

INTELLIGENT FINANCIAL TECHNOLOGIES: CONVERGENCE, MANAGEMENT, SYNERGISM AND TOTAL VECTORS OF INFLUENCE

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Abstract

The relevance of the study lies in the consideration of the issues of the financial sector transformation under the influence of the development of innovative intelligent financial technologies. Based on the application of institutional, evolutionary, synergistic methodological approaches, it is shown that the formation of the Fintech industry market has led to changes in the entire financial sector. The role of artificial intelligence and other intelligent technologies in the development of Fintech and the formation of a total vector of influence on financial systems on a macro scale is analyzed. The study led to the conclusion that the involvement of new participants in interaction through convergence based on smart solutions of “digital finance” expands the boundaries of the synergistic effect, covering not only Fintech, but the entire financial sector, and also contributes to the implementation of sustainable development goals, thus participating in the formation of social and general economic effects, including on a global scale. The study expands the boundaries of the analysis of macroeconomic effects caused by new financial technologies, and also complements the arsenal of scientific paradigms of Fintech, the banking sector and their interaction with synergetic methods.

Key words: AI, banking, convergence, ecosystem, Fintech, financial sector, financial and non-financial reporting, enterprises.

1. Introduction

The global development of the pandemic has led to a breakthrough transition from the physical to the digital format of organizing various processes, accelerating natural progress many times over. The unique

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situation of 2020 has further increased the importance of digitalization and the orientation of users towards a remote format for receiving services. People have adopted a new format of life, the availability of technology, which has modified their skills and habits. Financial technologies have not been left out in this process. The year 2020 has completely shifted customer expectations towards remote work, forcing financial institutions to reconsider outdated work organization technologies. Amid the pandemic, 88% of customers expected companies to step up their digital initiatives, according to Salesforce, and 68% said COVID 19 had raised their expectations for the digital capabilities of financial instruments (Sironi, 2021). The new digital paradigm includes the following areas of transformation:

1. Expanding digital perspectives. The global digital transformation has opened up entirely new possibilities. Nearly 70% of customers expect banks to create new ways to deliver existing products and services, such as digital versions of traditional interactions as well as modern product types (Wu et al., 2022). At the same time, despite the clear need for well-developed digital channels, the pandemic has highlighted the fact that the financial industry is not fully prepared to enter the digital age. "The number one bank in the world will be a technology company," predicted Brett King, American futurist, author, co-founder, and CEO of New York-based mobile banking startup Moven (King as cited in Choi & Huang, 2021). Successful digital businesses are always two steps ahead, constantly monitoring changing customer behavior, inventing new ways to adapt their products to meet rising expectations.
2. Customer-oriented thinking. A key factor here is to develop a specific type of customer-centric mindset at every level, including in operational and strategic processes, while ensuring that financial solutions meet the needs and expectations of users.
3. Modification of key performance indicators, as the digital paradigm is increasingly shifting towards customer centricity. It is imperative to rethink not only the internal culture and business approach of the company, but also the way its performance is measured, due to the fact that for decades the key performance indicators were the level of sales, conversion, and the number of leads. But in order to become a successful financial brand in the new era, the focus should be made on user reviews and feedback, the formed image of the technology and the service seller, and financial architecture (The state of Fintech report, 2020).

Financial technologies are implemented in different sectors of the financial industry. In terms of classification of the financial technology tree, they can be found in the following categories of financial services: digital banking, financing of Fintech platforms (crowdfunding and crowdinvesting), robotic consultations, electronic money, digital

payment services, insurance technologies and financial activities related to crypto assets, etc.

At the same time, new digital financial technologies influence also enterprises of real sectors of economy. In particular, an important trend in 2021 was the rapid growth and development of such areas as open banking, neobanks, digital services, and simplification of verification (authentication). B2B2C (Business-to-Business-to-Consumer) segment startups aimed at increasing the security level of online transactions (for example, tokenization) are of high interest. In addition, enterprises are also interested in ways to improve processes.

For the effective functioning and development of the financial market, financial innovations are of key importance. The financial sector is becoming one of the main drivers of the digital economy. Under the influence of the growing scale of digitalization, the landscape of the banking system is changing. The dynamic introduction of the possibilities of new technologies in the financial and credit sector makes it possible to single out several key development trends, including: a decrease in the cost of services of financial and credit institutions; provision of a wide range of services in a remote format; increase in non-banking organizations providing payment services; partnership of credit institutions with technology companies in order to implement innovative solutions and new efficient business models.

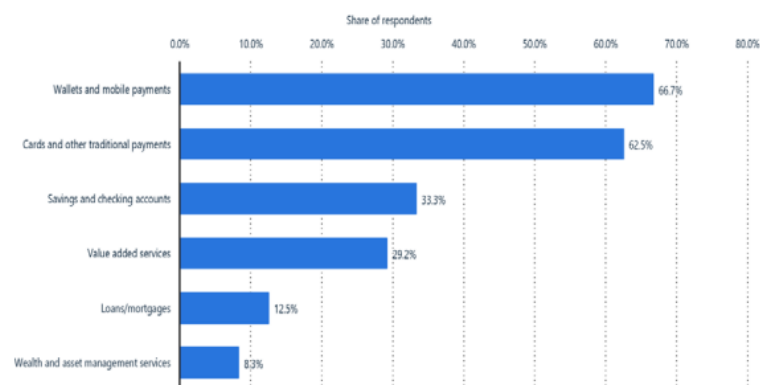
The intensive development of solutions based on artificial intelligence and neurotechnologies has led to an increasing demand for them from the state and business, including an explosive growth in venture capital investments and AI-based Fintech startups. The global financial crisis of 2008-2009 gave a powerful impetus to the development of Fintech companies, whose transaction costs were much lower compared to traditional market players. Fintech companies gradually began to seriously compete with banks and various financial intermediaries, and this accelerated the process of creating innovations due to the emergence of many Fintech startups. Thanks to the rapid development of Fintech based on breakthrough digital technologies, new services appear in the field of finance, while traditional ones become faster, more convenient, and more efficient. The volume of investment in the Fintech industry is now estimated at about \$20 billion per year. Leading consulting companies give the following estimates: KPMG says it \$19.1 billion, Deloitte says \$20 billion, and Accenture, an international system integrator, says a total investment of \$22.6 billion (Veloso et al. 2021). This indicates a very dynamic development of technologies in the financial sector, and projects that seemed fantastic or unrealizable just a year ago may already be in the final testing stage today. According to McKinsey, the number of Fintech companies has more than doubled over the past years, from 800 in April 2015 to over 2,000 in 2020 (Grennan &

Michaely, 2021). This explosive growth is becoming a platform for rapid change.

Intensified price competition provided more massive access for consumers in a number of sectors of the financial market (first of all, payments, transfers, microloans, etc.), which further spurred the technological race. As a result of an unprecedented acceleration in the pace of development and implementation of new technologies, the Fintech industry has become the fastest growing industry, the leader in innovation. Fintech companies are developing new software, mobile Internet applications, business processes and business models. They are moving from developing single products to creating hybrid ones that provide multi-solutions for financial services consumers.

In the early 2010s, commercial banks and other traditional financial market players began not only to compete, but also to cooperate with Fintech companies in various forms of partnership. The stage of development of the industry, which is called Fintech 2.0, has begun (Dapp & Slomka, 2015). Many large banks, the main consumers of Fintech products, decided to get involved in the process of creating and implementing Fintech innovations, which is new for them, and began to show great interest in Fintech startups. Banks began to sell Fintech services and related services to their customers, implementing a financial supermarket model based on digital platforms and applications that started to act as “markets” (marketplaces) where sellers and buyers of goods and services communicate remotely and without intermediaries. Impact of non-traditional financial firms on selected banking products and services according to senior banking executives worldwide back in 2018 is shown on Fig. 1 below.

Fig. 1. Impact of non-traditional financial firms on selected banking products and services according to senior banking executives worldwide back, as of 2018.



Source: Nguyen, D., Sermpinis, G., & Stasinakis, C. (2013). Big data, artificial intelligence and machine learning: A transformative

symbiosis in favour of financial technology. *European Financial Management*, 29(2), 517-548.

Simultaneously, banks began to acquire existing or support new startups, acting as venture investors, incubators or accelerators. At the same time, large telecommunications companies began to perform some of the functions of banks to issue bank cards and provide a number of financial services. Consumer services companies (marketplaces), Internet providers, telecom operators have increasingly joined the financial supermarket model, which has led to the emergence of large and small digital ecosystems (Puschmann, 2017; Lee & Shin, 2018). The model of a financial supermarket has transformed into a model of an immense marketplace, when a business is not based on the sale of goods and services, but depends on the ability of the ecosystem to quickly and efficiently satisfy the maximum number of vital needs of customers using a single technological platform. These ecosystems and platforms imply convergence and synergy of technologies as a necessary condition for their effective and stable functioning and in turn have vectorial effects on the financial and economic system both on a national and regional/global scale. These effects cannot go unnoticed by the expert community, as their influence is becoming increasingly more obvious, and the total impact vector is one of the factors determining the immediate prospects for the development of the global financial market.

2. Literature Review

Today, the world is on the verge of the sixth technological order, the contours of which have already begun to take shape in the developed countries of the world, primarily in the United States, Japan and China, and are characterized by a focus on the designing and application of “high technologies”, artificial intelligence. Economic cataclysms, especially those that are observed in the world since 2012, according to experts, can only be overcome through the modernization of business processes and the widespread introduction of multifunctional technologies that form the sixth technological mode (Haddad & Hornuf, 2019).

Today the main attention is paid to the technologies of data search and analysis. It is about data security and the use of the cloud environment. This was noted by 73% of respondents in the world (Imerman & Fabozzi, 2020). At the same time, the financial technology market today has a leading position in terms of investment dynamics, the number of transactions, user coverage, etc. In 2019, only 18% of customers visited the bank to conduct transactions, while the rest carried out their transactions online. Today it is becoming clear that

Fintech is much more than just online banking. As noted in today's publications, the leading indicator characterizing the development of the global financial technology market is the level of their penetration in the regions (Damen, 2021).

The pace of development of smart financial technologies is clearly evidenced by the fact that back in 2016 Fintech was a completely new concept, and the leaders were mainly Fintech startups. Many of them were missing two important components of the ecosystem: financial institutions and, more importantly, regulators. Table 1 presents a grouping of financial technologies that allow transforming traditional banking into digital banking based on Fintech, as well as expanding the capabilities of credit institutions, gradually turning them into ecosystems.

Table 1. Grouping of financial services and digital banking technologies

Financial services	Deposits and loans	Raising capital	Asset management	Payments and settlements	Insurance
Fintech-activities	Credit crowdfunding	Robo consultation Intelligent formation of financial balances	Asset crowdfunding	Electronic money Digital payments and services	Insurtech business models

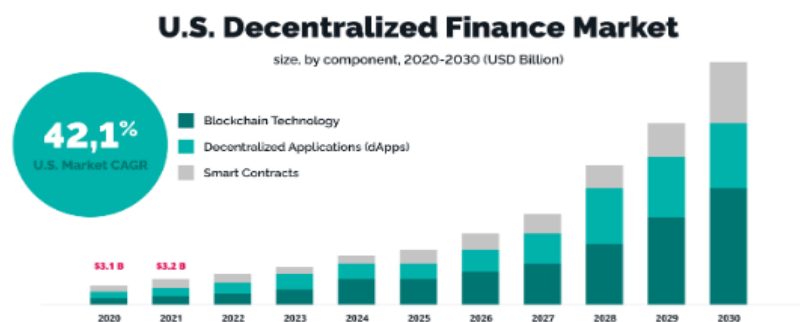
Source: Tanda, A. (2019).

Speaking of Fintech, earlier experts had in mind exactly new technologies in the field of finance, which meant blockchain, robotic consulting, mobile payments and peer-to-peer (P2P) lending. This definition has evolved over the past several years. Today, Fintech is defined as innovative financial technologies that can be used to gain a competitive advantage, namely (Wu et al., 2022):

- Artificial intelligence, big data and cloud technologies allow teams with the best technological resources to outperform those who do not;
- Blockchain could have major implications for financial institutions in the future. The technology is not yet fully mature and needs to overcome obstacles to developing a sustainable business model and gaining regulatory approval. At the same time, blockchain technology is increasingly being used in the banking sector, allowing the creation of decentralized online services based on smart contracts. Blockchain speeds up the decision-making process in the context of interaction with a large number of counterparties, and also improves the security of transactions.

In particular, in the Asia-Pacific region, China is leading in Fintech development, with a focus on the new technologies mentioned above; in many other markets in Asia-Pacific, Fintech is still defined by alternative lending, mobile payments, robocalls, etc. (Veloso et al., 2021). According to Google Trends, the current interest in Fintech around the world is 10 times higher than a couple of years ago (Grinberg, 2022). Figure 2 below illustrates that though connected with the cryptocurrency market and alternative financial instruments, decentralized finance is a new growing Fintech trend 2023.

Fig. 2. U.S. decentralized finance (DeFi) market.

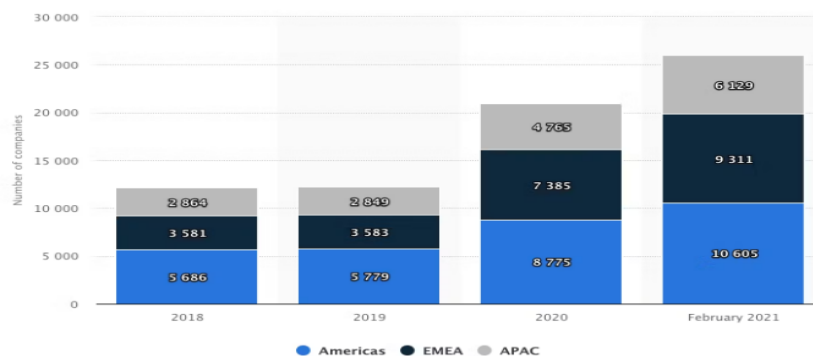


Source: Grinberg, D. (2022, December 29).

DeFi is “represented by various decentralized financial products that function without a central authority, such as: loans, exchanges, payment applications, etc.” (Grinberg, 2022).

According to Statista, “from 2018 to 2021, the number of Fintech companies in the EMEA region nearly tripled. And in 2018 alone, a total of \$254 billion was invested globally into roughly 18,000 Fintech startups through venture capital funds” (see Figure 3 below).

Fig. 3. Fintech companies across world regions, dynamics in the period 2018-2021.



Source: Damen, A. (2021, May 13). Fintech vs traditional banks: Competition or collaboration? MONEI.

The impact of AI technologies on the financial sector transformation is considered in many works. Deutsche Bank researchers in their report explore the transformation of the traditional banking system into a digital ecosystem under the influence of new technologies (Dapp & Slomka, 2015). The papers by Lee and Shin (2018), Puschmann (2017) discuss various types of business models for Fintech projects. The article by Haddad and Hornuf (2019) is devoted to the study of trends in the formation of the global Fintech market. The work of Giudici (2018) is devoted to the study of risk management in the Fintech sphere. The authors emphasize that for the sustainable development of Fintech projects, it is necessary to minimize their possible negative impacts on consumers and investors. Jaksic and Marinc (2019) also note that the business models of Fintech start-ups are not always aligned with the need for financial sector stability in particular, innovations in payments can affect the stability of financial systems infrastructure.

Increasingly more works are devoted to AI in the financial sector. In particular, among the benefits of AI, as well as the main reasons for the successful use of AI in finance, the following are noted (Chen et al., 2019; Choi & Huang, 2021; Giudici, 2018; Strietzel, 2018):

- Enhanced security, which consists in recognizing fraudulent behavior, repelling potential attacks and detecting suspicious transactions
- Reducing the speed of information processing fast and reliable processing of large amounts of data, since often namely the information processing is at risk of human error
- Process automation the ability to automatically generate documents; also, it helps organizations to monitor the implementation of the budget
- Improved understanding of work processes the results of processing huge amounts of data help to achieve an understanding of the current state of affairs and make appropriate decisions.

AI is used in a variety of processes and in the financial sector can be represented in two forms this is, first of all, the physical embodiment in the form of various robots and the virtual implementation of AI, represented by robotic advisers, virtual assistants, and chat bots. The areas of AI application in banks are currency control, credit risks, opening current accounts, and others.

Although most individual Fintech companies are still small in size, unlike traditional banking organizations, they are able to scale up their operations very quickly, both among riskier retail clients and in the corporate segment. Such rapid growth, along with the growing importance of Fintech financial services in supporting financial intermediation, is fraught with systemic risks. In this regard, the role of the increasing introduction of both financial and non-

financial/integrated reporting in the Fintech and neo-banking sector is growing, which will allow improving the predictability of this sector and reducing economic risks.

At the same time, as rightly noted in many sources, despite the strong competitive pressure of high-tech Internet platforms in the field of electronic financial services, it did not lead to the exclusion of banks from the market, but created additional competitive tension in the industry, the resolution of which today is possible within the framework of transition from rivalry to integrated development of Fintech companies and banks (Dietzmann, 2020; Vives, 2017). Despite the strong market pressure of the Fintech industry on banks, convergence the integration of both sides should be called the most relevant and complex resulting trend of their market confrontation.

Typically, Fintech companies are startups that attract venture capital investment, which is primarily due to high entry barriers to the market. According to Imerman and Fabozzi (2020), Fintech is the domain of tech start-ups revolutionizing things like mobile payments, money transfers, loans, fundraising, and even asset management. However, it is rather difficult to define the essence of Fintech, as there is a range of opinions from defining Fintech as unrelated startups to recognizing it as a branch of the economy (an industry).

There is an opinion that it is somewhat premature to call Fintech an industry, since usually an industry is understood as a set of enterprises that produce (manufacture) homogeneous or specific products using the same type of technology, or an industry is considered as a set of companies in a certain geographical area that produce (supply) the same type of products/services, with properties close to each other. Considering that Fintech companies are engaged in the development and sale of specific technologies, and the territorial principle is not at all defining for them, researchers who adhere to this concept believe that it is only a stretch to fully attribute Fintech to a separate industry (Tanda, 2019).

It is also quite common to believe that Fintech companies are information companies that combine core activities with financial ones (innovative financial products with innovative financial technologies) (Navaretti et al., 2018).

The lack of unified approaches to defining the essence of Fintech is largely due to the fact that in practice there is no consensus on the functions that they perform. There are especially few studies on the convergence and synergy of smart (intelligent) financial technologies, as well as the total vectors of their influence. In modern conditions, research is needed to reveal new forms of interaction between financial intermediaries, and not to find the advantages of new forms of mediation over traditional ones.

It can be said that, in general, smart financial innovations stimulate the development of the digital economy and digital finance, the formation of the “Fintech” sector, consisting of companies using financial technologies and innovations to compete with traditional financial institutions and financial market intermediaries. The development of financial technologies makes it possible to modernize traditional financial services in several areas: payments and transfers (online payment services, online transfer services); peer-to-peer currency exchange (ReeMo-reeg (P2P)); B2B payment and transfer services; cloud cash desks and smart terminals, mass payment services; financing: peer-to-peer consumer lending (P2P) and business lending, crowdfunding; money management: robo-advising, financial planning programs and applications, social trading, algorithmic exchange trading, targeted savings services. The spread of modern financial innovations contributes to the development of competition, increasing financial inclusion, enhancing the quality and range of financial services, and reducing the costs bearing by financial organizations in the financial market. At the same time, financial innovations can pose serious threats to the stability of the financial market and the financial system, the financial and economic security of countries in general. Thus, conducting integrative studies of convergence and synergy of smart financial technologies seems to be a critically urgent task at the present stage.

3. Methodology

The theoretical and methodological base was constituted of the concepts and provisions revealed in the works of scientists and experts in the field of economic theory, banking, finance, strategic and innovative management, and innovative development of the economy.

The methodological basis of the research is the general scientific methods of synthesis, analysis, structural analysis, systematization, classification, generalization, induction and deduction, the method of comparative and dynamic analysis. In the course of the study, systemic, expert-analytical, comparative, institutional, evolutionary, synergetic methodological approaches, modeling method, a combination of analysis and synthesis methods were also used to identify trends and patterns in assessing the impact of financial innovations on the financial market in modern conditions.

4. Results and Discussion

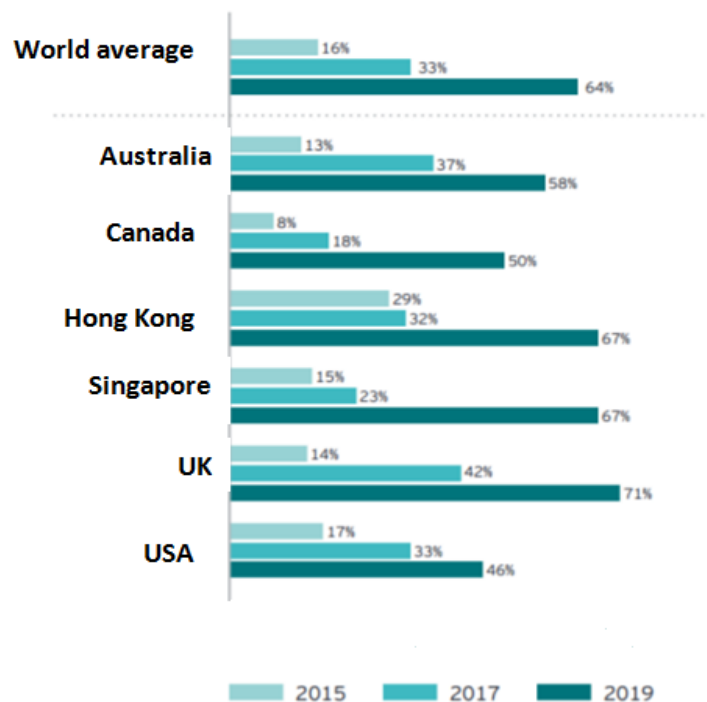
Movement within the paradigm of “new products and services, new production processes and new business models” is typical for the

financial environment. Thus, the now relatively rudimentary e-banking is an example: originally the technology was exotic as a transactional capability. Subsequently, the widespread adoption of technology by banks has transformed the environment and the very essence of traditional banks, where the physical provision of the service has become less relevant. Fintech, similarly to traditional financial innovations, appeared as a result of the transformation of the elements of the value chain of financial products, which led to the identification of development asymmetries in the current business models of banking institutions.

Since the financial crisis of 2008, the landscape of the financial services sector has gradually changed due to increased financial regulation as well as significant advances in Fintech innovation. In the context of banks, the structure and nature of markets, services, and institutions is changing due to the innovative technological practices of new entrants, including through the introduction of financial technologies (Fintech) into financial services.

If to look at the dynamics of the level of Fintech penetration in the world, it is possible to see a sharp rise in almost all markets (see Figure 4):

Fig. 4. Fintech Spread Dynamics from 2015 to 2019



Source: The State Of Fintech Report: Investment & Sector Trends To Watch

There are many real-world examples of how AI-based products and platforms are transforming the financial ecosystem. Currently, the most mature technological solutions in this area are the following:

MoneyPark is the first independent financial advisory platform for mortgage and insurance products in Switzerland that provides a comprehensive analysis of financial services to find those that best suit the client's needs.

Sindeo is a platform that provides tools, information, and guidance to find the right mortgage program and lender. Sindeo specializes in the PropTech segment and has raised \$6.5 million in funding (Ng et al., 2022).

Clear Minds is a digital investment platform that manages advisory and investment processes. It is oriented at long-term investments, wide diversification, high discipline, minimization of costly investment risks.

Revolut Ltd. is a UK-based Fintech company offering banking services including pound and euro bank accounts, prepaid debit card, commission-free currency exchange, exchange trading, crypto-currency exchange and peer-to-peer payments. Revolut was named Best Fintech Startup in the UK in February 2020.

GreenSky is an American platform that allows retailers and medical companies to offer their services to customers on credit. From 2012 to 2016, about \$5 billion in funding was provided under the GreenSky Loan Program.

Startup of the company Walnut Algorithms (France) was founded in 2014 by Guillaume Vidal to move away from classical asset management. The company works to match knowledge, research, and technology in the financial industry. In other words, artificial intelligence produces financial expertise and achieves an absolute return on investment.

Fintech startup Active.ai (Singapore), founded in 2016 by Ravi Shankar, Parikshit Paspulati, and Shankar Narayanan, today has subsidiaries in the US and India. The company uses artificial intelligence to provide banking services and helps financial companies integrate artificial intelligence into their services. Active.ai developers help banks and credit unions create virtual assistants, thereby increasing the level of service automation and the efficiency of customer interaction.

The most outstanding results in the B2C segment to date have been demonstrated by the American Fintech startup Lemonade, which specializes in InsurTech. The startup has rapidly evolved into a "unicorn company", that is, a company worth more than 1 billion US dollars. Lemonade is currently valued at US\$2 billion. The company has fundamentally changed the traditional insurance model its new business model is fully based on AI and behavioral economics (KPMG, 2023). The created business model runs on an AI platform, chatbots

deliver insurance policies and process customer claims without the use of insurance brokers. The transparency of the principles of the model eliminates the historical conflict of interest between the insurer and the insured. Social focus is another important part of the new business model. Lemonade donates a portion of the underwriting profits to non-profit organizations, and policyholders have the opportunity to determine the list of organizations that will receive financial support.

London is famous for its most consistent Fintech ecosystem for startups and is home to “the largest tech accelerator zone in Europe” called Level39, which supports a huge number of Fintech startups. Startup Bootcamp Fintech, located in London, operates worldwide, with an office in every major city with sufficient financial flows. They have their own proprietary Fintech start-up development program and a transparent mentoring system that helps them continuously expand their presence in the international markets (Lynn et al., 2019).

Let us turn to modern convergent innovative solutions that have formed a new (sixth) technological order, the transition to which is called the fourth industrial revolution. It is based on the convergence of info-, bio-, nano-, cognitive technologies, global computer networks, the Internet of things, and artificial intelligence. It is important to note here that revolutionary innovations go beyond the technological level. Indeed, the network interaction of economic entities, the Internet of things, artificial intelligence, as well as big data processing technologies, distributed registries have changed not only end-use products, but also their means of production, as well as distribution and exchange processes. For this reason, information resources, knowledge and tools for their production are in demand and the fastest growing resources of the modern economy. An essential and critical role of convergence is to generate wave processes of growth in business activity. In other words, the convergence of breakthrough technological, organizational innovations causes a wave of growth in the production of goods or services (Earnshaw & Vince, 2008). At the same time, the role of such convergent processes in economic development is so significant that they are associated with the emergence of new economic cycles and patterns. It is important to note that in the order of Industry 4.0, a number of modern goods, services, methods of management, etc., being the results of the creative intellectual activity of human capital, simultaneously show signs of intelligent decision-making in their use and operation. Such solutions inherently create the effect of digital convergence in the modern economy. A number of smart convergent solutions can be aggregated into a system, providing them with emergence compared to their counterparts, that is, new properties that are not inherent in any of the components that form such systems

(Subramaniam, 2022). A similar convergence effect is observed in the field of smart financial technologies.

For the design and implementation of convergent cybernetic systems, it is possible to establish the specifics of the tasks to be solved at each of the identified levels of convergence (Table 2). The obtained structural characteristics of convergence levels allow the choice of smart convergent solutions in the digital ecosystem of Fintech and the financial sector as a whole. This is of particular importance for stakeholders when achieving goals and ensuring efficiency in using convergent digital systems are critical for decision making.

Table 2. Typification of tasks by levels of convergence

Convergence levels	Problem typing	Algorithmization	Effects
Systems level	Unstructured tasks	Intelligent information systems and technologies, genetic algorithms	Synergistic, emergent, systemic, economic
Work level	Weakly structured tasks	Algorithms for solving optimization and synthesis problems	Providing customer value
Technology level	Formalized tasks	Functioning algorithms based on rationing, standardization	Increased performance, competitive advantages

The convergent processes enabled by the digitalization of interactions can be quantitatively expressed by the effect of convergence and solving own tasks, achieving own goals in the interaction of participants. The synergistic effect of integration processes and joint activities can be described by Zipf's law, which expresses the usefulness of interaction:

$$Y=N \cdot \ln(N) \quad (1),$$

where Y is the value of the synergistic effect (the usefulness of convergence (approaching) based on the consistency of the goals of interaction); $\ln(N)$ is the logarithm of the number of stakeholders in a convergent economic process.

Therefore, involving new participants in the interaction through convergence based on smart solutions of “digital finance” expands the boundaries of the synergistic effect, covering not only Fintech, but the entire financial sector.

Access to modern financial instruments can not only bring direct economic benefits to the consumer, but also largely determine his ability to carry out effective economic activity, either through

employment or through entrepreneurship. Financial services operate as infrastructure systems such as roads or communication networks, which are clear public goods (Ziolo, 2022).

In addition, in the last decade, a lot of studies have appeared in world economic science devoted to the analysis of the impact of the quantity and quality of the total consumption of financial services in certain countries on various socio-economic indicators of sustainable development. In our opinion, one can add to this the effect of the covering of the population with financial services, which in the scientific literature is often referred to as “financial inclusion”. Its importance to the global sustainable development agenda is evidenced by the fact that the G20 leaders back in 2010 approved the Financial Inclusion Action Plan. Thus, an international consensus was reached on financial inclusion, which is recognized by the World Bank as a key factor in improving shared prosperity in the fight against extreme poverty. The leaders of the G20 have created the Global Partnership for Financial Inclusion (GPFI), which includes representatives of national regulators, monetary and supervisory authorities from 94 countries. The GPFI is sharing best practices for management of risk, their concentration, and regulation measures that can help the poor to access financial services. The partnership is also involved in improving the financial literacy of the population, protecting the rights of consumers of financial services, and collecting information and statistics on national financial inclusion strategies. According to the World Bank, financial inclusion means the ubiquitous availability of financial services that are actively used and can contribute to the well-being of both individual users and the population as a whole, to retail consumers (Ziolo, 2022).

The growth of financial inclusion means an increase in the degree of involvement of economic agents in financial transactions. In this context, researchers define financial inclusion as the involvement of a significant part of the population and businesses in the financial services sector, characterized by equal opportunities for access to the market and resources (Mohammed & Uruguchi, 2017). The term “Fintech Adoption” is found in the literature, which is used when comparing the level of penetration (consumption) of financial services in different countries (Lynn et al., 2019).

In turn, the development of financial inclusion can play a key role in reducing poverty and improving macroeconomic indicators, including economic development and stability. In particular, analysis of macroeconomic data shows that a developed and inclusive financial system reduces information and transaction costs and at the same time stimulates investment decisions, technological innovation and growth rates in the long run (Bose et al., 2019). Conversely, the lack or low level of access to financial services (financial exclusion) can lead to

a “poverty trap”, exacerbate income inequality and slow down economic growth. Advanced Fintech companies find gaps in financial inclusion and free market niches, create attractive consumer offers. They respond more flexibly and promptly to market demands, actively develop and implement new services and products, and get rid of unnecessary intermediaries.

Financial inclusion has become a public good and benefits citizens and businesses in a variety of ways. Financial inclusion contributes to financial stability, and financial stability in turn has a positive effect on financial affordability in the long run. A number of works also show a non-linear relationship between economic growth and financial depth — the saturation of the economy with monetary resources and financial instruments, given the complexity and branching of the financial and monetary system (Sangwan et al., 2020; Sironi, 2021).

The evolution of the financial environment occurs through the development of small participants, gradually gaining experience, and gradually spreads to large players, integration with which allows access to broad financial and information opportunities, as well as to reducing costs, increasing profitability and efficiency, and enhancing security. All key retail channels of the banking business are appearing within the reach of Fintech companies — consumer finance, savings and investment, mortgages, insurance, SME lending, and retail payments.

Companies representing the Fintech industry are characterized by the presence of a unique specialization, combined with an improvement in the quality of financial services. Due to the effects of scale and concentration of activities in a certain area, they reduce costs, offer personalized service, and work with a rapidly changing clientele. Fintech offers the market new solutions that are more diverse, stable, and competitive. Small companies have entered the capital market in an environment where the supply of traditional institutions has become limited, without resorting to additional lending. Fintech companies have a broader, more expansive platform, reaching a wide range of participants, thus avoiding the two main risk factors inherent in traditional financial institutions: maturity and leverage mismatches. At the same time, the transformation of the environment following the development of financial technologies encourages participants to quickly respond to the changes that are taking place. Banking institutions are forced to continue cutting costs and margins while maintaining a competitive edge against new entrants.

Transformation periods are characterized by both a change in technologies and products, and changes in the distribution of sources, in particular, the client base, the end result between the players. Under the influence of Fintech, the competitive environment is being redefined and the structural lines that once separated the spheres of influence of competitors are changing. This all affects both consumers

and distribution channels. End users' benefits change their preferences and expectations regarding the cost, quality, and convenience of the service, which has an additional impact on the global distribution of financial services. Thus, the problem of the financial ecosystem transformation and changes in the models of banking institutions' activity is highlighted, which is essentially the total vector of influence of intelligent financial technologies.

The modern development of banking involves the modification of business models and the search for a suitable development strategy in order to revolutionize banking business based on Fintech (Tanda, 2019). However, since the banking industry can be very traditional, tech companies should focus on integrating innovation and applying scenarios to succeed in the financial sector.

Over the past decade, artificial intelligence technologies have had a huge impact on the banking industry, they are considered disruptive technologies. From a technical point of view, the application of artificial intelligence can be divided into two categories: basic (core) AI and industry AI. Basic AI can be integrated into applied systems such as face recognition, speech recognition, etc. Industry AI has more applications in business, such as anti-fraud, robotic advice, and so on. At present, the main technology of artificial intelligence is data-driven machine intelligence. The difference between the two categories is basically who takes over the data management or who uses the data to create AI models. Depending on the level of technical development of the company, three stages of the use of artificial intelligence can be distinguished: 1) business automation; 2) big data analysis; 3) comprehensive intelligent decision making.

The first stage is business automation, i.e., banks are revolutionizing their products and processes and replacing repetitive work with artificial intelligence (Choi & Huang, 2021). At the first stage, it is possible to constantly improve the efficiency of banking activities (for example, through the use of smart contracts and robotic consultations). In addition, the introduction of basic AI applications such as mobile banking biometrics, smart meters, and other scenarios can solve the key problem of customer verification and implementation of various business processes.

Big data analysis is the next stage in the development of artificial intelligence. Technological innovation will bring more use cases, which in turn are supported and driven by big data. In fact, the research and application of big data in banks began before the use of artificial intelligence. Currently, the focus is made on integrating core AI and industry AI to provide better services to customers.

The combination of big data and core AI can enhance the intelligence of system products and business processes. However, key

technologies must evolve independently, including customer and product profiling, behavior analysis, personalized recommendation engines, and so on.

The third stage in the development of AI is the execution of intelligent decisions across all channels, seamlessly connecting customer identification, behavior prediction, and other channels, updating dynamic optimization based on customer response. The bank must reach internal consensus and create an effective collaboration mechanism from business process creation to system development, from product design to marketing support, from simple data analysis to data mining.

In recent years, big data has been widely used in many areas of banking, from financial reports to data mining models for transactions and products. These use cases and modeling are the three main areas for banks to apply big data analytics. In fact, it is possible to start developing a data-driven product in any of three ways. For example, a transformation to a business that uses big data applications can start with data analysis that is used in a traditional banking business. Determining how internal and external big data should be used in a bank can be relevant to risk management and marketing. Finally, businesses need innovative models and technologies to meet new challenges. According to the 80/20 rule, most big data applications should be derived from business intelligence and do not necessarily require “huge” data and “esoteric” technologies, which is a major challenge in practice (Lynn et al., 2019).

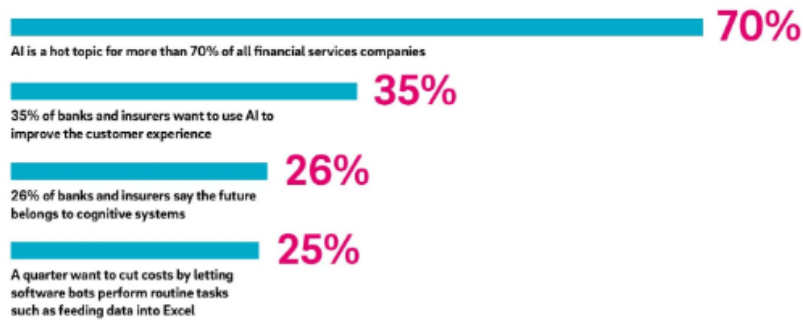
Artificial intelligence will be fundamental to improving core banking processes and transforming the banking industry. This will improve its performance by simplifying and streamlining traditionally lengthy and extensive operations, improving fraud detection. One example is the anti-money laundering machine learning solution jointly developed by OCBC Bank and Fintech Thetaray. This significantly reduced the volume of transactions verified by anti-money laundering analysts and more than quadrupled the accuracy of identifying suspicious transactions (Subramaniam, 2022).

In addition to improving operational efficiency, artificial intelligence also allows creating new or more personalized offers by anticipating customers' needs and changing the way of interaction with them, making it more natural and fluid. One of the examples is a voice-enabled mobile banking app. Such a “bank of the future” will provide customers with natural, convenient, and personalized banking services.

Roland Berger Consulting emphasized increasing importance of AI in financial services (see Fig. 5 below).

Fig. 5. Increasing importance of AI in financial services

INCREASING IMPORTANCE OF AI IN FINANCIAL SERVICES



Source: Strietzel, M. (2018, August 21).

The use of artificial intelligence systems makes it possible to operate with huge memory arrays, which is very important for the financial sector. The use of machines for making managerial and other decisions, for optimizing work with clients, calculating the effectiveness of investments without the impact of the human factor or minimizing it, means making decisions based only on information without a personal approach, which often imposes a negative connotation, and the corruption underlying reason for making a decision is leveled. The advantage of using artificial intelligence now is that data collection does not stop, and the larger the base, the more efficient the system. Consequently, those banks that delay the decision to implement artificial intelligence systems in their work run the risk of not catching up with more knowledge-intensive competitors. Through the interaction and learning of machines, natural language can be processed and decisions are made faster and more accurately than it was possible in the past.

The business model of ecosystems is not built around products or services, but around the customer. The task of artificial intelligence is to accurately determine the entire range of everyday needs of the client, his tastes and preferences, lifestyle. This will allow remotely offering customers the necessary products or services on acceptable payment terms with a choice of a convenient place and time of delivery. This task is still far from being solved, and customers continue to receive a lot of unnecessary advertising. Nevertheless, ecosystems allow faster and more efficient implementation of one of the main functions of Fintech — the expansion of financial inclusion. Using artificial intelligence and digital platforms, Fintech companies have expanded their customer base many times over, and also gained the opportunity to influence financial consumers not only through

advertising, but also through business intelligence, robo-advising, and other tools.

Analyzing the archetypes of AI-Fintech business models, Christian Dietzmann in his publication on CC Ecosystems News website proposes a figure showing the result of the application of Fintech business model taxonomy of Eickhoff et al. (2017) to the 75 Fintechs that operate the applications (see Figure 6 below).

Fig. 6. Fintech business model taxonomy according to Eickhoff et al. (2017)

Parameter	Characteristics											
Dominant Technology	Blockchain		Digital Platform		Decision Support System		Marketplace		Database		Transaction Processing System	
Value Proposition	Automation	Collaboration	Customization	Insight	Matching/Intermediation		Monetary	Financial Risk	Transparency	Unification/Consolidation	Security	Convenience/Usability
Delivery Channel	API		App		WWW		WWW + App		Instant Message			
Customers	B2B				B2C				B2B + B2C			
Revenue Stream	Pay Per Use		Revenue Share		Sales		Subscription		Free		Unknown	
Product/Service Offering	Information Aggregation	Brokerage	Currency Exchange	Current Account	Financial Education	Financing (Tax)	Investments	Payment Services	Personal Assistant	Lending/Credit	Fraud Prevention	User Identification

Source: Dietzmann, C. (2020, July 17).

The practice of competition between banks and Fintech companies shows that it does not lead to a clear victory for the Fintech industry in a world where there are regulators who consider banks as the backbone of the financial ecosystem, the parameters of which can be normalized through the regulation of banks. Nevertheless, Fintech innovations significantly increase the efficiency of banking at a level that is difficult to repeat, copy by traditional banks. In this case, it should be bought on the side. Internet lending platforms that work with Big Data and neural learning networks for risk identification show higher speed and reliability of risk assessment when lending to retail borrowers or small and medium businesses (Sangwan et al., 2020).

It is important to note that the development of Fintech startups is currently being held back by regulators through a system of ongoing bans, the lifting of which will mean new challenges for traditional banks, not all of which they will be able to accept.

Provided that banks create their own payment platforms in response, the remaining relatively higher regulatory burden will give a less competitive cost-to-revenue ratio, in which consumer preferences of “demand” will be on the side of Fintech, that is, the removal of restrictions a priori creates fundamentally different conditions of competition for banks in which the relevant scenarios of its market evolution do not work in favor of banks. This is an additional argument in favor of the fact that Fintech innovations are disruptive for banks,

and their influence today the power of this influence is artificially restrained by regulators.

In addition, it is important to take into account the fact that alternative financial services take into account the trends of retail digital transformation as much as possible, which changes the behavioral models of the customers themselves. Today, online payment platforms provide the latter with complementary opportunities: exchange of information, online search for goods, shopping in online stores.

5. Conclusion

Powerful technology solutions that meet the advanced analytics requirements of digital transformation enable financial institutions to fully exploit the power of unstructured and big data, unlock competitive advantages, and discover new market opportunities. The change in the architecture of the financial sector is primarily associated with advanced financial technologies, thanks to which banks and financial institutions create their ecosystems. The transition from a traditional financial services system to a digital one provides great opportunities for both large financial companies and Fintech startups to work with banks or financial institutions. As more key financial infrastructure projects go 'into production', there will be more players interested in digital Fintech adoption.

To take full advantage of the synergies generated by smart financial technologies that the digital economy can bring, financial institutions and governments must increase and improve their digital services, such as:

- Digital identity systems that enable citizens to access public, commercial, and financial digital services;
- Data protection regimes that allocate rights and obligations for accessing and exchanging consumer data;
- Cyber security strategies that help mitigate cyber security, mitigate risk, and effectively respond to and recover from cyber attacks;
- Open banking initiatives, which allow banks to share customer data subject to consent with third parties, and innovation facilitation initiatives, which enable innovation in digital financial services that are interesting and profitable for the market.

It is known that synergetics proceeds from the principle that the world evolves according to non-linear laws. Classical mathematical physics (that is, the science of studying mathematical models of physics and, with it, the one which determined the overall positivist paradigm of cognition, including in the economy and finance) dealt with linear equations. Formally, these are equations in which the unknowns enter

only to the first degree. In reality, they describe processes that proceed in the same way under different external influences. With an increase in the intensity of impacts, changes remain quantitative, while new qualities do not arise. The scope of linear equations is unusually wide. It covers classical and quantum mechanics, electrodynamics and wave theory. The method of their solution, developed over the centuries, has great generality and efficiency. However, scientists increasingly have to deal with phenomena where more intense external influences lead to a qualitatively new behavior of the system. Here we need non-linear mathematical models. Their analysis is much more complicated, but in solving many problems it is necessary. This leads to the formation of a new front of research into nonlinear phenomena, to attempts to create general approaches applicable to many systems (such approaches include synergetics). Modern science is increasingly formulating its laws, referring to the richer and more complex world of nonlinear mathematical models. In practice, this non-linearity manifests itself in an obvious way, in particular, in the convergence and synergy of smart financial technologies, and generated vector effects.

Let us note that the Fintech industry is currently bringing a much-needed, long-awaited revolution in financial services, but also raising additional regulatory issues: new systemic risk factors, data security, and agency issues. Activity models have not yet been tested either for their significance or for their sustainability, and therefore they are given special attention; the process of developing financial innovations is associated with a complex of factors, which predetermines the complexity of the system being formed, that requires further in-depth research.

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