

Mechanisms for Ensuring the Economic Security of the Banking Sector Based on Blockchain Technologies

Marat Rashitovich Safiullin^{1,2}, Leonid Alekseevich Elshin^{1,2,3}, Alia Aidarovna Abdukaeva^{1,2,3}

¹Kazan Federal University

²Advanced Economic Research Centre at the Academy of Sciences of the Republic of Tatarstan

³Kazan National University of Science and Technology

Abstract

Similar to how the digitalization of the socioeconomic environment destroys traditional areas of business (for example, digital channels replaced analogue ones), blockchain technologies can significantly transform existing business processes, including in the financial sector, thereby continuing to develop the FinTech paradigm. The introduction of blockchain technologies in the financial environment may violate the order of its functioning and development due to the fact that financial transactions can be generated in a decentralized way, while not violating the principles of verification, storage and data protection. In this regard, issues related to the empirical assessment of the possible effects arising from the “blockchain implementation” into financial markets are relevant and significant. The banking sector in the national economy of the Russian Federation was chosen as the object of research. The subject of research is the relationship built between participants in the financial market based on blockchain technologies and the resulting effects expressed in the potential to reduce the operational risks of credit organizations. In the course of our study, the scenario parameters for generating financial results of the banking sector as a result of the “blockchain implementation” into operational processes are disclosed in a formalized form; the functional capabilities of blockchain technologies are also

identified that help minimizing operational risks in the banking sector.

Keywords: blockchain technology, banking sector, operational risks, financial results, reserves for possible losses, financial system.

I. INTRODUCTION

In the coming years, blockchain technologies may become one of the breakthrough innovations in the financial sector of the economy optimizing and simplifying transaction operations in a number of areas, reducing their cost and minimizing the risks of making ineffective decisions. In this regard, representatives of the financial industry should understand the possible consequences caused by the integration of the technologies under consideration in business processes. It is important to understand that blockchain technologies have a very significant potential for transforming the established algorithms for the interaction of financial market participants, and also to know what are the boundaries of these changes, what new opportunities are presented by blockchain technologies and, finally, what are the expected consequences for the development of the financial sector itself and the other sectors of the national economy associated with it.

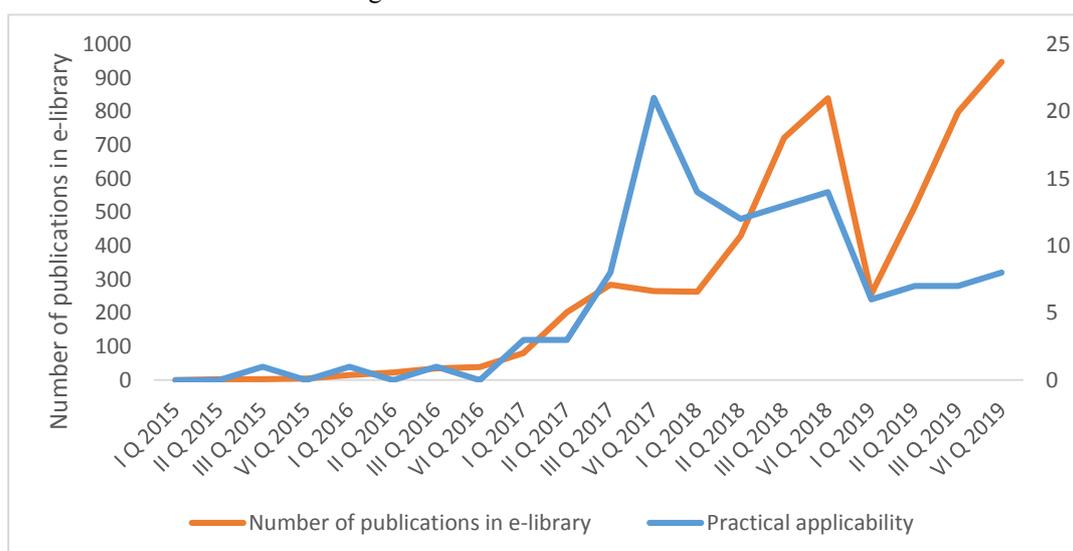


Figure 1. The number of registered facts concerning the use of blockchain technologies in the operational activities of Russian companies [1]

Given the very high rate of penetration of blockchain technologies into the real sector of the economy, as well as in the field of view of the expert and scientific community (Figure 1), it becomes extremely important to overcome the vacuum in understanding the essence and importance of distributed data storage technologies until they become a reality and finally penetrate in the sphere of business processes of business entities.

Despite its potential, it should be noted that studies on blockchain technologies are very fragmented and, as a rule, have an insufficient level of both theoretical and empirical studies.

Given the above, it seems relevant at the present stage of the development of economic science to conduct a systematic study aimed at finding and substantiating the principal directions and areas of economic activity that are most susceptible to penetration of blockchain technologies, with further justification of the possible consequences, using methods which belong to not so much qualitative, but to quantitative analysis.

In addition, there is a lack of deep understanding of how blockchain technologies are structured and designed, how they are able to revolutionize the development of markets based on the transformation of mechanisms of trust between its participants, how and to what extent distributed data storage technologies affect financial risks and efficiency of operating activities.

In this regard, the process of resolving the issues posed in order to minimize risks for financial and other organizations in the face of impending opportunities and threats under the pressure of the integration of blockchain platforms into the business environment becomes an extremely important and urgent task.

II. METHODS

It should be noted that the following technological procedures [2] are the most important components in the issue that reveal the features of the functioning efficiency of organizations in the financial sector of the economy (both in terms of the cost approach and in terms of time consumption) [2]:

- 1) Verification of assets;
- 2) Accounting and maintaining a database of transactions;
- 3) Data confidentiality;
- 4) Transaction costs.

In this regard, it is advisable to study in this research the necessity and validity of the transition of the financial industry to blockchain technology within the framework of these four functional components. However, given that the subject of this research is the operational risks of financial institutions that have their own specific characteristics different from other operational areas of banking institutions, the composition of technological procedures can be narrowed based on the specificity of the risks involved.

The concept on that introduction of blockchain technologies in the operational activities of the banking sector of the economy will prevent / minimize operational risk¹ or the maximum possible reduction in the threat of potential losses (direct and / or indirect) associated with the organization of internal processes is accepted as the main hypothesis of this research. The main list of operational risks of the banking sector is presented in table 1.

Table 1. The main list of operational risks of the banking sector [3]

Operational Risk Groups	Threat
Bank staff	Lack of competence and lack of experience
Internal fraud	Theft of money in one way or another
Processes and Internal Control	Use of incorrect data, transactions and calculations on financial transactions
	Inadequate distribution of powers
Information Systems and Technologies	Information System Failures and Equipment Failures
	Incomplete data backup
Insecure data processing	Data Theft by Third Parties
Hacking an information system and virus infection	Data loss, destruction, deliberate introduction of incorrect errors, etc.

The use of blockchain technologies in the banking sector will contribute to the “transparency” of financial activities through strict regulation of the rules and a set of blockchain-programmed actions, which will accordingly affect the elimination / minimization of operational risks. Strengthening the arguments of this point of view, some experts argue [6, 9, 13] that the financial crisis of 2008 could have been avoided if financial institutions adhered to strict rules in the sphere of regulation of financial operations and processes. In fact, an excess of illiquid assets formed in the financial capital markets and brought down the value of the last in the absence of clear and unambiguous rules for players, as a result of which many financial organizations began to go bankrupt.

III. RESULTS AND DISCUSSION

Further, relying on the above effects, which form the basis for eliminating / minimizing operational risks in banking based on the application and integration of blockchain technologies into the system of operational processes, a formalized assessment of them is carried out.

The concept on that introduction of blockchain technologies in the operational activities of the banking sector of the

¹ Operational risk is the risk that a bank would incur losses as a result of deficiencies in internal processes, unauthorized / illegal actions or errors of employees, or as a result of external events [8].

economy will ensure the elimination of operational risks is accepted as the main hypothesis of this stage of the study. When determining the possible effects generated by the hypothesis under consideration, it is assumed in accordance with the above defined effects, that the operational risk in the banking sector is absolutely localized. Undoubtedly, it must be understood that such an assumption is very abstract and conditional. However, having idealized our hypothesis, we believe in the process of calculating that the deployment of blockchain systems in the banking sector of the Russian

economy will be carried out in a full-scale format. Based on this, further calculations are based on the assumption that operational risks caused by losses of banks as a result of deficiencies in internal processes, unauthorized / illegal actions or errors of employees will be completely localized and reduced almost to zero level.

Table 2 below presents the main parameters of the operational risk in the banking sector of the Russian economy.

Table 2. Operational risks and income of credit organizations, billion roubles [16]

	1.01.17	1.01.18	1.01.19
Income - total	182 516,2	104 967,2	137 990,6
The value of operational risk (RR) with a coefficient of 12.5	7 486,4	8 369,8	8 137,4

Thus, we can state that the total size of operational risks in the banking sector of the national economy reaches about 8 trillion roubles per year (Table 3).

Given that, in fact, bank reserves “mothball” the liquidity of financial credit institutions, their creation narrows down lending opportunities and, accordingly, form the prerequisites for reducing the financial results of the banking sector of the economy. Undoubtedly, the formation of reserves is one of the mechanisms of the central regulator that contributes to the sustainable development of the financial sector of the economy in the context of its possible turbulence, caused, for example, by the growth of overdue debts in the loan portfolio. Without going into details about the reservation rates established by the Central Bank of the Russian Federation for one or another risk of the banking sector, it is unambiguously necessary to state that financial institutions suffer losses as a result of reduced liquidity as

part of the “freezing” of assets in funds intended for making reserves.

In order to detect such dependencies, a model has been constructed that assesses the impact of operational risks on key parameters of the financial results of the banking sector.

$$Y = 12.24 + 0.19X_1 - 0.18X_2$$

(Formula 1)

Where:

Y - Financial performance of credit organizations, billion roubles

X1 - The volume of loans issued, billion roubles.

X2 - The value of operational risk (OR) with a coefficient of 12.5%, billion roubles.

Statistical parameters of the significance of the model are presented in table 3.

Table 3. Statistical parameters of the significance of the model

	<i>Coefficients</i>	<i>Standard error</i>	<i>t-statistic</i>	<i>P-value</i>
Y intersection	12,24	308,31	0,03	0,96
The volume of loans issued, billion roubles	0,18	0,06	3,10	0,01
Operational risk (OR) with a coefficient of 12.5, billion roubles.	-0,18	0,08	-2,05	0,07

The results obtained prove the very significant effect of reserves on operational risks on the volume and dynamics of financial results of credit organizations. In this regard, it seems quite obvious that there is the need for searching the areas that contribute to the reduction of such risks, where the optimization of internal operational processes, unauthorized / illegal actions or errors of employees of credit institutions, and the like is a key mechanism.

Given that blockchain technologies can largely mitigate such risks, their use is very justified in banking sector concerning the system of building and “tuning” operational activities.

At the same time, it is undoubtedly necessary to realize that distributed data storage technologies are not able to eliminate the entire volume of operational risks. At the same

time, in solidarity with the position of many foreign experts [6, 8, 15], we suggest that the use of those technologies will reduce risks in the vast majority of cases.

In fact, this study is an invitation to a discussion about the prospects of using blockchain technologies in the operational activities of banking institutions with the presentation of the primary evidence base.

Guided by the estimates obtained (Formula 1) and the conclusions below, scenario calculations are presented that determine the possible effects generated as a result of a reduction in operational risks in the banking sector of the Russian economy and, accordingly, a decrease in the size of requirements to bank capital for operational risk as a result

of “blockchain implementation” in business processes (Table 4, 5). It is important to note that scenario estimates of the reduction in the coefficient reflecting the average level of unforeseen losses due to operational risk in relation to the size of the received income are consistent with the estimates of the consultancy Accenture Consulting [15] Here, the authors allow a decrease in operating risks of 50% or more as part of the transition of credit institutions to the blockchain in the system of forming operational activities. In this connection, it seems appropriate that the second scenario can be chosen as the base scenario (reduction of the reserve to 5%), since it forms the possibility of reducing the operational risk by about 60%. [18]

Table 4. Scenario parameters for the coefficient of operational risk capital, in % of the average gross income of a bank (financial institution) for the last three years

	The coefficient value reflecting the average level of unforeseen losses due to operational risk in relation to the amount of income received					
	Scenario Parameters				Actual Parameters	
	1%	3%	5%	10%	The value of operational risk (OR) with a coefficient of 12.5 in accordance with the instruction of the Central Bank of the Russian Federation. As of 01.01.2020.	15.0% (in accordance with the operational risk assessment methodology set out in the Basel Committee capital adequacy agreement “Basel II”).
Amount of capital requirements in relation to operational risk, billion roubles	651,0	1953,0	3255,0	6509,9	8137,4	9764,9

Table 5. Scenario estimates of changes in financial results (profit) of the banking sector of the Russian economy as a result of scenario adjustment to changes in operational risk due to the use of blockchain technologies

	Amount of capital requirements in relation to operational risk,%			
	1%	3%	5%	10%
Financial performance of credit organizations, billion roubles (calculated by formula 1)	3164,6	2927,0	2689,4	2095,4
Scenario analysis of the increase in financial results relative to the actual size as of 01.01.2020, billion roubles	1127,7	890,1	652,5	58,6

IV. SUMMARY

The obtained estimates of adjustments to changes in the financial results of the banking sector of the Russian economy as a result of scenario adjustment of changes in operational risk due to the use of blockchain technologies

were obtained by the ratio of actual and calculated (programmed) indicators as of 01.01.2019. For reference, the actual financial results of the activities of credit organizations as of the date under review amounted to 2036.8 billion roubles [19].

Considering that the scenario that assumes a reduction in the reserve ratio to 5% was selected as the base one, the growth potential of financial results in the banking sector as a result of the transition to the blockchain and optimization of operational processes reaches up to 652.5 billion roubles. Meanwhile, realizing that the increase in the efficiency of the functioning of financial markets forms the basis for the development of the real economy, the revealed growth reserves in the efficiency of credit organizations will indirectly determine the development of the national economy as a whole. However, this kind of statement of the problem requires additional studies and justifications.

V. CONCLUSIONS

In conclusion, it should be noted that in accordance with the principles and the algorithm for determining macroeconomic effects that we have introduced, the penetration of blockchain technologies into the banking sector also forms a number of other opportunities that provide an increase in its financial efficiency. This is a reduction in credit risks, costs of intermediary services, etc. At the same time, each of the noted areas requires its own individual approach in the research process. Restricting ourselves to operational risks, it should be noted that there is a very high level of potential for the use of blockchain technologies by banking institutions in their operational activities.

In addition, the most important result of assessing the possible consequences of the penetration of blockchain technologies into the banking environment is the potential for a formalized assessment of changes that could potentially occur in the national economic system as a whole. This, in turn, allows us to move on to developing new models of economic growth under the influence of economy digitalization elements (in particular, as a result of the use of blockchain technologies in the financial sector). This will be the subject of our future work.

Thus, it is necessary to state that the intensification of investment processes in the development of distributed data storage technologies is becoming a strategically important task in modern conditions of managing and developing technological solutions in the FinTech field (including, of course, the intensification of the penetration of blockchain technologies into ecosystems). Those market participants who are already solve this issue and are focusing on the development and integration of blockchain systems and their use in their business environment create their own handicap and a strategic competitive advantage in their development for the medium and long term.

ACKNOWLEDGEMENTS

The study was carried out with a grant from the Russian Science Foundation (project No. 19-18-00202).

We would like to express our gratitude to the participants of the scientific project supported by the RFBR No. 18-010-00536 for the help in preparing the paper.

REFERENCES

- [1] Safiullin MR, Abdukaeva AA, Yelshin LA. An integrated multicomponent assessment of the blockchain technology market development in the national economy of Russia. *Innovation*. 2019;7(249):41-49.
- [2] Tilooby A. The Impact of Blockchain Technology on Financial Transactions. Dissertation, Georgia State University, 2018. https://scholarworks.gsu.edu/bus_admin_diss/103
- [3] Operational risk assessment of Sberbank of Russia OJSC [Electronic source]. - Access mode: <https://infopedia.su/9xb73.html>, free (22.04.2020)
- [4] Risk report for 2018 (posted May 30, 2019, submitted to the Bank of Russia on May 31, 2019 [Electronic source]. - Access mode: <https://www.sberbank.com/en/investor-relations/reports-and-publications/ras> free access (13.04.2020)
- [5] Crosby M, Pattanayak P, Verma S, Kalyanaraman V. Blockchain technology: Beyond bitcoin. *Applied Innovation*. 2016 Jun;2(6-10):71.
- [6] Nasdaq. Nasdaq Linq Enables First-Ever Private Securities Issuance Documented With Blockchain Technology. 2015. Retrieved from <http://ir.nasdaq.com/releasedetail.cfm?releaseid=948326>.
- [7] Pazaitis A, De Filippi P, Kostakis V. Blockchain and value systems in the sharing economy: The illustrative case of Backfeed. *Technological Forecasting and Social Change*. 2017 Dec 1;125:105-15.
- [8] Workie H, Jain K. Distributed ledger technology: Implications of blockchain for the securities industry. *Journal of Securities Operations & Custody*. 2017 Aug 1;9(4):347-55.
- [9] Yli-Huumo J, Ko D, Choi S, Park S, Smolander K. Where is current research on blockchain technology?—a systematic review. *PloS one*. 2016 Oct 3;11(10):e0163477.
- [10] Overview of the banking sector of the Russian Federation (Internet version). Analytical indicators. No.200 June 2019 https://cbr.ru/Collection/Collection/File/19777/obs_200.pdf
- [11] Basel Accords. [Electronic source] - Access mode: https://en.wikipedia.org/wiki/%D0%91%D0%B0%D0%B7%D0%B5%D0%BB%D1%8C_II, free (04/22/2020)
- [12] Blockchain in banking: analysis of the value of technology for investment banks [Electronic source]. - Access mode: <https://habr.com/en/company/wirex/blog/400565/>, free access (04/22/2020).
- [13] Report “Overview: the banking sector in 2019” [Electronic source]. - Access mode: https://cbr.ru/Collection/Collection/File/19777/obs_200.pdf, free access (22.04.2020)