Shadow economy and its impact on the public administration: aspects of financial and economic security of the country's industry

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Abstract: Many countries face with a shadow economy today. This phenomenon is a real problem for the governments, especially in the context of significant upheavals, reducing fiscal potential, distorting the development indicators and complicating any analytical conclusions about the state of the economic system. Given these facts the study analyses the problem of shadow industry in the Ukraine's regions, in particular by evaluating the integral index of financial and economic security of the industry. Its goals are: 1) development of the theoretical and applied approaches to the impact of the shadow economy on the public administration in relation to financial and economic security of industry in the regions of the country; 2) improvement of the methodology for governmental policy analysis of the level of the shadow economy in the said industry. Recommendation of the public policy measures to reduce the level of shadow industry in the regions were also presented. The method of analytic hierarchy process, the expert methods and the method of calculating the integral index as research methods were used in the study. Based on the analysis conducted, the matrix of strategic zones "Level of the shadow economy - level of the financial and economic security" was constructed. The proposed matrix should be useful in taking public management decisions, depending on the strategic area in which the region is located.

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Introduction

The problem of the shadow economy is urgent in the modern world, as it poses one of the most dangerous threats to the public administration, especially in relation to financial and economic security of the country, region or industry. Attention to solving this problem is gaining in character, as the shadow economy causes corruption in the economic, social, public policy and many other spheres (Podhorska et al., 2019). One may add here that some scholars link the prone to corruption with religion (Valdovinos-Hernandez et al., 2019) or culture (Valdovinos et al., 2019; Placek at al., 2019). In addition, shadow economy incorrectly reflects indicators of the development of economic systems and destructively affects the socio-economic development of industry of country's regions.

High level of shadow economic activity has a negative impact on the image of the country, its competitiveness, and international economic interactions and on the efficiency of structural and institutional reforms (Markina et al., 2018; Todorovic et al., 2019). The level of the shadow economy is one of the most important factors influencing the financial security of the social protection system (Malyovanyi et al., 2016; Islam et al., 2020; Çera et al., 2020). Ivanova et al., (1999) consider the problem of the shadow economy as a component of the economic security problem in the country.

An essential economic feature of a shadow economy is its destructiveness, which has a direct negative impact on the public administration of the country, an industry, or a region. Taking action to counter this threat is a complex process. It requires the interaction of all structures at all levels of economic activity. Only properly designed measures can effectively combat illegal business.

According to a study by the international Association of Chartered Certified Accountants (ACCA) on assessing and forecasting the development of a global shadow economy, Ukraine is in the top five countries with the largest level of shadow economy and is ranked third out of 28 countries with 46.12% of official GDP volume in 2017 compared to 45.96% in 2016. Other countries with high levels of shadow economy are Azerbaijan (66.12%), Nigeria (47.4%), Russia (39.29%) and Sri Lanka (37.33%). Instead, the lowest shadow economy was observed in the United States – 7.69%, Japan – 9.89%, and China – 10.17% [*Ukraine is in the top 5 countries*]. In other words, the shadow economy constitutes a large sector of the economy and contributes to the significant shadowing of foreign economic activity of domestic producers (Martyniuk and Yakubowska, 2020).

Assessing the level of the shadow economy is important as it answers the question of how strong and targeted public policy measures should be taken to

overcome it, how much the state expects to benefit from the fight against the shadow economy and how much it is willing to spend on it. As the shadow economy is not evenly distributed between particular sectors, its measurement makes it possible to decide on which sectors of the economy urgently need to target corrective public policy measures. Given these deliberations, the study of the impact of the shadow economy on the level of financial and economic security is critical, because this problem is insufficiently addressed by the researchers. Particularly, the peculiarities of the shadow sector and its impact on ~~ensuring~~ public administration of the necessary level of financial and economic security in industry across the country's regions are under-researched. All this necessitates further research and scientific substantiation of scientific and methodological approaches to the formation of public policy for improving the level of financial and economic security by counteracting and combating the shadow economy. Therefore, the paper's goals are: 1) development of the theoretical and applied approaches to the impact of the shadow economy on the public administration in relation to the financial and economic security of industry in the regions of the country; 2) improvement of the methodology for governmental policy analysis of the level of the shadow economy in the said industry.

1. Literature review

Many studies are devoted to the study of the shadow economy and its impact on the financial and economic security of the country's industry. Various aspects of the issue were researched, such as: a) the formulation of the content of the concept; b) the negative impact of the shadow economy on the social, financial, economic spheres of the country; c) features of the influence of the shadow economy on various industries; d) identification of common features of the shadow economy as a negative phenomenon for different countries of a particular economic region, etc.

Considering the economic essence of the concept of "shadow economy", it should be noted that among researchers there is no consensus on its formulation and interpretation (Olah et al., 2019). One can find the following alternative names for the concept of "shadow economy": informal economy (Goel et al., 2020; Chavdarova, 2018; Bayar et al., 2020); black economy (Bevan et al., 1989; Lyssiotou et al., 2004; Dilnot and Morris, 1981), underground economy (Bajada, 1999; Feige and Urban, 2008), hidden economy (Giles, 1999; Kazemier and van Eck, 1992), second economy (Bagachwa et al., 1995), informal economy (Johnson et al., 1998), undeclared economy (Williams and Horodnic, 2015), unobserved (unregistered) economy (Feige and Urban, 2008;). Such alternative names have been given by scientists to activities that belong to the shadow sector, if they are illegal and informal. This phenomenon may be interpreted as a set of economic processes that bypass laws and state control (Markina et al., 2017; Androniceanu and Tvaronavičienė, 2019; Siekelova et al., 2020).

In addition, different authors have explored different aspects on which it has a negative impact. In particular, Malyovanyi, et al., (2016) studied the impact of the shadow economy on the public administration and proved that the growth of

the shadow economy leads to a decrease in social benefits per capita. In turn, Bilan et al., (2019) assessed the normal distribution of capital investment and the level of the shadow economy of the European Union and Ukraine. They showed that with the growth of the shadow economy, the amount of capital investment in the country decreases. Other researchers have studied the impact of the shadow economy not only on the economic development of the country as a whole, but also on the development of its individual industries (branches). In their works, scientists have taken into account that the branches of the economy are characterized by their specific functioning and development (Bayar et al., 2020). In particular, Kozlova (2017) as well as Burroni et al., (2008) analyzed the impact of the shadow economy on the development of the textile industry. Furthermore, Williams et al., (2007) as well as Chancellor and Abbott (2015) described the impact of the shadow economy on changes in labor productivity in the construction industry. And Kopytko (2013) reveals the features of the shadow economy on the efficiency of industrial enterprises. That's also worth adding that Markina et al., (2018) identified the main features of the shadow economy, common to all countries of a particular economic region. According to them, the average shadow economy level is 18% for OECD countries (an international organization of 35 countries, most of which are high-income countries and high HDI and are considered as developed ones), and about 37% for countries with a transitional economy, which confirms the concept of regionalization of the economy. The authors argued that the shadow economy depends not only on economic but also on public policy.

There is no single method of calculation that would accurately reflect the level of the shadow economy and fully take into account all the factors that may cause it or affect its level. The Multiple Indicators Multiple Causes (MIMIC) approach has become widespread. Dell'Anno (2007) estimates the Portuguese Shadow Economy (SE) from 1977 to 2004 and tests the statistical relationships between the SE and other economic variables. In order to carry out the econometric analysis, a multiple indicators multiple causes (MIMIC) model with means and intercepts is applied. Furthermore, they predict the evolution of the shadow economy in three Mediterranean countries, namely France, Spain and Greece using a multiple indicators and multiple causes model based on the latent variable structural theory. Alañón and Gómez-Antonio (2005) adopted this approach to the Spanish case that is based on the theory of unobservable variables. This methodology involves the estimation of structural models (MIMIC) which analyses a set of causes of the shadow economy while simultaneously taking into account its influence upon a series of indicators.

In turn, Feige and Urban (2008) examine the conceptual and empirical relationships between new National Income and Product Accounts (NIPA) methods for obtaining "exhaustive" measures of total economic activity and the two most popular macro-model approaches (electric consumption and currency ratio models) for estimating the size and growth of the shadow sector. In contrast to it, Lyssiotou et al., (2004) propose a consumer demand system approach to estimate the size of the shadow economy where alternative hypotheses affecting the empirical results can be tested in a nested framework. This approach allows the estimation of the under-reporting of household income from various sources,

dispensing with the need to use arbitrary criteria to classify households by their main source of income (Oláh et al., 2017).

For the estimation of the extent of the shadow economy in the regions of the European Union Tafenau et al., (2010) combine the multiple-indicators multiple-causes approach with elements of spatial econometrics. This is also worth mentioniong that Feige (1990) uses alternative micro and macro methodologies for measuring shadow activities including census and survey procedures, discrepancy and monetary methods.

According to Shpak et al., 2019, systematization of the basic requirements for the state institution where the new generation of employees will work may directly affect the reduction of the shadow economy and its impact on public administration of financial and economic security of the industry. The researchers identified crucial criteria shaping the characteristics of civil servants, and systematized distinctive features of generations X, Y and Z. The distribution of the number of civil servants in Ukraine was analyzed by gender, age and position. Based on the correlation and regression analysis, the authors investigated the trend of the share of civil servants in Ukraine by an age category up to 2020. Thus the hypothesis about the dependence of effectiveness of the reform of the Ukrainian civil service on interaction and cooperation of all generations of civil servants was confirmed.

In Ukraine, the most appropriate methods for determining the size of the shadow economy are the official methods of the Ministry of Economic Development and Trade which include: "population expenditures – retail turnover", financial, monetary, electrical, method of loss-making of enterprises. Each method covers a specific area of the national economy (with a correspondingly different proportion of the illegal sector). Therefore, only the integral indicator of the level of the shadow economy is a complex indicator, which fully characterizes such a phenomenon. We claim that for estimating the level of shadow economy of the Ukrainian regions' industry, the most appropriate method is "enterprise loss". This method is to determine the marginal minimum and maximum coefficients of the shadow economy as a fraction of GDP within which the shadow economy level is located. In our study, to calculate the level of the shadow sector in the industry of the regions, the method of enterprise loss will be used. When using the enterprise loss method, we adopt the following assumptions: all loss-making enterprises according to official statistics are actually profitable, which is considered as an overestimation of the shadow economy scale; the profitability of unprofitable enterprises is equal to the profitability of profitable enterprises in the analyzed period; the expense ratio of loss-making and profitable enterprises is identical to the ratio of the number of such enterprises.

2. Methodology approach

Considering that in the scientific sources the threshold of 30% is considered as a critical level of the shadow economy (e.g. Boryusevych, 2012, p.

117) we divided the regions of Ukraine into three groups: regions with permissible (0-30%), critical (31-50%) and catastrophic (more than 51%) levels of the shadow sector in the industry. To assess the financial and economic security of the region's industry, we propose to use the partial indicators that characterize the financial and economic aspects of the activity of industrial enterprises and are collected and published by the State Statistics Service of Ukraine (Table 1).

Table 1. Indicators of financial and economic security assessment of the region's industry

Indicators	Symbol	The direction of change
Volume of industrial production (goods, services), mln UAH	x_1	Stimulator
Volume of industrial production (goods, services) per capita, UAH	x_2	Stimulator
Industrial production index, in % compared to the previous year	x_3	Stimulator
Average monthly nominal wage of full-time employees, UAH	x_4	Stimulator
Proportion of profit-making enterprises, in % of total enterprises quantity	x_5	Stimulator
Volume of profit received by enterprises, mln UAH	x_6	Stimulator
Proportion of loss-making enterprises, in % of total enterprises quantity	x_7	Destimulator
Volume of loss received by enterprises, mln UAH	x_8	Destimulator
Profitability (unprofitability) of operating activity of enterprises, %	x_9	Stimulator
Structure of capital investment, in % of total investment in the region	x_{10}	Stimulator

(*Source*: own elaboration)

To determine the weight of indicators, the most appropriate is to use hierarchy analysis method (Saati method) (Saati, 1993). This method involves calculating the priority vectors of alternatives against the selected criteria. Pairwise comparisons are defined as an advantage of one element over another according to the relative importance scale (Table 2).

Table 2. The scale of the relative importance of the Saati's hierarchy analysis method

Score, k	Definition	Characteristics
1	Equal importance	Equal contribution of two elements to the overall score
3	Moderate preference	Minor preference of one item over another
5	Substantial advantage	A significant advantage of one element over another
7	Considerable advantage	The virtually significant advantage of one element over another

Score, k	Definition	Characteristics
9	A very big advantage	The obvious advantage – the dominance of one element over another
2, 4, 6, 8	Intermediate values	Used in transient cases
1/k	Symmetric elements values	Used to evaluate non-dominant elements

(*Source*: Saati, 1993)

The value of the integral indicator of financial and economic security of industry of the regions of a country ranges from 0 to 1. The higher the value of this indicator, the higher the level of financial and economic security of the industry in the region and vice versa.

In the literature, there is no unambiguous scale of the division of regions by the level of financial and economic security of industry. Kornienko (2013, p. 337) claims that the indicators characterizing economic security fluctuate in the range from 0 to 1, depending on the deviation from the limit value. Based on this, a country, region or enterprise can be classified into 4 groups in terms of economic security: 1) absolutely safe when the main characteristic is 1; 2) safe – 0.7-0.9; 3) safe enough – 0.5-0.6; 4) dangerous – 0-0.4. Harrington's Universal Scale (Harrington, 1965) is popular as well; it is used by scientists to divide regions by the value of the integrated financial and economic security indicator into the following groups: 0-0.2 – unacceptable; 0.2-0.37 – acceptable; 0.37-0.63 – sufficient; 0.63-0.80 – good; 0.80-1.00 – very good. In turn Demchenko (2012, p. 116) presents the following scale of the integral indicator of the financial security level of the enterprise: 0-25 points – catastrophic level of financial security; 26-50 points – low level of financial security; 51-75 points – average level of financial security; 76-100 points – high level of financial security of the enterprise. We propose to adapt this scale to the results of our research and to distinguish two groups of regions of the country by the value of the integral index of financial and economic security of the industry: 0-0.5 – critical level of financial and economic security; 0.51-1.00 – acceptable level of financial and economic security. We can separately distinguish catastrophic level of financial and economic security – 0-0.25 and high level of financial and economic security – 0.80-1.00.

We propose to make public management decisions to reduce the level of the shadow economy both at the level of public administration and at the level of regions or districts on the basis of a combined method (Table 3), which is to position the regions by comparing the level of the shadow sector (S) and the integrated indicator of financial and economic security of industry in the regions (I) with the subsequent formation of priority measures to reduce the shadow economy.

Table 3. Combined method for the selection of public policy measures to reduce the shadow economy of the regions

Stages of the combined approach		Rating scale, limit value	Formulas, indicators and methods for determining the components
Calculation of parameters	1. The level of the shadow sector in the industry of the regions (S)	S = 0-30% – allowable level of the shadow sector; S = 31-50% – critical level of the shadow sector; S > 51% – catastrophic level of the shadow sector	The level of the shadow sector in the industry of the regions is determined by the method of enterprises' unprofitability. This method is to determine the marginal minimum and maximum coefficients of the shadow economy as a share of GDP, within which the level of the shadow economy is.
	2. Integrated indicator of financial and economic security of industry in the regions (I)	I = 0-0.25 – catastrophic level of financial and economic security; I = 0.26-0.50 – critical level of financial and economic security; I = 0.51-0.79 – acceptable level of financial and economic security; I = 0.80-1.00 – high level of financial and economic security	The sequence of determining the integrated indicator of financial and economic security of industry in the regions: 1. Selection of indicators for assessing the financial and economic security of industry in the regions. 2. Determining the weight of indicators (w_i) by the T. Saati hierarchy analysis method. 3. Standardization of indicators according to the formulas: – for stimulator indicators: $$Y_{ij} = \frac{z_{ij} - z_{\min}}{z_{\max} - z_{\min}},$$ – for disincentive indicators: $$Y_{ij} = \frac{z_{\max} - z_{ij}}{z_{\max} - z_{\min}},$$ where Z_{ij} is the value of the i-th indicator of the j-th region; Z_{min} – the minimum value of the i-th indicator for all regions; Z_{max} – the maximum value of the i-th indicator in all regions. 4. Calculation of the integrated indicator of financial and economic security of industry in the regions (I) by the formula: $$I = \sum_{i=1}^{m} n_i \cdot w_i$$ where w_i – weights of indicators of financial and economic security of industry in the region; n_i – normalized values of the i-th indicator of financial and economic security of industry in the region; m – the number of indicators of financial and economic security of industry in the region.

Stages of the combined approach	Rating scale, limit value	Formulas, indicators and methods for determining the components
Comparison of parameters and construction of a matrix of strategic zones	Strategic zone A: $S \leq 30\%$; $I > 0,5$ Strategic zone B: $S > 30\%$; $I > 0,5$ Strategic zone C: $S \leq 30\%$; $I \leq 0,5$ Strategic zone D: $S > 30\%$; $I \leq 0,5$	A matrix is built in which 4 strategic zones A, B, C, D are formed at the intersection of the values of two parameters. The criterion for division into strategic zones for the shadow sector level is the critical threshold value of 30%, and for the integrated indicator of financial and economic security – 0,5. Regions are positioned in the matrix depending on the level of the shadow sector and the integrated indicator of financial and economic security of industry
Formation of a system of recommended public policy measures to reduce the level of the shadow economy of the regions' industry		Public policy measures to reduce the level of the shadow economy of the regions in the field of industry and the expected results that increase the financial and economic security of the regions are proposed for each strategic zone

(*Source*: own elaboration)

To calculate the level of the shadow sector in industry (*S*), the official data for 2018 of the Main Statistics Departments of the regions of Ukraine and the State Statistics Service of Ukraine were used.

The experts were 23 senior managers of industrial enterprises and 6 experts of the Departments of Economics and Industrial Policy of Lviv and Ternopil regional state administrations, as well as 24 economists (Lviv Polytechnic National University, Odesa National Polytechnic University, National Technical University, Kharkiv Polytechnic Institute, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"). Experts were asked to compare in pairs the advantage of one indicator over another according to the 10-point scale of Saati (Table 2).

3. Conducting research and results

3.1 Calculation of the shadow sector in the industry

Based on the data for 2018 of the Main Departments of Statistics of Regions of Ukraine and the State Statistics Service of Ukraine, the level of the shadow sector in the industry of the regions was calculated (Table 4).

Table 4. Ranking and grouping of regions of Ukraine by the level of the shadow sector in industry, 2018

Regions of Ukraine	The share of the shadow sector in industry, % of the volume of GVA	The level of the shadow economy
Cherkasy	10	Acceptable level
Kirovograd	13	
Rivne	13	
Chernihiv	14	
Ivano-Frankivsk	14	
Kharkiv	15	
Vinnytsia	15	
Poltava	16	
Mykolayiv	16	
Odesa	17	
Ternopil	17	
Zaporizhzhia	18	
Khmelnytsky	18	
Volyn	18	
Zhytomyr	18	
Kherson	22	
Lviv	23	
Transcarpathian	24	
Chernivtsi	25	
Donetsk	26	
Sumy	31	Critical level
Dnipropetrovsk	43	
Luhansk	68	Catastrophic level
Kyiv	72	

According to the rule of "three sigma" in the normally distributed data, the deviation of the value from its mathematical expectation should not exceed $\pm 3\sigma$ (i.e. the probability of such situation is P = 0.01).

According to the table 4, for the share of the shadow sector in industry mean and rms values are:

$\bar{x}$ = 23,58;

σ = 15,58;

2σ = 31,16;

3σ = 46,74.

According to the results of the calculation (Table 4) it can be seen that only the share of the shadow sector in the industry of Luhansk and Kyiv regions exceeds the value $\pm 3\sigma$, that can be considered as an anomalous value. The share of the shadow sector in the industry of all other areas is within $\bar{x} \pm \sigma$.

Considering "abnormal" values for our analysis, it can be stated that anomalous value is - the value of the sample, which differs sharply from the entire data set and at the discretion of a specialist in statistics can be excluded from further processing. This solution will make the sample homogeneous, but this approach is only correct when dealing with an unlimited amount of information (in practice, when the number of values is more than 30). At present, it is recommended to use the provision (ISO 5725-2: 1994) to detect anomalous value in small samples, in which it is proposed to use the Grabbs test to determine anomalous values, which is to check the largest or smallest of the test results for anomalous value.

Let's check by the Grabbs criterion whether the maximum value of the share of the shadow sector in the industry of Kyiv region is anomalous by the formula (ISO 5725-2: 1994):

$$G_{max} = \frac{x_{max} - \bar{x}}{\hat{s}},\qquad(1)$$

where $\bar{x}$ – is the average value of the data set;

$\hat{s}$ – standard deviation.

$$\bar{x} = \frac{1}{p}\sum_{i=1}^{p} x_i,$$

$$\hat{s} = \sqrt{\frac{1}{p-1}\sum_{i=1}^{p}(x_i - \bar{x})^2}.\qquad(2)$$

The value of the Grabbs criterion is compared with the critical value.

For Kyiv region the following result can be obtained:

$G_{max} = 3{,}024 < G_{cr} < 3{,}112.$

G_{cr} is the 1% critical value of the Grabbs test (for twenty-four values it is 3,112).

For Luhansk region the following result can be obtained:

$G_{max} = 2{,}791 < G_{cr} < 3{,}112.$

Since $G_{max} < G_{cr} < 3{,}112$, the share of the shadow sector in the industry of Kyiv and Luhansk regions is not recognized as anomalous value, which allows to exclude this value from the further processing.

According to calculations, the acceptable level of the shadow economy in industry in 2018 was in 20 regions, critical – in 2 regions. In 2018, 2 regions – Luhansk and Kyiv – were classified as having a catastrophic level. The study shows that the level of the shadow economy in the industry of Luhansk region exceeds 50% and is 68% of GVA in 2018. This can be explained by the military conflict in the eastern Ukraine, financial destabilization, growing panic of economic agents and increasing administrative pressure. Another reason for this is the inaccuracy and imperfection of the collection of statistical information. All these factors have a significant impact on the high level of the shadow economy, as Luhansk is a center of hostilities, where in such conditions it is impossible to control the transparency of industrial enterprises.

In Kyiv region, the level of the shadow sector in industry, as well as in Luhansk region, also exceeds the 50% threshold, and significantly increased by

72% in 2018. In Kyiv region the reason was an increase in the amount of loss in 2018, which amounts to -273,69 mln. EU. The level of development of industrial enterprises depends on the implementation of innovative developments. Insufficient financial condition of industrial enterprises (about half of them are unprofitable) does not meet their needs for modernization and replenishment of obsolete fixed assets. The industry is dominated by backward technologies that lead to the consumption of large amounts of materials and energy resources.

3.2 Calculation of the integrated indicator of financial and economic security

Based on the conducted expert assessment, the importance of indicators of financial and economic security of industry in the regions was determined. The method of determining the eigenvalue of an inversely symmetric matrix of pairwise comparisons (λ_{max}), consistency index (CI), coherence ratio (CR) and local priority vector (w_i) taking into account the basic provisions of the Saati method is described in more detail in (Shpak, 2020). Summary results of the matrix of pairwise comparisons with the definition of local priorities are presented in Table 5.

Table 5. Matrix of pairwise comparisons for indicators of financial and economic security of the industry

No.	Symbol of the indicator	The value of pairwise comparisons										Vector of local priorities (weight)
		x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	w_i
1	x_1	1	3	1/4	2	1/4	1/2	1/6	1/4	1/6	3	0.04
2	x_2	1/3	1	1/3	1/2	1/7	1/6	1/9	1/7	1/9	1/3	0.02
3	x_3	4	3	1	3	1/4	1/2	1/5	1/2	1/5	2	0.06
4	x_4	1/2	2	1/3	1	1/6	1/4	1/8	1/6	1/8	1/2	0.02
5	x_5	4	7	4	6	1	2	1/2	2	1/3	5	0.15
6	x_6	2	6	2	4	1/2	1	1/4	1	1/4	3	0.08
7	x_7	6	9	5	8	2	4	1	3	1/2	7	0.23
8	x_8	4	7	2	6	1/2	1	1/3	1	1/4	5	0.10
9	x_9	6	9	5	8	3	4	2	4	1	7	0.28
10	x_{10}	1/3	3	1/2	2	1/5	1/3	1/7	1/5	1/7	1	0.03
$\lambda max = 10.51$; $CI = 0.06$; $CR = 0.04 \leq 0,1$												

(*Source*: own elaboration)

The results of ranking and grouping of the regions of Ukraine by the value of the integrated indicator of financial and economic security of industry in ascending order are presented in Table 6.

Table 6. Ranking and grouping of regions of Ukraine by the value of the integrated indicator of financial and economic security of industry (*I*), 2018

Regions of Ukraine	Integral indicator, *I*	Change to the previous year, % (+/-)	The level of financial and economic security
Luhansk	0,17	+0,09	**Catastrophic level**
Chernivtsi	0,24	-0,23	
Vinnytsia	0,39	-0,16	**Critical level**
Kherson	0,39	-0,08	
Kirovograd	0,42	-0,23	
Lviv	0,42	-0,16	
Zhytomyr	0,46	+0,06	
Kyiv	0,47	-0,22	
Rivne	0,48	+0,07	
Ternopil	0,48	0	
Transcarpathia	0,49	-0,08	
Odesa	0,52	-0,1	**Acceptable level**
Sumy	0,53	-0,05	
Mykolayiv	0,54	-0,1	
Khmelnytsky	0,54	-0,02	
Chernihiv	0,54	-0,01	
Kharkiv	0,57	-0,1	
Poltava	0,62	-0,07	
Volyn	0,64	+0,01	
Donetsk	0,69	+0,15	
Cherkasy	0,69	-0,04	
Dnipropetrovsk	0,78	-0,11	
Ivano-Frankivsk	0,80	-0,04	**High level**
Zaporizhzhia	0,91	-0,05	

(*Source*: own elaboration)

The results of the study show that during 2017-2018 the catastrophic level of financial and economic security of industry is inherent in Luhansk region, which can be explained by the war, the cessation of normal operations of industrial enterprises etc. The leaders with a high level of financial and economic security of industry are Ivano-Frankivsk and Zaporizhzhia regions. 9 regions of Ukraine are characterized by a critical level, and 11 regions – an acceptable level of financial and economic security of industry.

3.3 Matrix of strategic zones

We propose to make the choice of public management actions depending on the strategic zone of each region in the matrix "The level of the shadow

economy – the level of financial and economic security." Taking into account the results of our study, we present the positioning of the regions of Ukraine in the matrix of strategic zones "The level of the shadow economy – the level of financial and economic security" (Figure 1).

Figure 1. Positioning of regions in the matrix of strategic zones "The level of the shadow economy – the level of financial and economic security", 2018

		The level of the shadow economy, % of the volume of official GVA (*S*)	
		Acceptable (up to 30%)	**Critical (more than 30%)**
Integrated indicator of financial and economic security (*I*)	Acceptable (more than 0.5)	Strategic zone "A"	Strategic zone "B"
		Cherkasy, Chernihiv Ivano-Frankivsk, Kharkiv, Poltava Mykolayiv, Odesa, Zaporizhzhia Khmelnytsky, Volyn, Donetsk	Sumy Dnipropetrovsk
	Critical (up to 0.5)	Strategic zone "C"	Strategic zone "D"
		Chernivtsi, Vinnytsia, Kherson Kirovograd, Lviv, Zhytomyr Rivne, Ternopil, Transcarpathian	Luhansk Kyiv

(*Source*: own elaboration)

Strategic zone "A" is characterized by the best ratio of parameter values for the assessed industry of the region: lower than the critical level of the shadow economy and higher than the critical level of financial and economic security. The regions that fall into this zone are the most transparent in their activities, and are characterized by high financial and economic performance of industrial enterprises, support high innovation activity of enterprises in industry etc. This zone includes 11 regions of Ukraine.

Strategic zone "D" is critical for the state and requires the most radical and urgent public policy measures to combat the shadow sector of industry and increase the financial and economic efficiency of industrial enterprises. Zone "D" is characterized by a high (critical) level of the shadow sector in industry and a low (critical) level of financial and economic security of industry. This zone includes Luhansk region, territories where military operations are being conducted, which poses a danger to the country's industrial production, as well as Kyiv region.

Strategic zone "B" is characterized by a high level of financial and economic security, which indicates the high efficiency of the public administration of industrial complex of the region, however, poor government policy leads to the transition of a certain part of the industry into the "shadow", which increases the share of the shadow sector. This zone includes Sumy and Dnipropetrovsk regions.

Low financial and economic performance of industrial enterprises in the regions and a low share of the shadow sector in industry are characteristic of the *strategic zone "C".* This zone includes Chernivtsi, Vinnytsia, Kherson, Kirovograd, Lviv, Zhytomyr, Rivne, Ternopil, Transcarpathian regions.

A characteristic feature of the division into strategic zones is the development and adoption of public policy measures to reduce the level of the shadow economy, which increase their influence, urgency and necessity for their implementation in the direction of transition from zone "A" to zone "B". Logically, the implementation of a more effective measure can be more expensive for the state, so it is necessary to balance between the cost and scope of the impact of the measure on the target results. The costs of developing and implementing public policy measures to reduce the level of the shadow economy should not exceed the financial results obtained by reducing the level of the shadow economy. Moreover, public policy measures to reduce the level of the shadow economy should lead to a strengthening of the level of financial and economic security of the region and the state as a whole.

4. Discussion

Ukraine has the highest level of the shadow economy in Eastern Europe (Markina et al., 2017; Schneider, 2014). According to the research on 162 countries on the level of the shadow economy in 1999-2014, the level of the shadow economy of Ukraine was 54.8% of GDP (Schneider, 2015). According to preliminary calculations of the Ministry of Economic Development, the level of the shadow economy of Ukraine in 2018 amounted to 30% of official GDP, which is 2% less than in 2017 and is the lowest level since 2009. The downward trend in the shadow sector in 2018 compared to 2017 was observed in most major aggregate economic activities, including in the mining industry – by 8%, in the processing industry – by 4%. Taking into account the results of the above research, we propose a list of priority measures to reduce the shadow economy scope and the expected results that increase the financial and economic security of industry in the regions for each of the proposed strategic areas (Table 7).

Table 7. Recommended public policy measures to reduce the level of the shadow economy of the regions

Strategic zones	Measures to reduce the level of the shadow economy	Expected results that increase financial and economic security
Strategic zone "A"	- improving the investment climate in the region; - ensuring the balance of supply and demand in the labor market and improving the quality of vocational education; - improving the mechanism of social assistance to the unemployed; - improvement of the information base	- increasing the competitiveness of industry in the region; - intensification of industrial enterprises' activity; - increase of analytical possibilities of calculations

Strategic zones	Measures to reduce the level of the shadow economy	Expected results that increase financial and economic security
Strategic zone " B"	- simplification of business activities, as well as its stimulation; - "amnesty" of capital of non-criminal origin, especially those directed to the innovation sphere and to other socially significant and priority sectors	- elimination of contradictions between entrepreneurs and regulatory authorities; - increase in the volume of production of innovative products, introduction of innovative technologies
Strategic zone " C"	- improving the business climate by increasing the level of confidence of businesses in the state; - real and radical simplification of conciliation and permitting procedures for doing business, especially in the field of innovation	- strengthening the role of the middle class; - elimination of contradictions between entrepreneurs and regulatory authorities; - intensification of entrepreneurial activity
Strategic zone " D"	- reducing the level of monopolization of production; - ensuring transparency and openness of public authorities; - taking effective measures in the fight against corruption; - strengthening responsibility for committing economic crimes, tax evasion, non-compliance with labor laws, etc.; - encouraging the investment use of legalized funds (in particular, by exempting from taxation of legalized invested funds); - state guarantee of non-prosecution of the owners of capital obtained illegally, provided that these funds are invested in the productive sphere of the economy	- expansion of production capacity; - increase in the number of enterprises; - intensification of industrial enterprises' activity; - withdrawal of funds from the "shadow"; - strengthening the role of market mechanisms and tools; - growth of investment resources in the development of industry in the region

(*Source*: own elaboration)

Of course, one shouldn't be limited only to these recommended measures. They can be used both separately and in combination. In addition, it is worth emphasizing the measures to increase the de-shadowing of the economy, which should be carried out at the national level in all regions of the country, in particular: the introduction of tax incentives in the form of reducing tax liabilities to the state; promoting the development of the banking system and reducing interest rates on loans; increasing the effectiveness of state control over business activities; adapting foreign experience to measures on combating the illegal economy; reducing the level of monopolization of production; ensuring transparency in the activities of the executive authorities; improving the business climate by increasing the level of business' confidence in the state; ensuring transparency and openness of public

authorities; taking effective measures to combat corruption; carrying out financial, pension, judicial, medical, educational and other reforms; strengthening the responsibility for committing economic crimes, tax evasion, non-compliance with labor laws, etc.; improving the country's investment climate; counteraction to money laundering, etc.

5. Conclusions

Much attention around the world is paid to the study of the shadow economy. This is due to the need for society to maintain a state of sustainable positive socio-economic development. The emergence and resumption of shadow activity is a kind of reaction of society to shortcomings in the development of legislation, authorities etc. Despite the fact that the shadow economy is an almost insurmountable element of social relations, it must be fought, because with the sustainable reproduction of the shadow sector, the inevitable destruction of the legal economy is equal to the loss of national economy's profitability and competitiveness, and country's financial and economic security.

It is impossible to eliminate the shadow sector of the economy as an economic phenomenon, even in the most effective ways. The task of all branches of government is to curb the informal economy within the framework in which it does not destroy the economic system. The problem of the shadow economy in the countries will remain relevant for a long time. Keeping this fact in our mind, we propose a scientific and methodological approach, which consists in positioning the regions by comparing the level of the shadow sector (S) and the integrated indicator of financial and economic security of industry in the regions (I) with the subsequent formation of priority measures to reduce the shadow economy.

Based on the data of the Main Departments of the State Statistics Service of Ukraine and the State Statistics Service of Ukraine, we calculated the level of the shadow sector in the industry of the regions in 2018. The results achieved showed that: the acceptable level of shadow economy in industry in 2018 was in 20 regions, critical – in 2 regions, catastrophic – in 2 regions. In two regions (Luhansk and Kyiv) the level of the shadow economy was more than 50%. Thus, the level of the shadow economy in industry in 2018 ranged from 10% to 72%. The lowest values are typical for Cherkasy region – 10%. The highest level, according to our calculations, were recorded in Luhansk and Kyiv regions (68% and 72%, respectively).

The catastrophic level of financial and economic security of industry was revealed in Luhansk and Kyiv regions. 9 regions of Ukraine are characterized by a critical level, and 11 regions – by an acceptable level of financial and economic security of the industry.

Taking into account the results of calculations, the regions of Ukraine were positioned in the proposed matrix of strategic zones "The level of the shadow economy – the level of financial and economic security." This allowed to propose a

list of measures to reduce the level of the shadow economy of the regional industries.

Using the measures proposed in the study, it becomes possible to reduce the level of the shadow economy by increasing budgetary discipline, legalization of capital, business opportunities, property rights, – all this will facilitate investment attractiveness and competitiveness of the economy, as well as strengthen financial and economic security of the country in general.

The method developed by us is characterized by the several advantages compared to the methods proposed by other scholars: 1) *complexity and integrity.* The assessment comprehensively took into account those indicators that best reflect the specifics of the industry of the regions of Ukraine and allow to make complete and adequate conclusions about the level of its financial and economic security by calculating the integrated indicator; 2) *taking into account the weigh*t, which allows to consider the strength of the impact of each of the partial indicators on the integrated indicator and the specifics of the study area. Ignoring the importance in assessing the level of financial and economic security of industry in the region can lead to distortion of the results of the study in the direction of the predominance of one of the factors.

The practical significance of the study is that the proposed scientific and methodological approach can be applied in practice by the authorities to form patterns of behavior for de-shadowing and improving the financial and economic security of regional industries.

In turn, as a limitation of the study, two main points should be mentioned: 1) when forming a system of indicators, it is proposed to exploit the indicators that are used in the practice of evaluating the effectiveness of industry in Ukraine and may be specific only to Ukraine; 2) this methodology cannot be applied to other sectors of the economy, as it takes into account the specifics of the industrial sphere.

In the future it is necessary to deepen research in this direction by calculating the levels of shadow economy and financial and economic security of Ukraine's regions in dynamics, which will identify trends as a result of the government's measures to de-shadow the economy, as well as using modeling methods to predict the direction of change in the level of the shadow economy in some regions and in the whole industry.

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