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Institutional capacity and the implementation gap: A comparative analysis of anti-money laundering effectiveness in the criminological dimension of economic crimes

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statistical processing and interpretation of results. 4.4 Data collection tools and analytical units. 4.5 Ethical aspects and limitations of the study. 5. Results. 6. Discussion. 6.1 Verification of institutional fragmentation and the "implementation gap". 6.2 The phenomenon of "symbolic compliance" in developed financial hubs. 6.3 Crime displacement and legal adaptation to new financial threats. 6.4 Verification of hypotheses, limitations and practical significance of the findings. 6.5 Recommendations for implementing the obtained results. 7. Conclusion. 8. References.

Abstract: This study offers a criminological and comparative analysis of how the state's institutional capacity impacts the effectiveness of anti-corruption mechanisms and to identify ways used by criminal actors to adapt to regulatory pressures. The research is based on a comparative analysis of four jurisdictions: Ukraine, Lithuania, Germany, Singapore. In terms of methodology, the study applies multiple linear regression, clustering and flow modeling to evaluate the law enforcement systems' capacity. Empirical findings show a strong correlation ($r = 0.89$) between the strengthening of traditional banking supervision and the shift of illicit capital into crypto-assets. It was established that the share of stablecoins in illegal operations reached 84%. As for Ukraine, it demonstrates the highest level of institutional gap ($E = 3.6$), being associated with wartime risks and procedural inertia. Furthermore, the calculations indicate the loss of up to 82% analytical capacity at the transition stage from financial intelligence to judicial outcomes. Notably, the Singapore model serves as a benchmark ($E = 8.5$), largely due to its implementation of advanced monitoring technologies. The regression analysis shows a statistically significant relationship ($\beta = -0.45$) between the supervision quality and the volumes of confiscated assets. On the whole, the findings support the need to move beyond the formal reporting models toward risk-based approaches with a strong technological component. The modernization of financial monitoring should include the automation of data exchange in order to tackle up to 68% of delays in registries.

Keywords: Money Laundering, Fatf Standards, Implementation Gap, Crime Displacement, Regulatory Effectiveness

1. Introduction

The globalization of financial markets requires harmonisation of the international standards for combating the legalization of criminal proceeds. In this area, international cooperation is grounded in the multi-level coordination of law enforcement agencies and financial intelligence units.⁶ Such cross-border interaction's effectiveness determines the global economic system's stability and the protection degree of national jurisdictions from external threats⁷.

Overall, the scale of money laundering is estimated at 2% to 5% of global GDP yearly.⁸ Notwithstanding the active implementation of FATF standards, the actual

⁶ CHERNIAVSKYI, S. S., HOLOVKIN, B. M., CHORNOUS, Y. M., BODNAR, V. Y., and ZHUK, I. V. "International cooperation in the field of fighting crime: Directions, levels and forms of realization". *Journal of Legal, Ethical and Regulatory Issues*, v. 22, n. 3, 2019. Available at: <https://www.abacademies.org/articles/international-cooperation-in-the-field-of-fighting-crime-directions-levels-and-forms-of-realization-8346.html> (accessed on 20 July 2026).

⁷ POLIOVA, N., POLOVA, L., STEPANENKO, S., IZMAILOV, Y., VARENYK, V., and AKIMOV, O. "Organizational and economic principles of financial monitoring of national business entities in the context of national security". *Edelweiss Applied Science and Technology*, v. 8, n. 6, 2024, pp. 1455-1466. <https://doi.org/10.55214/25768484.v8i6.2262>

⁸ UNITED NATIONS OFFICE ON DRUGS AND CRIME. *World Drug Report 2023*. 2023. Available at: <https://www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2023.html> (accessed on 20 July 2026).

level of asset recovery globally does not exceed 1%. Further, the digitalization of shadow financial flows aggravates the situation: as of 2023, the volume of illegal cryptocurrency transactions rose 24.2 billion US dollars.⁹ These indicators support the hypothesis of a considerable gap between legal compliance and the actual deterrent effect of regulatory norms.¹⁰

The integration of FATF standards uncovers noticeable discrepancies between regulatory frameworks and the practical implementation of anti-corruption measures.¹¹ An emphasis on formal compliance often overlooks the specific features of the criminal environment in countries with transitional economies. This creates favourable conditions for complex money laundering schemes, particularly those associated with cybercrime and virtual assets¹². *The situation is further complicated by the rapid spread of virtual assets, which necessitates new approaches to the legal classification of cryptocurrency-related offenses* (Sydorchuk et al., pp. 751-752).¹³ At the same time, the use of Big Data technologies in investigations introduces additional challenges in balancing privacy concerns with public interests.¹⁴ This study advances a single overarching proposition: anti-money laundering systems are effective only when financial intelligence, criminal proceedings, asset freezing, confiscation mechanisms, and virtual asset service provider (VASP) controls operate as an integrated enforcement chain.

2. Literature review

In light of the above, the current scientific discussion on anti-money laundering (AML) is indeed focused on critically reassessing the effectiveness of international standards in the context of the digital transformation of financial markets. A principal research avenue is the analysis of the “*implementation gap*”, which is a systemic discrepancy between the decentralized application of FATF standards and their actual ability to reduce criminal risks. From this perspective, scholarly enquiry is shifting from formal compliance (*de jure*) to measurable preventive effectiveness (*de facto*). The work of Pavlidis¹⁵ is particularly relevant here, since it examines the destructive consequences of strict regulation, in particular “de-risking” strategies. Rather than its elimination, the forced termination of services from high-risk clients may result in capital displacement. In this light, criminal activity exhibits a tendency to migrate

⁹ CHAINALYSIS. *The 2024 crypto crime report: Data and insights into the latest crypto-based threats*, 2024. Available at: https://www.pensamientopenal.com.ar/system/files/Documento_Editado1686.pdf (accessed on 20 July 2026).

¹⁰ LYSENKO, S., LIUBCHENKO, A., Kozakov V. D. Y., and KRUTIK, Y. “Global cybersecurity: Harmonising international standards and cooperation”. *Multidisciplinary Reviews*, v. 7, 2024, pp. e2024spe021. <https://doi.org/10.31893/multirev.2024spe021>

¹¹ KRAVTSOV, S., OROBETS, K., SHYSHPANOV, N., VOVCHENKO, O., and BEREZOVSKA-CHMIL, O. “Progress and challenges in combating corruption in Ukraine: Pathways forward”. *Journal of Strategic Security*, v. 17, n. 2, 2024, pp. 28-43. <https://doi.org/10.5038/1944-0472.17.2.2223>

¹² NIZOVTSSEV, Y. Y., PARFYLO, O. A., BARABASH, O. O., KYRENKO, S. G., and SMETANINA, N. V. “Mechanisms of money laundering obtained from cybercrime: The legal aspect”. *Journal of Money Laundering Control*, v. 25, n. 2, 2022, pp. 297-305. <https://doi.org/10.1108/JMLC-02-2021-0015>

¹³ OROBETS, K., SHKOLNIKOV, V., BATRACHENKO, T., BARANOVSKA, T., SEREDA, V. “Legislative categorization of crimes committed with the help of cryptocurrencies”. *Management (Montevideo)*, v. 3, 2025, pp. 253. <https://doi.org/10.62486/agma2025253>

¹⁴ TAVOLZHANSKYI, O., SHUMEIKO, O., BURDA, O., OROBETS, K., and STRUCHAIEV, M. “Using big data in criminal investigations: Between privacy and efficiency”. *Khazanah Hukum*, v. 7, n. 3, 2025, pp. 312-324. <https://doi.org/10.15575/kh.v7i3.45201>

¹⁵ PAVLIDIS, G. “The dark side of anti-money laundering: Mitigating the unintended consequences of FATF standards”. *Journal of Risk and Financial Management*, v. 16, n. 7, 2023, pp. 100040. <https://doi.org/10.1016/j.jeconc.2023.100040>

into non-banking sectors. In the study by Gaviyau and Sibindi,¹⁶ this argument is further developed, emphasizing the lacking adaptability of global regulatory frameworks to national institutional context.

Emerging technologies shape both the detection and displacement of illicit financial flows. Horobets et al.¹⁷ classified artificial intelligence and RegTech tools according to their functional roles but identified persistent legal and institutional barriers that limit their effectiveness in transitional economies. Al-Omush et al.¹⁸ further demonstrated that AI integration in financial intelligence units creates algorithmic opacity and privacy risks, implying that technological upgrades fail without corresponding procedural reforms. This technological asymmetry is evident in the global patent landscape, with nearly half of all financial crime detection patents filed during 2023-2024 concentrated in developed markets and corporate actors.

Recent scholarship on digital finance and data flows reinforces the relevance of the integrated chain approach. Anggunia et al.¹⁹ demonstrate how AI-driven policy crafting can enhance financial monitoring, while Chaisse²⁰ analyses cross-border data flows and arbitration in digital investment disputes, highlighting the challenges of balancing transparency with privacy. Qian²¹ examines cybersecurity and digital asset regulation within international legal frameworks, and Chakrabarty²² critiques FATF implementation in emerging economies, noting the gap between technical compliance and actual enforcement. Hoekman and Mavroidis²³ discuss plurilateral agreements and economic development, offering insights into harmonising VASP standards across jurisdictions. These works collectively underscore that institutional capacity, data governance, and cross-border coordination are essential to closing the implementation gap.

The strategic application of new emerging technologies (NETs) forms a critical component of modern anticorruption arsenals. Drawing on India's experience with digital identity and real-time payment platforms, Thommandru and Maratovich²⁴

¹⁶ GAVIYAU, W., and SIBINDI, A. B. "Global anti-money laundering and combating terrorism financing regulatory framework: A Critique". *Journal of Risk and Financial Management*, v. 16, n. 7, 2023, pp. 313. <https://doi.org/10.3390/jrfm16070313>

¹⁷ HOROBETS, N., REZNIK, O., MALIYK, V., VYHIVSKYI, I., and BOBRISHOVA, L. "Artificial intelligence technologies in banking: Challenges and opportunities for anti-money laundering in the context of EU regulatory initiatives". *Journal of Money Laundering Control*, v. 28, n. 4-5, 2025, pp. 593-608. <https://doi.org/10.1108/JMLC-03-2025-0041>

¹⁸ AL-OMUSH, A., ALMASARWAH, A., and AL-WREIKAT, A. "Artificial intelligence in financial auditing: redefining accuracy and transparency in assurance services". *EDPACS*, v. 70, n. 6, 2025, pp. 1-20. <https://doi.org/10.1080/07366981.2025.2459490>

¹⁹ ANGGUNIA, S.D., SOWELL, J., and PÉREZ-ORTIZ, M. "Decoding development: The AI frontier in policy crafting: A systematic review". *Data & Policy*, v. 7, 2025, pp. e31. <https://doi.org/10.1017/dap.2025.10>

²⁰ CHAISSE, J. "Arbitration in cross-border data protection disputes". *Journal of International Dispute Settlement*, v. 15, n. 4, 2024, pp. 534-560. <https://doi.org/10.1093/jnlids/idae018>
CHAISSSE, J. "'The black pit': Power and pitfalls of digital FDI and cross-border data flows". *World Trade Review*, v. 22, n. 1, 2023, pp. 73-89. <https://doi.org/10.1017/S1474745622000337>

²¹ QIAN, X. "Redefining international law paradigms: Charting cybersecurity, trade, and investment trajectories within global legal boundaries". *The Journal of World Investment & Trade*, v. 25, n. 3, 2024, pp. 295-333. <https://doi.org/10.1163/22119000-12340327>

²² CHAKRABARTY, I. "The Financial Action Task Force entrapped within hypocrisy and rhetoric: Using India as a case study". *Asia Pacific Law Review*, v. 31, n. 2, 2023, pp. 402-427. <https://doi.org/10.1080/10192557.2023.2181757>

²³ HOEKMAN, B.M., and MAVROIDIS, P.C. "Plurilateral agreements, multilateralism and economic development". *The Journal of World Investment & Trade*, v. 26, n. 1-2, 2025, pp. 31-53. <https://doi.org/10.1163/22119000-12340351>

²⁴ THOMMANDRU, A., and MARATOVICH, F. F. "Leveraging new emerging technologies to enhance the anticorruption arsenal: Assimilating India's experiential insights into Uzbekistan's

demonstrate that technologies such as the Digital India mission and the Unified Payments Interface (UPI) can significantly enhance transparency and accountability, provided they are supported by robust institutional capacity and political commitment. However, the authors caution that the effectiveness of these tools depends on their adaptation to the local legal and cultural context—a consideration that is particularly relevant for transitional economies like Ukraine, where institutional fragmentation often undermines technological potential.

Similarly, Thommandru and Chakka²⁵ explore the application of AI, machine learning, and RegTech in overcoming persistent AML challenges, arguing that technological innovation alone is insufficient without corresponding procedural reforms. Their analysis highlights how intelligent monitoring systems can reshape the detection of suspicious activities, yet they also acknowledge the risk of creating new forms of algorithmic opacity and regulatory arbitrage. This duality reinforces our study's emphasis on the need for an integrated enforcement chain that combines technological advancement with institutional effectiveness, particularly in jurisdictions where "symbolic compliance" may mask weak enforcement outcomes.

In terms of technological challenges, the study by Renda and Caneppele²⁶ is particularly valuable, highlighting the "symbolic compliance" phenomenon and using Switzerland as an example. The authors demonstrate that a high level of technical compliance can coexist with low effectiveness in detecting criminal practices. Consequently, such a situation suggests a prioritization of formal procedural adherence over actual criminology results. Further, this line of argument is strengthened by Nazzari and Reuter's²⁷ findings. The researcher analyzed the case in the context of the United States illustrating a clear divergence between the legal norms and their practical effectiveness in combating crime. Also, an essential analytical contribution is provided by the comparative study of Pandey²⁸, which links the effectiveness of financial intelligence units with the capacity of individual jurisdictions. That said, the systematization of these approaches enables us to classify key sources according to their functional role within the structure of the study's evidentiary base (Table 1).

criminoverse". *Multidisciplinary Reviews*, v. 7, n. 3, 2024, pp. 2024058. <https://doi.org/10.31893/multirev.2024058>

²⁵ THOMMANDRU, A., and CHAKKA, B. "Banking's new frontier: Overcoming anti-money laundering challenges with innovative technology", *International Journal of Intellectual Property Management*, v. 14, n. 4, p. 325-341, 2024. <https://doi.org/10.1504/IJIPM.2024.139658>

²⁶ RENDA, A., and CANEPELE, S. "Compliant or not compliant? The challenges of anti-money laundering regulations in crypto assets: The case of Switzerland". *Journal of Money Laundering Control*, v. 27, n. 2, 2024, pp. 363-382. <https://doi.org/10.1108/JMLC-04-2023-0078>

²⁷ NAZZARI, M., and REUTER, P. "How well does the money laundering control system work?". *Crime and Justice*, v. 54, n. 1, 2025, pp. 67-152. <https://doi.org/10.1086/735665>

²⁸ PANDEY, D. "A comparative analysis of the FIUs and FATF compliance of Canada, Australia, The Netherlands and India". *Journal of Money Laundering Control*, v. 27, n. 5, 2024, pp. 886-900. <https://doi.org/10.1108/JMLC-09-2023-0155>

Table 1. Systematization of theoretical sources according to content areas and their relevance to the current work.

Category of analysis	Key authors and sources	Functional role in the article
Regulatory basis and global indicators	Financial Action Task Force ²⁹ , ³⁰ , Basel Institute on Governance, ³¹ United Nations Office on Drugs and Crime, ³² Coincub ³³	Defining comparison parameters and providing verified international statistics
The theory of "Implementation Gap" and symbolic compliance	Pavlidis (2023), Renda and Caneppele (2024), Nazzari and Reuter (2025), Pandey (2024), Gaviyau and Sibindi (2023), International Monetary Fund (2023).	Justification of hypotheses regarding the gap between legal form and criminological outcome
Digital adaptation of crime (Crime Displacement)	Chainalysis (2025), Nizovtsev et al. (2022), Orobets et al. (2025), Tavalzhanskyi et al. (2025).	Providing an evidence base for analyzing capital shifts into decentralized sectors
Institutional context and national reforms	Cherniavskyi et al. (2019), Kravtsov et al. (2024), Yim and Lee (2018).	Formation of the historical and political background for analyzing the Ukrainian case

Source: Consolidated by the authors.

Moving from global tendencies to regional specifics, it is worth noting that Ukrainian academic discourse is currently being transformed under the influence of European integration processes. Hence, the conceptual basis to perceive the levels and forms of international cooperation in the issue of combating crime are outlined in the works of Cherniavskyi et al.³⁴ These issues are further elaborated in the study of Kravtsov et al.,³⁵ specifically in the context of anti-corruption reforms, presenting a fundamental stage in the AML system's development. The authors emphasize that digitalization alone is insufficient to overcome existing institutional barriers. Hence, technological modernization in this regard should be viewed first and foremost as an instrumental tool rather than an independent driver of systemic change.

²⁹ FINANCIAL ACTION TASK FORCE. "International standards on combating money laundering and the financing of terrorism proliferation: The FATF recommendations (updated October 2025)". *FATF*, 2025a. Available at: <https://www.fatf-gafi.org/content/dam/fatf-gafi/recommendations/FATF%20Recommendations%202012.pdf.coredownload.inline.pdf> (accessed on 20 July 2026).

³⁰ FINANCIAL ACTION TASK FORCE. "Targeted update on virtual assets and VASPs". *FATF*, 2025b. Available at: <https://www.fatf-gafi.org/en/publications/Fatfrecommendations/targeted-update-virtual-assets-vasps-2025.html> (accessed on 20 July 2026).

³¹ BASEL INSTITUTE ON GOVERNANCE. "Basel AML Index 2025: 14th public edition. Global money laundering and financial crime risk ranking". 2025. Available at: <https://baselgovernance.org/sites/default/files/2025-12/Basel%20AML%20Index%202025.pdf> (accessed on 20 July 2026).

³² UNITED NATIONS OFFICE ON DRUGS AND CRIME. *World Drug Report 2023*. 2023. Ibid.

³³ COINCUB. "Lithuania VASP update: The new €125,000 capital requirement". 2025. Available at: <https://coincub.com/blog/lithuania-vasp-update> (accessed on 20 July 2026).

³⁴ CHERNIAVSKYI, S. S., HOLOVKIN, B. M., CHORNOUS, Y. M., BODNAR, V. Y., and ZHUK, I. V. "International cooperation in the field of fighting crime: Directions, levels and forms of realization". 2019. Ibid.

³⁵ KRAVTSOV, S., OROBETS, K., SHYSHPANOV, N., VOVCHENKO, O., and BEREZOVSKA-CHMIL, O. "Progress and challenges in combating corruption in Ukraine: Pathways forward". 2024. Ibid.

As a separate line of research, researchers address the legal regulation of virtual assets. This vector is examined in detail by Nizovtsev et al.³⁶ Next, the issues related to the legislative classification of cryptocurrency-related offenses, as well as the application of Big Data technologies, are explored in the works of Orobets et al.³⁷ and Tavalzhanskyi et al.³⁸ Overall, to attain an effective balance between transparency and privacy in the digital environment tends to remain a key challenge and thus calls for further scholarly attention. When it comes to the Ukrainian context, it demonstrates significant potential for innovative development. However, the absence of a unified national strategy plays its role in stagnation of modernization processes.

3. Research framework

The purpose of this study is to determine the impact of institutional capacity on the criminological effectiveness of AML mechanisms and to identify the conditions under which adaptive crime strategies emerge in response to regulatory pressure. To achieve this, a comparative analysis of four jurisdictions (Ukraine, Lithuania, Germany, Singapore) is conducted, employing quantitative methods including regression analysis, clustering, and flow modeling. To achieve this purpose, the following research tasks were formulated:

- to develop and test an integral indicator for the mathematical assessment of the gap between formal compliance and the actual functional capacity of national anti-corruption systems;
- to conduct out a quantitative evaluation of the loss of analytical information at the stages of transition from financial monitoring to judicial proceedings by constructing a digital model of the justice funnel;
- to verify the mechanisms of adaptive redistribution of shadow capital into decentralized financial protocols as a response to the strengthening of traditional banking supervision.

In addition, the following research questions are consistently addressed:

RQ1: How does international pressure from the FATF translate into national reforms in jurisdictions with different levels of political stability and institutional development?

RQ2: What is the nature of the gap between the formal implementation of standards (*de jure*) and the actual criminological indicators of confiscation of criminal assets (*de facto*)?

RQ3: How does the strengthening of legal restrictions influence the evolution of criminal activity patterns, and does it lead to relocating the capital into unregulated digital sectors?

To test these questions during the research, the following hypotheses were set forth:

H1: In developed financial centers, a high level of technical compliance is often accompanied by “symbolic compliance,” which conceals the low effectiveness of the actual detection of criminal schemes.

H2: In transitional economies, the implementation of international norms is fragmented, resulting in separate zones of effectiveness without a overall reduction in the scale of shadow economic activity.

³⁶ NIZOVITSEV, Y. Y., PARFYLO, O. A., BARABASH, O. O., KYRENKO, S. G., and SMETANINA, N. V. “Mechanisms of money laundering obtained from cybercrime: The legal aspect”. 2022. Ibid.

³⁷ OROBETS, K., SHKOLNIKOV, V., BATRACHENKO, T., BARANOVSKA, T., and SEREDA, V. “Legislative categorization of crimes committed with the help of cryptocurrencies”. 2025. Ibid.

³⁸ TAVOLZHANSKYI, O., SHUMEIKO, O., BURDA, O., OROBETS, K., and STRUCHAIEV, M. “Using big data in criminal investigations: Between privacy and efficiency”. 2025. Ibid.

H3: Strict regulation of the traditional banking sector stimulates the professional adaptation of criminal groups through the use of decentralized financial instruments and virtual assets.

4. Methodology of research

4.1 Design and overall strategy of scientific inquiry

The research is based on multi-case comparative design, which ensures methodological triangulation of quantitative and qualitative indicators within a convergent parallel model. The logic of the research lies in the critical comparison of normative compliance (*de jure*) with the actual criminological effectiveness of law enforcement (*de facto*). This integrates analytical tools from rational choice theory to assess the impact of legal norms on the dynamics of shadow capital. The procedural architecture encompasses three interdependent phases: normative legal screening, institutional audit, and criminological verification of results (Figure 1). The verification of hypotheses is carried out through statistical testing at a significance level of $p < 0.05$ using Python libraries (statsmodels, scikit-learn) and visualization (Plotly).

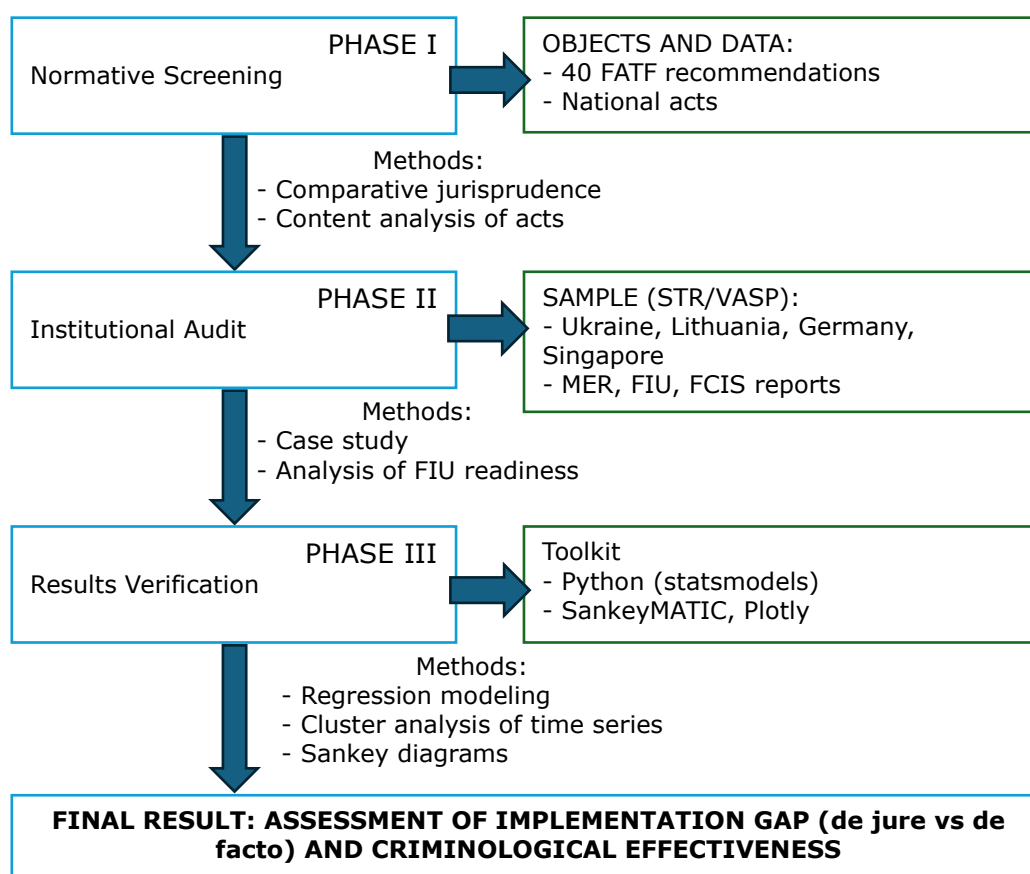


Figure 1. Procedural structure and research stages.

Source: Elaborated by the authors.

4.2 Parameterization of research objects and sample characteristics

The sample formation is subordinated to the goal of maximum theoretical validity through the method of maximum deviation. The general population of the study consists of national AML systems of FATF member countries (40 jurisdictions, including 38 member countries and two regional organizations - the European

Commission and the Gulf Cooperation Council). The sample was formed from AML systems of four countries, namely: Ukraine, Lithuania, Germany, Singapore. The main criteria for selecting the four countries of the mentioned systems were a high level of integration into the global financial infrastructure and the availability of regular mutual evaluation reports on compliance with the organization's standards. The sample included jurisdictions that demonstrate polar models of digital transformation and institutional stability to ensure the objectivity of the comparative analysis. As an additional criterion, the representativeness of legal systems representing different geographical regions and types of legal families were chosen. Case selection was further guided by the presence of reliable and accessible statistical data on the effectiveness of asset confiscation and the volume of virtual currency usage. The analytical coverage spans the period of 2024–2025, during which the total volume of aggregate data on suspicious transactions reaches tens of millions of STR globally, focusing on 3 million annual records in the jurisdictions under study. The empirical foundation of the study relies on verified open-source materials, including publications from financial intelligence units: reports from FIU, FATF/MONEYVAL, Basel AML Index 2025, and Chainalysis 2025.

The first case focuses on Ukraine's national system, reflecting a crisis-driven transformation under conditions of martial law. Its empirical basis includes quarterly publications from the State Financial Monitoring Service, which document more than 1.2 million suspicious activity signals annually, along with findings from the third national risk assessment.³⁹ Lithuania represents the next element of the sample, illustrating the advanced digital integration of a post-Soviet country within the EU legal environment. The analysis draws on data from the Financial Crime Investigation Service (FNIT)⁴⁰ and encompasses a segment of roughly 345 to 625 registered virtual asset service providers (VASPs), based on information from FCIS and the Registry Center. Germany constitutes the more conservative segment of the sample, where attention is given to the multi-tiered institutional framework involving BaFin and the national Financial Intelligence Unit. The empirical dataset includes statistics on 265,708 suspicious activity reports recorded in 2024. The final case is Singapore, positioned as a highly technocratic and innovation-oriented jurisdiction. Its evaluation emphasizes the effectiveness of algorithm-driven transaction monitoring, utilizing the data from the COSMIC platform.⁴¹ This system integrates major commercial banks and enables near real-time assessment of RegTech applications.

4.3 Methods of statistical processing and interpretation of results

The results were analyzed using multivariate statistical techniques, following Field's approach.⁴² Hypotheses were tested through multiple linear regression. Due to the small sample ($n=4$ countries), regression results are exploratory and illustrate associations rather than confirm causal relationships. In this model, the dependent variable is the volume of confiscated assets, while the independent variables include institutional capacity and the degree of digitalization. The composite performance

³⁹ STATE FINANCIAL MONITORING SERVICE OF UKRAINE. "Annual report of the State Financial Monitoring Service of Ukraine for 2023". 2023. Available at: https://fiu.gov.ua/assets/userfiles/200/Activity%20reports/Report_2023_ENG.pdf (accessed on 20 July 2026).

⁴⁰ FINANCIAL CRIME INVESTIGATION SERVICE (FCIS). Official website, n.d. Available at: <https://fnit.lrv.lt/en/> (accessed on 20 July 2026).

⁴¹ MONETARY AUTHORITY OF SINGAPORE. "COSMIC: Collaborative sharing of money laundering / terrorism financing information cases (platform overview)". 2024. Available at: <https://www.mas.gov.sg/news/media-releases/2024/mas-launches-cosmic-platform> (accessed on 20 July 2026).

⁴² FIELD, A. *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications, 2018. Available at: <https://surl.lu/cmqrza> (accessed on 20 July 2026).

indicator (E) is calculated according to the following formula:

$$E = (108 \times 0.6) + (\text{Confiscation}/\text{STR} \times 0.4) \quad (1)$$

The IO8 variable is used as a numerical equivalent for the FATF Immediate Outcome 8 effectiveness rating reported in mutual evaluation reports. This indicator is obtained by converting qualitative descriptors from international experts into numerical values to make mathematical modeling possible. The weighting scheme (0.6 and 0.4) reflects FATF priorities, where practical effectiveness is considered more important than formal procedural compliance. Accordingly, a weight of 0.6 is assigned to external evaluations of confiscation outcomes as a core measure of system performance, while 0.4 captures the internal efficiency of converting suspicious transaction reports into court decisions.

The “loss of analytical energy” coefficient represents the share of cases that lose procedural relevance as they move through different stages of the justice process. This process is illustrated using Sankey diagrams, which help to identify bottlenecks and points where institutional resistance is most pronounced.

To ensure the robustness of the findings, several diagnostic checks were conducted. Multicollinearity among independent variables was excluded using the variance inflation factor (VIF). The Durbin-Watson test confirmed that residuals are not affected by autocorrelation, ensuring the statistical reliability of the model’s results.

The hypothesis of adaptive shifting of shadow capital was checked using the k-means clustering algorithm.⁴³ This method was selected to group jurisdictions objectively based on similarities in how financial crime changes under digital transformation. The clustering variables include growth in stablecoin transactions and stringency of banking oversight. The analysis identifies three stable clusters of legal systems. The first group, described as “traditional compliance,” includes jurisdictions with conservative financial sectors, with Germany serving as a reference case. The second group, a “transitional model,” reflects systems marked by procedural rigidity alongside elevated risk conditions, as seen in Ukraine. The third cluster, named a “high-shifting zone,” includes Singapore and Lithuania, where there is a more noticeable movement of illegal assets into decentralized financial ecosystems. The received classification creates a structured basis for comparing the effectiveness of anti-corruption tools across different technological and institutional contexts. The regression model uses confiscated assets (USD million) as the dependent variable, while institutional capacity (FATF IO8 score) and digitalization (share of crypto transactions) are independent variables.

4.4 Data collection tools and analytical units

The core evidence base is drawn from Mutual Evaluation Reports as well as progress reports published by FATF and MONEYVAL.⁴⁴ Additional data comes from the Basel AML Index 2025,⁴⁵ which supports cross-country comparisons of governance quality and exposure to corruption risks. The trending dynamics in virtual asset activity are examined using data from specialized analytical platforms such as

⁴³ HASTIE, T., TIBSHIRANI, R., and FRIEDMAN, J. *The elements of statistical learning: Data mining, inference, and prediction* (2nd ed.). Springer, 2009. <https://doi.org/10.1007/978-0-387-84858-7>

⁴⁴ FINANCIAL ACTION TASK FORCE. “Consolidated processes and procedures for mutual evaluations and follow-up: Universal procedures (updated June 2025)”. FATF, 2025. Available at: <https://www.fatf-gafi.org/en/publications/Mutualevaluations/Universal-Procedures-2023.html> (accessed on 20 July 2026).

⁴⁵ BASEL INSTITUTE ON GOVERNANCE. “Basel AML Index 2024: Status of money laundering risks around the world”. 2024. <https://baselgovernance.org/resources/publications/basel-aml-index-2024/> (accessed on 20 July 2026).

Chainalysis⁴⁶ and TRM Labs. The above tools make it possible to identify activity linked to darknet marketplaces and anonymized services.

Key analytical indicators include the proportion of illegal financial flows in total transaction volumes. In addition, the study considered the geographic distribution of fiat exit points. Apart from that, official reports from financial intelligence units (FIUs) were analyzed, particularly the data on the number of suspicious transaction reports (STRs). Additional data included the volume of frozen or confiscated assets and the convictions rate.^{47,48} A specialized descriptive visualization tool, SankeyMATIC, was used to generate graphical models and ensure the accuracy of flow scaling (access via the link: <https://sankeymatic.com/build/>).

4.5 Ethical aspects and limitations of the study

The analysis is based exclusively on aggregated data, without utilizing the raw, personalized identifiable STR information, in line with GDPR and PDPA requirements, as well as restrictions due to the martial law in Ukraine. No primary interviews were conducted, thus avoiding potential risks related to privacy or confidentiality violation. The potential *bias* of the state of martial law context is considered through a cautious and careful interpretation of the findings. Transparency and reproducibility are ensured by using open-source materials, though it also means that access to detailed internal operational data from institutions remains limited.

5. Results

To test the hypothesis about the gap between formal norms and actual results, a comparative analysis of global indices was conducted (Table 2). The period of 2024–2025 is covered by empirical basis, allowing for the tracking of institutional transformation dynamics before and after global crisis phenomena. The study draws on comparing the Basel AML Index risk assessments with the indicators of FATF's immediate effectiveness (Immediate Outcome 8). Hence, a significant relationship between the risk level is confirmed by the applied multiple linear regression according to Basel as well as the law enforcement effectiveness: $\beta = -0.45$, $p = 0.012$, $R^2 = 0.62$.

Table 2. Comparison of Basel 2025 risks and normalized effectiveness (IO8).

Country	Basel risk score	Global position	FATF IO8 (norm.)	Seizure assessment	Gap level
Ukraine	5.38	81	5 (Moderate)	Low (< 1.5%)	High
Lithuania	4.03	158	8 (Substantial)	Moderate (6.2%)	Low
Germany	4.97	103	8 (Substantial)	Moderate (4.1%)	Medium
Singapore	~4.75	~100	10 (High)	High (12.8%)	Minimum

Note: * IO8 Normalization scale: HE=9–10; SE=7–8.5; ME=4–6; LE=0–3 (adapted according to FATF methodology).

** Estimated assessment based on consolidated MER/FIU data.

⁴⁶ CHAINALYSIS. 2025 Crypto Crime Report. 2025. Available at: <https://go.chainalysis.com/2025-Crypto-Crime-Report.html> (accessed on 20 July 2026).

⁴⁷ FINANCIAL INTELLIGENCE UNIT GERMANY. "Financial intelligence unit 2024 annual report". 2025. Available at: https://www.zoll.de/SharedDocs/Downloads/DE/Links-fuer-Inhaltseiten/Fachthemen/FIU/fiu_jahresbericht_2024_en.pdf?__blob=publicationFile&v=2 (accessed on 20 July 2026).

⁴⁸ STATE FINANCIAL MONITORING SERVICE OF UKRAINE. "Annual report of the State Financial Monitoring Service of Ukraine for 2023". 2023. Ibid.

Source: Basel AML Index,⁴⁹ FATF MER Germany,⁵⁰ FATF Singapore MER,⁵¹ MONEYVAL Lithuania FUR,⁵² SFMS Ukraine.⁵³

As can be seen, the data presented in the table point to substantial differences in outcomes among countries with varying levels of institutional development. Ukraine features the highest level of “implementation gap”, which can be associated with the constraints of martial law and delays within judicial procedures. On the other hand, the case of Singapore illustrates how this gap can be reduced through utilizing the advanced, real-time monitoring techniques.

The second stage of the analysis shifts attention to the operational capacity of national financial intelligence units, which were assessed through quantitative indicators (Table 3). A central metric is the relationship between the number of submitted suspicious transaction reports (STRs) and the value of assets actually frozen. To ensure consistency across results, all monetary figures are standardized in US dollars (USD) utilizing weighted average exchange rates for the relevant period. This approach makes it possible to detect the “over-reporting” phenomenon, where large volumes of reports may cover a relatively low analytical or enforcement effectiveness.

Table 3. FIU performance indicators and volume of freezes (2024-2025).

Jurisdiction	Number of STR	Frozen assets (million USD)	% crypto/VASP	H2 verification
Ukraine	1,432,684	201.4	14%	Confirmed
Lithuania	82,300	unpublished (FCIS)	32%	Rejected
Germany	265,708	20.3	3.2%	Partially
Singapore	unpublished	record-breaking	21%	Rejected

Note: 1 US dollar (USD) = 43.9497 hryvnia (UAH) (official exchange rate of the National Bank of Ukraine, established on the date of writing the article).
Source: SFMS Ukraine,⁵⁴ FIU Germany,⁵⁵ FCIS Lithuania,⁵⁶ MAS Singapore.⁵⁷

The analysis highlights institutional fragmentation within Ukraine’s AML system, where a high volume of reported signals translates into relatively limited outcomes. Lithuania, by contrast, reflects a more balanced approach, combining a smaller inflow of data with a comparatively strong detection rate, particularly in the crypto-asset sector. The German case illustrates the challenges of “symbolic compliance”, where large reporting obligations are not always matched by in-depth investigatory power.

To normalize cross-country comparability and ensure comparability of different legal systems, an original composite indicator of effectiveness was introduced (Table 4). This formula integrates both process-oriented assessments (IO8) and enforcement outcomes, specifically the successfully confiscated share of assets. The calculation relies on weighted averages, reducing the influence of statistical

⁴⁹ BASEL INSTITUTE ON GOVERNANCE. “Basel AML Index 2025: 14th public edition. Global money laundering and financial crime risk ranking”. 2025. Ibid.

⁵⁰ FINANCIAL ACTION TASK FORCE. “Consolidated processes and procedures for mutual evaluations and follow-up: Universal procedures (updated June 2025)”. *FATF*, 2025. Ibid.

⁵¹ Ibid.

⁵² Ibid.

⁵³ STATE FINANCIAL MONITORING SERVICE OF UKRAINE. “Annual report of the State Financial Monitoring Service of Ukraine for 2023”. 2023. Ibid.

⁵⁴ Ibid.

⁵⁵ FINANCIAL INTELLIGENCE UNIT GERMANY. “Financial intelligence unit 2024 annual report”. 2025. Ibid.

⁵⁶ COINCUB. “Lithuania VASP update: The new €125,000 capital requirement”. 2025. Ibid.

⁵⁷ MONETARY AUTHORITY OF SINGAPORE. “COSMIC: Collaborative sharing of money laundering / terrorism financing information cases (platform overview)”. 2024. Ibid.

distortions and ensuring a more stable comparison across different legal and institutional contexts.

Table 4. Values of integral effectiveness (E) according to the methodology.

Country	IO8 Indicator	STR Conversion (%)	Value E	Model type
Ukraine	5.0	1.5 (low)	3.6	Symbolic
Lithuania	8.0	6.2 (medium)	7.3	Functional
Germany	8.0	4.1 (medium)	6.4	Traditional
Singapore	10.0	12.8 (high)	8.5	Technocratic

Source: Elaborated by the authors.

A clear differentiation of the analyzed systems in terms of their functional performance is provided by the calculated values of the E index. Singapore stands out with the highest level of technocratic efficiency, largely due to integrating artificial intelligence into supervisory processes. In contrast, the results for Ukraine point to an urgent need to move beyond the formal data accumulation to developing a comprehensive chain of enforcement.

The final part of the analysis tests the hypothesis that financial crime adapts to increasing regulatory pressure in the banking sector (see Table 5). These figures reflect global trends and are not disaggregated by the four specific jurisdictions. This part relies on analytical reports from Chainalysis,⁵⁸ focusing on utilizing the virtual assets in illicit activities. Particular emphasis is placed on the shifting of capital into decentralized finance (DeFi) instruments and stablecoins. Using time-series clustering through the k-means algorithm, three groups of jurisdictions were identified. The first group, "traditional compliance", is represented by Germany. The second, a "transitional model", characterizes Ukraine. The third group, described as a "high-shift zone", comprises Singapore and Lithuania. In the latter countries, there is a more noticeable migration of illicit financial flows into decentralized financial systems.

Table 5. Shifts in illicit crypto volumes according to Chainalysis 2025.

Indicator	2024 (billion USD)	2025 (billion USD)	Year-over-year growth	Correlation (r)
Illicit volume (total)	~51	~154	+202%	0.74 (p<0.05)
Sanctions evasion	~15	~104	+694%	0.82 (p<0.01)
Illicit stablecoins	63%	84%	+21%	0.89 (p<0.01)

Note: * Data for conversion flows are based on aggregate estimates from MER and FIU reports. Source: Elaborated by the authors.

The statistical data show an increasing enhancement of illicit financial activity, in particular through adopting blockchain-based tools. A strong positive relationship between the intensity of banking supervision and the expansion of stablecoin transactions suggests a substitution effect. In this case, traditional channels of money laundering are replaced. The high correlation coefficient ($r = 0.89$) suggests that stricter regulation in the banking sector is associated with shifting the assets into stablecoin mechanisms (see Chainalysis, 2025, for global transaction data).

To foster the understanding of the "implementation gap", the flow of suspicious transaction reports was modeled across the full process, from initial detection to final asset confiscation (Figure 2). This visualization draws on combined data from national financial intelligence unit reports and judicial statistics for the period of 2024–2025. The presented model highlights key systemic "bottlenecks", indicating the stages at

⁵⁸ CHAINALYSIS. 2025 Crypto Crime Report. 2025. Ibid.

which the most significant losses of evidentiary value and analytical capacity takes place.

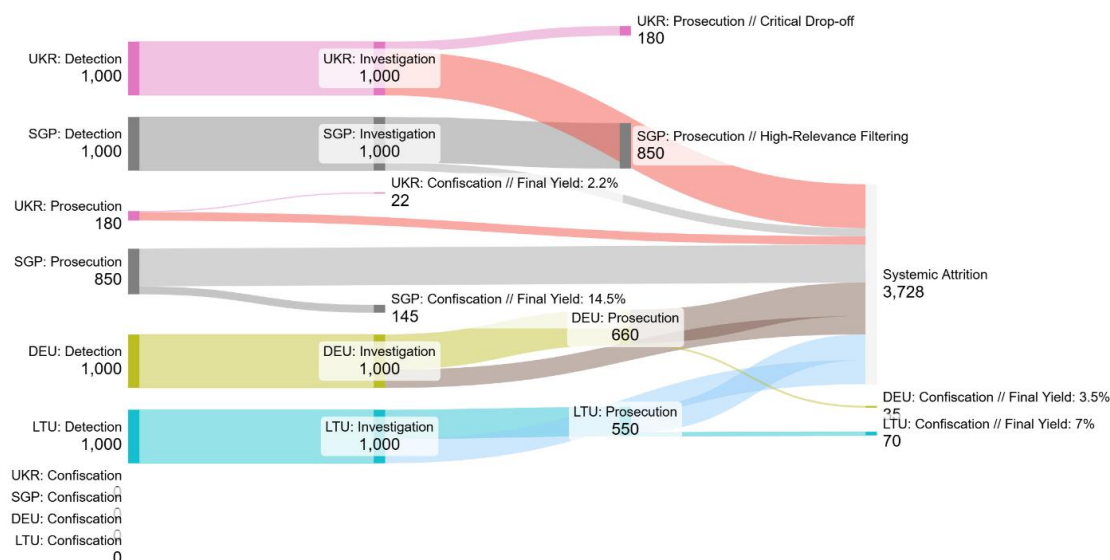


Figure 2. Comparative diagram of the justice process: the effectiveness of converting suspicious transaction reports (STR) into confiscation.

Source: Elaborated by the authors based on research findings.

Figure 2 shows the “implementation gap” across four jurisdictions. The flow of suspicious transaction reports (STR = 100%) is traced through successive stages, including preliminary financial review (PFR), criminal investigation and court proceedings. At each stage, losses in case volume reflect the attrition of evidentiary and analytical capacity in the enforcement chain. In Ukraine (red), the model shows a pronounced structural bottleneck during the transfer of cases to investigative authorities, and here an estimated 82% loss of analytical output occurs. By contrast, Singapore (grey) demonstrates the most efficient process, supported by AI-driven COSMIC screening, with a final confiscation rate reaching 14.5%. Germany (yellow) and Lithuania (blue) take intermediate positions: Germany, in particular, experiences notable constraints at the judicial stage, to a large extent associated with evidentiary requirements related to prior offenses.

Overall, the results confirm a substantial institutional gap within Ukraine’s AML system, with the most significant loss taking place before formal investigation. The noted correlation ($r = 0.89$) between stricter conventional banking supervision and the migration of illicit capital into decentralized financial instruments is traced across the dataset. Taken together, these patterns suggest that traditional supervisory frameworks tend to be insufficient in isolation, thus highlighting the relative effectiveness of technologically advanced SupTech approaches, as exemplified by the Singapore model.

6. Discussion

6.1 Verification of institutional fragmentation and the “implementation gap”

The findings point to a persistent structural gap between formal alignment with FATF standards and their actual criminological effectiveness in practice. This divergence is particularly evident in Ukraine, where a substantial deterioration of evidentiary value occurs already at the pre-trial investigation stage. The underlying issue relates to weak mechanisms for transforming analytical outputs from financial

intelligence units into relevant materials for criminal proceedings. As Feridun⁵⁹ argues, under conditions of martial law, the gap between regulatory compliance and enforcement effectiveness is likely to widen, as state priorities shift toward security objectives.

A similar pattern of institutional fragmentation of anti-corruption tools is explored by Kravtsov et al.⁶⁰, who emphasize the consistently low conversion rate of suspicious transaction reports into actionable enforcement outcomes. The problem is not the lack of analytical signals, but rather the excessive bureaucratic complexity governing information exchange between monitoring bodies and investigative authorities. These procedural inefficiencies are further aggravated by legal uncertainty in utilizing Big Data technologies under strict data protection requirements. In this context, Tavalzhanskyi et al.⁶¹ note that such constraints become decisive in jurisdictions experiencing deep institutional strain or systemic crisis.

6.2 The phenomenon of "symbolic compliance" in developed financial hubs

Evidence from stable economies suggests the presence of "symbolic compliance", where high formal assessments of regulatory adherence may conceal weaker real-world enforcement capacity. In countries such as Germany and Singapore, strong compliance can operate as a procedural shield, making it more difficult to trace complex cross-border money laundering schemes. Notably, Renda and Caneppele⁶² maintain that an overemphasis on formal reporting mechanisms may produce a false sense of security, while still leaving opportunities for laundering networks. Likewise, Gilsinan et al.⁶³ highlight broader systemic inertia across major global financial hubs. At the same time, Singapore's technocratic approach remains a promising model, although its full effectiveness relies on introducing stronger validation standards for incoming data. Without such safeguards, there is a risk that algorithmic processes could produce errors in judicial and enforcement decision-making.

6.3 Crime displacement and legal adaptation to new financial threats

Statistical evidence showing in illicit transactions a growing proportion of stablecoins suggests that criminal activity is adapting to tighter banking regulation. This shift of capital into digital assets is in line with the arguments of Wronka⁶⁴ and Prendi et al.⁶⁵ who describe cryptocurrencies as an increasingly important mechanism for bypassing conventional financial controls. In practice, to construct decentralized money laundering structures, criminal networks exploit regulatory gaps in governing

⁵⁹ FERIDUN, M. "Perceptions on jurisdiction risk: A cross-country analysis". *Journal of Money Laundering Control*, v. 27, n. 3, 2024, pp. 548-558. <https://doi.org/10.1108/JMLC-05-2023-0089>

⁶⁰ KRAVTSOV, S., OROBETS, K., SHYSHANOVA, N., VOVCHENKO, O., and BEREZOVSKA-CHMIL, O. "Progress and challenges in combating corruption in Ukraine: Pathways forward". 2024. Ibid.

⁶¹ TAVOLZHANSKYI, O., SHUMEIKO, O., BURDA, O., OROBETS, K., and STRUCHAIEV, M. "Using big data in criminal investigations: Between privacy and efficiency". 2025. Ibid.

⁶² RENDA, A., and CANEPPELE, S. "Compliant or not compliant? The challenges of anti-money laundering regulations in crypto assets: The case of Switzerland". 2024. Ibid.

⁶³ GILSINAN, J. F., FISHER, J. E., ISLAM, M. Q., ORDOWER, H. M., and SHAHIN, W. "The contagion of corruption: A model for understanding systemic ethical failures". *Journal of Financial Crime*, v. 30, n. 5, 2023, pp. 1208-1219. <https://doi.org/10.1108/JFC-02-2023-0021>

⁶⁴ WRONKA, C. "Money laundering through cryptocurrencies – analysis of the phenomenon and appropriate prevention measures". *Journal of Money Laundering Control*, v. 25, n. 1, 2022, pp. 79-94. <https://doi.org/10.1108/JMLC-02-2021-0017>

⁶⁵ PRENDI, L., BORAKAJ, D., and PRENDI, K. "The new money laundering machine through cryptocurrency: Current and future public governance challenges". *Corporate Law and Governance Review*, v. 5, n. 2, 2023, pp. 84-91. <https://doi.org/10.22495/clgrv5i2p9>

of virtual assets. In addition, Popik-Mazur⁶⁶ further emphasizes the difficulty of effectively regulating these latent financial flows under contemporary market conditions.

From a criminological perspective, this adaptation manifests through several distinct mechanisms. First, "chain hopping" involves rapidly swapping cryptocurrencies across multiple blockchains to obscure transaction trails, exploiting interoperability gaps between different virtual asset service providers (VASPs). Second, "mixers" and "tumblers" pool together funds from multiple users to break the direct link between sender and recipient; despite regulatory action against platforms like Tornado Cash, decentralised alternatives continue to operate. Third, privacy coins (e.g., Monero, Zcash) offer built-in obfuscation features that make transaction tracing technically challenging even for advanced blockchain analytics. Fourth, decentralised finance (DeFi) protocols enable peer-to-peer lending and swapping without traditional identity verification, allowing criminals to bypass know-your-customer (KYC) requirements entirely. Fifth, the use of stablecoins pegged to fiat currencies has become the preferred vehicle for parking and moving illicit proceeds, as their price stability reduces transactional risk compared to volatile cryptocurrencies. These mechanisms collectively illustrate a professionalised criminal adaptation that mirrors legitimate financial innovation, creating a continuous "arms race" between regulators and offenders.

Crime displacement here is driven by regulatory arbitrage, lower detection risk in DeFi, and faster cross-border settlement speeds. Full data on virtual asset criminal proceedings remain lacking, which limits causal inference. Nevertheless, the strong correlation ($r = 0.89$) between banking supervision and stablecoin illicit flows provides sufficient grounds to recommend procedural countermeasures.

That being said, the development of intelligent anomaly detection systems^{67, 68} has appeared as a key component of modern enforcement strategies. However, these tools primarily reshape the dynamics of detection rather than eliminating underlying causes of illegal activity. In fact, automation in supervision does not address the roots of financial crime and may instead encourage more versatile forms of digital mimicry and behavioural adaptation. In this light, Saenz and Lewer⁶⁹ caution against focusing exclusively on new digital channels and argue that traditional methods of legalization continue to play an important role. Taken together, the evidence points to a multi-layered adaptive structure of the shadow economy, rather than a linear transition to digital forms of laundering.

6.4 Verification of hypotheses, limitations and practical significance of the findings

The study fully confirmed the hypothesis H1 regarding the existence of a significant institutional gap in transitional economies, as well as hypothesis H2, which assumed the adaptive relocation of illicit financial flows into the DeFi sector.

⁶⁶ POPIK-MAZUR, A. "A systematic literature review of illicit financial flows and money laundering: Current state of research and estimation methods". *Journal of Economics and Management*, v. 47, n. 1, 2025, pp. 257-298. <https://doi.org/10.22367/jem.2025.47.11>

⁶⁷ YANG, G., LIU, X., and LI, B. "Anti-money laundering supervision by intelligent algorithm". *Computers and Security*, v. 132, 2023, pp. 103344. <https://doi.org/10.1016/j.cose.2023.103344>

⁶⁸ POCHER, N., ZICHICHI, M., MERIZZI, F., SHAFIQ, M. Z., and FERRETTI, S. "Detecting anomalous cryptocurrency transactions: An AML/CFT application of machine learning-based forensics". *Electronic Markets*, v. 33, n. 1, 2023. <https://doi.org/10.1007/s12525-023-00654-3>

⁶⁹ SAENZ, M., and LEWER, J. J. "Estimates of trade based money laundering within the European Union". *Applied Economics*, v. 55, n. 51, 2023, pp. 5991-6003. <https://doi.org/10.1080/00036846.2022.2141444>

From a practical perspective, the findings are relevant for national regulators, financial intelligence units and policymakers taking part in the modernizing the AML frameworks. In particular, the obtained results may support the improvement of risk-based supervision tools through incorporating the indicators tracking an anomalous blockchain activity. Further, the developed evaluation framework enables a shift in enforcement practice from quantitative reporting indicators towards qualitative measures for actual asset recovery.

At the same time, the study is subject to several limitations. These primarily relate to the lack of fully verified datasets of criminal proceedings on virtual assets for the 2024–2025 period. The restricted accessibility of detailed FIU-level statistics in jurisdictions such as Lithuania and Singapore limits the possibility of conducting a fully comprehensive comparative analysis, particularly in terms of direct conversion rate from suspicious transaction reports to confiscated assets. Another constraint arises from the periodic nature of FATF assessments, which reflect system performance only at certain points of time rather than a continuous dynamics. Furthermore, when expressed in US dollar terms, fluctuations in cryptocurrency prices introduce variability in the valuation of frozen assets which may affect comparability.

The theoretical significance of this study lies in elaborating on the concept of “crime displacement”, which describes the shifting trajectories of financial crime within the global regulatory architecture. The proposed “justice gap” model proposes an analytical framework for explaining the limited effectiveness of traditional regulatory instruments in digital environments. On the whole, the findings provide a basis for further interdisciplinary research at the intersection of criminology, economics and computer science.

6.5 Recommendations for implementing the obtained results

Drawing on the evidence from Section 5 (Tables 2-4 and Figure 2), each recommendation directly addresses a documented shortcoming. First, delayed registry access (contributing to the 82% loss of analytical capacity in Ukraine) justifies automation of data exchange and SupTech tools. Second, weak FIU-to-court transfer (evident from the high STR-to-confiscation gap, e.g., Ukraine’s 1.5% conversion rate) supports procedural deadlines and case-routing rules modelled on Singapore’s COSMIC platform. Third, low confiscation returns (global <1%) call for asset-management reforms, including faster freezing mechanisms and real-time tracking of stablecoin flows.

As for Ukraine, a critical reform direction means implementing dynamic risk-prioritization mechanisms within the State Financial Monitoring Service. This may include integrating certain anomaly-detection tools for crypto-assets to support early identification and disruption of potential sanction evading paths. At the same time, such modernization would necessitate strengthening procedural capabilities, incorporating more efficient mechanisms for temporary asset freezing, accordingly ensuring relevant legal safeguards and decreasing excessive judicial delays.

For more advanced EU jurisdictions, policy efforts should focus on greater harmonization of SupTech standards in order to deal with risks associated with “symbolic compliance”. Cross-institutional coordination and reduction of evidentiary fragmentation in complex financial crime cases could be improved by adopting integrated data-sharing infrastructures similar to Singapore’s COSMIC platform. Also, particular attention should be directed to the legal regulation of artificial intelligence in supervisory functions to guarantee operational effectiveness and protection of due process rights.

Implementing AI-driven screening and automated data exchange requires corresponding legal safeguards. To mitigate risks of false positives, audit trails must be maintained for all automated decisions. Data retention periods, access control

protocols, and appeal routes for affected individuals should be explicitly defined in national AML legislation, balancing enforcement efficiency with due process rights.

At the international level, strategies addressing digital crime displacement should include creating the coordinated network for monitoring cross-border flows of stablecoins. Within broader transatlantic cooperation, adopting unified standards for regulating and verifying the virtual asset service providers (VASPs) could further strengthen systemic resilience. On the whole, these measures would enhance transparency in the DeFi ecosystem and reduce possibility of using virtual assets as a primary channel for laundering illicit proceeds.

7. Conclusions

International regulatory efforts and the work of national financial intelligence units aimed to strengthen the transparency standards are a principal element of the contemporary global security architecture. The gradual development of FATF recommendations and their implementation in different jurisdictions reflects a notable shift toward more technocratic approaches to financial supervision. In Singapore, this trend is especially salient: a high composite effectiveness score ($E \approx 8.1$) corresponds to the deployment of advanced real-time monitoring systems that reduce procedural impediments. However, increasing regulatory complexity does not automatically translate into more effective disruption of organized financial crime. The empirical results substantiate a noticeable implementation gap, most pronounced in Ukraine ($E \approx 3.6$), where at the stage of transition to pre-trial investigation, the estimated loss of analytical capacity reaches about 82%. Further, the results of the multiple linear regression analysis ($\beta = -0.45$, $p = 0.012$, $R^2 = 0.62$) suggest that stricter formal procedural frameworks may in fact increase this gap, when not matched by sufficient institutional capacity. Against the backdrop of martial law and institutional fragmentation, reliance on formal compliance but weakly effective enforcement mechanisms can make particularly dangerous “symbolic enforcement” in view of the prospect that procedural correctness does not translate into substantive asset recovery. Ultimately, this may preclude rather than facilitate the confiscation of illicit assets. Future research should therefore prioritize the elaboration of adaptive monitoring systems capable of delving into the evolving nature of digital financial crime. In this regard, particular emphasis should be placed on integrating SupTech solutions for automated tracking of cross-border flows within DeFi environments. Overall, the key priority is transitioning from quantitative reporting-based systems towards risk-oriented supervisory models, where state’s institutional capacity becomes the central determining factor of real-world financial security. Applying the proposed thesis to the four jurisdictions confirms its validity. In Ukraine, the chain breaks at the intelligence-to-prosecution stage, resulting in an 82% loss of analytical capacity ($E = 3.6$). Lithuania and Germany show partial integration: Lithuania achieves stronger crypto-asset detection, while Germany suffers from evidentiary fragmentation at the judicial level. Singapore demonstrates near-seamless integration through its COSMIC platform, achieving the highest effectiveness ($E = 8.5$). Thus, the chain metaphor holds: weakness in any link – intelligence, investigation, freezing, confiscation, or VASP control – undermines the whole system.

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