can be defined as summarized basic information about the data (Opendatasoft, 2016). Publishers provide metadata, which includes author(s), affiliation(s), document title, year, electronic identifier (EID), source title, volume/number/pages, number of citations, source, document type, and identifier digital object identifier (DOI), among others. According to the Elsevier website, the Scopus content repository stores 3.7 TB of data, corresponding to 1.4 billion cited references. Considering the aforementioned information, (Biancone et al., 2020) state that the Scopus database provides a high-quality and reliable basis for bibliometric analysis. The bibliometric analysis in the paper represents a snapshot of research data on the subject of Fintech in the context of the digital age. To collect applicable data, keywords were entered into the Scopus database, such as: "Fintech" or "FinTech" or "Financial Technologies" and "Disrupt*" or "Transform*".

Metodologie. To answer the research question, the paper uses three types of bibliometric analysis techniques:

performance analysis; scientific mapping and network analysis (Donthu, 2021).

Performance analysis defines the contribution of research factors (authors, journals, countries) to the subject of Fintech in the context of the digital age, based on the number of relevant publications and citations (Donthu, 2021) . This technique defines the most cited or productive journals, authors and papers. Citation and publication counts help define the significance of the research topic, researchers, and journal (Shibata et al., 2008).

Applying the technique of scientific mapping, the paper demonstrates the relationship between different research factors on the given topic. This technique defines the relationship between publications, underlying themes and relationships between topics, using citation and co-citation analysis and co-word and co-author analysis; among others (Donthu, 2021).

And the third bibliometric analysis is network analysis, it allows visualization of different results through clustering and network metrics.

Figure 1. Overview of the work process

	Data mining and extraction	
Tools	Scopus	Entering the keywords ("Fintech" OR "FinTech" OR "Financial technologies" AND "Disrupt*" OR "Transform*")
Process		363 documents were extracted
Outcome		
	Bibliometric Analysis	
		Performance analysis
	Scopus	Total publications
	Scopus	Number of active years of publications
	Scopus	Number of contributing authors
	Scopus	Productivity per active year of publication
	Scopus	Total citaion
	Scopus	Collaboration index
	Scopus	Number of cited publicaitons
	Biblioshiny	h-index
		Science mappinig
	Biblioshiny	Relationship among publications
	Biblioshiny	Most influential publications
	Biblioshiny	Foundational themes
	Biblioshiny	Exisitng or future realtionship among topics
	Biblioshiny, Vosviewer	Written content (words)
	Biblioshiny, Vosviewer	Realtionships among authors
	Biblioshiny, Vosviewer	Authors and author affiliations
		Network analysis
	Biblioshiny	Degree of centrality
	Vosviewer	Clustering
	Vosviewer	Visualization

Research Results/Discussion. The data collected are presented in Table 1, and show us that the majority of documents identified on the topic of Fintech in the context of the digital age, are articles (46% of all documents) and conference papers (33%). Books constitute only 2% of the total documents, which could lead us to the hypothesis related to the relative novelty of the subject.

Table 1. Main data information, time frame 1984–2021

Description	Results
Document types	
Article	166
Book	9
Book chapter	39
Conference paper	120
Conference review	4
Editorial	6
Review	19
Document contents	
Keywords plus (ID)	1207
Author's keywords (DE)	1029
Authors	
Authors	896
Author appearances	970
Authors of single-authored documents	83
Authors of multi-authored documents	813
Authors collaboration	
Single-authored documents	91
Documents per author	0.405
Authors per document	2.47
Co-authors per document	2.67
Collaboration index	2.99

Source: Scopus, developed in Biblioshiny. Aysan, A.F.; Nanaeva, Z. Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1, 412–433

Starting from 1984 until 2016, the number of publications was insignificant, after which their volume began to increase and reached its peak in 2020 (Figure 2). Moreover, the annual growth in the number of publications accelerated after 2016 and almost doubled in 2020 year-on-year, as can also be seen in the figure below.

Figure 2. Presentation of annual scientific production between 1984 and 2021
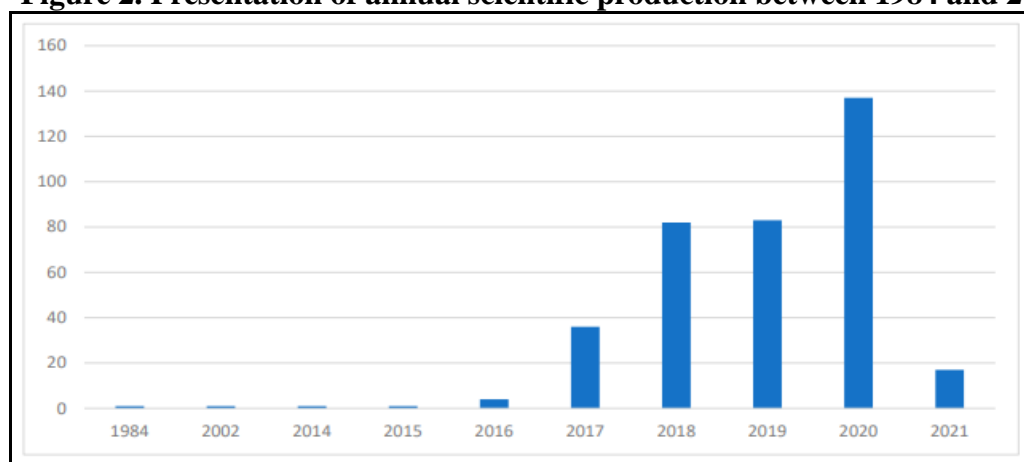
Source: Scopus, Aysan, A.F.; Nanaeva, Z. Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1, 412–433

The subject of Fintech is very varied, multidisciplinary and includes various thematic areas (see Table 2). The majority of publications (22%) are in the field of computing science, followed by the field of business, management and accounting (19%), and by a small margin the field of economics, econometrics and finance (13%). This distribution confirms PwC's definition of Fintech as a combination of technology and financial services, where it is difficult to tell where technology ends and financial services begin (PwC,2016) [2].

Table 2. Presentation of the thematic areas of the publications between 1984 and until 2021

Subject Area	# of Results	%
Computer Science	165	0.22
Business, Management and Accounting	144	0.19
Economics, Econometrics and Finance	98	0.13
Social Sciences	80	0.11
Engineering	77	0.10
Decision Sciences	51	0.07
Mathematics	31	0.04
Environmental Science	27	0.04
Energy	24	0.03
Biochemistry, Genetics and Molecular Biology	6	0.01
Earth and Planetary Sciences	6	0.01
Pharmacology, Toxicology and Pharmaceutics	5	0.01
Physics and Astronomy	5	0.01
Materials Science	4	0.01
Multidisciplinary	4	0.01
Psychology	4	0.01
Others	12	0.02

Source: Scopus, developed in Excel. Aysan, A.F.; Nanaeva, Z. Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1, 412–433

Figure 3 shows the twenty most cited sources of publications on Fintech, with dark blue defining the higher number of citations, and with the light shade the lower number of citations. The three most cited sources are the Journal of Management Information Systems, the Management Information Systems Quarterly (MIS Quarterly), and the Harvard Business Review, each with over 60 citations in this analysis.

Figure 3. Presentation of the most cited publication sources

Figure 4. presents the twenty most relevant sources of publications with the largest number of documents on the subjects of FinTech. For example, the most cited source, the Journal of Management Information Systems, published only two papers on the given topic. However, it has been cited in 71 papers. On the other hand, the ACM International Conference Proceeding series published 11 articles on the chosen topic but was cited in only one paper.

Figure 4. Presentation of the most relevant sources of publications
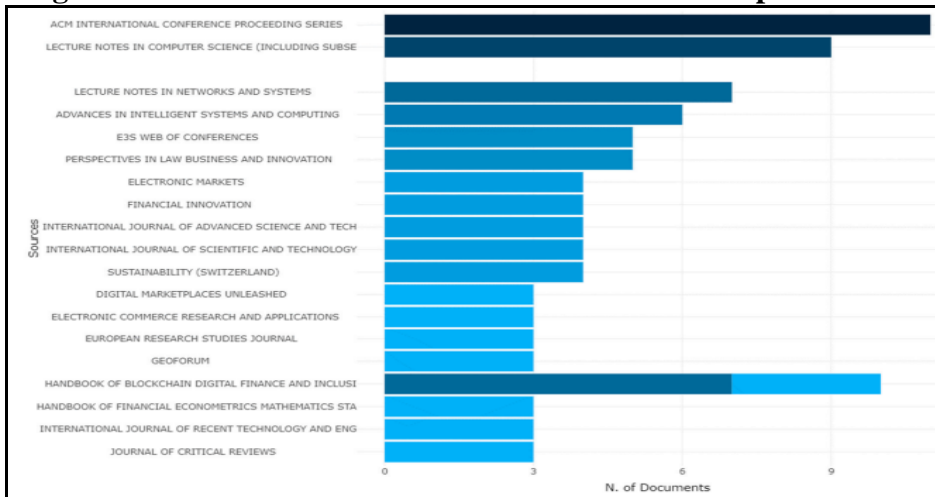
Figure 5 shows the list of the most cited documents about Fintech. The most cited article was by Lee and Shin, "Fintech: Ecosystem, business models, investment decisions and challenges" (Lee & Shin, 2018) [8]. The article was published in 2018 in the journal Business Horizons and generated 128 citations. The article discusses different Fintech business models as well as the challenges facing Fintech startups and existing financial institutions. The second most cited article (with 126 citations) was "On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services" by Gomber, Kauffman, Parker, and Weber (2018) [9].
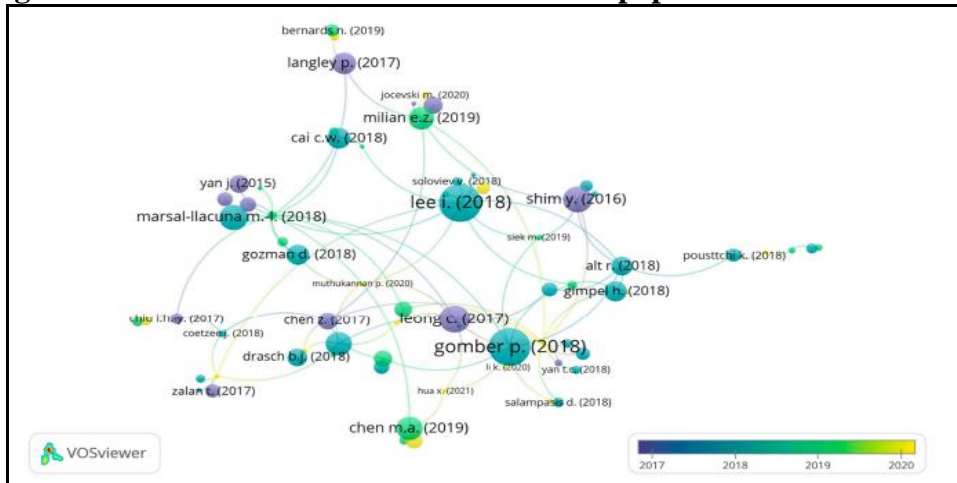
Figure 5. Presentation of the most cited scientific papers in the FinTech field
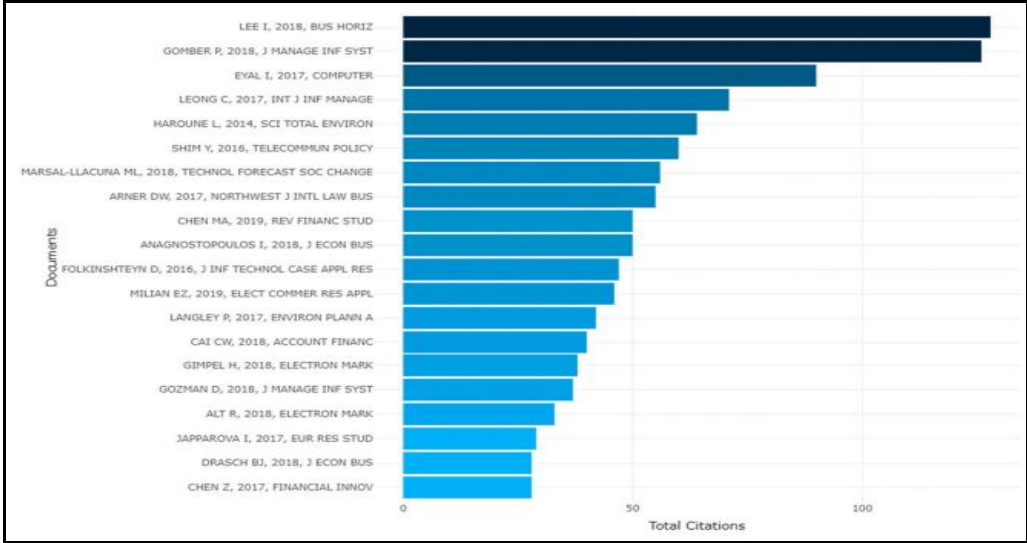
Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

Through the VOSveiwer program, the map of the citations of scientific works in the FinTech field is presented (Figure 6) and groups the 73 most cited published scientific works into 17 groups. The size of the bubble shows the number of citations. As mentioned earlier, the most cited papers by Lee and Shin [8] (128 citations) and Gomber et al. [9] (126 citations) were published in 2018, which allowed enough time to produce a large number of citations. The oldest of the most cited papers was "How Information Asymmetry Affects P2P Lending: Big Data Economics" by Yan, J. et al., [53] which was published in 2015, generating 28 citations (Yan et al., 2015) [53]. The most recent of the most cited papers was "Blockchain disruption and decentralized finance: The rise of decentralized business model" by Chen and Bellavitis, which was published in 2020 in the Journal of Business Venturing Insights and has already accumulated 23 citations.
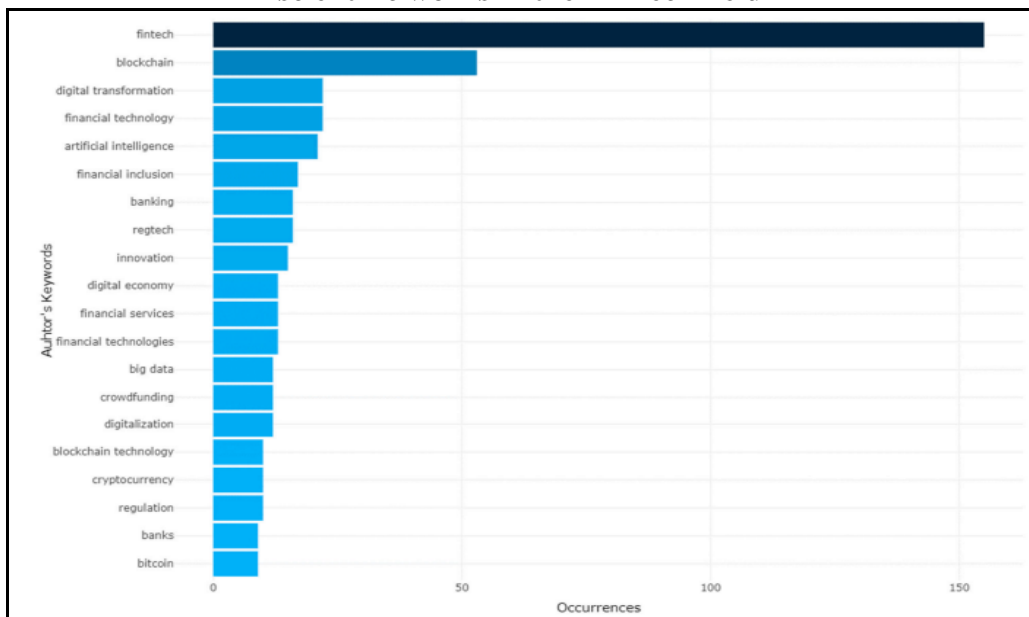
Figure 6. Presentation of citations of scientific papers in the FinTech field

Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

The most used keywords are presented in Figure 7 (the 20 most frequently used words by authors in published scientific works). It is evident that the most common keyword is "Fintech" was the most popular with a frequency of 155 (25%). "Blockchain" and followed by "digital transformation", with corresponding frequencies of 53 and 22 (8% and 3%).
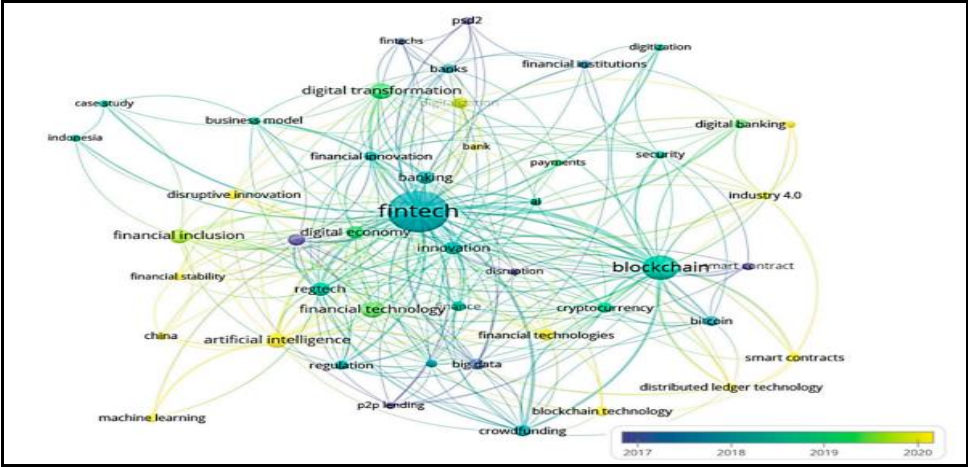
Figure 7. Presentation of the 20 words most often used by the authors of scientific works in the FinTech field

Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

The presentation of the VOSviewer map with the appearance of the most frequently used keywords by the authors is presented in Figure 8, within which the 50 most popular keywords used by the authors are grouped. The words "fintech", "blockchain" and "digital transformation" are indicated as the most popular.

Figure 8. Presentation of the weighted occurrences of the words used by the authors of scientific works

Source: Scopus, developed in VOSviewer/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

Another important aspect to be realized in the scientific works is given by the centralization of the topics addressed by the authors in the Fintech field. Therefore, the most popular topics are illustrated in Figure 9. By defining the frequency of use of words in the scientific works published annually.
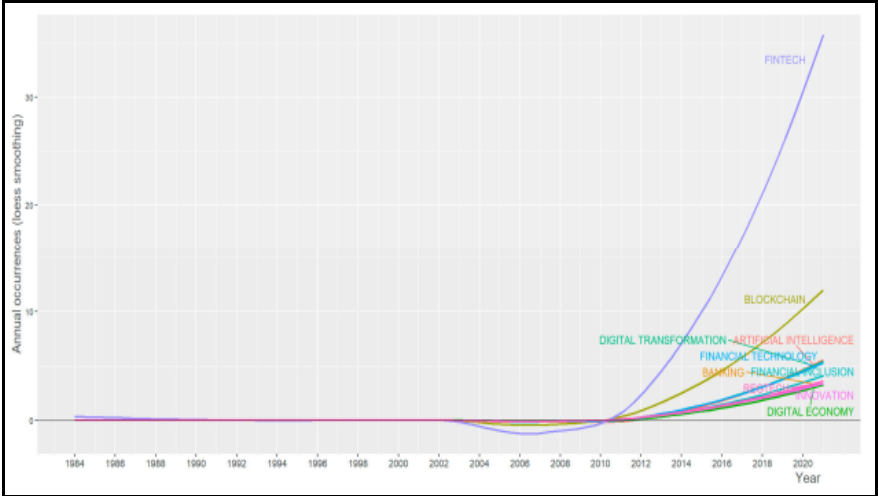
Figure 9. Presentation of trends in subjects addressed by authors in scientific papers
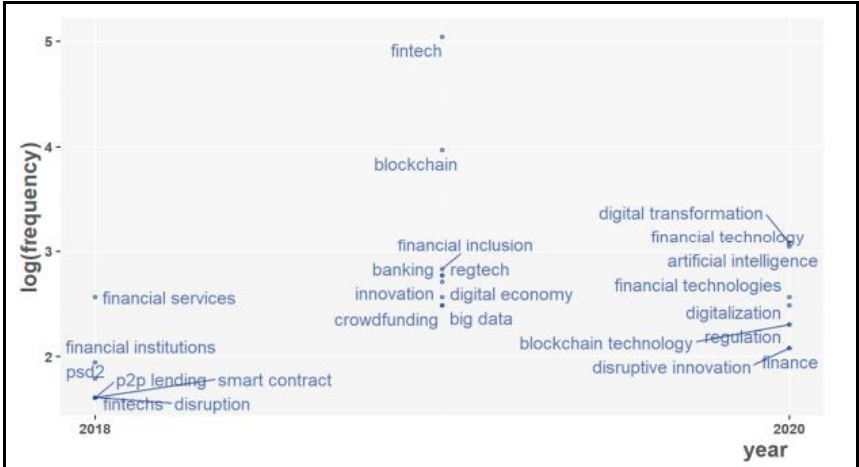
Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

The scale with which innovations are developing in the financial field, and in particular in the FinTech field, has led to the emergence of new keywords, as can also be seen in figure 10 (for example, keywords such as "digital transformation" and "artificial intelligence".

Figure 10. Presentation of the increase in the number of keywords addressed by authors in scientific papers

Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

The thematic map of the conceptual structure of the keywords is presented in Figure 11. For example, the clusters "fintech", "banking" and "digital transformation" are the core themes in the FinTech field. And currently, the topic "Artificial Intelligence" is a theme driver, which can be defined as important in the realm of FinTech and well explored in the context of digital finance. And as an innovative future keyword "time bank".

Figure 11. Presentation of the thematic map in the FinTech field
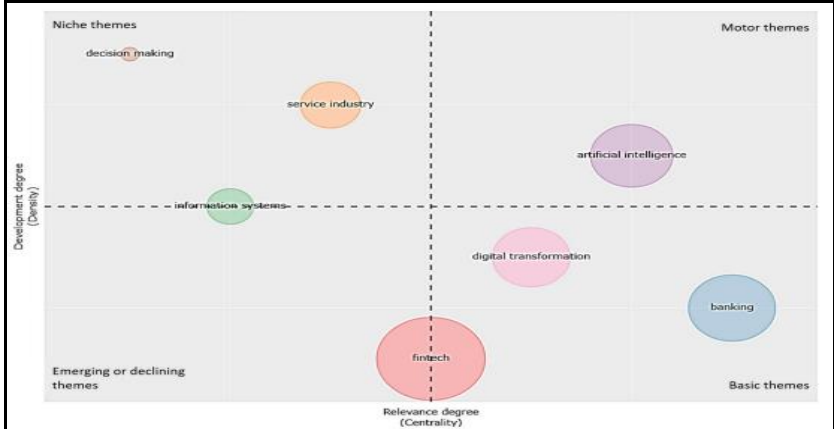
Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

Following the bibliometric analysis, we present the most cited authors, Lee, I.; Shin, Y. and Kaufmann, R. J. in the table below, respectively with the paper "Fintech: Ecosystem, business models, investment decisions, and challenges" (Lee & Shin, 2018).

Table 3. Presentation of the top twenty most cited authors globally in the FinTech field

Author	Documents	Citations	Total Link Strength
Lee, I.	1	128	67
Shin, Y.	1	128	67
Kauffman, R.J.	2	127	64
Gomber, P.	1	126	62
Parker, C.	1	126	62
Weber, B.W.	1	126	62
Eyal, I.	1	90	3
Tan, B.	3	74	48
Leong, C.	2	73	39
Tan, F.	2	73	39
Sun, Y.	1	71	36
Xiao, X.	1	71	36
Arner, D.W.	3	65	8
Buckley, R.P.	3	65	8
Bellenger, J.	1	64	0
Haroune l.	1	64	0
Legault, C.Y.	1	64	0
Ménard, A.	1	64	0
Salaun, M.	1	64	0
Marsal-llacuna M.	2	63	3

Source: Scopus, developed in Excel/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

Following the bibliometric analysis, we present the first 20 authors with the largest number of published works, respectively authors such as Gozman, D. and Lee Kuo Chuen, each with five publications on FinTech, followed by Bataev, A.; Fenwick, M. and Na Na, with four publications each (Figure 12).

Figure 12. Presentation of the most relevant authors globally in the FinTech field
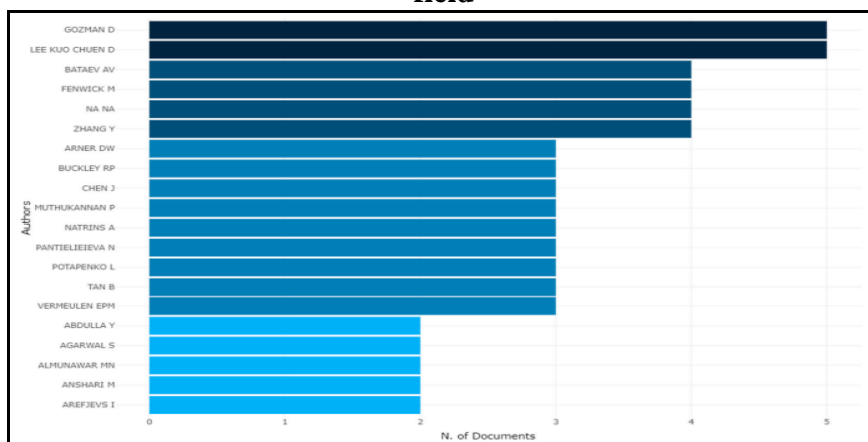
Source: Scopus, developed in Biblioshiny/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

Following the bibliometric analysis, we present in VOSviewer the most cited authors globally. As mentioned earlier, Lee and Shin's paper "Fintech: Ecosystem, business models, investment decisions, and challenges" (Lee and Shin, 2018).

**Figure 13. Presentation of the most cited authors globally in the field of FinTech**
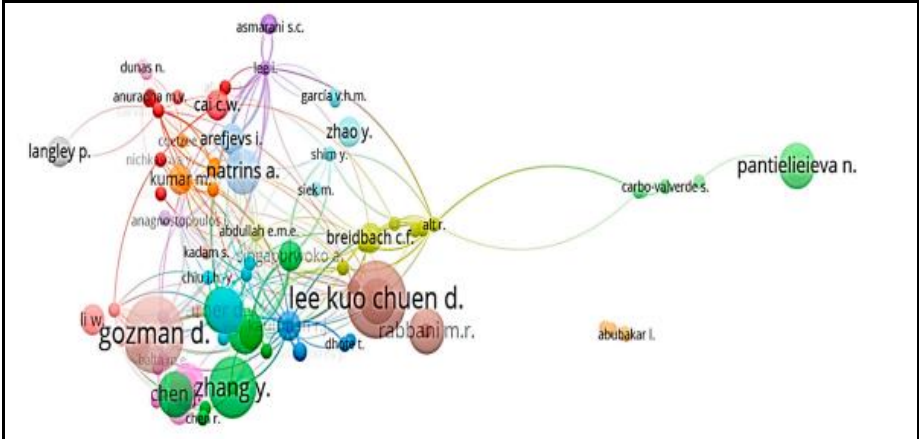
Source: Scopus, developed in VOSviewer/ Aysan, A.F.; Nanaeva, Z.Fintech as a Financial Disruptor: A Bibliometric Analysis. FinTech 2022, 1.

In the context of multiple crises and scientific progress generated especially by artificial intelligence, we can say that in terms of financial innovations we are in an extremely fertile moment that generates financial innovations at every moment, depending on the two determining directions.

The first direction is given by the existence of multi-crisis.

Figure 14. Presentation of multi-crises with direct impact on global financial innovations
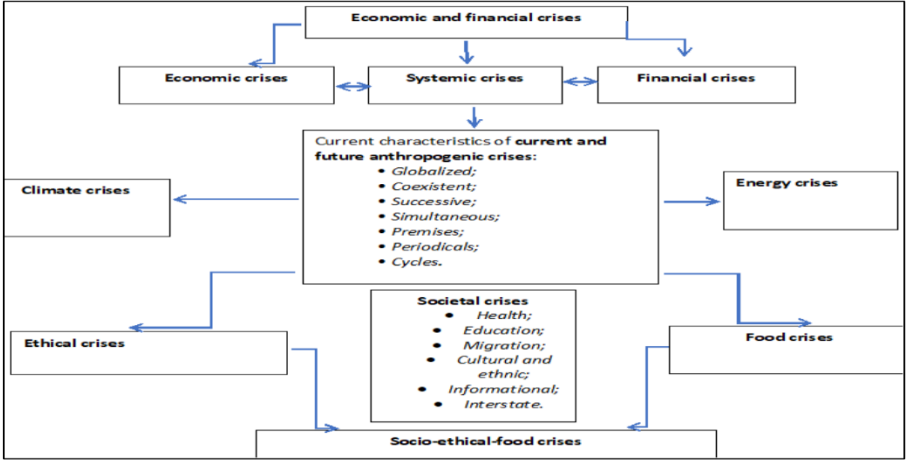
Source: own contributions

The second direction is given by the implications of artificial intelligence in the dynamics of financial innovations

✓ One of the supporters of this direction is US-based research, innovation and development group Accenture, with over 15 years of leadership in metaverse technology and experience capabilities and over 600 patents, bringing together over 800 of our skilled metaverse professionals and capabilities market leaders worldwide.

✓ In developing innovative Metaverse Fintech applications, Accenture starts from:

✓ Extended reality - analysis and support of companies starting from the realities of the market in the current conditions (respectively of the digital and green eras, and of the multi-crises);

✓ Digital identity - it's a reality we're all part of. The optimization of processes, of resources, determines us to be more and more present in the digital world, to manage access to systems and data at an internal institutional level, but also at a global level, by means of security protocols;

✓ Blockchain - through technology access to complex networks, with the possibility of building supply and sales chains as complex as possible and directly oriented towards the optimization of economic and financial indicators, respectively their profitability.

In the context of the second direction regarding financial innovations, we could redefine one of the most famous formulas of the marketing mix, namely the one proposed by the father of marketing Philip Kotler, respectively the 4Ps of the marketing mix, we can redefine them in the context artificial intelligence for a FinTech. For example, regarding the product/service in the context of AI: it is defined at the level of a Fintech as a multidisciplinary set of services and products at the level of an AI application that serves the multiple needs of the consumer, banking financial services (including payments), health, management personal finance, etc.

✓ Experience in customer service - constantly re-adapting according to the constantly changing needs of customers, especially in the field of financial innovations such as FinTechs;

✓ Technological innovation – in the finance industry, designers of systems, products and services, offer the right and oriented solutions to create competitive advantages and with a long-term strategic projection.

✓ The transformation of technology - causes company owners (especially financial ones) to turn directly to the transforming technology, respectively to adapt their businesses to these extremely fast changes, the metaverse in fintech being one of the revolutionary changes of the innovative financial market.

The marketing mix - the formula of the 4Ps of marketing Philip Kotler	The marketing mix - Fintech - proposal by author Otilia Manta
The product/service offered to the consumer	*AI Fintech application* - multidisciplinary services and products offered to the consumer through the application from different fields of activity (ex: finance, health, management, education, trade, etc.)
Price - the value of the product or service received	*App cost* – transaction fee/monthly cost as a subscription
Promotion - classic channels	*Promotion*- digital platforms, including metaverse applications, with optimized costs.
Distribution - the traditional value chain, with a clearly defined and limited time interval.	*Distribution* - Global distribution in real time and with multiplier effect.

Source: own contributions

An example of digital financial innovation is Siam Commercial Bank (SCB), which reinvented itself at the level of technological infrastructure by using innovative elements (data migration to the cloud) and succeeding in becoming a digital bank. This strategic decision has enabled the bank to grow its digital app user base to over 13 million users in 2022, up from 2.5 million before the transformation programme. Currently SCB has included in its reinvention strategy "fintech business group" - a technology company that offers customer-centric services, including banking services. Restructured into a new entity, SCBx, the firm plans to expand its reach to 200 million people. The company is investing in new technologies, including blockchain, metaverse and Web 3.0.

Figure 15. Reinventors continuously invest in their digital core
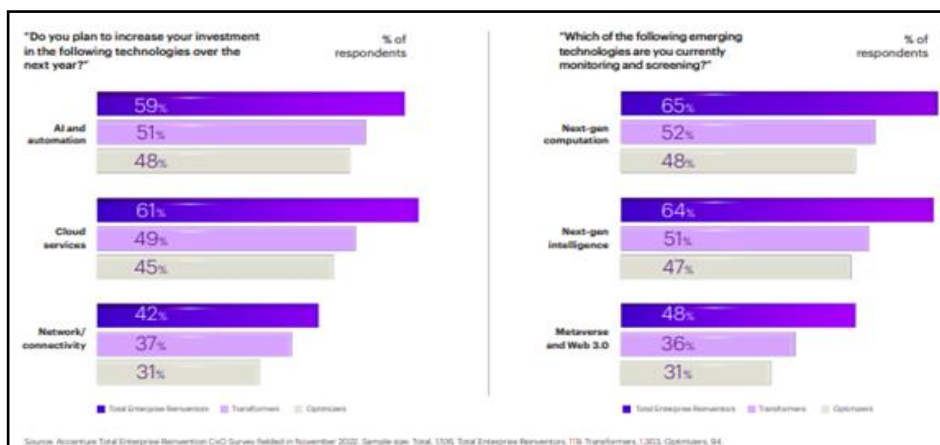
To define the market value of fintechs, we identified the top 10 fintech unicorns according to the market valuation, carried out by FinTech Magazine, and the largest fintech unicorns with a value of more than 1 billion USD in market valuation are: Stripe, Checkout.com, Revolut, Chime, Blockchain.com, Plaid, OpenSea, Devoted Health, Brex Ripple.

Conclusions. Bibliometric analysis on the subject of Fintech carried out in this paper, based on 363 documents identified in the Scopus database and published between 1984 and 2021, highlights the fact that the subject of Fintech is relatively new, but with a strong potential for further development. Furthermore, according to the data presented, we can say that the growing number of publications in recent years, especially since 2020, demonstrates the growth in popularity of the Fintech topic. This popularity can be explained on the one hand by the transition to the digital age (see the European Strategy on Digitization), and on the other hand by the accelerated development of innovative solutions in the Fintech field, also accelerated by COVID-19. Publications in prestigious journals such as the Journal of Management Information Systems and the Harvard Business Review indicate strong academic interest. Analysis of the most frequently used words reveals that "Fintech", "blockchain" and "digital transformation" are the most popular keywords. The relative popularity of the keyword "blockchain" could be explained by the association of authors who study the financial disruption and advancement of blockchain technology. In addition, through the biblioshiny program, the term "digital transformation" was mapped among the primary themes that require further research. Similarly, a shift in trending topics such as "digital transformation" and "innovation" as seen in VOSviewer indicates relatively recent academic interest in the topic. Moreover, the bibliometric analysis revealed that Lee Kuo Chuen, Arner, D. and Buckley, R. are the authors with the highest impact as measured by the h-index. The fact that the most productive authors are affiliated with relatively unknown universities can be explained by the fact that "most productive" does not necessarily mean "most cited", as the analysis shows that a higher number of publications does not guarantee more citations.

A limitation of this study is that the analysis was based on a relatively limited number of publications, which is a potential shortcoming that can be attributed to the developing stage of the subject (Manta, et al., 2022). This limitation may affect the results of the bibliometric analysis compared to the potential results if it had been performed on a larger sample size. It is also possible that there were publications in languages other than English that were not considered.

The progress of Fintech and its increasing impact on the financial system are expected to generate further academic interest and publications on the subject. Therefore, similar analyses can be performed at a later date, which could include a larger number of observations with which to compare the validity of the results presented in this paper, as well as the presentation of new trends and trends. The results of the analysis described in this paper represent an overview of the topic of Fintech as a financial disruptor. With this paper, the authors' goal and hope is to generate further interest and catalyze further research on this topic. The social and

economic impacts of financial disruption caused by Fintech are particularly promising areas for future study.

REFERENCES

Abubakar, J.; Aysan, A.F. (2022). Research Trends in the Field of Islamic Social Finance. *Eurasian Bus. Econ. Perspect. 23*, 253–268.

Aria, M.; Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr. 11,* 959–975.

Aysan, A. F., Belatik, A., Unal, I. M., & Ettaai, R. (2022). Fintech Strategies of Islamic Banks: A Global Empirical Analysis. *FinTech*, *1*(2), 206–215. https://doi.org/10.3390/fintech1020016

Aysan, A. F., Demirtaş, H. B., & Saraç, M. (2021). The Ascent of Bitcoin: Bibliometric Analysis of Bitcoin Research. *Journal of Risk and Financial Management*, *14*(9), 427. https://doi.org/10.3390/jrfm14090427

Biancone, P.P., Saiti, B., Petrican, D., & Chmet, F. (2020). The bibliometric analysis of Islamic banking and finance.*Journal of Islamic Accounting and Business Research, 11*, 2069-2086.

Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual Review of Information Science and Technology*, *37*, 179-255. https://doi.org/10.1002/aris.1440370106

Briones de Araluze GK, Cassinello Plaza N (2022) Open banking: A bibliometric analysis-driven definition. *PLoS ONE 17*(10): e0275496. https://doi.org/10.1371/journal.pone.0275496

Buttice, V., & Ughetto, E. (2021). What, Where, Who, and How? A Bibliometric Study of Crowdfunding Research. *IEEE Trans. Eng. Manag.* (99), 1-22. https://doi.org/10.1109/TEM.2020.3040902

Cai, C.W. (2018). Disruption of financial intermediation by FinTech: A review on crowdfunding and blockchain. *Account. Financ,* 58, 965-992.

Chen, T., & Peng, J. (2019). Statistical and bibliometric analysis of financial innovation. *Libr. Hi Tech.,* 38, 308-319.

Christensen, C. M., Raynor, M. E., Rory, M., & McDonald, R. (2015). What is disruptive innovation? *Harv. Bus. Rev,* 93, 44-53. https://www.pwc.com/us/en/financial-services/publications/viewpoints/assets/pwc-fsi-what-is-fintech.pdf

Deloitte. (2020, December). *Fintech: On the Brink of Further Disruption*. https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/financial-services/deloitte-nl-fsi-fintech-report-1.pdf

Deloitte. (2021). Five Fintech Trends. *What's Happening Now, and the Promise Ahead.* https://www2.deloitte.com/tr/en/pages/risk/articles/fintech-trends-insight.html

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.

Dosso, M., & Aysan, A. F. (2022). The Technological Impact in Finance: A Bibliometric Study of Fintech Research. In: *Eurasian Business and Economics Perspectives* (pp. 193-209). Cham, Switzerland: Cham.

Eyal, I. (2017). Blockchain technology: Transforming liberatrarion cryptocurrency dreams to finance and banking realities. *Computer,* 50, 38-49.

Firdaus, A., Ab Razak, M. F., Feizollah, A., Hashem, I. A. T., & Hazim, M. (2019) The rise of "blockchain": Bibliometric analysis of blockchain study. *Scientometrics,* 120, 1289-1331.

Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. *J. Manag. Inf. Syst*., 35, 220-265.

Haroune, L., Salaun, M., & Menard, A. (2014). Photocatalytic degradation of carbamazepine and three derivatives using TiO2 and ZnO: Effect of pH, ionic strength, and natural organic matter. *Sci. Total Environ*., 475, 16-22.

Janik, A., Ryszko, A., & Szafraniec, M. (2020). Scientific Landscape of Smart and Sustainable Cities Literature: A Bibliometric Analysis. *Sustainability*, *12*(3), 779. https://doi.org/10.3390/su12030779

Jiang, S., Li, X., & Wang, S. (2020). Exploring evolution trends in cryptocurrency study: From underlying technology to economic applications. *Finance Res. Lett*., 38, 101532.

Lakhe, P., & Kulkarni, M. (2020). FinTech regulations: Need, superpowers and bibliometric analysis. *Libr. Philos*. *Pract*., 1-11.

Lee, I., & Shin, Y. J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. *Bus. Horizons,* 61, 35-46.

Leong, C., Tan, B., Xiao, X., Tan, F., & Sun, Y. (2017). Nurturing a FinTech ecosystem: The case of a youth microloan startup in China. *Int. J. Inf. Manag.,* 37, 92-97.

Manta, O., Panait, M., Hysa, E., Rusu, E., & Cojocaru, M. (2022). Public procurement, a tool for achieving the goals of sustainable development. *Amfiteatru Economic*, *24*(61), 861-876.

Martinez-Climent, C., Zorio-Grima, A., & Ribeiro-Sorano, D. (2018). Financial return crowdfunding: Literature review and bibliometric analysis. *Int. Entrep. Manag. J*., 14, 527-553.

Muthukannan, P., & Gozman, D. (2019, December 15-18). Meeting the challenge of Fintech startups: The development of dynamic capabilities at incumbent banks. In: *Proceedings of the 40th International Conference on Information Systems*. ICIS. Munich, Germany.

Nasir, A., Shaukat, K., Khan, K. I., Hameed, I. A., Alam, T. M., & Luo, S. (2020). What is Core and What Future Holds for Blockchain Technologies and

Cryptocurrencies: A Bibliometric Analysis. *IEEE Access*, *9*, 989-1004. https://doi.org/10.1109/ACCESS.2020.3046931

Ndou, V., Mele, G., Hysa, E., & Manta, O. (2022). Exploiting technology to deal with the COVID-19 challenges in travel & tourism: A Bibliometric Analysis. *Sustainability,* *14*(10), 5917. https://www.opendatasoft.com/blog/2016/08/25/what-is-metadataand-why-is-it-important-data

Nobanee, H., & Ellili, N.O.D. (2022). Non-fungible tokens (NFTs): A bibliometric and systematic review, current streams, developments, and directions for future research. *Int. Rev. Econ. Financ*.

Sahni, N., & Lyne-Smith, K. (2022). *Metaverse: A New World of Opportunities.* CIO Academy. HSBC. https://www.privatebanking.hsbc.com/wih/investments-Insights/market-update/metaverse-a-new-world-of-opportunities

Sarhan, H. (2020). *Fintech: An Overview.* https://www.researchgate.net/publication/342832269

Seibel, H.D., & Khadka, S. (2002). SHG Banking: A financial technology for very poor microentrepreneurs. *Sav. Dev*., 26, 133-150.

Shibata, N., Kajikawa, Y., Takeda, Y., & Matsushima, K. (2008). Detecting emerging research fronts based on topological measures in citation networks of scientific publications. *Technovation*, 28, 758-775.

Shim, Y., & Shin, D. (2016). Analyzing China's fintech industry from the perspective of actor-Network theory. *Telecomm. Policy,* 40, 168-181.

Siek, M., & Sutanto, A. (2019). Impact Analysis of Fintech on Banking Industry. *Int. Conf. Inf. Manag. Technol*., 1, 356-361.

Statista. (2021). *Consumer fintech adoption rates globally from 2015 to 2019, by category.* https://www.statista.com/statistics/1055356/fintech-adoption-rates-globally-selectedcountries-by-category

Van Eck, N. J., & Waltman, L. (2010). *VOSViewer: Visualizing Scientific Landscapes* [Software]. https://www.vosviewer.com

Wu, P., (2017, December 4-8). Fintech trends relationships research: A bibliometric citation meta-analysis. In: *Proceedings of the 17th International Conference on Electronic Business* ICEB, (pp. 99-105). Dubai, United Arab Emirates.