

Theoretical and Applied Principles of Information Technology for Anti-money Laundering

Iryna Moiseienko^a, Ivanna Dronyuk^b

^a Prydniprovsk State Academy of Civil Engineering and Architecture, Chernyshevsky 24A, Dnipro, 49000, Ukraine

^b Lviv Polytechnic National University, Bandery 12, Lviv 79013, Ukraine

Abstract

Theoretical bases of corruption risk analysis are presented. Methodical bases of information technology construction to prevent money laundering are formulated. Methods for monitoring money laundering risks have been developed. The research of money laundering risks has been implemented by using system analysis and generalization for research of peculiarities of money laundering risks, grouping, and logical analysis to study the practice of identifying money laundering risks. Algorithms for identifying money laundering risks of suspicious financial transaction subjects have been developed. The presented models and methods have applied application for anti-money laundering processes digitalization.

Keywords

Artificial intelligence, big data, financial services, anti-money laundering, risk assessment, evaluation criteria

1. Introduction

Advanced artificial intelligence applications become critically important to observe for fraud risk monitoring, fraud detection, and various anti-money laundering techniques. With the development of financial markets, the technology of money laundering is constantly updated, and new challenges and threats arise. Therefore, the Financial Monitoring System at the macro level and the level of the subjects of primary financial monitoring needs to be updated and adapted to the new legal requirements and new threats of money laundering.

The financial monitoring system at the macro level and for the subjects of primary financial monitoring needs to be adapted to the new legal requirements and new threats of money laundering. This adaptation involves the formation of algorithms for identifying dubious financial transactions and verifying participants in these transactions using modern information technology tools.

Theoretical aspects of the study reflect the legal basis of financial monitoring at the macro and micro levels. They involve the initial identification of the object, size, nature, and participants of dubious financial transactions. Applied aspects are related to the peculiarities of the organization of primary financial monitoring. These include the legal and economic characteristics of direct financial monitoring and methods of compliance risk management.

This study aims to improve the procedure for the transition from monitoring financial transactions to monitoring the activities and behavior of participants in these operations and the use of information technology to identify the risks of money laundering. To determine the theoretical and applied features of financial monitoring, general scientific and unique research methods were used: generalization to determine the characteristics of the risks of money laundering; grouping and logical

IntellITSIS'2022: 3rd International Workshop on Intelligent Information Technologies and Systems of Information Security, March 23–25, 2022, Khmelnytskyi, Ukraine

EMAIL: iruna_m2015@ukr.net (Iryna Moiseienko); ivanna.m.droniuk@lpnu.ua (Ivanna Dronyuk)

ORCID: 0000-0002-3140-461X (Iryna Moiseienko); 0000-0003-1667-2584 (Ivanna Dronyuk)



© 2022 Copyright for this paper by its authors.
Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

CEUR Workshop Proceedings (CEUR-WS.org)

analysis for risk identification practice; algorithms to identify risks, entities, and suspicious financial transactions.

Among the methods of financial control of the legalizing processes of legalizing illegally obtained income, the analysis of financial transactions at the primary and state financial monitoring level. If there are signs of doubt in the financial transaction, it may be suspended. Financial monitoring of suspicious transactions involves procedures for the transition from monitoring the transaction to monitoring the activities and behavior of the client. Information technologies to combat money laundering involve the use of specific control methods.

The object of financial monitoring is actions with relevant financial assets and participants in these financial transactions. Such activities or events, purchases, and their participants, and any information on the legalization of illegal income are subject to monitoring. At the present stage of development, most of these actions occur in cyberspace, which creates the need to use computer tools to combat corruption. Therefore, the presented work is relevant.

2. Materials and methodologies

The basis of the methodology for the construction of information technology is a systematic approach to studying economic phenomena and processes. This approach involves the use of the following principles of analysis:

- completeness and objectivity of monitoring the processes of illegal income
- analysis of the processes of financial transactions and their participants in the dynamics
- verification of the subjects of dubious financial transactions and their property relations
- use of historical and international experience in organizing financial monitoring
- introduction of mathematical models, artificial intelligence, and information
- technologies for practical tools of financial monitoring.

2.1. State of the art

Currently, there is a transition of all human processes in cyberspace. Following the banks in virtual reality, scammers rushed. Cybersecurity has become a leading trend in the modern world. Modern information technologies have been actively introduced to ensure data integrity, customer confidentiality, and anti-corruption. Artificial intelligence (AI), machine learning methods, and classical methods are actively used to prevent money laundering. The investigation survey in this field is presented [1, 12, 24-26]. The advanced AI applications are the base of fraud risk monitoring, fraud detection, anti-money laundering methods, and cross-border payment handling and have become very effective tools [13-15]. Based on the Basel AML Index, an annual world ranking of countries at risk of money laundering is formed (see Table.1) [16,17]. A data mining approach for finding illicit transactions has been developed [18]. Leveraging machine learning methods for the struggle against money laundering are investigated [19]. Artificial Intelligence has become an essential resource for organizations and governments dealing with regulatory changes, new Anti-Money Laundering obligations, and ML/TF proven [20,27,28]. A systemic approach for creating information technologies is investigated [21- 23]. The presented literature review demonstrates that it is critically important for Ukraine to implement modern information technologies in ML/TF.

2.2. Theoretical fundamentals of money laundering analysis

Systematic analysis of money laundering processes will be considered scientific methods and practical analysis methods using international experience in detecting these transactions in global computer networks. The use of the category of the system as a unity of elements and relationships between them to achieve the study's objectives involves the use of the following system principles: multicriteria; hierarchy; uncertainty; autonomy; dynamism (inertia). Multicriteria means that there are many ways to legalize illicit income. Thus, the multi-criteria analysis method involves forming plans

for identifying money laundering risks, establishing the level of hazards, and response measures to identify suspicious transactions or participants in legalization processes in the computer network.

Table 1

Part of the ranking countries for money laundering and terrorism financing risks from the Basel AML Index [17,18]

Country	Basel Rank	KYC Rank
Cote D'Ivoire	18	67
China	19	24
Mongolia	20	30
Nicaragua	21	4
Argentina	22	75
Pakistan	23	5
Angola	24	63
Serbia	25	55
Tajikistan	26	47
Algeria	27	52
Kazakhstan	28	61
Ecuador	29	23
Jamaica	30	12
Thailand	31	51
Senegal	32	60
Turkey	33	54
Panama	34	6
Guyana	35	69
Morocco	36	26
Ukraine	37	19
Bolivia	38	28
Albania	39	15
Vanuatu	40	53
Kyrgyzstan	41	57
Bosnia-Herzegovina	42	13
Columbia	43	36
Philippines	44	27
Bangladesh	45	79
Marshall Islands	46	88
Honduras	47	48
Russia	48	18
Venezuela	49	7
Uzbekistan	50	43
India	51	59
United Arab Emirates	52	68

A hierarchy of analysis methods means such an algorithm for studying money laundering processes. The initial information on the decision-making response is formed at different levels of the economic system. The peculiarity of the current stage is that other software can be used at each level of this system. The autonomy of the financial analysis methodology involves the use of models of analytical research that take into account the specifics of the legalization of illicit funds at each level.

The methodology of systematic analysis of the legalization of illegal income involves the sequence of certain stages of the analytical process. These include the following:

the first - determination of the purpose, tasks, and conditions of the system analysis of processes of legalization of the means received illegally;

the second – is determining the list of parameters and indicators for establishing risks of legalization of illegal funds (synthetic, absolute and relative, quantitative and qualitative);

the third – is drawing up a general legalization model of illegally obtained income, determining its components, sequence, and relationships between elements of typological schemes of money laundering.

The method of systematic analysis of money laundering contains three analytical research complexes:

1. analysis of potential risks and threats of money laundering
2. analysis of the results of monitoring the objects and subjects of dubious financial transactions
3. analysis of internal and external environment measures aimed at counteracting the legalization (laundering) of proceeds from crime.

Depending on the set of research opportunities, all methods of analysis of money laundering can be divided into the following groups:

- Traditional methods of statistical analysis and use of relative, average values, grouping
- Methods of analytical research and presentation of results in graphical, tabular, or schematic form
- Logical heuristic methods (surveys, expert assessments, etc.)
- Typological studies of money laundering models.

Here we introduce investigation money laundering methods [2, 9]. Research methods are divided into primary and secondary.

Direct methods are used to study sources, gather information, observe, and survey. Secondary methods are used for data processing and analysis.

According to the implementation process, the plans are divided into Logical-Analytical Visual, Graphic, and Computational.

Logical and analytical methods test hypotheses and conclusions, mainly using deduction and induction methods. Visual or graphical methods are used to visualize the results. Computational methods are used to analyze and predict outcomes based on statistical and regression analysis calculations, using typological methods to study typical phenomena.

According to the nature of use, the procedures are divided into stages and universal. Sets are used only at specific research locations (observation, experiment) and are universal at all stages of research (abstraction, generalization, induction, deduction).

According to the nature of the study of the object of financial monitoring, the analysis methods are divided into general and unique.

Methods of empirical research include observation, comparison, measurement, and experiment. And methods used at the practical and theoretical levels include analysis, abstraction, induction, deduction, and modeling. Unique ways consider the specifics of specific processes (tactical research and empirical investigation).

The analysis of money laundering processes uses various research methods and techniques, depending on studying the models and tools for money laundering. Traditional systems analysis methods and empirical (typological) methods are used.

Typological research as a scientific method analysis of money laundering is an essential component of national anti-money laundering systems. They reflect international experience in using tools, schemes, and means of money laundering.

2.3. Methodical fundamentals of information technology anti-money laundering

To formalize the research processes of money laundering and the effective use of various methods of their control and analysis, it is necessary to use modern information technology.

The scheme of the research process for the operations of legalization of illegal income is presented in Fig.1.

The scheme of information technology can be presented in such a way:

1. The day of the manifestation of risks in money laundering and the model of the occurrence of losses.
2. Ways to drive illegal income.
3. Methods of risk analysis of money laundering at the macro and micro levels are used.
4. The Analysis of risks of receiving illegal incomes on objects of financial monitoring is carried out.
5. The nature and analysis of risks of receiving illegal income on subjects of financial operations are studied
6. The dynamics of indicators of legalization of illegal income by objects and subjects of dubious financial transactions are considered
7. Comprehensive analysis of suspicious financial transactions involves a combination of capabilities of the previous stages of their financial monitoring.

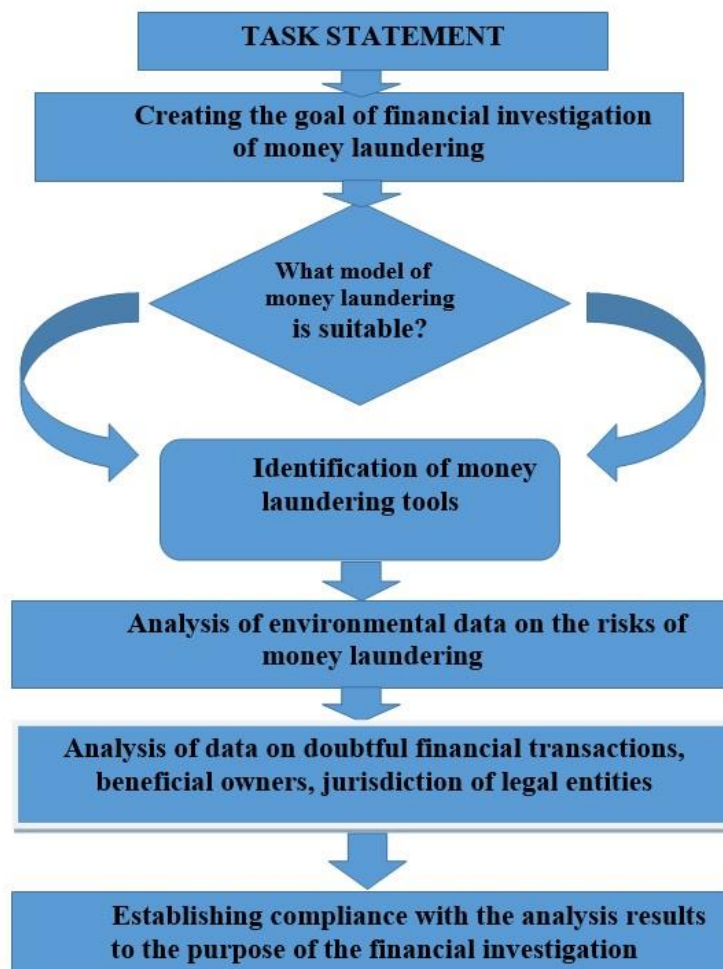


Figure 1: Stages of the information technology implementation in the process of financial investigations into the illegal funds' legalization

Information technology for the study of money laundering processes involves the detection of typological schemes at the macro level and analyzing money laundering processes at the micro-level by type of economic activity, type of financial assets, and participants in financial transactions. The method for detecting money laundering means establishing, recording, and determining this type of crime.

Modern information technologies are essential tools for preventing money laundering and struggling against terrorism financing.

3. Main Results: Information technology for determination and analysis of money laundering

3.1. Stages of Information technology creating

In the minds of the digital economy, it is necessary to develop information technology and analysis of illegal income. To reconcile the reduced ordering of the set of exact rules for the introduction of expenses, which are described, such in the sequence, it is necessary to conclude so that after the reduced number of short cuts, the achievement of the detection of the legalization of illegal income [4,6,8]. Information technology for the legalization of unlawful payments on macro-transfer lines, revealing and fixing typological schemes for transferring funds in various activities, assets, and financial operations. The algorithm for showing the recognition of income possessed by a malicious path means establishing, fixing, and confirming that it is necessary to set the specified type of evaluation [7].

Information technology can be modeled as a function of such parameters: the identification, verification, clarification of information about the objects and subjects of financial transactions:

$$I = F(ip, io, d, k), \quad (1)$$

Here we use notation as I is the result of the function, current stage of information technology;

ip is the process of identification, verification of subjects of financial transactions, the establishment of the fact of belonging of the client to the national or foreign public figure, close or related person,

io is the process of monitoring business relations and financial transactions on the activities of public figures;

d is the process of identification of sources of origin of funds and the establishment of actual financial capabilities of the client to conduct (initiate) financial transactions for the relevant amounts;

k is the process of monitoring: specific categories of clients and establishment of ultimate beneficial owners; verification of participants in financial transactions for their affiliation with persons or organizations related to terrorist activities or in respect of which domestic or international sanctions have been applied; identification of the nature of clients' activities, their forms of ownership, management structures and identification of clients with non-transparent ownership structures.

The formula (1) will be used in the software realization of the verification process of money laundering.

3.2. Identification of entities and object of the financial laundering operation

The research [2, 3] of the intergovernmental body that develops policies to combat money laundering and promotes its implementation at the national and international levels shows the most commonly used legalization methods in Table 2.

To improve the financial monitoring of money laundering operations under international standards, the concept of due diligence has been introduced in Ukraine. Applied aspects of monitoring dubious financial transactions contain current data:

- about the ultimate beneficial owners;
- ownership structure of participants in financial transactions;
- changes in the ownership structure and composition of participants in financial transactions.

Participants in suspicious financial transactions in these materials were officials, state bodies, local governments, and persons equal to them.

The following were used as instruments of money laundering: financial assistance (loans); cash; deposits; securities, and others [3].

Such an analysis involves the transformation of researched and verified information received by the subjects of primary financial monitoring into financial monitoring information through the interpretation and integration of all collected data.

IT analysis of financial transactions can be divided into the following procedures:

1. Verification of the received data on business entities or financial transactions, officials
2. Development of a working hypothesis regarding their involvement in money laundering
3. Collection, evaluation, and verification of additional information on the surveyed business entities, officials, and financial transactions
4. Identification of preconditions for doubtful financial transactions
5. Development of preliminary conclusions on the affiliation of financial transactions to typological schemes
6. Construction of arguments for financial monitoring of dubious financial transactions.

Ukraine has introduced a new regulation on financial monitoring of banks, which provides for the study of suspicious Financial transactions. The signs of suspicious financial transactions include those listed in table 3.

Table 2

The primary operations of money laundering

Model stage	Operation type
Smurfing	Shredding of deposits Structuring of cash transactions without exceeding the statutory limit
Use of correspondent relations of banks	Exchange operations Correspondent and transit accounts Transfer of funds abroad
Smuggling Hidden placement	Use of fictitious persons Use of shell companies Use of credit cards Use of cryptocurrencies
Legalization	Investing legally Using cryptocurrencies

Table 3

List of criteria for financial transactions suspicion

Classification feature	List of indicators
Preliminary stage (collection and generalization of information)	Clear division of powers in decision-making in the field of risk management; identification/review of existing risks regularly due to dynamic changes occurring in the external and internal environment; use of portfolio and individual approach in risk assessment and management; determining the position on different types of risks;
Stage of identification (identification) of risks Risk analysis	Determination of criteria for classifying specific processes phenomena as risky; setting indicators (limits) of risk Taking measures to reduce risks to an acceptable (acceptable) level; regularly updating procedures, methods of risk assessment, and management;
Risk assessment and management	Assessment of admissibility and justification of the size of certain types of risks; qualitative and quantitative evaluation of threats; identification of relationships between individual types of risks to assess the impact of measures to limit a kind of risk to increase (decrease) the level of other threats; application of unique methods of assessment for each type of risk;
Risk monitoring and management	Risk monitoring; regular implementation of control measures to determine the adequacy of the risk management system, verification of the reliability of the results of the risk system.

These methods include: monitoring the size of the financial transaction, analysis of the transaction based on comparison with regulatory indicators, risk assessment, control (cancellation) of the financial transaction, and adaptation of data on the financial marketing and the client.

In order to bring Ukrainian money laundering legislation in line with international standards, the concept of due diligence of participants in dubious financial transactions has been introduced. Such verification involves:

- Identification and verification of participants in financial transactions
- Establishment of the ultimate beneficial owner of the client
- Defining the goals and nature of financial transactions or business relationships
- establishing the dynamics of financial transactions and business relationships of the client
- Establishing compliance of customer monitoring data with customer databases of primary financial monitoring entities [10]
- Analysis of data on the client's activities, sources of funds for financial transactions, and the risks of such transactions
- Maintaining the relevance of databases on the bank's customers and participants in financial transactions, information on the ultimate beneficial owners, and ownership structure [11].

The procedure for identifying and verifying customers who may be involved in money laundering is presented in Table 4.

Table 4
Methods of customer identification and verification

off-line	online
The physical presence of customers and the presentation of copies of the original registration documents are required	For simplified customer verification models use data from credit bureaus and BankID NBU Ukraine (NBU), qualified electronic signature, chip of biometric document With full-fledged models provided for the use of BankID NBU, the resource of state online services "DIYA" a qualified electronic signature (QES), a video broadcast session

Let's build a mathematical model for the verification process V . Verification of a business entity with a non-transparent ownership structure consists of specific procedures that we note as rr, rv, c, a , and m .

$$v = f(rr, rv, c, a, m), \tag{2}$$

Here rr is the procedure for studying data on individuals;

rv is the procedure of data study of data on a legal entity and ownership structure, comparison of data on legal entities and individuals with data from the Internet and other sources of verification; c is verification of legal entities and individuals (owners and managers) against the following data: the presence/absence of criminal cases of fraud; the business reputation of individuals and legal entities, the presence of other legal entities in their ownership, relations with public figures, etc .; availability of trust agreements/declarations for persons registered in offshore jurisdictions;

a is the procedure of analysis of information on the content of statutory activities and the financial condition of the business entity;

m is the procedure of monitoring the risks of the business entity. The formula (2) will be used in the software realization of the verification process [11].

To establish the ultimate beneficial owner and ownership structure, the subjects of primary financial monitoring take the following mandatory measures: determine the ownership structure; analyze and identify persons who own 25% or more of the share capital of a legal entity (directly or through related parties); identify individuals who do not own a 25% stake in the share capital, but have a decisive influence on the activities of the legal entity [7].

Many legal and financial intermediaries provide nominee services to conceal beneficial owners and generate illicit income.

3.3. Monitoring of money laundering risks at the macro level

The risk assessment and management process contains the following steps and elements described in Table 5.

At the highest state level, the assessment of money laundering risks must necessarily contain information: the type and size of money laundering; deficiencies in the system of combating money laundering, elements of the system management, and other features supporting the environment with the possibility of money laundering; measures necessary to eliminate the vulnerable components in the system of combating money laundering and terrorist financing [4]. The national risk assessment in Ukraine combines quantitative data based on statistical characteristics and qualitative data based on expert judgments in various areas of prevention and combating money laundering and terrorist financing [5]. According to the second national risk assessment results, 11 threats to the anti-money laundering system were identified, and 24 risks of money laundering and terrorist financing were identified, including six high-risk risks, 16 medium-risk risks, and two low-risk ones [2].

Table 5
Stages and aspects of financial risk monitoring

Stages	Elements
Preliminary stage (collection and generalization of information)	Clear division of powers in decision-making in the field of risk management; identification/review of existing risks regularly due to dynamic changes occurring in the external and internal environment; use of portfolio and individual approach in risk assessment and management; determining the position on different types of risks;
Stage of identification (identification) of risks	Determination of criteria for classifying specific processes phenomena as risky; setting indicators (limits) of risk
Risk analysis	Taking measures to reduce risks to an acceptable (acceptable) level; regularly updating procedures, methods of risk assessment, and management;
Risk assessment and management	Assessment of admissibility and justification of the size of certain types of risks; qualitative and quantitative evaluation of certain types of threats; identification of relationships between individual types of risks to assess the impact of measures to limit a kind of risk to increase (decrease) the level of other threats; application of unique methods of assessment and management for each type of risk;
Risk monitoring and management	Risk monitoring; regular implementation of control measures to determine the adequacy of the risk management system, verification of the reliability of the results of the risk system.

Among the risks with a high level of importance are: manifestations of terrorism and separatism, the risk of falsification of invoices (invoices) in foreign economic activity (risk of illegal financial outflows from the country), high cash flow, low income, low income, VC / FT through remote services or use of virtual currencies, improper detection and authorization of suspicious financial transactions of public figures. The most significant risk is inherent in the development of corruption, mainly due to unsuccessful reform of economic relations in the country, political decision-making, non-compliance with ethical rules of conduct by public officials due to low governance culture, and inadequate financial status. Consider the typology of sets of dubious financial transactions in terms of analysis and creation of preventive measures to legalize illicit funds. Typical schemes of criminal

money laundering processes are conversion of cash into non-cash in significant amounts, with frequent (daily periodicity) and considerable speed of transactions; transfer of funds abroad. Several financial transactions associated with these processes are investigated to determine the typological schemes of money laundering obtained illegally. This considers financial transactions, distinct legal entities, and individuals.

The use of the principle of multicriteria in the study and economic analysis of money laundering revealed that the same typological scheme might include financial transactions using different instruments, such as cash, securities, insurance and reinsurance, settlements with nonresidents, bogus transactions, illegal reimbursement VAT, etc. At the same time, various combinations of financial transactions and financial instruments, methods of money laundering, the currency of dubious transactions, and international financial organizations are used to legalize illegal income.

Typological schemes reflect trends in combining traditional financial transactions of money laundering with financial transactions involving new technologies and legal, financial transactions. Thus, by using promissory notes and transferring funds to payment cards, financial transactions can be combined with subsequent use in other countries [18, 19].

The main characteristics of typological schemes include:

- A form of conducting - financial transactions
- The method of carrying out - moving, masking, transfer of financial assets
- The result is the possession of financial assets obtained illegally.

Systematized typical algorithms of money laundering can be implemented according to the next classification criteria: source of illegal funds, type of financial asset, business entities and institutions involved in financial transactions, and sales channels. The combination of originals and holdings of financial transactions in typical algorithms of money laundering are presented in table 6.

Thus, the typological scheme of legalization for income money obtained by criminal means consists of the identification of the next elements: the source of illicit income; the type of asset (financial instrument) with which the funds are transferred; the presence of a channel for the movement or transformation of illegal funds; use of financial transactions between certain business entities.

Financial monitoring during the transfer of funds was changed to increase the efficiency of control over money transfers. To the aim, the primary financial monitoring subjects' obligation to verify customer data and financial transactions was introduced, and the threshold value of UAH 30,000 is obligating. Therefore, all larger transfers have to be checked at the primary level.

4. Discussion

To ensure the control of cash flows and overcome the subjectivity of risk assessments, the following measures are proposed to improve the system of counteraction to legalization:

- Implement appropriate anti-money laundering software at all levels;
- Expand the control of financial transactions, make the transition from the "history of operations" (retrospective control of operations) to control over the initial placement of funds in the financial system;
- Apply control of operations with control over the subjects of these operations;
- Create a unique Ukraine database of business reputation of the subject of financial transactions, apply three levels of assessment of business reputation: impeccable (no risk); under control (probable and weak risk); doubtful (maximum risk);
- Monitor and assess compliance with financial discipline by the subjects of primary financial monitoring with the help of rating assessments;
- Use as a tool for assessing doubtful transactions new criteria of doubt to determine the economic feasibility of financial transactions;
- To strengthen the mechanism for preventing money laundering and combating corruption, it is proposed to use the following levers of influence: monitoring the client's financial transactions and rating goodwill; the use of preventive measures - limiting the volume of financial transactions in time and volume, expanding the criteria for risk assessment.

It is proposed to improve the methodological support of financial investigations of money laundering to identify and verify participants in financial transactions through a comprehensive combination of regulatory methods of the National Bank of Ukraine, the State Fiscal Service of Ukraine, and the State Financial Monitoring Service of Ukraine and introduce special software.

In addition, it is recommended based on the results of analysis and generalization of identified (typical and new) methods, financial instruments, and schemes of legalization (laundering) of proceeds from crime, terrorist financing, the priority areas of financial investigations and implementation of these program methods are identified for performances.

Table 6

Examples of combining sources of illegal income and assets to legalize them

Source of illicit income	Key examples	Asset schemes used in the process of money laundering
Corrupt actions of officials at all levels	Transfer of funds to the accounts of individuals and legal entities to purchase assets, invest, repay loans or obtain other illegal benefits	Highly liquid assets (gold, diamonds, jewelry)
The public sector of the economy	Schemes are related to payment by state enterprises for services that were not provided, manipulation of tender procurement, privatization of property	Securities: issue by companies, options, their subsequent resale, including abroad bypassing exchanges. settlement by a promissory note, transfer between the firms of the promissory message by forgery of reporting documents, and settlement by a promissory message of illegally obtained money by the issuer
Fraud	Theft of funds from banking institutions (lending to fictitious companies, withdrawal of funds through foreign banks), obtaining microloans on forged documents	Land, purchase of land by a resident of Ukraine, but on the loan of a non-resident
Cybercrime	Forgery of payment cards, online financial pyramids, access to remote banking connections, online casinos	seizure of property, falsifying documents (death, title, will, gift) with the subsequent sale of the property to third parties

5. Conclusion

Data analysis on suspicious transactions, fictitious legal entities, beneficial owners, and officials is the basis of information security of business relations of business entities. The monitoring of business relations often involves procedures for the transition from monitoring the operation to tracking the client's activities and behavior, applying specific control methods [4]. These methods include: tracking the size of the financial transaction, analysis of the transaction based on comparison with regulatory indicators, risk assessment of financial security, and adaptation of data on the financial marketing and the client.

Information technology identifying, monitoring, and analyzing money laundering risks is essential for financial monitoring.

Financial monitoring of suspicious financial transactions is carried out at the macro and micro levels.

Adaptation of financial monitoring procedures involves improving the methodological framework supporting the identification and verification processes of objects and subjects of suspicious financial transactions, establishing the ownership structure and ultimate beneficial owners.

Algorithms for monitoring money laundering risks have been developed to use owners' and ownership structures data.

Object models for describing objects and subjects of suspicious financial transactions are an auxiliary methodological tool that will allow the digitization of these processes.

The subsequent investigations can study the influence of actual war conditions on the economy of Ukraine and partially the money laundering and struggle against terrorist financing.

6. Acknowledgment

The authors would like to thank the Armed Forces of Ukraine for providing security to perform this work. This work has become possible only because of the resilience and courage of the Ukrainian Army.

7. References

- [1] K. Singh, P. Best. Anti-money laundering: Using data visualization to identify suspicious activity. *International Journal of Accounting Information Systems*, 34 (2019) doi:10.1016/j.accinf.2019.06.001.
- [2] P. Jurik, D. Panevski, *Anti-Money Laundering Institutions, and Their Practices within EU*, Bratislava, 2018.
- [3] The Eurasian group on combating money laundering and financing of terrorism (EAG) URL: <http://www.eurasiangroup.org/>
- [4] Law of Ukraine On Prevention and Counteraction to Legalization (Laundering) of Proceeds from Crime, Financing of Terrorism and Financing of Proliferation of Weapons of Mass Destruction, December 6, 2019, № 361-IX. URL: <https://zakon.rada.gov.ua/laws/show/361-20>
- [5] Report of the State Financial Monitoring Service of Ukraine for 2019. URL: <https://fiu.gov.ua/pages/zvit2019ua.pdf> (In Ukrainian).
- [6] Akartuna E.A., Johnson S.D., Thornton A. Preventing the money laundering and terrorist financing risks of emerging technologies: An international policy Delphi study. *Technol. Forecast Soc. Change* (2022) 179. DOI:10.1016/j.techfore.2022.121632.
- [7] I. Moiseienko, I. Dronyuk, I. Revak, Money laundering risk identification algorithms. Paper presented at the CEUR Workshop Proceedings, 2824 (2021) 120-129.
- [8] I.P. Moiseyenko, O.A. Martunyk Application of intelligent technologies in economic security a company, *Actual Problems of Economics*, 12 (2012) 234-238.
- [9] S.S. Chernyavsky, O.E. Korystin, V.A. Nekrasov. Financial investigations in combating the legalization of criminal income in Ukraine: guidelines. Kyiv: National academy of internal Affairs 2017. (In Ukrainian).
- [10] O. Svenonius, U. Mörth. Avocat, rechtsanwalt or agent of the state?: Anti-money laundering compliance strategies of french and german lawyers. *Journal of Money Laundering Control*, 23(4) (2020) 849-862. doi:10.1108/JMLC-09-2019-0069
- [11] Statistics of the State Financial Monitoring Service of Ukraine URL: <https://fiu.gov.ua/pages/dijalnist/funkcional/zviti-pro-diyalnist>, (In Ukrainian)
- [12] A. H. G. Suxberger, R. P. R. Pasiani The role of financial intelligence in the persecution of money laundering and related felonies. [O papel da inteligência financeira na persecução dos crimes de lavagem de dinheiro e ilícitos relacionados] *Revista Brasileira De Políticas Publicas*, 8(1) (2018) 290-318. doi:10.5102/rbpp.v8i1.4618.

- [13] E. E. Esoimeme, Balancing anti-money laundering measures and financial inclusion: The example of the United Kingdom and Nigeria, *Journal of Money Laundering Control*, 23(1), (2020). 64-76. doi:10.1108/JMLC-04-2018-0031.
- [14] M. Brewczyńska, Financial intelligence units: Reflections on the applicable data protection legal framework. *Computer Law and Security Review*, 43 (2021). doi:10.1016/j.clsr.2021.105612
- [15] Y. He, J. Chen, AMLChain: Supporting anti-money laundering, privacy-preserving, auditable distributed ledger (2022), doi:10.1007/978-3-030-93956-4_4.
- [16] J. N. Mordeson, S. Mathew, M. Binu, KnowYourCountry, *Studies in Systems, Decision and Control* (2022). doi:10.1007/978-3-030-86996-0_14.
- [17] Basel AML Index. 2022. URL: <https://baselgovernance.org/basel-aml-index>.
- [18] Corruption Perceptions Index, Transparency International, Corruption Perceptions Index. URL: <https://www.transparency.org/cpi2021>.
- [19] M. Starnini, C. E. Tsourakakis, M. Zamanipour, A. Panisson, W. Allasia, M Fornasiero, L.L. Puma, V. Ricci, S. Ronchiadin, A. Ugrinoska, M. Varetto, D. Moncalvo, Smurf-based anti-money laundering in time-evolving transaction networks, *Lecture Notes in Computer Science*, 12978 LNAI (2021) 171–186, doi:10.1007/978-3-030-86514-6_11
- [20] A. I. Canhoto, Leveraging machine learning in the global fight against money laundering and terrorism financing: An affordances perspective, *Journal of Business Research*, 131 (2021) 441-452. doi:10.1016/j.jbusres.2020.10.012.
- [21] M. Thisarani, S. Fernando, Artificial intelligence for futuristic banking. Paper presented at the 2021 IEEE International Conference on Engineering, Technology, and Innovation, ICE/ITMC 2021 - Proceedings, doi:10.1109/ICE/ITMC52061.2021.9570253.
- [22] V. Kovtun, I. Izonin, Study of the operation process of the e-commerce oriented ecosystem of 5G base station, which supports the functioning of independent virtual network segments, *Journal of Theoretical and Applied Electronic Commerce Research*, 16(7) (2021) 2883-2897. doi:10.3390/jtaer16070158.
- [23] T. Hovorushchenko , Y Hnatchuk, A. Herts, O. Onyshko. Intelligent information technology for supporting the medical decision-making considering the legal basis. Paper presented at the CEUR Workshop Proceedings, 2853 (2021) 72-82.
- [24] H. Mykhailyshyn, N. Pasyeka, V. Sheketa, M. Pasyeka, O. Kondur, M. Varvaruk, Designing network computing systems for intensive processing of information flows of data. *Lecture Notes on Data Engineering and Communications Technologies*, 48, (2021) 391–422 doi:10.1007/978-3-030-43070-2_18.
- [25] W. Hilal, S. A. Gadsden, J. Yawney, Financial fraud: A review of anomaly detection techniques and recent advances, *Expert Systems with Applications*, 193 (2022), doi:10.1016/j.eswa.2021.116429.
- [26] J. N. Mordeson, S. Mathew, M. Binu, Bribery and corruption *Studies in Systems, Decision and Control*, (2022) 391, 227 – 245, doi:10.1007/978-3-030-86996-0_11.
- [27] M. A. Naheem, Analysis of Bahrain’s anti-money laundering (AML) and combatting of terrorist financing (CTF) practices. *Journal of Money Laundering Control*, 24(4) (2021) 834-847. doi:10.1108/JMLC-04-2018-0033.
- [28] E. Fletcher, C. Larkin, S. Corbet, Countering money laundering and terrorist financing: A case for bitcoin regulation. *Research in International Business and Finance*, 56 (2021) doi:10.1016/j.ribaf.2021.101387.