



## Bank Financial Risk Assessment in the Digital Background

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### ABSTRACT

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The article establishes that the effective management of banking risks should be based on the relevant fundamental research on the formation of an effective mechanism for regulating financial relations in the banking sector. The purpose of the study was to substantiate the theoretical and methodological foundations of effective banking risk management and develop practical recommendations for improving its effectiveness in the context of digitalization. The study utilized various scientific methods, including financial stability indicator analysis, economic standards evaluation, financial condition coefficient calculation, and testing the CAMELS system within the digitalization context. Bank risk management is crucial for sustainable development. Studying risk management enhances the Russian banking sector's financial stability. However, risk management in stable conditions differs significantly from digitalization. In the digital era, objectives, resource availability, support, and decision-making time change. The goal becomes avoiding major performance deviations caused by risks in active and passive operations and bank activities.

## 1. INTRODUCTION

Banks are the main financial market participants, and the overall development of the economy of the Russian Federation depends on their sustainable functioning. At the same time, in the context of digitalization, the problem of ensuring the financial stability of the banking system becomes extremely important. The devastating consequences of the global financial crisis have called into question the adequacy of many basic principles of contemporary financial management, including issues about the effectiveness of bank risk management tools and financial engineering [1-3].

The nature and manifestation of risks differ in the context of digitalization. Because of this, bank risk management in the context of digitalization is typologically different from risk management in a relatively stable external environment. In addition, the severity of the problem is aggravated by the fact that the formation of the bank risk management system for most banks in the Russian Federation was imitative, that is, formal. Therefore, the inability of some of these banks to counteract the negative impact of digitalization was the main reason for their insolvency.

At the same time, effective management of bank risks should be based on relevant fundamental studies of forming an effective mechanism for regulating financial relations in the banking sector. Considering this, the problem of developing theoretical, methodological foundations, and practical

recommendations for effective bank risk management is important and relevant.

The purpose of the study is to substantiate the theoretical and methodological foundations of effective bank risk management and to develop practical recommendations for improving the effectiveness of bank risk management in the context of digitalization. Achieving this goal involves solving the following tasks: to find out the features of bank risk management in the context of digitalization to take them into account in the banks' activities; to analyze the current rehabilitation mechanism and modern tools for reducing systemic risk to increase their effectiveness.

The scientific novelty of the obtained results lies in solving the urgent problem of updating the concept of bank risk management and developing scientific and practical recommendations for improving the effectiveness of bank risk management in the context of digitalization.

## 2. LITERATURE REVIEW

The theoretical, methodological, and methodic aspects of risk management are considered in the works of leading scientists.

Ashta and Herrmann [4] note that risks are inherent in any area of economic activity, especially in banking institutions.

Bezrodna et al. [5] emphasize that for the functioning of

banking institutions, risk is a constant inherent component. Any decision in banking that deserves attention is burdened with risk, because the financial sector in general, and banking in particular, is very sensitive not only to various socio-economic factors but also to political, natural, and climatic.

Erykhailova and Bass [6] argue that in banking, the main task is to rationally manage banking risks and assess the structure and level of risk as correctly and efficiently as possible, carrying out a particular banking operation, seeking to reduce the degree of risk to a minimum level.

One cannot but agree with Omelchenko and Rats [7] that the issue of minimizing banking risks is significant. The assessment of the degree of risks and the scope of managing various risks and considering them in banking is an actual component of both the policy of banking institutions and their strategies.

Despite the availability of a significant amount of research, it should be noted that not enough attention is paid to the problems of bank risk management in the context of digitalization, and therefore, the scientific and practical foundations for the development of risk management in a period of digitalization are poorly researched, they lack consistency and thoroughness.

Andrievskaya and Semenova [8] note that the lack of fundamental developments in banking risk management in the context of digitalization negatively affects the financial stability of the modern banking sector in the Russian Federation.

Jo et al. [9] emphasize that for modern financial thought, the main problem is forming tools for implementing the bank risk management concept, which should be effective both in a relatively stable external environment and in the context of digitalization. Besides, increasing the effectiveness of such tools requires improving the scientific, methodological, and methodological foundations of bank risk management.

One cannot but agree with Ma et al. [10] that in order to avoid significant losses from non-repayment of loans, it is necessary already at the early stages of the credit process to build work to minimize banking risk in accordance with the classifier, which provides for an appropriate grouping of loans depending on the level of risk.

Pellegrini et al. [11] argue that banking risk often depends not so much on the activities of a banking institution, but on the state of the country's digitalization, the impact of external factors, and also the type of loan itself provided to the borrower.

Seho et al. [12] note that in their activities, banking institutions should be aware of interest rate risk, which is characterized by the danger of financial costs due to fluctuations in market interest rates and changes in the cost of loans.

Torri et al. [13] emphasize that interest rate risk arises when the terms of repayment of funds provided under the loan and borrowed funds do not correlate, or when interest rates on active and passive operations are set using different methods, that is, fixed.

Based on the aforementioned ideas, we formulated our research hypotheses as follows:

Hypothesis 1. An increase in the value of the integral indicator leads to an improvement in the financial condition of the bank in the context of digitalization.

Hypothesis 2. An increase in the value of the integral indicator leads to a deterioration in the financial condition of the bank in the context of digitalization.

### 3. METHODOLOGY

The methodological basis of the research was formed by the fundamental principles of management, the initial postulates of economic science, and theoretical and applied developments of scientists, in which the issues of bank risk management were studied. The article is carried out using general scientific and special research methods, in particular, scientific abstraction, analysis, synthesis, induction, deduction, and comparison, used for studying the conceptual construct; theoretical generalization and grouping; structural analysis; historical analysis; system analysis; grouping and sampling – to study the patterns and problems of the banking sector development; macroeconomic analysis of markets; neural modeling; formalizations, constructive and abstract-logical approaches.

The information base of the research included theoretical and scientific-practical research on banking risk management of 2014-2020, regulatory legal acts on banking regulation, materials of the Central Bank of the Russian Federation, the Federal State Statistics Service of the Russian Federation, the Association of Russian Banks, the Deposit Insurance Fund, annual reports of banking institutions, analytical reviews of the International Monetary Fund, the International Bank for Reconstruction and Development.

Structurally, the study includes an analysis of financial stability indicators of the banking system, an assessment of the economic statutory ratios in the banking system in general, the calculation of the general indicator of the financial condition of a banking institution, testing the CAMELS system for the banking system in the context of digitalization.

The parameters of the CAMELS system were evaluated on a five-point scale, where "1" was the highest rating, and "5" was the lowest [14-16]. Based on the estimates of all parameters on a five-point scale, a summary rating was compiled. The advantages of the CAMELS rating system are the visibility of the research results because, from the aggregate of a large amount of information, one indicator can be obtained that can be used for further decision-making.

In this case, the authors offer a system of timely warning of financial problems in the activities of banks, which includes sixteen economic indicators integrated into the following six groups: Capital adequacy, Asset quality, Profitability, Liquidity, Dynamics, and Risk management level.

The authors propose to include three following indicators in the Capital adequacy group:

1) The solvency indicator (K1), which reflects the bank's ability to pay off its obligations arising from the bank's economic activities in a timely and complete manner. The higher the capital solvency indicator, the greater is the risk share assumed by the bank's owners (shareholders), and conversely, the lower the value of the indicator, the greater risk share is assumed by the bank's creditors;

2) An indicator of the capital to total assets ratio (K2), which reflects the amount of capital required for the bank to carry out active operations;

3) The indicator of the capital to liabilities ratio (K3), which determines the adequacy of the bank's funds to fulfill its obligations to depositors and creditors.

The second group of Asset quality includes two indicators, namely:

1) The indicator of the loan portfolio quality (a1), which characterizes the degree of forming reserves for expected losses on the bank's operations;

2) The indicator of the bank's active operations efficiency (a2), which shows the proportion of overdue loans, doubtful accounts receivable, and other doubtful investments of the bank in its assets.

Three indicators are referred to the third Profitability group:

1) The return on assets indicator (ROA), that is, the ratio of profit to bank assets, which determines their profitability;

2) The return on sales (ROS), which characterizes the level of return on the bank's expenses and estimates the amount of profit per unit of costs;

3) The return on efforts (ROE), which shows how much net profit is accounted for by one ruble of the bank's capital, and characterizes the economic return on capital.

The next Liquidity group includes the following indicators:

1) Current liquidity indicator (L1), which characterizes the bank's ability to ensure timely fulfillment of its current obligations at the expense of highly liquid assets (cash, funds on demand to the Central Bank and other banks);

2) The liquid assets ratio (L2), indicating how big a reduction in the balance sheet can the bank withstand before it is forced to sell illiquid assets in the context of digitalization.

#### 4. RESULTS AND DISCUSSION

The most significant components of market risk are interest rate and currency risks. Derivative financial instruments can be used to manage such risks. The financial stability indicators of the banking system of the Russian Federation are shown in Table 1.

As can be seen from Table 1, the basic financial indicators in 2020 significantly deteriorated compared to 2019. Thus, the I1 index (the ratio of regulatory capital to risk-weighted assets) at the end of 2020 was 15.97%, which is 2.3 percentage points lower than that at the end of 2019. The I2 index (the ratio of

regulatory capital and level to risk-weighted assets) decreased by 2.26 percentage points over the same period. One can also note a decrease in the level of liquidity.

The losses of banking institutions in 2020 are confirmed by the negative values of the indicators I7 (-0.94%) and I8 (-7.07%). This information on financial stability indicators is confirmed by data on the economic statutory ratios of the Central Bank of the Russian Federation (Table 2) [17].

The analysis shows that liquidity statutory ratios at the beginning of 2020 decreased compared to 2019, namely, the standard H1 has decreased by 2.66 percentage points and the standard H5 – by 0.95 percentage points.

Besides, as of 01.01.2020, the statutory ratio for the maximum aggregate amount of loans, guarantees, and vouchers provided to insiders (H10) was 1.38%, which is 0.26 percentage points lower compared to the previous period.

During 2020, the dimension of bank risks significantly increased: the statutory ratio of large bank risks (N8) amounted to 250.05, which is 77.99 points higher compared to the previous period. At the same time, the assessment of the financial stability of the banking system is based on an analysis of the financial condition of banking institutions, which is determined using appropriate coefficients, a rating, or an integral indicator.

The main disadvantage of coefficient-based analysis is that a particular financial coefficient determines just one specific aspect of the bank's financial condition [18-20]. Therefore, for a comprehensive financial analysis of the effectiveness of banking activities in the context of digitalization, it is necessary to use a large number of various coefficients. The authors have developed a method for calculating the overall indicator of assessing the financial condition of the bank using the coefficients in the context of digitalization indicated in Table 3.

**Table 1.** Financial stability indicators of the banking system of the Russian Federation in the context of digitalization for 2014-2020 (as of the end of the year), %

Indicator	2014	2015	2016	2017	2018	2019	2020
<b>Basic indicators</b>							
I 1	14.02	18.09	20.84	18.91	18.07	18.27	15.97
I 2	11.16	14.24	15.11	13.98	13.78	13.88	11.62
I 3	9.17	31.98	29.18	25.77	36.04	30.66	54.99
I 4	3.89	13.71	15.28	14.74	16.55	12.88	16.74
I 5 (residents)	96.86	96.86	96.27	98.24	98.42	98.73	96.95
I 6 (non-residents)	3.16	3.45	3.72	1.78	1.58	1.29	3.07
I 7	1.29	-4.47	-1.42	-0.63	0.48	0.25	-0.94
I 8	10.54	-32.83	-9.83	-4.23	3.16	1.69	-7.07
I 9	51.17	66.77	65.97	63.08	64.14	58.57	49.12
I 10	52.96	61.09	61.88	68.27	65.96	65.96	53.46
I 11	9.36	11.46	18.85	18.66	22.14	20.64	24.32
I 12	32.98	35.89	91.18	94.74	90.29	89.12	86.76
I 13	33.11	28.52	21.62	8.42	2.51	6.95	23.68
<b>Recommended indicators</b>							
I 14	12.87	13.11	14.64	14.77	15.04	15.07	12.69
I 15	187.37	169.22	169.22	164.47	172.92	172.06	246.47
I 16	0.39	0.04	0.34	1.14	1.26	1.31	2.55
I 17	0.28	0.05	0.05	0.14	0.08	0.14	0.41
I 18	16.47	4.46	3.23	5.13	3.72	3.84	16.28
I 19	48.14	40.68	40.74	38.92	41.33	41.05	38.72
I 20	817	587	722	568	486	384	573
I 21	2,754	2,498	1,791	2,901	4,495	6,491	2,668
I 22	48.37	45.28	56.02	61.18	69.81	73.35	66.26
I 23	60.33	52.58	48.24	42.14	37.67	34.73	45.92
I 24	59.05	55.84	51.26	49.77	49.23	43.26	45.69

Source: Bank of Russia [17]

**Table 2.** The economic statutory ratios for the entire banking system of the Russian Federation for 2014-2020 in the context of digitalization (as of the beginning of the year)

Statutory Ratio		2014	2015	2016	2017	2018	2019	2020
H1	Regulatory capital adequacy ratio (at least 10%)	14.02	18.09	20.84	18.91	18.07	18.27	15.61
H2	Statutory ratio (coefficient) of regulatory capital to total assets (at least 9%)	11.83	13.92	14.58	14.97	14.88	13.99	-
H3	Statutory ratio (coefficient) of regulatory capital to liabilities (at least 10%)	-	-	-	-	-	17.42	-
H4	Instant liquidity statutory ratio (at least 20%)	62.39	64.46	58.81	58.49	69.27	56.98	57.14
H5	Current liquidity statutory ratio (at least 40%)	75.17	72.91	77.34	70.54	79.08	80.87	79.92
H6	Short-term liquidity statutory ratio (at least 20%)	32.98	35.89	91.18	94.74	90.29	89.12	86.15
H7	The statutory ratio of the maximum amount of credit risk per counterparty (no more than 25%)	23.05	21.57	21.05	20.77	22.11	22.34	22.02
H8	The statutory ratio of large banking risks	187.37	169.22	161.21	164.47	172.92	172.06	250.05
H9	The statutory ratio of the maximum amount of loans, guarantees, and vouchers provided to one insider (no more than 5%)	1.67	0.94	0.82	0.58	0.38	0.37	0.14
H10	The statutory ratio of the maximum aggregate amount of loans, guarantees, and vouchers provided to insiders (no more than 30%)	5.77	3.32	2.26	2.52	2.42	1.64	1.38
H11	The statutory ratio for investing in securities individually for each institution (no more than 15%)	0.23	0.08	0.06	0.07	0.08	0.05	0.02
H12	The statutory ratio of the total investment amount	5.53	3.13	3.36	3.25	3.49	3.16	2.98

Source: Compiled based on [17]

**Table 3.** Coefficients for calculating the overall indicator of the bank's financial condition in the context of digitalization

Ratios	Definition	Characteristics
The general reliability coefficient (K1)	The ratio of equity to the amount of working (risky) assets	This indicator determines how the bank's risky investments in operating assets are protected by the bank's own capital
Instant Liquidity Ratio (K2)	The ratio of liquid assets and on-demand liabilities	This indicator shows whether the bank uses customer money as its credit resources
Cross-coefficient (K3)	The ratio of the total liabilities of the bank to the amount of loans issued	This indicator shows the degree of risk that the bank allows when using the raised funds in the context of digitalization
General Liquidity Ratio (K4)	The ratio of liquid assets and protected capital to the total liabilities of the bank	This indicator characterizes the ability of the bank to satisfy the creditors' claims in the shortest possible time in case of non-repayment of the loans provided
Capital security ratio (K5)	The ratio of the protected capital to the equity capital	This indicator reflects the extent to which the bank takes into account inflationary processes, as well as part of the assets invested in real estate and equipment
Profit stock capitalization ratio (K6)	The ratio of the equity capital and the dimension of the authorized capital	This indicator characterizes the bank's ability to increase its capital at the expense of profit in the context of digitalization

Source: Compiled based on [21-23]

We developed the overall indicator of the bank's financial condition which we propose to determine using the formula:

$$N = 45K_1 + 20K_2 + 10K_3 + 15K_4 + 5K_5 + 5K_6 \quad (1)$$

Base on the proposed equation, the bank has the highest possible level of financial security in the case when  $K_1 = 1$ ,  $K_2 = 1$ ,  $K_3 = 3$ ,  $K_4 = 1$ ,  $K_5 = 1$ , and  $K_6 = 3$ . This means that the amount of working assets in the bank is equal to the amount of equity; liquid assets are equal to on-demand liabilities; total liabilities are three times higher than working assets; funds in the form of protected capital and liquid assets are equal to the total liabilities of the bank; protected capital fully corresponds to equity; equity exceeds the authorized capital three times. All this confirms hypothesis 2.

Common rating models that are used in contemporary banking practice include the CAMELS system, whose essence is to determine the overall condition of the bank based on uniform criteria covering all its activities. Such a system helps to identify banks whose financial condition, operations, or management have shortcomings that can lead to bankruptcy (Table 4).

**Table 4.** Parameters of the CAMELS system

Parameter	Parameter Characteristic
C	Capital adequacy ratio Determines the capital adequacy to cover open risky positions
A	Asset quality Determines the degree of riskiness of the bank's assets
M	Management Evaluates the quality of bank management based on the assessment of the entire financial statements and the determination of performance results
E	Receipts Determines the adequacy of income for the future growth of the bank and the formation of reserves to cover the expected risks
L	Liquidity Determines the degree of the bank's ability to fulfill its obligations
S	Sensitivity to market risk Assesses the impact of market risk on the profitability and capital of the bank

Source: Compiled based on [24-26]

The authors believe that most indicators reflecting the quality level of financial risk management are optimal if their absolute value is assigned 2 points; 1 point corresponds when most indicators of this level belong to the average category and

0 points – to the marginal category. At the same time, the change in the absolute indicator can be determined by a three-point scale: 0 points – deterioration in the absolute indicator; 1 point – retention at the same level; 2 points – an improvement in the absolute indicator.

Using the financial condition indicator, it is possible to determine the rank of a certain bank in a group of similar banking institutions in terms of their assets. A decrease in the integral indicator will mean deterioration in the bank's financial condition and, as a result, its lower rank in the group.

For the purposes of industrial development, it is necessary, first of all, to launch a development mechanism, relying on Russian financial resources and stimulating points of economic growth. According to the multiplier effect, such points of growth will stimulate the overall accelerated development. The effectiveness of such a mechanism largely depends on the coordination of joint programs and activities of the Central Bank and the Government of the Russian Federation in the context of digitalization.

In the framework of digitalization, the Government of the Russian Federation should develop a package of strategies and programs for the new economic course, which will form an effective industrial policy, including:

- a strategy of high-tech industrialization and the development of export-oriented production of goods with high added value;
- a strategy to stimulate import substitution to develop the domestic market, reduce the share of imports in the consumer basket, and stabilize prices;
- a strategy for the development of small and medium-sized businesses, which will help increase employment, incomes of the population, and the development of the domestic market.

There is also the problem of low interest of banks in lending to small and medium-sized businesses due to the fact that by providing a loan without collateral, they must form significant amounts of reserves for credit operations, which reduces the profitability of banking and increases the credit risk of the bank.

In this case, the following ways to solve the problem can be distinguished:

- the development of financial leasing for small and medium-sized businesses, which can become a real way to obtain the necessary material resources to start their own business without collateral;
- consistent incentives for credit and investment companies to invest in the real sector of the economy, i.e. providing long-term cheap loans to households and non-financial organizations.

Based on these priorities, it is necessary to develop a comprehensive program of bank lending for the development of the economy in the context of digitalization, which should include the strategic goals of the program for the medium and long term and principles and mechanisms for the implementation of the program, substantiate practical steps regarding the implementation of relevant activities, and identify specific sources of financial resources for the implementation of the program.

Moreover, in the Russian Federation, a bank-centric model for the development of the financial sector has historically been formed. Accordingly, the banking sector and its credit resources should become the main source of financing for digital economic development. The main source of credit resources with the right monetary and foreign exchange policy can be the funds of enterprises and the population, which are

currently outside the country's banks. This is due to low confidence in the state, in the banking system, and in the actions of the regulator.

The proposed approaches to assessing risks as a derivative of the financial stability of the banking system of the Russian Federation for the purposes of industrial development in the context of digitalization make it possible to evaluate indicators of the financial stability of the banking system, determine the values of economic standards in the banking system as a whole, determine indicators of the financial condition of a banking institution, and also use the CAMELS system for the banking system in the digital economy.

Our findings are consistent with the results of Alhassan et al. [27], Andrievskaya and Semenova [8], Ashta and Herrmann [4], Cabrera et al. [28], Chen and Lin [29], Hopper et al. [30], Hutchison [14], and Markova et al. [24] who note that in the event of a crisis situation, it makes sense to carry out remedial actions on the part of the national regulator and the Deposit Guarantee Fund for individuals to improve the solvency of banks or make a decision on the introduction of a temporary administration. Timely identification of problems helps to prevent the liquidation of banks.

Andrievskaya and Semenova [8] emphasize that in the digital economy, the assessment of the financial stability of the banking system and the financial condition of an individual bank should reflect the dynamics of increasing the amount of banking risks. In this context, the issue of identifying and applying the assessment of indicators of the quality level of the risk management system becomes quite urgent.

Several countries have already implemented and are actively developing their systems for assessing the financial stability of the banking system. In particular, the central banks of France, Sweden, Norway, Finland, Spain, and the United Kingdom conduct monitoring and prepare reports. The key components of the assessment depend on the specifics and degree of digitalization. Thus, while the report of the Bank of France focused on the market condition of Eastern Europe, the report of the Bank of Norway paid more attention to the analysis of the developed markets of the USA, the EU, and Japan [4, 14, 24, 31].

Cabrera et al. [28] show that the generally accepted indicator of liquidity is the ratio of liquid assets to short-term liabilities, which takes into account the amount of short-term liabilities that will need to be covered by the sale of assets in case of loss of access to financing. These indicators may indicate excessive discrepancies in terms of repayment periods, and the need for more careful liquidity management in the context of digitalization.

Hopper et al. [30] notice that the ratio of customer deposits to total loans (excluding interbank loans) is also used to identify liquidity problems. A low ratio may indicate a potentially tense liquidity situation in the digital economy.

Chen and Lin [29] rightly point out that as banks take an increasingly active part in various operations and open positions on financial instruments, they become more vulnerable due to changes in market prices, that is, sensitive to digital risk.

Thus, bank risk management becomes an integral condition for ensuring the bank's sustainable development in the digital economy. The study of the scientific and practical foundations of bank risk management allows increasing the level of financial stability of the banking sector of the Russian Federation. At the same time, bank risk management in the context of digitalization differs significantly from risk

management during a crisis in terms of management objectives, resource availability, payment and information support, and managerial decision-making time.

## 5. CONCLUSIONS

The purpose of bank risk management in the context of digitalization is to avoid a significant negative deviation from the planned performance indicators of the bank as a result of the implementation of risks associated with active and passive operations and the organization of the bank's activities. In this case, the purpose of anti-crisis management of bank risks is to avoid liquidation of the bank and overcome the crisis with a minimum of losses. This should be based on a situational approach that requires a partial or complete restructuring of the organizational structure, revision of the basics of risk management and control, changes in business lines, development strategies, and corporate governance.

Moreover, based on the analysis of the banking system, it is possible to suggest ways to improve the functioning of the transition bank, which can potentially improve the financial condition of an insolvent bank. The proposals concern the obligations of the transitional bank, which should be formed from the deposits of individuals that are guaranteed by the Deposit Insurance Fund of individuals, and the assets should be formed from a part of high-quality, highly liquid assets that should cover the difference between the amount of obligations on individuals' deposits and the amount of funds received from the DIF in the amount of contributions made by the bank as its participant. Our article has data limitations that need to be considered in future studies. The results of assessments based on data from enterprises from other countries in the context of digitalization may differ.

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