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Roleders V.V.

CIRCULAR ECONOMY MODEL IN INDUSTRIAL ECOSYSTEMS

Vinnitsia Education and Research Institute of Economics, West Ukrainian National University, Ministry of Education and Science of Ukraine, Department of Finance, Banking and Insurance, Honty str., 37, Vinnytsia, 21000, Ukraine, tel.: +380675091500, e-mail: nagaichukviktoriiia@gmail.com, ORCID: 0000-0002-6653-6583

Abstract. The purpose of the article is to determine the stages, mechanisms and competitive advantages of the transformation of industrial ecosystems to the circular economy model.

The methodological basis of the research is the method of scientific knowledge and system approach, comparison, analytical method, as well as dialectical, structural and functional methods. It has been proven that a closed ecological and economic cycle includes the achievement of sustainable economic growth through the use of global resources and the reuse of materials.

It was determined that in the circular economy, companies develop integrated supply chains, using resources more efficiently and creating new markets. The stages of the organization of the reconstruction of ecosystems: the assessment of ecosystem readiness and its transformation are considered, it is found that innovative technologies contribute to the systemic implementation of changes. The transformation of ecosystems is carried out with the help of mechanisms for limiting early investment costs, investing in IT infrastructure, and encouraging stakeholders to cooperate. It is proven that the riskiness of the transformed business model forces the parties to agree on the distribution of risks and revenues.

The principles of a circular ecological and economic cycle, which is based on circular development and reuse of waste, were proposed. The basis of the proposed scheme of principles reconstructs a simple economic linear scheme, which was previously based on the principles of "extracted - processed - consumed - discarded waste". To change the linear economy to the economy of a circular ecological and economic cycle, there is a need to ensure the maximum efficiency of each stage of the life cycle of a product or service. As part of the development of the circular ecological-economic cycle economy model, a conceptual approach to the introduction of a circular economy in Ukraine was proposed.

The transformation of industrial ecosystems can provide enterprises with various competitive advantages. Among the most common strategic advantages are differentiation and cost leadership. However, the main benefit of ecosystem transformation is to enhance the ability of ecosystems to achieve good triple bottom line outcomes, delivering social, financial and environmental benefits to

clients. In particular, companies achieve higher productivity, better use of resources, reduction of hazardous jobs, greater transparency of the ecosystem, market growth and financial returns. The transformation of the ecosystem to a circular economy model creates opportunities for the development of sustainable industry.

Key words: transformation, industrial ecosystems, circular economy, concept, circular ecological and economic cycle, business model

Роледерс В.В.

МОДЕЛЬ ЦИРКУЛЯРНОЇ ЕКОНОМІКИ В ПРОМИСЛОВИХ ЕКОСИСТЕМАХ

Вінницький навчально-науковий інститут економіки
Західноукраїнського національного університету,
МОН України,
кафедра фінансів, банківської справи та страхування,
вул. Гонти, 37, м. Вінниця,
21000, Україна,
тел.: +380675091500,
e-mail: nagaichukviktoriiia@gmail.com,
ORCID: 0000-0002-6653-6583

Анотація. Метою статті є визначення етапів, механізмів та конкурентних переваги трансформації промислових екосистем до моделі циркулярної економіки.

Методологічною основою дослідження є метод наукового пізнання та системний підхід, порівняння, аналітичний метод, а також діалектичний, структурний та функціональний методи. Доведено, що замкнений еколого-економічний цикл включає досягнення сталого економічного зростання за рахунок використання глобальних ресурсів і повторного використання матеріалів. Визначено, що в циркулярній економіці компанії розвивають інтегровані ланцюжки поставок, ефективніше використовуючи ресурси та створюючи нові ринки. Розглянуто етапи організації перебудови екосистем: оцінка готовності екосистеми та її трансформація, виявлено, що інноваційні технології сприяють системному впровадженню змін. Трансформація екосистем здійснюється за допомогою механізмів обмеження ранніх інвестиційних витрат, інвестування в IT-інфраструктуру та заохочення стейкхолдерів до співпраці. Доведено, що ризикованість трансформованої бізнес-моделі змушує сторони домовлятися про розподіл ризиків і доходів.

Запропоновано основні принципи кругового еколого-економічного циклу, в основі якого циркулярний розвиток та повторне використання відходів. Основа запропонованої схеми принципів перебудовує просту економічну лінійну схему, яка раніше буда заснована на принципах «добули – переробили – спожили – викинули відходи». Для зміни лінійної економіки на економіку кругового еколого-економічного циклу існує потреба в забезпеченні максимальної ефективності кожного етапу життєвого циклу товару або послуги. У рамках розробки моделі економіки кругового еколого-економічного циклу було запропоновано концептуальний підхід до запровадження циркулярної економіки на Україні

Трансформація промислових екосистем може надати підприємствам різні конкурентні переваги. Серед найпоширеніших стратегічних переваг – диференціація та лідерство у витратах. Проте головною перевагою трансформації екосистеми є підвищення здатності екосистем досягати хороших потрійних кінцевих результатів, забезпечуючи соціальні, фінансові та екологічні вигоди для клієнтів. Зокрема, компанії досягають вищої продуктивності, кращого використання ресурсів, скорочення небезпечних робочих місць, більшої прозорості екосистеми, зростання ринку та фінансової прибутковості. Трансформація екосистеми до моделі циркулярної економіки створює можливості для розвитку сталої промисловості.

Ключові слова: трансформація, промислові екосистеми, циркулярна економіка, концепція, циркулярний еколого-економічний цикл, бізнес-модель.

Introduction. Many countries of the world use a linear model of the economy, which includes extraction, processing of resources and processing them into waste, without further application. As a result of the processing of resources, there is environmental pollution, accumulation of waste, which leads to environmental disasters. In order to ensure the sustainable development of countries, there is a change in the production model from a linear to a circular model of the economy (or a closed cycle economy). The use of a closed ecological and economic cycle includes the creation of business conditions related to waste processing and minimizing the negative impact on the environment and climate [1; 7].

Research on this topic is just beginning to gain momentum, but such foreign and Ukrainian scientists as N. Boken and E. Olivetti [5]; Ghisellini P., Cialani C., Ulgiati S. [12]; E. MacArthur [14]; P.K. Fletcher [11] and others contributed to the problems and prospects of implementing a circular ecological and economic cycle.

The topics of the circular ecological-economic cycle have not been sufficiently researched, therefore there is a need to study the systemic impact of this model of the economy on economic relations, on the existence of application limitations.

Problem statement. The purpose of this article is to consider the stages, mechanisms and competitive advantages of the transformation of industrial ecosystems to the circular economy model.

The methodological basis of the research is the method of scientific knowledge and system approach, comparison, analytical method, as well as dialectical, structural and functional methods. The information base consisted of normative and legal documents that regulate entrepreneurial activity, as well as monographs, articles in scientific journals, materials of periodicals on the subject under study.

Results. There is a decrease in cheap resources, which requires the timely implementation of a closed-loop economy, which will improve the efficiency of enterprises and lead to a reduction in waste by turning garbage into money.

The concept of a circular ecological and economic cycle was adopted by the European Union, which provided for the introduction of new business models that will be focused on the reuse, repair, restoration of products and the maximum reduction of waste generation [17;1;15]. The European Union has approved key documents related to the transition of countries to the conditions of using the circular economy:

1. The Seventh EU Environmental Action Program until 2020 "Living well within the limits of our planet" (2012).

2. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Towards a Circular Economy: Zero Waste Agenda for Europe" (2014) and "Closing the Loop - EU Circular Economy Action Plan" (2015) etc.

The circular economy is based on a model of economic development, which is based on the rational use and recovery of resources, as well as the process of changing the classic linear model of production to a circular one, which is focused on changing the efficiency of production of products and providing services that minimize waste and other types pollution. This type of circular ecological-economic cycle of the economy is considered as part of the Fourth Industrial Revolution, with the application of which the rationality of the use of resources will generally increase, the development of the economy will become systematic, predictable and transparent [13].

The circular cycle concept is based on the "3R" principles: reducing consumption (Reduce); reuse (Reuse); processing (Recycle). But when switching to this model of the economy, we suggest improving the principles of a circular ecological and economic cycle [19].

The basis of the proposed scheme of economic principles of a circular ecological-economic cycle lies in circular development, which rebuilds a simple economic linear scheme, which was previously based on the principles of "extracted - processed - consumed - discarded waste".

The circular ecological and economic cycle includes the achievement of sustainable economic growth through the use of global resources and the reuse of materials.

With the production cycle, according to the most modest calculations, the world economy will be able to receive 1 trillion dollars annually by 2025, as well as in the next five years to create 100,000 new jobs, saving 500 million dollars on materials and preventing the appearance of 100 million tons of waste [19].

Most of the world's countries use an approach to economics that includes research, use, utilization, and recovery of resources. The goal of the circular ecological and economic cycle is to preserve materials, products, etc. at the highest level.

It is recommended that the advantages include a significant saving of resources, sustainable resource use, satisfaction of the needs of the population, growth of the economy and income in general, protection of enterprises from resource shortages and unstable prices, energy savings due to a circular production cycle.

This model of the economy also foresees changes in industry related to the selection of raw materials, product manufacturing processes, and the use of by-products as raw materials for further production. A circular ecological and economic cycle allows you to avoid the accumulation of waste, shortage of resources, deterioration of the environment and climate, and, in turn, will contribute to the development of innovative technologies for processing products, increasing the competitiveness of the economy in general.

The mechanisms of the circular ecological and economic cycle are subject to a number of concepts, specific approaches and rules:

- Cradle-to-Cradle concept ("from cradle to cradle") is a concept of waste-free production [6];
- Biomimicry is the search for stimulating environmentally sustainable solutions [20];
- Industrial Ecology ("industrial ecology") is the development of industrial products and processes that will provide a double assessment of the product's competitiveness and its environmental friendliness;
- Blue Economy ("blue economy") is the sustainable use of ocean resources to improve livelihoods and jobs while preserving the health of the ocean ecosystem [4];
- Biosphere Rules ("biosphere rules") is the application of principles using circular processes in nature and their implementation in industrial production systems [18].

Since 2013, the EaPGREEN program has been implemented, the basis of which is support for the transition to a "green" economy. This program is financed by the European Union and started to be used by six countries of the Eastern Partnership of the EU (Georgia, Moldova, Ukraine, Belarus, Armenia, Azerbaijan), the USA, Japan, South Korea, and the People's Republic of China [17].

The EaPGREEN program includes the project "Resource-Efficient and Clean Production (hereafter RECV)", which is proposed by the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The basis of this project is the dissemination of approaches and principles of effective use of resources among small and medium-sized businesses.

As noted by K. Romanova and M. Tsybka RECHV is a method of comprehensive and continuous application of preventive measures regarding the impact of production processes on the environment with the aim of improving productivity and production efficiency and reducing risks for people, reducing the volume of waste generation, improving the quality and safety of products and services [17].

In Ukraine, during the period of use of the RECV project, it is observed the potential of Ukrainian enterprises to improve the efficiency indicators of waste volume reduction, material consumption, increase of jobs.

The policy of the circular environmental and economic cycle has led to the creation of 1000 landfills, which are aimed only at disposal, a low level of recycling, and in turn this has led to an increase in jobs. As O. Semerak pointed out, the implementation of the principles of the circular cycle additionally gives 4% of the country's GDP growth.

It is appropriate to draw a comparison that in Sweden 99% of garbage is recycled, in the USA 35% is disposed of, in Germany - 65%, in turn in Ukraine 94% of garbage is taken to landfills.

This comparison requires the introduction of tools that will allow efficient use of waste, as waste is an opportunity to introduce new technologies and preserve the environment. Therefore, according to the association agreement, Ukraine began to reduce the volume of waste generation, increase recycling and reuse, sort garbage and introduce a ban on landfilling untreated waste.

In the EU, by 2035, goals have been set, including the recycling of up to 65% of the total volume.

In December 2015, the European Commission adopted an action plan for the transition to the economy of a circular ecological and economic cycle, which provides for the development of relevant state regulation. When signing the Association Agreement with the EU, Ukraine undertook to adapt the legislation to the EU policy, since although the implementation of the circular cycle requires investments, it is not possible without clear legislative regulation. Regulatory and legal frameworks for the greening of the economy are developed and developed by the relevant ministries.

State regulation also includes and considers the allocation of grants, in relation to research data, priority is given to the use of state procurement and tax benefits.

It should be noted that when buying, for example, any electrical appliance, the buyer pays a small amount for further recycling of this product, which leads to a reduction in waste and recycling of objects that are already unusable, without harming the environment. Therefore, let's emphasize that when buying a particular product, the buyer must be responsible for product labeling and trademarks. In Ukraine, the implementation of the circular economic cycle has started in the field of public procurement, which is one of the largest blocks of obligations within the framework of the Association Agreement between Ukraine and the EU and is the field where the integration of the domestic market into the European one is foreseen.

In 2010, the State Environmental Policy Strategy of Ukraine until 2020 was adopted, which includes the development of a mechanism for sustainable production and consumption. Since 2017, Ukraine has joined the formation of the policy of "green" public procurement, the advantages of which are: improvement of working conditions, development of innovations, efficiency of the economy, attraction of investments, environmental and social responsibility.

After joining "green" public procurement, a new State Environmental Policy Strategy was developed - until 2030, in which the course towards a "green" economy remains key.

The model of the economy of the circular ecological and economic cycle includes as a basis the goal of reducing the consumption of natural resources, while not sacrificing the quality of life. The main principles of the model of a closed ecological and economic cycle lie in circular development, which includes secondary processing of resources, preservation of the value of the product, materials.

According to the linear model, low-waste technologies are implemented, where if waste is generated, it is completely disposed of, which is what led to the need for a model of a circular ecological and economic cycle.

The author proposed the principles of a circular ecological and economic cycle, which is based on circular development and reuse of waste. The basis of the proposed scheme of principles reconstructs a simple economic linear scheme, which was previously based on the principles of "extracted - processed - consumed - discarded waste". To change the linear economy to the economy of a circular ecological and economic cycle, there is a need to ensure the maximum efficiency of each stage of the life cycle of a product or service.

As part of the development of the circular ecological-economic cycle economy model, a conceptual approach to the introduction of a circular economy in Ukraine was proposed.

First, the conceptual approach to the development of the circular economy should be based on the strategy of sustainable development - a complex, multifaceted concept that tries to harmonize three dimensions of development: economic, social and environmental. It is linked to the circular economy through economic and environmental dimensions, as well as through corporate social responsibility, which is a business gateway to sustainable development.

The next criterion - environmental change - is a multifaceted concept that includes theory, discourse and implementation. It is used by governments (such as in France) to describe a multilateral process to guide society towards economic development within planetary constraints.

The criterion that emerges from the previous two - ecological economics, is an interdisciplinary system that seeks to combine two historically separate fields - economics and ecology.

Industrial symbiosis, sustainable consumption and dematerialization are attempts to further develop this theory. Dematerialization means using less or no material to provide the same level of functionality to the user.

This includes improving the use of materials or moving from goods to services. When it comes to making better use of materials, there are two main solutions to applying this philosophy to waste: avoiding products or purchasing durable products.

In the field of industrial ecology, lean manufacturing is used as an operational tool for continuous and incremental elimination of waste due to improved production processes.

Extended producer responsibility (EPR) implements the principle - the polluter pays and aims to transfer the environmental responsibility of the product throughout its life cycle to the producer. Although extended producer responsibility can affect life-cycle changes, it has mostly provided an opportunity to manage consumer products at the end of their useful lives. Extended producer responsibility, a model where packaging companies are responsible for the end-of-life of materials, is critical to closed economy policies to promote sustainable materials management, recycling and reduced environmental impact. Manufacturers can influence change by making products and packaging more durable so that materials can be reused, recycled or reintegrated into new product designs [21].

The concept of eco-design is based on the integration of environmental aspects into product development. Ecodesign can be used as a tool to implement the results of life cycle assessment. It can be a guideline, a checklist or an analytical tool that supports the process of developing a product based on eco-efficiency.

Related to ecodesign is environmental design, a process used in many industries to help organizations improve the environmental impact of their products and services throughout their development process. Each industry approaches this process differently, and there are several standards. Moreover, for small producers it is often seen as a time-consuming and expensive additional cost. It's still a new process for most designers and engineers, but it's slowly evolving.

Product maintenance systems (described by Arnold Tukker) are seen as an excellent means of implementing sustainable solutions. They consist of tangible products and intangible

services, designed and connected in such a way that together they can meet the specific needs of consumers for environmentally friendly outcomes.

Shared consumption is a general term with a wide range of meanings. The concept focuses on reducing the negative impact on the environment by reducing the number of goods that are produced, reducing industrial pollution (for example, reducing the carbon footprint and overall resource consumption).

It seeks to change our perception of waste, arguing that much of what we define as waste still has value that, if properly designed and distributed, can safely serve as "nutrients" for downstream processes, unlocking new levels of value in an ever-diminishing environment. more and more expensive resources. Shared consumption develops circular systems, i.e. product service systems.

We are currently using resources unsustainably. We are consuming and extracting more resources than our planet can sustain in the long term. It is estimated that by 2050, the total number of middle-class consumers will reach 6-7 billion, putting more pressure on consumption and the environment.

The modern way of life forces us to expect more and more comfort, and this has its price. Pay attention to the use of plastics that are not sufficiently recycled. Many plastic products end up in the seas and oceans, causing serious damage.

Examining the experience of the world's leading countries, it is worth emphasizing that the European Union and other developed countries around the world are making significant progress in the fight against climate change thanks to the reduction of carbon emissions. It has been proven that reducing emissions does not hinder economic growth; on the contrary, since 1990, the gross domestic product in the EU has increased by 50%, while greenhouse gas emissions have decreased by 24%. More and more people are looking to reduce emissions by sharing cars, reducing energy consumption or recycling and sorting waste. While this is commendable, we know that it will not be enough to ensure future low carbon emissions or to achieve the long-term goal of "a good quality of life within our planet."

There are signs that public awareness of the problem is growing and new policy plans are being developed that will fundamentally change the way we produce, consume and live. These political plans are comprehensive and systematic long-term actions. At the end of 2015, the European Commission presented the circular economy package – Europe's response to future challenges. It covers various stages of the long life cycle of products: from production and consumption to waste management. The proposed actions should be beneficial for both the environment and the economy. The idea is to keep materials in the economic cycle as long as possible, thereby reducing waste, contributing to energy savings and reducing greenhouse gas emissions. The transition to a circular economy will help alleviate the environmental and health problems caused by today's linear economy that follows the principle of "produce, use and discard". However, this will require radical changes in production and consumption systems that go far beyond the rational use of resources and waste processing.

A key aspect of achieving a circular economy will be training, monitoring progress and providing information, developing the concepts, methods and models necessary to develop flexible policies and to achieve this goal. There is also a need for breakthrough innovations and technologies, without which it is impossible to achieve the transition to a low-carbon circular economy [2;8;10].

Enterprises are developing integrated supply chains that allow more efficient use of resources and the creation of new markets. Innovative information and communication technologies and social changes contribute to this systemic transformation. Ecosystem organizers usually approach this goal in two stages: ecosystem readiness assessment and its transformation.

At each stage, special and complementary mechanisms are developed to achieve their goals. Assessing ecosystem readiness is an important starting point for understanding the transformation processes that manufacturing companies and their ecosystem partners must undertake to move to a circular economy paradigm. Readiness assessment is a fundamental step that allows business leaders to be sensitive to external information, identify new business opportunities related to the circular economy, and understand their own capacity to embrace these opportunities.

The readiness of manufacturing enterprises for the circular economy is assessed using key parameters:

- existing trends that directly or indirectly affect the business potential of the ecosystem;
- the possible impact of transformational measures on the existing business;
- assessment of potential business models;
- assessment of opportunities and goals of partners in the ecosystem.

World experience shows that leading manufacturing companies carry out the transformation of ecosystems with the help of several mechanisms. In particular, it is about limiting early investment costs related to the circular economy [9]. This is caused by the lack of free working capital or other financial resources for investing in a circular business model, as well as the high uncertainty of this paradigm. The way out of the situation in such a case can be active investment by ecosystem organizers in IT infrastructure, which allows them to stimulate stakeholders to participate in transformations. Another mechanism consists in supporting the development of innovative procedures and processes by partners: the use of digitization for the provision of services, development of competencies, portfolio management, customization of product and service components (table 1).

Such measures contribute to the equalization of incentives and the rapid adaptation of circular business models.

The relationship of large manufacturing enterprises with the ecosystem shows a certain tendency to conflicts. The solution to this problem lies in the plane of relational interdependence between ecosystem partners. For example, a company involved in the telecommunications industry, offering a business model on the market based on the use of its own potential, must coordinate it with customers and consumers.

The corresponding proposals carried significant economic and environmental advantages, as they allowed to save on the costs of equipment, the service life of which was supposed to increase due to better maintenance. However, since the new business model has significant risk characteristics and is not completely functionally understandable for both parties, they must agree on the distribution of risks and revenues, which creates incentives for interdependence.

On the other hand, small businesses in existing business ecosystems are usually hesitant to invest heavily in circular economy offerings due to the high initial investment and significant uncertainty of their profitability. Therefore, the encouragement of investment by the leaders of the ecosystems may consist in granting the status of exclusivity or other economic preferences to such enterprises. Appropriate agreements are able to influence mutual interdependence, thanks to which all involved enterprises receive a clear division of roles and joint benefits.

Transformational business models of the circular economy

Трансформаційні бізнес-моделі циркулярної економіки

Business model	Circulatory features
Cyclic supply	<ul style="list-style-type: none"> - use of biomaterials capable of self-degradation; - conclusion of contracts with suppliers of eco-raw materials for the return of waste for further processing
Processing of resources	<ul style="list-style-type: none"> - composting, anaerobic fermentation in the production of fertilizers and renewable energy; - processing of products unsuitable for repeated use; - development of infrastructure for collection, sorting and processing of waste
Exchange platforms	<ul style="list-style-type: none"> - continuation of the life cycle of products; - reduction of production volume of non-recyclable products
Continuation of the life cycle of products	<ul style="list-style-type: none"> - availability of capacity for recovery at primary production enterprises; - domestic investment in new technologies; - direct foreign investment and technology import; - interaction of business and scientific centers
Product as a service	<ul style="list-style-type: none"> - offering package services, including after-sales service; - manufacturer's responsibility for disposal of products after the end of the life cycle; - formation of closed supply chains

*Source: built by the author

Business model and ecosystem partner assessments complement the external ecosystem assessment as they provide information on the readiness of the ecosystem host and partners for transformation. Taken together, all three assessments establish a gap between the aspirations of a circular economy and the capacity of the ecosystem to achieve these aspirations. The gap identifies the capabilities and resources that are missing from the ecosystem and the ecosystem management processes that would be necessary for the ecosystem to transition to a circular economy paradigm. In particular, ecosystem readiness assessment is rarely a linear process. After closing the gaps, manufacturing companies participate in the transformation of ecosystems. At this stage, we have identified three mechanisms that jointly move the ecosystem towards establishing its circular economy goals. Standardization mechanisms are used to define and legitimize goals for ecosystem partners. Organizers establish general standards against which the ecosystem will be evaluated (e.g., life-cycle costs of equipment and its use), develop specific standards with selected ecosystem partners (e.g., engine design standards), and impose specific standards on a broader set of ecosystem partners, including potential new partners (for example, the quality of materials).

Once goals are established through standardization mechanisms, ecosystem organizers turn their attention to ensuring that all partners have access to the necessary resources and capabilities to realize the goals. Mechanisms of upbringing are central to this process. In addition to internal investment, ecosystem organizers bear the early costs of infrastructure

investment and facilitate investment by key ecosystem partners, helping them offset uncertainty.

Once incentives are provided, the activities of multiple ecosystem actors must be coordinated as they incorporate circular economy standards into their individual offerings. Ecosystem organizers achieve this coordination by using negotiation mechanisms such as give-and-take rules, establishment of relational interdependencies, and risk-benefit analysis to include new partners. In this way, mechanisms of standardization, education and negotiation guide the transformation from the point where each partner has circular economy goals that contribute to the alignment of ecosystem aspirations.

Conclusions. Thus, in the closed-loop model, the economic cycle has the same stages as in the linear one, but here the cycle is not interrupted. After the product is used, the waste is not disposed of, but is sent to special waste processing centers, where it is processed and takes the form of resources for further production of goods, or goods that have lost their price appeal for one industry may become attractive for another [16].

At the same time, long-term multiple life cycles are important for the circular economy, and short-term, from purchase to sale, for the linear economy. To change the linear economy to a circular one, it is necessary to ensure the maximum efficiency of each process at each stage of the life cycle of a product or service.

As part of the development of the model of the economy of the closed ecological and economic cycle, a conceptual approach to the introduction of the circular economy was proposed, which should be based on the strategy of sustainable development - a complex multi-valued concept that tries to harmonize three dimensions of development: economic, social and ecological. It is linked to the circular economy through economic and environmental dimensions, as well as through corporate social responsibility, which is a business gateway to sustainable development.

It was determined that in the circular economy, companies develop integrated supply chains, using resources more efficiently and creating new markets. The stages of the organization of the reconstruction of ecosystems: the assessment of ecosystem readiness and its transformation are considered, it is found that innovative technologies contribute to the systemic implementation of changes. The transformation of ecosystems is carried out with the help of mechanisms for limiting early investment costs, investing in IT infrastructure, and encouraging stakeholders to cooperate. It is proven that the riskiness of the transformed business model forces the parties to agree on the distribution of risks and revenues. The competitive advantages of transformations of industrial ecosystems consist in differentiation and cost leadership, strategic ones in increasing the ability of ecosystems to achieve social, financial and environmental results, creating opportunities for the development of sustainable industry.

The circular economy will promote the use of the reverse flow of resources, help eliminate waste from the value chain. And conducting research and development on the main aspects of the circular economy will give an impetus to progress in the field of materials science and the development of higher-quality and durable components.

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Кропельницька С.О.¹, Криховецька З.М.², Мацьків В.В.³, Плещ І.І.⁴
ПРОБЛЕМНІ АСПЕКТИ УПРАВЛІННЯ РИЗИКАМИ ІНВЕСТИЦІЙНИХ ТА
ІНФРАСТРУКТУРНИХ ПРОЄКТІВ ВІДНОВЛЕННЯ УКРАЇНИ

Прикарпатського національного університету імені
Василя Стефаника
Кафедра фінансів
вул.Шевченка, 57, м.Івано-Франківськ,
76018, Україна,

¹тел: +380982835169

e-mail: svitlana.kropelnytska@pnu.edu.ua

ORCID: 0000-0003-4992-9550