OPERATION OF INDUSTRIAL PARKS IN THE CONDITIONS OF SUSTAINABLE DEVELOPMENT AND THE PARADIGM OF CIRCULAR ECONOMY

INTRODUCTION
World practice today proves the effectiveness of industrial parks, which are a mutually beneficial combination of industry, entrepreneurial initiative and the necessary localized infrastructure. However, as in any process, the development of industrial parks has negative consequences in terms of environmental consequences, as concentrated production leads to the concentration of greenhouse gases and environmental pollution, increased depletion of natural resources and more. It is this in the conditions of sustainable development and the paradigm of the formation of a circular economy that prompts the revision of the concept of creating eco-industrial parks. Eco-industrial parks fully comply with the concept of sustainable development as they ensure the achievement of economic, social and environmental development.

The purpose of the article is to substantiate the principles of functioning of eco-industrial parks in terms of sustainable development and the paradigm of the circular economy. To achieve this goal, the authors set and solved the following research objectives:

- the parameters of functioning of industrial parks in Ukraine are characterized;
- the directions of stimulation of development of eco-industrial parks are defined;
- varied possibilities of creation of eco-industrial parks and reformatting of existing industrial parks into eco-industrial ones are outlined;
- the definition of the essence of the concept of eco-industrial parks is substantiated;
- the characteristic features of eco-industrial parks in the conditions of sustainable development and paradigm of circular economy are singled out;
- the advantages for all participants of eco-industrial parks are clarified;
- the vision of development policy in the conditions of sustainable development and formation of circular economy in the direction of creation and functioning of eco-industrial parks is substantiated;
- the toolkit of maintenance of formation and functioning of eco-industrial parks in the conditions of sustainable development and paradigm of circular economy is offered and the consequences of its introduction are substantiated.

LITERATURE REVIEW
Many researches of domestic and international scientists are devoted to sustainable development. Particular attention is paid to ensuring environmental development, including through the creation of eco-industrial parks. Among the scientists studying this issue should be noted: De Laurentis C. (2020); Dergaliuk M., Khanin S. (2021); Dubyna M., Zhuk O. (2019);
The scientist (SUGAK, 2021) proposes to assess and predict environmental risks using the method and model of data extraction, which uses data from long-term environmental observations, as well as statistics on the health of the population of these regions. The purpose of the article (KALDIYAROV et al., 2021) is to study the problems of sustainable development of rural areas as a component of investment policy. The study is devoted to the analysis of investment attractiveness of rural areas of Kazakhstan and available methods for assessing the investment attractiveness of rural areas from the standpoint of their sustainable development. A scholarly paper (NGO et al., 2021) analyzes the relationship between local culture and Tao and Tao minority forests and their contribution to sustainable development in Won Na, a mountainous region in northern Vietnam.

Researchers in their paper (LINDSAY et al., 2021) argue that while maritime policy can be an important tool in achieving the two UN Sustainable Development Goals (poverty reduction and protection of vulnerable marine resources), their success is far from guaranteed and requires land and sea social-economic ties in rural areas. In their study, researchers (GUO et al., 2020) argue that industrial and technological innovation promotes and has become a key requirement for China's sustainable development.

The study (ZIGLIO et al., 2019) is based on the concept of international cooperation and the Global Alliance for Recycling and Sustainable Development - a social and environmental network created by a coalition of NGOs involved in solid waste disposal. Researchers (MABE et al., 2021) analyzed how food security in households in northern Ghana has improved the awareness of smallholders about the goal of sustainable development. A study by Chinese scientists (WU et al., 2020) provided theoretical support for the analysis of environmental problems and existing causes and proposed measures to protect the environment to improve the capacity of environmental management and promote sustainable regional development.

The aim of the research of scientists (PRUS et al., 2021) is to analyze the impact of transport infrastructure on the sustainable socio-economic development of Lake Walch. The authors of the article (SURÓWKA et al., 2021) emphasize and note the problems in the sustainable development of infrastructure, namely in the field of water resources management, sewerage and water supply. The authors (ZHANG et al., 2020) proved that forest resources are an important asset for sustainable social and economic development.

The authors considered several perspectives, including: economics, water conservation, soil conservation, and carbon sequestration. Scientists (KUZNETSOVA et al., 2020) argue that the concept of sustainable development provides a holistic approach to the development of the economy, society and biosphere. The use of statistical methods and models is one of the tools for making informed decisions on a scientific basis in solving this problem. The aim of the article (VOLKOV, 2020) is to study the tools of sociological research used to study the state and prospects of socio-economic and environmental development of the Karelian Arctic region, its human capital as a factor in sustainable development of the region.

According to the results of research (TOSCANO et al., 2020), Italian scientists have collected useful information on the development of air quality management policy, which can be adopted after the introduction of sanitary emergencies to ensure sustainable development of the Campania region. The aim of the article (SHIYAN et al., 2020) is to study the geographical, ecological and territorial features of the dynamics and causes of morbidity depending on the state of the environment of Kryvyi Rih in order to ensure sustainable development of the region.
Indonesian scholars (PAULUS et al., 2020) seek to support inclusive and sustainable economic growth through the SDGs by creating border areas that are relatively isolated from economic growth centers. Research by a British scientist (DE LAURENTIS, 2020) is based on the role of regions in the implementation of renewable energy policy, the relationship between public policy and the implementation of renewable energy, which allowed to take into account regional characteristics that would ensure sustainable development.

**METHODOLOGY**

The authors used a systematic approach to the functioning of eco-industrial parks in terms of sustainable development and the paradigm of circular economy and used general economic and specific methods of scientific knowledge, including the method of analysis, synthesis, deduction, monograph and others.

**RESULTS**

Today in Ukraine the legislation is created and industrial park's function. If we talk about their number, unfortunately, despite the existing priorities of such entities, their number still remains small, despite the existing need and opportunities for their creation.

If we take the experience of industrial parks in Ukraine, there are 52 parks. The largest number of them falls on Kyiv (10 industrial parks) and Lviv (9 industrial parks) regions. Regions such as Zakarpattia, Kharkiv, Kherson and Chernihiv regions do not have any registered industrial parks.

The adopted National Economic Strategy for the Development of Ukraine for the period up to 2030 provides for government directions for the support and development of industrial parks through their financial support. In particular, it is determined that support for the development of industrial parks is aimed at improving their environmental, economic, energy performance, which shapes the functioning of eco-industrial parks. This testifies to the intentions of the Government of Ukraine to promote the model of functioning of eco-industrial parks and the formation of a legal framework in this direction. Such intentions of the state contribute not only to modernization of production and stimulation of innovative activity of industrial enterprises, but also to achievement of the purposes of sustainable development in economic, ecological and social directions considering formation of circular economy. The main areas of stimulating the development of eco-industrial parks are:

- soft loans for park participants;
- tax benefits, including exemptions from taxes and customs duties;
- provision of land plots on preferential terms for the long term;
- provision of premises under subsidy conditions;
- subsidizing tariffs for the use of electricity and water;
- comprehensive use of services provided by the management company and the assets of the park;
- preferential use of tariffs for telecommunication services;
- simplification of regulatory procedures for park residents;
- use of the single window system within the operation of the park;
- creation and use of a single infrastructure.

Eco-industrial parks are focused primarily on economic development, but, unlike industrial ones, further contribute to social development and reduce the negative impact on the environment in the formation of a circular economy. Eco-industrial parks can be created as new formations, and industrial parks can move to them under the following conditions:

- increasing the efficiency of their management structure;
- development and implementation of measures for resource-efficient and clean production;
- increase the efficiency of joint use of the park infrastructure by its participants.
The operation of eco-industrial parks increases the requirements for the park management company, which manages and ensures the coordinated daily work of all park participants as a whole, serves the park infrastructure and its property, actively promotes the park and its marketing, cooperates with regional and local authorities. Eco-industrial parks are a system consisting of a management company, the subjects of the park, the so-called reviewers, includes the territory of the park and its property, as well as constantly interacts with the authorities and the united territorial communities. In general, an eco-industrial park is an industrial park where companies cooperate with local communities and regional authorities in order to reduce waste and environmental pollution, efficient sharing of resources. Eco-industrial parks are characterized by such features as (Fig. 1):

- the use of previously disposed waste (solid, liquid, gaseous, etc.) from one production to another to obtain a valuable by-product that meets the paradigm of circular economy and sustainable development;
- location and merging of companies within the eco-industrial park into supply chains and added value, taking into account the most efficient use of resources and waste-free production, which helps to increase the efficiency of the members of the associations;
- sharing of communal infrastructure, mainly related to water and energy use (in particular, water reuse, energy cogeneration), as well as activation of the system of energy use from renewable sources;
- exchange of services between companies, in particular, joint staff training, joint service, association in achieving the goals of sustainable development in the formation of a circular economy.

**Fig. 1. Features of functioning of eco-industrial parks**

Source: Suggested by the authors
The operation of eco-industrial parks has many advantages for all participants, namely, especially for participants of such parks because it allows to minimize material, labor, resource costs and provides faster opening of economic activity or its diversification. The management company provides an opportunity to obtain the necessary services to increase the efficiency of eco-industrial parks.

Secondly, for the management company, the unconditional benefit is the receipt of income from the provision of land and production areas for the participants of the eco-industrial park, as well as income from the provision of services for the subjects of the eco-industrial park.

Third, for the national economy, as it provides an opportunity to increase employment and income, reduce migration, and so on. It also makes it possible to increase the efficiency of resource use with minimal negative impact on the ecosystem due to the ecological paradigm of development of eco-industrial parks.

Fourth, it provides an opportunity for local authorities to increase local budget revenues and self-sufficiency of local self-government and increase the socio-economic development of the respective territories.

To introduce the functioning of eco-industrial parks on a national scale, it is important to formulate an appropriate vision of their development policy in terms of sustainable development and the formation of a circular economy. Course directions, vision and goal of development of eco-industrial parks in Ukraine should be based on the following vectors (Fig. 2):

- paradigmatic approaches to the circular economy;
- sustainable economic growth in economic, social and environmental areas, development of regions and united territorial communities;
- use of significant potential of eco-industrial parks as an effective mechanism for overcoming problems in industry and the consequences of the current economic crisis in Ukraine;
- growth of resource-efficient and environmentally friendly production, reduction of negative environmental impact;
- transparent and predictable approach to the location of eco-industrial parks;
- increase resource efficiency, create a closed cycle of resource and waste use, which can improve the economic, environmental and social qualities of business and help attract investment to the region, attract prestigious foreign companies and increase the profits of eco-industrial parks;
- innovative direction of activity of participants of eco-industrial parks;
- creation of production and business infrastructure that will facilitate the localization of companies that adhere to the world’s best business practices.
Fig. 2. Directions and tools of formation and functioning of eco-industrial parks

### DIRECTIONS AND TOOLS OF ESTABLISHMENT AND FUNCTIONING OF ECO INDUSTRIAL PARKS

| Vectors of development of eco-industrial parks | Tools for the development of eco-industrial parks | Intensification of decision-making on eco-industrial parks |
|-----------------------------------------------|--------------------------------------------------|----------------------------------------------------------|
| paradigmatic approaches to the circular economy | management of the functioning of eco-industrial parks | Private sector - participation as their residents of parks, investing in environmentally friendly production |
| sustainable economic growth in economic, social and environmental areas | regulation of the formation and functioning of eco-industrial parks | The public sector - developing measures to stimulate parks, providing state support to increase the efficiency and environmental friendliness of their activities |
| overcoming problems in industry and the consequences of the current economic crisis | economic tools to encourage the development of eco-industrial parks | Entrepreneurial sector, intensification of activity, establishment of cooperation with park management companies |
| growth of resource-efficient and environmentally friendly production, reduction of negative environmental impact | information tools to increase the innovative culture of the population and awareness of the benefits of the operation of eco-industrial parks | Financial sector, intensification of financing and crediting of green technologies, support of eco-oriented projects |
| transparent and predictable approach to the location of eco-industrial parks | | Regional sector, obtaining a synergetic effect from the interaction with parks by local authorities |
| improving resource efficiency, creating a closed cycle of resource and waste use | | |
| innovative direction of activity of participants of eco-industrial parks | | |
| creation of production and business infrastructure | | |

Source: Suggested by the authors

To ensure the establishment and functioning of eco-industrial parks in Ukraine, it is necessary to use such tools, firstly, the management of eco-industrial parks, which provides for the formation of institutional institutions with certain functions and responsibilities to ensure the necessary regulatory reforms and further support the implementation of eco-industrial parks and development.
Secondly, regulation of the formation and functioning of eco-industrial parks in terms of sustainable development in accordance with the paradigm of circular economy and transformation of industrial parks into eco-industrial, which provides for the adoption of legal framework for such processes, strategic planning at the national and regional levels, concerning ecological responsibility of monitoring, control and maintenance of activity of parks according to the established requirements of ecological friendliness of industrial production.

Thirdly, economic tools to encourage the development of eco-industrial parks, including incentives, including tax incentives to enhance the functioning of eco-industrial parks and support from local authorities and self-government in promoting the provision of services, land, etc.

Fourthly, information tools to achieve an increase in the innovative culture of the population and awareness of the benefits of the operation of eco-industrial parks, which contribute to the introduction of clean production, conservation and care for the environment. Informing about the consequences of pollution and the benefits of environmental protection, the consequences of depletion of resources and the possibility of avoiding these processes, attracting investment in clean technologies and innovative developments and innovative production.

Thus, management and regulation of eco-industrial parks in terms of sustainable development in accordance with the paradigm of the circular economy, the use of economic and information tools to encourage the development of eco-industrial parks and awareness of the benefits of eco-industrial parks will help ensure the formation and functioning of eco-industrial parks.

In turn, the use of such tools will provide a shift in the direction of intensifying decision-making in:

- the private sector, to decide to participate in eco-industrial parks as their residents, investing financial resources in environmentally friendly production;
- the public sector, in the direction of developing effective measures to stimulate the functioning of eco-industrial parks, identifying priority sectors of the economy to provide state support to improve the efficiency and environmental friendliness of their activities;
- business sector, in the direction of intensifying activities in accordance with the requirements of eco-industrial parks, establishing cooperation with park management companies and other stakeholders;
- financial sector, in the direction of intensification of financing and crediting of green technologies, support of eco-oriented projects and startups;
- regional sector, due to the synergy of regional and local authorities, through the promotion of eco-industrial parks in regions and communities, increasing corporate social responsibility in sustainable development and the circular economy, attracting investment, including international in environmental, industrial and innovative projects, etc.

CONCLUSIONS

The functioning of eco-industrial parks contributes to the formation of a balanced industrial competitive territorial space, which ensures the creation of jobs, efficient use of resources and increases the environmental friendliness of production. The functioning of eco-industrial parks helps to attract investment and increase the level of social development of the territories. For the functioning of eco-industrial parks in Ukraine, it is necessary to intensify the development of the potential for their creation and increase the awareness of stakeholders about the opportunities and benefits of eco-industrial parks. And:

- provide institutional and regulatory support for their formation;
- stimulate support for the implementation of effective management of eco-industrial parks;
to agree on methodological principles of transformation of industrial parks into eco-industrial parks;

to intensify local authorities to support the creation and operation of eco-industrial parks and stimulate them to provide local support;

increase the capacity of company managers to effectively attract participants to eco-industrial parks;

to direct efforts to increase the innovative culture of the population and the perception of the goals of sustainability and the paradigm of the circular economy.

Further research into the formation and operation of eco-industrial parks requires issues related to the dissemination of information and knowledge about eco-industrial parks, their importance for industrial development and environmental significance.

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VOLKOV, A. 21 Methodological approaches to the study of socio-economic constraints on sustainable development of the Karelian Arctic region in modern conditions. *E3S Web of Conferences*, 2020, v. 203, 05023.
In this study, the authors examine the functioning of eco-industrial parks in terms of sustainable development and the paradigm of the circular economy. The purpose of the article is to substantiate the principles of functioning of eco-industrial parks in terms of sustainable development and the paradigm of the circular economy. The methodological basis of the study is a systematic approach to the functioning of eco-industrial parks in terms of sustainable development and the paradigm of circular economy and the use of general economic and specific methods of scientific knowledge, including the method of analysis, synthesis, deduction, monograph and others. The conclusions of the study are the justification of the vision of development policy in terms of sustainable development and the formation of a circular economy in the direction of creation and operation of eco-industrial parks. The tools for ensuring the formation and functioning of eco-industrial parks in the conditions of sustainable development and the paradigm of the circular economy are proposed and the consequences of its introduction are substantiated.

Abstract

Resumo

Neste estudo, os autores examinam o funcionamento dos parques eco-industriais em termos de desenvolvimento sustentável e o paradigma da economia circular. O objetivo do artigo é fundamentar os princípios de funcionamento dos parques eco-industriais em termos de desenvolvimento sustentável e o paradigma da economia circular. A base metodológica do estudo é uma abordagem sistemática do funcionamento dos parques eco-industriais em termos de desenvolvimento sustentável e do paradigma da economia circular e da utilização de métodos econômicos gerais e específicos do conhecimento científico, incluindo o método de análise, síntese, dedução, monografia e outros. As conclusões do estudo são a justificação da visão da política de desenvolvimento em termos de desenvolvimento sustentável e a formação de uma economia circular no sentido da criação e exploração de parques eco-industriais. São propostas as ferramentas para assegurar a formação e funcionamento dos parques eco-industriais nas condições de desenvolvimento sustentável e o paradigma da economia circular e fundamentadas as consequências da sua introdução.

Palavras-chave: Desenvolvimento sustentável. Desenvolvimento ecológico. Ambiente. Parque Eco-industrial. Economia circular.

Keywords: Sustainable development. Ecological development. Environment. Eco-industrial park. Circular economy.

Resumen

En este estudio, los autores examinan el funcionamiento de los parques ecoindustriales en términos de desarrollo sostenible y el paradigma de la economía circular. El propósito del artículo es fundamentar los principios de funcionamiento de los parques eco-industriales en términos de desarrollo sostenible y el paradigma de la economía circular. La base metodológica del estudio es un enfoque sistemático del funcionamiento de los parques ecoindustriales en términos de desarrollo sostenible y el paradigma de la economía circular y el uso de métodos económicos generales y específicos de conocimiento científico, incluido el método de análisis, síntesis, deducción, monografía y otros. Las conclusiones del estudio son la justificación de la visión de la política de desarrollo en términos de desarrollo sostenible y la formación de una economía circular en la dirección de la creación y operación de parques ecoindustriales. Se proponen las herramientas para asegurar la formación y funcionamiento de parques ecoindustriales en las condiciones de desarrollo sostenible y el paradigma de la economía circular y se fundamentan las consecuencias de su implantación.

Palabras-clave: Desarrollo sostenible. Desarrollo ecológico. Medio ambiente. Parque ecoindustrial. Economía circular.