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Assessment of efficiency indicators of internal control system functioning

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Abstract: The results of the research will be useful for audit service professionals directly involved in the process of evaluating the effectiveness of the internal control system and scientists who are concerned with the development of scientific and methodological apparatus for assessing the effectiveness of not only the internal control system, but also other systems in the field of management, as well as all concerned with risk-oriented internal control.

The material presented in the study offers theoretical and practical coverage of the results regarding the solution of the urgent task today - the development of a methodological apparatus for evaluating the effectiveness of the internal control system of the Ministry of Defense of Ukraine.

In the article, by specifying a certain algorithm, the substantiation and prioritization of indicators, which can testify to the effectiveness of the internal control system in the system of the Ministry of Defense of Ukraine and the Armed Forces of Ukraine, are determined.

The object of the study is the process of evaluating the effectiveness of the internal control system in the system of the Ministry of Defense of Ukraine, since it is under-researched. The study presents the results of the empirical justification of the indicators, which confirmed the possibility of taking them into account in further studies.

The study proposes to shed light on the results of the use of the peer review method for solving the scientific problem and justify the application of this method.

The article presents the results of calculating the final amount for each indicator, calculating the arithmetic mean, selecting the most significant indicators and building a new ranking of

indicators. To assess the average consistency of all experts, a concordance coefficient was used when related rankings were available, that is, the same rank values in the estimates of one expert.

The significance of the coefficient of concordance by its Pearson test was determined and all 92 indicators were evaluated.

By performing the relevant mathematical calculations of the processing of the information obtained on the basis of the questionnaire of experts, six priority indicators were determined in determining the assessment of the effectiveness of the internal control system.

Keywords: internal control, internal audit, risk management, assessment of the effectiveness of internal control.

1. Introduction

In the Ministry of Defense of Ukraine (hereinafter 'MoD') and the Armed Forces of Ukraine a system of internal control and risk management is being implemented. According to the decision of the National Security and Defense Council of Ukraine dated May 20, 2016 'On Strategic Defense Bulletin of Ukraine' approved by the Decree of the President of Ukraine No. 240/2016 (2016), defined the task of creating an integrated risk management system.

The task is implemented in accordance with Strategy for Reforming the System of Public Finance Management for 2017-2020 approved with the resolution of the Cabinet of Ministers of Ukraine No. 142-p (2017) dated February 8, 2017, and the Plan of Action approved with the resolution of the Cabinet of Ministers of Ukraine No. 415-p (2017) dated May 24, 2017.

Accordance with the requirements the Decree of the Cabinet of Ministers of Ukraine No. 1001 dated 28.09.2011 'Formation Procedure for the Structural Units of Internal Audit and Conductance of Audit in the Ministries, Other Central Bodies of Executive Power, Their Territorial Bodies and Budget-Financed Institutions Subordinated to the Ministries and Other Central Bodies of Executive Power' (2011)the internal audit service assesses the effectiveness of the internal control system(hereinafter 'SIC').

However, there is no scientifically substantiated methodology for assessing the efficiency of the SIC in the MoD and the Armed Forces and at the national level.

The procedure for conducting the risk management audit determined by the order of the Department of Internal Audit of the Ministry of Defense of Ukraine No. 33 «On approval of the Temporary guidance on conducting the risk management audit» (2017) dated October 6, 2017does not give a practical assessment and effectiveness of the SIC.

The solution of the scientific task is synchronized with the implementation of the research work «Internal Audit» and the dissertation research carried out by the Department of Economics and Financial Support of Ivan Chernyakhovsky National University of Defense of Ukraine.

1.2. Setting objective

The purpose of the article is to highlight the practical results of the development of a part of the scientific and methodological apparatus for assessing the efficiency of the SIC – a system of indicators that can testify to the effectiveness of the operation of the MoD.

2. Material and Method

The research covered a number of scientific methods of theoretical and empirical research, namely: analysis, synthesis, induction, comparison, deduction, systematic approach.

In order to achieve the goal of the article, it is proposed to decompose the purpose of the scientific research and to carry out in the following order:

to clarify the preparatory bases for the implementation of justification of the performance indicators of the SIC;

practically make the appropriate calculations.

3. Results and Discussion

3.1. In the previous stage of the study (Loishyn, 2019), the selection of indicators for evaluating the effectiveness of the SIC was made using the method of analysis of guidelines, scientific publications and other sources and interviews. The qualitative and quantitative indicators were grouped. In total, 93 qualitative and quantitative indicators have been identified, which can be taken into account when assessing the effectiveness of a SIC.

Further, there was a problem in determining their priority and importance. The solution of the problem requires the use of a certain method by which it is possible to carry out their ranking and assign them weights. This makes it possible to select the most relevant and important indicators for the impact on the SIC, which in their totality are an integral part of the scientific and methodological apparatus of assessing the performance of the SIC.

Expert methods are mainly used to rank and assign weights, the main ones being: the peer review method and the analogy method.

The method of expert evaluation refers to the method, which is carried out by an expert (Novosad V., 2009), that is, the use of the experience of professionals to assess and the likelihood of predicting the occurrence of certain events.

This method is also called heuristic, which is based solely on the practical experience of the expert. It should also be added that the method of expert judgment should be applied in the absence of comprehensive statistical information. The peculiarity of the expert method is the lack of complex mathematical calculations and mathematically justified reasoning, because the assessment is determined by the person based on his own experience.

In proposing the use of the method of expert judgment in the process of substantiating the performance of the SIC, the advantages and disadvantages of that method should be highlighted and the adaptability of the method to the use in the SIC environment should be substantiated.

Advantages of using the method of expert evaluation should be applied in the absence of comprehensive statistical information, a relatively complex system of calculations.

The disadvantages of the peer review method include the absence of competent experts.

To determine the hierarchically constructed list of indicators for evaluating the effective SIC, it is necessary to make a questionnaire indicating all indicators in two components: qualitative and quantitative indicators of SIC functioning. The questionnaire should include all 93 indicators identified on the basis of the analysis.

Further, it is suggested that with the help of experts, a survey should be conducted with the subsequent mathematical calculation of the result obtained.

Next, the composition of the expert group must be determined.

Since 2016, the development and construction of risk-oriented SIC within the system of the MoD and the Armed Forces of Ukraine is carried out directly by representatives of the Main Inspectorate of the MoD, the Department of Internal Audit of the MoD and the Internal Control Division of the General Staff of the Armed Forces of Ukraine.

Also, International Auditing Standard (ISA) 315 (Revised) "Identifying and Assessing Risks of Significant Distortion through an Understanding of an Entity and its Environment" considers the auditor's responsibility for identifying and assessing the risks of material misstatement of the financial statements by understanding the entity and its environment, including its internal control.

Next, the category of experts involved in the peer review was identified.

First, the expert group should include representatives of the Main Inspectorate of the Ministry of Defense of Ukraine, namely representatives of the relevant structural unit headed by the Chief Inspector of the Organization of Internal Control of the MoD and the Armed Forces of Ukraine. The Chief Inspectorate, in collaboration with the Department of Internal Audit of the MoD, directly implemented internal controls based on risk management.

Secondly, the Organization of Internal Control and Risk Management within the MoD established that the internal audit units perform an assessment of the effectiveness of the SIC.

Representatives of both internal and internal audit and internal control experts should be involved in conducting the expert evaluation of the justification of the performance evaluation of the SIC. The inclusion of experts from the audit team is mandatory.

According to the views of Permyakova O. (2005) and other scientists, as a rule, from 12 to 20 specialists are included in the expert group.

If the number of experts is very large, then their opinions may not be consistent, whereas, when attracting a small number of experts, there may be some difficulty with the accuracy of the generalized estimates.

This is primarily due to the fact that the number of experts should be sufficient to take into account the essential properties of the problem being solved and to ensure the accuracy of the forecast. It is proposed to include at least 12 people in the expert group.

Having received the basic (key) indicators, which testify to the effectiveness of the functioning of the SIC, we will be able to form one of the elements of the scientific and methodological apparatus of the subject of research.

To determine the key and most important indicators, one of the questionnaire methods was applied, namely the method of average points, that is, the hierarchical

placement of elements depending on the significance in the process, which is investigated by assigning a certain score, in our case, with a priority of 1 to 10 points.

In the course of the study it is proposed to use the following algorithm of the method of average points:

1. Calculation of the finite sum for each indicator (1):

$$S_{ij} = \sum bij\ , \tag{1}$$

2. Calculation of arithmetic mean ranks (2):

$$rj = \frac{S_{ij}}{n}, \tag{2}$$

3. Building a new ranking of indicators.

4. The choice of the most significant indicators by the principle - the higher the average rank, the more significant the indicator.

After determining the key scores by the method of mediation, the median method was applied to verify and confirm the results obtained.

A group assessment can only be considered objective and reliable if the opinions of expert experts are consistent. For this reason, statistical processing of information received from experts should include an assessment of the degree of coherence of experts' opinions and identify the reasons for their heterogeneity.

Consistency of experts' opinions is suggested to be estimated using the coefficient of concordance (W), that is, the total rank correlation coefficient for a group consisting of m experts.

The coefficient of concordance (Belov V.& Chumakov V., 2019), (Belov V., 2011), (Kendall M. G., 1958), (Zastelo O., 2015) can vary from 0 to 1$W \in [0,1]$, in view of the above, its equality of units means that all experts have given the same estimates of certain factors, and in the case of a result equal to zero indicates that there is no correlation between the points obtained in the expert questionnaire process(Traskovetska L. & other. 2013).

To check the consistency of experts, it is proposed to determine the coefficient of concordance was determined using the Eq. (3), which is used in the case of the assignment by experts of several factors of the same points (ranks):

$$W = \frac{S}{\frac{1}{12} * m^2(n^3 - n) - m * \sum T_i}, \tag{3}$$

where, $T_i = \frac{1}{12}\sum_{t_i}(t_l^3 - t_l)$,

t_l – the number of identical ranks in i^{th} row.

The last stage of the mathematical processing of the results of expert evaluation was the determination of the significance of the concordance coefficient by its

conduction using the Pearson criterion given in Eq. (4); this is due to the fact that in some blocks the number of factors is n>7:

$$x^2 = \frac{S}{\frac{1}{12} * mn(n+1) + \frac{1}{n-1} * \sum T_i}, \quad (4)$$

Having obtained the results of the peer review method, we will be able to identify key indicators that, in the opinion of experts, play a decisive role in assessing the performance of the SIC.

3.2. For practical reflection of the results obtained in the course of the study, in our opinion, it is advisable to present the results of the application of the above method in substantiating the qualitative and quantitative indicators of the evaluation of the efficiency of the SIC and to demonstrate the possibility of using the method of expert assessments.

Thus, for the placement of qualitative (*n*) and quantitative (*k*) indicators in the order from the highest grade point average to the lowest grade point average, an appropriate matrix (Table 1) was compiled by peer review.

Table 1. Fragment of the SIC Peer Performance Matrix.

Indicators	Experts												Total	Mean score
	1	2	3	4	5	6	7	8	9	10	11	12		
n_1	4	4	1	1	4	5	5	3	5	1	1	1	35	2,9166666666667
…														…
n_{74}	5	5	1	4	2	9	3	2	4	2	1	1	39	3,25
k_1	2	2	1	4	3	1	6	3	1	1	1	1	26	2,1666666666667
…														…
k_{20}	3	3	3	7	8	8	5	10	5	9	5	5	71	5,9166666666667

Further, on the basis of the average grade obtained, the final ordering was carried out, using the principle that the lower the average, the more important the indicator.

The highest scores were given to:

Quality of risk identification (1.33);

The level of competence of those involved in control measures (1.41);

The quality of risk assessment (1.5);

State of implementation of control measures (1.5);

Quality of financial (accounting) reporting (1.83);

Loss and shortfall ratio (1.83).

The lowest scores were:

Average duration of the control measure (5.91);

Number of control actions (5.91);

The number and regional heterogeneity of the location of well-known units or subsidiaries (5.58);

Number of misunderstandings and messages (5.41).

According to the results of calculations, some indicators received the same amount of points, and then according to the method considered they are equivalent, and therefore grouping into one group – equivalence class.

Further, to calculate the consistency of experts using the coefficient of concordance of the analyzed indicators and assigning weights by priority, the values of the 50 most significant indicators were identified: n_{11}, n_{43}, n_{12}, n_{13}, n_{45}, k_3, n_{55}, n_{56}, n_{57}, n_3, n_{60}, n_{64}, n_{65}, n_{67}, n_2, n_{20}, n_{21}, n_{29}, n_{33}, n_{68}, n_7, n_{37}, n_{54}, n_{58}, k_1, n_6, n_{51}, n_{18}, n_{31}, n_{32}, n_{52}, n_{14}, n_{19}, n_{28}, n_{50}, n_{69}, n_{10}, n_{27}, n_{49}, n_9, n_{25}, n_{35}, n_{61}, k_{15}, n_4, n_{23}, k_5, k_1, k_{42}, k_{14}.

Using the calculated rank matrix, a concordance coefficient was calculated to construct a rank matrix to verify the correctness of the matrix composition based on the checksum calculation.

Since the matrix contains indicators with the same rank in the experts' estimates, we will reformat them without changing the opinion of the experts. That is, the corresponding ratios (greater, less, or equal) must be maintained between ranks.

Also, you should not rank above 1 and below the value of equal number of parameters (in this case n = 50).

The reformatting of ranks is carried out in the corresponding table, according to which a new matrix of ranks is constructed.

Next, check the correctness of the matrix composition based on the calculation of the checksum (Table 2).

Table2. Fragment of the table for checking the correctness of the matrix based on the calculation of the checksum.

Indicators / Experts	1	2	3	4	5	6	7	8	9	10	11	12	Total of the ranks	d	d^2
x_1	18,5	18	25	3	20,5	8,5	16	12,5	8,5	15,5	24	17	187	-119	14161
…													…	…	…
x_{50}	33	33	50	41,5	35,5	35,5	50	39,5	32	15,5	24	17	406,5	100,5	10100,25
∑	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	15300		159932

Where, $d = \sum x_{ij} - \frac{\sum x_{ij}}{n} = \sum x_{ij} - 306$;

Checking the correctness of the matrix composition based on the calculation of the checksum:

$$\sum x_{ij} = \frac{(1+n)n}{2} = \frac{(1+50)50}{2} = 1275;$$

The sums on the columns of the matrix are equal between themselves and the checksum, thus, the matrix is correct.

Next, we have determined the total ranking of the elements of the matrix.

To estimate the average consistency of all experts, we use a coefficient of concordance when there are related rankings (the same rankings in the estimates of one expert.

Definition of estimation of degree of consistency of opinions of experts according to using the Eq. (3):

$$W = \frac{S}{\frac{1}{12} * m^2(n^3 - n) - m * \sum T_i}, \quad (3)$$

Where, S = 159932, n = 50, m = 12

$$T_i = \frac{1}{12}\sum_{t_i}(t_l^3 - t_{il})$$

l_i – the number of connections (types of duplicates) in the estimates of the i^{th} expert, t_l – the number of elements in the l^{st} connective for the i^{th} expert (the number of repetitive elements).

T_1 = [(12^3-12) + (12^3-12) + (17^3-17) + (4^3-4) + (4^3-4)]/12 = 704
T_2 = [(13^3-13) + (11^3-11) + (17^3-17) + (3^3-3) + (5^3-5)]/12 = 712
T_3 = [(49^3-49)]/12 = 9800
T_4 = [(5^3-5) + (10^3-10) + (15^3-15) + (16^3-16) + (4^3-4)]/12 = 717,5
T_5 = [[(18^3-18) + (11^3-11) + (12^3-12) + (6^3-6) + (3^3-3)]/12 = 757
T_6 = [(16^3-16) + (12^3-12) + (13^3-13) + (6^3-6) + (3^3-3)]/12 = 684,5
T_7 = [(21^3-21) + (5^3-5) + (13^3-13) + (2^3-2) + (6^3-6) + (2^3-2)]/12 = 980,5
T_8 = [(24^3-24) + (4^3-4) + (9^3-9) + (12^3-12)]/12 = 1358
T_9 = [(16^3-16) + (12^3-12) + (7^3-7) + (7^3-7) + (2^3-2) + (5^3-5)]/12 = 549,5
T_{10} = [(30^3-30) + (2^3-2) + (13^3-13) + (2^3-2) + (2^3-2)]/12 = 2431
T_{11} = [(47^3-47) + (2^3-2)]/12 = 8648,5
T_{12}= [(33^3-33) + (4^3-4) + (4^3-4) + (3^3-3) + (2^3-2) + (2^3-2)]/12 = 3005
$\sum T_i$Ti = 704 + 712 + 9800 + 717,5 + 757 + 684,5 + 980,5 + 1358 + 549,5 + 2431 + 8648,5 + 3005 = 30347,5

$$W = \frac{159932}{\frac{1}{12} * 12^2(50^3 - 50) - 12 * 30347{,}5} = 0{,}14$$

W = 0,14 indicates a weak degree of consistency of experts' opinions.

This is primarily due to the fact that the group of experts included representatives in two areas of participation in the process of internal control functioning in the MoD and the Armed Forces of Ukraine.

Next, to determine the significance of the coefficient of concordance, we use the Pearson consistency criterion, was determined using the Eq. (4):

$$x^2 = \frac{159932}{\frac{1}{12} * 12 * 50(50 + 1) + \frac{1}{50 - 1} * 30347.5} = 82.84$$

The calculate dx^2 is compared with the table value for the number with the degree of freedom $K = n - 1 = 50 - 1 = 49$ and at a given level of significance $\alpha = 0{,}05$.

Next, x^2 calculated 82,84 ≥ tabular (67,50481), то W=0,14 – the value is not accidental, and therefore the results obtained during the calculations are meaningful and can be used in further studies.

On the basis of the received sum of ranks (Table 3) it is possible to calculate weight indicators of the considered parameters, the matrix of information received from experts is transformed into the matrix of reformatted ranks by the using the Eq. (5):

$$S_{ij} = x_{max} - x_{ij}, \quad (5)$$

Where, $x_{max} = 9$.

Table3. Fragment matrix of converted metrics.

Indicator/Experts	1	2	3	4	5	6	7	8	9	10	11	12	∑	λ
x_1	7	7	8	8	7	8	7	8	8	8	8	8	92	0,02268
…														…
x_{50}	6	6	6	5	6	6	2	6	6	8	8	8	73	0,018

The obtained weight characteristics of these indicators are calculated on the basis of an evaluation of 50 indicators, which experts have preferred among the 93 proposed indicators for assessing the effectiveness of the SIC.

For further research using the Key Performance Indicators (KPI) system, we select the 6 most relevant indicators selected by experts.

Using the method above, we calculate the weights of the selected items:

The quality of risk identification (0.1781);

The level of competence of those involved in control measures (0.1741);

The quality of risk assessment (0.17);

State of implementation of control measures (0.17);

Quality of financial (accounting) reporting (0.1538);

Indicator of losses and shortages (0.1538).

4. Conclusions and prospects of further research

The article demonstrates the feasibility of using the peer review method to identify key performance indicators for the functioning of the SIC.

Thus, all 92 indicators were evaluated on qualitative and quantitative grounds.

The following six priorities were identified in determining the effectiveness of the SIC by conducting relevant mathematical calculations of the information obtained on the basis of the expert's questionnaire:

The quality of risk identification;

The level of competence of those involved in control measures;

The quality of risk assessment;

State of implementation of control measures;

Quality of financial (accounting) reporting;

Indicator of losses and shortages.

The prospects for further research are seen in the development of a comprehensive methodology for evaluating the functioning of the SIC institution of MoD.

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