

UDC 336.71:351.863+[330.342:338.28:004.67]

Lieonov S.

*Doctor of Economics, Professor,
Professor of Economic Cybernetics Department,
Sumy State University, Ukraine;
e-mail: s.lieonov@uabs.sumdu.edu.ua; ORCID ID: 0000-0001-8520-2266*

Vasilyeva T.

*Doctor of Economics, Professor,
Director of Academic and Research Institute of Business, Economics and Management,
Sumy State University, Ukraine;
e-mail: t.vasilyeva@fem.sumdu.edu.ua; ORCID ID: 0000-0003-0635-7978*

Mynenko S.

*Postgraduate student of the Department of Economic,
Sumy State University, Ukraine;
e-mail: s.minenko@uabs.sumdu.edu.ua; ORCID ID: 0000-0003-3998-9031*

Dotsenko T.

*manager,
TVBV № 10018 / 0172
Branch — Sumy Regional Department «Oschadbank» JSC, Ukraine;
e-mail: t.dotsenko@uabs.sumdu.edu.ua; ORCID ID: 0000-0001-5713-2205*

BANKING IN DIGITAL AGE: EFFICIENCY OF ANTI-MONEY LAUNDERING SYSTEM

Abstract. The article is devoted to the problems of the development of a system for combating the legalization of income obtained illegally in the context of digitalization of banking activities. The concept of the effectiveness of the anti-money laundering system was considered. The expediency of using the utility approach for modeling the effectiveness of the system for combating money laundering has been determined. The indicator of the effectiveness of the system of combating money laundering was chosen as the share of indictments sent to the court in the total number of criminal offenses for which pre-trial investigation was carried out in the corresponding period. The first alternative of choice — the focus on the development of identifying suspicious financial transactions is characterized by the indicator Share of criminal offenses for which pre-trial investigation was carried out per one transaction report submitted to the State Financial Monitoring Service. The second alternative of choice — the development of innovative technologies, is characterized by the indicator of the Level of digitalization of the economy. The input data are the indicators on the crime rate in Ukraine, the work of the pre-trial investigation bodies, obtained from the State Financial Monitoring Service of Ukraine, the General Prosecutor's Office of Ukraine and the State Statistics Service of Ukraine, suspicious financial transactions and the number of Internet subscribers. On the basis of the calculated autocorrelation coefficients of zero differences and determination of their statistical significance, a nonlinear function of the relationship between mictoramas was selected. Using the Stone-Geary utility function, which for the selected input data took the form of a Cobb-Douglas power function, the degree of response of alternative approaches to improving the effectiveness of the system of combating criminal proceeds was determined. The degree of digitalization of the economy has a high level of elasticity. Therefore, to increase the effectiveness of the system of combating money laundering, it is necessary to develop innovative information technologies in the field of FinTech.

Keywords: bank, countering the legalization of criminal proceeds, the utility function of Stone-Geary, the Cobb-Douglas function, the effectiveness of combating the legalization of criminal proceeds, the digitalization of the economy.

JEL Classification C49, O17, O33, G21, G14

Formulas: 4; fig.: 5; tabl.: 0; bibl.: 32.

Леонов С. В.

доктор економічних наук, професор,
професор кафедри економічної кібернетики
Сумського державного університету, Україна;
e-mail: s.lieonov@uabs.sumdu.edu.ua; ORCID ID: 0000-0001-8520-2266;

Васильєва Т. А.

доктор економічних наук, професор,
директор навчально-наукового інституту бізнесу, економіки та менеджменту
Сумського державного університету, Україна;
e-mail: tavasilyeva@fem.sumdu.edu.ua; ORCID ID: 0000-0003-0635-7978

Миненко С. В.

аспірант кафедри економічної кібернетики
Сумського державного університету, Україна;
e-mail: s.minenko@uabs.sumdu.edu.ua; ORCID ID: 0000-0003-3998-9031

Доценко Т. В.

керуючий,
ТББВ № 10018/0172 Філії — Сумського обласного управління АТ «Ощадбанк», Україна;
e-mail: t.dotscenko@uabs.sumdu.edu.ua; ORCID ID: 0000-0001-5713-2205

БАНКІНГ В ЕПОХУ ДІДЖИТАЛІЗАЦІЇ: ЕФЕКТИВНІСТЬ СИСТЕМИ ПРОТИДІЇ ЛЕГАЛІЗАЦІЇ КРИМІНАЛЬНИХ ДОХОДІВ

Анотація. Присвячено проблемам розвитку системи протидії легалізації доходів, отриманих незаконним шляхом, в умовах цифровізації банківської діяльності. Розглянуто поняття ефективності системи протидії легалізації доходів, отриманих незаконним шляхом. Визначено доцільність застосування підходу корисності для моделювання ефективності системи протидії легалізації кримінальних доходів. Показником ефективності системи протидії легалізації кримінальних доходів було обрано частку направлених до суду обвинувальних актів у загальній кількості кримінальних правопорушень, за якими проводилось досудове розслідування у відповідний період. Першу альтернативу вибору — фокус на розвиток виявлення підозрілих фінансових операцій характеризує показник частки кримінальних правопорушень, за якими проводилось досудове розслідування, яка припадає на одне повідомлення про операцію, що було передане до Державної служби фінансового моніторингу. Другу альтернативу вибору — розвиток інноваційних технологій, характеризує показник Рівня діджиталізації економіки. Вхідними даними виступають отримані від Державної служби фінансового моніторингу України, Генеральної прокуратури України і Державної служби статистики України показники про рівень злочинності в Україні, роботу органів досудового розслідування, виявлені підозрілі фінансові операції та кількість абонентів мережі «Інтернет». На основі розрахованих коефіцієнтів автокореляції нульових різниць і визначенні їхньої статистичної значущості було обрано нелінійну функцію залежності між мікрорами. За допомогою функції корисності Стоуна — Гірі, яка для обраних вхідних даних набула форми степеневі функції Кобба — Дугласа, було визначено ступінь реакції альтернативних підходів до підвищення ефективності системи протидії кримінальних доходів. Високий рівень еластичності має ступінь діджиталізації економіки. Тому для підвищення ефективності системи протидії легалізації кримінальних доходів потрібно розвивати інноваційні інформаційні технології у сфері FinTech.

Ключові слова: банк, протидія легалізації кримінальних доходів, функція корисності Стоуна — Гірі, функція Кобба — Дугласа, ефективність протидії легалізації кримінальних доходів, діджиталізація економіки.

Формул: 4; рис.: 5; табл.: 0; бібл.: 32.

Introduction. The rapid development of information technology makes adaptive transformation in all spheres of human activity. Over the past twenty years, fundamental changes

have taken place in the field of sales, so the proportion of online sales has exceeded real sales (RetailTech). The sphere of education has also changed significantly. IT technologies have allowed not only to conduct distance learning, but also to simulate any technical or biological processes (EdTech). Financial services did not stand aside either. Thus, in the banking sector, IT technologies have changed the speed of transactions, increased the level of customers' access to banking services, expanded the range of banking services, and so on. However, along with positive shifts in the financial sphere, IT technologies have intensified the processes of legalization of criminal proceeds, accelerated their implementation and complicated the process of their exposure and monitoring. For the 4th quarter of 2019, the banking establishments have transferred to the State Service of Financial Monitoring of 3 million of information about the operations, which are responsible for the obligatory financial monitoring.

In the 4th quarter of 2019, banking institutions submitted to the State Financial Monitoring Service more than 3 million notifications of transactions subject to mandatory financial monitoring.

Literature review and the problem statement. A number of national and foreign scientists have been conducting research on this topic, among them: Lopez B., García D., Alcaide A., Zarutskaya E., Pavlova T., Sinyuk A., Buriak An., Artemenko Al., Demkiv Yu., Djalilov Kh., Araujo R., Ngoc Lam T., Dmytrov S., Medvid T., Dudchenko V., Lebid O., Chmutova I., Zueva O., Veits O., Karaoulanis A., Bukhtiarova A., Semenog A., Razinkova M., Nebaba N., Haber A. J., Kuzmenko O.V., Yarovenko H., Boyko A., Levchenko V., Lyeonov, S., Demkiv Yu., Samusevych Ya., Koibichuk V., Judrupa I., Żurakowska-Sawa J., Šuleř P., Dotsenko T., Boyko A., Savchenko T., Bozhenko V., Humenna Yu., Pilin R., Dobrowolski Z., Sułkowski Ł., Subeh M., Stumpo M., Andros S., Akimova L., Butkevich O., Logan W., Esmenov O., Kibaroglu O. [1—26].

However, the issue of ways to quantify and further improve the efficiency of the system for combating the legalization of income obtained illegally in the context of the digitalization of financial activities of banks remains fully disclosed.

Purpose of the study is to characterize the effectiveness of the system for combating the legalization of criminal income in a bank in the context of digitalization.

Research results. Considering the effectiveness of the system of combating money laundering in the context of digitalization of banking, we will focus, first of all, on the direct concept of «efficiency».

Thus, in economics, this category is considered from different points of view: as the excess of income over expenditure, as absolute savings, as an increase in profits or as a decrease in cost. The authors of the article propose to consider efficiency as a characteristic of an object that reflects its ability to bring usefulness, ie a positive change in certain parameters of the object under study [27].

Based on this statement, the mathematical formalization of the process of assessing the level of effectiveness of the system of combating money laundering in the bank should be considered in terms of utility theory.

According to the classical approach, utility is a pleasure, or an effect, a client receives from the consumption of a set of goods or services. When it comes to utility, it is understood that there are several alternative options for a set of goods that have different values for the consumer. Their pairwise comparison is formed in the form of an indifference curve [28].

The use of this approach to analyze the effectiveness of the system of combating money laundering requires the following concepts.

The consumer in this case is the system of combating money laundering. The system, striving for maximum efficiency, chooses one of two alternative ways of its development: the development of mechanisms and typologies for identifying transactions, as such, subject to mandatory financial monitoring, or the extensive introduction of information technologies both in banking services and in the entire countermeasures system.

For economic and mathematical formalization of the utility function, it is proposed to choose the share of indictments sent to the court in the total number of criminal offenses for which a pre-trial investigation was conducted in the relevant period. This parameter allows you to assess the

level of preventive measures that should reduce the number of financial frauds in the future. The dynamics of the performance trait is shown in *Fig. 1*. Based on the data in Figure 1, it should be noted that only in the 4th quarter of 2019 there was a significant excess of the number of indictments submitted to the court compared to the number of offenses under investigation. For the entire study period, this figure did not exceed 0.5 units. On average, the share of indictments was 0.27 units, and the median share of indictments was 0.06 units. The studied data indicate a low level of investigation of criminal offenses. The reasons for this phenomenon can be different: from the incompetence of investigators to systemic shortcomings of the pre-trial investigation [30].

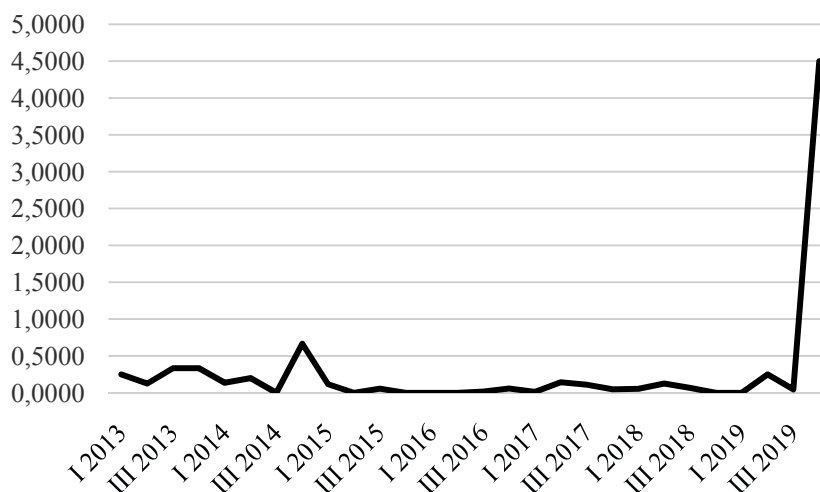


Fig. 1. The share of indictments sent to the court in the total number of criminal offenses, which were conducted pre-trial investigation in the relevant period

Source: Compiled by the authors on the basis [30].

The first alternative is characterized by the share of criminal offenses under pre-trial investigation, which falls on one notification of the transaction, which was submitted to the State Financial Monitoring Service (*Fig. 2*).

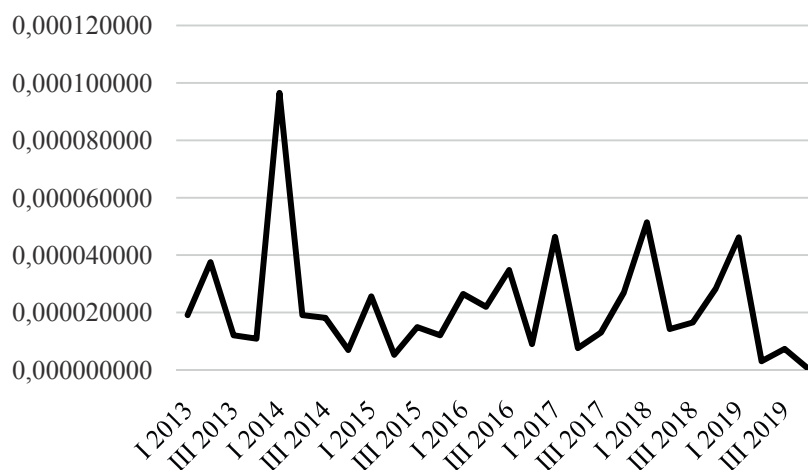


Fig. 2. Proportion of pre-trial criminal offenses per one transaction notification submitted to the State Financial Monitoring Service

Source: Compiled by the authors on the basis [31; 32].

The value of this indicator during the study period was fluctuating. On average, there were 2.56 transactions per 10,000 transaction reports. confirmed criminal offenses and 1.73 units in the median dimension. Low values of this indicator indicate either the inability to prove that a suspicious transaction had signs of a criminal offense, or that most transactions were legal and were

not aimed at legalizing criminal proceeds. Analyzing this indicator, we can conclude that the effectiveness of the use of resources of the system of combating money laundering in this case is not obvious.

The characteristic of the second alternative is the indicator of digitalization of the economy, which is the ratio of the number of Internet subscribers to the population (*Fig. 3*). The values of this indicator indicate that since the end of 2015 the number of active Internet users is growing. At the end of 2019, the number of Internet subscribers was over 28 million people. We can fully assume that Internet users pay for the services of the provider to access online services, including banking. The digital awareness of the population is growing.

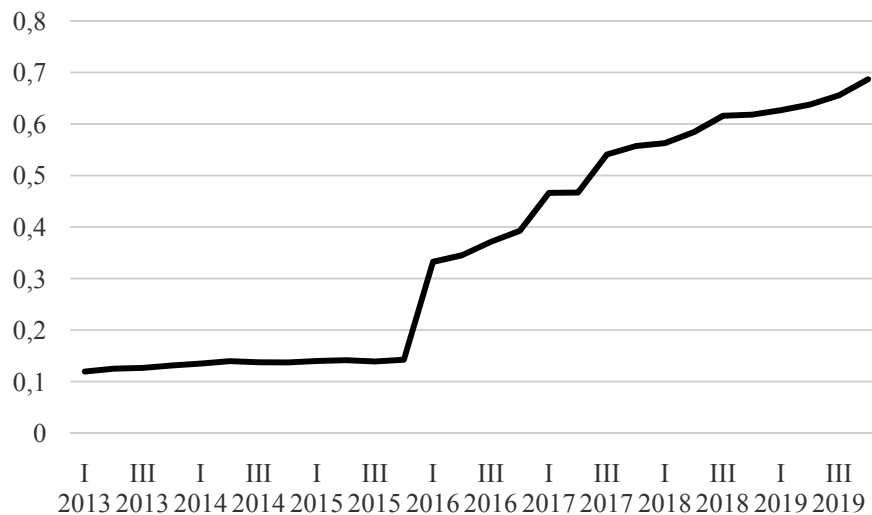


Fig. 3. Dynamics of digitalization of the economy

Source: Compiled by the authors on the basis [32].

To specify the function of the dependence of the resultant feature on the factor, we construct a correlogram of zero differences (*Fig. 4*) and a table of the autocorrelation function (*Fig. 5*).

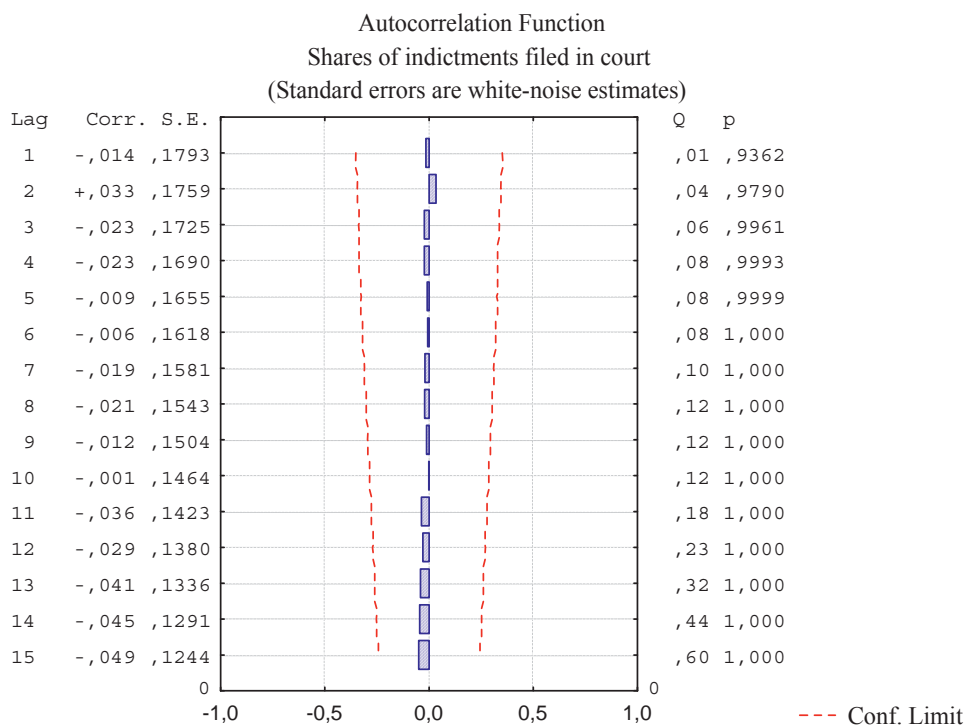


Fig. 4. Correlogram of zero differences. Shares of indictments filed in court

Source: Compiled by the authors.

| Autocorrelation Function (Spreadsheet1.sta) Shares of indictments filed in court (Standard errors are white-noise estimates) | | | | |
|--|------------|----------|---------------|----------|
| Lag | Auto-Corr. | Std.Err. | Box & Ljung Q | p |
| 1 | -0,014342 | 0,179284 | 0,006399 | 0,936242 |
| 2 | 0,033433 | 0,175933 | 0,042511 | 0,978969 |
| 3 | -0,023088 | 0,172516 | 0,060422 | 0,996121 |
| 4 | -0,022579 | 0,169031 | 0,078265 | 0,999254 |
| 5 | -0,008631 | 0,165472 | 0,080986 | 0,999904 |
| 6 | -0,006001 | 0,161835 | 0,082361 | 0,999989 |
| 7 | -0,019062 | 0,158114 | 0,096895 | 0,999998 |
| 8 | -0,020793 | 0,154303 | 0,115054 | 1,000000 |
| 9 | -0,012206 | 0,150396 | 0,121641 | 1,000000 |
| 10 | -0,001459 | 0,146385 | 0,121741 | 1,000000 |
| 11 | -0,035572 | 0,142261 | 0,184266 | 1,000000 |
| 12 | -0,028970 | 0,138013 | 0,228326 | 1,000000 |
| 13 | -0,040780 | 0,133631 | 0,321452 | 1,000000 |
| 14 | -0,045332 | 0,129099 | 0,444750 | 1,000000 |
| 15 | -0,049087 | 0,124403 | 0,600440 | 1,000000 |

Fig. 5. The value of the autocorrelation function and the statistical significance of the autocorrelation coefficients of zero differences. Shares of indictments filed in court

Source: Compiled by the authors.

As can be seen from Fig. 4 and 5, there is no clear dependence of the values of autocorrelation coefficients of different orders on the time lag, in addition, the autocorrelation coefficients are statistically insignificant (p-value close to 1). This indicates a deviation of the hypothesis of linear dependence of the share of indictments sent to the court in the total number of criminal offenses under pre-trial investigation from two alternatives: the share of criminal offenses under pre-trial investigation per one notification of a transaction that was transferred to the State Financial Monitoring Service; digitalization of the economy. That is why it is advisable to choose as a function of fit — a nonlinear function of the influence of factor characteristics on the effective. To assess the effectiveness of the system of combating money laundering, it is proposed to use the utility function of Stone-Geary, which in general takes the following form:

$$u(x_1, x_2, x_3, \dots, x_n) = \prod_{j=1}^n (x_j - \varphi_j)^{\beta_j}, \tag{1}$$

where $x_1, x_2, x_3, \dots, x_n$ — acceptable alternatives to the system of combating money laundering;
 n — a number of recognized acceptable alternatives to the system of anti-legalization of criminal income;

$u(x_1, x_2, x_3, \dots, x_n)$ — the function of the corporeality of the formalization of the efficiency of the system and of the anti-legalization of criminal incomes from the admissible alternatives;

φ_j — constant in the development of j alternative to the system of anti-legalization of criminal income;

β_j — the coefficient of elasticity of the utility function in terms of j alternative to the system of combating money laundering.

Consider as an effective sign of the formalization of the effectiveness of the system of combating money laundering in the digitalization of banking through the construction of the utility function of Stone — Geary indicator of the share of indictments sent to court, and as factors, respectively, 2 indicators: the share of criminal offenses operation; indicator of digitalization of the economy. In addition, making assumptions about the zero values of φ_j Stone — Geary utility function, formula (1) takes the form of a Cobb — Douglas function (formula 2).

$$u(x_1, x_2) = \prod_{j=1}^2 (x_j)^{\beta_j}, \sum_{j=1}^2 \beta_j = 1. \tag{2}$$

Due to the limitations $\sum_{j=1}^2 \beta_j = 1$ formula (2), to formalize the effectiveness of the system of combating money laundering in the digitalization of banking by constructing a utility function, it is proposed to consider the problem of finding the values of the coefficients of elasticity of the two considered alternatives as a nonlinear programming problem:

$$\sum_{t=1}^T \left(u_t - \prod_{j=1}^2 (x_{jt})^{\beta_j} \right)^2 \rightarrow \min; \quad (3)$$

$$\sum_{j=1}^2 \beta_j = 1, \beta_j \geq 0,$$

where u_t — The share of indictments sent to the court for the t time interval (quarter of the corresponding year of the studied time range);

T — the length of the studied time series.

To solve the problem of nonlinear programming of minimizing the sum of squares of deviations of the actual values, the proportion of indictments sent to the court from their theoretical levels, determined using the utility function, it is proposed to use the generalized gradient method using the Data / Search for solution of the software package MS Excel.

Thus, the solution of the nonlinear optimization problem (3) for assessing the effectiveness of the anti-money laundering system using the utility function makes it possible to obtain the following results (function 4) with the minimum value of the sum of squares of deviations of the actual values, the proportion of indictments sent to the court from their theoretical levels at the level of 18, 28 units.

$$u(x_1, x_2) = x_1^{0,0019} \cdot x_2^{0,9981}. \quad (4)$$

Coefficient $\beta_1 = 0,0019$, reflects the degree of elasticity of the effectiveness of the system of counteraction to legalization of criminal proceeds from the share of criminal offenses under which the pre-trial investigation was conducted, which falls on one notification of the transaction, which was submitted to the State Financial Monitoring Service. The proximity of the coefficient to 0 indicates the low effectiveness of the existing approach to combating legalization and the low usefulness of identifying transactions subject to mandatory financial monitoring.

Coefficient $\beta_2 = 0,9981$, reflects the degree of elasticity of the effectiveness of the system of combating money laundering from the indicator of digitalization of the economy, which is the ratio of the number of Internet subscribers to the population. The proximity of this ratio to 1 indicates the high impact of innovative digital technologies on the system of combating money laundering. A significant level of utility is expected from the introduction of information technology in the system of combating money laundering. At the same time, the effect is expected both from the implementation of innovative technologies both at the stage of monitoring of banking operations and at the stage of pre-trial investigation of the relevant offense.

Conclusions. In the course of the study, it was empirically proved that the modern form of the system for combating money laundering is ineffective. Significant efforts are being made to identify transactions that show signs of legalization, but the law enforcement unit of the anti-money laundering system is unable to provide a high level of evidence in the investigation of specific criminal offenses. As a result, millions of suspicious transactions are detected, and the court receives 1—4 indictments in a quarter.

The digitalization of the economy is of great utility for the system of combating money laundering. The introduction of innovative systems for carrying out financial transactions, for example, using a secure blockchain, will not only reduce the risk of using this tool in legalizing criminal proceeds, but also save the resources needed to identify suspicious transactions through automation. The development of information systems will allow the pre-trial investigation of criminal offenses in the financial sphere to work more effectively. At the same time, it is worth

noting the readiness of the information system of Ukraine to introduce innovative technologies into the system of combating money laundering.

Acknowledgements. The article was prepared based on the results of a study funded by the National Research Fund of Ukraine «Optimization and automation of financial monitoring processes to increase information security in Ukraine» (registration number: 0120U104810).

Література

- Lopez B. S., Garcia D. I., Alcaide A. V. Blockchain Technology Facing Socioeconomic Challenges. Promise versus Probability. *SocioEconomic Challenges*. 2019. № 3 (4). P. 13—24.
- Zarutskaya E., Pavlova T., Sinyuk A. Structural-functional analysis as innovation in public governance (case of banking supervision). *Marketing and Management of Innovations*. 2018. № 4. P. 349—360.
- Buriak A., Artemenko A. Reputation risk in banking: application for Ukraine. *Financial Markets, Institutions and Risks*. 2018. № 2 (2). P. 100—110.
- Demkiv Yu. M. The ISO 9001 International Standards in a System of the Banking Services Quality Management. *Business Ethics and Leadership*. 2018. № 2 (3). P. 94—102.
- Djalilov Kh., Ngoc Lam T. Ownership, Risk and Efficiency in the Banking Sector of the ASEAN Countries. *Financial Markets, Institutions and Risks*. 2019. № 3 (2). P. 5—16.
- Araujo R. Assessing the efficiency of the anti-money laundering regulation: an incentive-based approach. *Journal of Money Laundering Control*. 2008. № 11. P. 67—75.
- Dmytrov S., Medvid T. An approach to the use of indices-based analysis subject to money laundering and terrorist financing national risk assessment *SocioEconomic Challenges*. 2017. № 1 (1). P. 35—47.
- Lyeonov S., Żurakowska-Sawa J., Kuzmenko O., Koibichuk V. Gravitational and intellectual data analysis to assess the money laundering risk of financial institutions. *Journal of International Studies*. 2020. № 3 (4). P. 259—272.
- Kuzmenko O., Šuleř P., Lyeonov S., Judrupa I., Boiko A. Data mining and bifurcation analysis of the risk of money laundering with the involvement of financial institutions. *Journal of International Studies*. 2020. № 13 (3). P. 332—339.
- Kuzmenko O. V., Koibichuk V. V. Econometric modeling of the influence of relevant indicators of gender policy on the efficiency of a banking system. *Cybernetics and Systems Analysis*. 2018. № 54 (5). P. 687—695.
- Dudchenko V. Yu. Interaction of Central Bank Independence and Transparency: Bibliometric Analysis. *Business Ethics and Leadership*. 2020. № 4 (2). P. 109—115.
- Lebid O., Chmutova I., Zuiyeva O., Veits O. Risk assessment of the bank's involvement in legalization of questionable income considering the influence of fintech innovations implementation. *Marketing and Management of Innovations*. 2018. № 2. P. 232—246.
- Karaoulanis A. Big Data, What Is It, Its Limits and Implications in Contemporary Life. *Business Ethics and Leadership*. 2018. № 2 (4). P. 108—114.
- Bukhtiarova A., Semenog A., Razinkova M., Nebaba N., Haber A. J. Assessment of financial monitoring efficiency in the banking system of Ukraine. *Banks and Bank Systems*. 2020. № 15 (1). P. 98—106.
- Кузьменко О. В., Яровенко Г. М., Бойко А. О., Миненко С. В. Розробка бізнес-моделей процесів фінансового моніторингу економічних агентів. *Ефективна економіка*. 2019. № 12.
- Миненко С. В., Кузьменко О. В., Яровенко Г. М., Левченко В. П. Автоматизація процесу фінансового моніторингу легалізації коштів, отриманих незаконним шляхом. *Наукові записки Національного університету «Острозька академія». Економіка*. 2019. № 15 (43). С. 162—171. URL : <https://eprints.ua.edu.ua/id/eprint/8069>.
- Lyeonov S., Kuzmenko O., Yarovenko H., Dotsenko T. The Innovative Approach to Increasing Cybersecurity of Transactions Through Counteraction to Money Laundering. *Marketing and Management of Innovations*. 2019. № 3. P. 308—326.
- Levchenko V., Boyko A., Savchenko T., Bozhenko V., Humenna Yu., Pilin R. State Regulation of the Economic Security by Applying the Innovative Approach to its Assessment. *Marketing and Management of Innovations*. 2019. № 4. P. 364—372.
- Леонов С., Демків Ю., Самусевич Я. Оцінювання якості банківських послуг на основі підходу SERVQUAL: сучасна інтерпретація. *Фінансово-кредитна діяльність: проблеми теорії і практики*. 2018. № 2 (25). С. 47—55.
- Dobrowolski Z., Sułkowski Ł. Implementing a Sustainable Model for Anti-Money Laundering in the United Nations Development Goals. *Sustainability*. 2020. № 12. P. 244.
- Subeh M. A., Boiko A. Modeling efficiency of the State Financial Monitoring Service in the context of counteraction to money laundering and terrorism financing. *SocioEconomic Challenges*. 2017. № 1 (2). P. 39—51.
- Yarovenko H., Kuzmenko O., Stumpo M. Strategy for Determining Country Ranking by Level of Cybersecurity. *Financial Markets, Institutions and Risks*. 2020. № 4 (3). P. 124—137.
- Andros S., Akimova L., Butkevich O. Innovations in Management of Banks Deposit Portfolio: Structure of Customer Deposit. *Marketing and Management of Innovations*. 2020. № 2. P. 206—220.
- Logan W., Esmanov O. Public financial services transparency. *Business Ethics and Leadership*. 2017. № 1 (2). P. 62—67.
- Lyeonov S., Samusevych Ya., Demkiv Yu. The measurement of influence of innovations' implementation on the commercial banks performance. *Scientific Bulletin of Polissya*. 2018. № 1 (13). Part 2. P. 68—76. URL : <http://nvp.stu.cn.ua/article/view/139536/136494>.
- Kibaroglu O. Self Sovereign Digital Identity on the Blockchain: A Discourse Analysis. *Financial Markets, Institutions and Risks*. 2020. № 4 (2). P. 65—79.
- Чучук Ю. Теоретична сутність понять «економічна ефективність» та «ефективність діяльності». *Ефективна економіка*. 2014. № 2. URL : <http://www.economy.nayka.com.ua/?op=1&z=2765>.
- Про запобігання та протидію легалізації (відмиванню) доходів, одержаних злочинним шляхом, фінансуванню тероризму та фінансуванню розповсюдження зброї масового знищення : Закон України. *Відомості Верховної Ради України*. 2020. № 25. URL : <https://zakon.rada.gov.ua/laws/show/361-20#Text>.

29. Małecka M. Values in economics: a recent revival with a twist. *Journal of Economic Methodology*. 2021. № 28 (1). P. 88—97.
 30. Генеральна прокуратура України : офіційний сайт. URL : <https://www.gp.gov.ua/ua/1stat>.
 31. Державна служба фінансового моніторингу України : офіційний сайт. URL : <https://fmu.gov.ua/pages/dijalnist/funkcional/statistika-ta-infografika>.
 32. Державна служба статистики України : офіційний сайт. URL : <http://www.ukrstat.gov.ua>.
- Статтю рекомендовано до друку 05.04.2021* © Леонов С. В., Васильєва Т. А., Миненко С. В., Доценко Т. В.

References

1. Lopez, B. S., García, D. I., & Alcaide, A. V. (2019). Blockchain Technology Facing Socioeconomic Challenges. Promise versus Probability. *SocioEconomic Challenges*, 3 (4), 13—24. [http://doi.org/10.21272/sec.3\(4\).13-24.2019](http://doi.org/10.21272/sec.3(4).13-24.2019).
2. Zarutska, E., Pavlova, T., & Sinyuk, A. (2018). Structural-functional analysis as innovation in public governance (case of banking supervision). *Marketing and Management of Innovations*, 4, 349—360. <http://doi.org/10.21272/mmi.2018.4-30>.
3. Buriak, A., & Artemenko, A. (2018). Reputation risk in banking: application for Ukraine. *Financial Markets, Institutions and Risks*, 2 (2), 100—110. [http://doi.org/10.21272/fmir.2\(2\).100-110.2018](http://doi.org/10.21272/fmir.2(2).100-110.2018).
4. Demkiv, Yu. M. (2018). The ISO 9001 International Standards in a System of the Banking Services Quality Management. *Business Ethics and Leadership*, 2 (3), 94—102. [http://doi.org/10.21272/bel.2\(3\).94-102.2018](http://doi.org/10.21272/bel.2(3).94-102.2018).
5. Djalilov, Kh., & Ngoc Lam, T. (2019). Ownership, Risk and Efficiency in the Banking Sector of the ASEAN Countries. *Financial Markets, Institutions and Risks*, 3 (2), 5—16. [http://doi.org/10.21272/fmir.3\(2\).5-16.2019](http://doi.org/10.21272/fmir.3(2).5-16.2019).
6. Araujo, R. (2008). Assessing the efficiency of the anti-money laundering regulation: an incentive-based approach. *Journal of Money Laundering Control*, 11, 67—75. <http://doi.org/10.1108/13685200810844505>.
7. Dmytrov, S., & Medvid, T. (2017). An approach to the use of indices-based analysis subject to money laundering and terrorist financing national risk assessment *SocioEconomic Challenges*, 1 (1), 35—47. <http://doi.org/10.21272/sec.2017.1-04>.
8. Lyeonov, S., Żurakowska-Sawa, J., Kuzmenko, O., & Koibichuk, V. (2020). Gravitational and intellectual data analysis to assess the money laundering risk of financial institutions. *Journal of International Studies*, 3 (4), 259—272.
9. Kuzmenko, O., Šuleř, P., Lyeonov, S., Judrupa, I., & Boiko, A. (2020). Data mining and bifurcation analysis of the risk of money laundering with the involvement of financial institutions. *Journal of International Studies*, 13 (3), 332—339. <http://doi.org/10.14254/2071-8330.2020/13-3/22>
10. Kuzmenko, O. V., & Koibichuk, V. V. (2018). Econometric modeling of the influence of relevant indicators of gender policy on the efficiency of a banking system. *Cybernetics and Systems Analysis*, 54 (5), 687—695. <http://doi.org/10.1007/s10559-018-0070-8>.
11. Dudchenko, V. Yu. (2020). Interaction of Central Bank Independence and Transparency: Bibliometric Analysis. *Business Ethics and Leadership*, 4 (2), 109—115. [https://doi.org/10.21272/bel.4\(2\).109-115.2020](https://doi.org/10.21272/bel.4(2).109-115.2020).
12. Lebid, O., Chmutova, I., Zuieva, O., & Veits, O. (2018). Risk assessment of the bank's involvement in legalization of questionable income considering the influence of fintech innovations implementation. *Marketing and Management of Innovations*, 2, 232—246. <http://doi.org/10.21272/mmi.2018.2-19>.
13. Karaoulanis, A. (2018). Big Data, What Is It, Its Limits and Implications in Contemporary Life. *Business Ethics and Leadership*, 2 (4), 108—114. [http://doi.org/10.21272/bel.2\(4\).108-114.2018](http://doi.org/10.21272/bel.2(4).108-114.2018).
14. Bukhtiarova, A., Semenog, A., Razinkova, M., Nebaba, N., & Haber, A. J. (2020). Assessment of financial monitoring efficiency in the banking system of Ukraine. *Banks and Bank Systems*, 15 (1), 98—106. [http://doi.org/10.21511/bbs.15\(1\).2020.10](http://doi.org/10.21511/bbs.15(1).2020.10).
15. Kuzmenko, O. V., Yarovenko, H. M., Boiko, A. O., & Mynenko, S. V. (2019). Rozrobka biznes-modelei protsesiv finansovoho monitorynhu ekonomichnykh ahentiv [Development of business models of financial monitoring processes of economic agents]. *Efektivna ekonomika — Efficient economy*, 12. <https://doi.org/10.32702/2307-2105-2019.12.4> [in Ukrainian].
16. Mynenko, S. V., Kuzmenko, O. V., Yarovenko, H. M., & Levchenko, V. P. (2019). Avtomatyzatsiia protsesu finansovoho monitorynhu lehalizatsii koshtiv, otrymanykh nezakonnym shliakhom [Automation of the process of financial monitoring of legalization of funds obtained illegally]. *Naukovi zapysky Natsionalnoho universytetu «Ostrozka akademiia». Ekonomika — Scientific notes of the National University «Ostroh Academy». Economy*, 15 (43), 162—171. Retrieved from <https://eprints.ua.edu.ua/id/eprint/8069> [in Ukrainian].
17. Lyeonov, S., Kuzmenko, O., Yarovenko, H., & Dotsenko, T. (2019). The Innovative Approach to Increasing Cybersecurity of Transactions Through Counteraction to Money Laundering. *Marketing and Management of Innovations*, 3, 308—326. <http://doi.org/10.21272/mmi.2019.3-24>.
18. Levchenko, V., Boyko, A., Savchenko, T., Bozhenko, V., Humenna, Yu., & Pilin, R. (2019). State Regulation of the Economic Security by Applying the Innovative Approach to its Assessment. *Marketing and Management of Innovations*, 4, 364—372. <http://doi.org/10.21272/mmi.2019.4-28>.
19. Lyeonov, S., Demkiv, Yu., & Samusevych, Ya. (2018). Otsiniuvannia yakosti bankivskykh posluh na osnovi pidkhodu SERVQUAL: suchasna interpretatsiia [Evaluation of the quality of banking services based on the SERVQUAL approach: modern interpretation]. *Finansovo-kredytna diialnist: problemy teorii i praktyky — Financial and credit activities: problems of theory and practice*, 2 (25), 47—55. <https://doi.org/10.18371/fcapter.v2i25.135978> [in Ukrainian].
20. Dobrowolski, Z., & Sulkowski, Ł. (2020). Implementing a Sustainable Model for Anti-Money Laundering in the United Nations Development Goals. *Sustainability*, 12, 244. <https://doi.org/10.3390/su12010244>.
21. Subeh, M. A., & Boiko, A. (2017). Modeling efficiency of the State Financial Monitoring Service in the context of counteraction to money laundering and terrorism financing. *SocioEconomic Challenges*, 1 (2), 39—51. [http://doi.org/10.21272/sec.1\(2\).39-51.2017](http://doi.org/10.21272/sec.1(2).39-51.2017).
22. Yarovenko, H., Kuzmenko, O., & Stumpo, M. (2020). Strategy for Determining Country Ranking by Level of Cybersecurity. *Financial Markets, Institutions and Risks*, 4 (3), 124—137. [https://doi.org/10.21272/fmir.4\(3\).124-137.2020](https://doi.org/10.21272/fmir.4(3).124-137.2020).
23. Andros, S., Akimova, L., & Butkevich, O. (2020). Innovations in Management of Banks Deposit Portfolio: Structure of Customer Deposit. *Marketing and Management of Innovations*, 2, 206—220. <http://doi.org/10.21272/mmi.2020.2-15>.
24. Logan, W., & Esmenov, O. (2017). Public financial services transparency. *Business Ethics and Leadership*, 1 (2), 62—67. [http://doi.org/10.21272/bel.1\(2\).62-67.2017](http://doi.org/10.21272/bel.1(2).62-67.2017).

25. Lyeonov, S., Samusevych, Ya., & Demkiv, Yu. (2018). The measurement of influence of innovations' implementation on the commercial banks performance. *Scientific Bulletin of Polissya*, 1 (13), 2, 68—76. Retrieved from <http://nvp.stu.cn.ua/article/view/139536/136494>.
26. Kibaroglu, O. (2020). Self Sovereign Digital Identity on the Blockchain: A Discourse Analysis. *Financial Markets, Institutions and Risks*, 4 (2), 65—79. [https://doi.org/10.21272/fmir.4\(2\).65-79.2020](https://doi.org/10.21272/fmir.4(2).65-79.2020).
27. Chuchuk, Yu. (2014). Teoretychna sutnist poniat «ekonomichna efektyvnist» ta «efektyvnist diialnosti» [Theoretical essence of the concepts «economic efficiency» and «efficiency»]. *Efektivna ekonomika — Efficient economy*, 2. Retrieved from <http://www.economy.nayka.com.ua/?op=1&z=2765> [in Ukrainian].
28. Verkhovna Rada Ukrainy. (2020). Pro zapobihannia ta protydiuu lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu teroryzmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia: Zakon Ukrainy [On prevention and counteraction to legalization (laundering) of proceeds from crime, financing of terrorism and financing of proliferation of weapons of mass destruction: Law of Ukraine]. *Vidomosti Verkhovnoi Rady Ukrainy — Bulletin of the Verkhovna Rada of Ukraine*, 25. Retrieved from <https://zakon.rada.gov.ua/laws/show/361-20#Text> [in Ukrainian].
29. Małecka, M. (2021). Values in economics: a recent revival with a twist. *Journal of Economic Methodology*, 28 (1), 88—97.
30. Heneralna prokuratura Ukrainy. (n. d.). *Ofitsiyni sait [Official site]*. Retrieved from <https://www.gp.gov.ua/ua/1stat> [in Ukrainian].
31. Derzhavna sluzhba finansovoho monitorynhu Ukrainy. (n. d.). *Ofitsiyni sait [Official site]*. Retrieved from <https://fiu.gov.ua/pages/dijalnist/funkcional/statistika-ta-infografika> [in Ukrainian].
32. Derzhavna sluzhba statystyky Ukrainy. (n. d.). *Ofitsiyni sait [Official site]*. Retrieved from <http://www.ukrstat.gov.ua> [in Ukrainian].

The article is recommended for printing 05.04.2021

© Lieonov S., Vasilyeva T., Mynenko S., Dotsenko T.