

# Conceptual Principles of the Transformation of Industrial Parks into Eco-Industrial Ones in the Conditions of Sustainable Development

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## Abstract

The article investigates the conceptual principles of transformation of industrial parks into eco-industrial ones in the conditions of sustainable development. It is substantiated that the concept of sustainable development in the transformation of industrial parks is to grow industry and jobs, modernize production and introduce innovative technologies, resource and energy efficiency, reduce greenhouse gas emissions and waste storage, social protection of local communities and create favorable infrastructure. It is determined that for the transformation of industrial parks, it is necessary to improve regulatory changes, introduce criteria for compliance of industrial parks and the importance of their consideration, ensure park management by the management company and create favorable incentives for industrial entry into industrial symbiosis. It is proved that industrial parks can be an incentive for industrial development and competitiveness of enterprises. The availability of talented human capital, attractive territories, minerals, energy and mineral resources, developed domestic market, agricultural potential, transport networks is becoming an attractive place for investment and development. Industrial parks need investment. Transformation into eco-industrial parks through the implementation of sustainable development goals opens additional opportunities for access to investment funds and contributes to the implementation of growth and prosperity strategies of the country.

## Key words:

*eco-industrial park, industrial symbiosis, sustainable development, ecological and social problems, production efficiency.*

## 1. Introduction

Sustainable development is closely linked to industrial development, innovation, economic growth, the fight against climate change and, as a result, the creation and transformation of industrial parks. Ukraine's industrial development requires radical changes in production processes, the rational use of natural resources and the provision of environmental and social development. The economies of countries are constantly evolving and tend to increase production, so the formation of industrial symbioses to ensure inclusive and sustainable industrial development is very important. The transformation of

industrial parks into eco-industrial ones will help create a comfortable environment for participants, increase their competitiveness, save and use resources efficiently, create jobs and provide social infrastructure to the surrounding area.

The purpose of this study is to substantiate the conceptual foundations of the transformation of industrial parks into eco-industrial in terms of sustainable development.

## 2. Literature review

Transformational features of the functioning of industrial parks in terms of sustainable development are an extremely relevant and timely area of research. Among the scientists who have studied this issue should be noted: Andreichenko S. S. (2020) [1]; Anishchenko V.O. (2008) [2]; Mashnenkov K. (2021) [3]; Ivanova N. (2016) [4]; Khanin S. (2021) [5]; Lazarenko Yu. (2020) [6]; Lütje A. (2020) [7]; Marhasova V. (2017) [8]; Pohrebniak A. (2021) [9]; Popelo O. (2017) [10]; Butko M. (2021) [11]; DergaliukB. (2021) [12]; Kleshchov A. (2021) [13]; Kravchuk Yu. (2021) [14]; Wang J. (2015) [15]; Wang N. (2021) [16]; Wang T. (2021) [17]; Wen Z. (2018) [18]; Yang T. (2018) [19]; Yu C. (2015) [20]; Zeng D.Z. (2021) [21]; Zhao R. (2021) [22]; Zhou M. (2018) [23] and others.

The article [21] analyzes how China has achieved outstanding results in green transformation through the introduction of eco-industrial parks (EIP). The results of scientific research prove a positive impact on both the environment and competitiveness. The authors argue that their research strengthens the evidence base for Chinese politicians and business modulation for entrepreneurs when considering green investment.

The authors of the article [16] argue that testing the effectiveness of the circular economy (CE) of industrial parks and studying the potential causes requires systematic research. The authors believe that it is necessary to create a new dimension and quantify the effectiveness of the

circular economy of industrial parks in order to form appropriate policies. Based on the authors' research, it can be concluded that they make an important contribution to policy instruments for the development of viable and efficient industrial parks.

The scientific work [17] is based on research on the transformation of industrial parks, which has become a key aspect in the development of the concept of circular economy at the regional level in China. The authors investigated that the audit of net production of enterprises can be the basis for a critical analysis of material flows. The developed proposals of scientists will contribute to the increase of stable per mille symbiosis and will promote the development of eco-industrial parks in the context of the circular economy.

The aim of the article [22] is to study the concept of ecological transformation of industrial parks and analyze the main aspects of the processes of implementation in various political practices around the world. The authors argue that this is a long-term process, which is also useful for countries that are just beginning the ecological transformation of industrial parks. This will help identify signals of new local initiatives and facilitate their implementation in national practice.

The main idea of circular symbiosis [7] is the creation of advanced circular and cascade systems, in which energy and material flows are extended for multiple use in industrial systems, which increases productivity and resource efficiency. All this reduces the burden on the environment.

The article [19] proves that assessing the ecological progress of chemical industrial parks is a difficult task due to their complexity and diversity. The authors have built an integrated evaluation system through a combination of qualitative and quantitative evaluation. In turn, the qualitative assessment is based on observations of the coevolution of the three main elements of the parks, which are the industrial chain system, the infrastructure system and the management system. The quantification was based on a rating of environmental indicators, which included 15 indicators and an analysis of key components.

The article notes [18] that the transformation of the industrial park for waste processing was one of the main demonstration programs for building a circular economy in China. It was based on 7 main tasks for the transformation of traditionally high resource- and energy-intensive production into highly efficient and low production of pollutants. According to research, the authors argue that information exchange platforms benefit businesses by raising awareness of both private and public entities about circular economy projects.

Researchers [23] have shown that eco-industrial parks can play a significant role in making economic, environmental and social improvements for both individual plants and a network of companies. The

researchers found that the main aspects for developing a successful Eco-Industrial Park are to identify the best links between the various industrial enterprises and adjacent communities within the Eco-Industrial Park.

The aim of the article [20] is to analyze the impact of policy instruments on the development of viable eco-industrial parks in China. The authors analyze the roots of China's national program of eco-industrial parks and explore common tools available to local governments to shape and promote environmental and industrial development. The authors argue that the planned model is useful in the early stages of the development of eco-industrial parks, but, according to scientists, it is advisable to combine it with a lightweight model to achieve long-term goals of eco-transformation.

The authors point out [15] that China's traditional industrial parks have grown rapidly over the past 30 years, which has contributed to stable and steady GDP growth, but has also caused serious pollution. This issue is proposed to be addressed through their transformation into eco-industrial parks. Scientists analyze the features of the main strategies in the policy system in order to better achieve the Eco transformation of Chinese traditional industrial parks.

### 3. Results

The Law of Ukraine "On Industrial Parks" states that an industrial park is defined by the initiator of the creation in accordance with urban planning documentation directly equipped with the appropriate infrastructure area within which the participants of the industrial park can carry out diverse economic activities in the processing industry and research activities in the field of information and telecommunications under the conditions specified by the Law and the agreement on the implementation of such activities within the industrial park [24].

The current global economic development challenges associated with the pandemic have raised questions about the logistics of resources and products within the global economy. Large corporations and manufacturing companies are reviewing their logistics flows and looking for new opportunities to optimize production processes, including by finding new partners.

It should be noted that the availability of natural resources, favorable geographical location, human potential are the advantages of Ukraine in the European market and should be the basis for economic growth and strengthening its position on the world stage. Ukraine ranks 56th in the world in terms of GDP, and 119th in terms of GDP per capita [25]. Ukraine has a strong energy and industrial sector, a well-developed transport infrastructure, but most enterprises are in critical condition due to a lack of incentives to modernize and innovate. One

of the vectors for solving the existing problems of development of the industrial sector of Ukraine may be the development of eco-industrial parks in the country, including through the transformation of industrial parks into a new environmentally friendly format of production activities.

Developed and proposed in Ukraine, the National Economic Strategy for the period up to 2030 provides for the implementation of the Strategic Goal:

- number one "Create the necessary conditions to attract investment";

- number four "Creation of new production facilities through the stimulation of innovative activities of enterprises in all regions of the country to use the competitive advantages of each of them."

Creating the necessary conditions for attracting investment is aimed at expanding and building new industrial parks, providing conditions for doing business within the industrial park. Stimulating the expansion of production capacity through the organization of innovative activities of enterprises involves providing conditions for the creation and development of industrial parks as investment sites with existing engineering and transport infrastructure. As well as providing incentives for residents of industrial parks and state support for their development, included in the Register of Industrial (Industrial) Parks of Ukraine, by providing funding for measures to improve environmental, energy and economic performance, building a circular principle of resource use. This will contribute to the transformation of industrial parks into eco-industrial ones and the introduction of the concept of developing eco-industrial parks.

The experience of many countries around the world proves that industrial parks are a stimulus for business and industrial development. Involvement of enterprises in industrial symbiosis gives competitive advantages of cooperation, use of resources, energy, exchange and processing of by-products of production and increase of work efficiency. Cooperation and the use of synergies, which are related to the proximity of the location to each other, contribute to solving waste problems and creating closed cycles of use of raw materials within the industrial zone.

The ability of enterprises to use shared infrastructure and services reduces operating costs and expands opportunities to increase the efficiency of business start-ups.

There are two models in the world to promote the state development of industrial parks: Asian and American. The essence of the development of industrial parks according to the Asian model is that the state allocates territory for the project, stimulates infrastructure development, creates jobs and attracts international investment. Private companies are engaged in the maintenance and improvement of development.

According to the American model, the creation of industrial parks is financed by state and international development programs, and public agencies to promote park development are responsible for the location of production.

Analyzing the international experience of industrial parks, it should be noted that they have become widespread. Thus, in Turkey there are 331 organized industrial zones, the state support of which is provided by the possibility of acquiring land resources without VAT, exemption from real estate taxation, low tariffs for natural gas and water resources, no fee for consolidation or division of land and exemption from local taxes during construction using solid waste.

There are 96 industrial parks registered in Romania, which are exempt from paying land tax for the possibility of changing the purpose of land and construction.

There are 14 special economic zones and 80 industrial, technological and science and technology parks registered in Poland. The state provides exemption from corporate tax, partially exempts from property tax, supports the creation of new jobs and provides grants for staff training.

If you take Ukraine and at the end of 2021 in Ukraine there are 53 industrial parks, which are located throughout its territory.

Regarding the stimulation of industrial parks by the state, it should be noted that in Art. 24 of the Budget Code of Ukraine [26] provides for the financing of industrial parks, which are entered in the state register and ensure the development of their infrastructure. Funding is provided by the state fund for regional development.

Over the past five years, four industrial park projects have been funded in Ukraine. Industrial parks are located in different regions of the country. Industrial parks located in Sumy region were financed in the amount of UAH 4.4 million for the construction of electrical and engineering water supply and sewerage networks, as well as the reconstruction of roads. In the Chernivtsi region, the construction of water supply and sewerage networks in the Novodnistrovsk industrial park was financed in the amount of UAH 5.175 million.

Today in Ukraine all works on preparation of design and estimate documentation which are necessary for functioning of industrial parks are financed from local budgets and extra-budgetary means.

Local support for industrial parks is provided through the provision of benefits by local governments for the payment of land tax and real estate tax. A minimum rental rate is set for the lease of state and communal lands. Favorable conditions are being created for the issuance of permits required for the implementation of projects, for the provision of utilities and access to sites allocated funds from local budgets, staff training is carried out to work in industrial parks.

In 2021 in Ukraine to improve regulatory changes in the creation and operation of industrial parks was initiated the draft Law of Ukraine "On Amendments to Some Laws of Ukraine on Improving the Principles of Establishment and Functioning of Industrial Parks", which was approved by the Cabinet of Ministers and submitted to the Verkhovna Rada of Ukraine. This draft Law should amend the Laws of Ukraine "On Industrial Parks", "On the Electricity Market" and "On Regulation of Urban Development". The draft law will promote the development and maintenance of industrial parks by local authorities in terms of simplified connection to electricity networks and arrangement of engineering and transport infrastructure.

These changes will strengthen the requirements for inclusion in the Register of Industrial Parks, will allow harmonization of financing and state aid mechanisms with the Budget Code of Ukraine, the laws of Ukraine "On State Aid to Business Entities" and "On Principles of State Regional Policy" and will allow industrial parks to join networks for free.

The implementation of the norms proposed by the draft Law will make it possible to exclude from the Register industrial parks that are not developing and will provide state support for industrial parks at the expense of budget funds, which will comply with current legislation and promote park development and prosperity.

In 2020, a draft Law "On Amendments to the Tax Code of Ukraine aimed at attracting investment in the industrial sector of the economy by introducing incentives in industrial parks" was submitted. It is envisaged to introduce a 3% value added tax on the import of equipment, machinery and components into the customs territory of Ukraine. Exempt from corporate income tax enterprises whose export revenue is at least 70% of total turnover. A list of criteria to be met by participants in industrial parks for the application of special taxation is also defined. When connected to the grid, according to the law, half of the costs must be reimbursed. To manage the development of industrial parks, conduct monitoring and evaluation, a state institution is determined, which will also represent and protect the interests of participants in public authorities and at the international level.

The draft Law "On Amendments to the Customs Code of Ukraine aimed at attracting investment in the industrial sector of the economy through the introduction of investment incentives in industrial parks" provides for exemption from customs duties on equipment, facilities and components for the arrangement and operation of industrial parks; identification of participants who will operate this equipment; determination of the type of economic activity for which it is allowed to import equipment at preferential taxation by import duty.

In December 2020, the draft Law of Ukraine "On Amendments to the Law of Ukraine" On Industrial Parks

"aimed at attracting investment in the industrial sector of the economy by introducing incentives in industrial parks" was registered. The bill provides for compensation of fifty percent of the costs of management companies and all participants in industrial parks to connect to the grid, also provides compensation for interest payments on loans depending on the volume of exports of domestic products and partial compensation for investments to create new production facilities.

Thus, it can be noted that in Ukraine there are significant institutional changes in the direction of stimulating the development of industrial parks and their transformation into eco-industrial parks. The need to transform industrial parks means that participating companies will reap significant benefits through close collaboration and exchange processes through the use of shared resources and infrastructure. In general, this will provide additional opportunities to support small and medium-sized businesses, create jobs and social infrastructure for the local population. Participants of the industrial park can be any interested persons, entrepreneurs, public organizations, local community, civil servants, scientists, financial and international organizations.

To implement the process of transformation of the industrial park, it is necessary to monitor the current state and development opportunities of the eco-industrial park. Monitoring should include the following main analytical components (Fig. 1):

- location, in this aspect the size of the territory of the industrial park, the presence of an extensive transport network, water supply system and, accordingly, drainage are analyzed in more detail;

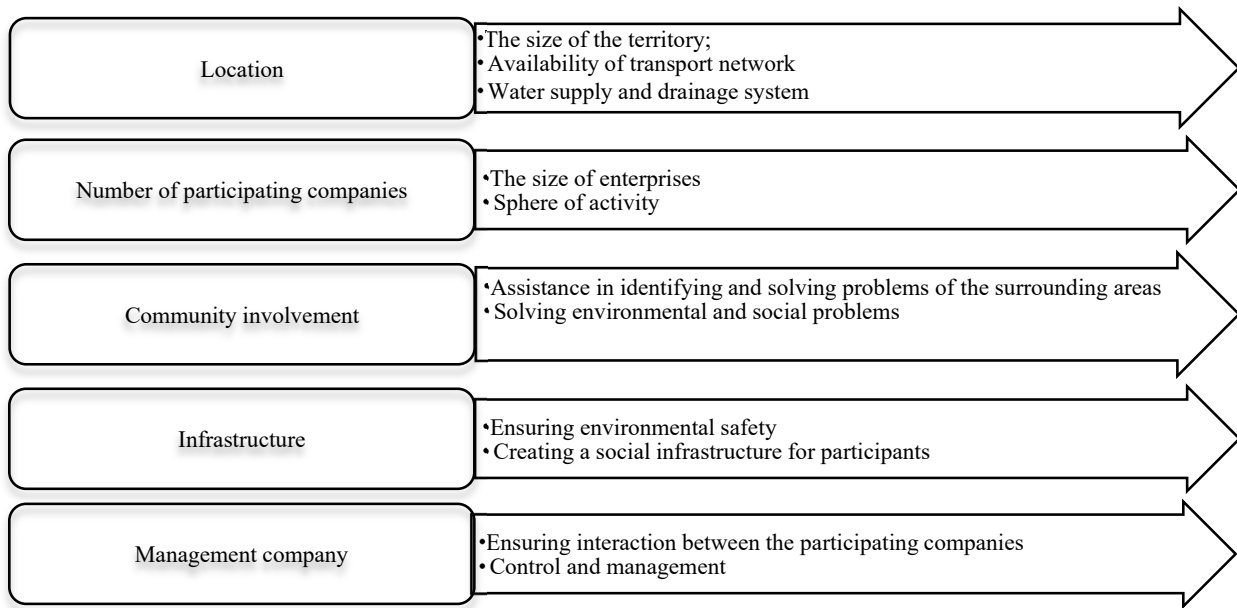
- the number of participating companies, which details not only their number, but also their size and scope of activity;

- involvement of communities, this is important because the receipt of taxes within certain limits of state legislation goes to local budgets and leads to close cooperation and cooperation with regional and local authorities. Detailed in this context are issues related to assistance in solving the problems of local communities, with special emphasis on environmental and social components;

- infrastructure, important in monitoring is the study of environmental safety of the industrial park, the creation of social infrastructure for its participants;

- management company, special attention should be paid to monitoring the interaction between the companies participating in the park, as well as control and management of the industrial park.

Such monitoring of the activity of industrial parks will help to single out the peculiarities of its functioning and will give an opportunity to outline the directions of its transformation into eco-industrial parks.



**Fig. 1** Directions of monitoring of industrial parks for their transformation into eco-industrial ones. (Source: developed by the authors.)

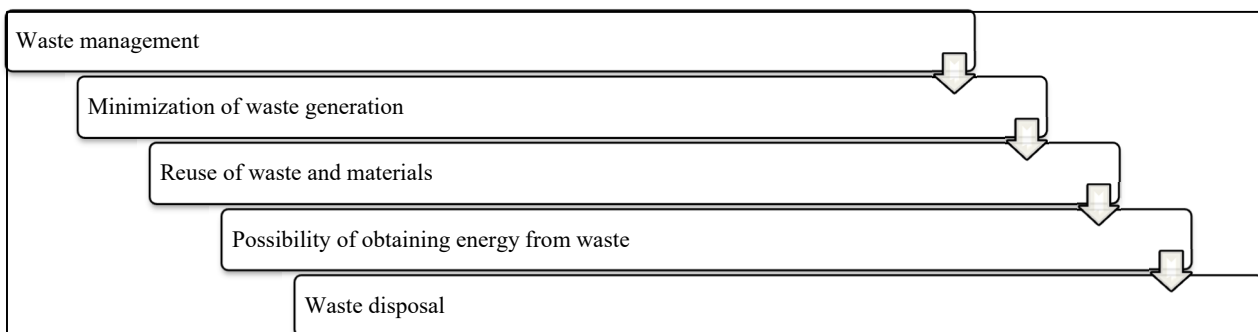
The paradigm of sustainable development provides for the efficient use of material, energy and water resources.

In the industrial park for its transformation into eco-industrial park should be introduced a modern system of waste management and use (Fig. 2), which should include:

- waste management system of the industrial park;
- development of directions for minimization of waste generation in the industrial park;

- ensuring the reuse of waste and materials in accordance with the principles of the circular economy;
- introduction of innovative technologies to expand the possibilities of obtaining energy from industrial park waste;
- organization of waste management system in the park.

Such a system of waste management and use will promote the transformation of industrial parks into eco-industrial ones.



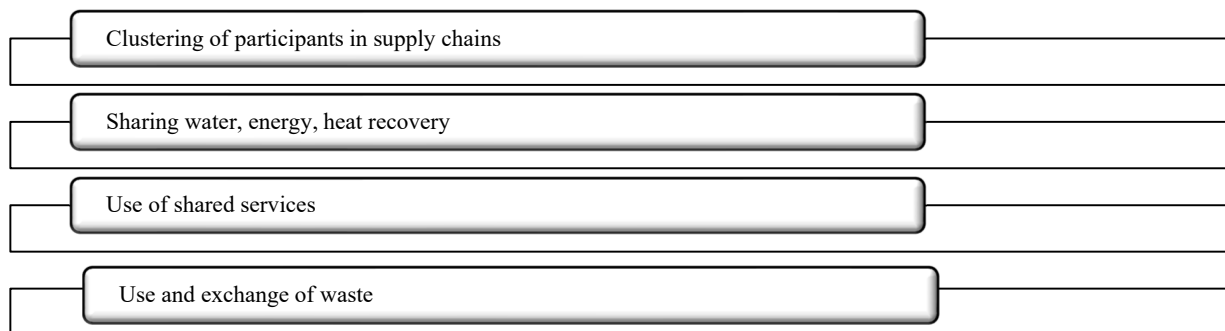
**Fig. 2** The system of management of measures for the formation and use of waste industrial parks in order to transform them into eco-industrial. (Source: developed by the authors)

Also, increasing the efficiency of the industrial park can occur due to industrial symbiosis (Fig. 3). The industrial symbiosis of the industrial park should include:

- clustering of participants in supply chains;

- ensuring the joint use of water, energy, heat recovery and other resources within the park;
- use of joint services for participants of the industrial park;

- use and exchange of waste to achieve the goals and principles of the circular economy.



**Fig. 3** Direction of industrial symbiosis of industrial park in the direction of transformation into eco-industrial park. (Source: developed by the authors).

The introduction of synergies will reduce the use of input resource flows (raw materials, energy and water) and reduce the volume of output resource flows (generation and storage of waste, liquid effluents and pollution of surface and groundwater). This will help to participate companies reduce waste recycling costs and increase the productivity of converting raw materials and resources into useful products or services, reduce the burden on the ecosystem and promote human development and local communities.

The main part of industrial parks in Ukraine created on state and communal lands, so their development and development can be offered to investors for investment projects. Industrial parks must become real platforms for creating conditions for the growth of the state economy and ensuring conditions for sustainable development. Effective implementation of the project of changes in industrial parks in Ukraine will promote the development of human capital, innovative industrial enterprises and new technological solutions, environmental safety and decarbonization of the economy.

#### 4. Conclusions

Thus, the synergetic approach will allow the transformation of industrial parks into eco-industrial and realize the goals of sustainable development, namely: production efficiency, environmental management, human development. As well as increase the efficiency of natural resources, reduce the impact on the environment and ecosystem, minimize the risks of negative impact on people and communities, increase the welfare of the local population.

The novelty of this study is the development of conceptual foundations for the transformation of industrial parks into eco-industrial ones, taking into account the paradigmatic features of sustainable development, circular economy and synergetic approach in the activities of industrial parks. Conceptual principles of transformation of industrial parks into eco-industrial ones provide for the development and implementation of measures to monitor the activities of industrial parks, systems for implementing measures for the generation and use of waste and directing the activities of industrial parks to industrial symbiosis.

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