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Digital transformation of the banking system of Russia with the introduction of blockchain and artificial intelligence technologies

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Abstract. The article analyzes the problems of the development of modern banking business in Russia in the context of the growing share of large banks in the market. The aim of the work is to determine the need for the introduction of new advanced technologies by small and medium banks in order to increase the efficiency of their activities. The working hypothesis is that against the background of low economic growth in Russia and high competition among state and quasi-state banks, small and medium-sized banks can remain competitive only through cooperation and the introduction of new advanced technologies (artificial intelligence technology and blockchain technology).

The article provides a brief overview of theoretical and empirical studies of the introduction of modern information technologies in banking. Briefly describes the international experience in implementing information technology in the financial sector of the economy. The article also provides a qualitative and quantitative analysis of the development of the modern Russian banking system.

The analysis of official statistics of the Bank of Russia was carried out, which confirmed the tendency to decrease in the number of banks in the Russian economy, as well as the increase in the degree of monopolization of the banking sector of the Russian economy. Together, these two phenomena lead to increased competition between large banks on the one hand and medium and small banks on the other, in which the latter can only be actively introduced by new information technologies.

The study clearly showed that the monopolization of the banking sector leads to the need to look for new development paths for small and medium-sized banks through the introduction of modern technologies.

keywords: bank, Russian banking system, blockchain, artificial intelligence, modern technologies

1. Introduction

In recent years, the share of large banks in the Russian banking market has increased significantly. The top 5 banks account for more than 60% of the assets of the banking system of the Russian Federation. Under current conditions, small and medium-sized banks are leaving the market, and the remaining banks are trying to compete with large banks in the market. One of the most effective means of increasing efficiency in the activities of small and medium-sized banks may be the introduction of modern technologies. The most promising technologies in the banking sector may be blockchain technology and the use of artificial intelligence.

2. Review of theoretical and empirical studies to assess the impact of the implementation of blockchain and artificial intelligence technologies on the state of the banking system

The development of the banking sector, the impact on it of technological changes in the industry have been the subject of research by both individual accounting and consulting companies and national regulators.

The problems of growth retardation in the banking sector and the need for urgent development of modern technologies are reflected in McKinsey & Company research. “Global return on tangible equity (ROTE) has flatlined at 10.5 percent, despite a small rise in rates in 2018. Emerging market banks have seen ROTEs decline steeply, from 20 percent in 2013 to 14.1 percent in 2018, due largely to digital
disruption that continues unabated. Banks in developed markets have strengthened productivity and managed risk costs, lifting ROTE from 6.8 percent to 8.9 percent. But on balance, the global industry approaches the end of the cycle in less than ideal health with nearly 60 percent of banks printing returns below the cost of equity. A prolonged economic slowdown with low or even negative interest rates could wreak further havoc [14].

In the academic literature, studies on the development of the banking sector, its profitability, and technology were carried out by Carmen M. Reinhart and Kenneth S. Rogoff [16].

3. Analysis of world experience in introducing advanced technologies in the banking sector

Banks Commerzbank and Landesbank Baden-Wuerttemberg (LBBW) in 2019 began conducting transactions on blockchain platform for trade finance by Marco Polo, offering factoring services, discounting of receivables and payment obligations [17]. Further plans are related to the implementation of transactions on the Marco Polo platform, for which it is planned to integrate with client ERP systems, as well as join transport and insurance companies to Marco Polo, which will expand the available range of services. Marco Polo is a blockchain platform for trade finance, which TradeIX is developing on the basis of the Corda blockchain from the R3 consortium.

The London Metal Exchange plans to support the new Forcefield blockchain consortium aimed at tracking metal shipments [18]. Companies included in Forcefield include companies such as Mercuria (commodity trading), and banks ING and Macquarie. At the same time, Mercuria and ING are also participants in the VAKT blockchain platform (a logistics platform for tracking oil supplies), while ING and Macquarie are also participants in the komgo blockchain platform (a platform for trade financing of oil supplies).

One of the uses of artificial intelligence in banking is the use of biometric data. Biometrics is used in the security protocol: face and voice recognition is getting smarter as it intersects with artificial intelligence, which uses accurate data to fine-tune authentication. For example, National Westminster Bank (NatWest) offers its customers to open accounts remotely using a selfie [20]. At the same time, the bank’s software allows real-time matching of the applicant’s selfie with a passport or other official identification document [2].

4. Analysis of trends in the Russian banking system

The Russian banking system is characterized by stable positive indicators for assets, profit, low overdue debt. In the coming years, the stability of the Russian banking system is likely to remain amid low economic growth rates.

| Indicators                          | units rev. | Fact   | Forecast |
|------------------------------------|------------|--------|----------|
|                     |            | 2017   | 2018     | 2019     | 2020     | 2021     | 2022     |
| Balance sheet data                |            |        |          |          |          |          |          |
| Assets                            | %          | 6.4    | 10.4     | 5.3      | 6.5      | 6.7      | 6.9      |
| Securities portfolio              | %          | 7.5    | 6.4      | 6.0      | 7.2      | 7.4      | 7.6      |
| Loans and other loans in total    | %          | 4.5    | 12.0     | 4.6      | 7.5      | 7.7      | 7.9      |
| Corporate                         | %          | 0.2    | 10.5     | 2.0      | 4.7      | 4.8      | 4.9      |
| Retailers                         | %          | 12.7   | 22.4     | 20.3     | 16.7     | 17.2     | 17.7     |
| In the number of mortgages        | %          | 12.7   | 24.9     | 21.9     | 19.2     | 19.8     | 20.4     |
| Provided by interbank loan        | %          | 7.8    | -4.8     | -0.2     | 1.1      | 1.1      | 1.1      |
| Attracted by interbank loan       | %          | 6.9    | 0.3      | -0.2     | 1.1      | 1.1      | 1.1      |
| Customer accounts, total          | %          | 7.4    | 14.2     | 5.6      | 7.1      | 7.3      | 7.5      |
| Corporate                         | %          | 7.4    | 18.7     | 1.9      | 5.6      | 5.8      | 6.0      |
| Population contributions          | %          | 7.4    | 9.5      | 9.7      | 8.7      | 9.3      | 9.3      |
| Capital                           | %          | 4.1    | 3.8      | 9.1      | 7.6      | 7.8      | 8.0      |
| Asset quality                     |            |        |          |          |          |          |          |
| Arrears                           | %          | 5.2    | 4.7      | 5.9      | 6.2      | 6.4      | 6.6      |
| Cost of risk                      | %          | 2.5    | 2.1      | 1.9      | 2.2      | 2.3      | 2.4      |
| Financial ratios                  |            |        |          |          |          |          |          |
| NIM                               | %          | 3.5    | 3.9      | 4.1      | 3.8      | 3.9      | 4.0      |
Low rates of economic growth are the main factor limiting the development of the banking system. According to our forecasts in 2020-2022, the rate of growth in bank assets amount to about 6.7%, while there is a sharp decrease in Russian banks' creditworthiness.

The development of the banking system of Russia is limited by the tendency to increase the share of the largest banks, mainly with state participation. By 01.01.2019 Top-5 largest banks of the country account for 61.1% of the assets of the banking system of the Russian Federation.

Table 2. The degree of concentration of banking assets of the banking system of the Russian Federation [20]

| Group of credit organizations | 01.01.2017 | 01.01.2018 | 01.01.2019 | 09.01.2019 |
|------------------------------|------------|------------|------------|------------|
| Top 5 banks                  | 55.3%      | 55.8%      | 60.4%      | 61.1%      |
| 6-20                         | 22.8%      | 23.5%      | 21.2%      | 21.7%      |
| 21-50                        | 10.6%      | 10.8%      | 9.8%       | 9.6%       |
| 51-200                       | 9.4%       | 8.4%       | 7.6%       | 6.8%       |
| Other banks                  | 1.9%       | 1.5%       | 1%         | 0.8%       |

Amid the growing role of large banks, it will be even more difficult for small banks to compete for quality borrowers. The total number of banks in the country continues to decline [7]. So in less than three years, the number of bank headquarters in Russia decreased by 27%, and bank branches by 41.1% [26].

Figure 1. The number of operating credit organizations and their branches

At least a substantial reduction in structural divisions of banks in Russia (-14.6%) can be explained by lower costs for their maintenance as compared to branches of banks [26].
The current trend towards a reduction in the number of banks, branches and structural divisions is likely to continue and possibly even intensify. Many banks close their branches, transferring customer relationships online. In the Russian market there are examples of banks that do not have a single office. So, from the very beginning of its work, Tinkoff Bank offered all customers to conduct all operations through a personal account on its website or through an application installed on smartphones. This type of banking business has gained great popularity over several years, especially among young customers. In recent years, many banks have been actively introducing similar methods of customer relationship.

5. The development in the banking sector of the application of artificial intelligence technologies and blockchain technologies

However, the development of technology for the banking sector of the economy is not limited to the active use of the Internet. To maintain competitiveness for small and medium-sized banks in the context of the growing share of large banks, it is necessary to introduce artificial intelligence technologies and blockchain technologies.

Let us consider in more detail about these most promising technologies for the banking sector.

Artificial Intelligence Technologies. Artificial intelligence (AI) includes certain software systems and algorithms that have the ability to solve any problems, like a person. Artificial intelligence systems include devices or programs that have such characteristics and parameters that are typical of human intellectual behavior in ordinary life.

For the banking business, the use of such systems can be used to solve the following problems [15]:
- pattern recognition;
- creation and work in symbolic computing systems;
- creation of expert systems;
- behavior planning (search and suggesting the most optimal way to achieve the goal, based on this situation).

The intelligent information system is based on the concept of using databases and accumulated knowledge in order to generate algorithms for solving various applied problems depending on specific needs.

Among the technologies used with the use of artificial intelligence in the banking business include Chat-bots and Robo-Advising [3].

Modern Chat-bots perform the following functions:
- informing about the features of products and services;
- providing contact data;
- payment transactions;
- financial recommendations to the client;
- show courses and exchange currency;
- keep track of personal finances;
- answer user questions.
Robo-Advising has become an alternative to financial advisors on banking issues, specific purchases and other cash transactions. Robo-Advisors provide great advantages in the field of online trading. First of all, these are applications in one click and opening an account in real time, monitoring, current news and processing of large volumes of transactions immediately.

Among Russian banks, the active use of AI is carried out by Sberbank [1]. The bank implements the AI-first concept, embedding artificial intelligence in all its processes. In 2018, the bank was focused on creating the necessary conditions for AI transformation, including the preparation of infrastructure, data, models, processes. The bank creates unified open platforms on which a service is provided for all internal business customers. In 2019, the bank's focus shifts to products, customer experience and the financial effect of using AI.

Blockchain technology. A blockchain is a sequential and continuous chain of transaction blocks built according to certain rules. The technology of blockchain systems is able to provide high-level protection, integrity and safety of data in almost any field.

The basic principles underlying this system are openness, distribution and security. The data log based on blockchain technology is distributed among all network participants, where each participant has full access to the entire database and the history of its operations, and guarantees the immutability, integrity and reliability of the data.

After the successful use of the blockchain at the heart of the Bitcoin payment system, special attention is focused on the possibility of using the technology to implement a number of financial instruments. Today it is possible to distinguish three main areas of technology development: blockchain 1.0 is used in the implementation of cryptocurrencies, blockchain 2.0 represents smart-contracts and financial instruments, blockchain 3.0 is an application outside the financial sector that can completely change the life of society[10].

A smart-contract is a digital protocol for transmitting information using a mathematical algorithm with which it is possible to automatically conduct a transaction after fulfilling the specified conditions for the conclusion and complete control of the contracts. Smart-contracts are implemented in the blockchain registry in the form of code. The advantages of smart-contracts are independence from specialists when concluding a transaction, a guarantee of the security of the transaction, the absence of the possibility of falsification in view of repeated data duplication, savings due to the absence of intermediaries and commissions. It is rational to use smart-contracts for standard, repeated transactions (supply and lease agreements, letters of credit, royalties), the execution of which is easy and simple to control.

In December 2016, Alfa Bank, together with S7 Airlines, was the first in Russia to performed settlements with the counterparty using smart-contracts. And in July 2017, S7 Airlines and Alfa Bank launched a blockchain platform to automate trading operations with airline ticket agents [27].

The modern banking system is not perfect. Clients pay high fees to banks and do not understand where their money is going. Banks must have a large staff and use the not always reliable SWIFT interbank transfer system. Using blockchain eliminates intermediaries in banking operations and automates many processes. The efficiency of the banking system is also enhanced by lowering costs. Banks can receive additional sources of income, thanks to the advent of new business models and products based on the blockchain.

Key areas of application blockchain in the banking sector:
- Conducting fast and cheap transfers. This is especially true for cross-border transfers and micropayments, where the bank commission may be comparable to the amount of the transfer. While in banks, such transactions take a long time (up to 3-5 business days) and are expensive (from 1% of the amount). On a global scale, this is a huge expense. In cryptocurrency networks, transfers take several minutes and cost significantly less.
- The ability to automate processes and quickly process operations. This allows you to reduce costs and reduce staff. Blockchain makes it possible to get rid of a complex workflow, because any operation can be traced. The guarantee of the immutability of the data is the technology itself, the human factor is excluded. There are already projects on the blockchain in the field of loans, customer identification, corporate finance.
- Ensuring the impossibility of making retroactive changes and forging reporting. The banking system is not transparent. Blockchain will make all operations transparent and increase the level of trust between all participants.

The main difficulties in introducing blockchain into the banking system are that the essence of the blockchain is decentralization, and the essence of the banking system is complete centralization and total control.
Investments in blockchain can destroy the existing business-model of banks. If the blockchain gets distributed, banks will be able to provide services faster, cheaper and easier, which will lead to a drop in their income - and it is not profitable for them.

Today, blockchain and artificial intelligence technologies are used mainly by large banks that are not very interested in changing the current business model of banks. However, for small and medium-sized banks, the use of these technologies opens up great opportunities in the context of a small number of branches in comparison with large banks.

6. Summary

The development of modern technologies in the banking sector leads to a reduction in a large number of branches of the bank, which allows banks to optimize costs. Already, there are examples of banks that do not have a single branch, while their assets are growing and the client portfolio is expanding.

Due to the nature of their work, banks must constantly verify and coordinate data. Each company maintains the relevance of data in its database independently. If bilateral exchange is necessary, these processes are too slow and inefficient. Blockchain can greatly simplify the process of reconciling data, making it part of the transaction processing procedure. This technology is actively developing, however, its implementation is hindered by state regulators, since the blockchain is aimed at decentralizing processes.

The use of artificial intelligence in banking can accelerate the processing of information and significantly reduce the number of bank employees. Already, many banks use Chat-bots and Robo-Advisors, as well as other AI technologies to optimize activities, increase labor productivity and increase the financial performance of banks.

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