

CHANGING FINANCIAL SYSTEM ARCHITECTURE UNDER THE INFLUENCE OF THE FINTECH MARKET: A LITERATURE REVIEW

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Review

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ABSTRACT In the past seven decades, especially since the Global Financial Crisis, the financial system's architecture has changed significantly around the world. New financial market entrants, such as fintech start-up companies, offer financial products and services more efficiently than established financial institutions (especially banks and insurance companies), bypassing the regulatory requirements established intermediaries must comply with. Despite the heterogeneity in the fintech concept, we use this term to consider innovations in financial products and services based on emerging information and communication technologies (i.e., information technology and mobile connectivity) as solutions that are changing the financial structure worldwide. Although the share of new participants in the financial system is rather small compared to the incumbents, fintech innovations are continuously advancing (e.g., crowdfunding, marketplace lending, cryptocurrencies, copy trading, robo-advice, insurtech, etc.), and their share is growing fast. This paper provides an overview of the fintech market and its impact (actual and potential) on the financial system's architecture based on a comprehensive review of the theoretical and empirical literature.

KEYWORDS: *fintech, financial system, financial services, banking, insurance, fintech innovations.*

1. INTRODUCTORY CONSIDERATIONS

Owing to the advancement and proliferation of information and communication technologies (ICTs), today's financial services ecosystem can be considered digital as much as physical. As such, the financial services ecosystem contributes to the emergence and development of a digital economy in any country, its business entities, and the household sector. The interaction between ICTs and financial services has ex-

isted for about seven decades. In the 1950s and 1960s, ATMs emerged to replace customer service agents in banks, enabling customers to self-serve. At the same time, credit cards and electronic funds transfers at point-of-sale terminals were invented to withdraw cash as needed. In the mid-1990s, commercial Internet connectivity led to 24/7/365 e-banking. On a cost basis, ICTs significantly exceed banks' capital expenditures (in some cases by a factor of ten) and account for a large portion of a bank's total costs (between

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10-15%) (Haber, D'yakonova, & Milchakova, 2018).

Fintech (short for "financial technology" or "technology applied to finance") also goes beyond banking; new disruptive ICTs in the financial services system range from peer-to-peer (P2P) lending to nearly over 10,000 active cryptocurrencies that bypass financial institutions in financial services processes. Fintech companies or fintechs are new players in the financial services system, even though most of their economic activities are small-scale compared to the financial system. Their numbers have increased since the 2010s and evolved to offer online banking as a service. However, assessing the impact that fintechs might have on the financial system's stability remains difficult due to limited data availability (both formal and informal information). The Covid-19 pandemic was an additional incentive for a rapid digital transformation of the financial services systems. During this period, particularly from March 2020 onward, major financial intermediaries such as banks and insurance companies continued to operate without significant disruptions, largely because their business models were based on online communications. The increased reliance on online technology has forced organizations to quickly adapt to changing customer behavior and expectations. This has also led to reduced operating costs and better control of overall spending in some business areas. Bill Gates' popular 1994 quote, "Banking is necessary, but banks are not," implies the space for digitalization in banking and, more broadly, in the financial services ecosystem and for the digital transformation of banks and non-banking financial institutions. The upcoming transformation from Industry 4.0 to 5.0 will impact all industry sectors, including banking (which may become Banking 2.0). New technologies, such as various forms of automation, artificial intelligence, human-robot collaboration, and the focus on sustainability, will require continuous assessment of the application of various transformation trends and tendencies in finance and banking. The industry must be able to adapt to technological developments and use them to its advantage, introducing new practices as the "new normal." This may lead to entirely new banking models that must be embedded in the existing business practices (Nicoletti, 2021). For example, retail banking still needs improvement, as around 73% of the world's population is unbanked, i.e., financially excluded (Lévy-Bencheton, 2016). This paper aims to review the fintech market and its actual and potential impact on the financial system's architecture based on a comprehensive review of the existing literature and empirical data.

The remainder of the paper is divided into three sections. The second section of this paper provides theoretical insights into fintechs, fintech companies,

and the scope of their activities; the third section highlights some stylized facts about the impact of fintechs on the architecture of the financial system and offers some predictions, and the fourth section provides conclusions and suggestions for future research.

2. THEORETICAL INSIGHTS INTO THE FINTECH MARKET AND ITS IMPACT

2.1. Heterogeneity in the concept of fintech

The term "fintech" was introduced by the bank manager Abraham Leon Bettinger in 1972. Since then, it has become widely adopted, especially after the Global Financial Crisis of 2008, which jeopardized the financial customer's trust worldwide and accelerated the creation of fintech start-ups. The global recession 2009 also played a significant role in the rise of fintechs. Namely, corporate and household debt increased significantly (before the recession), and suddenly (during the recession), it became increasingly difficult to get credit. These conditions created an ideal environment for the emergence of a new set of lenders, i.e., fintech pioneers. According to Mohan (2020), there is no doubt that business concepts of fintech firms have influenced banks, especially in the area of customer service, and with so much of fintech relying on mobile communication technology, banks are increasingly looking for other ways to communicate with customers outside of the traditional, brick-and-mortar branches. Although the latter trend started before the fintech revolution, it has de facto accelerated as many fintech start-ups have become extremely popular due to their great success.

Table 1 summarizes various interpretations of fintech as they have appeared in the academic literature. Since some authors define fintech while others define fintechs, it should be noted here that fintech is an activity while the fintech operator is an entity. Moreover, the search for a common definition of fintech(s) reflects the need to identify the authorities that can be trusted to oversee a rapidly expanding landscape/environment in which certain entities engage in activities related to savings, credit, and money but outside the boundaries of the regular supervision (Lemma, 2020).

TABLE 1. A chronological (and alphabetical) list of selected fintech definitions

Author(s) (year)	A descriptive explanation of fintech
Bettinger (1972)	Financial technology that combines banking expertise with contemporary techniques to manage science and IT.
Arner, Barberis, & Buckley (2015)	Technology-enabled financial solutions.
Schueffel (2016)	A new branch of the financial industry that uses technology to improve day-to-day financial activities.
Dorfleitner et al. (2017)	Companies or their representatives that combine financial services with innovative technologies.
Wonglimpiyarat (2017)	One of the technologies that would revolutionize the banking industry. The challenging technology would enable companies to compete effectively in the 21 st century.
Gupta & Tham (2018)	Any start-up that uses technology to develop a financial product or service.
Schena et al. (2018)	A “horizontal” phenomenon within the financial services sector is developing within the broader digital economy framework.
Breidbach, Keating, & Lim (2020)	The broad intersection of ICTs and finance.
Thakor (2020)	ICTs deliver new and improved financial products and services.
Wewege & Thomsett (2020)	An industry composed of companies that use ICTs to make financial services more efficient.
Elsaid (2021)	Using ICTs to develop and deliver financial products and services to individuals and businesses at lower costs.

Source: Authors.

The international (or supranational) bodies compiled in Table 2 provide their working definitions

of fintech. The Financial Stability Board (FSB) statement is the most commonly used.

TABLE 2. Institutional definitions of fintech

Institution	A descriptive explanation of fintech
Consumers International (2017)	The point at which financial products and services and ICTs meet.
FSB (2017)	Technology-enabled innovations in financial products and services could drive the industry to develop new business models, applications, processes, or products with associated material impacts on providing financial products and services.
International Organization of Securities Commissions, IOSCO (2017)	A variety of innovative business models and emerging ICTs have the potential to revolutionize the financial services industry.
Organization for Economic Co-operation and Development, OECD (2017)	<i>Fintechs</i> are non-banks that use advanced ICTs to conduct traditional banking transactions (emphasis added).
Basel Committee on Banking Supervision, BCBS (2018)	Decided to use the FSB’s working definition of fintech.
European Central Bank, ECB (2018)	Based on the FSB’s definition, the ECB explains <i>fintech banks</i> as those with “a business model in which the production and delivery of banking products and services are based on technology-enabled innovation” (emphases added).

Source: Authors.

Overall, there is a wide range of interpretations of what fintech means, so it is not easy to determine the size of the fintech market. Some interpretations understand fintech to mean financial technology start-ups. In contrast, others use the term fintech to describe the broader industry/sector around financial technology, including many players distinct from fintech start-up companies. In addition, according to some authors/institutions, fintechs include technology-enabled customized financial services offered by banks (e.g., Bettinger, 1972; Consumers International, 2017; FSB, 2017; IOSCO, 2017; Wonglimpiyarat, 2017; Bucharak et al., 2018; BCBS, 2018, etc.), while others exclude banks from the definition (e.g., Gupta & Tham, 2018; Breidbach, Keating, & Lim, 2020; Thakor, 2020; Wewege & Thomsett, 2020, etc.). In short, there are two types of fintech definitions: In the broader sense, fintech refers to all ICT-enabled financial service activities with or without the intermediation of banks and non-bank financial institutions; in the narrower sense, it includes ICT-enabled financial services offered by new market entrants that are not incumbent financial institutions, such as IT and mobile connectivity. In this paper, we use the term “fintech” to consider innovations in financial products and/or services based on ICT solutions that are changing the financial system’s architecture worldwide.

It is necessary to distinguish the term fintech from related acronyms such as techfin (a combination of the words “technology finance”), regfin (“regulation technology”), and insurtech (“insurance” and “technology”). Techfin is a company that collects data to solve consumers’ non-financial problems and then uses that data to enter the financial market (leading players in this space or big tech companies include Apple, Amazon, Microsoft, Google, Facebook, Alibaba, Uber, etc.). While fintechs are often considered financial intermediaries, techfins are data intermediaries (Zetzsche et al., 2017). Thus, unlike fintechs, techfins do not compete with the incumbent financial institutions but often act as potential suppliers or partners supporting their technological and operational development. Regfin consists of the use of technology, particularly IT, “in the context of regulation, monitoring, reporting, and compliance” (Arner, Barberis, & Buckley, 2017) or to “help firms comply with regulatory requirements, especially in a post-crisis environment where requirements have been increased but might even refer, more widely, to the use of similar technologies by financial authorities to perform their supervisory tasks” (Macchiavello, 2017). As the financial system shifts from an earlier know-your-customer (KYC) approach to a know-your-data (KYD) approach, a new regulatory paradigm (regime) must address everything from trusted digital/online identity to digital

data sovereignty. Insurtech is the application of ICTs to solve the long list of problems insurance companies currently face. Regarding customer engagement, insurtech includes using ICTs to improve customer relationship management, price aggregation, omnichannel acquisition, digitized claims processing, and online policy purchasing (Yan, Schulte, & Chuen, 2017). Insurtechs such as Oscar in the US and ZhongAn Insurance in China operate exclusively online and have achieved significant business volumes in recent years.

2.2. The scope of the activities of fintech companies

The scale and number of fintech companies have increased dramatically worldwide in recent years. As of 2019, there are more than 10,000 such companies – 60 of which have vertically integrated into credit, payments, wealth tech, banking, and cryptocurrency services for the public – and 39 exceed \$150 billion in value (Rubini, 2020). For example, Ant Group (formerly known as Ant Financial and Alipay), China’s largest fintech operator founded by Alibaba in 2014, aims to transform China’s financial system, including credit, digital payments, wealth management, etc.

Based on Table 1, the question is to what extent fintech companies/lenders are active. IOSCO (2017) mapped the global fintech landscape into eight categories – payments, insurance, planning, lending and crowdfunding, blockchain, trading and investment, data and analytics, and security – and then focused on the provision of securities and capital markets products and services through the use of fintech, such as financing platforms, retail trading and investment platforms, institutional trading platforms, and distributed ledger technologies. It is worth noting that BCBS (2018) has categorized fintech innovations (products and services) or segments, as shown in Table 3.

TABLE 3. Taxonomy of fintech innovations

Fintech innovations				
Credit, deposit, and capital-raising services	Payments, clearing, and settlement services		Investment management services	Fintech innovations in the making
Crowdfunding	Retail	Wholesale	High-frequency trading (HFT)	Insurtech
Marketplace (P2) lending	Mobile/digital wallets	Value transfer networks	Copy trading platforms	Search engines and comparison sites
Mobile banking	P2P money transfers	Foreign exchange (FX) wholesale	E-trading	ICTs and infrastructure
Credit scoring	Digital currencies	Digital exchange platforms	Robo-advice investing platforms	ESG-focused fintech innovations

Source: Adapted from BCBS (2018)

NOTE: While the cells highlighted in brown were added to the original matrix created by BCBS, the cells related to market support services (e.g., distributed ledger technologies, artificial intelligence, data applications, etc.) were removed from the matrix.

As shown in Figure 3, fintechs in the financing segment offer crowdfunding, P2P lending, mobile banking, and credit scoring to end users. Crowdfunding is financing where many people (contributors, “backers”) collectively raise funds to achieve a common goal. Crowdfunding portals can be divided into crowd investing (including donations) and crowdlending (or rewards-based crowdfunding). P2P transfer is an online marketplace for individual and institutional investors to fund those players in the system with a deficit of financial resources. In this process, 100% of off-balance-sheet loans are funded by “peers,” a new type of funding model (Patwardhan, 2017). When the lender is not a bank (or a deposit-taking institution), Bucharak et al. (2018) use the term “shadow bank.” The two largest and oldest P2P lending platforms in Europe are Mintos and Twino, with more than 60% and 20% market share, respectively. Furthermore, fintechs are equipping banks with tools such as artificial intelligence-based chatbots and anti-money laundering software, improving banks’ efficiency more than ever.

Fintech innovations in payments, the segment where they have had perhaps the greatest impact to date, depend on whether they are targeted at retail or wholesale customers. Fintechs offer mobile wallets, P2P transfers, and digital currencies (e.g., Bitcoin, Ethereum, Tether, Litecoin, etc.) to retail customers. Fintech companies can offer value transfer networks, FX markets, and digital exchange platforms for wholesale customers. For example, digital wallets (such as PayPal) “tokenize” digital payments, replacing physical wallets with smartphones. Some of the global leaders

in digital wallets include Google Pay, Venmo, Apple Pay, Cash App, PayPal, etc. Digital/virtual currencies, cryptocurrencies, or “digital gold” (probably the best known is Bitcoin, created in 2009) represent digital computer codes stored in electronic wallets in cyberspace. Most cryptocurrencies use blockchain-based technologies. In short, blockchain refers to how data is organized in a database. In the case of Bitcoin, for example, transactions (data) are packed into “blocks,” and the “blocks” are linked together in a “chain”. Cryptography, more specifically the hash function, is used to connect the “blocks” in such a way that it is impossible to change the content of one “block” without changing the content of all subsequent “blocks.” This is an extremely important feature of the blockchain, as it ensures the immutability of the data entered. In addition, in 2011, TransferWise established the world’s first P2P money transfer service compatible with Apple products, allowing end users to transfer money abroad without involving a bank, and often at a lower cost.

In the asset management segment, fintech services may include HFT, copy trading platforms, electronic trading platforms, and robo-advice investment platforms. For example, copy trading means “copying the trades of successful traders” because today, “many successful traders provide access to their trades, either for a fee or for free” (Thakor, 2020). A robo-advisor is a low-cost online platform that provides automated, algorithm-driven services related to financial planning (from saving for a university to investing for retirement) and managing investment

portfolios with minimal human supervision. As software programs, robo-advisors can be used by ordinary people to automatically invest their money in the best possible way, often at a low cost (Valavan, 2023).

Emerging fintech innovations dedicated to the insurance sector are called insurtech (an example of a digital insurer is Zendrive). Insurtech becomes very important when it comes to auto and health insurance. Consumers may use smart equipment/devices as part of an automated machine-learning approach for smarter insurance (e.g., car insurance trackers that collect data that insurers can use in pricing, especially risk-based pricing of insurance policies). More generally, the personalization of insurance services is facilitated by technology. Although fintech innovations have been part of our lives for several decades, we recognize their rapid development in recent years (Fujii-Rajani, 2018); hence, "fintech innovations in the making" in the right cell(s) of Table 3.

3. SOME STYLIZED FACTS AND PROJECTIONS ABOUT THE INFLUENCE OF FINTECH ON THE ARCHITECTURE OF THE FINANCIAL SYSTEM

Studying data on fintech markets and banks in 15 European countries over the period 2013-2017 Q3, Mansilla-Fernández (2017) found the following regularities:

- Investment in fintech companies is greater in more financially developed countries (e.g., the United Kingdom, Germany, France, etc.).
- The use of electronic payments is higher in countries where a larger proportion of the population has an account with a financial institution.
- Investment in fintech companies is higher in countries with less competition in the banking sector.
- Investment in fintech companies is higher in countries with higher lending interest rates and lower deposit interest rates.
- Investment in fintech companies and strict regulation complement each other.

Since 2010, venture capitalists (VC), private equity (PE) firms, corporations, and others have poured unprecedented money into global fintech start-ups. According to KPMG (2022), global fintech investment in 2021 was \$210 billion. A useful measure of how big the fintech market is and how it is growing is VC investment in fintechs. KPMG's report shows that VC investment internationally peaked at \$115 billion in 2021, surpassing the previous maximum of \$53.2 billion in 2018. In addition, PE companies globally were

more active in the fintech industry than ever before, with a record 144 deals with over \$12 billion in investment, doubling the previous high of \$5 billion in 2018. 2021 was a successful year for cryptocurrencies and blockchain, with \$30 billion in investments globally.

Furthermore, financial institutions are under significant pressure to reduce their reliance on legacy infrastructure and improve their core banking operations to deliver a better customer experience using cloud computing. In 2021, interest in fintechs that can help with such activities increased, especially in Tier 1 of the Basel III accord. As a result, the key fintech trends KPMG identified for 2022 were as follows:

- Embedded financial solutions for banks;
- Increased regulatory scrutiny of embedded financial offerings;
- Fintechs would use the opportunity to focus on branding themselves as data companies;
- Fintechs focusing on ESG (environmental, social, and governance) would seek a major growth trajectory;
- Exploring deal opportunities in underdeveloped regions;
- Slowing growth in developed markets while focusing on emerging markets.

As for the 2023 forecasts, KPMG (2023) highlights the following:

- Regtech continues to gain importance in the eyes of investors;
- Increased priority for fintech solutions that align with ESG and climate change priorities and goals;
- Continued trends in start-ups and larger transactions in initial public offerings (IPOs) and mergers and acquisitions (M&As);
- Continued interest in blockchain solutions that extends beyond the crypto space and is receiving increasing attention from investors and
- Growing focus and investment in B2B, such as embedded finance, payments, and insurance.

It is still unclear how the financial system's architecture will evolve over time, such as whether new providers of financial services will be bought out by incumbent financial institutions or become their competitors. What we can say at this stage is that financial technologies are promising and will be a driving force for the fintech industry in the coming period. Consequently, the financial services system will undergo significant changes in the future. In addition to widespread global connectivity, rapid technological advancements, urbanization, and an aging population, the Covid-19 pandemic serves as an accelerator of these changes (Walker, NikBakht, & Kooli, 2023; Harris & Wonglimpiyarat, 2023; Barjaktarović Rakočević & Rakić, 2023; Valavan, 2023, etc.).

Numerous changes can currently be observed in the financial system's architecture that can be attributed to the new ICTs. Changes in customer demands, demographics, and legislation would probably drive financial services toward full digitization and automation and financial institutions toward digitalization or, more broadly, digital transformation. For example, banking could benefit from modern technologies such as distributed ledger technologies, big data, cloud computing, machine learning, artificial intelligence, and similar decision-making technologies. However, along with the strengths come disadvantages such as increased reliance on ICTs and rapid technological change, high technology costs, threats to data security, fraud risks, increased job losses, etc., which could make collaboration or competition between fintech companies and established financial intermediaries even more important (Varma et al., 2022; Hanafizadeh & Amin, 2022).

4. CONCLUSIONS AND RECOMMENDATIONS

There is no denying that fintech innovations are transforming the way financial institutions operate worldwide. Fintechs have a tremendous potential to change the financial system's architecture by bringing innovative products and services to market, implementing contemporary business models, and increasing competition for established financial institutions, particularly banks and insurance companies. This could increase the efficiency of the financial system but also raise questions about the stability and resilience of the financial system. To maintain financial soundness and create a more inclusive financial system, fintech companies can eliminate business inefficiencies, create important economic opportunities, and accelerate social development by focusing on markets underserved by established financial institutions. However, it is too early to determine how the financial system's architecture will change over time, i.e., whether fintech companies will be bought out by traditional financial institutions or become their competitors. Convergence and collaboration between fintech companies and established financial intermediaries could spread as new entrants to the financial market continue to carry on with the digital disruptions in financial services. In such a scenario, banks could become fintech Maecenas by investing in fintechs or providing them with some of the critical infrastructure needed for growth. According to Consumers International (2017), banks are resilient to the disruptive influence of fintech due to the advantages offered by their corporate environment

and the willingness of some banks to engage with fintech, preventing a Kodak scenario (that famously declared bankruptcy in 2012 due to the lack of a business strategy for the digital age). While resisting the loss of market share to new entrants, fintech services through traditional banking providers offer consumers the opportunity to access its benefits through a familiar institution, which can accelerate fintech adoption among those who would otherwise have delayed learning about it.

As for the policymakers, as the fintech market grows, they must continue to assess the existing regulatory system's performance to support innovations and mitigate risks. Since fintech operators, unlike banks, do not participate in the fractional reserve banking system and can conduct international transfers without interbank clearing, they have far fewer compliance obligations than banks and lower operating costs than banks. Moreover, they are not subject to the capital requirements agreed with the Basel III regulatory framework.

A particular concern is the lower potential for digital transformation of other financial institutions, such as microcredit organizations, leasing companies, currency exchanges, etc. Today's market warrants the innovative application of new technologies and processes to business transactions and financial services, and consumer sentiment (especially among Millennials) reflects this. Digital access to financial services is enjoying popularity beyond mere convenience and may bring unprecedented benefits to some sectors. One of the unanswered questions is how the massive digital transformation of the financial system, which is currently underway, can support and benefit small and medium-sized businesses that employ the majority of the global workforce. There is also an area that has not yet been explored – fintechs focused on ESG solutions and their contribution to sustainable finance.

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PROMJENA ARHITEKTURE FINANCIJSKOG SUSTAVA POD UTJECAJEM TRŽIŠTA FINTECH-a: PREGLED LITERATURE

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SAŽETAK

Tijekom posljednjih sedam desetljeća, posebno nakon globalne financijske krize, arhitektura financijskog sustava znatno se promijenila širom svijeta. Novi akteri na financijskom tržištu, kao što su fintech start-up tvrtke, nude financijske proizvode i usluge učinkovitije od uspostavljenih financijskih institucija (posebno banaka i osiguravajućih društava), zaobilazeći regulatorne zahtjeve kojih se uspostavljene posredničke organizacije moraju pridržavati. Unatoč heterogenosti u konceptu fintecha, ovaj pojam koristimo da razmotrimo inovacije u financijskim proizvodima i uslugama temeljene na nastajućim informacijskim i komunikacijskim tehnologijama (tj. informacijska tehnologija i mobilna povezanost) kao rješenja koja mijenjaju financijsku strukturu širom svijeta. Iako je udio novih sudionika u financijskom sustavu prilično mali u usporedbi s postojećima, fintech inovacije neprestano napreduju (npr. crowdfunding, tržišno posuđivanje, kriptovalute, copy trading, robo-savjetovanje, insurtech, itd.), a njihov udio brzo raste. Ovaj rad pruža pregled tržišta fintecha i njegovog utjecaja (stvarnog i potencijalnog) na arhitekturu financijskog sustava temeljen na sveobuhvatnom pregledu teorijske i empirijske literature.

KLJUČNE RIJEČI: *fintech, financijski sustav, financijske usluge, bankarstvo, osiguranje, fintech inovacije.*