

Review

An exploratory review of the fintech influence field

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Abstract: Fintech as a three-dimensional phenomenon reflects the rapidly changing technological, financial and business environment. The bibliometric analysis of scientific articles allowed us to identify the main themes and create a map of the field of fintech influences. Systematization of scientific articles revealed the influence of economic development and socio-demographic inequality on fintech development. Government regulatory policies can accelerate the digitisation of financial services and financial inclusion and help the fintech sector face geopolitical challenges. Fintech's impact was divided into three areas: financial stability and sustainable development, the business ecosystem and human behaviour. The research we summarised allowed us to identify the mechanisms through which fintech influences various fields. A complex approach to the influence of fintech enables us to understand the phenomenon and make better decisions.

Keywords: fintech regulation; financial stability; sustainable growth; business ecosystem; human behaviour; impact channels

1. Introduction

The definition of fintech covers several dimensions (Gomber et al., 2017). The first is technological progress: all changes on the Internet, mobile phones and applications market, as well as innovations in business intelligence, are also applicable to the field of finance. Blockchain technology, artificial intelligence and big data analytics not only open new possibilities but can also be disruptive technologies in the financial sector. The second dimension is the financial sector itself, where changes are taking place at speed in financial services such as lending, payments and investment. Lastly, the third component is institutions, which can be divided into traditional financial companies, fintech companies and non-financial companies. Scientific review articles typically examine the impact of one component of fintech on some dependent phenomenon. The authors note the disruptive effect of new technologies in the financial sector. The impact of peer-to-peer lending platforms and blockchain on financial intermediation was examined in a literature review by Cai (2018). The impact of blockchain on business was examined in a literature review by Sun et al. (2022). Bajwa et al. (2022) reviewed the scientific literature on the impact of changes in the financial sector on the financial services market. These authors performed a detailed bibliometric analysis of 2006–2020 articles on fintech and singled out the 4 financial sectors that experienced the biggest changes: digital currency, the crowdfunding, the mobile payment, the blockchain.

Another group of review articles examines a separate object of impact. For example, Elsaid (2021) examines the scientific literature on the impact of fintech on the traditional banking system. A fragmented approach to fintech and its impact does not allow us to understand the phenomenon as a whole and the entire impact map,

which would allow governments and businesspeople to make complex insightful decisions.

Fintech is a multifaceted phenomenon that is fast growing, fast changing and fast changing people's habits. Financial technologies are often called "disruptive", but the ecosystem of the financial sector has not yet collapsed, traditional financial institutions successfully compete with new fintech companies. People adapt to the changes offered by fintech, trust, enjoy quality and availability, and contribute to the success of fintech companies with their behaviour and creativity.

A unique approach was taken to examine fintech as a multifaceted phenomenon and deepen knowledge in order to understand the entire field of fintech impacts. The study focuses on the impact examined in scientific publications. The objective of this literature review is to answer the following questions:

- Who impact fintech?
- Who is impacted by fintech?
- What are the mechanisms of impact?

2. Review of literature

In order to deepen the knowledge about fintech, we try to understand the evolution of the phenomenon, the current state and the trend towards the future. The bibliographic mathematical approach to the development of fintech is reflected in Abad-Segura et al. (2020), which examined the evolution of the number of articles and the topics of 1975–2019. The trend of these articles leads to sustainable financing, sustainable development, financial inclusion and the reduction of development inequality between countries. Rahman et al. (2022a) presents a literature review on the links between fintech and green finance, sustainable development and insights into future trends.

In the scientific literature reviews, knowledge about the phenomena that influence fintech is very fragmented, covering only specific fintech sectors. Utami et al. (2021) systematized the attitude of innovators and adapters in scientific literature to the factors influencing the adaptation of fintech products. The influence of financial, social, geographical and demographic factors on peer-to-peer lending platforms was summarized in the literature analysis of Basha, et al. (2021). The success factors of equity crowdfunding are reviewed by Mazzocchi and Lucarelli (2023).

Agarwal and Chua (2020) examined the impact of fintech on household financing borrowing and investment decisions. A review of the scientific literature revealed that financial payments, consulting, crowdfunding and other technologies are changing consumer behaviour.

For the development of scientific knowledge, it is very important to understand not only who influences whom, but also the mechanisms of how this happens. Pal et al. (2021) systematized the impact of blockchain on business and named the mechanisms through which that impact is made: business process simplification, safe and reliable management of contracts and transaction records.

Articles (Nasir et al., 2021; Zou et al., 2023) were also found, which carried out a detailed bibliometric analysis of articles on fintech from different periods, evaluating the growth of the number of articles, changes in citations, popularity of authors,

finding the most popular keywords and topics.

Our literature review aims to summarize research, create a map that reflects the field of influence, and highlight the mechanisms through which fintech makes an impact.

3. Methodology

For the literature analysis, we selected 510 articles from the Web of Science (Clarivate Analytics) database based on the keywords ‘fintech’ and ‘impact’, examining the scientific research produced in January 2020–May 2023 and type of publication (articles, early access, conference proceedings, and book chapters) The exported data were then grouped into “impact on fintech” and “fintech impact on” groups. Journal rankings, number of citations, author information was not taken into account.

The co-occurrence network based on the titles and keywords of the articles in the selected bibliography is presented in **Figure 1**. The most frequently used words are marked with the largest dots in the figure and correspond to the keywords ‘fintech’ and ‘impact’. We chose only keywords with a co-occurrence of at least 10; thus, seven keywords were combined. Edges are the connections between words. Colours identify potential topic clusters. Digital technologies such as text analysis and co-occurrence networks are increasingly used for the systematization of scientific literature. Bibliometric analysis reveals statistical data of articles, authors and citations by country or journal and reveals topic clusters (Li and Xu, 2021, Sahabuddin et al., 2023). Bhatt et al. (2022) compiled a fintech thematic map and thematic evolution by examining keywords, authors and citation rates. Co-occurrence networks are used in various ways in the scientific literature: Rahman et al. (2022) employ them to find geographic centres and scientific institutions that develop certain fintech topics and in the analysis of the most popular keywords. Maknickiene (2022) utilised these networks to represent the dynamics of genetic algorithm topics in scientific literature, whereas Brahimi and Haneya (2023) explained the mapping of scientific literature using WOSviewer. We used co-occurrence networks only to identify topic clusters.

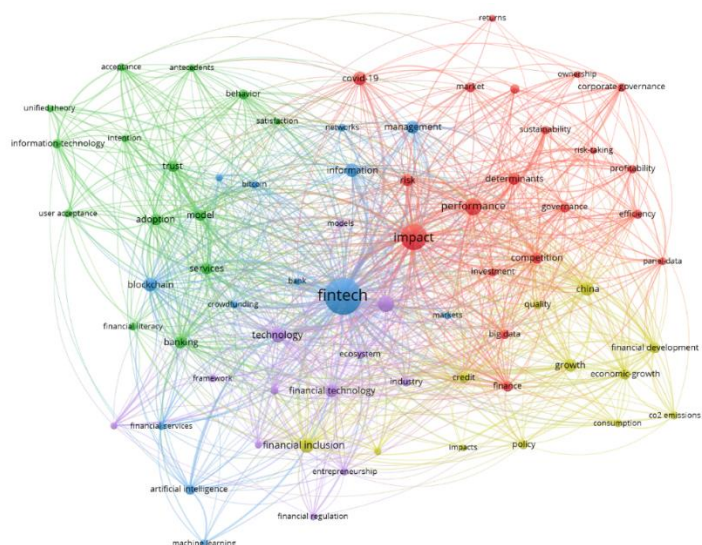


Figure 1. Co-occurrence network for the selected bibliography. (via WOSviewer).

The research used co-occurrence networks (via WOSviewer), which were created based on a bag-of-words model (Jin & Srihari, 2007). A co-occurrence network is a graph that represents the connections between words in a data set. The most popular way of using them is to display the communication of users of social networks; in other areas, they are employed to display flights, neural connections and mutual connections in scientific journals. We selected the titles of articles, conference reports and book chapters in the Web of Science database to find the most popular topics and areas of interest related to fintech. Graphs represent relationships between words using the following metrics:

- *Nodes* are test objects and include all significant words in the titles once the stop words are removed with the stop-word function.
- *Edges* are the connections between objects; the more connections between objects, the thicker the line on a scale of 1 to 5.
- The *degree* is the number of edges connected to each node.
- *Neighbours* relate to the degree of all nodes connected by an edge to a specific node.
- *Total link strength* indicates the total strength of the co-occurrence links of a given word with other words.

The code allows us to determine which words are most often used with a selected word. The graphical representation of network connections enables the identification of groups of objects.

The object of our study was ‘impact’. The network found a link strength of 486 (+ 24 with ‘impacts’) for this keyword. We had two options: ‘whose effect?’ and ‘effect on whom?’ (**Figure 2**). We divided the impact on fintech into four interrelated groups. The highest number of connections (195) concerned challenges, which we separated into security, trust and COVID-19. Governance, politics and financial regulation had a link strength of 176. We selected the socio-demographic impact and found that the phrase ‘financial inclusion’ was the most frequent. All demographic, social, economic and technological changes affect every market participant, including fintech.

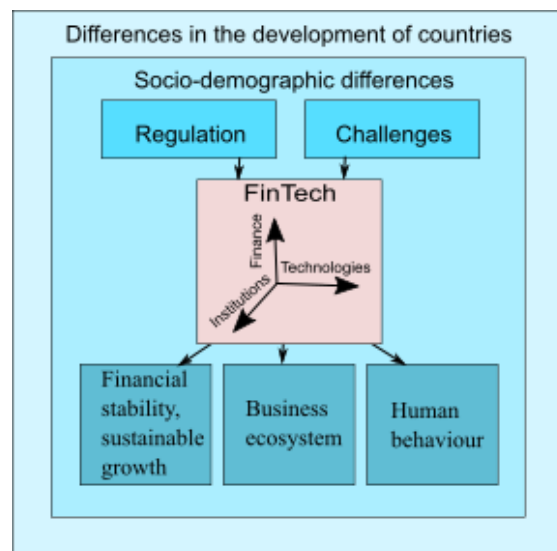


Figure 2. The fintech influence field.

The influence of fintech was divided into three groups. Financial stability and sustainable development display the most links (394) based on the keywords ‘financial inclusion’, ‘growth’, ‘economic growth’ and ‘sustainability’. The second group was labelled as the business ecosystem, with a link strength of 354. It consists of the keywords ‘efficiency’, ‘ecosystem’, ‘industry’, ‘companies governance’, ‘firm performance’ and ‘entrepreneurship’. The third group, human behaviour, garnered the fewest links (273), with the keywords ‘behaviour’, ‘satisfaction’, ‘adoption’ and ‘financial literacy’. Co-occurrence networks made it possible to classify 615 scientific articles into the unified system presented in **Figure 1**, to summarize and extract the main subtleties of scientific research.

4. Factors impacting fintech

4.1. Differences in the development of countries

The development of fintech around the world is very uneven. Low-income countries are currently deciding how to increase financial literacy and the availability of financial services. A large part of their population does not have mobile phones and bank accounts. Meanwhile, high-income countries pay attention to financial stability, efficiency and sustainable economic growth. Examining the level of fintech in Latin American countries, Ioannou and Wójcik (2022) identify large percentages of the population without a bank account, which they relate to the estimate of fintech borrowers classified as unbanked. They suggested that the low level of financial integration in Latin America is caused by specific instability characteristics of this region. Ashenafi and Yan (2023) point out that because the oligopolistic system, the low financial literacy of the population and corruption flourish in low-income African countries, the development of the financial sector does not reduce income inequality and poverty. Siddiqui and Siddiqui (2020) demonstrate, using the example of India, that the development of fintech is inseparable from that of telecommunications. Access to telecommunications in low-income countries, combined with education, can increase financial inclusion. Blažek and Hejnová (2020) analysed the statistical data of small banks in the macro-regions of the European Union (Western Europe, Southern Europe and Central and Eastern Europe). The results show that there is no general clear trend in the development of small banks, but there is diversity, which is determined by the competition of banks with fintech companies. Andrikopoulos and Dassiou (2022) investigated the effect of bank power on fintech companies and found that these financial institutions have a complementary rather than competitive relationship. Sohns and Wójcik (2020) analysed in detail the impact of Brexit on the fintech ecosystem of the United Kingdom, including the domains of human capital, finance, markets, policy and support. Their interviews with managers of solid financial companies revealed that this rich country with a reputation as a financial centre faced large-scale relocations of financial incumbents after Brexit, and this process tends to accelerate. However, the start-up rate has increased, showing that the sphere of fintech services does not tend to shrink in this situation. Differences in the development of countries influence the behaviour of the population of these countries.

4.2. Socio-demographic differences among fintech users

The behaviour of fintech users also affects the efficiency of fintech companies. Different generations have different attitudes towards technology, traditions and reliability, which determine consumer choices. Alshari and Lokhande (2022) analysed the influence of demographic factors on fintech services using a survey method and found that age does not have a significant effect on payment services, whereas gender, income and education have a significant impact, including on different aspects of customer behaviour. Khuong et al. (2022) studied the attitudes of the Z generation (Vietnamese aged 18–24 years) towards the use of fintech technologies and found that perceived benefit and belief have the strongest influence on user intentions, although the relationship is not statistically significant enough. The two studies (Alshari & Lokhande, 2022; Khuong et al., 2022) were conducted in individual countries and may not reflect the behaviour of youth around the world; nonetheless, they point out that demographic differences and generational change are important for the development of fintech. Every business needs to understand the behaviour of the user to increase their loyalty to the company. Lin and Desai (2022) summarised seven studies on consumer satisfaction with the allocation of money and time and found that it is important for the modern consumer to feel happy when shaping their budget expenditures. Such research can be useful for fintech companies in providing services to clients and connecting them with green and social initiatives. Consumer behaviour when choosing fintech services was analysed by Alkhwalidi et al. (2022). Their study revealed that three factors increase the loyalty of fintech service users: personal innovativeness, financial literacy and uncertainty avoidance. The behaviour of m-wallet users was explored by Sari et al. (2021), who showed that trust and perceived benefit influence the intention to purchase m-wallets. Frare and Beuren (2021) studied the influence of the reputation and social identity of start-up companies on innovative work styles. These phenomena unite employees of different ages, education and experience around progressive changes in the company. Jibril et al. (2020) investigated fintech consumer behaviour from a different perspective. Their study examines the reasons why users avoid using e-banking. Fear of loss, fear of damage to reputation and fear of identity theft stops people from choosing online services. These fears are thus holding back the sustainable growth of fintech services. Nguyen et al. (2021) sought to determine what influences the user's perceived security. Knowledge of the mobile fintech payment service, the user's attitude and the enterprise's image impact trust in fintech services. The survey conducted by Bhutto et al. (2023) revealed that fintech application requires human resource competencies such as creativity and analytical and leadership skills. People's attitudes towards fintech development shape the assumptions on which government policies are based.

4.3. Fintech regulation

Fintech users need service availability, a secure environment and a developed infrastructure. The development of technologies and digitisation affect countries' economic growth. As a result, governments often take measures to accelerate the development of fintech companies while simultaneously protecting consumers from unscrupulous businesses. Governments often aim for sustainable national

development and poverty reduction. Emara (2022) found that fintech development has a statistically significant effect on poverty reduction. The author calculates a threshold estimate for the fintech index, after which poverty suddenly decreases. Folwarski (2018), examining the changes in the Polish non-cash payment market due to the second payment services directive in the EU space, observed that strategic regulation by the national bank promotes the development of open banking. This encourages the emergence of new fintech companies and changes in the solutions offered by already existing financial companies. López (2019) examined the impact of government regulatory forms in 12 countries around the world on peer-to-peer lending platforms and the development of small and medium-sized enterprises and concluded that the right choice of regulatory and risk-assessment data sets leads to faster credit in small and medium enterprises (SMEs) and a more efficient financing system in the country. In 2018, the European Union (EU) adopted the General Data Protection Regulation, which severely restricted the use of online data without the user's consent. Li and Saxunová (2020) point out that data is divided into categories of sensitivity for the user and studied the impact of this decision on the development of fintech. They showed that the EU Regulation focuses on higher standards for companies. Bajakić (2020) compared UK and Croatian financial innovation regulatory frameworks and confirmed that innovation hubs and sandboxes are new governance models based on a culture of collaboration rather than control. However, the transition to such regulatory innovation tools must be gradual to provide the public and the government with enough time to properly prepare for the changes. A detailed analysis of information from 27,149 reward-based crowdfunding campaigns from 45 platforms conducted by Adamek and Janku (2022) revealed that the level of a country's economy, the quality of banking-sector services and the activities of innovative crowdfunding platforms influence each other. Maman et al. (2022) investigated the impact of degrees of regulation on public trust in a fintech company and found that the strongest model of government regulation led to the highest level of trust, followed by self-regulation types and no regulation. Fu et al. (2022) applied an evolutionary game to model the effects of government oversight on the behaviour of innovative fintech firms. With the help of simulations of rewards and punishments of different intensities, they showed that setting appropriate upper limits can significantly reduce the profits of illegal innovative companies. An example of positive fintech regulation is the development of financial-market infrastructure described by Dörry and Hesse (2022), who study freeports with ArtTech that facilitate company logistics and patronise young fintech businesses. Phung (2023) demonstrated that financial knowledge and fintech capacity development in universities have an indirect positive effect on fintech entrepreneurship via attitude towards fintech.

Thus, research indicates that governments achieve the best results by creating the right conditions for fintech development, fast Internet access and attractive infrastructure.

4.4. Fintech challenges

One of the challenges facing fintech developers is data security. Stewart and Jürjens (2018) found that the fintech sector is affected by data-security issues, poor

user-interface design and customer mistrust. Therefore, it is important to increase data transparency and security, use strategic fraud-prevention methods and secure encryption technologies. Thach et al. (2021) assessed two objections: 1) fintech innovations enable faster and more accurate data evaluation and better decision-making; 2) data security issues entail certain threats. The authors of this article demonstrate the necessity of having a cybersecurity risk management plan. Therefore, cyber security and the security of digital technologies are factors that influence the development of the fintech sector.

In the examined period of 2020–2023, the world faced enormous challenges. Societies and individuals had to adapt to the survival conditions imposed by the pandemic, and the progressive society was shocked by the Russian war against Ukraine that began in February 2022. Wójcik and Ioannou (2020) examined the impact of the pandemic on financial markets and the financial sector in the short term. The obvious negative reaction of the market during the first months showed the confusion of investors in the face of uncertainty. However, the authors also see the possibility of very positive changes in the field of fintech development, and optimistic forecasts have been confirmed. Hacıoğlu-Hoke et al. (2021) also studied the onset of the pandemic, specifically the dynamics of household income and expenditure in real time. They observed that households with the lowest incomes responded less than those with the highest incomes. The data came from a large fintech company in the UK. Li (2021) proposed a model for the post-COVID-19 period, which explains how changes in consumer habits and emotions during the pandemic modified attitudes towards the development of financial technologies. The authors suggest paying attention to artificial intelligence, blockchain, digital transformations and big data analytics. Elsewhere, China's unique pandemic management policies have inspired scientists to investigate the consequences of the pandemic. To determine the impact of COVID-19, estimates that describe the pandemic must be selected. Yang et al. (2022) used the case fatality rate, calculated as the number of deaths divided by the number of confirmed cases, the mortality rate, which denotes the percentage of deaths in the total population, the confirmed rate, which indicates the percentage of confirmed cases in the total global population, death, which represents the natural logarithm of the number of deaths by country, and confirmed, which corresponds to the natural logarithm of the number of confirmed cases by country. Using regression analysis, the authors found that the pandemic had a significant impact on the value of a company, while the negative impact of the pandemic was reduced by the development of fintech services. Yan and Jia (2022) identified a negative impact of COVID-19 on the banking sector and a positive impact on fintech companies. The negative influence of fintech on SMEs during the pandemic was examined by Gao (2022). Lockdowns, longer pandemics and fintech have a negative impact on the creation and registration of new manufacturing companies and the sustainable distribution of finance. The consequences of China's pandemic restrictions on companies were examined by Ling et al. (2021). The results of their study show that financial constraints have a negative influence on companies, but they can be mitigated by the development of financial technologies. Similar conclusions are drawn by Jing et al. (2022), who summarised the impact of the pandemic on financial markets in Asian, European and American countries. The authors note that the banking sector has faced increased risks, but

digitisation and electronic processes in companies have accelerated. Tut (2023) demonstrated that the pandemic accelerated the development of mobile payments in Kenya and reduced the use of credit cards. China's experience may not be useful for the rest of the world as there have been many very different forms of pandemic management. The world has watched the impact of the COVID-19 pandemic on financial markets, consumer behaviour, education and the cryptocurrency market. Sharma et al. (2022) examined the resilience of five technology-based investment funds to the impact of the COVID-19 pandemic. The authors categorised this impact into volatility quintiles and identified technology-based funds that are the most resilient and exhibit the fastest recovery from shocks. Herdinata and Pranatasari (2022) investigated the impact of the pandemic on the training of micro, small and medium-sized fintech companies in the areas of fintech regulation, cooperation and financial literacy. Both education and fintech companies faced the challenges posed by restrictions, lockdowns and uncertainty. However, new opportunities are opening up for fintech companies as new distribution channels emerge that increase the number of customers and reduce the cost of business operations. Minutolo et al. (2022) explored the impact of the pandemic on the cryptocurrency market, which remains quite confusing for investors but whose capitalisation is constantly growing. The authors chose to measure the spread of COVID-19 calculated as the ratio of expected new cases in time to the total infected individuals at a specific time. The results showed that the spread of COVID-19 either did not significantly affect the prices of cryptocurrencies at all or only affected individual cryptocurrencies in a particular country. The business world is full of challenges, and the fintech sector is no exception, having to adapt to external and internal events.

5. The impact of fintech

5.1. Financial stability and sustainable growth

New technologies are often called disruptive because they can dramatically change the market, economy, sector ecosystem and even human behaviour. Blockchain, artificial intelligence, big data and real-time technologies are the main fintech components on which financial services are built. Concerns about whether they will cause the collapse of the financial system and disrupt the sustainable development of a country are reflected in scientific research.

Fintech as a phenomenon in the economy is measured differently by researchers. In the articles examined in this review, we find general indicators describing digitisation, the number of fintech companies, the number of sandboxes and a comparison of conventional economic indicators before and after the emergence of fintech.

Financial stability in the country is closely related to the stability of banks, which scholars propose to evaluate through bank riskiness and distance-to-default or the volatility of return on average assets. Banna and Alam (2021) demonstrated that fintech technologies can influence the stability of banks and described the Digital Financial Inclusion (DFI) index, which is already known in the scientific literature. The results of the study revealed that the digitisation of banking services ensures not only stability but also resistance to shocks such as the COVID-19 pandemic. Safiullah

and Paramati (2022) examined the impact of fintech firms, that are closely related and not related to the banking industry, on bank stability. According to Malaysian data, financial stability is positively affected regardless of bank size, type (Islamic or conventional) or management style. A study of the stability of the Indian financial system (Verma and Chakarwarty, 2023) confirmed that financial innovation has a positive and significant impact on financial stability, but the development of fintech is closely related to the growth of cybercrime, which undermines the stability of the banking sector. Liem et al. (2022) studied the impact of credit-information sharing on banking stability using data from 73 countries. They concluded that the emergence of credit fintech companies and cooperation in information sharing increases the stability of the financial system. Fung et al. (2020) sought a regression equation to determine the impact of fintech regulation on financial stability. The researchers found that banking stability depends on the market: a positive effect of sandboxes in emerging markets and a negative effect in developed markets. Sandboxes as a fintech variable were also chosen by Stankevičienė and Kabulova (2022), who analysed financial institutions in 37 countries and showed that financial stability resulting from the growth of financial regulation through sandboxes depends on the country's level of development. In addition, the authors proved that fintech affects the stability of financial institutions through profitability. Yin et al. (2022) looked for variables that influence the banking stability and nonperforming loans, using the example of China. They revealed that during the first wave of fintech (before the 2008 crisis), the impact was negative and the second one was already positive because it was properly prepared.

Financial stability is inseparable from financial markets, although scientists have not been able to prove their effectiveness, but markets perfectly reflect the state of the entire financial system. The cryptocurrency market is very young compared to other financial markets. Othman et al. (2020) studied the long-term and short-term effects of cryptocurrency market capitalization on the volatility of bank deposits in the Gulf Cooperation Council (GCC) region and demonstrated a drastic negative effect on bank deposits. The need to assess the impact of the cryptocurrency market on the stability of the financial system and to develop coherent regulatory strategies was addressed by the Jovanić (2020) based on the experience of the Western Balkans region. Emerging from new blockchain technology, cryptocurrency market is successfully changing not only the financial sector but also electronic commerce and healthcare. Ilk et al. (2021) examined the impact of transaction fees on users and miners based on an analysis of supply and demand. A well-balanced tax system can ensure the stability of the cryptocurrency market.

Economic growth. Bogdanova and Arefjevs (2020) examined the influence of three factors (financial stability, financial inclusion and the transparency of financial flows) on the development of a country's economy. The proposed financial trilemma index makes it possible to model the impact of the emergence of new fintech services. Faster and more accurate distribution of money in the country reflects good financial development. Zhang et al. (2020) found that financial exclusion and the lack of access to the Internet have a negative impact on economic growth, while the development of fintech has a positive impact. They also observed that the development of fintech affects migration to cities, regardless of whether these residents have access to the Internet or not. Junarsin et al. (2021) noted that peer-to-peer (P2P) lending fintech

companies have a delayed impact on a country's economic growth and made suggestions on how to balance lending and borrowing needs. Bu et al. (2022) examined the impact of fintech development on economic growth in Chinese provinces. In their study, fintech development is expressed by the DFI, which includes 24 indicators. They showed that the relationship between economic growth and fintech is not linear and depends on the specifics of the region. When fintech is not sufficiently developed, it inhibits economic growth, but once fintech development reaches a tipping point, the effect is growth promoting. Muganyi et al. (2022) attributed the opportunities for the development of the financial sector to two factors: government decisions, which can improve fintech development, and fintech development, which can have a positive impact on the financial sector. Using regression analysis, Chen et al. (2022) proved that fintech influences the development of the digital economy. For their part, Song and Appiah-Otoo. (2022) studied Chinese provinces and found two-way causality between fintech and economic growth.

Sustainable growth. Green fintech aims to create a more sustainable future through its philosophy of balancing green technology, sustainable human resources management and a high-quality economy. Merello et al. (2022) sought to describe the profile of a sustainable fintech company by combining sustainability and financial indicators and focused on transparency and corporate governance.

Liu et al. (2022) noted conflicting societal goals that influence the green course of the future. As the economy grows, people's purchasing power rises and more goods are consumed, which requires more energy and increases carbon emissions. Green finance encourages investment in renewable energy and the availability and efficiency of financial services ensured by fintech companies. Reviewing works published in 2008–2020, Wang et al. (2021) identified the main directions of green finance: green bonds, carbon dioxide emissions, green paradox and government subsidies, along with innovative technologies such as big data, blockchain and fintech development. Schulz and Feist (2021) studied the impact of digital technologies such as blockchain and distributed ledger-based systems on solving climate change problems. The authors remarked that facilitating secure, immutable and standardised transactions, reducing the need for administrative processes, strengthening the responsibility of governments, a decentralised and transparent register and information availability are new factors that encourage green investments. Bidirectional causality between the green economy, fintech and cleantech indices was established by Metawa et al. (2022). The authors proved that the availability of financial services, easier access to credit and contracts based on the blockchain influence ecological development. Taskin et al. (2022) found that financial technologies can increase energy efficiency and reduce pollution through financial investments. Using a semi-parametric difference model, Nenavath (2022) proved that the development of fintech increases the volume of investments in environmental protection. In addition, Puschmann et al. (2020) argue that a key aspect of green fintech is the availability, transparency and reliability of data that blockchain technology can provide. It is also important to obtain reliable data to monitor ecological changes and evaluate them together with the entire international business ecosystem and supply chains.

Zhao and Yan (2022), using regression analysis, determined that digital finance, along with economic modernisation and ecological development, influences the

reduction of haze pollution in Chinese cities. He et al. (2020) examined the impact of green finance on the construction of smart cities, concluding that fintech innovations can speed up the obtention of credit, diversify funding channels, reduce risk and offer online innovative products. However, the study revealed that fintech innovation has the opposite effect on the construction of smart cities because of the high costs of high tech.

The goal of every progressive country is to achieve sustainable economic growth, which is often associated with equal opportunities for all market participants. The United Nations has broken down sustainable growth into 17 indicators, five of which are directly related to financial inclusion. Pandey et al. (2022) explored fintech and digitisation together with financial literacy, financial initiatives and regional and gender differences and found positive effects on sustainable economic growth. Yang et al. (2021) linked green finance with fintech development and observed that they influence high-quality economic development, which corresponds to the ecological environment, economic efficiency and economic structure. Deng et al. (2019) compiled a system of sustainable development indicators, which consists of four primary and 20 secondary indicators. In their article, fintech's impact on sustainable development can be represented in a U-shape and also depends on the level of development of the region. Zhou et al. (2022) examined the influence of fintech on green development in 31 Chinese provinces and concluded that the main mechanisms of influence are green credit and green investment. It is important not only to identify effects but also to understand the mechanisms of impact. A study of indicators for 66 countries conducted by Awais et al. (2023) revealed that the acceleration of the Internet and the development of fintech have a positive effect on ecological economic activity and reduce carbon dioxide emissions. Studying green initiatives in three South Asian countries, Zhang (2023) found that fintech accelerates the issuance of green loans and promotes sustainable economic growth. Li et al. (2023) determined that the development of financial technologies and digitisation as well as the quality of management of institutions reduces countries' dependence on natural resources. It can be summarized that fintech creates a faster and more targeted distribution of money in the economy, which leads to stability and sustainable economic growth.

5.2. Business ecosystem

The emergence of fintech has been seen as disrupting the traditional ecosystem of the financial sector, so impact assessment is often associated with evaluating the efficiency of the sector or individual companies. Financial efficiency is usually assessed for individual companies and is understood as the ability to provide the highest-quality financial services at the lowest possible cost. For the assessment of financial efficiency, certain sets of financial indicators of the company are taken, depending on the type of company. To evaluate the influence of fintech, various indicators of innovativeness are used (Wang et al., 2021), such as payment calculation, resource allocation, risk management and network channels, or indices covering big data, blockchain, artificial intelligence, distributed technology, the interconnectedness of technology and the security of technology.

Financial sector. To evaluate the efficiency of banks, researchers usually use two

methods: stochastic frontier analysis and data envelopment analysis (DEA; Yeh et al., 2022). Wu et al. (2022) investigated the effect of Chinese provincial fintech indices on financial efficiency and found that the effect of fintech is expressed by an equation with a U-shaped curve, which means that in the active period of fintech development, the effect of fintech on financial efficiency is negative, but the effect becomes positive when it reaches sufficient integration in the financial sector. Yeh et al. (2022) assessed the efficiency of 23 Taiwanese banks, dividing them into the governance, operational and innovation efficiency stages. The results showed that the greatest contribution to efficiency can be achieved through government innovation promotion. Le et al. (2021) examined (through DEA) the impact of credit fintech development on the efficiency of the banking sector. Four-year (2013–2017) data from 80 countries showed that the development of credit fintech has a negative impact on the efficiency of banks, but competition encourages banks to improve financial services, and the impact is stronger when the banking sector is less developed. Competition between the banking sector and fintech companies depends on the country's level of development. Druhov et al. (2019) studied development trends in the banking sectors of EU countries and found that investments in artificial intelligence, virtual reality, blockchain, cloudy technology, cryptography and cybersecurity technologies, big data technologies, bioethical authentication systems, Internet of things, mobile technology, application programming interface, robots-assistants and consultants, robotisation of business processes and intelligent contracts will definitely grow. The development of fintech companies is changing the banking sector. Adapting to rapidly evolving conditions, banks digitise their services and become more competitive. Broby (2021) proposed four strategies for digitising banking services for different types of customers, which, along with risk assessment and building trust in financial institutions, can improve the delivery of banking services. Bertsch et al. (2020) proved that in such a situation, banks first refuse riskier borrowers and create conditions for the development of fintech companies. Sheng (2021) studied the impact of fintech credit companies on banks depending on their size and observed that large banks have more opportunities to introduce innovations into their processes and are therefore more resistant to this impact than small banks. Using data from various countries, Hodula (2023) found that the development of fintech companies providing lending services reduces loan interest and increases deposit interest. Banks are forced to digitise their services and invest in technology to make a profit. Almulla and Aljughaiman (2021) noted a negative impact of fintech development outside and inside banks on the performance of banks. Nian et al. (2022) investigated the impact of fintech development on the equilibrium of China's labour market, product and loan markets. Hadad and Bratianu (2019) examined the process of dematerialisation of banking products and found that fintech has a greater impact on customer behaviour than the internal operations of banks. Cappa et al. (2022) studied the impact of bank mergers and acquisitions with fintech companies on the stock market and concluded that investors react negatively to such developments. Chen et al. (2021b) explored the impact of the implementation of fintech products inside commercial banks on the work efficiency and proved through research that there is a significant positive relationship between the quality of bank services and employee job satisfaction. Meanwhile, Deng et al. (2021) found that fintech development reduces banks' risk-taking through internal and external channels

such as the bank's internal interest margin, decisions of managers, the intensity of external competition, and residents' financial behaviour. When examining the impact of fintech on bank credit risk, Zhang et al. (2022) found a significant negative impact on pre-loan credit risk and a negative but insignificant impact on post-loan risk. Yao and Song (2021) reported that fintech has a significant negative impact on profit and economic capital of bank, although large banks have capital, experience and infrastructural advantages. Chen et al. (2022c) investigated the impact of fintech on the financial risk of commercial banks and found that it can be represented by an inverted U-shaped graph. When fintech companies appear with innovative solutions, the impact on banks' financial risk is negative, but once banks adapt and integrate technology into their operations, their efficiency improves and risks decrease. Qi et al. (2022) distinguished two types of impact—technological innovation and business innovation—and proved that fintech has an impact on banking-sector market power and that this impact depends on the ownership status of the bank. Using 16 years of data from 115 countries, Murinde et al. (2022) studied the impact of fintech on the banking sector and determined that it is unlikely that fintech will defeat the banking sector as mutual competition forces adaptation and improvement. Zhang et al. (2023) found that regional fintech development in China is strengthening the shadow banking sector. In some cases, the solution to the competition of banks with fintech may be their merger. Collevocchio et al. (2022) examined the conditions in which such a merger is beneficial for banks and when it is not.

Non-financial corporations. The impact of innovations on the efficiency of non-banking companies was analysed by Pham and Quddus (2021). Data from Vietnamese joint-stock companies were used to derive efficiency and innovation estimates. Innovation was measured as the ratio of fixed intangible assets to fixed or total assets. The authors found that innovation has a stronger impact on financial firms than on technological firms and that firm efficiency depends on firm age and size. The efficiency of capital allocation in Chinese companies and how it is affected by the development of fintech was examined by Xie and Zhu (2022). The efficiency of the financial market was evaluated as the use of external finance by companies, and fintech estimates are obtained by carefully selecting companies according to selected criteria and keywords. The researchers interpret the objection that the efficiency of capital allocation decreases as the influence of fintech in the city increases as a result of the competition between traditional banks and fintech loan companies. The influence of the fintech ecosystem on P2P lending platform cash flows was analysed by Chen et al. (2021a). They found a positive U-shaped relationship between platform lifetime and cash flow, but the level of development of the fintech ecosystem was also a very significant factor. Liu et al. (2023) also obtained a U-shaped relationship, investigating the impact of fintech on agribusiness. As they show, at first, financial technologies can hinder the digitisation of agricultural businesses and reduce the efficiency of companies, but strengthened agro-enterprises start to grow rapidly. Adeleye et al. (2022) studied the impact of information and communication technology development on tourism business in Asian countries. The results confirm that the synergy between fintech and tourism can boost the development of tourism in the region.

Small and medium enterprises. Abbasi et al. (2021) examined the impact of

fintech on the efficiency of SMEs by relating it to various cultural dimensions. Using data from 1,617 SMEs from 22 Organisation for Economic Co-operation and Development (OECD) countries during 2011–2018, they showed that fintech has a positive impact on SME efficiency. This influence can be strengthened by the masculinity of society and weakened by the dominance of individualism and long-term orientation in society. Huang (2022) examined the impact of fintech on SME investment efficiency with data from Chinese cities. Detailed regression analysis revealed that fintech development has a positive influence on SME investment efficiency but depends on company size and regional competitiveness. The main economic factors created by the development of fintech are the reduction of information asymmetry, the increase of pricing accuracy and the reduction of SME financing constraints. SMEs often face a lack of financing, and the traditional financial system does not always help them. Łasak (2022) examined the influence of fintech in SMEs in developing countries and found that fintech not only improves corporate financing but also provides access to data, speeds up settlements and strengthens relationships with customers. Using data from German SMEs, Teltz (2019) linked the degrees of digitisation, business success and internalisation to create a three-dimensional model.

Green innovations. Modern society is faced with ecological problems that fintech development can help solve. Rao et al. (2022) studied the impact of digital finance, measured with a digital finance index, on a company's green innovation. The number of patents has become a quantitative indicator of green innovation, and the number of patent citations has become a qualitative indicator. The development of digital finance has been shown to influence the quantitative and qualitative indicators of green innovation of companies for several years. Reza-Gharehbagh et al. (2022) modelled new scenarios for the financing of new green-product development chains to balance corporate risk aversion and government support for green initiatives. Chen et al. (2022a) examined the impact of government green initiatives on polluting and less polluting companies and evaluated the role played by fintech and company ownership. Using expert data and the structural equation modelling method, Zheng and Siddik (2022) proved that fintech adoption influences the financial sector's green finance, green innovation and environmental performance. Yan et al. (2022), who conducted a similar study with two-stage artificial neural networks and data from Bangladesh Bank employees, proved that fintech adoption significantly influences green finance, green innovation and sustainability performance and is very important for the sustainable development of the country. Xue et al (2022) explored the relationship between fintech and corporate green technology innovation and found, that the effect can be made through alleviating financing constraints, raising the competences of specialists and balanced environmental regulations.

It can be concluded that Fintech affects the business ecosystem through competition, increasing availability of services and indicative changes in infrastructure.

5.3. Human behaviour

People who create new technologies and financial solutions in a world full of challenges and new business models are called fintech talents. Fintech development is

not possible without talent development, training and promotion. A functioning fintech ecosystem affects the activities of all people, their financial behaviour and their adaptation to life changes.

Financial inclusion is one of the goals of modern society. Wang et al. (2021a) found that IT investment has a positive impact on human capital, expressed as the total cost of employees, and on competitive advantage, expressed as the difference between a firm's profitability and the average profitability of its industry. Yang and Zhang (2022) obtained reliable results showing that fintech increases financial inclusion and reduces customer inequality. Chen et al. (2022b) studied the total factor productivity (TFP) of Chinese provincial companies and observed that financial inclusion increases TFP only in larger cities where infrastructure is developed. Wu and Kao (2022) drew attention to human-resource issues in the face of rapid fintech development. The authors note that fintech companies in Southeast Asia face talent shortages, wage inequality, racial and religious discrimination and employee qualification issues and summarize that human-resource management tools can influence the sustainable development of the fintech sector and the economy. Aziz et al. (2022) assessed women's growing labour market inclusion opportunities using fintech services as particularly helpful during the pandemic in Islamic countries. Esmaeilpour Moghadam and Karami (2023) also examined women's financial inclusion as one of the goals of sustainable development. They analysed data from 113 countries and found concluded that in countries with low levels of discrimination against women, women's financial inclusion increases with fintech development, but in countries with high levels of discrimination against women, this relationship is insignificant.

Consumer behaviour. The development of fintech is changing consumer behaviour and perceptions of benefits and risks. As the range of services of Internet fintech companies grows, banks must adapt and optimise the operations of their branches. Nam et al. (2016) investigated the impact of the digitisation of bank services on a bank's financial performance and the behaviour of the bank's customers. Ryu (2018) analysed fintech user behaviour by distinguishing between early adopters and late adopters and compared their perceived risks and benefits in choosing fintech services. Son et al. (2020) explored the impact of the digitisation of financial services on customer loyalty and the volume of outsourced services. Lien et al (2020) studied the intentions of bank customers to use fintech services and found that customers are positively affected by the perceptions of usefulness and ease of use, as well as customer trust and social impact. Arora et al (2023) examined the impact of AI technologies on fintech customers. Using a Fuzzy-Analytic Hierarchy Process (AHP) technique, they revealed that service quality and perceived usefulness and convenience have the greatest impact on fintech users in India. Chen et al. (2021) looked at the influence of negative information on users of P2P lending platforms and found that the trading volume and participation of most users respond to platform hiding, the reaction is quick and short-term, and investors on different platforms react differently to negative information. The negative attitude towards Islamic fintech lending platforms was also identified by Alsmadi et al. (2023), but perceived ease of use and usefulness have a positive influence on customer behaviour. Lee (2021) examined the impact of technostress created by fintech on Generation Z consumers and proposed marketing measures to reduce it. Fintech is broken down into four dimensions here:

complexity, overload, invasion and uncertainty. The negative impact on Generation Z can be minimised by choosing attractive visualisations, ensuring data security and avoiding frequent updates. Solarz and Swacha-Lech (2021) analysed the fintech user profile of Millennials (the generation born in 1980–1995) and evaluated the factors that have the greatest influence on their financial decisions. Banks should pay attention to customers who avoid digital or online services and find appropriate consumer channels for them. The relationship of Generation Y with fintech services was scrutinised by Aggarwal et al. (2023), who reported that the quality of information has the greatest influence on young people which they define as the generation Y when making financial decisions. Li et al. (2022) compared investor behaviour before and after the advent of mobile investing and noted that mobile trading affects herd behaviour and the dispersion of equity returns. Alnsour (2022) investigated the impact of fintech on consumer loyalty and found that fintech factors influence consumer behaviour through cognitive experience, effective experience and social experience. Ye et al. (2022) examined the involvement of households in the risky investment process and concluded that digital finance has a positive impact on households through access to financial information and investment platforms.

Human vs. machine. Increasingly, technologies are created that compete with or even replace the human professional. Robo-advisors, robo-analysts, recommendation and support systems are penetrating life and creating human vs. machine problems. Belanche et al. (2019) examined the issue of robo-advisor adoption by assessing the factors that influence clients' decisions to engage with a robo-advisor or not. According to their study, demographic factors and familiarity with robo-advisors influenced clients' decisions and choices. Costello et al. (2020) explored the role of human decisions on lending platforms. The article seeks to determine whether a referral system or a professional skills can give lenders more discretion. Coleman et al. (2022) compared the investment proposals of robo-analysts and professional analysts. They found that robo-analysts do not have human biases such as over-optimism or representativeness, but not all of their recommendations are profitable. An alternative to the technology-recognition paradigm was explored by Aw et al. (2023) using surveys to investigate the reasons for customer resistance to robo-advisors. They reported that perceived fairness, intrusiveness and invasion of privacy are the main drivers of consumer resistance to the technology. Wan et al. (2023) studied a multi-level fuzzy set-based support system for fintech lending platforms and paid attention to security-risk management. The authors found that the most important risk factors for fintech lending are security and profitability. Lin and Lee (2023) examined the behaviour of users of mobile banking support systems. They found that in artificial-intelligence support systems, perceived intelligence and perceived anthropomorphism have the greatest influence on consumer satisfaction with banking.

Fintech development is boosting financial inclusion, changing consumer behaviour in the ever-changing environment of the technology boom. People must compete with technologies, but new opportunities open up for them to become fintech talents or smart users.

6. Discussion

The development of fintech depends on factors that can and cannot be affected by people or directly influenced by governments. A country's economic development and socio-demographic situation determine different fintech development needs, goals and scope. Governments aim to accelerate economic growth, reduce poverty and solve ecological and sustainable development problems through fintech regulation. The main challenges noted during the research period were the COVID-19 pandemic, Russia's war in Ukraine and data security. Here, fintech can become both a new problem and a new solution or development opportunity.

Examining the impact of fintech is not sufficient; it is necessary to understand the mechanisms through which this impact is made. **Figure 3** presents the influence channels found in scientific sources.

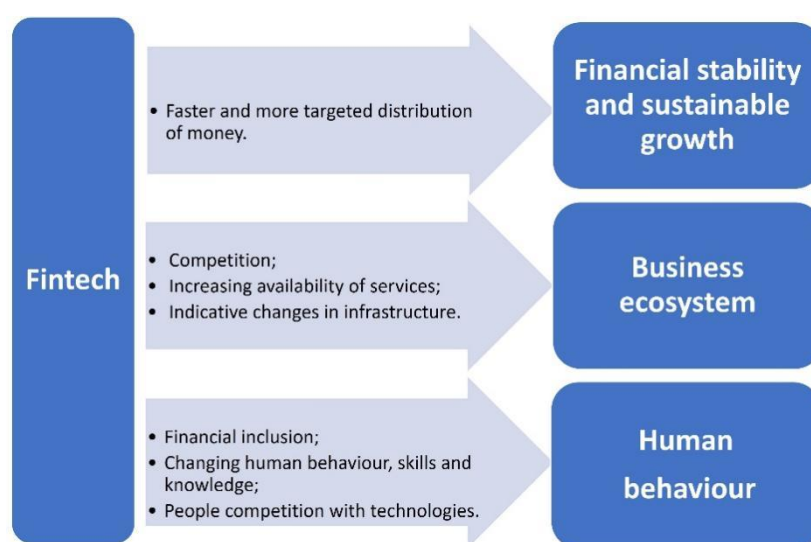


Figure 3. Mechanisms of fintech impact.

In the conducted review, the field of influence of fintech was divided into separate areas, the impact mechanisms were distinguished, but the complexity of fintech as a phenomenon remains. The development of financial technologies, the demand and supply of financial services and the decisions of institutions fit into one term "fintech". The fintech impact field map provides the beneficiary with a more complete understanding of the fintech phenomenon, allowing better decisions to be made. It is useful for regulators to know the risks of the financial system and the consequences of management decisions. It is not enough for companies to react to changes and create new products and services, but they need to be responsible for financial stability, and it is necessary to know the impact on customers and employees. The field of experimental research of the authors is human vs. machine in the financial sector, so a look at the entire fintech field will undoubtedly be useful in the future, taking into account geographical, socio-demographic country differences, regulatory peculiarities, in the search for sustainable solutions in the entire fintech ecosystem.

The main limitation is the short publication window (41 months), which does not include exposure studies before this period, therefore does not reflect the dynamics of the number of articles and topic. Additionally, only articles from one database, Web

of Science (Clarivate Analytics), were examined. In order to cover more databases, innovative publication classification methods should be used and this could be done in the future. Moreover, 13.7% consists of articles that used Chinese data, which also limits the understanding of global diversity.

7. Conclusion

A very broad spectrum of effects was obtained through this review of articles published in January 2020–May 2023 found in the Web of Science database according to the keywords ‘financial technologies + impact’. The co-occurrence networks chosen for the analysis helped to classify, assess the importance in numbers and put emphasis on the selection of articles.

Fintech comprises three closely related components: finance, technology and sector. Fintech was measured in the articles in various ways: the number of fintech companies, the number of patents, fintech indices, the number of sandboxes and comparisons of different indicators before and after the emergence of fintech. The most common method used by the authors was regression analysis, which not only estimates the effect of a certain factor, but also determines the reliability of this estimate. However, in the case of regression, the choice of variables is limited, and a rather fragmentary view of the phenomenon or the factors affecting it is obtained. Factors influencing fintech indirectly influence factors influenced by fintech itself. A comprehensive approach allowed us to map the field of fintech influences.

After summarizing the information found in the selected scientific articles, the external factors influencing fintech were distinguished. Major development, social and demographic differences across countries determine the development of fintech through the selection of goals and priorities. To a large extent, this also shapes the decisions of governments in regulating and promoting the development of fintech. In the reviewed articles, the challenges faced by the fintech sector had both positive and negative effects, sometimes encouraging the growth of service availability and digitisation and sometimes hindering the development of infrastructure. Data protection is one of the constant challenges for those working with data. Here, we notice a contradiction between the desires for data to be available in real time and for it to be highly reliable and secure. A large number of articles examined the impact of the COVID-19 pandemic on the fintech sector, the digitisation of services and the behaviour of fintech customers.

Fintech technologies create a new standard of services and, through quick and targeted distribution of money, affect the stability of the financial system, economic growth and sustainable development. A contradiction between the measurement of financial stability through bank indicators and the influence of fintech on financial stability has been observed. The flexible and attractive services offered by fintech companies challenge traditional companies, forcing them to digitise and modernise. Authors often draw attention to a U-shaped effect: when fintech is weak and traditional companies are strong, competition hurts traditional companies; however, when they find technological solutions, the development of fintech encourages the development of traditional companies.

The development of fintech is changing people’s behaviours. Services on

smartphones and the Internet make financial transactions more accessible but require customers not to be afraid of technology, manage risks and trust support systems when making financial decisions. Digitisation puts humans in competition with machines and forces them to constantly improve their abilities as users and even developers of technology.

Systematization and summarization of information from 158 scientific articles by creating a fintech influence field map and distinguishing the main impact mechanisms can be useful for financial policy makers, business actors and investors. Perhaps the selection of articles from the database 510 did not avoid subjective selection and confirmation bias of authors.

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