Strategic management, scenario analysis and competitive advantage analysis: New opportunities for anti-money laundering system reform

Serhiy Lyeonov[1], Yurii Bilan[2], Olha Kuzmenko[3], Olena Krukhmal[4], László Vasa[5]

[1]   Sumy State University, Education and Research Institute of Business, Economics and Management, Economic Cybernetics Department, Ukraine, ORCID: 0000-0001-5639-3008, s.lieonov@uabs.sumdu.edu.ua;
[2]   Alexander Dubcek University of Trencin, Faculty of Social and Economic Relations, Slovakia, ORCID: 0000-0003-0268-009X, y.bilan@csr-pub.eu;
[3]   Sumy State University, Education and Research Institute of Business, Economics and Management, Economic Cybernetics Department, Ukraine, ORCID: 0000-0001-8520-2266, o.kuzmenko@uabs.sumdu.edu.ua;
[4]   Sumy State University, Education and Research Institute of Business, Economics and Management, Department of Financial Technologies and Entrepreneurship, Ukraine, ORCID: 0000-0001-9118-1713, o.krukhmal@uabs.sumdu.edu.ua;
[5]   Széchenyi István University, Faculty of Economics, Hungary, ORCID: 0000-0002-3805-0244, laszlo.vasa@ifat.hu (corresponding author).

Abstract: *The article identifies and mathematically substantiates vectors of reforming the financial monitoring system based on the synergistic approach in the cross-country context by developing scenarios by selecting internal and external factors that stimulate money laundering. The key external and internal factors of the money laundering process intensification are indicated. Competitive advantages of the anti-money laundering processes, the achievement of which is possible in terms of key external and internal factors for activation of money laundering process are formed. The relationship between the key internal and external factors of money laundering intensification and competitive advantages by building a binary characteristic matrix is formed. The synergy effect made by the mutual influence of simultaneously acting internal and external factors – a quantitative feature of the further strategy of the financial monitoring system reforming in terms of cross-country analysis is calculated. An economic-mathematical model for evaluating and interpreting strategy for improving the financial monitoring system in terms of cross-country context based on integer optimization is developed. In the article, there is calculation of the number of competitive advantages received by each observed country, without considering the possible synergy effect of mutual influence of simultaneously acting internal and external factors on each other. Moreover, there is quantitative assessment of the synergy effect made by the emergence of additional competitive advantages due to a certain combination of simultaneous influence made by external and internal factors of the money laundering intensification. The "ideal" situation of the possibility of gaining all possible competitive advantages in reforming the financial monitoring system in terms of cross-country context by overcoming internal and external factors stimulating the money laundering is studied. The results of the cross-country analysis form a basis for the further formalization of the limits for quantitative evaluation of the developed strategies through a uniform distribution.*

Keywords: *Economic growth, sustainable growth, economic development, reforming scenarios, competitive advantages, internal factors, external factors, financial monitoring, synergy effect.*

JEL Classification: *G28, C10, C44, C49.*

Introduction

The development of economic relations, the emergence of new financial instruments, scientific and technological progress are among those factors that increase the risk of attracting cash flows to the shadow economy, create conditions for their laundering, and in some cases, find opportunities for corruption and organized crime. At the same time, the development of the financial monitoring system creates competitive advantages for developing the national economy and its sustainable growth.

1. Theoretical background

Given the scientific literature, one should note that the general theoretical and practical issues of anti-money laundering and the impact of the financial monitoring system are studied in the works of many scientists. Researches in this area have different directions and reveal various aspects of the topic.

Levchenko et al. (2019) investigate the risk of money laundering in developing and transition economies and the impact of the financial monitoring system on economic development. Levchenko et al. (2018) summarize the arguments and counterarguments in the scientific discussion on the main tools for the national economy de-shadowing, as well as offer theoretical and methodological principles to create the de-shadowing strategy of the national economy.

Lyulyov et al. (2021) identify drivers of the shadow economy in countries and substantiate the empirical relationship with the level of investment, economic growth, social and physical health of the population. According to Ginevicius et al. (2020a), Ginevicius et al. (2020b), Shpak et al. (2021) and Simovic (2021), the higher the level of national economic development, the lower the size of the shadow economy. The long-run analysis revealed that shadow economies negatively affected foreign direct investment inflows (Bayar et al., 2020; Bilan et al., 2020; Boyko et al., 2014).

Ivanova and Kordos (2017) analyse the competitive advantages caused by the reduction of the shadow economy and the strengthening of the anti-money laundering policy. Tiutinyk and Mazurenko (2021) also study the country's competitive advantages and determine the level of financial monitoring as an important factor in defining the favourable business environment, the level of protection of citizens' rights, material well-being of the population.

The relationship between factors of macroeconomic stability and state regulation effectiveness was studied by Roszko-Wójtowicz and Grzelak (2020). Bouchetara et al. (2020) analyse the role and tools of macroprudential policy. An important area of research is the study of the effectiveness of the different factors providing macroeconomic stability (Kobushko et al., 2021; Kohnova et al., 2019; Kosch & Szarucki, 2020; Oliinyk et al., 2019; Petroye et al., 2020; Thai et al., 2021; Tkachenko et al., 2019; Stradomska et al., 2019).

An important area of research is to assess the role of the financial monitoring system for economic growth and strengthen other competitive advantages of the country (Batyk et al., 2020; Brychko et al., 2021; Glova et al., 2020; Kryvych & Goncharenko, 2020; Pakhnenko et al., 2021). Bernardelli et al. (2021) analyse the temporal stability of the relationship between institutions and economic growth and real economic convergence. Mujtaba et al. (2018) analyse the relationship between two important indices of business activity, namely: the degree of entrepreneurial activity regulation by the central system and the corruption in the country. Legenzova et al. (2019) use network analysis to assess the links of the global banking system. Country-specific factors of macroeconomic stability were studied by Telizhenko et al. (2019), Saeed and Shanan (2020), Piplica (2021), Plastun et al. (2018), Mierzejewska and Dziurski (2019), and Uddin et al. (2021).

One should note that The Financial Action Task Force (FATF) (2021) carries out the evaluation of the anti-money laundering system in the country. The FATF methodology does not reflect the focus on the anti-money laundering results. Pol (2018) examines the FATF approach and notes the misuse of outcome

labels to outputs, as well as the methodology for assessing the anti-money laundering regime's effectiveness.

On the other hand, the positive impact of an effective anti-money laundering system contributes to overcoming the shadow economy and is manifested in the improvement of the country's macroeconomics (Al-Tkhayneh et al., 2019; Juznik, 2021; Kuznetsova et al., 2018; Sysoyeva & Kleinschmidt, 2017; Vasilyeva et al., 2016). Competitive advantages are overcoming corruption, improving the investment climate, increasing economic activity, ensuring and improving the legal environment, ensuring sustainable social development, increasing the stability of the financial sector and others (Boronos et al., 2020; Chigrin & Pimonenko, 2014; Chukwu & Kasztelnik, 2021; Vasilyeva et al., 2020; Yelnikova & Barhaq, 2020). Studying approaches to assessing the effectiveness of the anti-money laundering system are represent by many scholars around the world (Andrade & Loureiro, 2020; Jarošová & Noskievičová, 2019; Kozmenko et al., 2013; Mustafa et al., 2019; Petrushenko et al., 2018; Yarovenko et al., 2021). The scientists' worldwide experience of studying the effectiveness of complicated systems was studied to build a model that takes into account the influence of various factors (Kasych & Vochozka, 2017; Kobushko et al., 2020; Koibichuk et al., 2021; Schwab & Zahidi, 2021; Shipko et al., 2020; Skrynnyk & Vasilyeva, 2020a; Skrynnyk & Vasilyeva, 2020b; Novikov, 2021; Syniavska et al., 2019).

Although many scholars around the world are studying approaches to assessing the effectiveness of the anti-money laundering system, anti-terrorist financing and the proliferation of mass destruction weapons, this question remains open in terms of the impact made by the system effectiveness on the country's economic and social development, the possibility of obtaining positive consequences for the economy and society. We believe that the study of vectors of the financial monitoring system reform in terms of cross-country context needs special attention. Assessment of the impact made by the system's effectiveness on the country's economic and social development allows for determining the degree of perfection of the system and the need for its reform, which has practical implications for practitioners.

Thus, the hypothesis is that there is a relationship between key internal, external factors for the intensification of anti-money laundering based on FATF assessment and competitive advantages and, in consequence of this, economic and mathematical models regarding the interpretation of strategies for reforming the financial monitoring system in terms of cross-country context may be developed.

This article aims to identify and mathematically substantiate vectors of reforming the financial monitoring system based on the synergistic approach in the cross-country context by developing scenarios by selecting internal and external factors that stimulate money laundering.

2. Research methodology
Modelling of the competitive strategies
Integer modelling of competitive strategies as a methodological ground for forming a basis for reforming the financial monitoring system in terms of cross-country analysis using a synergy approach by overcoming internal and external factors of money laundering involves the following stages:

1 Stage. Identification of the key external and internal factors of the money laundering process intensification. The indicators of technical compliance of the financial monitoring system in the country with the FATF recommendations are taken. According to the FATF methodology, factors are united into:

- Group AML/CFT Policies and coordination: R1 – Assessing risks and applying a risk-based approach; R2 – National cooperation and coordination;
- Group Money laundering and confiscation: R3 – Money laundering offence; R4 – Confiscation and provisional measures;
- Group Terrorist financing and financing of proliferation: R5 – Terrorist financing offence; R6 – Targeted financial sanctions related to terrorism & terrorist financing; R7 – Targeted financial sanctions related to proliferation; R8 – Non-profit organisations;
- Group Preventive measures: R9 – Financial institution secrecy laws; R10 – Customer due diligence; R11 – Record keeping; R12 – Politically exposed persons; R13 – Correspondent banking; R14 – Money or value transfer services; R15 – New technologies; R16 – Wire transfers; R17 – Reliance on third parties; R18 – Internal controls and foreign branches and subsidiaries; R19 – Higher-risk countries;

R20 – Reporting of suspicious transactions; R21 – Tipping-off and confidentiality; R22 – DNFBPs: Customer due diligence; R23 – DNFBPs: Other measures;

- Group Transparency and beneficial ownership of legal persons and arrangements: R24 – Transparency and beneficial ownership of legal persons; R25 – Transparency and beneficial ownership of legal arrangements;
- Group Powers and responsibilities of competent authorities and other institutional measures: R26 – Regulation and supervision of financial institutions; R27 – Powers of supervisors; R28 – Regulation and supervision of DNFBPs; R29 – Financial intelligence units; R30 – Responsibilities of law enforcement and investigative authorities; R31 – Powers of law enforcement and investigative authorities; R32 – Cash couriers; R33 – Statistics; R34 – Guidance and feedback; R35 – Sanctions;
- Group International cooperation: R36 – International instruments; R37 – Mutual legal assistance; R38 – Mutual legal assistance: freezing and confiscation; R39 – Extradition; R40 – Other forms of international cooperation.

2 Stage. Formation of competitive advantages of the anti-money laundering processes, the achievement of which is possible in terms of key external and internal factors for activation of money laundering process: KP1 – Overcoming corruption, KP2 – Improving investment climate, KP3 – Increasing economic activity – ensuring and improving the legal environment, KP5 – Ensuring sustainable social development, KP6 – Increasing the stability of the financial sector, the sources of information in terms of which are respectively: Corruption Perceptions Index (Transparency International, 2021), A Global Foreign Direct Investment Country Attractiveness Index (Riadh, 2020), Ease of Doing Business Index (World Bank, 2021), World Justice Project Rule of Law Index (World Justice Project, 2021), Economic Well-being Index (Kowalski & Veit, 2020).

3 Stage. It is proposed to form a sample of 42 countries based on countries that are assessed by all the above criteria. The list of countries includes: Italy, Denmark, United Kingdom, Spain, Sweden, Belgium, China, Canada, the USA, Singapore, Korea, United Arab Emirates, Ukraine, New Zeland, Australia, Botswana, Burkina-Faso, Cambodia, the Czech Republic, Dominican Republic, Ethiopia, Finland, Greece, Honduras, Hungary, Jordan, Madagascar, Mali, Mauritania, Mauritius, Mexico, Morocco, Nicaragua, Norway, Pakistan, Peru, Philippines, Russian Federation, Tunisia, Turkey, Uganda, and Uruguay.

4 Stage. Formalizing the relationship between key internal and external factors of money laundering process activation and competitive advantages by building a matrix of binary characteristics (Tab. 1).

A report on progress in addressing the technical compliance deficiencies identified in the FATF assessment of their measures to combat money laundering and terrorist financing was analysed, and weaknesses that do not allow to achieve certain competitive advantages were identified to build a matrix of binary characteristics for each country.

Elements in the matrix of binary characteristics of internal and external factors to activate the money laundering process, providing competitive advantages, presented in Tab. 1, are formalized in the form of the following formula:

$$a_{ij} = \begin{cases} 1, \text{if } i\text{-factor provides } j\text{-competitive advantage} \\ 0, \text{if } i\text{-factor does not provide } j\text{-competitive advantage} \end{cases} \tag{1}$$

where: a_{ij} – binary indicator, which corresponds to the intersection of the i-factor (internal or external) regarding activation of the money laundering process and the j-competitive advantage.

$$S_{gj} = \sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij} \text{ , or} \tag{2}$$

$$S_{g1} = \sum_{j=1}^{2} a_{ij}, S_{g2} = \sum_{j=3}^{4} a_{ij}, S_{g3} = \sum_{j=5}^{8} a_{ij}, S_{g4} = \sum_{j=9}^{23} a_{ij}, S_{g5} = \sum_{j=24}^{25} a_{ij}, S_{g6} = \sum_{j=26}^{35} a_{ij}, S_{g7} = \sum_{j=36}^{40} a_{ij}$$

where: S_{gj} – the sum of binary indicators in terms of internal and external factors to activate the money laundering process in terms of g-group; N_g – the number of external or internal factors intensifying the money laundering process in terms of g-group; N_{gs} – ordinal number of the indicator in total, which begins the sequential calculation of the g-group indicators.

| Tab. 1: | Matrix of binary characteristics of internal and external factors for money laundering process activation, providing competitive advantages |

Factors intensifying the money laundering process		Competitive advantages					
		KP1	KP2	KP3	KP4	KP5	KP6
AML/CFT Policies and coordination	R1	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	a_{16}
	R2	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	a_{26}
	Total	S_{g11}	S_{g12}	S_{g13}	S_{g14}	S_{g15}	S_{g16}
Money laundering and confiscation	R3	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	a_{36}
	R4	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}	a_{46}
	Total	S_{g21}	S_{g22}	S_{g23}	S_{g24}	S_{g25}	S_{g26}
Terrorist financing and financing of proliferation	R5	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	a_{56}
	…	…	…	…	…	…	…
	R8	a_{81}	a_{82}	a_{83}	a_{84}	a_{85}	a_{86}
	Total	S_{g31}	S_{g32}	S_{g33}	S_{g34}	S_{g35}	S_{g36}
Preventive measures	R9	a_{91}	a_{92}	a_{93}	a_{94}	a_{95}	a_{96}
	…	…	…	…	…	…	…
	R23	a_{231}	a_{232}	a_{233}	a_{234}	a_{235}	a_{236}
	Total	S_{g41}	S_{g42}	S_{g43}	S_{g44}	S_{g45}	S_{g46}
Transparency and beneficial ownership of legal persons and arrangements	R24	a_{241}	a_{242}	a_{243}	a_{244}	a_{245}	a_{246}
	R25	a_{251}	a_{252}	a_{253}	a_{254}	a_{255}	a_{256}
	Total	S_{g51}	S_{g52}	S_{g53}	S_{g54}	S_{g55}	S_{g56}
Powers and responsibilities of competent authorities and other institutional measures	R26	a_{261}	a_{262}	a_{263}	a_{264}	a_{265}	a_{266}
	…	…	…	…	…	…	…
	R35	a_{351}	a_{352}	a_{353}	a_{354}	a_{355}	a_{356}
	Total	S_{g61}	S_{g62}	S_{g63}	S_{g64}	S_{g65}	S_{g66}
International cooperation	R36	a_{361}	a_{362}	a_{363}	a_{364}	a_{365}	a_{366}
	…	…	…	…	…	…	…
	R40	a_{401}	a_{402}	a_{403}	a_{404}	a_{405}	a_{406}
	Total	S_{g71}	S_{g72}	S_{g73}	S_{g74}	S_{g75}	S_{g76}
Total		S_1	S_2	S_3	S_4	S_5	S_6

Source: own

5 Stage. Development of economic and mathematical models regarding complete evaluation and interpretation of strategies for reforming the financial monitoring system in terms of cross-country context based on integer optimization. The synergy effect of mutual influence made by simultaneously acting internal and external factors is calculated to implement this stage. These are quantitative features of further strategy to reform the financial monitoring system in terms of cross-country analysis, and strategy formalization: rapid, moderately fast, slow and neutral adaptability to external factors.

Quantifying the strategy to reform the financial monitoring system in terms of cross-country analysis, there is a need for some intermediate calculations – steps to summarize the binary indicators presented in Tab. 1.

Step 5.1: Calculation of the number of competitive advantages received by each observed

country, without considering the possible synergy effect of mutual influence of simultaneously acting internal and external factors on each other as a set:

$$\sum_{j=1}^{6} Z_j, \text{ if } \sum_{g=1}^{7} S_{gj} \geq 1 = \sum_{j=1}^{7} Z_j, \text{ if } \sum_{g=1}^{7} \sum_{j=1}^{N_g} a_{ij} \geq 1 = \sum_{j=1}^{7} Z_j \Bigg|_{\sum_{g=1}^{7} \sum_{j=1}^{N_g} a_{ij} \geq 1} \tag{3}$$

where: Z_j – binary indicator, acquiring a single value, if it is possible to obtain the j-competitive advantage by overcoming the external or internal factor for money laundering intensification, and zero level otherwise.

Step 5.2: Quantitative assessment of the synergy effect made by the emergence of additional competitive advantages due to a certain combination of simultaneous influence made by external and internal factors of the money laundering intensification. A synergy effect occurs if the sum of binary indicators within each competitive advantage $\sum_{g=1}^{7} S_{gj}$ without considering the synergy effect is at least level 2; and we calculate the additional effect $\sum_{g=1}^{7} S_{gj}$ when exceeding level 1. We use a mathematical ratio that contains a combination of integer and a maximum of two functions to record a quantitative assessment of the synergy effect of additional competitive advantages due to a combination of simultaneous influence of both external and internal factors for money laundering activation:

$$\max\left\{ \left(\sum_{g=1}^{7} \left[\frac{1}{N_g} \sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 2} ; \left[\frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 2} \right\} \tag{4}$$

Step 5.3: Quantitative assessment of the synergy effect regarding the emergence of additional competitive advantages by exceeding the sum of binary indicators within each competitive advantage $\sum_{g=1}^{7} \sum_{j=1}^{N_g} a_{ij}$ of thresholds 10, 20 and 30:

$$\left(\sum_{g=1}^{7} \left[\frac{4}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 10} + \left(\sum_{g=1}^{7} \left[\frac{5}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 20} + \left(\sum_{g=1}^{7} \left[\frac{6}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 30} \tag{5}$$

Step 5.4: The last step to form the relationship between key internal and external factors for intensification of money laundering and competitive advantages by building the matrix of binary characteristics as an integrated absolute quantitative assessment of scenarios for reforming the financial monitoring system in terms of cross-country analysis (*SR*) provides for an additive convolution of the above components [Formulas (1–5)] by forming the following mathematics:

$$SR = \sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij} + \sum_{j=1}^{7} Z_j \Bigg|_{\sum_{g=1}^{7} \sum_{j=1}^{N_g} a_{ij} \geq 1} + \max\left\{ \left(\sum_{g=1}^{7} \left[\frac{1}{N_g} \sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 2} ; \left[\frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 2} \right\} +$$

$$+ \left(\sum_{g=1}^{7} \left[\frac{4}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 10} + \left(\sum_{g=1}^{7} \left[\frac{5}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 20} + \left(\sum_{g=1}^{7} \left[\frac{6}{3} \cdot \frac{1}{40} \sum_{j=1}^{40} a_{ij} \right] \right) \Bigg|_{\sum_{g=1}^{7} S_{gj} \geq 30} \tag{6}$$

6 Stage. A study of the "ideal" situation of the possibility to gain all possible competitive advantages within the financial monitoring system reforming in terms of cross-country context by overcoming internal and external factors stimulating the money laundering process. This stage is implemented by forming the maximum possible situation, characterized by the unit

levels of binary values in terms of compliance of all considered internal and external factors to all potential competitive advantages (Tab. 2).

Thus, given the "ideal" situation, the elements of Formula (6) acquire the following values: $\sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij}$ – the last line of Tab. 2; $\sum_{j=1}^{7} Z_j\big|_{\sum_{g=1}^{7}\sum_{j=1}^{N_g} a_{ij}\geq 1}$ will have individual values;

$\left[\frac{1}{40}\sum_{j=1}^{40} a_{ij}\right]\Big|_{\sum_{g=1}^{7} S_{gj}\geq 2}$ take zero values in terms of all six competitive advantages;

$\left(\sum_{g=1}^{7}\left[\frac{1}{N_g}\sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij}\right]\right)\Big|_{\sum_{g=1}^{7} S_{gj}\geq 2}$ – quantification of the synergy effect of additional competitive advantages due to exceeding the threshold level 2 for each group of internal

Tab. 2: Determining the "ideal" situation of the possibility to gain all potential competitive advantages within the financial monitoring system reforming in terms of cross-country context by overcoming internal and external factors stimulating the money laundering process

Factors intensifying the money laundering process		Competitive advantages					
		KP1	KP2	KP3	KP4	KP5	KP6
AML/CFT Policies and coordination	R1	1	1	1	1	0	1
	R2	1	1	1	1	1	1
	Total	2	2	2	2	1	2
Money laundering and confiscation	R3	1	0	0	1	1	0
	R4	1	1	0	1	1	0
	Total	2	1	0	2	2	0
Terrorist financing and financing of proliferation	R5	1	0	0	1	1	0
	…	…	…	…	…	…	…
	R8	1	1	1	0	1	0
	Total	4	1	1	3	4	0
Preventive measures	R9	0	1	1	1	1	1
	…	…	…	…	…	…	…
	R23	1	1	1	1	1	1
	Total	9	12	10	9	14	14
Transparency and beneficial ownership of legal persons and arrangements	R24	1	0	1	1	1	1
	R25	1	0	1	1	1	1
	Total	2	0	2	2	2	2
Powers and responsibilities of competent authorities and other institutional measures	R26	0	0	0	1	1	1
	…	…	…	…	…	…	…
	R35	1	0	0	1	0	1
	Total	7	2	2	9	8	7
International cooperation	R36	1	1	1	1	1	1
	…	…	…	…	…	…	…
	R40	1	0	0	1	1	0
	Total	5	1	1	5	5	1
Total		31	19	18	32	36	26

Source: own

and external factors separately and

$$\max\left\{\left(\sum_{g=1}^{7}\left[\frac{1}{N_g}\sum_{j=N_{gs}}^{N_{gs}+N_g}a_{ij}\right]\right)\Big|_{\sum_{g=1}^{7}S_{gj}\geq 2}; \left[\frac{1}{40}\sum_{j=1}^{40}a_{ij}\right]\Big|_{\sum_{g=1}^{7}S_{gj}\geq 2}\right\}$$

are: 5 (for KP1), 1 (for KP2), 2 (for KP3 and KP6), 4 (for KP4 and KP5); quantitative assessment of the synergy effect of the additional competitive advantages by exceeding the sum of binary indicators within each competitive advantage $\sum_{g=1}^{7}\sum_{j=1}^{N_g}a_{ij}$ of thresholds at the levels 10, 20 and 30: $\left(\sum_{g=1}^{7}\left[\frac{4}{3}\cdot\frac{1}{40}\sum_{j=1}^{40}a_{ij}\right]\right)\Big|_{\sum_{g=1}^{7}S_{gj}\geq 10}$ takes a unit value only for KP4 and KP5, $\left(\sum_{g=1}^{7}\left[\frac{5}{3}\cdot\frac{1}{40}\sum_{j=1}^{40}a_{ij}\right]\right)\Big|_{\sum_{g=1}^{7}S_{gj}\geq 20}$ and $\left(\sum_{g=1}^{7}\left[\frac{6}{3}\cdot\frac{1}{40}\sum_{j=1}^{40}a_{ij}\right]\right)\Big|_{\sum_{g=1}^{7}S_{gj}\geq 30}$ takes a unit value only for three competitive advantages KP1, KP4, KP5.

Thus, considering these quantitative values in Formula (6) in the case of an "ideal" situation, the integrated absolute quantitative assessment of scenarios to reform the financial monitoring system in terms of cross-country analysis (*SR*) takes the value of 197 units.

7 Stage. Calculation of integrated relative quantitative assessment (VSR) of scenarios to reform the financial monitoring system in terms of cross-country analysis by formalizing the relationship of key internal and external factors for the intensification of the money laundering process and competitive advantages. It is necessary to weigh the absolute estimate [Formula (6)] on the value *SR* for the "ideal" situation, i.e., 197 units:

$$VSR = \frac{1}{197}SR \tag{7}$$

8 Stage. Qualitative interpretation of the relative quantitative assessment of strategies to reform the financial monitoring system: rapid, moderately fast, slow and neutral adaptability to external factors.

The "ideal" situation of gaining all possible competitive advantages within reforming the financial monitoring system in terms of cross-country context by overcoming internal and external factors stimulating the money laundering process is studied. The implementation of this stage involves the formalization of the maximum possible situation, characterized by the unit levels of binary values in terms of compliance of all considered internal and external factors to all potential competitive advantages.

The strategy of rapid adaptability demonstrates the country's acquisition of certain competitive advantages while achieving compliance of internal and external factors for intensifying the money laundering process with specific FATF recommendations. The strategy of neutral adaptability indicates the inconsistency of the technical features in the monitoring system with the FATF recommendations and demonstrates the lack of competitive advantage. Strategies for moderately fast and slow adaptability are intermediate. We use a uniform distribution of the possible range of values from zero to one to determine the lower and upper limits of strategies for reforming the financial monitoring system in terms of cross-country context (Tab. 3).

Implementing the integer modelling of competitive strategies as a methodological ground to form a basis for reforming the financial monitoring system in terms of cross-country analysis using synergy approach by overcoming internal and external factors for money laundering, we consider the matrix of input binary values on the example of Italy (Tab. 4).

Tab. 3:	Qualitative interpretation of the relative quantitative assessment of strategies for reforming the financial monitoring system in terms of cross-country context	
Strategy	**Lower limit of possible values**	**Upper limit of possible values**
Neutral adaptability to external factors	0.00	0.25
Slow adaptability to external factors	0.25	0.50
Moderately rapid adaptability to external factors	0.50	0.75
Rapid adaptability to external factors	0.75	1.00

Source: own

| Tab. 4: | Matrix of binary characteristics of internal and external factors for activating the money laundering process, providing competitive advantages for Italy – Part 1 |

Factors intensifying the money laundering process	Competitive advantages					
	KP1	KP2	KP3	KP4	KP5	KP6
R1	1	1	1	1	0	1
R2	1	1	1	0	0	0
R3	1	0	0	1	1	0
R4	1	1	0	1	1	0
R5	1	0	0	1	0	0
R6	1	0	0	1	1	0
R7	0	0	0	0	1	0
R8	0	0	1	0	1	0
R9	0	1	1	1	1	1
R10	1	0	0	1	1	1
R11	1	1	1	0	1	1
R12	0	1	0	0	1	0
R13	0	1	1	0	0	0
R14	0	1	1	0	1	0
R15	0	1	1	0	1	1
R16	0	1	1	0	1	1
R17	0	1	1	1	1	1
R18	1	0	0	0	0	1
R19	0	1	1	0	0	0
R20	1	0	0	1	1	1
R21	1	1	1	0	1	0
R22	1	1	0	1	1	1
R23	1	1	1	1	1	0
R24	1	0	1	1	1	1
R25	1	0	1	1	1	1
R26	0	0	0	1	1	1
R27	0	0	0	1	1	1
R28	0	0	0	1	1	1
R29	1	0	0	1	1	1
R30	1	0	0	1	1	0
R31	1	0	0	1	1	0
R32	1	0	0	1	1	1
R33	1	1	1	0	0	1
R34	1	1	1	1	1	0
R35	1	0	0	1	0	1

Tab. 4:	Matrix of binary characteristics of internal and external factors for activating the money laundering process, providing competitive advantages for Italy – Part 2					
Factors intensifying the money laundering process	**Competitive advantages**					
	KP1	**KP2**	**KP3**	**KP4**	**KP5**	**KP6**
R36	1	1	1	1	1	1
R37	1	0	0	1	1	0
R38	1	0	0	1	1	0
R39	1	0	0	1	1	0
R40	1	0	0	1	1	0

Source: own

3. Research results

Based on the matrix of binary indicators, we will perform several intermediate calculations to develop an economic and mathematical model of absolute evaluation and interpretation of strategies for the financial monitoring system reforming in cross-country context based on integer optimization for Italy (in terms of steps in 5 stage). We will demonstrate the relevant components from Formula (6) in Tab. 5.

We calculate the relative assessment and interpretation of strategies for reforming the financial monitoring system in terms of cross-country context for other 41 countries and systematize the results in Tab. 6.

Thus, according to the study results, strategies for reforming the financial monitoring system by overcoming the factors for intensifying the money laundering process according to data of 42 countries are identified. A qualitative interpretation of the relative quantitative assessment of strategies for reforming the financial monitoring system, determines the rapid adaptability in 25 cases and moderately rapid adaptability in 17 cases. Countries for which rapid adaptability has been identified have high scores on overcoming corruption, investment climate, economic activity, ensuring the legal environment, sustainable social development, and financial sector stability. Countries for which

Tab. 5:	Intermediate calculations of the economic and mathematical model of relative evaluation and interpretation of strategies for reforming the financial monitoring system in terms of cross-country context – Part 1						
Indicator	**KP1**	**KP2**	**KP3**	**KP4**	**KP5**	**KP6**	**KP1**
$\displaystyle\sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij}$	27	18	18	27	32	20	145
$\displaystyle\sum_{j=1}^{7} Z_j \Bigg\|_{\sum_{g=1}^{7}\sum_{j=1}^{N_g} a_{ij}\geq 1}$	1	1	1	1	1	1	6
$\displaystyle\left[\frac{1}{40}\sum_{j=1}^{40} a_{ij}\right]\Bigg\|_{\sum_{g=1}^{7} S_{gj}\geq 2}$	0	0	0	0	0	0	-
$\displaystyle\left(\sum_{g=1}^{7}\left[\frac{1}{N_g}\sum_{j=N_{gs}}^{N_{gs}+N_g} a_{ij}\right]\right)\Bigg\|_{\sum_{g=1}^{7} S_{gj}\geq 2}$	4	1	2	3	3	1	-

Tab. 5: Intermediate calculations of the economic and mathematical model of relative evaluation and interpretation of strategies for reforming the financial monitoring system in terms of cross-country context – Part 2

Indicator	KP1	KP2	KP3	KP4	KP5	KP6	KP1
$\max\left\{\left.\left(\sum\limits_{g=1}^{7}\left[\frac{1}{N_g}\sum\limits_{j=N_{gs}}^{N_{gs}+N_g}a_{ij}\right]\right)\right|_{\sum_{g=1}^{7}S_{gj}\geq 2}\; ;\; \left.\left[\frac{1}{40}\sum\limits_{j=1}^{40}a_{ij}\right]\right|_{\sum_{g=1}^{7}S_{gj}\geq 2}\right\}$	4	1	2	3	3	1	14
$\left.\left(\sum\limits_{g=1}^{7}\left[\frac{4}{3}\cdot\frac{1}{40}\sum\limits_{j=1}^{40}a_{ij}\right]\right)\right|_{\sum_{g=1}^{7}S_{gj}\geq 10}$	0	0	0	0	1	0	1
$\left.\left(\sum\limits_{g=1}^{7}\left[\frac{5}{3}\cdot\frac{1}{40}\sum\limits_{j=1}^{40}a_{ij}\right]\right)\right|_{\sum_{g=1}^{7}S_{gj}\geq 20}$	1	0	0	1	1	0	3
$\left.\left(\sum\limits_{g=1}^{7}\left[\frac{6}{3}\cdot\frac{1}{40}\sum\limits_{j=1}^{40}a_{ij}\right]\right)\right|_{\sum_{g=1}^{7}S_{gj}\geq 30}$	0	0	0	0	1	0	1
Total	170						
Relative evaluation of the strategy	0.8629						

Source: own

Tab. 6: Scenarios for reforming the financial monitoring system by overcoming the factors for intensification of the money laundering process according to data of 42 countries – Part 1

No.	Country	VSR	Strategy	No.	Country	VSR	Strategy
1	Italy	0.8629	Rapid	12	United Arab Emirates	0.8528	Rapid
2	Denmark	0.9391	Rapid	13	Ukraine	0.7107	Moderately rapid
3	United Kingdom	0.9543	Rapid	14	New Zeland	0.8832	Rapid
4	Spain	0.9137	Rapid	15	Australia	0.8731	Rapid
5	Sweden	0.9086	Rapid	16	Botswana	0.7513	Rapid
6	Belgium	0.9239	Rapid	17	Burkina-Faso	0.7208	Moderately rapid
7	China	0.7259	Moderately rapid	18	Cambodia	0.6751	Moderately rapid
8	Canada	0.9036	Rapid	19	Czech Republic	0.8629	Rapid
9	USA	0.8680	Rapid	20	Dominican Republic	0.8223	Rapid
10	Singapore	0.9188	Rapid	21	Ethiopia	0.7005	Moderately rapid
11	Korea	0.8782	Rapid	22	Finland	0.9086	Rapid

Tab. 6:	Scenarios for reforming the financial monitoring system by overcoming the factors for intensification of the money laundering process according to data of 42 countries – Part 2						

No.	Country	VSR	Strategy	No.	Country	VSR	Strategy
23	Greece	0.8274	Rapid	33	Nicaragua	0.7411	Moderately rapid
24	Honduras	0.7005	Moderately rapid	34	Norway	0.9239	Rapid
25	Hungary	0.8020	Rapid	35	Pakistan	0.7259	Moderately rapid
26	Jordan	0.7157	Moderately rapid	36	Peru	0.7665	Rapid
27	Madagaskar	0.6751	Moderately rapid	37	Philippins	0.6802	Moderately fast
28	Mali	0.7056	Moderately rapid	38	Russian Federation	0.7411	Moderately rapid
29	Mauritania	0.6904	Moderately rapid	39	Tunisia	0.7614	Rapid
30	Mauritius	0.8223	Rapid	40	Turkey	0.7817	Rapid
31	Mexico	0.7411	Moderately fast	41	Uganda	0.6193	Moderately rapid
32	Morocco	0.7360	Moderately rapid	42	Uruguay	0.8173	Rapid

Source: own

moderately rapid adaptability has been identified have not fully overcome the external factors for intensifying the money laundering process and do not show high marks for the identified competitive advantages. Strategies of slow and neutral adaptability were not identified among the formed sample.

We demonstrate the variation of possible levels of the relative indicator for evaluation of strategies for the financial monitoring system reforming in terms of cross-country context using a dot Fig. 1.

Thus, the analysis of Fig. 1 and Tab. 7 regarding the main descriptive statistics of the

Fig. 1:	Distribution of considered countries according to the VSR indicator
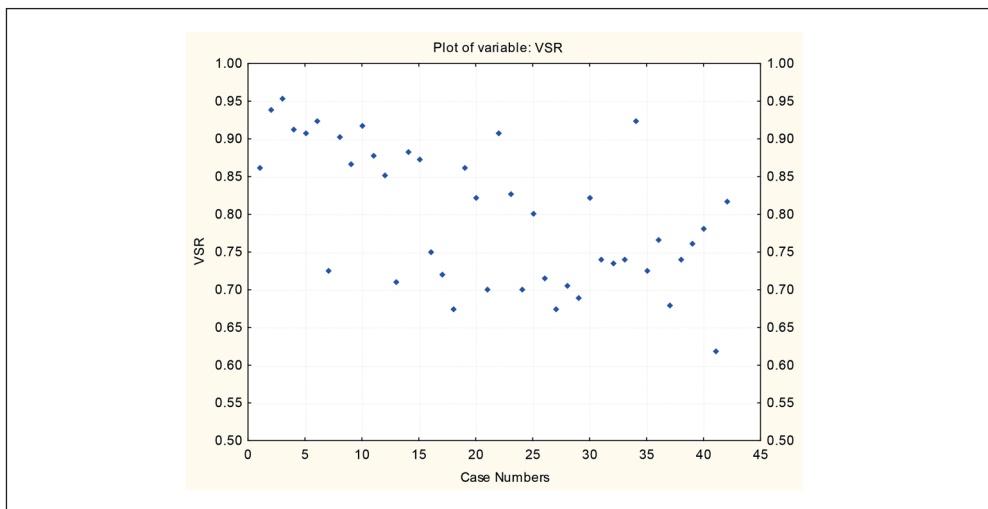
Source: own

Tab. 7: Descriptive statistics within the relative assessment of strategies for reforming the financial monitoring system in terms of cross-country context

Variable	Descriptive statistics								
	Mean	Median	Mode	Frequency of mode	Min	Max	Variance	Std. dev.	Coef. var.
VSR	0.798405	0.791878	0.7411168	3	0.619289	0.954315	0.008340	0.091324	11.43836

Source: own

Tab. 8: Frequency table according to the relative evaluation indicator of strategies for reforming the financial monitoring system in terms of cross-country context

Category	Frequency table: VSR (K-S d = 0.13953; $p > 0.20$; Lilliefors $p < 0.05$)					
	Count	Cumulative count	Percent of valid	Cumulative % of valid	% of all cases	Cumulative % of all
$0.5 < x \leq 0.6$	0	0	0.00000	0.00000	0.00000	0.00000
$0.6 < x \leq 0.7$	5	5	11.90476	11.90480	11.90476	11.90480
$0.7 < x \leq 0.8$	16	21	38.09524	50.00000	38.09524	50.00000
$0.9 < x \leq 0.9$	12	33	28.57143	78.57140	28.57143	78.57140
$0.9 < x \leq 1.0$	9	42	21.42857	100.00000	21.42857	100.00000
Missing	0	42	0.00000		0.00000	100.00000

Source: own

countries by VSR indicator shows that the relative level of evaluation of strategies for financial monitoring system reforming varies from the minimum possible value of 0.6193 to the maximum possible level of 0.9543 share units. The average statistical of this indicator for 42 countries selected for analysis is 0.7984. It corresponds to the rapid adaptability to external factors. At the same time, the modal value by the VSR indicator, i.e., the most common in this sample of countries, is 0.7411. It corresponds to moderately rapid adaptability to external factors. Analysing the variation coefficient, which is equal to 11.44%, we can say about the homogeneity of countries.

We analyse the frequency table (Tab. 8) for a deeper analysis regarding the obtained levels of relative evaluation of strategies for reforming the financial monitoring system in terms of cross-country context.

Thus, the analysis of Tab. 8 shows that most countries belong to the range from 0.7 to 0.8 share of the unit in terms of relative evaluation of strategies for reforming the financial

monitoring system in terms of cross-country context, which is 38.10% of the total research objects. It indicates that most countries have a marginal level of VSR indicator between rapid and moderately rapid adaptation to external factors. The next largest group (28.57%) contains countries where the level of the indicator range from 0.8 to 0.9 units. Countries with extremely high and extremely low levels of relative assessment of financial monitoring reform strategies in the cross-country context are 21.43% and 11.90% respectively.

Conclusions

The hypothesis that there is a relationship between key internal and external factors for the intensification of anti-money laundering based on FATF assessment and competitive advantages has been validated. And, in a consequence of this, an economic and mathematical model regarding the interpretation of strategies for reforming the financial monitoring system in terms of cross-country context has been formulated.

The proposed modelling of competitive is a methodological ground for forming a basis for reforming the financial monitoring system in terms of cross-country analysis using a synergy approach.

The proposed model is based on indicators of the technical compliance of the financial monitoring system in the FATF country and it provides for the formation of competitive advantages of anti-money laundering processes, the achievement of which is possible by key external and internal factors of activation of the process. The relationship between key internal and external factors of money laundering process activation and competitive advantages by building a matrix of binary characteristics was defined and the synergy effect made by the emergence of additional competitive advantages due to a certain combination of simultaneous influence made by external and internal factors was assessed.

Based on the relationship between key internal and external factors for the intensification of money laundering and competitive advantages economic and mathematical models regarding the interpretation of strategies for reforming the financial monitoring system in terms of cross-country context were developed. These are quantitative features of further strategy to reform the financial monitoring system in terms of cross-country analysis, and strategy formalization: rapid, moderately fast, slow and neutral adaptability to external factors.

Therefore, the proposed modelling is a methodological ground for forming a basis for reforming financial monitoring.

According to the research results, the vectors of reforming the financial monitoring system in terms of cross-country context are determined and mathematically substantiated using the synergy approach. Based on the modelling, scenarios on selecting internal and external factors, which stimulate the money laundering process, were developed. The synergy effect of the mutual influence made by simultaneously acting internal and external factors, calculated by the authors, is a quantitative characteristic of the further strategy to reform the financial monitoring system in the context of cross-country analysis. The interrelation of key internal and external factors intensifying the money laundering process and competitive advantages, formed by building a matrix of binary characteristics, allows evaluation and interpretation

strategies for reforming the financial monitoring system in a cross-country context based on integer optimization. A qualitative interpretation of the relative quantitative assessment of strategies for reforming the financial monitoring system determines the rapid adaptability in 25 cases and moderately fast adaptability in 17 cases.

Defining a strategy based on the relationship between the received assessment of the anti-money laundering system and competitive advantages from the implementation of such a system is the basis for reforming and improving the anti-money laundering system, which is the direction of further research.

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