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Digital Technologies in the Financial Sector: Evolution and Major Development Trends in Russia and Abroad

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ABSTRACT

The **subject** of the research is a complex of financial technologies that are actively used in the financial and credit sector in Russia and abroad. The study **aims** to show the place of technological progress based on the use of FinTech and the development of human capital in the Russian economy; transformation of business processes based on modern financial technologies, creating new promising opportunities, and responding to the challenges of Industry 4.0. The paper considers the issues related to the study of the prospects for the development of financial technologies in global practice and the possibilities of their adaptation in the activities of Russian financial organizations. The research is based on the analysis of data provided by international consulting companies, analytical centers, and official data sources of the Central Bank (Bank of Russia). The authors apply **methods** such as comparative research, empirical, logical, graphical, analysis, interpretation, and comparison. The study assesses the growing role of financial technologies in the Russian economy, identifies the main problems, and outlines development prospects based on the integration of traditional institutions and FinTech companies for the reproduction of financial innovations in the future. As a result, it was **concluded** that improving the technological effectiveness of banking processes is possible on the basis of digitalization using various financial technologies, which will lead to the simplification and optimization of traditional operations, prevention of fraud, create new and more personalized offers according to customer needs, while changing the way of interaction with them.

Keywords: digital economy; financial technology; artificial intelligence; big data; blockchain

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INTRODUCTION

The global development of the pandemic has led to a revolutionary transition from physical to digital format of organizing various processes, accelerating natural progress. The unique situation of 2020 has further increased the importance of digitalization and the commitment of users towards a remote format for receiving services. People have adopted a new style of life, the availability of technology, which has changed their skills and habits. Financial technology did not stand aside in this process. 2020 has completely changed customer expectations towards telecommuting, forcing financial institutions to rethink outdated work technologies. Amid the pandemic, 88% of customers would expect companies to step up their digital initiatives according to Salesforce, and 68% stated COVID-19 raised their expectations for the power of digital financial instruments. The new digital paradigm includes the following directions of transformation [1, 2]:

1. Expanding digital perspectives. The global transition to digital technology has opened up entirely new opportunities. Nearly 70% of customers expect banks to create new ways to promote existing products and services, such as digital versions of traditional interactions as well as modern product lines. At the same time, despite the obvious need for well-developed digital channels, the pandemic has highlighted the fact that the financial industry is highly unprepared to enter the digital age.

"If you want to be a leading bank, you have to be a technology company," predicted Brett King, American futurist, author, co-founder, and CEO of New York-based mobile banking startup Moven. Successful digital business is always two steps ahead, constantly monitoring changing customer behavior, inventing new ways to adapt their products in accordance with growing expectations [3].

2. Customer-oriented thinking. A key factor here is to develop a dedicated, customer-centric mindset at every level, including operational and strategic processes while ensuring that financial decisions are aligned with the needs and expectations of users.

3. Modification of key performance indicators, as the digital paradigm is increasingly shifting towards customer focus. It is important to rethink not only the internal culture and business approach of the company, but also the way of measuring its performance, given that sales, conversions, and the number of leads have been the key performance indicators for decades. However, to become a successful financial brand in the new era, the focus should be on user reviews and feedback, the image of the technology and service seller, and the financial architecture.

Fintech is being implemented in various sectors of the financial industry. In terms of the 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, e-money, digital payment services, insurance technologies, and financial activities related to crypto-assets, etc. [4, 5].

The main goals of the development of financial technologies in accordance with the state program "Digital Economy of the Russian Federation" are[1]:

- promoting the development of competition in the financial market;
- increasing the availability, quality, and range of financial services;
- reduction of risks and costs in the financial sector;
- ensuring security and sustainability in the use of financial technologies;

[1] The national program "Digital Economy of the Russian Federation", approved by the minutes of the meeting of the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects No. 7 dated 04.06.2019 (accessed on 26.12.2020).

• increasing the level of competitiveness of Russian technologies.

The Bank of Russia is working to achieve these goals together with financial market participants, fintech companies, and interested government agencies.

TRENDS OF THE FINANCIAL INFORMATION AND COMMUNICATION TECHNOLOGIES MARKET

Today the world is moving to the sixth technological order, the contours of which have already begun to take shape in the developed countries, primarily in the USA, Japan, and China, and are characterized by a focus on development and the application of "high technology" and artificial intelligence.[2]

The economic depression and crisis that have been developing in the world since 2012, according to experts, can be overcome only through the modernization of business processes and the widespread introduction of multifunctional technologies that form the sixth technological order[3] [6].

Russia still lags far behind the world leaders in terms of volume, variety of use of scientific, technical, and intellectual potential, but rather intensively introduces them into the production process, specifically in the financial and banking sectors. However, a 2017 study by PwC, a global network of firms delivering consulting and auditing services, showed that despite constant investments in information technology, including financial ones, many companies in Russia are far behind.

The situation is similar in global practice. Thus, in connection with the reduction of global uncertainty, companies are doubling their investments in information and telecommunication technologies, and the software market will be the fastest-growing (*Table 1*) [7].

The main attention today is paid to the technologies of data search and analysis [7, 8]. This applies to both data security and cloud usage. This was noted by 73% of respondents in the world (65% in Russia) [9]. At the same time, considering the data of the Analytical Report "Barriers to the Development of the Digital Economy in the Constituent Entities of the Russian Federation",[4] the lack of educational programs in the field of the digital economy is a key problem in most regions of Russia.

The key barriers to the digital economy include problems in the field of legal regulation (17.3%), difficulties with the financial support of regional budgets (16.9%), lack of financial technologies (16.0%), difficulties in the development of information infrastructure (13.9%), in the implementation of projects based on "end-to-end" digital technologies (6.0%), the unbalance of information and administrative barriers (11.1%).[5]

The fintech market today occupies a leading position in the dynamics of investments, the number of transactions, the reach of users, etc.[6] In 2019, only 18% of customers visited their bank to conduct transactions, the rest used online banking.

Today it is becoming increasingly clear that financial technology is much more than just online banking. The leading indicator characterizing the development of the global financial technologies market is the

[2] Kablov E. The sixth technological order. Science and life. 2010;4. URL: https://www.nkj.ru/archive/articles/17800/ (accessed on 26.12.2020).

[3] Netscribes Global Fintech Market (2018–2023). Mumbai (India): Netscribes Pvt Ltd. 2019. URL: https://www.marketresearchhub.com/report/global-fintech-market-2018–2023-report.html (accessed on 26.12.2020).

[4] Analytical report "Barriers to the development of the digital economy in the constituent entities of the Russian Federation.". URL: http://ac.gov.ru/files/publication/a/ 25838.pdf (accessed on 26.12.2020).

[5] Ibid.

[6] Regions and innovation: Collaborating across borders. Paris: OECD; 2013. 235 p. (OECD Reviews of Regional Innovation). DOI: 10.1787/ 9789264205307-en. URL: https://read.oecd-ilibrary.org/urban-rural-and-regional-development/regions-and-innovation-collaborating-across-borders_9789264205307-en#page3 (accessed on 26.12.2020).

Table 1

The volume of investments in IT technologies in the world, billion US dollars

	The volume of investments, 2019	Specific gravity, %	Growth rate in 2019, %	The volume of investments, 2020	Specific gravity, %	Growth rate in 2020, %	Growth rate in 2021 (forecast)	Specific gravity, %	Growth rate in 2021, %
Data processing systems	205	5.49	–2.7	208	5.38	1.9	212	5.29	1.5
Enterprise application software	456	12.20	8.5	503	13.01	10.5	556	13.9	10.5
Electronic devices	682	18.25	–4.3	688	17.80	0.8	685	17.1	-0.3
IT services	1030	548.6	3.6	1081	27.97	5	1140	28.5	5.5
Communication services	1364	36.50	–1.1	1384	35.81	1.5	1413	35.3	2.1
Total costs	3737	100	0.5	3865	100	3.4	4007	100	3.7

Source: Gartner report (January, 2020). URL: https://www.gartner.com/en/newsroom/press-releases/2020–01–15 (accessed on 25.12.2020).

level of their penetration into the regions. Russia's place in the global fintech market is shown in *Fig. 1* [10]. According to the results of various research projects, the level of penetration of financial technologies in Russia is from 40 to 80%. The leaders are largest urban cities — Moscow, St. Petersburg and Kazan. In these conditions, the new market is actively gaining volume, as evidenced by the penetration index. Despite lagging behind world leaders, it is developing at the level of 80%. According to Deloitte estimates, the volume of the financial services market in Russia in 2018 amounted to 54 billion rubles, in 2019–60 billion rubles (an increase of 11%), and in 2020 it was planned to increase by 8% — up to 65 billion rubles.[7] The slowdown in growth is due to the instability of the Russian financial market in comparison with the markets of the USA, the UK, Singapore, etc. And Russian financial institutions, for example, banks, independently introduce financial technologies and buy promising startups or form strategic partnerships (for example, Sberbank, VTB, Tinkoff, AK Bars, etc.).

Back in 2016, fintech was a completely new concept, and the leaders were

[7] Sedykh I.A. Market of innovative financial technologies and services — 2019URL: https://dcenter.hse.ru/data/2019/12/09/1523584041/%D0%A0%D1%8B%D0%BD%D0%BE%D0%BA%20%D1%84%D0%B8%D0%BD%D0%B0%D0%BD%D1%81%D0%BE%D0%B2%D1%8B%D1%85%20%D1%82%D0%B5%D1%85%D0%BD%D0%BE%D0%BB%D0%BE%D0%B3%D0%B8%D0%B9–2019.pdf (accessed on 26.12.2020).

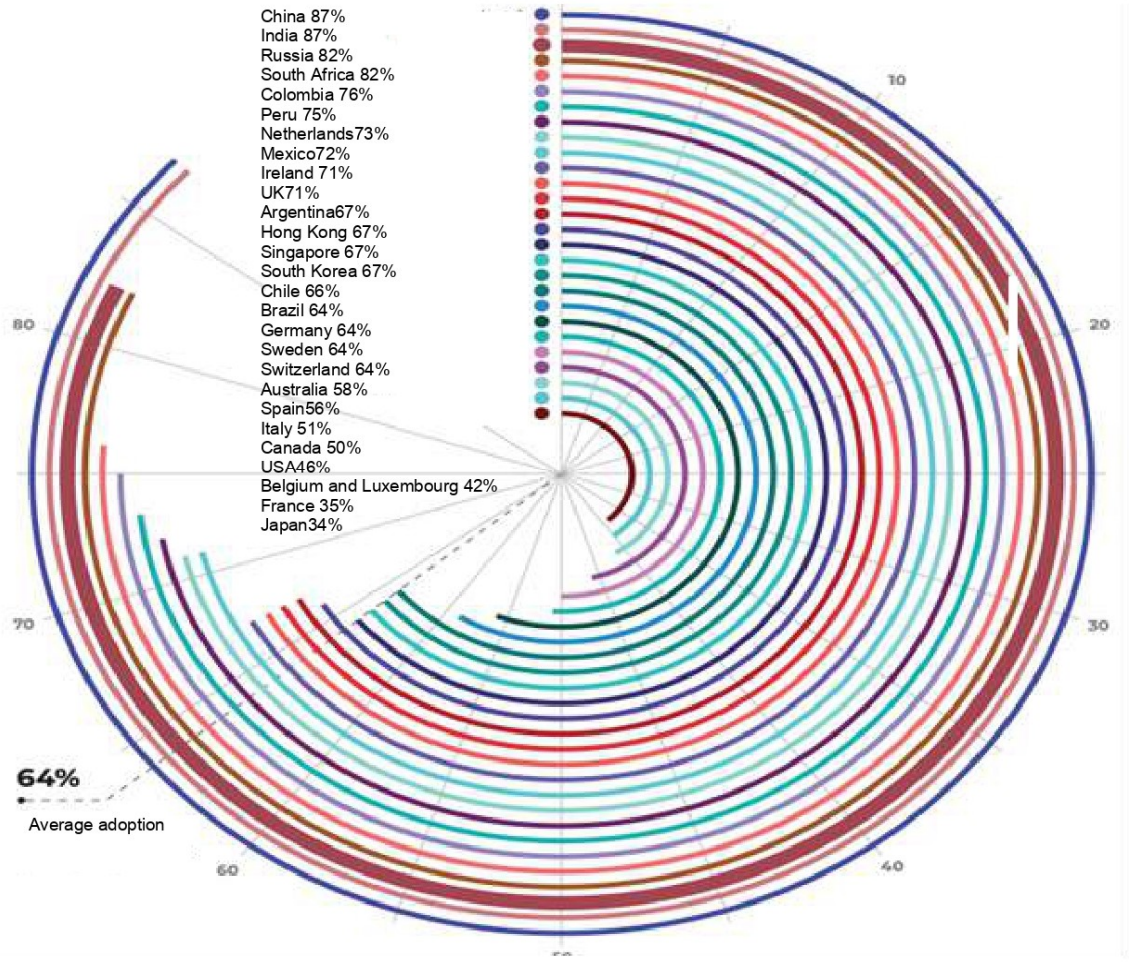

Fig. 1. **Russia's place in the global FinTech market and indicators of "technological" penetration**

Source: Global Fintech adoption index 2019. URL: https://www.ey.com/en_gl/ey-global-fintech-adoption-index (accessed on 26.12.2020).

mainly fintech startups. Many of them lacked two significant elements of the ecosystem: financial institutions and, more importantly, regulators. *Table 2* presents a grouping of financial technologies that allow transforming traditional banking into digital, based on fintech, as well as expanding the capabilities of credit institutions, gradually transforming them into ecosystems.

Regarding fintech, we meant exactly new technologies in the field of finance, namely blockchain, robotic consulting, mobile payments, and P2P lending (*Table 2*). This definition has undergone changes over the past five years. Today fintech is defined as innovative financial technologies that can be used to gain a competitive advantage, namely [10][8]:

- artificial intelligence, big data, and cloud technologies enable the teams with the best technological resources to outperform those without them;
- blockchain may have serious implications for the operation of financial institutions in the future. The technology has not yet matured and needs to overcome the obstacles to developing a sustainable

[8] Developing Skills for Innovative Growth in the Russian Federation. Report No. ACS 1549. The World Bank. June 10. 2013. URL: http://documents.worldbank.org/curated/en/460821468107067600 (accessed on 25.12.2020).

Table 2

Grouping of financial services and digital banking technologies

Financial services	Deposits and loans	Raising capital	Asset management	Payments and settlements	Insurance
FinTech activities	Digital banking Crowdfunding	Robo-advisers Intelligent formation of financial balances	Asset crowdfunding	E-money Digital payments and services	InsurTech Business models

Source: compiled by the authors (accessed on 25.12.2020).

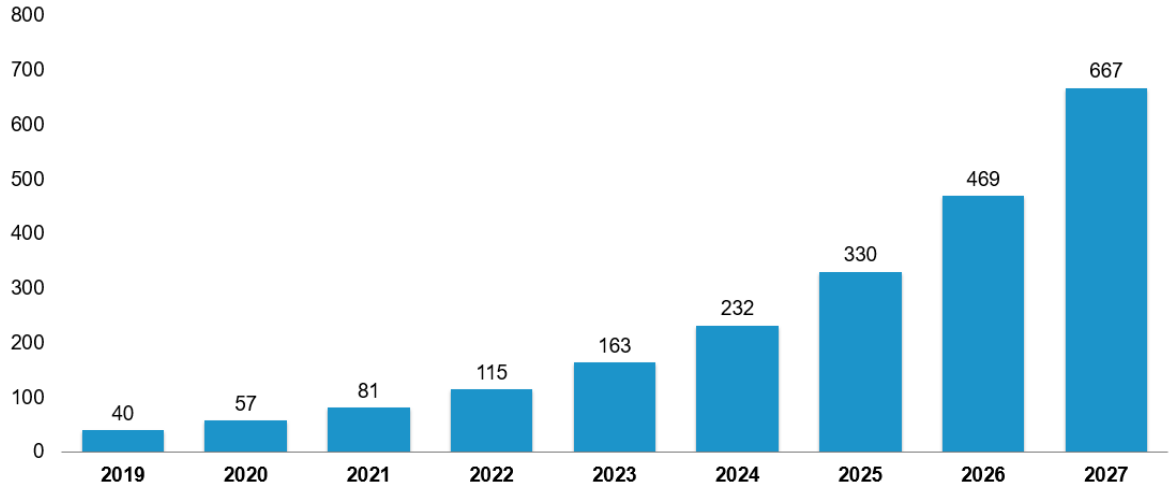

Fig. 2. **The size of the global artificial intelligence market, billion US dollars**

Source: Industries of the future. Investing in big data. URL: https://bcs-express.ru/novosti-i-analitika/industrii-budushchego-investitsii-v-iskusstvennyi-intellekt (accessed on 25.12.2020).

business model and gaining regulatory approval.

China leads the Asia-Pacific region in fintech development, with a focus on the new technologies mentioned above; in many other Asia-Pacific markets, fintech is still defined by alternative lending, mobile payments, robotic consulting, etc. [11]. According to research by Google Trends, the current interest in fintech around the world is 10 times higher than three years ago. So how will financial technology evolve? Will they replace or improve the financial services industry?

STAGES OF THE FINTECH IMPLEMENTATION IN THE BANKING AND FINANCE SECTOR

Over the past two years, CFA Institute has negotiated with many financial institutions, fintech entrepreneurs, regulators, researchers, technology companies, and venture capital investors in the Asia Pacific region. We believe that clear patterns emerge in the growth of fintech, both in terms of popular areas of activity and stages of development, which include the following.

Early stage: years before financial technology [12]. Financial institutions have

always invested heavily in the development of information technology (IT), associated with the acquisition of equipment, software, such as Fiserv and Oracle, attracting additional IT services and specialists in addition to their own teams.

The most difficult situation in banking IT. The regulatory and security burden made it extremely difficult to update information systems in a financial institution. Often, management had to sacrifice user-friendliness, fearing that installing a new system could cause compatibility and security issues for the bank's entire IT system.

Stage 1: formation. This stage is associated with the competition between IT financial service providers. Peer-to-peer lending, mobile payments, and robotic consultation were the three most active areas worldwide during the fintech development phase. The US was by far the leader in this phase, and many pioneers entered the fintech business even before the term fintech existed. PayPal, Betterment, Wealthfront, and Lending Club are the world's pioneers of fintech (*Fig. 2*).

Overall, the major financial markets in the Asia-Pacific region (APAC) entered Stage 1 around 2015–2016 [13]. China has clearly been a leader in the region, and current fintech leaders like CreditEase, Lufax, and Ant Financial (AliPay) opened their doors to service mostly around the same time as the US fintech pioneers. Russia entered the financial technology market only in 2017.

Typical emerging companies: fintech startups and venture capital firms. In most markets, successful fintech startups prefer to work with unserved or poorly served clients. For example, CreditEase lends primarily to borrowers that banks do not lend; AliPay only entered the market due to the lack of payment services that was an obstacle to the growth of its parent e-commerce company Alibaba.

Stage 2: building partnership. This stage is associated with the active interaction of leading players from both the financial services sector and the high-tech industry. ChinaAMC, a 2017 deal between a Chinese venture capital fund and Microsoft, and a similar deal between Bank of China and Tencent are notable examples of partnership. In early 2018, a joint venture between Amazon, Berkshire, and JPMorgan was created. Typical Stage 2 companies are leaders in financial services and technology.

Stage 3: sustainable development. Compared to the rapid changes observed during the formation stage, stage 3 is relatively stable. The positions of key players in the market will remain unchanged as the pace of development of technological and financial markets slows down. Most of the remaining market share will be held by successful Stage 1 companies. However, since Stage 2 companies entered the game, the competitive environment has become much more complex. In addition to the deterrent costs associated with customer acquisition and tight regulation, it is much more difficult to gain the trust of your customers so that they allow you to access the money.

Early-stage companies are likely to be largely liquidated if they resist change and stick to legacy systems. A plausible scenario is that over time, customers will move their businesses to successful Stage 2 and Stage 1 companies, with the result that firms using legacy systems will eventually become unprofitable. This trend will intensify as clients from the more tech-savvy younger generation become the main client base for high-tech financial services.

Typical Stage 3 companies: A small number of successful Stage 2 companies will dominate the market, while more successful Stage 1 companies will capture the remaining market share. While collaboration is key at this stage, there is a real risk of long-term disruption. Fintech players around the world will actively partner with shareholders and customers to actively implement the company's strategies, which will increase

their chances of success in the three stages of fintech development.

FINTECH DEVELOPMENT PROSPECTS IN THE BANKING SECTOR

The modern development of banking involves the modification of business models and the search for a suitable development strategy to revolutionize fintech-based business [14]. However, since banking can be very traditional, tech companies need to focus on integrating innovation and applying scenarios to succeed in the financial sector.

Over the past decade, artificial intelligence (AI) technologies have had a huge impact on the banking sector, they are disruptive innovations [14]. From a technical point of view, the use of artificial intelligence can be divided into two categories: basic AI and industry AI. Basic AI can be integrated into application systems such as face recognition, speech recognition, etc. Industrial AI is finding more applications in business, for example, for combating fraud, for robotic consulting, etc. Currently, the main technology of artificial intelligence is data-driven machine intelligence. The difference between the two categories is mainly about which takes over the data management or which uses the data to create AI models.

Depending on the level of technical development of the company, we have identified three phases of using artificial intelligence [15]:

1) business automation;

2) big data analysis;

3) comprehensive intelligent decision making.

The first phase is business automation, that is, banks revolutionize their products and processes and replace repetitive work with artificial intelligence [16]. At the first phase, it is possible to continuously improve the efficiency of banking activities (for example, through the use of smart contracts and robo-advisers). In addition, the introduction of basic artificial intelligence applications such as mobile bank biometrics, smart meters, and other scenarios can solve the key problem of customer verification and the implementation of various business processes. Big data analysis is the next phase 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, research and the use of big data in banks began before the use of artificial intelligence. The current focus is on integrating basic AI and industry AI to improve customer experience.

The combination of big data and basic 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, etc.

The third phase in the development of AI is the implementation of intelligent solutions across all channels, seamless connection of customer identification, predicting behavior and other channels, updating dynamic optimization based on customer response. The bank must reach an internal consensus and build 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 reporting 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, one can start developing a data-driven product in any of three ways. For example, a transformation into a business that uses big data applications can start by analyzing the data that is used in traditional banking. Determining the direction of use of internal and external big data in a bank can be relevant to risk management

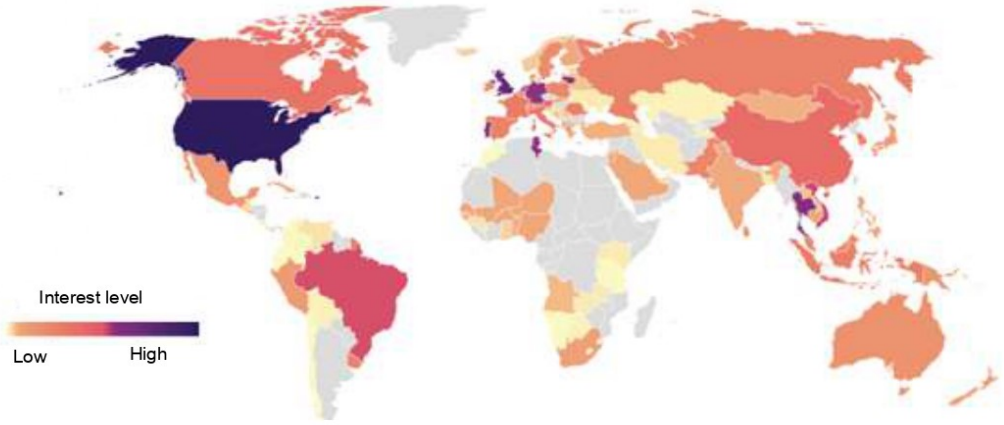

Fig. 3. **The activity of the world's Central banks in the study of blockchain technology**
Source: MINDSMITH Analysis, 2021. URL: https://mindsmith.io/blockchain-central-banks/ (accessed on 26.12.2020).

and marketing. Finally, businesses need innovative models and technologies to address new challenges. According to the 80/20 rule, most big data applications must be derived from business intelligence and do not necessarily require "huge" data and "esoteric" technologies, which is a serious problem in practice [17].

Cloud technology is the use of the Internet to access applications, data, or services that are stored or run on a remote server. Cloud computing typically exists at one of three tiers: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Digital infrastructure provides performance enhancements to underlying resources, while PaaS serves as the primary platform for hosting applications. Infrastructure development is constrained by many objective conditions in the bank, including technical failures, computer hardware, software, and other problems. By looking at the banking technology platform from a fintech perspective, besides the standard development middleware, we are trying to make it a platform for the other three core technologies (ABD). Based on the deep development of open source technology, the bank can create a platform with independent intellectual property rights. For small and medium-sized financial institutions, it is more cost-effective to use a PaaS platform than to invest in innovative applications.

Finally, the software layer directly provides an application corresponding to business scenarios [18]. These can be cloud banking services such as cloud payments or fintech cloud services, risk management, marketing, operations, and other smart products.

Blockchain is one of the most controversial, but highly demanded technologies [19]. Two factors are limiting the widespread adoption of blockchain:

1. The technology is not mature enough. Its performance, privacy concerns, operation and service are substandard for corporate use.

2. The business model is not ready. In a multi-center scenario, it is difficult for different parties to reach a consensus.

However, this certainly does not mean that the blockchain is not good enough, but rather that there are not enough good projects in the blockchain space. Blockchain 1.0 is a digital currency represented by Bitcoin; blockchain 2.0 is a smart contract platform represented by Ethereum; blockchain 3.0 is moving forward in the fields of cryptography, consensus algorithms, cross-chain

combining, performance optimization, etc. (*Fig. 3*).

In addition, the development of fiat digital currency could be a breakthrough for the blockchain. Although there is no direct connection between them, it can be expected that the emergence of fiat digital currency will open up great potential for the development of existing blockchain applications, as evidenced by the data in *Fig. 3*. In our opinion, only 10% of countries have actively introduced this technology into the business processes of national economies, therefore they have great development opportunities.

Finally, compared to artificial intelligence, big data, and cloud computing, blockchain applications are completely technology-driven. In our opinion, the use of such a "clean" technology is worth the effort.

Therefore, banks can develop a global perspective only by building their new business model based on the use of the entire range of financial technologies.

CONCLUSIONS

Thus, 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 system of offering financial services to a digital one provides great opportunities for both large financial companies and fintech startups to work with banks or financial institutions. As more and more key financial infrastructure projects are launched, there will be more players who will be interested in adopting digital financial technologies. And this is the prospect of the next five years.

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 and improving fraud detection. One example is an 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 increased the accuracy of detecting suspicious transactions by more than four times.

In addition to improving operational efficiency, artificial intelligence also enables the creation of new or more personalized offerings, anticipating customer needs and changing the way of interaction with them, making it more natural and smoother. One example is the voice-enabled OCBC mobile banking application. And such a "bank of the future" will provide customers with natural, convenient, and personalized banking services.

To take advantage of all the opportunities that the digital economy can bring, financial institutions and government agencies must increase and improve their digital services, such as:

- digital identity systems that allow citizens to have access to public, commercial and financial digital services;
- data protection regimes that distribute rights and obligations for access and exchange of consumer data;
- cybersecurity strategies that help reduce cybersecurity, mitigate risks, 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 promotion initiatives, which enable innovation in digital financial services that are interesting and profitable for the market.

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