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# ANALYTICAL SUPPORT FOR ORGANIZATIONS' ECONOMIC AND ENVIRONMENTAL SAFETY MANAGEMENT

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**Abstract.** In order to form an effective analytical support for the management of the economic and environment safety of organizations, the initial positions of environmental and economic analysis were substantiated. This allowed expanding the understanding of economic analysis in ensuring the effective interaction of the organization with the environment. As a result of the study of the methods of environmental and economic analysis of the priority objects of management of economic and environment safety, the absence of a system of indicators and a mechanism for their use has been established, which significantly reduces the quality level of the management information space. In order to solve this problem, the work developed the author's methods of environmental and economic analysis:1) models of environmental and economic analysis of the production process in terms of waste management (proposed calculation procedure, interaction mechanism, information support, procedure for factor models construction of waste cost ratios, waste capacity ratios, waste replacement ratios, waste replacement efficiency ratios); 2) procedure for analyzing the cost of processing, recycling and disposal of waste. The use of these techniques allowed us to identify the reserves for increasing the level of environmental and economic security of organizations.

**Keywords:** analytical management support; economic and environment safety; mechanism, reserves; information space; efficiency

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## 1. Introduction

In modern economic conditions, the economic and environment safety of industrial organizations depends on the reasonableness of management decisions. Under market conditions, an organization independently makes management decisions, and this happens when there is an uncertainty in the organization's external and internal financial and business environment, so there are risks caused by deviations of actual results from those planned. Under the influence of any risk, negative consequences can occur, resulting in the need for each organization to develop a system of measures aimed at reducing the undesirable consequences as much as possible. The main tool for such measures assessment is the system of economic analysis, which allows to establish causal relationships between measures, risks and their environmental and economic consequences for organizations.

The most effective impact on the change and development of economic phenomena and processes in conditions of democratization of management and management systems will be achieved when their regulators are balanced and comprehensively substantiated and convincing. Systematic analytical substantiation of the quantitative and

qualitative measurement of their effectiveness in a specific economic environment is a necessary and sufficient condition for implementation and spreading. The complex of such analytical tools is not regulated, however, the weight of its activities in harmonizing public, corporate and personal interests is undeniable.

## 2. Literature Survey

Modern approaches to the development of economic analysis are more focused on ensuring the financial and investment activities of organizations and, consequently, increasing their rating on the security market (Carranza, M. E. (2017), Bai, Y., Jiang, B., Wang, M., Li, H., Alatalo, J. M., & Huang, S. (2016)). Environmental and economic issues have been neglected and need to be developed. Researchers have made a significant contribution to the development of the science of economic analysis, but with the development of economic relations there is a need to expand its methodological tools and develop new theories that would characterize modern economic realities. So, today the priority is the development of economic analysis, which characterizes the relationship between the economic environment and the natural environment through the prism of economic activities of industrial organizations (Skrynkovskyy, R., Pawlowski, G., Harasym, P., & Koropetskyi, O. (2017)). George, R. Z., & Rishikof, H. (Eds.). (2017) in this context, note the following: economic analysis as an applied functional science has a close relationship with practice; studies, develops, improves the methods of obtaining, processing information about economic phenomena and processes, their formation and development. Practice here is a source of knowledge, because the existence of economic analysis as a science is caused by the needs of practice (Jackson, S. (2017)); is the basis of knowledge, its driving force - penetrating the entire process of scientific knowledge, ranging from its empirical level and to the construction of abstract theories, the constant movement from the concrete to the abstract and in the opposite direction; a fundamental direction (the goal in the general sense) - scientific knowledge is not happening for its own sake, but to ensure the regulation of economic phenomena and processes, their development, strengthening of positive trends and leveling of negatives (Lee, C. (2017)); is an integral criterion of truth and value of the knowledge gained - the test of knowledge for truth is a complex and ambiguous process, given the constant dynamism of the economic environment (Okoye, P. U. (2016)).

Thus, the current economic conditions have significantly influenced the development of economic analysis, because there was a need for a synthesis of economic and environmental indicators of economic activities of industrial organizations (Rushdi, A. M. A., & Hassan, A. K. (2016), Lutchman, C., Ghanem, W., & Maharaj, R. (2016)). Until now, these characteristics were considered in different planes and, accordingly, users did not require the delivering of information that is of an ecological and economic nature (Tetiana, H., Chorna M., Karpenko L., Milyavskiy M. & Drobyazko S. (2018)). When it is necessary to ensure a high level of economic and environment safety of an industrial organization, which is a determining component of its continuity, indicators of environmental and economic nature, their parameters, forecasts and changes must be taken into account in business activities management (Liu, H., & Lin, B. (2016); Atari, S.; Bakkar, Y.; Olaniyi, E. O.; Prause, G. (2019); Pavolová, H.; Bakalár, T.; Emhemed, E.M.A, Hajduová, Z.; Pafčo, M. (2019); Lavrinenko, O.; Ignatjeva, S.; Ohotina, A.; Rybalkin, O.; Lazdans, D. (2019); Hasanudin, A.I.; Yuliansyah, Y.; Said, J.; Susilowati, Ch.; Muafi (2019)). This will ensure an appropriate level of economic, environmental and social performance on the path to sustainable development.

Based on this, the development of environmental and economic analysis should be accompanied by the formation of a system of economic and environmental indicators. Ecological and economic indicators of the analysis should reflect the economic and environmental processes in all business processes of economic activities of industrial organizations, and they can be expressed both in absolute and relative values. A significant number of economic and environmental indicators of economic activities of industrial organizations is an integral part of financial indicators, because it plays a substantial role in the financial stability of organizations. Thus, environmental risks influence the system of financial indicators that determine the financial condition of an organization, its investment attractiveness and social significance.

The main difference between the indicators of environmental and economic analysis from purely economic and

financial is that they reflect not only the process or phenomenon in dynamics, but widen the consumer's view of financial information about the results of industrial organizations both for an individual user and for society as a whole (Kotzee, I., & Reyers, B. (2016), Sebesvari, Z., Renaud, F. G., Haas, S., Tessler, Z., Hagenlocher, M., Kloos, J., ... & Kuenzer, C. (2016)). It is this property that defines them as carriers of specific information, allows not only to form conclusions about the management object for the current period, but also to predict changes in the future with less error and, accordingly, to ensure a certain level of economic and environment safety and operation continuity of industrial organizations.

## 3. Methods

Despite the actualization of problems of managing objects of ecological and economic nature, the theoretical principles of environmental and economic analysis of the economic activities of organizations require substantial improvement, because the range of objects is expanding, new tasks are being set, and technology is changing (Gil'orme, T., Ryzhyk, Y., & Yaresko, A. (2016), LIAO, L., & QIN, J. (2016)). In these conditions, we consider it necessary to establish the place of environmental and economic analysis in the system of economic analysis in general and determine the specifics of the components of the theoretical and methodological structure and form a forecast of its development, which will become the basis for improving and expanding the methodological tools.

In general, it is possible to form the following general list of users of analytical information with regard to the economic subject, which most clearly determines the interest in the results of environmental and economic analysis:

external users: lenders and borrowers (interested in assessment: financial resource needs for investment in environmental projects; risks and ways to minimize their consequences related to the financing of environmental projects), counterparties (interested in assessment: external and internal environmental risk factors affecting the contractual relationship with the organization), owners and potential investors (interested in assessment: environmental risks and their impact on the operation continuity of organizations; sources of financing of environmental projects; increasing environmental investment performance), state authorities (interested in assessment: influence of organizations on the ecological and economic situation in the region);

internal users: management staff, functional services of organizations (interested in assessment: maximization of target ecological and economic projects; assessment of environmental and economic performance of waste management operations; risks of formation of low-waste and waste-free production in organizations; funding mechanism for waste-free and low-waste production; risks of emergency situations and their environmental and economic consequences for organizations and the environment; effectiveness of preventive measures to prevent emergency situations).

It should be noted that both internal and external users of environmental and economic analysis can act not only as passive users, but also as customers of analytical information. For example, potential investors in assessing the continuity of organizations and the efficiency and safety of investments may be interested in analyzing the impact of the environmental component on the condition of organization business and the level of environmental and economic security, which is an integral part of economic security in general. The lenders to assess the loan project using the data of environmental and economic analysis to assess environmental risks. The owners are interested in the continuity of organizations, and therefore, when making any strategic decisions, they assess the level of environmental and economic security.

In order to ensure the functioning of an effective system of environmental and economic analysis, there is the need to determine the specifics of the functioning of the entity performing the analytical procedures (Tetiana, H., Karpenko, L., Fedoruk, O., Shevchenko, I., & Drobyazko, S. (2018), He, L., Jia, Q., Li, C., Zhang, L., & Xu, H. (2016)). After all, the environmental and economic analysis has a corresponding specifics, which consists in covering the various activities of organizations (operational, investment, financial and activity in emergency situations), various business processes (acquisition, production and sale) and various groups of integrated

facilities (waste management operations, environmental and economic consequences of emergency situations, environmental investments, etc.). These features determine the specifics of the formation of the composition of analysts or the distribution of analytical functions among employees of various analytical services. In general, the functioning of the subject of the implementation of analytical procedures in the system of environmental and economic analysis depends on the selected objects and methodology of analytical research. The questions of methodology characterize the relationship between the object and the subject and, accordingly, users of environmental and economic analysis (Nakashydze, L., & Gil'orme, T. (2015), Amalberti, R. (2017)).

## 4. Results

The study of the indicators of environmental and economic analysis, which allow us to assess the level of economic and environment safety of industrial organizations is quite diverse. However, such a system of indicators not always allows to determine the environmental and economic performance of the management system of priority objects of economic and environment safety of industrial organizations. Despite the identified priority objects of economic and environment safety management in the previous sections, there is a need to justify the methods of environmental and economic analysis of waste management operations and the environmental and economic consequences of emergency situations. Let's consider the features of the formation of a set of indicators for each of these objects and determine the direction of the formation of information support and presentation of the results of analytical procedures.

Ecological and economic analysis of waste management operations. Waste and handling operations is a complex object of economic analysis, in particular, and management in general, because it determines the relationship of the organization with the environment. In addition, waste management operations are an integrated object that covers a combination of business processes and types of activities of organizations. Ecological and economic analysis of waste management operations should provide information on alternative areas for further operation of production processes and waste management systems in order to improve the rationality of natural resources use, waste treatment, reducing waste generation and, consequently, environmental pollution. In accordance with this, the analyst should evaluate the production processes for the efficiency of waste management operations both at the stages of its generation and at the stages of processing:

The condition of the system of production of finished industrial products for the formation of returnable and non-returnable waste. In particular, it is necessary to analyze the volume of waste generation for individual types of products, redistribution and calculation sites. In general, this will allow building multi-factor models and determining reserves for reducing waste volumes for individual components of industrial processes at an industrial organization. In fact, we are talking about the cost of waste of a separate type of product, redistribution and calculation sites. There is also a need to estimate the cost of waste of a separate type of material resources, which are released for the production of one or another type of finished industrial products. It should be noted that the calculation of waste cost indicators should be calculated both in cost measurers (cost of waste generated and cost of production, redistribution and calculation site), and quantitative measurers measurers (amount of waste generated and volume of finished products, volume of semi-finished products by redistribution and calculation sites). The analyst should evaluate the cost of waste of both returnable and non-returnable waste. When analyzing the cost of waste in value terms for returnable waste, its cost is used in accordance with assessment methods, taking into account the directions of its further use, and for non-returnable waste we suggest using the value of all costs associated with its storage, disposal or dumping. When analyzing in quantitative terms the generated returnable and non-returnable waste, such questions do not arise. This group of indicators for analyzing the generation of industrial waste should be analyzed over time, since the calculated indicators at the balance sheet date will not give an opportunity to evaluate the effectiveness of production processes for waste management operations for a separate reporting period. It should be noted that the waste cost indicator should be reduced, that is, the lower the waste cost ratio of finished industrial products, redistribution or calculation site, the better for organization, and therefore this indicates less environmental impact and a high level of economic and environment safety of organizations.

The condition of the system of production of finished industrial products and the subject of the use of secondary resources (Hilorme, T., Nazarenko Inna, Okulicz-Kozaryn, W., Getman, O. & Drobyazko, S. (2018)). In this direction, analytical procedures are used to assess the share of secondary products in the material component of the cost of finished products. In fact, this indicator is a composite material consumption of finished industrial products. However, the volume of secondary products is taken as the analyzed indicator, that is, the products generated as a result of waste recycling - waste capacity. The analyst must perform an analysis in the following areas: firstly, secondary resources formed as a result of waste recycling on its own; secondly, secondary resources generated as a result of waste recycling using the services of third parties (waste disposal organizations / waste recycling organizations); thirdly, secondary resources, which are wastes that do not require recycling and can be used in primary and / or auxiliary production. Such an analysis should be carried out both as a whole at the cost of production, and at individual redistribution and calculation site of the production process at industrial organizations. When using these analytical procedures, the analyst should determine the valuable components, in particular, the cost of secondary resources should include the cost of waste generated as a result of production and the costs associated with recycling both with its own efforts and using services of third parties (waste disposal organizations / waste recycling organizations). It should be noted that these indicators show the effectiveness of waste management operations, and therefore the larger the indicator is, the better it is for organizations. However, there is one condition: while reducing waste returns, there may be a decrease in the capacity of waste products in terms of secondary resources, because the volumes of their recycling are reduced. Therefore, these indicators should be analyzed in a complex, and, accordingly, the analyst should build factor models to increase or decrease such indicators, which will allow to estimate the reserves in one case decrease, and in another increase in the indicator.

The condition of the system of production of finished industrial products and the subject of waste replacement. In order to assess the waste management system, the analyst should assess the possibility and direction of the substitution of material resources with secondary resources, which are formed as a result of the recycling of waste generated at industrial organizations. We propose to determine the waste replacement by determining the share of secondary resources in the composition of a separate type of material resources. This will determine what proportion of the i-resource production costs replaced by a secondary resource created as a result of recycling its own waste. This indicator shows a positive trend in waste management, and therefore, the higher it is, the better it is for organizations. However, there is a need to take into account the cost of waste. In addition, the calculation must be made both in terms of value and in quantity. This will allow to estimate replacement by volume and cost. These indicators are proposed to use as for the analysis of the cost of production of a separate type.

The condition of the system of production of finished industrial products and the subject of the effectiveness of waste replacement. This direction of environmental and economic analysis should show what economic result will give for the organization of the replacement of material resources with secondary resources formed as a result of recycling. Such an assessment can be carried out by comparative assessment of the value of material resources with analogues of their secondary resources, provided that such a replacement does not affect the quality of finished industrial products. The corresponding kind of calculations should be carried out, both at the cost of production as a whole, and for each redistribution or calculation site, which will determine the reserves for increasing the economic benefits from the use of secondary resources at industrial organizations. Indicators of this kind are positive for organizations, and therefore should increase. These areas of analytical assessment of production processes for the effectiveness of waste management operations allow us to evaluate both economic and environmental performance of economic activities. For the possibility of carrying out these directions of environmental and economic analysis, there is a need to formalize indicators and determine the directions of information support for their calculation.

The proposed model makes it possible to form a fragment of analytical support for the management of environmental and economic security in terms of waste management operations The peculiarity of the model is that its provisions assess the industrial production system for an environmental component, namely, the generation of waste and its reuse as secondary resources. All of these indicators and their calculations are made by the author, based on the characteristics of the functioning of industrial organizations and using the mathematical apparatus. The peculiarity of indicators of waste cost, waste capacity, waste replacement and

economic efficiency of waste replacement is that all of them are interrelated and must be calculated together.

It is impossible to evaluate the effectiveness of waste management operations using only one indicator without comparing it with another. In addition, it is very important to calculate indicators both in terms of value and in quantity. Thus, in particular, the indicators of the waste cost and the waste capacity, expressed in terms of value, should correspond to the values of these indicators, expressed in quantitative terms. The same applies to waste replacement, provided that the secondary resources are of identical quality and are used in the same volume as the primary material resources per unit of finished product.

We suggest evaluating the economic efficiency of waste reuse as secondary resources by calculating the corresponding indicator. Thus, by analyzing the difference between the material costs of a specific production and the production of material costs and the waste replacement rate, the analyst estimates the degree of reduction of material costs by using waste as secondary resources. In order to determine the procedure for calculating the proposed indicators, we propose the following mechanism for the formation of their components.

Waste cost of returnable waste. In order to calculate this indicator, the analyst uses data on the cost of returnable waste for the reporting period and the cost of finished products manufactured during the reporting period. The cost of returnable waste depends on the direction of its further use. In addition, the analyst must determine what the cost of waste is derived from a particular type of finished industrial products. When calculating the indicator in quantitative terms, the analyst should determine whether the volume of waste generated does not exceed the standards set for the specific type of finished industrial products.

The waste cost of non-returnable waste is a specific indicator, because it allows you to determine the amount of waste generated as a result of the production of a unit of products. For the calculation of this indicator, the analyst determines the amount of waste generated as a result of the production of a specific type of finished industrial product, and then calculates the index of waste cost. When calculating in terms of value, the waste cost is taken as the sum of expenses associated with the storage, disposal and dumping of non-returnable waste.

Waste capacity. This indicator is calculated only for returnable waste, because non-returnable waste is not reused by organizations. The analyst may use several approaches to determine the indicator of waste capacity, in particular: firstly, the analyst takes as the cost of secondary resources the amount of costs associated with recycling and the cost of waste generated by the organization; secondly, only the cost of waste generated is included in the cost of secondary resources; thirdly, the cost of secondary resources includes only the cost of recycling, provided that the cost of the generated waste has not been excluded from the cost of finished industrial products with which they are associated. However, the indicators will not always be comparable, because the issue of waste assessment is a specific and multivariate process at industrial organizations.

Resources replacement. This indicator is designed to assess the efficiency and effectiveness of the use of secondary resources generated from the recycling of own waste. Thus, when calculating this indicator, the analyst estimates how much the use of secondary resources allows to reduce the material costs in the cost of finished industrial products in terms of value and to what extent they allow to save the expenditure of material resources in quantitative terms. The calculation of the indicator can be carried out in different directions, which depends on the denominator of the indicator, that is, the primary material resource. Thus, as an indicator of the primary material resource we can use: firstly, the cost of resources, which could be in the absence of a secondary resource; secondly, when calculating in quantitative terms, the need for estimating the savings of the primary material resource, that is, an indicator is used of the secondary material resource volume that is needed to make a certain volume of finished industrial products. In turn, to calculate the waste replacement efficiency index, only the waste replacement indicator, which is calculated in terms of value, will be required. As noted above, the peculiarity of the presented system of indicators of environmental and economic analysis is their interdependence, which allows you to determine the effectiveness of the production process for waste management. Such interdependence is presented in Table 1.

**Table 1.** Mechanism of interdependence of indicators of environmental and economic analysis

| Index | Interactions | Interaction value | Influence factors |
|---|---|---|---|
| Interdependence of the expression of indicators in terms of value and quantity | | | |
| Waste cost of returnable waste | KB ≈ BB | A positive tendency that indicates the conformity of a value expression to a quantitative one. | Indicates that the value expression fully corresponds to the quantitative, which is a positive tendency |
| | KB > BB | The reason for the difference may be: selected assessment of returnable waste; inefficient management of production processes | |
| | KB < BB | | |
| Waste cost of non-returnable waste | KB ≠ BB | Waste cost of non-returnable waste in quantitative terms will not correspond to its value terms, because different output data are used. | |
| Waste capacity | KB ≈ BB | Standard | |
| | KB > BB | Positive tendency | Indicates savings resulting from the use of secondary resources. |
| | KB < BB | Negative tendency | Indicates the overvalued cost of secondary resources |
| Limit indicator value | | | |
| Waste cost | 0 < BB < 1 | Positive tendency when indicator moves to 0 | |
| | 0 ≤ BB | Waste-free or low-waste production | |
| | BB ≈ 1 | The situation is possible in emergency situations. | |
| Waste capacity | 0 < BM < 1 | Positive tendency when indicator moves to 1. The value of the indicator depends on the material capacity of the manufactured products of an industrial organization. | |
| | BM ≈ 0 | Indicates the absence of reuse of own waste as secondary resources. | |
| Waste replacement | 0 < BM < 1 | Positive tendency when indicator moves to 1 | |
| Interdependence of indicators | | | |
| Waste cost and waste capacity | BM ≈ 0 / 0 ≤ BB | Waste capacity may have a low value, provided that the waste capacity is 0 (waste-free production) or tends to 0 (low-waste production) | |
| Waste cost and waste replacement | BM ≈ 0 / 0 ≤ BB | Waste replace can be equal to 0, provided that the cost of waste also tends to 0 (waste-free and low-waste production) | |

The interdependence of the indicators is presented, which indicates the need for their use in complex in the analytical assessment of operations with waste generation and its reuse in the production process. However, separate comments should be submitted to this, in particular, with regard to the capacity of the waste and its replacement. When calculating these indicators, the analyst should take into account whether all types of waste can be used in the main production, in particular in the production of products, as a result of which it was generated. So, provided it is used in auxiliary production, or the production of another type of product, or even outsourcing, these indicators cannot be used by the analyst. So, there is a need to assess waste management operations subject to its further use in another form of production or auxiliary production and sale of waste to the side.

## 5. Discussion

The specified direction of environmental and economic analysis should include a number of indicators that will allow determining the economic efficiency of waste management, based on the position of reducing its environmental damage. This will allow to get an ecological and economic effect and to increase the level of economic and environment safety of industrial organizations. The first and most important stage of this direction of environmental and economic analysis is the analysis of operations for the recycling, disposal and dumping of waste, which determines the effect of its further use. In addition to this, there is a need for the formation of analytical information on waste recycling, disposal and dumping, in particular, it is necessary to evaluate the effectiveness of the process of recycling, disposal and dumping of waste both using own resources and using third-party services. Such analysis should be aimed at studying the cost of recycling (disposal, dumping) of waste for all business processes that accompany it.

The economic component of the effect is of great importance, because the harmonization of such components will allow to bring economic activities in accordance with the provisions of sustainable development. If it is impossible to generate environmental performance and efficiency in numerical terms (only in terms of reducing waste volumes or its reusing), then the economic efficiency of waste management operations should be expressed in a cost measurer.

The component of the information space, which is aimed at establishing the causal relationships of the condition of economic and environment safety of an industrial organization and allows to identify the reserves for increasing its level, is an economic analysis. The work widens the understanding of economic analysis through the justification of the organizational and methodological provisions of one of these types - environmental and economic analysis. This allowed to develop the theory and method of economic analysis in ensuring the effective interaction of industrial organization with the environment.

## Conclusions

According to the results of the study of types of economic analysis in general and the specifics of the application of environmental and economic, in particular, the evidences of the latter were formed, which include: specific objects of management, functional relatedness of objects, methods of study of the economic activity of the enterprise, aspects of the economic activity study. It is established that the environmental and economic analysis of economic activities of industrial organizations is a component of economic analysis, which studies the specific management objects that characterize the interaction of the organization with the environment. The objects have ecological and economic character. The main objects are the priority objects of management of environmental and economic security, namely: waste and operations to handle it, the environmental and economic consequences of emergency situations and measures to prevent and eliminate them. Ecological and economic analysis of economic activities of industrial organizations is aimed at the study of the environmental impact of economic activity and at the study of the environmental risks that generally influence the continuity of organizations.

The task of environmental and economic analysis is manifested through its place in the system of management of economic activities of organizations. Ecological and economic analysis is associated with all information subsystems of industrial organizations and is the resulting link, which forms the information space for making management decisions on environmental and economic security. On this basis, the goals and objectives of environmental and economic analysis are justified. Thus, the goal is to understand the formation of information on the impact of economic activities of organizations, which is based on established cause-effect relationships, which allows to obtain a comprehensive assessment for making management decisions on changing the parameters of the management system as a whole and individual management subsystems aimed at ensuring the environmental and economic security of industrial organizations

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