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## Modern features of environmental and economic analysis of the enterprise

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# Modern features of environmental and economic analysis of the enterprise

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**Abstract.** The features of environmental and economic analysis of the enterprise are considered in the article taking into account dynamically changing external challenges. The purpose of the study is to improve the system of environmental and economic analysis at the enterprise. The study of the main approaches to the implementation of environmental and economic analysis based on the corresponding systems of indicators with the identification of the factors that have the greatest impact is carried out. The main result of the study is the development of the system of environmental and economic indicators, maximally oriented to the specific enterprise. The practical significance of the study conducted is that it is possible to use the developed system of indicators at the enterprises to improve the efficiency of environmental and economic analysis in order to minimize the negative impact on the environment.

## 1. Introduction

The environmental and economic spheres are equal components of the enterprise's activities. Despite this, in most cases, significant environment characteristics are considered in isolation from the economic indicators of the enterprise operation or under significant limitations. In this regard, in the practice of analyzing the enterprise activities, all aspects of its operation should be considered only in a relationship, which will allow identifying the causes of significant environmental problems, their possible consequences and solutions [1-10].

To assess the environmental balance of production activities and environmental protection at the enterprise, the most informative indicators should be selected, since the quality of the created models of environmental management largely depends on the objectivity of the initial information. In this regard, it is necessary to improve the methodological foundations of environmental and economic analysis of production on the basis of the set of indicators calculated using practically accessible and most reliable information.

The formed system of indicators should include characteristics that are the diagnostic tool in determining the enterprise's environmental management and environmental competitiveness policies. Such indicators are of greatest importance for all types of environmental support for economic activities, from environmental auditing to optimizing the use of materials, raw materials and energy. The identified problems require the development of a system of environmental and economic indicators based on the most reliable data, with the possibility of its adapting to the specifics of the particular enterprise [11].



## 2. Materials and methods

The object of the study is the environmental and economic analysis of the large chemical enterprise which has highly diversified production program.

The subject of the research is the system of environmental and economic indicators, which correspond to the specific features of the operation of the particular enterprise.

The study is based on the analysis of domestic and foreign literature on the problems of the environmental and economic analysis of enterprises and other geographically-distributed environmental and economic systems. Particular attention is paid to the diagnosis of the developed system of indicators based on the environmental and economic SWOT-analysis.

The statistical processing of the environmental data of the industrial enterprise was carried out to appraise the proposed methodology on the basis of reporting forms [12]: 4-OS - Information on current costs for environmental protection and environmental payments; 2-TP (air) - Information on the protection of atmospheric air; 2-TP (waterworks) - Information on the use of water; 2-TP (waste) - Information on generation, processing, recovery, disposal, transportation and dumping of production and consumption waste. The elements of system analysis and the results obtained by the specialists in the field of environmental and economic analysis of the research objects of different levels are also used in the work.

## 3. Results and discussion

The analysis of known systems of environmental and economic indicators allows drawing a conclusion about different approaches to their formation.

In the work [13], the indicators of the state of natural resources were developed, including: air quality; disturbed lands; water amount; water quality; use and reproduction of forests; depletion of stocks; reproduction of mineral resources; waste management and others.

Some authors identify the industry affiliation of the enterprise as the determining factor influencing the formation of environmental and economic indicators [14].

The innovative methods for assessing the environmental and economic situation were proposed in the studies [15-17], for example, using the mathematical apparatus of fuzzy logic to assess the environmental and economic security of enterprises and assess risks [18-21] arising in the course of their economic activities.

The work [22] is devoted to the development of the system of indicators characterizing the degree of waste use, which is used to diagnose the activities of the enterprise as a whole and its individual units. Conduction of environmental and economic analysis using this system of indicators allows identifying the reasons for the low level of waste use and ways to increase the volume of their involvement in production turnover, as well as effectively manage the nature use process and ensure the rational use of the natural resource potential.

The issues of environmental and economic efficiency of nature protection activities, which characterizes the ratio of total economic benefits and losses from nature protection measures, including external environmental effects, and the associated social and economic consequences, are considered in the article [23].

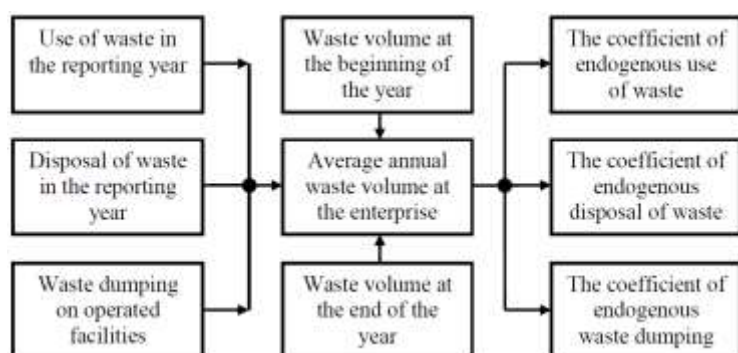
In order to determine the environmental and economic efficiency of nature protection activities, an assessment of nature protection measures, the existing environmental situation and the established system of urban landscape renovation is made. Based on this, a system of environmental and economic assessment of nature protection activities is proposed.

The author [24] developed a methodology for expert evaluation of the environmental and economic efficiency of metallurgy waste recycling, the use of which allows analyzing and comparing the environmental and economic parameters of the corresponding technologies. Environmental and economic efficiency of waste processing is determined by the degree of approximation to the best available technologies, which allows planning the optimization of environmental and economic characteristics of the analyzed technological processes according to the results of comparison with the best available technologies.

When developing the efficient environmental and economic indicators, the consideration of the factors influencing their formation is of great importance. In particular, the main factors affecting the efficiency of logistics environmental management in industrial enterprises is considered in the study [25]. Of great importance is the generalization of existing classifications of factors that influence the efficiency of the logistics management of environmental activities of enterprises. In addition, the role of changes made to environmental legislation to increase the interest of enterprises in sustainable environmental and economic development is noted. The work indicates that the majority of researchers classify the factors influencing the development of environmental and economic indicators, dividing them into external and internal. The analysis of the groups of factors identified by scientists allows concluding that their set is determined by the field of research and the scope of scientific interests of each author, the specificity of the enterprises under study in terms of their industry. These groups of factors differ in their nature and degree of impact and characterize the performance of the enterprise. Summarizing the existing classifications, we the following large groups of factors can be distinguished: external and internal environment. The environmental factors include: natural and environmental; political and legal; the level of economic and scientific-technical development of the region, its socio-demographic state; activity of consumers of services and performance of enterprises; level of market infrastructure development, marketing environment; competitor strategies and others. The second group of factors includes: the qualitative composition of the company's management and the personal characteristics of the leaders; the quality of the personnel of the enterprise; material and technical base, the introduction of innovative methods and technologies; availability and completeness of the use of information resources; financial management system and quality; communication policy; organizational structure of management; corporate culture, etc. Internal factors that can be controlled to reduce negative impact are formed by the working environment and are located within the organization. External factors arise under the influence of the environment and do not depend on the business entity, being uncontrollable or poorly controlled.

The conducted analysis [26-28] of systems of environmental and economic indicators has shown that they are based on a number of factors, which can be grouped in different directions of classification: the size of the enterprise, industry affiliation, the characteristics of the negative impact on the environment, and others [29].

One of these factors is the level of negative impact on a particular element of the environment. In this regard, environmental and economic indicators characterizing the movement and use of production and consumption wastes are relevant for such an enterprise as KJSC "Azot". Based on the available developments of environmental and economic indicators reflecting the generation, movement and efficiency of production and consumption waste [30, 31], an adjustment of this system of indicators is proposed (figure 1).



**Figure 1.** Improved system of ecological and economic indicators characterizing the internal use, neutralization and disposal of production and consumption wastes.

Based on the proposed scheme, the formulas for this system of ecological and economic indicators were developed, the calculation of which is presented in the table 1.

*Average annual waste volume at the enterprise* ( $Q_{AV}$ ) is determined by the formula (1):

$$Q_{AV} = \frac{Q_{BY} + Q_{EY}}{2}, \quad (1)$$

where  $Q_{BY}$  – waste volume at the beginning of the year, t;  $Q_{EY}$  – waste volume at the end of the year, t. This indicator "averages" the movement of waste at the enterprise during the year.

The coefficient of endogenous use of waste ( $K_{EU}$ ) is determined by the formula (2):

$$K_{EU} = \frac{QW_U}{Q_{AV}} \cdot 100\%, \quad (2)$$

where  $QW_U$  – use of waste in the reporting year, t. This coefficient shows the level of independent use of waste by the enterprise.

The coefficient of endogenous disposal of waste ( $K_{ED}$ ) is determined by the formula (3):

$$K_{ED} = \frac{QW_D}{Q_{AV}} \cdot 100\%, \quad (3)$$

where  $QW_D$  – disposal of waste in the reporting year, t. The considered coefficient in the relative dimension reflects the internal waste disposal capabilities of the enterprise.

The coefficient of endogenous waste dumping ( $K_{EDM}$ ) is determined by the formula (4):

$$K_{EDM} = \frac{QW_{DOF}}{Q_{AV}} \cdot 100\%, \quad (4)$$

where  $QW_{DOF}$  – waste dumping on operated facilities, t. This indicator characterizes the level of technical feasibility of waste dumping at own operated facilities (sites, landfills).

The need for additional calculation of indicators for I and II classes of hazard wastes is caused by the significant share of economic damage from the negative impact of pollutants and production and consumption wastes on the environment in the total amount of economic damage (from 10.86 to 12.07 %).

**Table 1.** Calculation of environmental and economic indicators characterizing the internal use, disposal and dumping of production and consumption wastes.

Indicator	2013	2014	2015
Waste volume at the beginning of the year, t	30116.43	31219.43	29831.22
including, I and II classes of hazard, t	1058.77	1060.17	1059.80
Waste volume at the end of the year, t	31219.42	29831.22	30435.77
including, I and II classes of hazard, t	1060.17	1059.80	1058.46
Average annual waste volume at the enterprise, m	30667.93	30525.33	30133.50
including, I and II classes of hazard, t	1059.47	1059.99	1059.13
Use of waste in the reporting year, t	434.96	296.26	18.20
including, I and II classes of hazard, t	0.00	0.00	0.00
The coefficient of endogenous use of waste, %	1.42	0.97	0.06
including, I and II classes of hazard, %	0.00	0.00	0.00
Disposal of waste in the reporting year, t	2.87	0.77	2.24
including, I and II classes of hazard, t	2.87	0.77	2.24
The coefficient of endogenous disposal of waste, %	0.01	0.003	0.007
including, I and II classes of hazard, %	0.27	0.07	0.21
Waste dumping on operated facilities, t	750.00	750.00	750.00
including, I and II classes of hazard, t	0.00	0.00	0.00
The coefficient of endogenous waste dumping, %	2.45	2.46	2.49
including, I and II classes of hazard, %	0.00	0.00	0.00

Analysis of Table 1 shows that due to the relative stability of the production program of the enterprise, the average annual amount of waste at the enterprise, including those of I and II classes of hazard, almost does not change. The negative trend is the significant reduction in the waste mass that the company used independently from 434.96 tons in 2013 to 18.2 tons in 2015. As a result, the proposed and calculated coefficient of endogenous use of wastes is significantly reduced, from 1.42 % in 2013 to

0.06 % in 2015. The dynamics of waste disposal during this period is non-linear, for example, from 2013 to 2014, there is a decrease in the mass of waste by 2.1 tons, after which there is the growth to 2.24 tons in 2015. Similarly, the coefficient of endogenous waste disposal is changing. The dynamics of waste dumped at own operated facilities does not change (750 tons), which is caused by the capacity of the enterprise's landfill. In general, the analysis of the table shows that the capacity of the company to use and treat waste is not fully used, including for the most hazardous wastes of I and II hazard classes, determining the need to increase the effectiveness of this activity [32-37].

The final elements of the proposed system of environmental and economic indicators are the loss-making capacity of the enterprise, including for pollutants and wastes of I and II hazard classes, as well as the waste capacity of the enterprise, including separately for pollutants and wastes of I and II hazard classes.

Calculation of these indicators at the object of the study characterizes the change in the enterprise's loss-making capacity from 3.94 to 4.49 rubles/thousand rubles including waste of I and II hazard classes from 0.45 to 0.52 rubles/thousand rubles, as well as the enterprise's waste capacity in the range from 1.10 to 1.59 tons / million tons.

In the conclusion of the work, SWOT-analysis of the developed system of environmental and economic indicators was carried out, which showed its viability on the actual data and the possibility of using the enterprise's environmental and economic analysis in modern practice.

#### 4. Conclusion

The conducted research of modern approaches to conducting environmental and economic analysis allowed drawing the following conclusions:

- the features of carrying out the environmental and economic analysis of the enterprise in conditions of increasing the significance of the environmental component are considered;
- the analysis of known systems of environmental and economic indicators is conducted;
- the system of environmental and economic indicators that are maximally adapted to the specifics of a particular enterprise is developed and its validation on actual data is carried out;
- the calculation of the developed environmental and economic indicators was carried out, which showed the significant share of economic loss from the negative impact of pollutants and production and consumption wastes of I and II hazard classes on the environment in the total amount of economic damage (up to 12.07 %). The coefficients of endogenous disposal, use and dumping of waste have low value (from 0 to 2.49 %), which characterizes the significant waste management reserves of the enterprise;
- the SWOT-analysis of the developed system of environmental and economic indicators is carried out, allowing to draw a conclusion about the possibility of its practical use.

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