Когда наука достигает какой-либо вершины,
с нее открывается обширная перспектива
дальнейшего пути.
С. И. Вавилов

Механізм регулювання економіки

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METHODOLOGICAL APPROACHES TO ESTIMATING THE CONDITIONS OF ECONOMIC-ECOLOGICAL BALANCE IN THE DEVELOPMENT OF FRESHWATER SYSTEMS OF WATER BASINS OF UKRAINE

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The territorial economic and ecological systems formed by water objects of a diverse physical and geographical basis – the water basins of Ukraine – have been studied. The methodological approaches to the assessment of the conditions for sustainable and balanced development of economic and ecological systems of Ukrainian water basins have been developed.

The impact of environmental protection activities in the water basin on the region's economic and social development has been analyzed. The sources of delays in the reaction of the economic-ecological system to the environmental measures have been assessed. One of the leading factors in ensuring an optimal strategy for sustainable development of the entire complex of elements of a multifactorial economic and ecological system of the water basin is reasonable probability assessment of both the occurrence of risks of different nature and their quantitative impact on the factors of sustainable and balanced development of the territory. The conditions that determine the possibility of risks in the development of a regional water basin system have been investigated taking into account external and internal factors of influence.

The analysis of the structural elements of the economic and ecological system of the water basin, as well as their role and importance in ensuring a stable and balanced development of the regional system, has been carried out to achieve the objectives of the research based on the methods of analysis and synthesis, comparative analysis and logical generalization. The methodological approach presented in the work is a fairly flexible tool with a free choice of elements of analysis depending on the goals and objects of management.

Keywords: *water basins, economic and ecological systems, balanced and sustainable development.*

МЕТОДОЛОГІЧНІ ПІДХОДИ ДО ОЦІНЮВАННЯ УМОВ ЕКОНОМІКО-ЕКОЛОГІЧНОЇ ЗБАЛАНСОВАНОСТІ В РОЗВИТКУ ПРІСНОВОДНИХ СИСТЕМ ВОДНИХ БАСЕЙНІВ УКРАЇНИ

Сербов М. Г.

Досліджено територіальні економіко-екологічні системи, утворені водними об'єктами різноманітної фізико-географічної основи – водні басейни України. Розроблено методологічні підходи до оцінювання умови для сталого та збалансованого розвитку економіко-екологічних систем водних басейнів України.

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Здійснено аналіз впливу природоохоронної діяльності на території водного басейну на економічний і соціальний розвиток регіону. Дано оцінку джерел виникнення затримок у реакції економіко-екологічної системи на вжиті природоохоронні заходи. Одним із важливих умов забезпечення оптимальної стратегії сталого розвитку всього комплексу елементів багатофакторної економіко-екологічної системи водного басейну є обґрунтована імовірнісна оцінка як виникнення ризиків різної природи, так і їхнього кількісного впливу на фактори сталого та збалансованого розвитку території. Розглянуто умови, що визначають можливість виникнення ризиків у розвитку регіональної системи водного басейну з урахуванням зовнішніх і внутрішніх факторів впливу.

У ході вирішення поставлених у роботі завдань на основі застосування методів аналізу та синтезу, порівняльного аналізу та логічного узагальнення здійснено аналіз структурних елементів економіко-екологічної системи водного басейну, а також їхньої ролі та значення в забезпеченні сталого та збалансованого розвитку регіональної системи. Поданий у роботі методологічний підхід є досить гнучким інструментом із вільним вибором елементів аналізу, залежно від поставлених цілей та об'єктів господарювання.

Ключові слова: *водні басейни, економіко-екологічні системи, збалансований і сталий розвиток.*

МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К ОЦЕНКЕ УСЛОВИЙ ЭКОНОМИКО-ЭКОЛОГИЧЕСКОЙ СБАЛАНСИРОВАННОСТИ В РАЗВИТИИ ПРЕСНОВОДНЫХ СИСТЕМ ВОДНЫХ БАССЕЙНОВ УКРАИНЫ

Сербов Н. Г.

Исследованы территориальные экономико-экологические системы, образованные водными объектами разнообразной физико-географической основы – водные бассейны Украины. Разработаны методологические подходы к оценке условий для устойчивого и сбалансированного развития экономико-экологических систем водных бассейнов Украины.

Проведен анализ влияния природоохранной деятельности на территории водного бассейна на экономическое и социальное развитие региона. Дана оценка источников возникновения задержек в реакции экономико-экологической системы на проведенные природоохранные мероприятия. Одним из важных условий обеспечения оптимальной стратегии устойчивого развития всего комплекса элементов многофакторной экономико-экологической системы водного бассейна является обоснованная вероятностная оценка как возникновения рисков различной природы, так и их количественного влияния на факторы устойчивого и сбалансированного развития территории. Рассмотрены условия, определяющие возможность возникновения рисков в развитии региональной системы водного бассейна, с учетом внешних и внутренних факторов влияния.

При решении поставленных в работе задач на основе применения методов анализа и синтеза, сравнительного анализа и логического обобщения проведен анализ структурных элементов экономико-экологической системы водного бассейна, а также их роли и значения в обеспечении устойчивого и сбалансированного развития региональной системы. Представленный в работе методологический подход является достаточно гибким инструментом со свободным выбором элементов анализа в зависимости от поставленных целей и объектов хозяйствования.

Ключевые слова: *водные бассейны, экономико-экологические системы, сбалансированное и устойчивое развитие.*

Sustainable development of a social economic and ecological system of water basins implies a development under which meeting all needs of productive forces emerging in the territories is provided, with the qualitative indices of the involved natural and power resources, as well as the ones for all natural spheres maintained and the social needs of the society met.

The topicality of the problem related to sustainable economic, environmental and social development of economy-and-ecology systems of water basins in Ukraine is conditioned by the pronounced degradation of nature and resource potential leading to emergence of complex and negative situations of socioeconomic and environmental origin.

Resource intensity of production and economic activity within a water basin is of great importance for implementation of environmentally sound and balanced development, in view of the amount of natural resources being limited to a considerable degree. Therefore, to ensure a positive impact on the environmental security and sustainable development, measures shall be taken to develop resource-saving technologies and methods for productive and economic activity, to provide increase in the feed stock utilization ratio, to develop and implement technologies which could facilitate recycling of the generated (gaseous, liquid and solid) wastes.

Sustainability of a nature management system in the course of implementation of productive and economic activities in the territory of the water basins will in turn exert positive influence on environmental safety in cases when measures for restoration of quantity and quality of the natural resources used in productive and economic activity are conducted; development and practical application of a system of norms to provide sustainable use of natural resources and their protection from a negative influence on the part of productive and economic facilities will be carried out.

Considering the paramount importance of water resources in socio-economic development, the fact that the water and environmental crisis is primarily a component of the ecological crisis in Ukraine [1; 2], it is highly relevant to study the conditions for a balanced and sustainable development of economic and environmental systems of the water basins of Ukraine.

The goal of the study is the development of methodological approaches used in assessing the conditions for sustainable and balanced development of economic and ecological systems of Ukrainian water basins.

To achieve this goal the following tasks were set:

1. Conducting analysis of the impact of environmental protection as one of the factors of sustainable and balanced development of economic and environmental systems.

2. Assessment of the sources of delay in the reaction of the economic-ecological system to the implementation of environmental measures.

3. Conducting a risk assessment in the development of the economic and ecological system of the water basin taking into account external and internal factors of influence.

In recent years, the spectrum has significantly expanded, and various scientific research has been significantly intensified in the issues of sustainable development of freshwater systems related to the solution of urgent problems of optimization of nature management, protection and improvement of the natural environment.

Today, the hydroecological problems of Ukraine have acquired not only national but also international significance. The water factor has become not only one of the main indicators that limit the development of the production sphere of individual regions, but also the unconditional paradigm of Ukraine's national security.

The methodological basis for assessing the conditions for sustainable and balanced development of various economic and ecological systems in the territory of Ukraine was laid in the research of a number of scientists [3 – 8]. Particular attention in these studies was always given to the analysis and assessment of freshwater resources as a basic natural factor that determines not only the level of development of the production sphere of the region, but also the social component of community life.

Among the main directions of the solution to the problem in question identified in the resources of the world scientific periodicals, there are the following:

• the development of the conceptual framework for the economic evaluation of the natural resource potential in terms of sustainable development of the region [7; 9; 10];

• the economic aspects of the theory of regional sustainable development [11 – 14];

• resolving the institutional issues as well as addressing the problems of environmental policy at different levels along with the economic and financial aspects of solving the problems under consideration [6; 15];

• a somewhat alternative variant proposed in works [16 – 19] which assumes that the main focus in the solution of the task should be directed to environmental activities in water basins, the development of modern low-waste and resource-saving technologies. The authors [3; 5] have greatly contributed to the environmental protection of water basins in Ukraine.

A different approach to solving the problem under investigation is proposed in [20 – 22] where sustainable and balanced development of the territory is carried out in the context of the development of integrated water basin management schemes.

Despite the considerable amount of scientific research, the issues of methodological justification of the overall strategy from the point of view of sustainable and safe development of economic and ecological systems at the regional level – the level of the water basin – remain insufficiently studied.

To solve the tasks set in the work, the methods of analysis and synthesis, comparative analysis, logical generalization and analogies were used, in combination with monographic and graphoanalytical studies.

One of the major factors influencing environmentally sound and sustainable development of the economy-and-ecology system in the water basins is efficient nature protection activity [3; 23; 24].

Nature protection activity in the territory of water basins shall develop on the basis of comprehensive nature protection programmes which foresee protection from negative influences on the part of productive and economic facilities in all natural spheres.

The research results demonstrate that inclusion of relevant nature protection aggregates and systems, as well as the systems for recycling of raw material resources directly into the technological processes will prove the most efficient solution.

Currently, the following types of regions in Ukraine are distinguished: high risk regions, medium risk regions,

relative risk regions and safe regions. It is obvious that the mentioned classification of the regions based on the level of risk requires their differentiation for development of appropriate economy-and-ecology systems.

Safe and sustainable development of the economy-and-ecology systems of the indicated water basins consists in sustainable development of economic, environmental and social conditions of population life.

Development of the economic constituent of the economy-and-ecology system of the water basins predominantly depends on the state of the finance and credit system as well as investment and fiscal policies.

Presently, the crisis in the world economic system exerts a strong impact on the development of the economic constituent of the mentioned economy-and-ecology system.

It should be also pointed out that all the constituents of the economy-and-ecology system of the water basins are closely interrelated and have constantly influenced each other through the results of their development.

Progress of the economic constituent exerts impact on the development of the environmental component through creation of appropriate conditions for development of nature protection activity, which, in its turn, influences the environmental situation in this water basin. Deterioration or improvement of the environmental situation exerts respective negative or positive effect on economic and social constituents of this economy-and-ecology system in a water basin.

Thus, sustainable development of the economy-and-ecology system of the water basins means, establishment and maintenance of sustainable and safe development of all of the structural constituents of this economy-and-ecology system (economic, ecological and social ones). A leading role herein is played by the economic constituent, in view of the required investment and financial resources for all of the constituents of the economy-and-ecology systems in the water basins (economic, ecological and social ones) being dependent on its development.

Safe and sustainable development of all of the three constituents of the economy-and-ecology system depends on the optimality of the development strategy.

Another important factor in the provision of sustainable and safe development of the economy-and-ecology system of the water basins is propagation of nature protection activity.

Efficient nature protection activity provides creation of favourable conditions for advance of the economic constituent of the economy-and-ecology system, since it contributes to introduction of up-to-date low-waste and resource-saving technologies and approaches into productive and economic activity.

Efficient nature protection activity also contributes to improvement of living conditions, increase in working capacity of the population, decline in morbidity, i.e. provides a solution to a number of social problems, which favourably affects advance of the economic constituent.

Provision of safe and sustainable development of the economy-and-ecology systems of the water basins is founded on finding solutions to the following problems:

- study and analysis of the available reserves of natural resources and appraisal of their output capability for the use in productive and economic activity;
- research into a possibility of substituting abundant resources for the scarce ones;
- development of energy-saving technologies and approaches;
- development of new energy sources (sun and wind power, energy of sea tides, etc.);
- development of resource-saving and low-waste technologies and approaches;
- development and scientific-and-technological advance-based introduction of technological approaches into productive and economic activity aiming to decrease emissions and discharge of harmful substances into the natural environments;
- development of the methods for restoration of qualitative indices of natural resources;
- development of technologies and approaches to providing recycling of wastes from productive and economic activity;
- increased efficiency of the use of financial, material and human resources in productive and economic activity;
- increased personal interest of domestic and foreign investors in making an input to the development of all of the constituents in an economy-and-ecology system;
- creation of favourable conditions for development of small and medium-size enterprises.

Safe and sustainable development of the economy-and-ecology systems of water basins is conditioned by a number of factors:

- resource intensity of productive and economic activity;
- sustainability of the system of nature management;
- development and efficiency of the nature protection activity;
- availability and development of environmentally dangerous industries;
- occurrence of harmful emissions into the atmosphere in the course of productive and economic activity;
- discharges of harmful substances into the water bodies;
- availability and development of natural reservation measures;
- introduction of innovations into the nature protection activity;
- environmental situation in marine nature management;
- change in the climate conditions.

Resource intensity of productive and economic activity is of great significance in the course of implementation of safe and sustainable development of economy-and-ecology systems in the water basins, since, as it has been mentioned, the amount of natural resources is limited to a considerable degree and they, as a rule, are nonrenewable.

Therefore, in order to ensure positive impact of this factor on safety and sustainability of development of the mentioned systems, it is necessary to take measures aimed at the establishment of resource-saving technologies and approaches in productive and economic activity; increase in the feedstock use coefficient; development and introduction of technologies to provide recycling of the generated wastes (gaseous, liquid and solid).

Sustainability of the nature management system in water basins will have a positive effect on the safe development of the economy-and-ecology systems in case of conducting measures for restoration of the amount and quality of the natural resources used in productive and economic activity, elaboration and practical application of a system of norms to provide sustainable use of natural resources and protection of resources from negative influences of productive and economic facilities.

Availability and development of environmentally dangerous industries substantially aggravate safety of the development of the economy-and-ecology systems in Ukrainian water basins which is of crucial importance for the economy, since environmentally dangerous facilities such as chemical enterprises, petroleum refineries and nuclear power plants have considerable unit weight in the structure of industrial production.

Environmentally dangerous production facilities account for more than 42 % of industrial capital assets, with more than 33 % of production and 21 % of the population employed in the industry. Currently, the negative impact on safe functioning of environmentally dangerous enterprises has increased through depreciation of their basic productive assets, which is 55 % for the chemical and petrochemical industry and more than 40 % in the power industry. All these conditions result in an increased number of emergency situations.

Along with the environmentally dangerous production facilities, solid and liquid wastes containing plenty of harmful substances also exert negative influence on safe and sustainable development of economy-and-ecology systems of the water basins. As a result of conducting productive and economic activity in the territory of the water basins in Ukraine, about 730 thousand tons of toxic solid wastes are generated annually. Their total accumulated amount makes 4.2 billion tons, with the area of land under these wastes reaching 135,000 hectares.

Liquid wastes from chemical enterprises are kept in the special storages, which occasionally carry out emergency discharges into the reservoirs. In this way the chemical enterprises annually discharge about 50 million tons of pollutants into the rivers and other water bodies. The waste waters contain fluorine, phenol, formaldehyde, pesticides and other harmful substances. More than 80 % of the water resources are polluted with radioactive substances. A large amount of solid wastes which contain toxic and often radioactive substances, in various regions of Ukraine has negative impact on safe and sustainable development of the economy-and-ecology systems. Obsolescence of technological equipment, ineffective technologies and approaches used in productive and economic activity lead to a substantial decrease in safety and sustainability of development of these systems.

Pollution of the atmosphere with harmful substances negatively affects safe and sustainable development of economy-and-ecology systems of the water basins. The largest amount of the harmful substance inflow gets into the atmosphere from electrical power, metallurgical, chemical and petrochemical enterprises, as well as from motor transport.

The state of water objects also has negative impact on safe and sustainable development of the economy-and-ecology systems of the water basins. Ukraine could be classified as an ecocatastrophe zone as relates pollution of reservoirs, rivers and coastal areas.

About 20 km^3 of sewages are annually discharged into the water bodies of Ukraine, including more than 5 km^3 of insufficiently treated waters.

More than 50 million tons of harmful substances, including fluorine, formaldehyde, phenol, pesticides and other harmful substances, get into water bodies annually.

The environmental situation in the sea water area of the north-western part of the Black Sea is a negative factor for safe and sustainable development of the economy-and-ecology systems of the water basins. The main pollution sources for this part of the Black Sea are as follows: sea transportation of oil and oil products, freight operations with oil and oil products, bilged water drain, watercraft bunkering, sea shipwrecks, municipal waste waters and sewages from coastal facilities of various origin, river runoffs, marine oil production and polluted atmospheric precipitation. Furthermore, high accident rate of watercraft is observed.

To increase safety and enhance sustainability of development of economy-and-ecology systems in the water basins, there is a need for greening industrial production and economic activity based on faster and extended application of scientific and technical advances (primarily low-waste technologies and approaches where efficient raw material and power resource use is made).

A certain positive role in ensuring the mentioned safety and sustainability is first and foremost played by specially protected areas such as reserve zones of various kinds, namely biosphere reserves, natural reserves and national nature parks.

These protected zones are environmentally secured by a package of special measures to provide conservation of invariable environmental situation in this territory.

Presently, the protected zones of various status in Ukraine amount to more than 7040 with the total area of 2715.4 thousand hectares.

The protected zones can be of the national and the local value which is why their influence on environmental safety may vary to a substantial degree.

The protected zones of nationwide significance, as a rule, have positive influence on environmental safety at the national scale. The protected zones of local significance exert positive impact on environmental safety in a particular

region. It is necessary to notice that the protected zones are unevenly allocated across the territory of Ukraine. The least amount of the protected areas is the share of the Vinnytsia, Dnipropetrovsk, Kyiv, Kirovohrad and Kharkiv provinces and the greatest portion is in the Zakarpattia, Ivano-Frankivsk and Khmelnytsk ones.

The positive influence of the protected areas on environmental safety is in the fact that their availability in a province ensures a decrease in the negative load on natural spheres through the instrumentality of relevant legislative and regulatory acts on prohibition or limitation of productive and economic activity in a given territory.

Nowadays, we all are witnesses to and participants in the development of adverse climate conditions which will affect safe development of the economy-and-ecology systems. Reasons for emergence and development of such phenomena as warming-up of the climate, increased number of earthquakes, intensification of volcanic activity, flash floods, etc., have not yet been finally established, though vast research into them has already been conducted. At the same time it should be noted that research into the influence of weather-climate factor on safe and sustainable development of the economy-and-ecology systems in Ukraine are conducted in an insufficient scope.

Topicality of such research is substantiated by the fact that an annual socioeconomic loss from natural calamities makes up about USD 1 bn. The total socioeconomic loss from natural calamities worldwide increased 40 times within the latest three decades. A tendency to considerable rise in socioeconomic loss from natural calamities conditioned by the climate change may partially be attributed to the rise in the humanity awareness of the global nature of these problems and their significance for safe development of society which resulted in the increased accuracy of keeping record of the natural calamities and the extent of emerging socioeconomic damage.

The most dangerous natural calamities for the south regions of Ukraine are: storms (hurricanes), droughts and icing.

The weather-climate factor affects not only the economic situation in various regions but also safe life of all of the peoples and countries, e.g. many years' drought in Sahara and Ethiopia compelled hundreds of thousands of people to imigrate to more favourable regions.

The greatest influence on safe development is exerted by such climate parameters as temperature of the outdoor air, illuminance, air humidity, atmospheric pressure, motion of air masses, etc.

Among the criteria for characterizing safe and sustainable development of the economy-and-ecology system in Ukraine an account should be taken of a decline in risk to human life and a decrease of economic losses from anomalous natural phenomena and the global climate change. It is also necessary to consider a possibility of additional positive economic outcome of the efficient use of the weather-climate factor in productive and economic activity.

Therefore, inclusion of the information received from a geographic information monitoring system into the mentioned criteria proves necessary. It will enable enhancement in the efficiency of the use of natural and resource potential and at least partially overcome the negative global climate change occurring nowadays.

The factors listed above can be subdivided into two groups based on the territorial influence on safe development of the economy-and-ecology systems:

- a group of global factors which influence safe and sustainable development of the world economy-and-ecology system (an increase in average temperature on the planet, a change in the global sea level, a change in ocean currents, a change in the atmosphere composition, etc.);
- a group of local factors which influence safe and sustainable development of the economy-and-ecology systems in certain countries or their particular areas (availability of hazardous production facilities, local emissions of harmful substances into the natural spheres, high resource consumption of the finished goods, imbalance of productive and economic activity, ineffective nature protection activity, high waste intensity of industrial and economic activity, etc.).

Safe and sustainable development of the economy-and-ecology systems is assessed based on the following indices:

- the structure of productive and economic activity;
- the rate of change in the volume of productive and economic activity;
- the rate of change in the profit of each type of productive and economic activity;
- the rate of change in the volume of investment in the development of productive and economic facilities;
- the volume and dynamics of investments in the development and adoption of scientific and technological advances;
- the rates of decline in the capacitory indices for the finished goods (energy intensity, intensity for material and cash resources, intensity for raw material costs, intensity for generation of various wastes, capacitive indicators for the inflow of radioactive and extremely toxic substances into the natural spheres, etc.).

The indices listed above make it possible to get a sufficiently coherent picture of the economic and environmental situation in a region and the principal directions for its change. The analysis of these indices provides an opportunity to determine the degree of safety and sustainability under development of national economy-and-ecology systems and bring out the main directions of practical activity to ensure the mentioned safety and sustainability.

In the aggregate, the indices listed above provide the systems and integrated analysis of safety and sustainability under development of economy-and-ecology systems.

To provide safe and sustainable development of the economy-and-ecology systems of the water basins it is necessary to solve a number of problems:

- problems of economic nature;
- environmental problems;
- social problems;
- problems of household nature;

• political problems;
• problems of legal and legislative nature;
• problems related to the banking, credit and monetary system stability;
• problems related to the stability of investment policy for nature protection activity;
• problems related to the system of taxation.

Environmental problems which require solution to ensure safe and sustainable development of economy-and-ecology systems in the water basins become apparent under deterioration of the atmosphere, water and land areas, natural and energy resources.

Social problems that should be solved to ensure safe and sustainable development of the economy-and-ecology systems in the water basins emerge under aggravation of economic conditions for the life of the population in the regions.

Problems of household nature, whose solution is essential to ensure safe and sustainable development of the economy-and-ecology systems in the water basins, are conditioned by demographic situation, living conditions, occurrence of unresolved social problems, unemployment, higher sickness rate, etc.

Political problems under provision of safe and sustainable development of the economy-and-ecology systems in the water basins consist in the necessity for development and subsequent implementation of a national doctrine to ensure rational nature management in them. These problems can be solved only on the assumption of persistence on the part of the managerial, political and economy personnel, clear-cut domestic and foreign public policy as regards efficient nature management under productive, economic, community and consumer activities in the water basins and provision of environmental protection.

Problems of legal and legislative nature affecting safe and sustainable development of the economy-and-ecology systems can be solved on the assumption of stable legal and legislative bases, as well as sustained law-enforcement and judicial system, which shall be grounded on the basis of legislative package to provide the legal aspect for nature protection activity and arrangement of conditions for compulsory implementation of the taken decisions.

Safe and sustainable development of the economy-and-ecology systems is influenced by the system of taxation, which shall provide regular inflow of funds resulting from the nature protection activity into the budgets of various levels as well as offer an incentive for productive and economic facilities to develop and implement nature protection measures, which will bring about a decrease in the amount of emissions and discharges of pollutants into the natural spheres, moderate generation of wastes of various types and provide increased efficiency of natural resource and energy potential management [3].

Apart from all of the problems listed above, safe and sustainable development of the economy-and-ecology systems is substantially influenced by the stability of banking, credit and monetary systems, as well as consistency of investment policy related to nature protection which shall be founded on increased attractiveness of nature protection activity for the investors.

In the course of conducting analysis of safety and sustainability of the development of the economy-and-ecology system in the water basins, the interconnection of particular factors should be given due consideration.

Development and subsequent implementation of the projects related to the use of scientific and technical advances in the nature protection activity to provide favourable conditions for safe and sustainable development of the economy-and-ecology systems are required for risk factors to be taken into account.

In this case, the sources of risks may be as follows: volatility of economic and environmental situation in a country or in a particular region; instability of political situation; occurrence and aggravation of emergency situations; initiation and development of meteorological catastrophes; occurrence of nuclear contamination of natural resources; emissions of toxic substances into the natural spheres; terrorism acts, etc.

An integrated assessment of economy-and-ecology significance of one risk source or another could be based on the relevant expert appraisals.

The appraisal of risk significance conducted by an expert based on the parameters of a process under study is performed to estimate a probability of emergency situations and a decrease in the influence of favourable conditions for safe development of the economy-and-ecology systems.

Probability analysis of economy-and-ecology risk conducted in the course of implementation of innovative projects for nature protection purposes makes it possible to considerably raise standards of quality for the relevant planning, manufacturing and subsequent exploitation of complicated technological and organizational schemes, where the use of scientific and technical advances in the nature protection activity is made with the aim of attaining a higher level of safe development for the economy-and-ecology systems.

Reasonable and effective methods should be used to provide minimization of the risk impact on the results of implementation of scientific and technical advances in the nature protection activity to influence the possible sources of risks under provision of safe development for the economy-and-ecology systems.

It is crucial to consider the fact that primarily risks exert a latent negative impact on the economic and environmental efficiency of the project which is concealed within the stochastic fluctuations in some parameters of the nature protection process. To reveal the probability of economic or environmental risk in the course of implementation of a number of nature protection measures, it is necessary to use special methods for probabilistic forecast of the values of the nature protection process index under study.

In this case, the measures for prevention of a possible risk impact will represent conventional measures to suppress the fluctuations of the index towards the negative.

If the changes of this parameter exceed the permissible limits under the influence of growing economic and environmental risks, special measures should be taken for further improvement of the project decisions made.

Crisis management measures imply bringing the package of nature protection activities in accordance with the internal dynamics of change in the economic and environmental situation due to the varying external situation.

Apart from the measures listed above, crisis management actions of sufficient effectiveness may consist in writing off outdated fixed capital, urgent replacement of out-of-date technological and nature protection equipment, limitation in the employment of factory and office staff, professional development, reduction of nonmanufacturing overheads, etc.

The negative impact of risks, pertaining to the nature protection activity, depends to a large extent on the timeliness of taking crisis management measures.

The conducted research [3; 23] shows that risks are divided depending on the characteristics into the following groups: internal, external, reasonable, incidental, microlevel, macrolevel, objective, subjective, system, current, predictable, insured, etc.

Practical activity of the predominant number of productive and utility enterprises proves that in the course of implementation of the nature protection activity aimed at ensuring safe development of the economy-and-ecology systems, it is reasonable to apply probability prognostication for the risks treated as the sources of crisis phenomena under this type of activity. It provides an opportunity for taking crisis management measures in accordance with the scheduled procedure.

Thus, in the course of implementation of the nature protection activity, to ensure safer and more sustainable development of the economy-and-ecology systems, organizational and economic methods should be used for identification of risk probability under practical application of scientific and technical advances to decrease the probability of these risks and the possibility of their development towards a crisis phenomenon.

One of the factors that contribute to the emergence and development of risks under introduction of scientific and technical advances in the nature protection activity is a delay in the response of an economy-and-ecology system to the results of the nature protection activity.

The research has proved that there are two sources of delay in the response of an economy-and-ecology system to the implementation of nature protection measures:

• extensionality of the economy-and-ecology systems causes a time lag in the manifestation of the results of the nature protection activity which gives rise to the development of an erroneous idea of inefficiency of the influence of scientific and technical advances being put to use in the exercise of nature protection measures taken under the economic-and-environmental situation;

• a time delay in the course of introduction of scientific and technical advances under the nature protection programs which is brought about by unsatisfactory organization of the stated nature protection measures, lack of the necessary legislative and regulatory acts and insufficient funding.

The following four types of delay in the response of an economy-and-ecology system to the use of scientific and technical advances under provision of safe and sustainable development of the economy-and-ecology systems can be distinguished:

• a response delay against the moment when scientific and technical advances start to influence an economy-and-ecology system in the course of implementation of the nature protection activity;

• a strategic delay, which results in the response of an economy-and-ecology system, which takes shape only upon introduction of all of the supposed alternatives of scientific and technical advances aimed at the enhancement of the nature protection activity, to ensure safe development of the economy-and-ecology systems;

• a delay caused by a threat of change in the status of a particular economy-and-ecology system which brings about adoption of additional regulatory and legislative acts as well as taking supplementary organizational measures on the use of scientific and technical advances;

• a delay caused by inertia of thought of the executors, their psychological unpreparedness for introduction of such innovations and, as a consequence, leading to false assessment of economic and environmental efficiency of the implemented scientific and technical advances.

One or another type of risk becomes apparent depending on the following external and internal factors: the economic and environmental situation; availability of stakeholders who are ready to make investments of the required amount; availability of the necessary equipment; availability of properly trained personnel; availability of methods to provide introduction of relevant scientific and technical advances into the practical nature protection activity; operation of legislative and regulatory acts to provide legitimacy for the application of relevant scientific and technical advances under the nature protection programmes to ensure safe development of the economy-and-ecology systems.

The use of the system and integrated approach in the course of application of scientific and technical advances in the nature protection activity to ensure safe development of the economy-and-ecology systems is to be one of the principle directions for risk prevention. This shall imply not only economic, environmental and technical adaptation of these systems to practical application of the relevant scientific and technical advances but also appropriate academic and psychological training of the staff.

Organization of prognostication aiming to detect probable positive changes in the safe development of the economy-and-ecology systems is of great importance for the efficient use of scientific and technical advances to provide safe and sustainable development of the economy-and-ecology systems and risk prevention. Successful performance of such prognostication provides

an opportunity for considerable reduction in risk probability.

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МЕТОДИЧНИЙ ПІДХІД ДО ОЦІНЮВАННЯ ПОТЕНЦІАЛУ ЕКОЛОГІЧНОГО ТУРИЗМУ

Зима О. Г.
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Зима О. Г. Методичний підхід до оцінювання потенціалу екологічного туризму / О. Г. Зима, М. О. Голуб // Економіка розвитку. – 2018. – № 1 (85). – С. 14–21.

На сучасному етапі розвитку екологічного туризму існує проблема визначення його потенціалу. У наукових працях більшість учених використовують методи анкетування та опитування, але під час оцінювання потенціалу екологічного туризму потрібно враховувати не тільки суб'єктивні, а й кількісні показники, які мають об'єктивний характер. Охарактеризовано різні підходи до визначення потенціалу загалом. Окреслено рівні туристичного потенціалу. Визначено специфічні ознаки поняття "екотуристичний потенціал". Проаналізовано