

THE MANAGEMENT MODELING OF ECOLOGICAL AND ECONOMIC SYSTEM

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Introduction. Entrepreneurs play an important role in the socio-economic development of the country, providing employment and saturation of the market with a variety of goods and services to meet social needs. However, the growth of industrial production increases the man-made load on the environment, contributes to the emergence of environmental problems that threaten the living conditions of the population, forming humanitarian problems. Therefore, the successful management of business entities requires the coordination of their economic performance, environmental safety and social responsibility, ie the balance of economic, environmental and social spheres, which corresponds to the principles of sustainable development.

Presentation of the main research. Ensuring the balance of economic, social and environmental dimensions of sustainable development of the regions and Ukraine as a whole requires the broad participation of all stakeholders. Entrepreneurial structures must take real steps towards sustainable development. The goals of sustainable development serve as guidelines for long-term planning of business structures. Thus, control of business processes can be carried out based on the use of modern information technologies.

Scientists actively use the system-situational approach in the study of production and economic processes, economic and environmental phenomena, management problems at the level of independent business entities. Thus, exploring the definition of the word “sustainable” in the concept of "sustainable development" Zagorsky V. S. notes its ‘double load’: on the one hand, economic development provides a stable state of the environment, and on the other – sustainable economic growth. Given this, the environment and the economy must be considered in one system and properly manage this system (Zagorsky, 2018).

Rozum R. I. distinguishing two interconnected subsystems in the ecological and economic system: ecological and economic, emphasize that the unifying section between them is the sphere of nature management (Rozum et al., 2018).

Scientists in determining the initial conditions for sustainable development of the ecological and economic system emphasize the need for transition from spontaneity to manageability. And this involves the following steps: to assess the state of the system (the system of indicators is provided for this, its development is a separate task), to forecast (predict) the development of the situation, to determine the necessary indicators that need to be achieved and to establish the necessary management influences which will ensure the achievement of these indicators over a period of time or ensure the stable existence of the system. Solving these problems makes it possible to increase the validity of management decisions and requires appropriate information and analytical support. This determines the feasibility of applying mathematical modeling during the study of such systems.

Ecological and economic systems are a set of objects of human and nature production activities and their interaction. Such systems are characterized by a large number of elements, the interaction between which is difficult to describe in the form of analytical functions.

The relationships between the factors that describe the functioning of the system may be implicit, the influence of one factor on another is not always known and can sometimes be detected only in the process of research. Thus, such systems are poorly structured, so to study scenarios of its development, taking into account possible situations, as well as to determine ways to achieve the desired state of the system through targeted management influences, it is advisable to use cognitive analysis, what focuses on the study of poorly structured systems.

It involves the representation of the system in the form of a cognitive map and its further study using the theory of impulse processes. The authors conducted a study of the ecological and economic system on the example of the company of the fuel and energy complex as the activities of such enterprises have a significant impact on the environment and therefore require special attention (Tymoshenko et al., 2020).

To study the production and economic activities of the company as an ecological and economic system, the following main indicators (factors) were identified, which were taken as the tops of the cognitive map:

- 1 investments in environmental protection, million UAH;
- 2 net cash flow, million UAH;
- 3 coal production, thousand tons;
- 4 electricity generation, million kWh;
- 5 specific emissions into the atmosphere, t / t;
- 6 specific discharges of wastewater, cubic. m / kWh.

The characteristics of emissions into the atmosphere were taken in this form, as emissions into the environment depend not only on the treatment technology used, but also on production volumes. The use of specific emissions into the atmosphere makes it possible to assess the effectiveness of the company's environmental activities, as they reflect how many tons of emissions per ton of coal produced.

The influence of one factor on another was assessed on the basis of expert assessments and methods of statistical analysis. Based on the constructed cognitive model, three problems were solved:

- forecasting the company's development and its impact on the environment under conditions of sustainable production growth;
- determination of the necessary management influences to achieve the desired state of the company after a certain period of time;
- definition of management influences to achieve the desired ratio between the indicators that describe the company's activities.

The study of the constructed model showed that in the presence of an increase in production we have a tendency to reduce harmful emissions into the atmosphere and wastewater pollution due to the steady increase in investment in environmental activities.

Subject to the submission of control effects, the set environmental and economic indicators can be achieved in a much shorter time (all results are achieved in 4 years, if control effects are not applied – the results are not achieved within 5 years). At the same time, the main investments in the company's environmental activities should be made in the initial period, namely in the first two years, then they are used as corrective actions.

Conclusions. Thus, the methodological approach to justify management decisions on the functioning and development of the

business structure as an ecological and economic system to ensure the solution of sustainable development based on the application of cognitive modeling was improved by the authors. It is established that business structures that carry out production and economic activities and actively use natural resources, are poorly structured systems on the basis of the fact that not sufficiently defined both the system of factors and the relationships between them, so it is advisable to apply cognitive analysis for these structures.

The cognitive model of activity of a fuel and energy complex company taking into account ecological and economic aspects is constructed. On the basis of the constructed cognitive model, the forecast of a condition of business structure for 5 years is carried out and the managing influences which provide achievement of desirable ecological and economic indicators of the company activity for a certain period of time and / or the set ratio between indicators are defined. It is proved that cognitive modeling should be used to increase the validity of management decisions in developing a scenario to achieve the desired state of the business structure, taking into account a certain level of environmental protection. If necessary, it is possible test on the model several alternatives to assess new opportunities for system development.

References

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