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RISK MATRIX OF BANK CREDIT MANAGEMENT

The author's interpretation of risk factors for each type of credit risk of a bank and his views are analyzed ant proposed; the essence of credit risk matrix and different methodological approaches to its construction are disclosed; and also the proposals to decision making management on the analysis of the matrix are worked out.

Keywords: credit risk, risk factors, risk map, quantitative and qualitative risk assessment, combined approach to risk assessment.

Шульга Н., Гордиенко Т. Матрица рисков в системе кредитного менеджмента банка. *Проанализированы существующие взгляды и предложено авторское толкование риск-факторов по каждому виду кредитного риска банка; раскрыта сущность матрицы кредитного риска и различных методических подходов к ее построению, а также разработаны предложения по принятию управленческих решений на основе анализа этой матрицы.*

Ключевые слова: кредитный риск, факторы риска, матрица рисков, карта рисков, количественная и качественная оценка рисков, комбинированный подход к оценке рисков.

Background. Improvement of effectiveness in bank risk management process in terms of increasing global financial disbalances, rising volatility of prices in financial and commodity markets requires the improvement of credit risk management, which starts with identification phase of risk and construction of its matrix. When making management decisions in the sphere of credit risk management matrix plays a key role: on its basis the strategy of credit risk managementis substantiated (C.R.); credit risk position of a bank as a whole and on certain credit products is defined; a clear division of responsibilities between the unit of front – middle – bank offices which are involved in the management of CR defined by the type of risk control is established and so on.

The practical solution of this problem will allow to formalize factors of credit risk, systematize its types to present different modifications of CR matrix which may be used by the bank management to make informed management dicisions aimed at improving the effectiveness of its credit risk management.

Analysis of recent research and publications. The questions under discussion about the types of CR and factors of its occurrence are revealed in scientific studies of foreign and home scientific studies of foreign and home scientists: V. Baribina, G. Kriksina [1], N. Verhushy [2], A. Gavrilina [3], M. Kuzmina, T. Novashinoi [4], V. Podchesovoi [5], N. Sokolinskoi [6]. Recently in economic literature there appeared publications on risk matrix formation whose authors are: M. Nikolachuk [7], I. Prigodish [8], O. Rozanova [9], I. Iakos [10],

While there are some scientific achievements, there remain unsolved issues regarding the development of various matrix modifications of bank credit risk depending on the purpose of management and formation of typical management decisions based on the results of identification on of possibility of arising risk and possible losses due to its occurrence. The relevance of this study is enhanced by the fact that the CR is now important for home banking activities as credit portfolio that generates this risk is 60 – 90 % of their total assets.

The aim of study is to analyze existing views and offer a new interpretation of the risk factors for each type of credit risk of a bank, to explore different methodological approaches to the construction of the corresponding matrix and to develop typical managerial decisions on its base.

Results. Credit risk is actual or potential risk of losses due to disability of the borrower to meet his obligations during the lending or other activities. To ensure a common understanding of CR facing the bank in the normal course of operations, the corresponding matrix is developed, which is a visual (graphical or tabular) representation of credit risk types, of factors influencing it, the probability of occurrence and magnitude of possible losses.

The study has allowered to reveal the following methodological approaches to the construction of a matrix of bank risk; simplified qualitative and qualitative assessment of credit risk, as well as a combined one.

The first methodical approach to developing a credit risk matrix doesn't provide qualitative or quantitative evaluation. This matrix consists of organizing all credit risks faced by the Bank, as identifying the most significant risk factors. The CR is affected by numerous factors, the list of which in many publications is ambiguous. A critical review of the literature on this subject has allowed to identify the following key positions of scientists for their systematization. According to the first position the factors are grouped for each type of CR. This point of view is held by Russian scientist V. N. Kostiuchenko, which considers credit risk factors for each of its species, namely:

the risk of a country, region, industry, customer, production, payment risk project risk, software risk [11, p. 86]. In the second position CR bank factors are united into two groups: external and internal environment. This approach dominates in economic literature. Its supporters are both – foreign and domestic scholars, including: N. Verhusha [2, c. 69], V. Zharikov, M. Zharikova, A. Ievseychev [12, p. 36]. According to the third position credit risk factors differ in their impact on the credit portfolio the volume and profitability of credit activities [13, p. 133].

Without denying the expediency of the considered opinions it is thought first of all fall for this research reasonable to underline two groups of credit risk factors – managed and unmanaged, which may be considered in terms of the following types: individual and portfolio risk also country risks, credit spread and decreasing the rate of debt securities. This will clearly allow to distinguish between the direct influence of factors (managed) and indirect influencies (unmanaged). The latter should also be in the field of view of the bank. For each controlled factor of influence on CR the bank should develop a set of measures aimed at optimizing its level. Uncontrolled factors of bank CR must be taken into consideration in a stress – testing making which must be resulted in, decision management for moderating significant risk factors for future bank activities. The author's vision of the first methodological approach to the development of credit risk matrix of a bank in distinguishing controlled and uncontrolled risk factors is presented as follows *(table 1)*.

Individual credit risk – the possibility that borrower fails to repay the loan according to the terms of the contract, and the bank fails to timely and fully benefit from the provision of credit to cover potential losses due to reduction/ loss of liquidity of the collateral. The source of an individual CR bank is a borrower, a debtor or an issuer of securities.

Portfolio credit risk – a decrease in the value or profitability of the bank's assets represented by the sum of loans and debts acquired. Source of portfolio credit risk is a total debt of the bank for the transactions which are subject to CA – loan. Securities portfolio, receivables portfolio, off – balance sheet credit commitments and soon. Risk of lowering rates of debt securities is the possibility of an income loss of their owner in connection with a reduction in the rating of these securities. Credit country risk (unfavorable actions of sovereign government of the country) is – the likelihood of the fact that the actions of sovereign government can directly or indirectly affect negative ability of the borrower (debtor, issuer) to meet its obligations on time. Risk spread credit is the risk of losses of a debt securities holder due to increased credit spread, by which is meant the difference between the basis asset profitability (corporate bonds, credit interest rates) and standard profitability with the same maturity date. According to the accepted standard, as a rule state government debt securities are taken and they have virtually no risk of default. The credit spread reflects the size of the risk premium in default of the main assets, which is taken by investors. Its reducing leads to a reduction in the risk of default of the issuer of debt securities.

Table 1

Aggregated matrix credit risk of a bank

Type of CR	Controlled risk-factors	Uncontrolled risk-factors
Individual (Risk contractor)	The worsening of financial capabilities and reputation of one of the borrowers. Liberal credit policy of the bank (overstatement of the actual rating of the borrower). Unreliability of information about the borrower. The poor quality of the collateral for the loan	Cyclical processes in the economy. And the worsening of the main macroeconomic indicators the country. Unfavorable credit monetary of policy of the central bank. Change of the value of bonds and other financial assets, goods, commercial and residential real estate, kinds of other collateral. The high level of competition between banks for customers
Portfolio risk	Providing large loans for a borrower or group of related persons. A large proportion of new customers for whon the bank has no credit history. Issue of unsecured loans or loans with insufficient collateral. The high concentration of bank lending activities in less known, new, non – traditional areas. Making frequent or significant changes in the Bank's policy on lending and a portfolio of securities. Low levels of quality of information on customers, markets, loans, etc.	Poor financial market in the country. Uncontrolled factors on an individual's credit risk
Country Risk (risk of transaction or transfer risk)		Limited convertibility of the local currency (the country where the borrower functions). Dynamics of interest rates on the loan. The presence of local economic cycles. Political processes in the country of the borrower’s territorial distribution
The risk of a downgrade of debt securities	The worsening of the financial condition and reputation of the issuer of debt securities, which leads to lower their credit rating	The unfavorable economic situation, which leads to lower its credit rating. The subjectivity of assessment of debt securities by rating agencies
Credit spread risk	Methods of pricing for basic credit assets. The worsening of the financial condition of the borrowers which leads to their default	Volatility in the stock market. Reducing liquidity issue of debt securities due to fluctuations in Market

Aggregated matrix credit risk of a bank may have afferent variants. In particular, the bank is used to formation of aggregated matrix of credit authority, which displays their distribution betveen the units of front – back middle – officies that are involved in the management process of separate individual and portfolio CR. This allows to clearly subdivide functions on the identification, analysis sef – management coufrol and monitoring of credit risk, which corresponds to the principles of effective banking credit risk management of the bank.

The second methodological approach to build up a matris based on a qualitative assessment of credit risk, based on expert judgment and therefore is inaccurate, but easy to use and doesn't require a significant investment from banks. Matrix assessment of the credit risk on the basis of quantitative characteristics makes it possible to rank the risk in terms of their significance for the bank. Under this approach banks often represent a matrix in the form of an analytical table, which vertically indicates the probability risk (high, medium and low) and across – the impact (high, moderate, low) *(figure 1)*.

Possibility of CR						
	E – certainly	C	C	B	B	B
	D – high probability	C	C	C	B	B
	C – probably	H	C	C	C	B
	B – almost impossible	H	H	C	C	C
	A – impossible	H	H	H	C	C
		a – very low	b – low	c -moderate	d – high	e – дvery high
	The impact on banking					

Figure 1. Matrix qualitative assessment of the credit risk of the bank
Level of risk: N – low, C – medium, H – high.

With this matrix it is possible to identify three areas of credit risk. Zone N – a zone of low level risks that are combination of probabilities (A, B, C) and the degree of impact on the bank – (a, b, c) – Aa, ab, As, Ba, V, Ca. Risks that fall info this area, do not create a threat to the bank's activities and are practically not considered when making management decisions. Hovever the bank must identify and implement continuous monitoring of risk in order to track trends in preservation of their level or move to more risky areas. Zone C – a Zone of acceptable risks wrich are characterized by high reliability, but with little impact (combinations of Cb, Cc, Da, Db, Db, Dc, Ea, Eb) and low probability, and a significant impact

on the bank (Cd, Bc, Bd, Be, Ad, Ac). To risks that are part of the first group, it is necessary to detect correlations, since their combined effect may result in significant losses for the bank. For the second group of risks banks should take steps to reduce their negative effects. In addition, for the risks that fall in this area, it is appropriate to develop a plan of actions of force majeure in case their probability or impact on the performance of the bank are underestimated. Zone H is Zone of catastrophic risks – risks with high probability and high impact on the bank's activities (combinations Ec, Ed, Ee, Dd, De, Ce). For risks that are in the area, the banks are offered to develop individual management strategies that aim to reduce the likelihood of their occurrence and adverse effects.

Separation in matrix of credit risk may vary depending on the tolerance (appetite) of the bank for them. In particular, for banks with high "appetite" for risk it is characteristic to have wider area H and narrower Zone B, and vice versa, for banks with low "appetite" and low resistance risk there is a wider area for catastrophic risk and narrow for low ones *(figure 2–3)*.

Possibility of CR						
	E – certainly	C	C	C	B	B
	D – high probability	C	C	C	C	B
	C – probably	H	C	C	C	C
	B – almost impossible	H	H	C	C	C
	A – impossible	H	H	H	C	C
		a – very low	b – low	c – moderate	d –high	e – дvery high
	The impact on banking					

Figure 2. Matrix qualitative assessment of credit risk with a high "appetite" to risk

Possibility of CR						
	E – certainly	B	B	B	B	B
	D – high probability	C	C	B	B	B
	C – probably	C	C	C	B	B
	B – almost impossible	H	C	C	C	B
	A – impossible	H	H	C	C	B
		a – very low	b – low	c – moderate	d – high	e – дvery high
	The impact on Banking					

Figure 3. Matrix qualitative assessment of credit risk with low "appetite" to risk

Up to the third methodological approaches to the construction of a matrix the results of a quantitative assessment of the credit risk of banks are displayed. The condition for the formation of the matrix of quantitative credit risk assessment is the availability of specific analytical module in a bank "Credit Risk Management", a centralized database and highly qualified specialists and highly qualified specialist in risk management. In addition, the bank must accumulate a large amount of statistical information about the probability of default of borrowers over a long period of time (10–15 years). Matrix of quantitative assessment of individual credit risk may take the form of a table, which indicates the amount of actual or potential losses calculated with a certain probability of occurrence for each borrower *(table 2)*.

Table 2

Matrix of quantitative assessment of individual credit risk of a bank

Bank losses	Probability, %				
	1–19	20–39	40–59	60–79	80–99
<1					
<5					
5–0					
10–20					
More than 20					

Note. P – the borrower.

Matrix, which is based on the results of quantitative credit risk assessment can have a wider range of use in management decisions. In particular, it allows to determine the significance of individual losses as a result of the emergence of CA, compare the effects of onset for different borrowers, justify the choice of methods and tools of management.

The advantages of a matrix of matrix of quantitative credit risk assessment should include its greater accuracy and wider analytical capabilities. However, the development of this matrix is time consuming and costly process that requires the use of modern powerful mathematical tools for reliable calculations and high level of professionalism of risk managers.

Up to the fourth methodological approach combined matrix of credit risk is based on the combination of both qualitative and quantitative methods of their evaluation. Qualitative risk characteristics, such as the impact on the bank activity and cumulative effects on the implementation of the loan project is advisable to determine by the expert method.

Quantitative characteristics that can be evaluated on the basis of mathematical and statistical calculations, include the likelihood of risk, loss of a bank in the event of borrower non – payment of principal debt and interest, the number of calendar days of delay in payment of loan obligations *(table 3)*.

Combined matrix of credit risk allows to set priorities for allocation of limited bank credit resources based on profitability and risk of the projects credited (credit projects).

Table 3

Combined matrix of credit risk

Influence on the activity of a bank	Very high	High	Moderate	Low	Very low
Probability, %	80–99	60–79	40–59	20–39	1–19
Loss in the event of non-payment of principal debt and interest, %	100	50	20	< 5	< 1
The number of calendar days of delay	more than 180	91–180	31–90	8–30	0–7
Cumulative effects	Impossibility of realization	Important changes in project realization	necessity of survey of key conditions of the project	Insignificant index deviation	Changes are almost unnoticeable

Combined matrix of banking risks has both advantages (flexible, based on extensive information) and disadvantages (requires a clear interpretation of each quantitative and qualitative parameters) and therefore is somewhat labour consuming.

Abler the development of the matrix (except for the first approach) the card of credit risks is built which allows to group them according to certain categories *(figure 4)*.

For each category of a bank credit risk the sufficient management strategy can be selected *(figure 5)*. Thus, for the first category it would be appropriate risk taking and losses coverage the related allowance. For the second category it would be appropriate the limit of risk and taking actions to reduce the probability of loss and minimizing their consequences, which includes conducting reengineering of business processes, improving internal control procedures, strengthening monitoring compliance with internal procedures, standards and legislative requirements, introducing more stringent limits to high- risk credit positions, extending the diversification of the loan portfolio and the extent of hedging transactions and securitization.

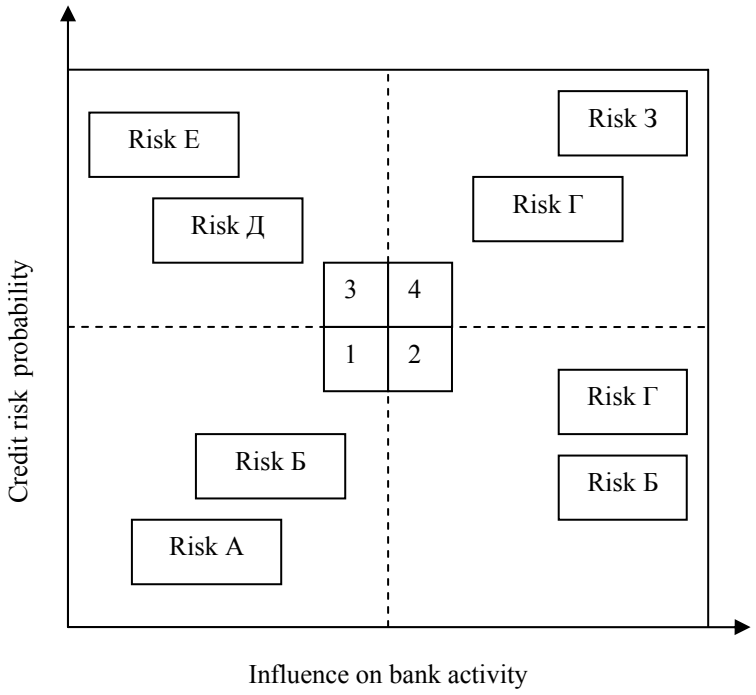

Figure 4. Map of a bank credit risk

Figure 4 shows the four categories of credit risk:
With a low probability and low impact (risks А and Б – category 1);
With a low probability but significant impact (risks Б and Г – category 2);
With a high probability but little impact (risks Е and Д – category 3);
With a high probability and significant impact (risks Г and З – category 4).

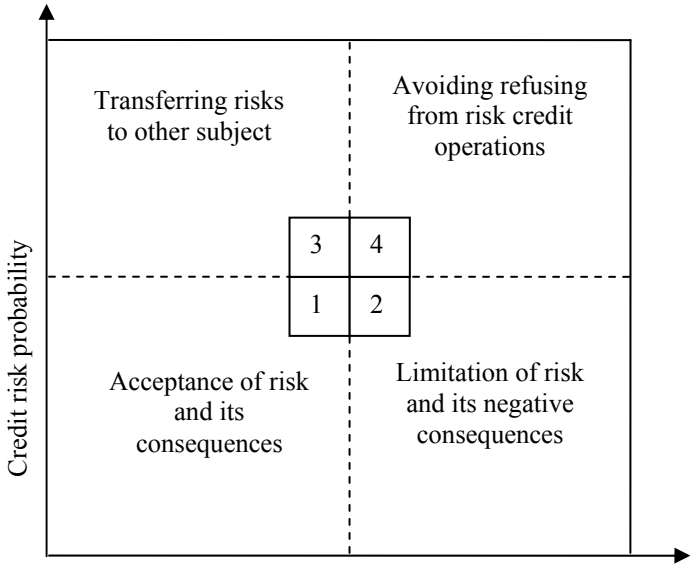

Figure 5. Strategies of credit risk management

For the third category its appropriate to apply risk transfer strategy, i.e. complete or partial transfer of risks to other entities through insurance, credit sale of credit assets to another bank or factoring company. The fourth category of risks as the most threatening, involves the refusal of the bank to conduct high – risk credit operations.

According to these risk categories its necessary to choose the type of control on the part of credit risk management *(figure 6)*. Detective (diagnostic or search) control is designed to detect possible cases of deterioration of the results of the bank credit activity. This type of control can be applied to the first category of risks, which allows to track in time the occurrence of negative trends as to their conversion to other, more dangerous risk categories and their surgical removal as. An example of a detective control of credit risks is to monitor the financial conditions of borrowers.

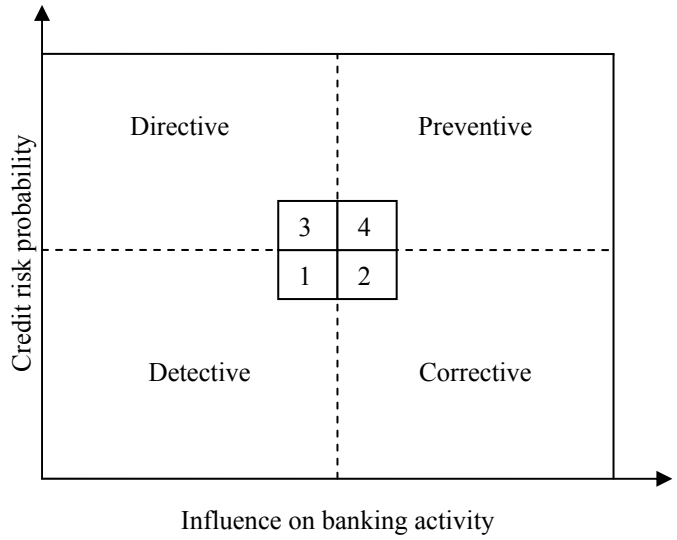

Figure 6. Types of control for credit risk

Correcting or corrective control is applied to the second category of credit risk. This type of control is designed to limit the amount of bank losses and reduce the likelihood of the realization of unwanted results. Correcting control measures can ensure minimization of losses in the future due to a critical analysis of the reasons for the losses of the CR in the past and the development of measures to prevent them.

Directive control should be used in case of acceptance of the transfer of credit risk strategy and, therefore, in their second category. Directive control is aimed at ensuring of the achievement by the bank of a specific desired effect from risk transfer and tracking compliance with the provisions by the employees of the bank positions and instructions for managing the bank's CR.

For the fourth category of risk, it is appropriate to use a preventive (prophylactic) control, which aims to prevent or limit the implementation of negative results. The more threatening is the negative impact of credit risks,

the stricter should be the appropriate control. Preventive control is associated with the analysis of systemic risks that are not directly belong to the credit, but can specify their origin.

The scheme of risks allows us to estimate not only changes of the probability and impact of risks on the bank activities but also on the effectiveness of control at the appropriate risks categories *(figure 7)*.

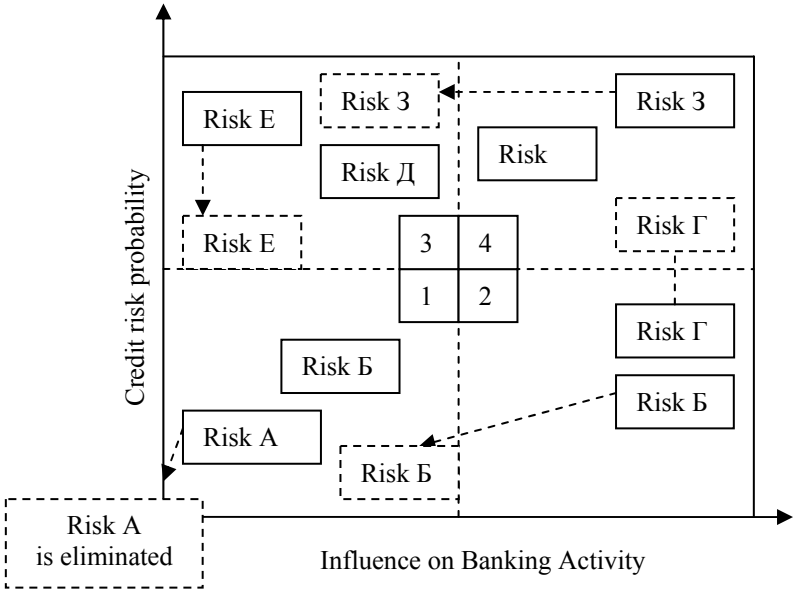

Figure 7. Migration of credit risks

Thus, the change in credit risk categories can be tracked for each borrower, and on the positions of the loan portfolio (risks of loans by industry and sectors, of economy, regional intuitions, etc.).

Graphical interpretation of CR moving from one category to another provides relevant information to the bank management regarding management decisions, which may relate to: softening (or strengthening) the requirements to the financial conditions of borrowers and (or) the third party (the surety and guarantor), the introduction of graduation in types of mortgage insured from the most secured (funds on deposits, liquid products) to the least secured (eg, mortgage of uninsured goods in circulation), the introduction of limit values in terms of assessing the creditworthiness of borrowers, exceeding of which diagnoses clearly the problems in their financial conditions which is the ground for refusing to grand a loan to the client.

Conclusion. The division of credit risk factors into two groups were suggested: managed and unmanaged as defined in contrast to existing points of view in the context of each of its forms: Individual and portfolio, countries (transactions), the downgrade of the debt securities, credit spread. Differed methodological approaches to the formation of the matrix to credit risk were researched (aggregated, qualitative and quantitative assessment of the level of risk combined), their advantages and disadvantages and their

practical use were defined in contrary to the existing publications the range of administrative decisions in the credit risk management of the bank, were formulated, subject movement borrowers (or other positions covered by credit risk) from one area (or category) of credit risk to another.

Matrix of credit risk, which is formed by the results of identification and systematization of its kinds is an important source of information to justify the choice of methods of managing this risk, which acts as a dominant in banks activity.

The results of the presented research deepen the essential understanding of the credit risk, formalize its representation in the form of various modifications of matrices which serve as the basis for making informed management decisions.

The conceptual provision require further research as to construction of local matrices of credit risk, in particular matrices of credit limits, the division of powers between the units, front – middle –back offices, allocation of economic capital to cover unexpected losses among differed credit products depending on their level of risk.

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Articles submitted to editors office of 11.11.2013.

Шульга Н., Гордієнко Т. Матриця ризиків у системі кредитного менеджменту банку.

Постановка проблеми. *Підвищення ефективності управління кредитним ризиком банку обумовлює необхідність розроблення різних модифікацій його матриці, яка дозволить формалізувати фактори кредитного ризику, систематизувати його види, визначити величину потенційних втрат та економічного капіталу для їх покриття.*

Аналіз останніх досліджень і публікацій. *Дискусійні питання стосовно видів кредитного ризику та факторів його виникнення розкрито в наукових публікаціях низки вчених. Попри наявність окремих наукових доробок, залишаються невирішеними питання щодо розробки різних модифікацій матриць кредитного ризику залежно від мети менеджменту та формування типових управлінських рішень за результатами визначення ймовірності ризику та можливих втрат внаслідок його настання.*

Мета *статті – проаналізувати існуючі погляди та запропонувати авторське тлумачення ризик-факторів по кожному виду кредитного ризику банку, дослідити різні методичні підходи до побудови матриці кредитного ризику, а також на її основі розробити управлінські рішення.*

Матеріали і методи. *Під час дослідження використано методи: порівняння, графічний, табличний, дослідження практики вітчизняних та зарубіжних банків щодо формування матриць кредитних ризиків.*

Результати дослідження. *Матрицю кредитних ризиків банку запропоновано формувати за такими підходами: агрегованим, якісної та кількісної оцінки, а також комбінованим. За першим методичним підходом матриця складається для систематизації усіх кредитних ризиків, на які наражається банк, а також виявлення найбільш значущих ризик-факторів або підрозділів, що задіяні в процес управління ними, тощо; за другим – передбачається якісна оцінка кредитних ризиків банків, яка базується на експертних судженнях; за третім – відображається результат кількісної оцінки кредитних ризиків банків, а саме втрати банку внаслідок їх настання; за четвертим – матриця формується на основі поєднання як якісних, так і кількісних методів їх оцінки. На основі матриці кредитних ризиків можна формулювати управлінські рішення щодо зміни в кредитній політиці банку, методичних підходів до оцінки кредитоспроможності позичальників, вимог до заставного забезпечення, напрямків кредитних вкладень банку тощо.*

Висновки. *Фактори кредитного ризику банку поділяються на: керовані та некеровані, які визначено, на відміну від існуючих точок зору, в контексті кожного з його видів. Матрицю кредитного ризику банку пропонується формувати за різними підходами залежно від мети кредитного ризик-менеджменту. Сформульовано спектр управлінських рішень у сфері кредитного ризик-менеджменту банку. Викладені концептуальні положення потребують подальшого наукового дослідження щодо побудови локальних матриць кредитного ризику, зокрема, кредитних лімітів, розподілу повноважень між підрозділами фронт-бек-мідл-офісів, алокації економічного капіталу на покриття неочікуваних втрат по різних кредитних продуктах залежно від рівня їх ризику.*

Ключові слова: кредитний ризик, фактори ризиків, матриця ризиків, карта ризиків, кількісна та якісна оцінка ризиків, комбінований підхід до оцінки ризиків.