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Khyzhniakova N. O.[1]
PhD in Economics, Associate Professor
ORCID ID: 0000-0003-3690-9331
E-mail: nadiya.khyzhnyakova@rshu.edu.ua

[1]*Rivne State University of Humanities, Rivne, Ukraine*

FUNDAMENTALS AND ECONOMIC-STATISTICAL ANALYTICAL CHARACTERISTICS OF ECO-INNOVATION MANAGEMENT: FROM ENTERPRISE TO INTERNATIONAL LEVEL

The following article is devoted to fundamentals of ecological innovation management as the specific type of management at whole and of the ecological management in particular. The main stages and functions of ecological innovation management are determined. The fact that implementation of ecological innovations is the specific type of the ecologically oriented decision making is prooved. The types of economic activity that are prioritized for the implementation of ecological innovations and technologies are determined. The analytical characteristics of the state of these economic activities on the international level based on the statistical data is given in the article.

Keywords: management; fundamentals of management; ecological innovation management; enterprise level; international relations; analytical characteristics; statistical data.

Introduction. The ecological problems reached the international level since the end of the 20th century and now many of them became very edge and have global character. The human society has the problems of global nature pollution, of climate change, of forest decrease, of desert increase, of ocean streams, of waste management and many others. That is the solving of global ecological problems is very important, but too hard for the separate country. So it needs regulation on the international level and participation of many countries of the world. Eco-innovations, i.e. ecological innovations are the specific type of ecologically oriented decisions helping different subjects to solve ecological problems and receiving as a rule both ecological and economic effect. So we can see the eco-innovation management is realised on the

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different levels: from the separate enterprise to the town, the city, the region, the country, the group of countries and to the world at whole. And this article is devoted to the fundamentals of the eco-inovation management and its analytical characteristics on the international level based on the statistical data.

Materials and methods. There are many publications of foreign and domestic scientists in the sphere of ecological management and environmental economics. They include information about ecological innovations and their management, the problems and results of their implementation and so on. Some of them are devoted to green economy and modern green deal. They also contain informatin about green sectors of economy and about perspective ecological innovations in these sectors. These publications are based on the international analytical documents, materials and statistical information.

And we can't see the systematic investigation of the ecological innovation management on the international level at the same time. So this research devoted to the fundamentals, methodology and characteristic features of ecological innovations and their management is essential and actual. It also pay attention to analytical characteristics of this type of management on the international level based on the statistical data.

The following research uses the methods of analysis and synthesis. These methods are used for the content of the scientific publications in the sphere of management and ecological management. They are also suitable for the content of the websites of the international ecological organizations. These methods accompanied by system approach. It has been used in the process of formation of the list of perspective ecological innovations and of analytical characteristics of ecological innovation management on the international level.

The purpose of the article. The purpose of this article is to investigate the fundamentals, methodology and characteristic features of ecological innovations and their management as the specific type of management. And also to form the analytical characteristics of this type of management on the international level based on the statistical data.

Research results. Modern trends in the development of environmental management and protection in all countries of the world need innovative decision making and use of technologies in the sphere of "profitable ecology" (or "green" technologies) simultaneously satisfying the interests of producers, consumers and society, that is allowing to

obtain a positive ecological, economic and social effect [1].

Ecological innovations include a coordinated set of modifications or new decisions for products (goods or services), processes, market approach and organizational structure leading to a company's performance and competitiveness. This approach can help enterprises access new and expanding markets, increase productivity, attract new investment into the business and increase profitability [2]. Ecological innovation management is the specific type of management. It is the natural part of management at whole and of the ecological management in particular [3]. Ecological innovation management embraces the process of planning and implementing of ecological inovations on the different levels of management and economic systems – from the level of separate enterprise through regions and countries to the international level. Its purpose is to receive the ecological result followed by the economic one. The fundamentals of the ecological innovation management are correlated with the basic grounds of management at whole and of the ecological management in particular. They are following.

Ecological innovation planning. The first stage and function of the ecological innovation management. It includes the research of the essence of each innovation and ground of the project of it implementation with evaluation of the environment influence, of expected social results and the influence on the economic development of the specific type of economic activities, of the region, the country or the world economy at whole.

Ecological innovation implementation. This stage and function of management process is in accordance to traditional organisational and operational management function. Implementation of ecological innovations includes the distribution of positions, roles and duties, different resources' supply, organisation of process and procedures of ecological innovation implementation.

Motivation for ecological innovation implementation. This management function suggests the methods and instruments for influence on the participants of the process of ecological innovation implementation. These methods have to stimulate people to work with high quality during the process of ecological innovation implementation.

Checking and corrective measures. This stage and function is the analogue of control management function of the classical variant of management. It expects monitoring of key ecological, social and

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economic indicators, control of correspondence to current requirements, ecological auditing, ground and use of preventive and corrective measures.

Ecological innovation management review and analysis. This function embraces the the measurement of different indicators, collection of statistical data, their keeping, compilation and analysis. The result of this stage of management is analytical conclusions and recommendations for improvement of the process of ecological innovation implementation.

All these stages and functions of management processare in correlated. They create the circle of ecological innovation management.

Implementation of ecological innovation management begins from the level of the separate enterprise. At this level ecological innovations must give not only ecological effect, but also economic one. Ecological innovations are very effective for cities, regions and countries because of their future perspectives and ecological, social and economic efficiency. Thus ecological innovation management has achieved the international level today [4]. It is used for implementation of modern green deal into practice.

Implementation of ecological innovations is the specific type of the ecologically oriented decision making. *Ecologically oriented decisions* have all the characteristic features of decisions in management but they are the specific type of decisions using only in ecological management and environmental economics. This type of decisions is the definition of the activities necessary to solve or to reduce some ecological or to be more clear ecological and economic problems in the relationship of the human society and nature. Ecologically oriented decisions can be determined as the decisions about some changes in economic activity directed to the following: improvement of its natural resources support or reduce of its negative influence on the environment [5, p. 94-95].

Thus we can see the planning and implementation of ecological innovations belong to ecologically oriented decision making and realization. The types of economic activity that are prioritized for the implementation of ecological innovations and technologies include, in particular, agriculture, forestry and the development of ecological infrastructure, energy generation and energy supply, industry, waste management, construction and housing, transport, water management, fishery, tourism [6].

According to the recommendations of UNEP experts and the world's leading experts in the field of environmental management, the following

innovative solutions can be identified for priority green types of economic activity (see Table).

Table

Ecological innovations in priority green sectors of economic activities

N	Economic activity	Perspective types of ecological innovations
1	Agriculture	Efficient use of water; wide use of organic fertilizers; complex control over pests, limiting the use of chemical plant protection agents; development of organic agriculture; cultivation of energy crops.
2	Forestry and development of ecological infrastructure	Ecological infrastructure: reproduction and protection of forests; increase in areas covered by forests; increasing the productivity of forests; increasing the number and area of objects and territories of the nature reserve fund; protection of natural landscapes and biological diversity.
3	Energy generation and energy supply	Use of renewable energy sources and technologies with reduced carbon emissions; diversification of fuel and energy resources, increased use of domestic, primarily local, resources; diversification of importers of fuel and energy resources; saving energy resources during energy production and energy during energy supply.
4	Industry	Increasing energy efficiency; reduction of harmful emissions to water, air and ground; reduction and utilisation of waste.
5	Waste management	Prevention of waste generation; reuse of materials; obtaining energy from waste; safe disposal of waste.
6	Construction and housing	Increasing the energy efficiency of new and existing buildings and structures.
7	Transport	Use of energy-efficient types of transport; use of fuel with low carbon emissions; transition to more environmentally efficient modes of transport.
8	Water management	Improvement of water purification and water consumption systems; saving water; improvement of used water purification technologies.
9	Fisheries	Reduction of fish catch; prevention of fish resources; replacement of vessels; development of fish breeding.
10	Tourism	Development of rural and ecological tourism.

Source: Compiled by the author based on [6]

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In agriculture, the level of agricultural development and the level of land plowing, as well as the level of use of mineral fertilizers, need to be regulated. Preference should be given to the wide application of organic fertilizers, which will contribute to the restoration of humus.

As for organic farming, the number of enterprises that grow organic products is constantly growing in the world. Worldwide, there are 22 countries with an organic share of total agricultural lands of 10% or more in 2023. Liechtenstein has the highest share at 44.6%. Austria obtaines the second place with 27.3% and Uruguay is the third in the world with 25.4%. In European Union 14 countries have an organic farmland share of at least 10%. Austria (27.3%) has surpassed the 25% mark. EU average level of organic farming lands riched 11% of total agricultural land in 2023. Organic farmland occupied 98.9 million hectares in the world in 2023. That is 2.6% (2.5 million) more than in 2022. 2.1% of the world's farmland is organic. Largest increases there were in Uruguay, China and Spain [7].

As for forests, priority should be given to the growth of forest cover in the territory, as well as wood harvesting, mainly when felling for the formation and improvement of forests. The area of forest regeneration should exceed the area of felling for main use, preferably not less than twice. It is also worth limiting forest losses due to unauthorized use. Special attention should be paid to the protection of evergreen tropical forests supplying oxygen for the entire planet.

As for the forestry in Europe a total of 30 countries reported nearly 140 million hectares of forest under management plans or equivalent documents. The percentage of forest area under management varied considerably, ranging from 55% in Switzerland to 100% in several countries, including Finland, Slovenia and the Netherlands [8, p. 106].Management plans are obligatory in 22 countries and must be reported to an official body in 27 countries. Twenty-six countries indicated that the measures in the management plans are correlated with most cases focusing primarily on harvest volume and regeneration [8, p. 106].

As we can see management plans or equivalent documents.for forestry development in European countries are the instruments for forest use control, development and regeneration.

As for the nature reserve fund, the aim of this activity is to increase the share of nature reserve territories and to reserve the biological diversity. In addition, it is necessary to create a network of ecological

corridors that will ensure the migration of animals between the objects of the nature reserve fund.

Energy generation and energy supply are represented by the production and supply of electric and thermal energy, as well as the production and sale of fuel and energy resources. A positive shift in this area can be considered the increase in electricity production by hydroelectric power plants and especially the emergence of alternative types of power plants (wind and solar), which are safe for the environment and economically profitable due to the introduction of a "green" electricity tariff.

Solar power generation needs effective energy storage systems to ensure a stable and reliable energy supply. Innovations such as advanced battery technologies, including lithium-ion batteries and flow batteries, have greatly improved the storage capacity and efficiency of solar energy systems. These storage solutions enable the capture and storage of excess solar energy during peak production periods, which can then be utilized during periods of low or no sunlight [9].

An important direction in the development of alternative energy should be considered the introduction of wind power plants and small-capacity solar collectors into domestic serial production, allows each state to get new jobs and facilitate access to this technology for owners, primarily of private houses, as well as apartment buildings.

The use of organic materials in thermal energy is also promising, but it is worth noting that a balance must be maintained between the formation of organic energy carriers and their use, because otherwise the destruction of forests will be observed for the use of wood as a raw material for the generation of thermal energy. In this regard, the cultivation of energy crops seems very promising.

As for waste management, an increase in the rate of waste utilization and a decrease in the rate of removal to places of unorganized storage are positive in this area. Prevention of waste generation and disposal of existing waste is also of great importance. The accumulation of hazardous waste should be as small as possible, and the use of technologies for their disposal should be as wide as possible.

As for transport, the transportation of goods over long distances is carried out by less expensive and more environmentally friendly modes of transport - railway and pipeline. At the same time, the global trend is the increase in vehicle mileage when transporting goods, indicating, on the one hand, a fuller use of the possibilities of road

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transport, and on the other hand, an increase in environmental pollution: air, soil in the roadside lane, as well as groundwater.

Therefore, road transport is more mobile and convenient, but the expansion of its use leads to wear and tear of roads and an increase in environmental pollution. Thus, in the transport sector, the expansion of the use of environmentally safe transport remains relevant: railway and pipeline - for freight transport, and railway and electric transport (tram, trolleybus, metro) - for passenger transport. Arrangement of parking lots at the entrance to cities to intercept motor vehicles, arrangement of bicycle paths inside cities and use of electric vehicles are also relevant.

Wide use of electric vehicles is the tendency for modern cities. They are ecologically friendly because of reduce of air pollution and use of fuel. But their use needs special infrastructure for their charging.

The latest trends on the international market of electric cars are following. Total 17.3 million electric cars were produced worldwide in 2024, about onequarter more than in 2023, largely as a result of increased production in China, which reached 12.4 million electric cars. China remains the world's electric car manufacturing hub, accounting for more than 70% of global production in 2024 [10, p. 31].

In the world's second-largest electric car manufacturing region, the European Union, production stagnated at 2.4 million cars in 2024, but surpassed domestic sales by more than 5% [10, p. 31].

The low level of water losses can be considered positive in water supply, as well as a significant excess of the volume of circulating and repeated water supply over the volume of fresh water intake. As for water drainage, it is worth introducing new highly effective technologies for saving water and cleaning it wi the aim to increase the level of environmental safety.

The development of ecological tourism will contribute both to the increase of the ecological culture of the population and to the growth of income from the implementation of tourist activities. A mandatory requirement for its development is the prevention of damage to the recreational potential and natural capital. A prerequisite for the development of ecological tourism is the increase in the number and area of objects of the nature reserve fund. The development of rural and ecological tourism is interconnected, since the availability of nearby places of residence in the form of agrarian estates greatly contributes to the implementation of hiking, horseback and bicycle trips.

Conclusions. Thus, the world is gradually adopting and implementing innovative decisions that allow the development of environmentally safe and energy-efficient technologies in various types of economic activity. At the same time, the development of innovative activities in the field of nature management and environmental protection is carried out rather unevenly, and in many countries there are significant reserves for improvement in comparison with the developed countries of the world. In order to increase the rate of innovative development in this area, it is necessary to create an organizational and economic mechanism that would facilitate the application of such technologies on the different management levels: from enterprise through region and country to the international level. state and local levels. This will make it possible to gradually build an ecologically oriented society and ensure the sustainable development of territories on a global scale.

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Хижнякова Н. О.[1]
кандидат економічних наук, доцент
ORCID ID: 0000-0003-3690-9331
E-mail: nadiya.khyzhnyakova@rshu.edu.ua

[1]*Рівненський державний гуманітарний університет, м. Рівне, Україна*

ОСНОВИ ТА ЕКОНОМІКО-СТАТИСТИЧНА АНАЛІТИЧНА ХАРАКТЕРИСТИКА МЕНЕДЖМЕНТУ ЕКОЛОГІЧНИХ ІННОВАЦІЙ: ВІД ПІДПРИЄМСТВА ДО МІЖНАРОДНОГО РІВНЯ

Дана стаття присвячена висвітленню основ менеджменту екологічних інновацій як специфічного виду менеджменту в цілому та екологічного менеджменту зокрема. Встановлено, що менеджмент екологічних інновацій охоплює процес планування та впровадження екологічних інновацій на різних рівнях управління та економічних систем – починаючи від рівня окремого підприємства до рівня міст, регіонів та країн і до міжнародного рівня. Його мета – отримання екологічного ефекту, який супроводжується соціальним та економічним ефектами. Визначено основні етапи та функції менеджменту екологічних інновацій. Вони є наступними: планування екологічних інновацій, впровадження екологічних інновацій, мотивація щодо впровадження екологічних інновацій, контроль та вживання коригувань, аналіз досягнутих результатів. Доведено той факт, що впровадження екологічних інновацій є специфічним видом прийняття та реалізації екологічно орієнтованих

рішень. Визначено види економічної діяльності, які є пріоритетними для впровадження екологічних інновацій і технологій. До них, зокрема, належать сільське господарство, лісове господарство та розвиток екологічної інфраструктури, енергогенерація та енергопостачання, промисловість, поводження з відходами, будівництво та житлово-комунальне господарство, транспорт, водне господарство, рибне господарство, туризм. У статті наведено аналітичну характеристику стану цих видів господарської діяльності на міжнародному рівні на основі статистичних даних.

Ключові слова: менеджмент; основи менеджменту; менеджмент екологічних інновацій; рівень підприємства; міжнародні відносини; аналітична характеристика; статистичні дані.

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