Investigating the role of Fintech in the banking industry: what do we know?

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Abstract

Purpose – In recent years, the penetration of digital technologies in the financial industry determined the arising of Fintech, which generated a dynamic and rapid change that business operators and supervisory authorities in the banking industry are struggling to follow it. This is especially due to issues affecting financial intermediaries and customers, and potential risks of stability of the financial system. The aim of this paper is to provide a review of Fintech in the banking industry thus to update the knowledge about technology innovation in the banking sector, identify the major trends in the domain and delineate future research directions.

Design/methodology/approach – The study reviews 377 articles indexed on Scopus from 2014 to 2021 that focus on Fintech and the banking industry. The methodology adopted is structured in two steps: the keywords selection and the analysis of the documents extracted. The first step identified "Fintech" and "bank" as keywords to be searched within the title, abstract or keywords of documents indexed on Scopus; whereas the second step combined R and VOSviewer to provide a descriptive analysis of the dataset and the analysis of keywords and occurrences, respectively.

Findings – Results achieved in the study allow providing a systemic view of the Fintech in the banking industry, including the emergent phenomenon of digital banking. In particular, it is provided with a general overview and descriptive information on the entire sample of documents analyzed, their authors, the keywords used and the most cited works. Besides, a deepening on the model of digital banking is provided, by delineating the six dimensions of the key effects generated by the digital bank model.

Originality/value – Two main elements of originality characterize this study. The first one is related to the fact that few review studies have been published on Fintech in the banking industry, and the second one concerns the multiple dimensions of the impact of Fintech in the banking sector, which includes customer, company, bank, regulation authority and society.

Keywords Financial technologies, Financial services, Fintech, Innovation, Bank

Paper type Literature review

1. Introduction

"Disruptive innovations" is a term indicating a shift in the technological paradigm and business routines due to the introduction of new technologies, which allow for subverting an economic sector, increasing its competitiveness, redefining pre-existing business models and changing the consumers' behavior in the approach to products and services (Bower and Christensen, 1995; Tajudeen *et al.*, 2021). In the financial sector, the emerging digital technologies such as robot advisory, artificial intelligence, blockchain, big data, cloud computing, etc. have generated the disruptive innovation of Fintech by changing the traditional financial system and the entire competitive business dynamic through the introduction of new services for payment, insurance, asset management, as well as regulations and legislative foundations (FSB, 2017; Shaydullina, 2018).

This brought to the entry of new operators with innovative business models, thus pushing incumbent financial intermediaries to evolve toward digital transformation strategies and

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modifying the business relations with customers (EBA, 2018a; Spender *et al.*, 2017; Schena *et al.*, 2018). In this context, the relationships between Fintech operators and traditional financial operators are evolving toward new schemes of collaboration and integration, and this change is also reflected in the enhanced availability of digital and user-friendly financial products, as well as in the renewed relationship with smarter customers (EBA, 2018b; Temel *et al.*, 2021; Corvello *et al.*, 2021). Alongside significant market growth opportunities (e.g. digital payments, crypto-currency or peer-to-peer lending), technological innovations expose the financial sector to new risks that can compromise the sound and prudent management of operators, threatening the protection of customers, as well as the stability and efficiency of the entire sector.

On the other hand, the supervisory authorities are called for not limiting the evolution that is characterizing the sector but, at the same time, they must ensure the stability and efficiency of the system and the protection of the customer. The regulation of the Fintech sector, contrarily to what happens in other sectors, is not able to anticipate innovation, but it usually follows an adaptation pattern. Many countries have developed a mechanism known as a "regulatory sandbox" which offers intermediaries the opportunity to test a financial innovation with the support of the regulator, trying to reduce the risk (ESA, 2019). While this tool provides operators with the possibility to carry out a "controlled trial," on the other hand, it allows financial authorities to test and assess the impact on risks for the financial sector and define adequate internal and supervisory controls in an environment that constantly evolves.

For these reasons, in recent times, regulators, scholars, academicians and practitioners are wondering about the novelties and changes that Fintech is bringing to the financial sector, and in particular in the banking industry. Actually, most of the existing studies on Fintech in the banking industry provides only a partial view of the phenomenon, by focusing on very specific issues belonging to different scientific areas that include legal issues (Shaydullina, 2018), security issues (Milian *et al.*, 2019) and blockchain applications (Cai, 2018). Other studies focus on the geographical dimension of the phenomenon such as in Russia (Rudskaya *et al.*, 2018) or Indonesia (Putra *et al.*, 2019), and its distinguishing features with respect to other contexts (e.g. Europe or the USA).

From an institutional perspective, the Basel Committee on Banking Supervision (2018) discussed the effects of Fintech on the banking sector and assessed the risks and opportunities for both intermediaries and customers by highlighting the need for institutions to adapt from a purely supervisory perspective. Fintech regulation is in fact necessary to reduce risks and protect all those who use Fintech instruments, even if there is still no any common international regulatory framework for all countries (Das *et al.*, 2018).

Although the increasing interest of Fintech in the banking industry, few studies have been realized to provide a systematization of the domain and, in particular, literature studies are relatively scarce (Milian *et al.*, 2019). Besides, given the rapidity and pervasiveness of the change, we believe it is important to develop a systemic analysis of the existing literature on this topic in order to outline the current state of knowledge on Fintech in the banking industry, identify the major trends in the studies and delineate future research directions. In this perspective, by reviewing 377 articles indexed on Scopus, this article aims to provide a systemic view on the state of the art of Fintech in the banking industry and suggests possible proposals for future research developments.

The paper is structured as follows: Section 2 describes the theoretical background of the study and illustrates the arising of the Fintech paradigm; Section 3 illustrates the methodology adopted to carry out the study; Section 4 illustrates the results achieved by showing both descriptive data about the publications and authors engaged in the Fintech domain, and the main contributions provided in the domain; Section 5 discusses the results by highlighting both the research and practitioners' implications. Finally, Section 6 concludes the study by identifying the limits of the research and possible avenues for future studies.

2. Theory background

Digital technologies in the financial industry have contributed to the arising of the Fintech paradigm.

Fintech is a word combining the Internet-related technologies (e.g. mobile, cloud computing and blockchain) with the main processes characterizing the financial services industry (e.g. loans, payments and money transfers) (Gomber *et al.*, 2017).

A more formal definition of FinTech adopted by the regulation and professional bodies considers Fintech as a "technologically enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions, and the provision of financial services" (Agarwal and Zhang, 2020).

Actually, at an operational level, it includes financial services and solutions delivered by technology (Swan, 2017; Arner *et al.*, 2017), whereas at a more strategic level, Fintech represents a new financial industry that applies technology to improve financial activities (Schueffel, 2016), where companies both compete and collaborate each other, and also with financial institutions (Pollari, 2016).

Fintech services and applications have a significant impact on society and business through the diffusion of technology-enabled product categories such as loans, payments and billing, personal finance and asset management, money transfer and remittance, cryptocurrency, capital markets and crowdfunding (Milian *et al.*, 2019).

Also, the diffusion and usage of Fintech offer numerous benefits at both company and industry levels. Actually, Fintech provides risk finance to smaller innovative companies (Milne, 2016), sustains fairness and trustworthiness of financial transactions (Medeiros and Chau, 2016), guarantees lower costs of transactions (Teja, 2017), support safe and transparent transactions (Rooney *et al.*, 2017), lowers entry barriers for new players and creates new business models and startups (Krishnan, 2017). More specifically, concerning the last issue, the main Fintech business models include insurance services, crowdfunding, payment, lending, wealth management and capital markets (Lee and Shin, 2018).

Although the numerous applications of Fintech services worldwide and its growing relevance for both academicians and financial managers (Schueffel, 2016), there are still few studies that provide a literature overview on Fintech with the aim to build a consensual definition and highlight the key research topics (Milian *et al.*, 2019). Such studies are briefly introduced below.

Shaydullina (2018) focused on the analysis of Fintech from a normative perspective, by comparing the country-based regulations at the international level in order to highlight the need for harmonization of the different approaches adopted by the different authorities to support the development and diffusion of technological innovation, especially in the bank industry. Cai (2018) adopted an interdisciplinary approach to study the Fintech paradigm mainly from a social and economic perspective. By adopting the customer view, Putra *et al.* (2019) studied the sentiment of end-users with the aim to improve and align better the Fintech services with the market expectations.

The most recent literature studies have focused on the diffusion of Fintech in the financial intermediation domain, especially for lending and payment systems, thus highlighting the need to test the new technological products through sandbox regulation (Suryono *et al.*, 2020). In their research, the authors have also highlighted the key research topics characterizing the Fintech domain such as payment, clearing and settlement; risk management and investment; market aggregation; crowdfunding; peer-to-peer lending; cryptocurrency and blockchain. Finally, the authors analyzed also the most challenging issues that concern the proposition of new frameworks and models for Fintech, the exploration of new regulations and policies, the analysis of portfolio risk management and data privacy and security (Suryono *et al.*, 2020).

Further research have analyzed Fintech to investigate how it may affect the transmission of monetary policy, as well as the information content of key monetary indicators, by focusing on two key issues (Agarwal and Zhang, 2020): the credit supply by banks and capital raising in the market, and the innovations in payment and clearing services.

Afterwards, Agarwal and Chua (2020) investigated the effect of Fintech on personal finance with the aim to study their effect on the overall financial development and national competitiveness, including the security levels of financial services.

Some more niche studies focused on the characteristics of those technologies that enable the development of the bitcoin as the blockchain (Fosso Wamba *et al.*, 2020) or on the models underpinning the development of the Fintech domain for specific targets such as the Islamic countries (Rabbani *et al.*, 2020).

A more recent study focused on the drivers of Fintech demand and offer (Utami *et al.*, 2021), thus contributing to both the development of the overall financial sector and the resolution of social problems and financial inclusion, especially in Europe and Asia (Takeda and Ito, 2021).

Table 1 provides a synthetic summary of the main literature review studies on Fintech, by indicating the aims of the paper, the methods adopted and the main findings achieved.

As shown in Table 1, existing literature studies on Fintech provide a partial view of the phenomenon and do not highlight in a systemic way the patterns of evolution of the main conceptual pillars, as well as the most active contributors. In this perspective, this paper aims to provide a systemic view on the state of the art of Fintech in the banking industry and suggests possible proposals for future research developments, by answering the following research question: What are the main concepts existing in the literature that characterize the Fintech in the banking industry?

3. Research method

The method adopted to carry out this study is the Systematic Literature Review (Kitchenham *et al.*, 2008). This allowed for both grouping existing studies about the Fintech paradigm and deriving coherently insights and considerations useful for researchers and professionals involved in this domain (Kitchenham, 2004). The analysis consisted of two main steps, which are: (1) the selection of keywords and database in order to extract the set of documents to analyze; (2) the analysis of the entire list of documents extracted. The two steps are described below.

3.1 Selection of keywords and database

The initial step concerned the identification of the keywords and database to use for the search. For this purpose, the search string included the terms "FinTech" and "bank" to be searched within the title, abstract or keywords of documents indexed on Scopus. The choice of the two keywords allowed to focus the attention on the core issue to investigate, which concerns the study of the literature of Fintech in the banking sector. The search process returned 377 documents, related to a time range from January 2014 to February 2021.

3.2 Literature analysis

The literature analysis has been performed by using two software tools, i.e. R and VOSviewer. The former was used to provide a descriptive analysis of the dataset such as the trend of publications over time, the most cited documents, the most cited authors and the most productive countries (Aria and Cuccurullo, 2017; Chambers and Hastie, 1992). The latter was used to conduct a co-occurrence analysis and provide more details about the occurrences of keywords (number of times a keyword is used) and the strength of the links (the number of

Table 1. Summary of the literature review studies on Fintech in the banking industry

N	Author/s and year	Aims of the paper	Methods	Main findings
1	Shaydullina (2018)	• To identify institutional and legal drivers for the development of the Fintech sector through the launch of new financial products that leverage the features offered by the digital technologies	• Analysis of the legislation of 23 countries that are leaders in the Fintech domain	Three main approaches to the Fintech regulation • Legislation is neutral toward the digital technologies (as happens in Australia, China, Spain, the USA, Canada, Japan, Singapore, Malaysia, Russia, Germany, Estonia, New Zealand) • Legislation encourages the adoption of digital technologies for the development of Fintech by offering exemptions and benefits (as happens in Korea, India, Swiss, Spain, Ireland, UAE), by supporting sandbox activities and the incubation of Fintech startups (as happens in Hong Kong, Japan, Singapore, UAE, Indonesia, Netherlands, UK, Korea, Australia, Canada, Swiss, Malaysia) • Legislation changes radically and allows for the creation of a new systemic framework specially designed for the Fintech domain (as happens in the UK, Hong Kong, UAE)
2	Cai (2018)	• To provide a systemic map about the main themes characterizing the research on Fintech in Economics and Finance • To provide an overview on crowdfunding and blockchain	• Bibliographic mapping of 402 papers published in the period 2010–2018	• The awareness of the importance to adopt an interdisciplinary approach that combines technology, economy and psychology to comprehend deeply the Fintech paradigm
3	Putra *et al.* (2019)	• To highlight the importance for Fintech companies of knowing in real-time the customers' opinions in order to face the market competition • To propose a methodology that leverages sentiment analysis techniques for classifying the customers' opinions	• Text mining methodology and algorithm to analyze English and Bahasa texts extracted from Google Android Play Store	• Two applications of sentiment analysis for understanding the mood of customers toward Fintech services in Indonesia

(*continued*)

Table 1.

N	Author/s and year	Aims of the paper	Methods	Main findings
4	Suryono *et al.* (2020)	• To comprehend the trends and challenges of the research on the Fintech domain	• Structured literature review supported by the NVIVO suite, which included 1,002 research articles extracted from ACM, IEEE, SCOPUS and ScienceDirect databases	• Research on Fintech is mainly focused on: digital payment, risk management, new funding models (crowdfunding and peer-to-peer lending), market aggregators, crypto currency and blockchain • The main challenges of the research on Fintech concern the definition of an integrated framework integrating both business dynamics and cultural flows, which influence governmental policies and laws • Effective Fintech services require huge data management capabilities and controlling procedures, which call for continuous development of both infrastructural and security policy • Fintech is a strategic partner enabling the digital transformation of the bank industry
5	Agarwal and Zhang (2020)	• To highlight the recent development of Fintech toward banks and customers, especially for what concerns credit provisioning and payment services	• Review of the literature on Fintech and its impact on the bank industry • Review of studies on mobile digital payment and its effect on e-commerce	• Fintech is an emerging paradigm that requires more study and research, especially for what concerns the regulation for the digitalization of money and the effectiveness of instruments of monetary policy
6	Agarwal and Chua (2020)	• To understand how the Fintech paradigm has influenced the family finance, and especially the payment, loans and portfolio investments	• Empirical analysis of international data concerning digital payments, mobile money, digital loans, robo-advising, and crowdfunding	• The diffusion of Fintech contributed significantly to enhance the family consumption and loans, sometimes beyond the own possibilities
7	Fosso Wamba *et al.* (2020)	• To shed the light on Bitcoin, blockchain and Fintech by providing an integrative framework through which categorizing both research and practitioner contributions, and debating on the main advantages and challenges related to their mutual interactions	• Mixed method combining a literature review including 141 articles published in the period 2007–2017 with case study applied to three companies	• A systematization of the concepts related to Blockchain and Fintech • An integrative framework that includes applications, sources of benefits and value, set of challenges and problems and research methodologies to build robust business cases in the Fintech domain

(*continued*)

N	Author/s and year	Aims of the paper	Methods	Main findings
8	Rabbani *et al.* (2020)	• To understand the development of Fintech in Islamic countries by focusing on three main issues: opportunities and challenges of digital technologies for the financial industry, level of fit between crypto currency and blockchain with the sharia and regulation	• Structured literature review and analysis of 133 research articles	• The level of fit between crypto currency and blockchain with the sharia represents the main challenges that Fintech players in Islamic countries are facing • Fintech players in Islamic countries are considered key partners of financial institutions rather than competitors • Islamic financial institutions have the opportunity to enhance efficiency, transparency and customer satisfaction by establishing a partnership with Fintech Islamic operators
9	Utami *et al.* (2021)	• To reveal the main factors influencing the adoption of Fintech products by considering both the customers (consumers of Fintech products) and companies (providers of innovative Fintech products) perspective	• Review of the main articles concerning the Fintech published in the period 2010–2020	• The main factors influencing the adoption of Fintech products are: product orientation, investments in R&D and technologies, continuous learning, market orientation, strategic cooperation with stakeholders, environmental pressures and communication between customers and companies
10	Takeda and Ito (2021)	• To investigate how digital technologies can innovate financial services and provide better services to the customers	• Analysis and classification of 88 articles to derive the value generated by the application of digital technologies to financial services	• Fintech operators provide solutions to social problems through the design of new financial ecosystems • The most used technology for Fintech services is blockchain

Table 1.

times two keywords are used simultaneously). For a more efficient representation, the co-occurrence analysis considered only the keywords with at least five occurrences.

The results of data processing are shown through the network visualization and overlay visualization, by using the association strength method to normalize the strength of the connections between the elements (Eck and Waltman, 2009).

More specifically, the network visualization mode highlights how the keywords are connected (the thicker the line connecting two keywords, the greater the number of links between them), the relevance of each keyword (through the size of the circle) and the most significant clusters.

As for the overlay visualization, it allows for identifying any trend topics by showing the periods in which a specific keyword was used, thus creating clusters of keywords belonging to the same period.

4. Results

The findings of the overall analysis are here reported and presented. Coherently with the research goal of the article, they highlight six main dimensions that are: (1) a general overview and descriptive information on the entire sample of documents extracted from Scopus; (2) information about the publication outlet in terms of typologies of documents; (3) a synthesis about the number of authors revealed by the analysis, as well as the most productive author and country; (4) an analysis of the keywords used to classify the papers by considering both the bottom-up keywords defined by the author (DE–Author Keywords) and the top-down and standardized keywords defined by Scopus (ID–Index Keyword-Plus); (5) a synthetic view about the top 20 most cited manuscripts; (6) and finally a deepening on the model of digital banking.

4.1 Descriptive information on the papers selection

Table 2 shows the main information on documents and authors related to the 377 papers extracted from the Scopus database and published in the period 2014–2021.

Table 2 shows that every document was cited 3 times on average, and the sample included 85 single-authored documents out of a total of 888 authors. Besides, on average, two authors cooperated in drafting a document as highlighted by the collaboration index calculated as the total authors of multi-authored documents/total multi-authored documents (Elango and Rajendran, 2012).

In terms of the number of papers published on Fintech related issues, Figure 1 shows a growing trend in the period of analysis. This result is in line with the diffusion of these new technologies in the financial industry and highlights the great importance and interest of the theme in the scientific community.

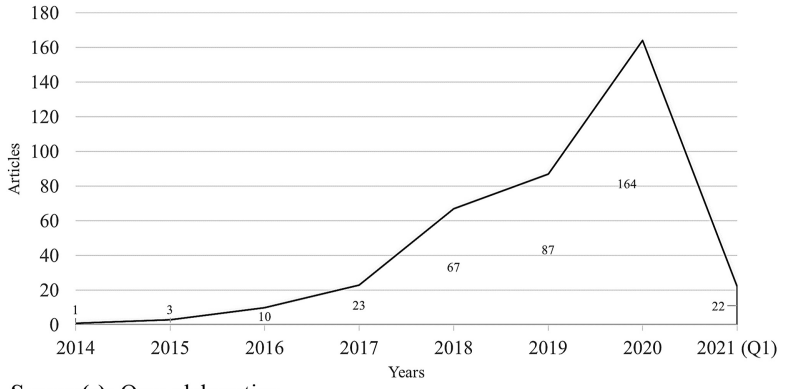
4.2 Publication outlet

As for the publication outlet, 233 documents extracted have been published in scientific journals (61.8%), 100 in conference proceedings (26.5%), 17 as book chapters (4.5%), 10 as reviews (2.7%), 10 as books (2.7%) and the rest of other types (1.9%).

The most relevant sources are the *Journal of Payments Strategy and Systems* with eight articles published, *ACM International Conference Proceeding Series* with seven articles published, the *International Journal of Scientific and Technology Research* with 7 articles published, the *Journal of Economics and Business* with seven articles, *Sustainability* with six papers and *Advances in Intelligent Systems and Computing* with five papers. This confirms a significant interest of scholars having a profile not completely centered on the financial themes but also open to explore digital technologies for finance and financial intermediation processes.

Documents area	N°
Documents	377
Sources (Journals, Books, etc.)	262
Index keywords plus (ID)	998
Author keywords (DE)	1,074
Average citations per documents	2.905
Authors area	**N°**
Authors	888
Author Appearances	948
Authors of multi-authored documents	803
Single-authored documents	85
Documents per Author area	***Percent***
Documents per author	0.425
Authors per document	2.36
Co-Authors per documents	2.51
Collaboration index	2.87

Table 2.
Information on the papers selection (period 2014–2021)



Source(s): Own elaboration

Figure 1.
Annual scientific production since 2014

4.3 Productivity analysis

The analysis reported in Table 2 revealed the presence of 888 different academic authors who contributed to the literature. In particular, as shown in Table 3, most of the publications are written by two authors (33.69%) or a single author (24.14%), with a limited contribution produced by three authors (18.04%), four authors (13%) or more.

Among the 10 most productive authors, the average number of the article published per author is 3, as shown in Table 4. Moreover, the countries of origin of the aforementioned authors are all outside the European area.

From a geographical perspective, Figure 2 shows the 10 most productive countries, by highlighting both the Single Country Publications (SCP) and Multiple Country Publications (MCP) metric. More specifically, the SCP represents the number of publications resulting from collaboration between authors from the same country, whereas the MCP represents the

number of publications with authors from different countries. China contributes to the total literature production on the Fintech domain with 28 articles, 24 of which written by authors from the same country and 4 resulting from collaboration with other countries. Korea with 17 articles and the UK with 16 articles follows, respectively. Finally, Korea, Indonesia and France are totally characterized by a country-centered production.

4.4 Keywords analysis

Keyword analysis plays a crucial role in the literature study. The keywords outline the main topics dealt with by the article they refer to. By studying the keywords through the co-occurrence analysis, it is possible to identify those macro-areas made up of similar topics. Table 5 shows the 10 most relevant keywords organized by two categories such as "Author keywords (DE)" and "Index Keyword-Plus (ID)." Differently from the DEs that are defined by the single author, the IDs are standardized because they are defined by Scopus to simplify the research.

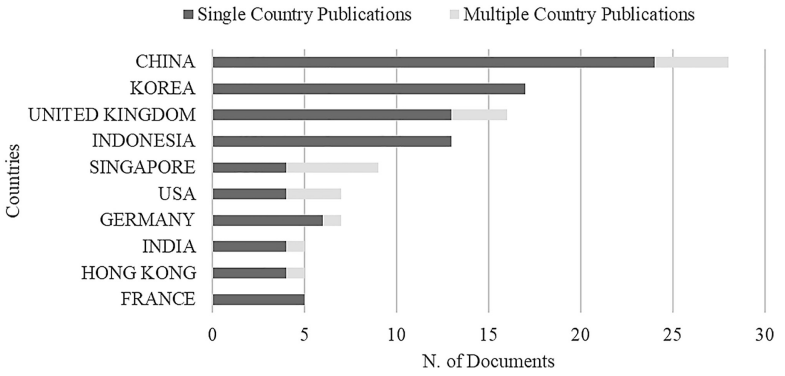
These results are interesting because they allow us to form a general overview of what has been covered in the literature and what needs more attention. In fact, the main themes that emerge from the analysis are related to the use of digital technologies (e.g. blockchain, big

Table 3.
Authorships per paper

Authorship	Frequency	Percent
Single author	91	24.14%
Two authors	127	33.69%
Three authors	68	18.04%
Four authors	49	13.00%
Five authors	25	6.63%
>5 authors	11	2.92%
Authors do not appear	6	1.59%
Total	377	100%

Table 4.
Most productive authors

	Author name	Author's country	Affiliations	No of papers
1	Baber, H.	Daejeon, South Korea	Endicott College of International Studies, Woosong University	4
2	Jagtiani, J.	Philadelphia, PA, United States	Federal Reserve Bank of Philadelphia	3
3	Knaack, P.	Oxford, United Kingdom	Blavatnik School of Government, University of Oxford	3
4	Sinha, S.	Gurgaon, India	M-CRIL	3
5	Wang, Y.	China	School of Economics, Capital University of Economics and Business	3
6	Zhang, J.	Middlesbrough, United Kingdom	School of Computing, Engineering and Digital Technologies, Teesside University	3
7	Agrawal, S.	Uttar Pradesh, India	IILM Academy of Higher Learning, Lucknow	2
8	Coetzee, J.	South Africa	Department of Economics and Finance, University of the Free State	2
9	Arami, M.	London, United Kingdom	PARDIS Ltd	2
10	Bataev, A.	St. Petersburg, Russian Federation	Peter the Great St. Petersburg Polytechnic University	2



Source(s): Own elaboration

Figure 2.
Most productive countries

	Author keywords (DE)	Articles		Index keywords-Plus (ID)	Articles
1	Fintech	169	1	Fintech	78
2	Blockchain	28	2	Banking	38
3	Banking	23	3	Sales	26
4	Financial technology	20	4	Finance	25
5	Banks	17	5	Commerce	21
6	Financial inclusion	16	6	Blockchain	20
7	Big data	13	7	Financial institution	19
8	Artificial intelligence	11	8	Financial service	17
9	Bank	11	9	Big data	14
10	China	11	10	Competition	14

Table 5.
The most relevant keywords (author keyword versus index-keyword plus)

data and artificial intelligence) and their impact on the organization (e.g. banking, financial inclusion, sales, finance and competition).

A more detailed investigation of this issue has been carried out by using network and cluster analyses. Such analyses have been conducted on the entire sample of 377 documents, and two measures have been calculated such as: (1) the index keywords co-occurrence; and (2) the author's keywords co-occurrence. Figure 3 identifies five clusters of documents based on the values of the Index Keyword co-occurrences.

The first cluster (in red) is identified by the keywords "big data," "business modeling," "commerce," "commercial bank," "competition," "costs," "electronic commerce," "financial innovation," "financial markets," "fintech," "investments" and "peer to peer networks." This cluster represents the field of research relating to studies on the impact of Fintech on business models of traditional banks (e.g. Acar and Çıtak, 2019; Rangkuti *et al.*, 2020; Zhang and Zhuang, 2020). Furthermore, this cluster analyzes how big data technology can be used to acquire customer information for optimizing the service offering and enhance the market positioning (e.g. Gupta *et al.*, 2019; Zhao, 2020; Zhuo *et al.*, 2020).

The second cluster (in green) includes the terms "banking," "Blockchain," "China," "decision making," "finance," "financial market," "financial systems," "information systems" and "information use." This cluster groups the studies for deeply understanding blockchain technology and discovering how it can be applied to innovate the offering of the financial industry (e.g. Luz and Farias, 2020).

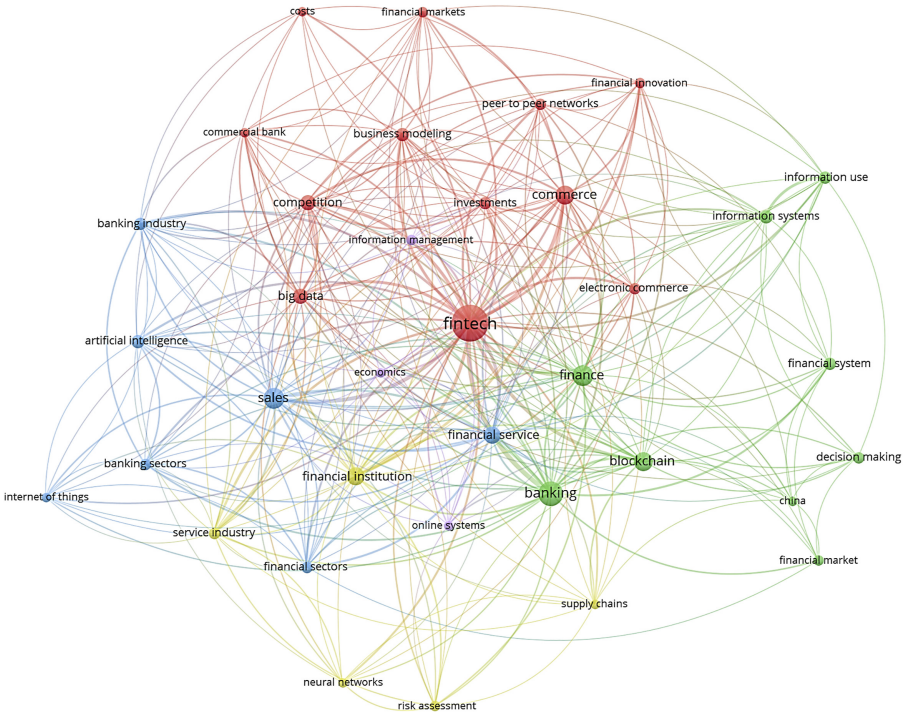


Figure 3.
The 36 most frequent index keyword co-occurrences

Source(s): Own elaboration

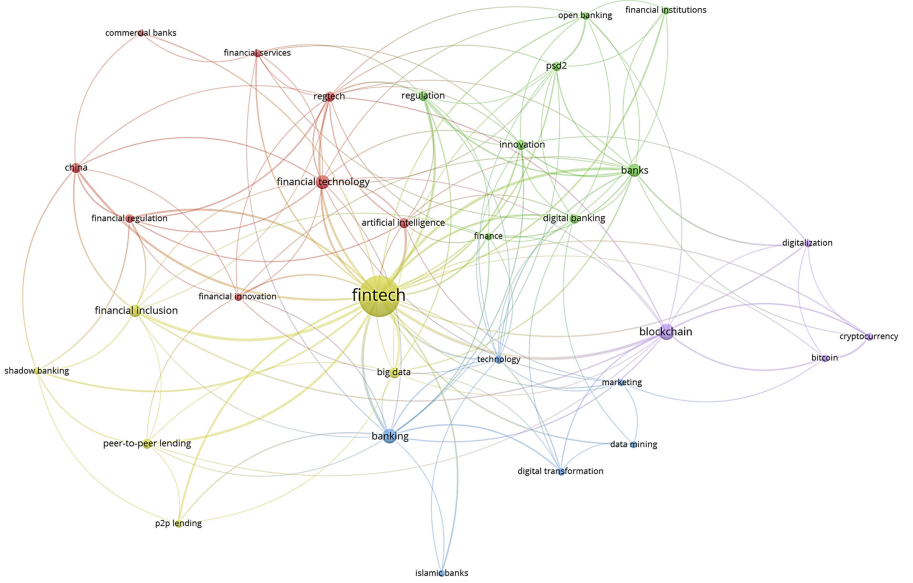
The third cluster (in blue) is made up of "artificial intelligence," "banking industry," "banking sectors," "financial sectors," "financial service," "Internet of things" and "sales." This cluster refers to the use of artificial intelligence to analyze consumer behaviors for implementing new financial services and applications (e.g. Belanche *et al.*, 2019; Quah and Chua, 2019).

The fourth cluster (in yellow) is identified by the keywords "financial institution," "neural networks," "risk assessment," "service industry" and "supply chains." This cluster concerns the assessment of financial risk related to the adoption of Fintech technologies along the entire supply chain (Sang, 2020).

Finally, the fifth cluster (in purple) is made up of "economics," "information management" and "online systems." This cluster groups together studies related to the analysis of different aspects of Fintech connected to the banking system in order to support managerial decision-making processes (e.g. Neng, 2017; Tay and Mourad, 2020).

Similarly, Figure 4 highlights five clusters of documents based on the values of the Authors' Keyword co-occurrences.

The first cluster (in red) is identified by the keywords "artificial intelligence," "China," "commercial banks," "financial innovation," "financial regulation," "financial services," "financial technology" and "regtech." This represents the research field related to studies that analyze financial technologies from a regulatory point of view. Representative studies deal with the topic of artificial intelligence to analyze the legislative gaps and the use of financial technology to design regulation, also known as "regtech" (e.g. Dashottar and Srivastava, 2021).



Source: Own elaboration

Figure 4.
The 32 most frequent authors' keyword co-occurrences

The second cluster (in green) is made up of "banks," "digital banking," "finance," "financial institution," "innovation," "open banking," "PSD2" and "regulation." This cluster represents the research field focused on digital banking. This cluster brings together the studies carried out in the field of open banking and digital banking following the PSD2 regulation about the new categories of payment service providers (e.g. Döderlein, 2018; Premchand and Choudhry, 2018), with the related opportunity and risk analysis (Romānova *et al.*, 2018).

The third cluster (in blue) includes the keywords "banking," "data mining," "digital transformation," "Islamic banks," "marketing" and "technology." This cluster refers mainly to studies focused on the development of new tools for data mining, and in particular to predict the future state of corporate banking clients (Osowski and Sierenski, 2020), to assess the riskiness of lending to consumers (Saia *et al.*, 2019), to envision the feasibility of a model based on blockchain technology to assist financial institutions in their digital transformation (Boulmakoul and Khanboubi, 2019).

The fourth cluster (in yellow) is identified by the keywords "big data," "financial inclusion," "Fintech," "p2p lending," "peer-to-peer lending" and "shadow banking." This cluster refers to studies on financial inclusion and pervasiveness, bringing together studies addressing the issue of credit granting, with related benefits and risks (e.g. Jagtiani and Lemieux, 2018; Jagtiani and Lemieux, 2019; Knaack and Gruin, 2020).

Finally, the fifth cluster (purple) includes "bitcoin," "Blockchain," "cryptocurrency" and "digitalization," thus focusing on security issues through digital technologies. This cluster brings together studies that have contributed to broadening the knowledge of cryptocurrency (e.g. Arli *et al.*, 2021; Dupuis and Gleason, 2020; Nabilou, 2020), and in particular of Bitcoin (e.g. Saiedi *et al.*, 2020).

Shifting toward the Index Keyword co-occurrences, Figure 5 shows the temporal trend of the 36 more frequent Index Keyword co-occurrences, by considering the period from 2018 to 2020.

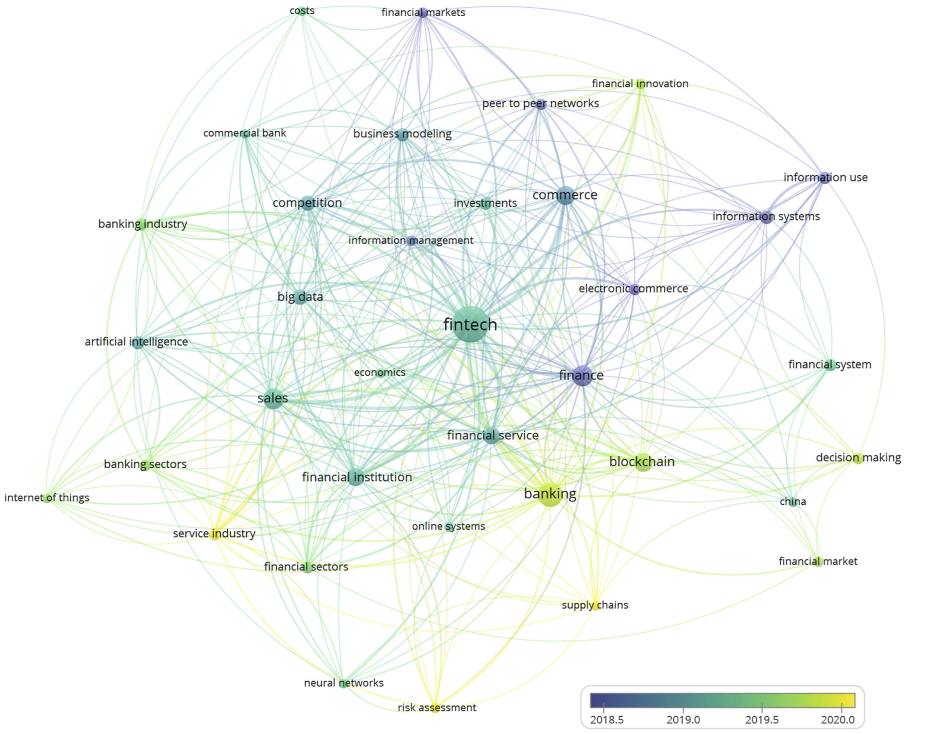


Figure 5.
Temporal trend of the 36 more frequent index keyword co-occurrences

Source(s): Own elaboration

In 2018, keywords such as "electronic commerce," "financial markets," "peer-to-peer networks," "information systems," "information use," "finance," "information management" and "commerce" were used, which highlight that the central theme of the research concerned mainly the potential of Fintech. In that period, research was carried out to study how the retail banking sector should adapt to new service innovations (Gozman *et al.*, 2018), how the business model of banks would evolve by fostering collaboration with Fintech companies (Schmidt *et al.*, 2018) and finally how the peer-to-peer lending would be treated (Patwardhan, 2018).

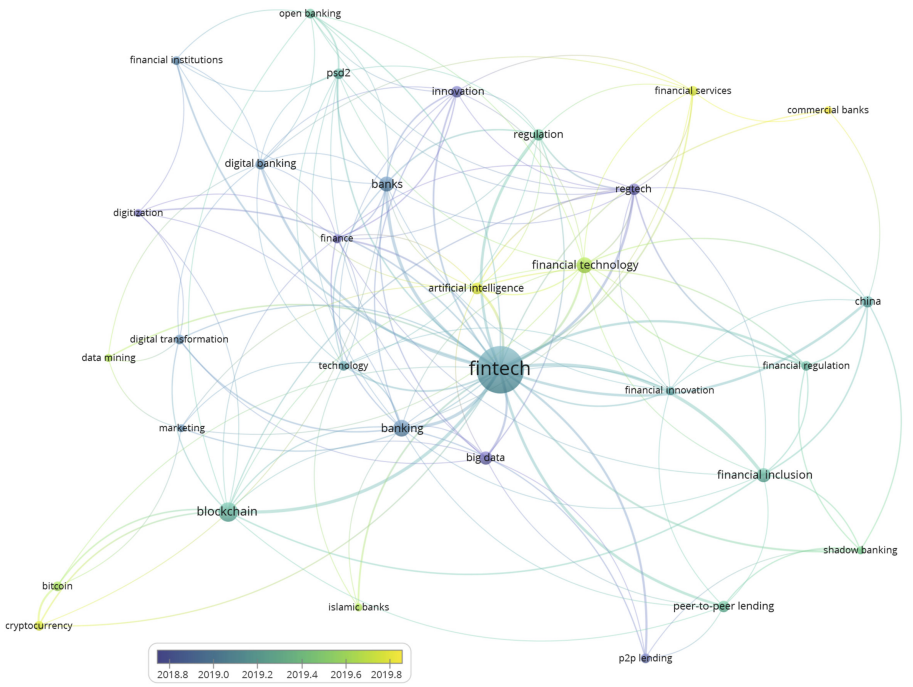
Then, in 2019, keywords such as "competition," "financial service," "China," "online system," "big data," "Fintech," "sales," "financial institution," "economics," "artificial intelligence," "costs," "commercial bank," "neural networks," "business modeling," "investments," "financial sectors," "financial innovation," "banking industry," "Internet of things," "banking sectors," "banking," "Blockchain," "decision making," "financial market" and "financial system" were used more frequently. Such keywords highlight that the core of the research was mainly focused on service innovation and delivery. During that year, numerous topics emerged. The first group of studies concerned how big data technology could be used to acquire information on customers to optimize the service offering, thus increasing the competitiveness of financial intermediaries on the market (e.g. Gupta *et al.*, 2019). Another group focused on the impact that financial innovation can have on the business models of banks (e.g. Acar and Çıtak, 2019).

In 2020, the most used keywords were "service industry," "supply chains" and "risk assessment," which underline that the main research theme of that period concerned the financial risk assessment of the supply chain (Sang, 2020).

By continuing the analysis, Figure 6 shows the most used Authors' Keywords in the period from 2018 to 2019.

Figure 6 shows that at the end of 2018, the most used Authors' Keywords were "regtech," "innovation" and "finance," thus confirming the focus on the use of new tools to support the regulatory processes. In the first half of 2019, the Authors' Keywords were "digitalization," "digital banking," "banks," "banking," "Fintech," "financial institution," "financial innovation," "China," "technology," "marketing," "digital transformation," "psd2," "open banking," "regulation," "financial regulation," "financial inclusion," "Blockchain," "peer-to-peer lending," "bitcoin" and "shadow banking." Such keywords confirm that the interest was primarily oriented toward the field of open banking and digital banking following the PSD2 regulation, which regulates the new categories of payment service providers (e.g. Premchand and Choudhry, 2018). Afterwards, the attention focused on peer-to-peer lending (e.g. Jagtiani and Lemieux, 2019), by following the issue of the Fifth Anti-Money Laundering Directive, which regulates the new categories of exchange service providers between virtual currencies and legal currencies and digital wallet. Later, in the second half of 2019, the most used Authors' Keywords were "financial services," "financial technology," "artificial intelligence," "cryptocurrency," "big data," "data mining," "Islamic banks," "p2p lending" and "commercial banks," which highlight the arising of new trends in the domain, especially oriented to support the assessment on corporate banking customers (Osowski and Sierenski, 2020).

Finally, Table 6 shows how the FinTech activities highlighted by the Financial Stability Institute (FSI, 2020) and reported into the rows are supported by the FinTech clusters derived from VOSviewer, in order to identify differences and complementarities.



Source(s): Own elaboration

Figure 6.
Temporal trend of the 32 most frequent authors' keyword co-occurrences

4.5 Top 20 most cited manuscripts

This section provides the main results derived from the analysis of the 20 most cited papers, which are listed in Table 7. The table highlights that most of these papers were published in 2017 (7 articles), 2018 (5 articles) and 2019 (5 articles). Moreover, most of them were carried out on a national basis, while few studies deal with the topic at a global level. The analysis of such articles reveals that there is a great interest in studies focused on Fintech in China and USA, whereas there is a limited attention in the European context. The case study is the most diffused methodology, probably also to overcome the lack of official and large data sources available on the Fintech phenomenon. Moreover, most of the papers analyze the relationship between FinTech and the banking sector, a high number of documents deals with the lending theme, and there is a low interest in FinTech regulation.

4.6 Fintech and digital banking

Focusing on the sub-group of articles specifically dealing with the phenomenon of digital banking, the analysis identified 16 papers that envision the model of the bank of the future, which combines virtuously the reduction of costs with the enhancement of customer experience.

Table 7 lists such 16 papers extracted from the group of 377 documents, which allowed to identify the 6 dimensions of the key effects generated by the digital bank: (a) effects on the entire industry; (b) effects on the business model; (c) effects on the society, especially from the family perspective; (d) effects on the customers and their relationship with the banks; (e) effects on the lending process toward small and medium enterprises; and (f) effects on the level of innovation of financial services.

Table 8 illustrates which papers address the six dimensions characterizing the relationship between Fintech and Digital Banking.

The dimension (a) includes articles that examined the Fintech impact on traditional bank's role and work. Bhasin and Rajesh (2021) analyzed the challenges and opportunities faced by the Indian banking system. Dratva (2020) discussed the main effects and benefits that open banking could bring to the banks. Gupta and Xia (2018) analyzed the changes that Asian banks faced due to the penetration of new digital technologies, by highlighting the primary position of Asian banks in Fintech transactions and the strategic importance of governments and central banks in supporting Fintech development. Finally, Li *et al.* (2017) examined the impact of the financing of Fintech start-ups on the equity returns of US retail banks.

The dimension (b) deals with articles that examined the banking sector transformation stimulated by market penetration of the Fintech paradigm. Rangkuti *et al.* (2020) identified the IT impacts on the business model change of a specific bank. Klioutchnikov *et al.* (2019) examined the role of big data in developing the banking business model, discovering a link between the "financialization" of the economy and the increase of information flows in the banking sector. Khanboubi and Boulmakoul (2019) offered an approach that can support

Table 6. Matching FinTech activities

Fintech activities by FSI	Fintech cluster by VOSviewer	
	Index Keyword	Authors' Keyword
Deposit and lending	X	X
Capital-raising	X	X
Asset management	X	
Payments, clearing, settlement		X
Insurance		
Cryptoassets	X	X

No	Author (s)	Year	Citations	TCperYear	Themes	Methodology	Spatial Scales
1	Buchak *et al.*	2018	55	13.75	Evolution of shadow banking and FinTech lenders	Quantitative model	USA
2	Larios-Hernández	2017	49	9.8	Blockchain entrepreneurship opportunity	Fuzzy-set Qualitative comparative Analysis (fsQCA)	Global
3	Anagnostopoulos	2018	43	10.75	Implications for financial institutions and regulation, possible evolution of FinTech	Review	Global
4	Mao *et al.*	2019	41	13.67	Developing a new method for MAGDM with PLTSs, application of the method to a FinTech example	New method, case study	China
5	Kandpal and Mehrotra	2019	31	10.33	Financial inclusion: The role of fintech and digital financial services	Review	India
6	Japparova and Rupeika-Apoga	2017	29	5.8	Banking sector changes	Case study, review	Latvia
7	Belanche *et al.*	2019	28	9.33	Better understand robo-advisor adoption	Survey	Global
8	Yan *et al.*	2015	27	3.86	Impacts of big data in the lending business, theory on the economics of big data, theoretical guidelines	Theoretical overview	General
9	Chen *et al.*	2017	13	3.25	The transformation and upgrade of traditional banks into everyday banks through FinTech, The difficulties involved in transforming Chinese banks	Comparative case analysis method	China
10	Jagtiani and Lemieux	2018	26	6.5	FinTech lenders' penetration of areas that are underserved by traditional banks, the impact of FinTech lending on the availability of unsecured consumer credit	Case study	USA
11	Jung *et al.*	2017	25	6.25	Robo-advisory solutions for risk-averse, low-budget, inexperienced consumers	Lab study	General
12	Drasch *et al.*	2018	25	6.25	A taxonomy for cooperation between banks and FinTech	Conceptual-to-empirical (C2E), Empirical-to-conceptual (E2C)	General

(*continued*)

Table 7.
Top 20 most cited papers

No	Author (s)	Year	Citations	TCperYear	Themes	Methodology	Spatial Scales
13	Maier	2016	24	4	SME behavior to switching to crowd-lending, consumer innovativeness as a driver of this switching, consumer investments in SME loans	Field study	Europe
14	Romānova and Kudinska	2016	23	3.83	The development of financial innovation and technology market, the existing practices applied in the FinTech, the main risks related to Fintech development, financial innovations the banks are exposed to at micro and macro level	Synthesis, comparison, generalization and specification, expert evaluations, survey, graphical analysis of statistical information	Trans-national
15	Wonglimpiyarat	2017	20	4	Exploration of FinTech and its dynamic transitions in the banking industry, the development of systemic innovation model	Case study	Thailand
16	Li *et al.*	2017	20	4	The role of startups in FinTech and digital banking, in the overall financial industry	Regression method	USA
17	Hu *et al.*	2019	19	6.33	The adoption of Fintech services	Technology acceptance model (TAM)	General
18	Saksonova and Kuzmina-Merlino	2017	18	3.6	Development of Fintech, recommendations for managers	Survey	Latvia
19	Tsai and Peng	2017	18	3.6	The FinTech revolution, Financial regulation	Theoretical overview, case study	China
20	Zhao *et al.*	2019	18	6	Improvement financial service innovation strategies for enhancing China's banking industry competitive advantage	Hybrid MCDM model	China

Table 7.

financial institutions in their digital transformation process. Soloviev (2018) analyzed the Russian context and showed that there has not been a radical change within the financial sector. Riyanto *et al.* (2018) examined the attitude of Indonesian banks toward the change process, and how they changed their business model according to industrial needs.

The dimension (c) deals with articles that examined the effects of Fintech on society, especially from the household point of view. Jünger and Mietzner (2020) examined the propensity of German households to adopt Fintech solutions, indicating the factors that influenced their choice. Riyanto *et al.* (2018) studied how digital technologies have been implemented within Indonesian society, noting that they contributed significantly to change the social behavior of Indonesian people.

The dimension (d) includes papers that examined the effects of Fintech from the banks' customers' perspective. Cuadros-Solas *et al.* (2020) adopted a machine learning approach to

	Authors/Theme	(a) Whole Sector	(b) Business Model	(c) Society	(d) Customers	(e) SMEs lending	(f) Innovation of services
1	Bhasin and Rajesh (2021)	X					
2	Cuadros-Solas *et al.* (2020)				X		
3	Rangkuti *et al.* (2020)		X				
4	Dratva (2020)	X					
5	Shaikh and Karjaluoto (2019)						X
6	Son *et al.* (2020)				X		
7	Jünger and Mietzner (2020)			X			
8	Klioutchnikov *et al.* (2019)		X				
9	Semenyuta *et al.* (2019)					X	
10	Khanboubi and Boulmakoul (2019)		X				
11	Soloviev (2018)		X				X
12	Riyanto *et al.* (2018)		X	X			X
13	Gupta and Xia (2018)	X					X
14	Patwardhan (2018)					X	
15	Li *et al.* (2017)	X					
16	Altenhain and Heinemann (2017)				X		

Table 8.
List of 16 papers dealing with Fintech and digital banking

examine the digitization process of customer relationship management. Son *et al.* (2020) analyzed the phenomenon of the customers' hidden defection toward their primary banks, showing that such phenomenon is more concentrated among the most loyal customers. Altenhain and Heinemann (2017) showed that there is a strong link between wealthy investors and the mastery of the Internet so that they considerably rely on the services that banks offer even if they demonstrate a great interest in innovative products to improve their investment opportunities.

The dimension (e) includes articles that examined the new forms of granting credit to SMEs. Semenyuta *et al.* (2019) investigated how new technologies changed the lending standards for SMEs in Russia, whereas Patwardhan (2018) examined how peer-to-peer lending may provide access to capital for SMEs.

The dimension (f) includes articles that examined the services introduced by Fintech, such as mobile payments and mobile banking. Shaikh and Karjaluoto (2019) provided a unified perspective on mobile financial services. Soloviev (2018) described innovative financial services in Russia and observed that there was not a significant radical change. Riyanto *et al.* (2018) described Fintech services in Indonesia, noting that business payments are in first place followed by loans. Gupta and Xia (2018) identified the evolution of the Fintech services in Asia, noting the same conclusions as Riyanto *et al.* (2018).

5. Discussion

The analysis of the literature carried out in this study provides interesting insights on both the current situation of Fintech and future trends and perspectives. The multidimensional

analysis based on both publication data (e.g. number of citations, authors, provenience, etc.) and contributions (contents, perspective of the analysis, methodology, etc.) gives a systemic overview of the knowledge in the Fintech field.

The time distribution of publications confirms the growing interest of both academicians and practitioners toward the Fintech paradigm, as well as its impact on the banking and financial industry overall. Also, the nature of the papers, which are mainly published on qualified scientific journals, demonstrates both the quality of the works and the multi-disciplinary aspects of the phenomenon that embraces not only the financial community but also adjacent domains like digital innovation, digital transformation, digital business models and service innovation (Dapp, 2017).

As shown in Table 3, most of the publications were written by two authors. Besides, as highlighted in Table 4, the 10 most productive authors published 3 papers on average. Then, as illustrated in Figure 2, the countries of origin of the aforementioned authors are all outside the European area, and there is a tendency to collaborate with authors from the same country, as shown also by the SCP variable. This is probably because it is easier for an author collaborating within the same research group or with colleagues having the same national background, thus publishing research focused on national geographical context, which they presumably know best. In this perspective, to increase the international level of the research teams, some political actions should be taken to promote cooperation between researchers from different countries.

The most productive countries are China (with 28 studies) followed by Korea (17 studies) and UK (16 studies). Two European countries, Germany and France, are also in the ranking. As for the main issues analyzed, the co-occurrence analysis of the index keywords represented in Figure 3 returned five clusters. The first cluster identifies the studies on the impact that financial innovation can have on the business models of traditional banks; the second cluster concerns the use of blockchain technology; the third cluster identifies the studies that focus on the implementation of artificial intelligence within the financial sector; the fourth cluster groups together studies that have addressed the issue of financial risk assessment associated with the adoption of Fintech technologies; and the fifth cluster identifies the studies that deal with the topic of Fintech to provide information to the managers of banking institutions. By complementing this view, the co-occurrence analysis of the Authors' Keywords reported in Figure 4 returned five clusters. The first cluster refers to the regulation and regtech area; the second cluster to the online and digital banking; the third cluster to the data mining area; the fourth cluster to the financial inclusion area; and the fifth cluster to the cryptocurrencies area. From the analysis of the temporal trend of the most frequent Index Keyword co-occurrences, Figure 5 illustrates an initial interest of researchers in the effects of financial innovations on the work of banks and then moved to analyze the individual sectors affected by Fintech, in line with the trend of the development of technologies and uses of FinTech. From the analysis of the temporal trend of the most frequent Authors' Keyword co-occurrences reported in Figure 6, it is revealed that in the end of 2018 the studies focused on the use of new tools to support the regulatory processes. Then, in the first half of 2019, the research interest shifted toward the innovation that Fintech brought to open banking and digital banking. Later, in the second half of 2019, peer-to-peer lending interest emerged in a significant way, and several studies focused mainly on the use of artificial intelligence within banks and financial institutions.

The analysis of keywords, both those selected from the Scopus database and those defined by the authors, allowed for having a general and intuitive picture of what has been covered in the literature and what needs more attention. More specifically, the results confirm two major trends in the Fintech domain: from one side, the diffusion of digital technologies to innovate the service through new features and mobile devices (Gomber *et al.*, 2017; Lee and Shin, 2018; Schulte and Liu, 2018; Dahlberg *et al.*, 2015); from the other side, the relevance of regulation

framework and industry-related issues that influence the competitive strategies and positioning of both incumbents and new entrants (Chiu, 2016; Gold and Kursh, 2017).

Furthermore, Table 6 showing the comparison between the Fintech activities identified by the FSI and the clusters identified by the VOSviewer highlights that insurance is a topic that requires more attention from the Fintech perspective and applications. A similar condition characterizes the regulation aspect, as confirmed by the analysis of the 20 most cited manuscripts reported in Table 6 that shows that the studies dealing with the topic of lending obtain more citations than those ones dealing with the issue of legislation. The same conclusion comes from the analysis of Table 7 related to the papers dealing with the Fintech in digital banking.

Tables 7 and 8 refer to articles dealing with the development of new methods that encourage investments in the Fintech domain (Mao *et al.*, 2019), the adoption of Fintech services (Hu *et al.*, 2019), as well as the innovation of financial service to enhance banking activities (Zhao *et al.*, 2019). No work investigates the effects of regulation on Fintech, as well as the level of compliance of Fintech with the reference standards (EBA, 2018a). Yet it is important to know the organizational and internal control characteristics of Fintech to assess how these new operators manage their risks and if there are threats to the stability of the financial system (FSB, 2017). Knowing these aspects of Fintech also allows them to increase their resilience on the financial market since they are usually start-up companies and collaborating with banks.

Further results deriving from this analysis concern: (1) the attention of scholars on the evolution of banking business models based on technological innovation; (2) a concentration of studies analyzing the effects of financial technologies on customers; (3) a focus on SMEs lending, especially enhanced by new digital technologies.

The results obtained and described highlight how the Fintech paradigm combines both sustainable and disruptive Fintech practices. The former include financial service providers that leverage digital technologies to consolidate their market position, whereas the latter refers to companies and startups that launch on the market new products and services (Milian *et al.*, 2019). In both cases, such providers aim to align their offering with the customer needs and expectations, as well as to exploit the potential of digital technologies for ideating and developing new service concepts and applications. Furthermore, the agility and flexibility of the culture characterizing these providers and IT companies play a very important role in their market success in terms of innovativeness and cost efficiency (Pollari, 2016).

A further dimension of the debate deriving from this study may concern the entrepreneurial impact of Fintech on the economic development. Actually, the emergence of Fintech pushed many countries to introduce regulatory sandboxes in this sector (CBinsights, 2019), thus providing a "safe space" in which companies can test their innovative offering (e.g. products and services), processes (e.g. delivery mechanisms) or business models into controlled environments under the regulator's supervision (HKMA, 2019). Such companies can thus have the opportunity to understand if their innovative solutions can meet the customers' expectations and achieve the desired market success.

A side effect of the introduction of Fintech enabling regulatory sandboxes concerns the open innovation paradigm (Gassmann *et al.*, 2010) under a twofold perspective: the increase of interest of venture capitalists to explore and invest in new Fintech startups that can be further involved in business relationships with medium or large established firms (Goo and Heo, 2020); and the encouragement to establish new collaborations among existing companies and new ventures (e.g. merge and acquisition, joint ventures) to exchange knowledge with Fintech startups and ideate, design and implement innovative Fintech services to be commercialized through a new market actor (Mention, 2019; Brunswicker and Chesbrough, 2018).

Furthermore, the introduction of Fintech regulatory sandboxes may also favor the shaping of Fintech ecosystem (Lee and Shin, 2018) by involving five key categories of actors: Fintech startups (e.g. payment, lending and crowdfunding); technology developers (e.g. big data analytics, cloud computing or social media developers); governmental bodies (e.g. financial regulators); financial customers (e.g. citizen and companies); and traditional financial institutions (e.g. banks and insurance companies) who interact and collaborate each other to stimulate economy, innovation and growth. Such an ecosystem provides the opportunity to both modernize the core business activities of traditional banks and financial operators through virtuous interactions with Fintech startups, and the creation of new ventures focused on delivering innovative Fintech services (Hornuf *et al.*, 2021).

Finally, by leveraging the modular architecture of the service industry in the digital economy, Fintech will contribute to accelerate the offering and the innovative level of such services by integrating financial and insurance intermediaries in the entire service industry (Schena *et al.*, 2018).

6. Conclusions, limitations and insights future research

This study is moved by the desire to examine the state of the art on the use of Fintech in the banking industry in order to outline the most and least (or not yet) discussed topics. This analysis is made necessary by the dynamism and speed with which Fintech is evolving and expanding, a reality that undermines the supervisory authorities' tasks. This result was achieved by examining the studies that addressed and analyzed the changes that these technologies have made to the banking system, including the phenomenon of digital banking. Since 2014, a total of 377 articles have been published on Fintech in the banking sector. The analysis built by combining the R package with Vosviewer highlights that the production of literature increased exponentially between 2017 and 2018. This shows the growing attention of studies to the application opportunities of digital technologies in the banking sector, in different business lines. The study perspective on the topic includes not only scholars in financial issues but also researchers with technical and management backgrounds.

The results achieved through the analysis has allowed to identify working areas for future research, including: (1) the development of more cross-country studies to compare different social, economic and legislative conditions from a geographical perspective, as well as find similarities and share best practices; (2) a deeper investigation on alternative processes for payment and lending in the wide domain of the financial intermediation; (3) the exploration from the strategic and organizational views of the behavior of Fintech actors within the market of reference, including both the industrial dynamics of "coopetition" between incumbent banks and Fintech operators and the individual challenges related to the use of innovative digital services and devices; and (4) a careful analysis of the aims and contents of Fintech regulation and its impact on the financial sector in terms of efficiency, stability and risks. Furthermore, this study may open the ground to explore new trends and issues related to the diffusion of digital technologies that are of interest to both scholars and practitioners. Actually, they could be attracted to investigate more deeply and experiment with the impact of emerging technologies like Blockchain, Artificial Intelligence or Robot Process Automation on traditional transactions (e.g. payments, lending and money transfers), collaborative-based financial services (e.g. crowdfunding and loans) and the overall business model (insurance services, wealth management, market aggregators, venture capital startups funding and crypto-currency) (Chen *et al.*, 2017; Lee and Shin, 2018; Mamonov and Malaga, 2018; Jonker, 2019; Suryono *et al.*, 2020).

Moreover, by leveraging robust theories and models on innovation management such as the Technology Organization-Environment (TOE) (Zhu *et al.*, 2006), the Theory of Planned Behavior (TPB) (Ajzen, 2011), the Technology Acceptance Model (TAM) (Davis and Al-Suqri,

1989), the Theory of Reasoned Action (TRA) (Madden *et al.*, 1992) or the Innovation Diffusion Theory (IDT) (Rogers, 2003), further research and experimentation could be addressed to study the penetration of new technologies within both the financial operators and customers.

Finally, a less developed set of issues that could be further investigated in future studies concerns ethics, data protection and securitization in order to contribute to develop trusted relationships among the participants (Suryono *et al.*, 2020).

Like many research, also this study has some limitations concerning the typology of documents considered for the analysis and the subjective interpretation of the results. For what concerns the former issue, actually, the Scopus database does not offer any documents released by the supervisory authorities, and therefore this dimension has been excluded from the analysis. Also, the keywords chosen by the authors to locate the Scopus dataset, although representative of the theme, could exclude relevant documents detectable by other keywords. As for the latter issue, the objective results derived from the analysis have been discussed and interpreted by the authors of this study, so a level of individual interpretation is associated with the final discussion and conclusion. These two aspects, together with the research themes above indicated, represent useful insights to inspire future studies.

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