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CONVERGENCE IN ECOLOGICAL SYSTEM PROJECTS

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The article substantiates the feasibility of convergent management of environmental systems projects, which is based on the convergence of values, systems, methodologies and approaches. The convergence of economic and environmental values is due to changes in the worldview of mankind from consumer attitudes to nature to environmentally-oriented development, which meets the objectives of the Concept of Sustainable Development. Convergence of systems is the creation of environmentally-oriented economic systems, which include environmental systems, which is a tool for implementing a circular model of the economy, which aims to achieve sustainable development goals. Management of ecological systems is based on the convergence of methodologies of design, logistics and Ecological management, as well as the convergence of general management and scientific and natural approaches.

INTRODUCTION

Sustainable development is one of the main problems of civilizational development, on which depends not only the future of mankind, but life on the planet as a whole. In recent years, the significant factors of human development have been the high growth rates of material production and population, which has led to an imbalance of economic, social and environmental aspects of life and an increase in anthropogenic growth.

The whole history of mankind is characterized by a continuous increase in the scale of consumption of natural resources. Modern production attracts as many resources as have been used in all previous millennia. Every 10 years the extraction and consumption of mineral resources doubles, every 12 years - energy capacity, every 15 years - the volume of industrial production, the number of equipment increases twice as fast as the population [1]. As a result, there is a global ecological crisis, which manifests itself as a tense state of relations between humanity and nature, which is characterized by the mismatch of the degree of development of productive forces and production relations to the capabilities of the biosphere.

Despite the enormous scale of the damage that humanity is doing to the biosphere, at the beginning of the 21st century, economic development continues to be largely based on the further extensive use of natural resources. In general, the growth of the world economy is about 3% per year, and the growth rate of productivity of living matter on the planet is less than 1% for the same period [2]. That is, there is a threefold imbalance between technical and natural growth.

Today, the biosphere is unable to cope with the consequences of human activity, it has begun irreversible changes. Current research shows that the natural assimilation potential no longer ensures the restoration of the status quo of the natural environment - in many ecosystems significant changes have begun, which are caused by human activity and may be irreversible in the foreseeable future.

To reduce the burden of human activity on the environment requires a change of man-made type of civilizational development to another paradigm. The problem of future humanity in general has come to the forefront of scientific research and public consciousness in general.

Since the second half of the twentieth century, there has been an intensive search for a new strategy for the survival of mankind in conditions of limited natural resources and deterioration of natural living conditions. The way out of the current situation is the application of the Concept of Sustainable Development, which is a natural reaction of the world community to existing threats and presupposes the harmonious coexistence of nature and society, which requires the consideration of ecological and human line and economic activity.

CONVERGENCE OF VALUES IN ACHIEVING THE GOALS OF SUSTAINABLE DEVELOPMENT

The concept of sustainable development was adopted in 1992 in Rio de Janeiro at the United Nations Conference on Environment and Development, which was attended by governments and experts from 179 countries. The conference adopted a number of important documents defining the strategy of human development on the basis of sustainable development, including the "Agenda for the XXI century" ("Agenda 21"), which formulates *the concept of sustainable development as meeting the needs of the present but does not jeopardize the ability of future generations to meet their own needs* [3].

The concept of sustainable development has recently been introduced by Ukraine. Thus, sustainable development is defined in the "State Strategy for Regional Development until 2027", as one in which the needs of the current generation can be met without reducing the future opportunities of generations, forming a relationship between the competitiveness of the economy and quality of life" [4].

Today, there are already numerous developments of scientists, which are the basis for the formation of the scientific and methodological foundations of the theory of steel development. Prominent contributions to the study of theoretical and practical avenues of steel development were made by such scientists as G. Daley, I. Huyt, A. David, W. Galperin, V. Heets, D. Hilder, K. Hoffman, A. Granberg, K. Errow, J. Jalilo, S. Montfred, L. Onisto, A. Atkisson, B.V. Burkinsky, V.N. Stepanov, S.K. Kharichkov, A.B. Weber, B.M. Danilyshyn, S.I. Dorohuntsov, J. M. Mayer, J. E. Rauch, A. Filipenko, L.G. Melnikov, L. Hens, etc.

The formation of the Concept of Sustainable Development was influenced by prominent Ukrainian scientists S.A. Podolinsky and V.I. Vernadsky. It is the work of S.A. Podolinsky [5] became the basis of a new economic theory, considered from the angle of energy processes. His ideas were later developed by V.I. Vernadsky in the doctrine of the biosphere and noosphere [6].

The essence of the Concept of Sustainable Development lies in the triad of its main aspects: economic, social and environmental. Among the existing approaches to the implementation of the ideas of sustainable development, the most famous is the Venn diagram, proposed by Edward Barbier in 1987, which reflects *the convergence* (approaching) of economic, environmental and social components of human development.

*Convergence (*from the Latin *con* - together, *verger* - direction, descent*)* - a process, convergence, convergence of properties, signs, which arises as a result of evolution in the phenomena between them independent, insane [7]. The term is used in various sciences, in particular: economics, biology, political science, brain activity, etc.

For example, in biology, convergence is the appearance in unrelated organisms of similar traits that arise as a result of the adaptation of these organisms to the same living conditions; in linguistics, convergence is the coincidence of two or more phonemes in one sound as a result of the historical development of the phonetic system of language [7]; in economics, convergence is a gradual convergence in terms of per capita income of rich and developing countries [8].

The concept of sustainable development is based on *the convergence of worldview values of mankind*, which reflect various aspects of civilizational development, namely the economic, social and environmental components. The change of worldview took place in the direction of convergence of these values, because at the present stage of human development it became clear that achieving only economic goals and building a technocratic society will lead to environmental and social catastrophe.

The convergence of values is reflected in the formulation of the components of sustainable development, which show how each of the aspects reflects not only its own, but also characteristic of other components of values.

The *economic* component means the optimal use of limited resources and the use of environmental nature, energy and material-saving technologies, including the extraction and processing of raw materials, the creation of environmentally friendly products, minimization, processing and processing.

The *social* component of sustainable development is human-oriented and aimed at maintaining the stability of social and cultural systems, including the reduction of the number of destructive conflicts between people. An important aspect of this approach is the equitable distribution of wealth among people on a global scale.

From an *ecological* point of view, sustainable development must ensure the integrity of biological and physical natural systems, including the man-made environment - the anthroposphere. Of particular importance is the viability of ecosystems, on which depends the global stability of the entire biosphere.

Determining the progress of countries in achieving its goals is an important task on the way to implementing the Concept of Sustainable Development. The list of sustainable development goals was officially approved in the Resolution of the UN General Assembly in 2015 [9]. The Sustainable Development Goals, which are currently being pursued by all countries of the world, set development indicators and include 17 goals (SDGS) and 169 specific goals to be achieved by 2030. All goals focus on six areas of change: education, gender and inequality (SDGS 1, 5, 7–10, 12–15, 17); health, well-being and demography (SDGS 1, 2, 3, 4, 5, 8, 10); reducing carbon emissions and sustainable industries (SDGS 1-16); food, land, water and the oceans (SDGS 1-3, 5, 6, 8, 10-15); cities and communities (SDGS 1–16); digitization (SDGS 1–4, 7–13, 17).

To assess the achievements of countries on the path of sustainable development, the Sustainable Development Goals Index (SDGI) was created by experts from SDSN and Bertelsmann Stiftung, which publish reports of the index, calculated for 165 countries, including Ukraine, based on 100 countries. related to the implementation of 17 goals (table 1) [10].

Ukraine's achievements can be considered satisfactory, as Ukraine ranked 36th in 2020 with an SDGI value of 75.5, which exceeds the average regional level of SDGI, which is 71.4 (fig. 1) [10].

In the list of goals of sustainable development it is easy to single out the ecological component, which is presented in the tasks of up to 12 goals out of 17 stated (fig. 2).

Table 1

Achieving sustainable development goals: Ukraine 2020

Sustainable Development Goals (SDGs)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
🟢	🟠	🟠	🟡	🟠	🟠	🟡	🟠	🟠	🟢	🟠	🟡	🟠	🔴	🔴	🔴	🟠
↑	↗	↗	••	↗	↗	↗	↗	↗	••	→	••	↗	→	→	↗	↗

Current assessment of goal achievement			Dynamics of goal achievement		
🟢	-	the goal is achieved	↑	-	supported
🟡	-	challenges remain	↗	-	moderate improvement
🟠	-	significant challenges	→	-	stagnation
🔴	-	main challenges	↓	-	reduction
⚪ (grey)	-	no information	••	-	no information

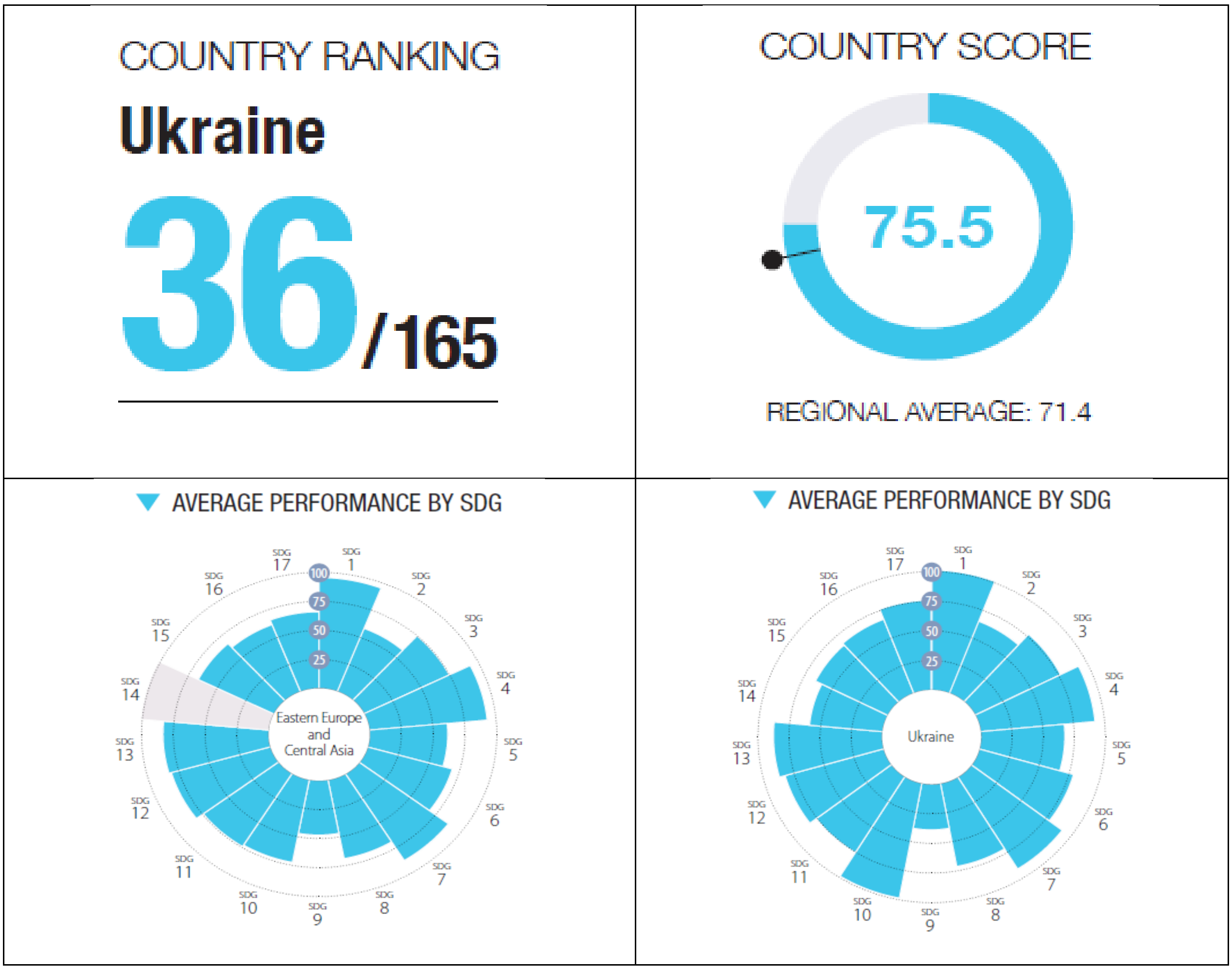


Fig.1. Level of achievement of sustainable development goals: Ukraine 2020

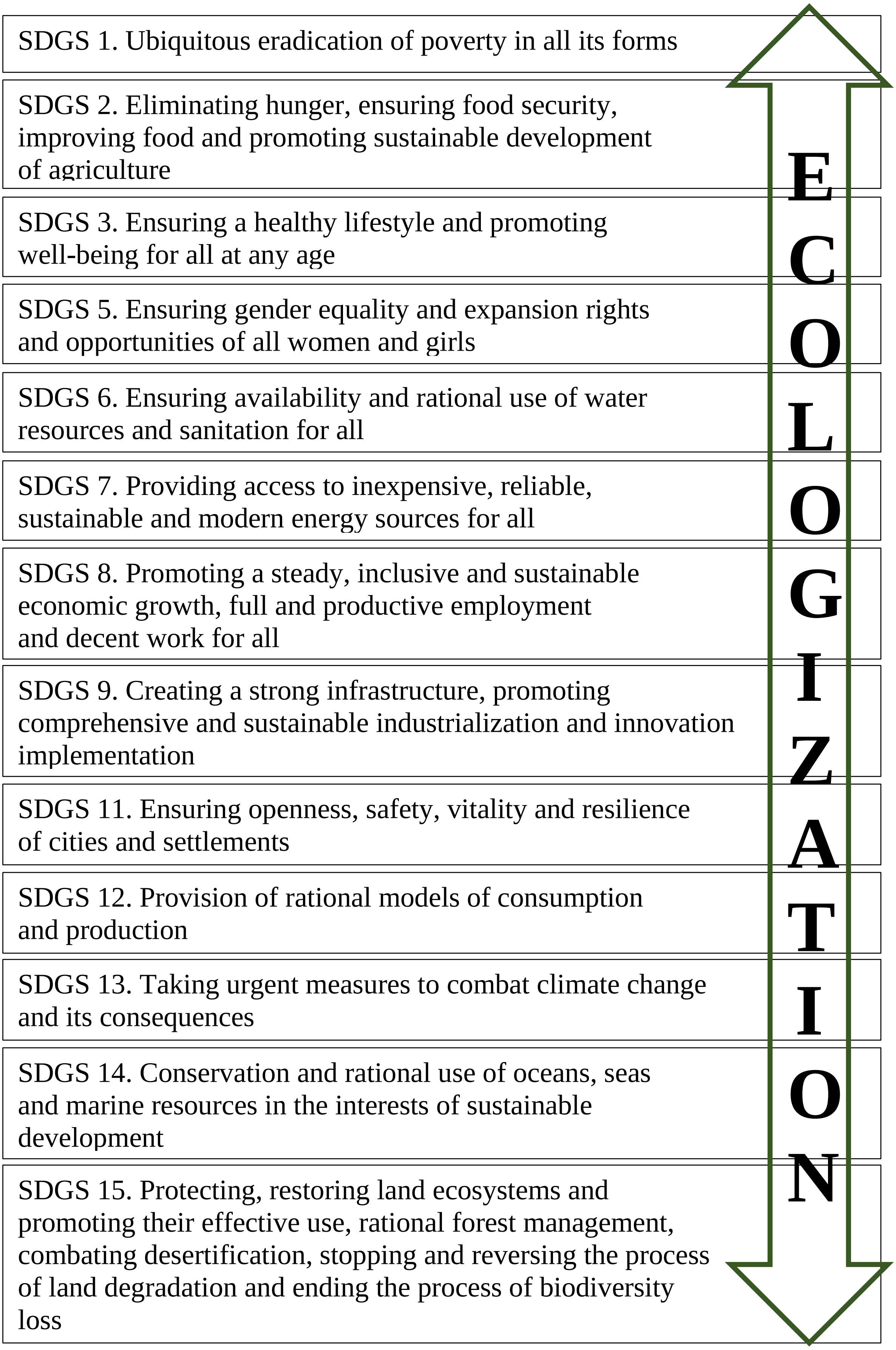


Fig. 2. Ecologization for the purpose of sustainable development

Among the goals of sustainable development are those that implicitly reflect the strategy of greening, but to achieve which it is necessary to solve tasks that are directly aimed at greening the economy and society (SDGS 1; 5; 8; 9; 11). There are also goals that are entirely devoted to the greening of the economy or society in the process of achieving sustainable development (SDGS 2; 3; 6; 7; 12; 13; 14; 15) [11].

The set goals and corresponding tasks have a complex character and provide *convergence of three value components of sustainable development,* which proves the need to take measures for greening and implementation of ecological values of modern worldview in all spheres of human life.

Issues of ecologization of the economy and society are studied in numerous scientific works of V.T. Andrushko, A.A. Golovko, O.E. Grydzhuk, A.M. Deyneko, N.M. Duda, L.D. Zagvoyska, I.I. Koblyanska, V.R. Kovalishina, Ya.V. Kotlyarevsky, M.S. Kravets, V.S. Kravtsiv, Ya.V. Kulchytsky, I.P. Magazinshchikova, L.I. Maksymiva, L.G. Melnik, O.V. Melnikova, E.V. Misshenina, T.V. Olyanishena, A.M. Polovsky, E.P. Semenyuk, V.M. Senkivsky, I.M. Synyakevych, Yu.Yu. Tunitsa, T.V. Ustik, I.E. Yarova and other scientists.

The concept of "ecologization" is interpreted quite widely, but always leads to a decrease in the negative impact of human activity on the environment (table 2).

In the monograph "Ecologically Oriented Logistics Management of Production", edited by E.V. Mishenin [15], the term "ecologization" is used in such interpretations as "ecologization of production", "ecologization of products", "ecologization of production technologies", "ecologization of social production", "ecologization of economic activity", "ecologization of agro-industrial complex", etc.

Thus, the ecologization of almost all spheres of human life is a prerequisite for the survival of mankind and the planet as a whole, as modernity has demonstrated the severity of environmental problems that have arisen as a result of anthropogenic impact on the environment.

Table 2

Interpretation of the concept of "ecologization"

Ecologization
V.S. Kravtsiv [12] The process of penetration of ideas, knowledge, laws of ecology, ecological thinking into science, production, life of society, state.
L.G. Melnyk [13] The process of permanent environmental improvement, which is aimed at eliminating ecodestructive factors, and, accordingly, the need for special nature protection measures.
A.A. Sadekov [14] The process of creation, development and use in the production of scientific, technical, technological, administrative, legal and socio-economic innovations, as a result of which increases the biosphere compatibility of both individual economic systems, types of products, and the economy as a whole.

Ecologization of economic activity is associated with the organization of an optimal aggregate resource and material cycle from the development and production of raw materials to the utilization of waste consumption [16]. In this context, the formation and development of integration connections between enterprises of different industries, the formation of network entrepreneurial structures for the purpose of complex and rational use of resources (waste of one production is used as raw materials in other industries) and environmental protection.

Issues of ecologization of production activity are associated with a decrease in the nature of production. Greening is accompanied by a shift in the centre of economic analysis from costs and intermediate results to the final results of economic activity; the process of ecologization has a systemic nature and connection with the economic aspects of management [17].

Ecologization can be viewed as the direction of the development of society and the economy, which, first, changes the outlook of man and allows to eliminate the contradiction between the needs of life and the quality of the environment, to achieve a harmonious coexistence of society and nature, secondly, as a system of intravlinear interventions that [11].

Ecologization is not some abstract phenomenon that is artificially implanted in the economy and society. It has reasonable preconditions for the emergence and stages of development, which depend on changes in the conditions of existence and ecological consciousness of mankind (table 3).

Table 3

Stages of ecologization [13, 17]

1) prerequisites for ecologization - reducing the impact of negative factors per unit area (1950 - 1690), 2) stage of control over environmental pollution, mass construction of ecological structures (1970s), 3) stage of pollution prevention and waste reuse, application of low-waste technologies (1980s), 4) stage of increasing the efficiency of Ecological management within the Concept of Sustainable Development, replacement of environmentally hazardous substances and processes with more efficient analogues, reduction of energy and material consumption of goods and services (1990s), 5) stage of lifestyle ecologization (present).

Ecologization has led to the emergence of a modern ecological direction of the economy - ecological or green economy, which is based on the concept of sustainable development and has become a new paradigm of economic relations in contrast to the existing economic model.

The issue of ecological economics is considered in the works of such scientists as M.R. Aurora, M.S. Andersen, Lester R. Brown, L.N. Bobilov, L.G. Melnik, L.A. Musina, V.G. Potapenko, A.A. Tkachenko, K.E. Boulding, H. Daly, R. Costanza, J. Martínez-Alier, R. Muradian, H. George and others.

By definition of L.G. Melnyk [13], *ecologization of the economy* is a purposeful process of economic transformation associated with reducing the integrated eco-destructive impact of production and consumption of goods and services per unit of total social product, which is carried out through a system of organizational activities and transformation of environmental activities.

The concept of "green economy" was first used in the work "Blueprint for a Green Economy", which focuses on the economy of sustainable development [18]. Later, the international phrases "green economy", "green industry", "green markets", "green employment", "green technologies" and other terms with the adjective "green" began to be widely used.

The United Nations Environment Program (UNEP) released a report in 2011 entitled Towards a Green Economy: Towards Sustainable Development and Poverty Eradication, according to which green (ecological) is an economy that provides a long-term increase in human well-being, allowing future generations to avoid significant risks to the environment [19], ie satisfies the conditions of sustainable development. A simpler understanding *of the green economy is to reduce emissions of pollutants into the environment through the integrated use of raw materials, materials and electricity, ie an economy that meets the interests of society as a whole* [20].

The priority areas of the green economy, according to UNEP, are: efficient use of natural resources, conservation and increase of natural capital; pollution reduction; low carbon emissions; prevention of loss of ecosystem services and biodiversity; income and employment growth [21].

Proponents of the green economy believe that the current economic system (brown economy) is not perfect. The development of scientific and technological progress has led to an increase in living standards, but has negatively affected the environment. Comparative analysis of market and environmental economic systems is presented in table 4.

According to experts, in the short term, the green economy is able to provide GDP growth, increase per capita income and employment at the same or even higher rates than the traditional brown economy. In the medium and long term, the green economy will overtake the brown one and will also give much more advantages in terms of environmental protection and reduction of social inequality.

Table 4

Comparative analysis of brown and green economy models

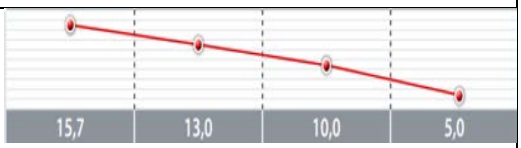
Characteristics	Brown economy	Green economy
General principles	an economy based on extensive consumption of natural resources without their recovery, an open production cycle and significant emissions of waste into the environment	an economy based on rational models of consumption and production, introduction of ecological technologies, reduction of consumption of natural resources and emissions of waste into the environment
Outlook	mechanical, static, atomistic	dynamic, systemic, evolutionary
Academic position	disciplinary (economics)	interdisciplinary (economics, ecology)
Management object	economic systems	ecological and economic systems
The main macro goal	growth of the national economy	sustainability of the socio-ecological-economic system
The main micro-goal	maximum profitability	maximum utility
Beneficiaries	modern generation	modern and future generations
Technologies	highly productive	resource-, material- and energy-saving
Technological style	fourth (scientific and technological revolution)	fifth (information revolution)

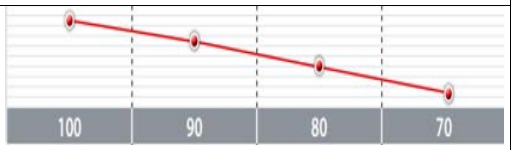
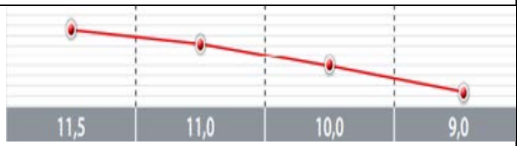
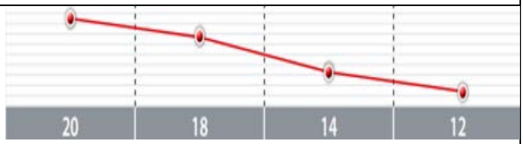
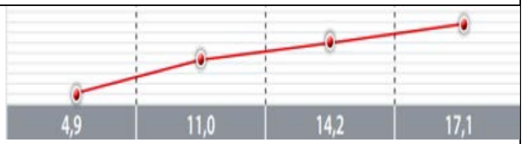
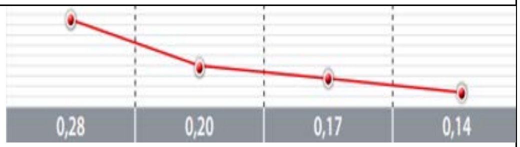
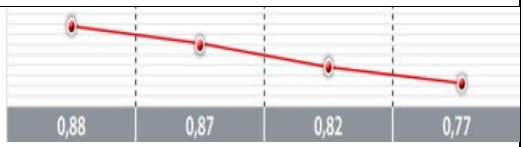
Various tools are used to implement the concept of green economy in the world. Its goals must be achieved by attracting public and private investment. UNEP notes that the transition to a green economy requires 1-2% of world GDP to be invested in ten key sectors: agriculture, housing and utilities, energy, fisheries, forestry, industry, tourism, transport and transport resources [21].

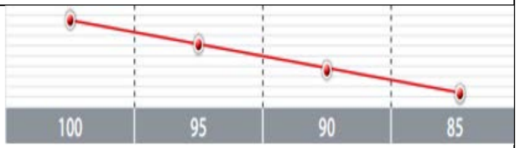
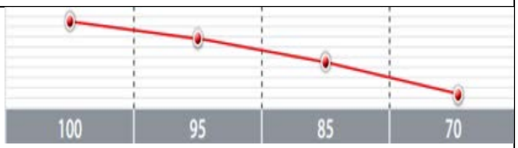
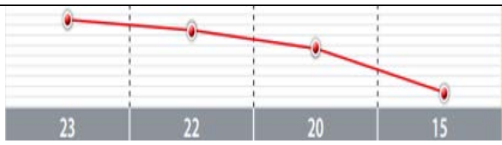
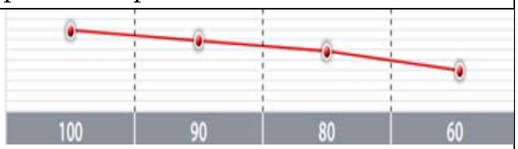
In the developed countries of the world, in order to achieve the goals of sustainable development, the policy of resource conservation has been implemented for the last decades. Today, European countries use 50-70% of production and consumption waste, planning in the future to completely stop the disposal of waste at landfills. Ukraine, as an integral part of the world economy, will also gradually implement resource-saving measures. According to the Concept of Sustainable Development, Ukraine seeks to achieve the goals of sustainable development through the implementation of certain tasks set out in [22] (table 5).

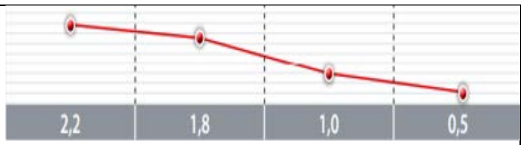
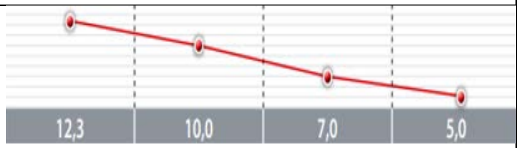
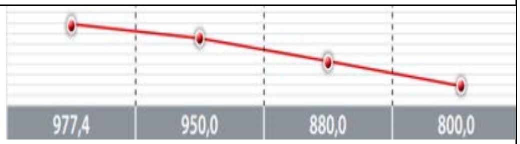
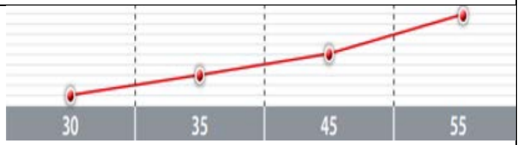
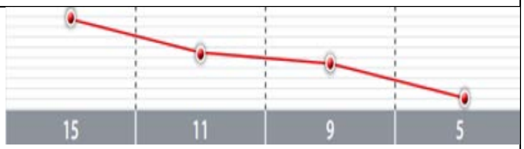
Table 5

Perspective tasks of achieving the goals of sustainable development of Ukraine

Tasks of sustainable development goals	**Task performance indicators**	**Values of indicators** **2015 2020 2025 2030**
1	***2***	***3***
Goal 6. Clean water and proper sanitation		
Task 6.3 Reduce discharges of untreated wastewater, primarily through the use of innovative water treatment technologies at the state and individual levels	▶ Indicator 6.3.1. Reduce discharges of untreated wastewater, primarily with the use of innovative water treatment technologies at the state and individual levels Volumes of discharges of contaminated (contaminated without treatment and insufficiently treated) wastewater into water bodies, million cubic meters, m	
	▶ Indicator 6.3.2. Share of discharges of polluted (polluted without treatment and insufficiently treated) wastewater into water bodies in the total amount of discharges, %	

Task 6.4. Increase the efficiency of water use	▶ Indicator 6.4.1. Increase the efficiency of water use Water capacity of GDP, cube. m of used water per 1000 UAH of GDP (in actual prices)	
	▶ Indicator 6.4.2. Water capacity of GDP, % to 2015 level	
Goal 7. Affordable and clean energy		
Task 7.1. Expand infrastructure and upgrade networks to ensure reliable and sustainable energy supply based on the introduction of innovative technologies	▶ Indicator 7.1.2. Technological consumption of electric energy in distribution grids, %	
	▶ Indicator 7.1.3. Heat loss in heat networks, %	
Task 7.3. Increase the share of energy from renewable sources in the national energy balance	▶ Indicator 7.3.1. Share of energy produced from renewable sources in total final energy consumption, %	
Task 7.4. Increase energy efficiency of the economy	▶ Indicator 7.4.1. Energy intensity of GDP (primary energy consumption per unit of GDP), kg. E. on 1 USD. United States for PCS 2011	
Goal 8. Decent work and economic growth		
Task 8.2. Increase production efficiency on the basis of sustainable development and development of highly technological competitive industries	▶ Indicator 8.2.3. Material capacity of GDP (the ratio of the volume of intermediate expenditure from the tables of "expenditure-output" types of activity that produce material products to the total volume of GDP)	

Goal 11. Sustainable development of cities and communities		
Task 11.5. Reduce the negative impact of pollutants, including on the environment of cities, by using innovative technologies	▶ Indicator 11.5.2. The total amount of emissions into the atmospheric air of pollutants from stationary sources, conditionally brought to carbon oxide, taking into account the relative aggressiveness of the main pollutants, % to the level of 2015	
	▶ Indicator 11.5.3. The total amount of emissions into the atmospheric air of pollutants from mobile sources, conditionally brought to carbon oxide, taking into account the relative aggressiveness of the main pollutants, % to the level of 2015	
	▶ Indicator 11.5.4. The number of cities in which the average daily concentrations of the main pollutants in the air exceed the average daily maximum allowable concentrations, units	
Goal 12. Responsible consumption and production		
Task 12.1. Reduce the resource capacity of the economy	▶ Indicator 12.1.1. Resource capacity of GDP (share of the value of natural resources per unit of GDP), % to the level of 2015	

Task 12.2. Reduce food losses in production chains	▶ Indicator 12.2.1. The share of post-harvest losses in the total production of grain crops, %	
	▶ Indicator 12.2.2. The share of post-harvest losses in the total production of vegetables and melon crops, %	
Task 12.4. Reduce waste generation and increase the amount of recycling and reuse based on innovative technologies and industries	▶ Indicator 12.4.1. The volume of generated waste of all types of economic activity per unit of GDP, kg per 1000 dollars. United States for PCS 2011	
	▶ Indicator 12.4.2 The share of incinerated and recycled waste in the total amount of waste generated, %	
Goal 14. Conservation of marine resources		
Task 14.1. Reduce marine pollution	▶ Indicator 14.1.1. The share of discharges of contaminated sewage in the total volume of discharges to the marine environment, %	

Economic growth will inevitably lead to an increase in the use of natural resources and waste, which in turn will intensify the anthropogenic invasion of the natural environment. Understanding of the sensitivity of the implementation of the relevant consumption and production in the country is, but the resolution of these issues requires a well-established and long-lasting political and economic effort, focused both on production, and on consumption [22].

An integral part of economic activity is the generation of waste - any substances, materials and objects generated in the process of human activity and have no further use at the place of formation or detection and which their owner must dispose of by disposal or disposal (according to Law "On waste" d.d. 05.03.98 № 187/98-VR, with changes and additions made by the Law of Ukraine № 554-IX d.d. 13.04.2020) [23].

At present, humanity produces 2,000 times more organic waste than all of nature [24]. To meet the needs of one person in everything necessary, about 20 tons (according to some data 45 tons) of various raw materials are extracted per year. At the same time, only 1-2% (according to more optimistic estimates, up to 6%) of used resources is transferred to finished products [25]. Thus, more than 90-95% of primary raw materials are converted into waste generated at all stages of production and consumption. As a result, the product itself turns into waste, so we can say that everything ends with the formation of waste.

Waste retains its original material substance and a certain part of its residual value. Therefore, waste can and should be considered as a source of material resources with a certain residual value, which allows to use them in further activities in the form of raw materials and to form a logistical flow of secondary material resources.

Waste generation accompanies all stages of the product life cycle (Table 6).

Recycling of material resources is an objective necessity, which is due primarily to the limited natural resources and pollution of the environment by human waste. The use of waste as a secondary raw material saves primary raw materials and materials. For example, the use of 1 ton of waste paper saves 3.5 cubic meters. m of wood, 1 ton of secondary polymer raw materials - 0.7 tons of primary polymer raw materials; 1 ton of worn tires - 0.33 tons of synthetic rubber, 1 ton of secondary textile raw materials - 0.7 tons of natural or synthetic fibres [26].

Today, the average level of waste use as a secondary material resource is about a third. At the present stage of development of processing technologies, only highly liquid and cost-effective wastes are involved in economic circulation; for example, scrap ferrous and non-ferrous metals, high-grade waste paper brands, slag, textile products, polymeric materials, and polymeric materials.

Table 6

Waste generation during the product life cycle

Stage of the product life cycle	Waste generated
Design and development of a prototype product	- waste paper; waste raw materials; remnants of prototypes.
Product production	- technological waste of raw materials; rejected products.
Sales of goods	- containers and packaging; waste technological operations that accompany the process of storage, transportation and sale of products; products that cannot be sold.
Product operation	- waste from operation and storage of the product.
Repair, product service	- defective products; products of their part which are not subject to repair.
Product disposal and waste disposal	- products that have expired or are damaged; substances; materials.

Waste is often more hazardous than primary raw materials and can contain lead, mercury, chlorine, nickel, cadmium and other very dangerous toxic chemicals. Therefore, it is necessary either to use waste as a source of valuable elements, or, if this is not possible, to dispose of them properly. Burning, burying in soil or water, leaving waste on an open surface is very dangerous, as it causes irreparable damage to the environment.

Unfortunately, such methods of waste disposal have been used by mankind for many years, but gradually came the realization of the imperfections of existing methods of waste management. In the late 70's - early 80's, the best methods were identified to reduce the amount of waste (in descending order): prevent the formation and reduce their amount; processing (including composting); waste treatment; burial in the ground [27]. Today's level of development of recycling and recycling technologies allows waste to become a source of regeneration and reuse of valuable resources.

The need to optimize the work with waste that has the potential of secondary material resources, led to the concept of integrated waste management, the basic principles of which are:

- reduced waste sources (reduction of unnecessary emissions before they enter the waste stream);
- expedient processing (return of the product to the production chain);
- extraction of the maximum possible benefit from resources (incineration of waste to obtain energy);
- safe disposal of waste that cannot be used at the current level of scientific and technological development [28].

Some authors claim in their works [25, 29] that the main provisions of the concept of integrated waste management coincide with the concept of 3R (reduce, reuse, recycle) - minimization of waste, their secondary use and return to the production process as secondary raw materials. They even offer a new concept - 3LR, which takes into account the factor of logistics of waste management and more accurately meets the challenges and opportunities of today.

Thus, the implementation of the concept of integrated waste management is possible under the conditions of the implementation of a circular model of the economy, which is based on the convergence of sustainable development goals.

USING A CONVERGENT MODEL OF CIRCULAR ECONOMY TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

Ecological economy includes ecologically-oriented types of economy that reflect possible ways of greening: circular economy, bioeconomy, low-carbon economy, digital economy, common economy, blue (blue) economy, etc. An important place in this list is occupied by *the circular economy, which aims to maintain the value of products, materials and resources for as long as possible by returning them to the production cycle while minimizing waste generation, ie reduces the eco-destructive impact on the environment.*

For the first time the development of efficient current and secondary use of products and recycling is identified as a promising direction of economic development in the Report of the Club of Rome "The Limits to growth" [30], published in 1975 and contains the results of analysis of possible civilization the scale of use of natural resources, environmental problems.

In 2015, the European Commission addressed the European Parliament and the Council of Europe, socio-economic and regional committees with a report "Closing the loop - An EU action plan for the Circular Economy" [31], which substantiated the concept of circular economy.

The works of such authors as N. Batova, D.V. Valko, M.A. Vetrova, I.I. Koblyanska, E.V. Mishenin, N.V. Pahomova, K.K. Richter, P. Sachek, I. Tochytska, C. Cialani, Y. Kalmykova, F. Krausmann, A. Murray, G. Roos, L. Rosado, K. Skene, P. Ghisellini, S. Ulgiati, W. Haas, K. Haynes, M. Heinz, D. Wiedenhofer etc.

The circular economy offers modern approaches and business models that can increase the resource and energy efficiency of production and consumption of goods, to reduce the negative impact on the environment.

The processes of eco-destructive impact of mankind on the environment are grouped in the following areas:

– pollution (chemical, noise, electromagnetic, thermal, radiation, biological, etc.);

– disturbance of landscapes (digging canals, ditches, plowing soils, forming dumps, changing riverbeds, draining swamps, flooding areas, etc.);

– direct impact on the human body (occupational injuries, occupational diseases, increased radiation background);

– influence on the characteristics of man as a person (conveyor production, intensification of mental activity, etc.);

– direct negative impact on flora and fauna (death of plants and animals from pollution of water bodies, air, transport, etc.) [25].

To determine the degree of eco-destructive impact on the environment allows a special indicator - the ecological footprint, which reflects the demand of the human population for natural capital, which may even exceed the ecological capacity of the planet to regenerate this capital. The term "environmental footprint" was coined in 1992 by Canadian Professor William Reese. This is a conditional concept that reflects the human consumption of biosphere resources and is measured by the area (in hectares) of productive territory required for the resource provision of human life, as well as for the absorption and processing of waste.

The concept of calculating the ecological footprint has spread rapidly thanks to the World Wildlife Fund's (WWF) Living Planet Report, which claims that the human footprint has exceeded the planet's biopotential by 20% [9].

The ecological footprint in Ukraine is 3.19 hectares per person. Today, each person needs an average of 2.7 hectares to provide themselves with resources and get rid of waste, which is much more than the capacity of the planet. The ideal in the world is an eco-trail of 1.8 hectares, which reflects the real possibilities of the planet. Thus, Ukraine ranks 51st among 149 countries in the area used by one person to consume resources. The impact of the average Ukrainian on the environment exceeds the threshold by 1.88 times [24].

According to the UN report "World Population Prospects" [32] by 2030 the population of the planet will grow to 8.3 billion people, the middle class will be joined by at least 2.5 billion new consumers. To meet their needs, taking into account the consumption of primary resources, according to experts [33], four planets such as Earth by 2050.

It is possible to reduce the consequences of eco-destructive impact on nature through the introduction of new concepts of life. There is a clear link between the concepts of sustainable development, green economy and circular economy. Ecological economy is one of the ways to achieve sustainable development, and circular economy is a specific tool for the transition to an ecological economy (fig. 3).

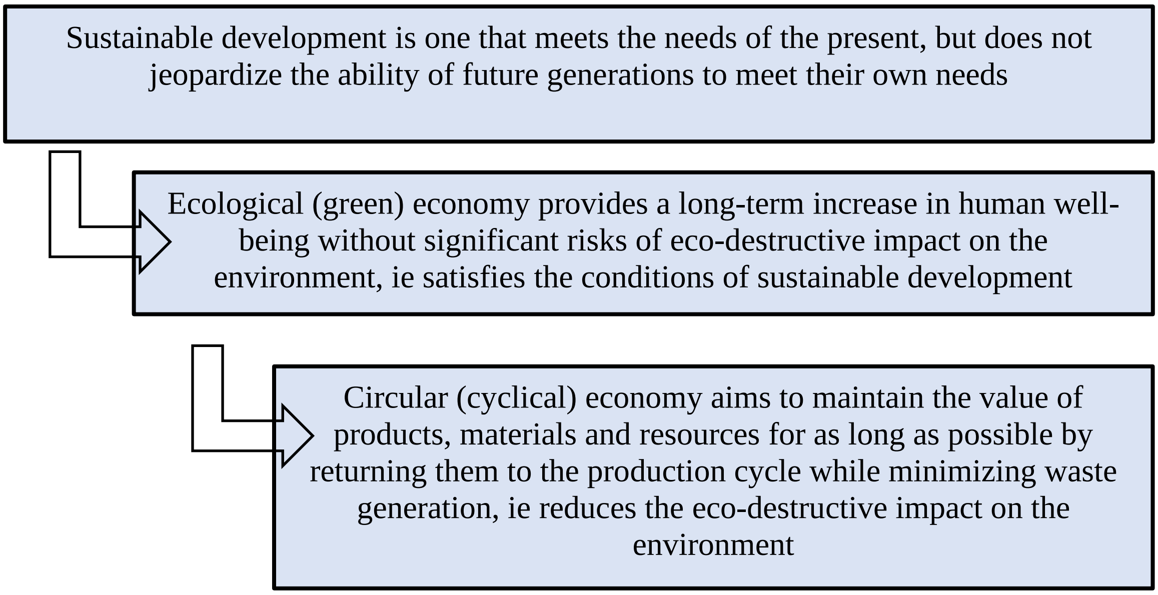


Fig. 3. The relationship between the concepts of sustainable development, environmental and circular economy

The use of circular economy tools allows to achieve some goals of sustainable development directly, and some - indirectly. For example, achieving SDGS 12 (providing rational models of consumption and production) is impossible without the introduction of business models of the circular economy. And the achievement of SDGS 12 will affect the achievement of other sustainable development SDGS, which implement the principles of environmental economics, namely: SDGS 6 (ensuring the availability and rational use of water resources and sanitation for all), SDGS 7 (providing access to affordable, affordable, affordable) modern energy sources for all), SDGS 11 (ensuring openness, security, sustainability and sustainability of cities and towns), SDGS 13 (taking urgent measures to combat climate change and its consequences), SDGS 14 (conservation and rational use, and marine resources for sustainable development), SDGS 15 (protection, restoration of land ecosystems and promotion of their efficient use, rational forest management, desertification control, cessation and reversal of land degradation and cessation of land degradation and cessation).

The methodological approaches that form the basis of the circular economy are not fundamentally new. The interdisciplinary modern concept of circular economy is the result of scientific research of scientists in the field of ecological (green) economy, industrial (industrial) ecology, economics of nature management, etc.

The methodological basis of the circular economy is the paradigm of industrial (technological, industrial) ecology, the main purpose of which is to replace the existing, in most cases, the linear nature of the man-made system to a cyclic system, where waste is often used as energy for other products or raw materials.

From the standpoint of industrial ecology, the ideal state of a man-made system is considered to be one in which the material and energy cycles of resources are closed, organized like natural ecosystems. This idea of closed cycles of resource turnover, supplemented by estimates of the value of natural capital, reflecting its importance and usefulness (and, consequently, potential losses from the extraction of resources with waste), forms the substantive basis of the circular economy.

The peculiarity of the circular economy is determined by the fact that its implementation is associated with the formation of new business models to ensure more environmentally friendly resource use [35]. The model of the economic system, which corresponds to the principles of the circular economy, is a regenerative (restorative) system that focuses on the reuse of resources, components, products, and so on.

The principles of the circular economy are implemented through five well-known innovative business models, classified by Accenture specialists: circular suppliers, resources recovery, sharing platforms, product life extension, product as a service [36] (table 7).

Table 7

Business models of the circular economy [37]

Business model name	**Characteristics of the business model**	**Companies conducting a business model**
Circular suppliers	Provides delivery by the supplier of resources that are completely recycled or biodegradable and underlie the circular system of production and consumption.	Ford, Fairphone, 3D Hubs, Desso, Toyota, Cisco
Resources recovery	Helps eliminate resource losses due to waste generation, and increases the profitability of production from reverse flows.	Coca-Cola, Maersk, Michelin, Philips, Walt Disney World Resort
Sharing platforms	Serves to promote platforms for interaction between product users, individuals or organizations.	Patagonia, BlaBlacar, Nearly New Car, BMW, Drivy, Daimler, Lyft
Product life extension	Provides preservation or improvement of the product which has been in use, at the expense of its repair, modernization, reconstruction or restoration.	Bosch, Caterpillar, Volvo, Renault, Apple, BMA Ergonomics, Michelin
Product as a service	Serves as an alternative to buying a product, providing it for use, for example, through a lease, lease, etc., which increases the incentives to create durable products, extend its life cycle.	Rolls-Royce, Mud Jeans, De Kledingbibliotheek

Despite the diversity of circular business models, their use is aimed at: reducing the number of resources, materials and energy used in the production process; use of environmentally friendly sources of resources; reducing the number of products consumed due to the transition from individual to shared use; extension of the useful life of products; reducing the amount of waste and their rational utilization [38].

The circular economy is an alternative to the traditional linear economic mechanism, as it is characterized by a closed nature of resource use and recovery. In contrast to the traditional model of economy, which works on the principle of "take, make, use, waste", the circular economy offers a fundamentally new stable model based on the principle of “take, make, use, repair or recycle, reuse”. The circular model is a good way to save resources and materials, reduce the negative impact on the environment and sustainable economic growth.

In modern conditions, the transition to a circular economy is possible due to the closure of the resource cycle and the creation of closed logistics chains. In the process of developing the concept of circular economy, framework conceptual structures were formed - frameworks, which were transformed as the ideas of circularity became stronger: *"3R"*, *"4R"*, *"6R"* and *"9R"* (Table 8) [38].

Table 8

Characteristics of processes of frameworks of circular economy

The level of circularity of the economy	**Framework**	**Characteristics of the process**
1	*2*	*3*
First level - useful use of raw materials	4R, 6R, 9R	Recover (recovery, return) - the process of collecting products and components at the end of use, disassembly, sorting and cleaning for the purpose of using in the next life cycles.
	3R, 4R, 6R, 9R	Recycle (recycling, processing) - the process of returning waste, discharges and emissions into the processes of technogenesis. Reuse of waste for the same purpose, as well as return of waste after appropriate treatment in the production cycle.

The second level is the extension of the service life of the product and its parts	9R	Refurbish (renewal, repair) - restoration and renewal of an old but serviceable product.
	6R, 9R	Remanufacture (update, modification) - the process of restoring a product to bring it into working order by replacing or repairing major components or components.
	9R	Repurpose (reorientation) - re-profiling, the use of a failed product, and its parts in a new product with a second purpose.
	9R	Repair (repair, correction) - repair and maintenance of a defective product for use in accordance with the original purpose.
	3R, 4R, 6R, 9R	Reuse assumes that a product is reused for original or new purposes in its original form or with some changes and minor improvements.
The third level is a smart production and use of products	3R, 4R, 6R, 9R	Reduse (reduction, decrease) involves the reduction of the use of resources and energy at the stages of planning and production of the product, and the reduction of emissions and waste at the stage of its use.
	9R	Rethink (rethinking) - increasing the intensity of product use (for example, sharing).
	9R	Refuse - reduction of excessive consumption of products due to the complete abandonment of their functionality by transferring their functionality to other products.
	6R	Redesign is the process of developing next-generation products that use components, materials, and resources derived from the previous life cycle or previous-generation products (redesign to use as many extracted components and parts as possible) without loss.

The circular economy takes into account the biological and technical cycles of resources and the potential benefits that can be obtained at different levels of these cycles, it involves the transition from a linear economy to a closed cycle economy, because the linear economy as a result, produce a large amount of waste.

The Ellen McArthur Foundation transformed the principles of the circular economy into a model based on the 6R processes of the framework and considering technical and biological cycles (fig. 4) [39].

Within the limits of the biological cycle, this scheme envisages the following chain: non-toxic wastes, after use, fall back into the natural environment and become a nutrient medium for biological organisms, and then, as a result of further biological processes, are used as biochemical. The principle of functioning of the biological cycle corresponds to the concept of "cradle-to-cradle", which is based on the idea of waste-free production.

The technical cycle forms closed supply chains and consists of the following processes: maintenance; product reuse (reuse / redistribute); refurbishment of products and / or restoration of obsolete components (refurbish / remanufacture); recycle.

The traditional linear economy is presented in fig. 4 as a vertical process in the middle, from resource extraction and production to waste disposal. Also presented are two cycles of circular economy - biological and technical substances. In the linear model, technical materials do not create a consistently closed consumption cycle, which generates a loss of valuable material and energy resources.

The convergence of the principles of functioning of biological and technical systems is traced in the circular model.

By analogy with biological systems, which are aimed at creating closed cycles, technical systems implement the restoration and reproduction of products, components, materials through reuse, repair, regeneration, recycling, etc.

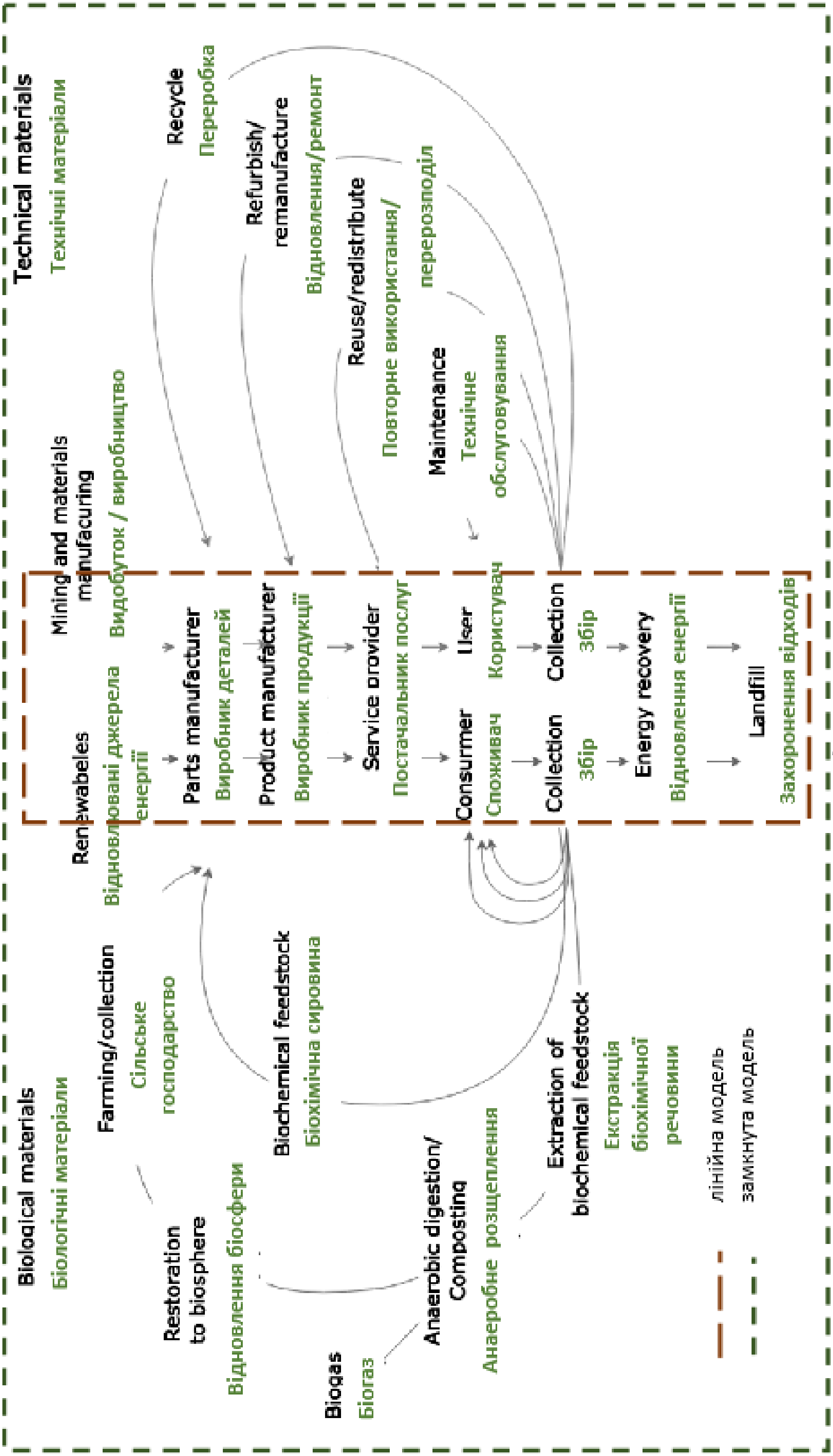


Fig. 4. Model of circular economy proposed by the Ellen McArthur Foundation

The implementation of a convergent model of the circular economy is possible at the micro, meso and macro levels. At the micro level, the company takes into account the environmental factor in the supply of raw materials, production and marketing, waste management. At the micro level, the idea of a circular economy is embodied in closed micrologistics systems. In addition, eco-design (ecodesign) is carried out at the micro level, which takes into account the ecological component of supply, production and sales, and is a manifestation of environmentally-oriented management.

At the meso level, eco-parks are being created - associations of producers of goods and services that want to improve the economic and ecological situation through joint management of natural resources and the environment. In this case, production is carried out in a closed system, which is similar to natural ecosystems, ie waste or by-products of one production chain are raw materials for another [40]. Eco-cities, eco-regions, etc. are created at the macro level. Thus, at the Meso- and macro-level ideas of the circular economy are embodied through closed logistics chains and the general ecologization of man-made systems.

Thus, the convergent model of circular economy is a successful tool, the use of which allows to achieve sustainable development as a harmonious economic and social development of society in a safe environment due to the convergence of economic, social and environmental values.

CONVERGENCE OF METHODOLOGIES OF LOGISTICS, ECOLOGICAL AND PROJECT MANAGEMENT IN PROJECTS OF ECOLOGICAL SYSTEMS

Sustainable development necessitates the transformation of human economic activity from hostile to environmentally friendly. Each activity must be environmentally safe, its consequences should not adversely affect the current and future state of the environment.

Logistics, as a sphere of practical activity, also makes a negative contribution to the current state of the environment. Thus, logistics should consider the issue of ecologization in the context of its activities, which is possible due to *the convergence of methodologies of logistics and ecological management.*

Logistics management is carried out on the basis of the basic principles of management with the implementation of the specifics of logistics. The question of logistic management is highlighted in the nautical works of such scientists as R. Ballow, D. Bauersox, G. Vardanyan, R. Voloshina, A. Gajinski, A. Kalchenko, E. Krykavsky, D. Lambert, S. Mocherny, Yu. Ponomarova, B. Palasyuk, V. Sergeev, J. Stock, I. Strutinska, L. Frolova and others.

In scientific sources, logistics management is defined as "targeted influence on logistics flows in order to synchronize their interaction and achieve the effect of synergism" [41] or "A kind of administration of the logistics system, ie the performance of basic management functions (organization, planning, regulation, coordination, control, accounting and analysis) to achieve the goals of the logistics system" [42].

Given the current trends in the development of logistics and its transformation into Ecological management, logistics management is gradually being transformed into Ecological management through the convergence of logistics and Ecological management.

Ecological management is a means of harmonizing relations between society and nature in the context of global trends in the greening of human life, the implementation of practical actions on the way to environmentally balanced management. The main issues of Ecological management, economic and social aspects of its formation and implementation are covered in the works of domestic scientists T. Galushkina, B. Danylyshyn, S. Bogolyubov, V. Zuev, S. Doroguntsov, V. Sakhaev, V. Shevchuk, I. Sinyakevich, Y. Shemshuchenko, E. Khlobystov, L. Hryniv, O. Veklych, etc.

Ecological management is the process of preparation, adoption and implementation of decisions aimed at achieving environmental goals using various special and system-wide, administrative and economic methods and mechanisms [43].

Ecologically-oriented management should be consistent with the scale and depth of penetration of problems into virtually all spheres of human life and be based on the laws of *ecology* – science that studies the laws of the relationship of organisms with the environment, as well as the organization and activity of systems of superorganismic organization (populations, species, biocenoses, and biosphere). Modern ecology studies, first of all, the objective laws of human existence and nature, the relationship between the development of ecosystems at all levels, it is a science of the problems of survival in the environment.

Ecologically-oriented logistics management is a type of management activity, which involves taking into account environmental factors at all stages of spatial-temporal planning, organization, control and regulation of the movement of material and informational sources, information. The purpose of ecologically oriented logistics management is to obtain an integrated ecological and economic effect as a result of optimization of flow processes.

The works of foreign and domestic scientists such as A.U. Albekova, V.V. Borisova, R. Dannu, T. Dowie, L.M. Zaretska, A.A. Kizim, N.P. Koropova, I.I. Koblyanska, A.F. Kryachkova, A. McKinnon, V.P. Meshalkin, E.V. Mishenin, M.N Nekrasova, I.M. Omelchenko, N.V. Pakhomova, P. Poist, J.-P. Rodrigo, D. Rogers, A. Tambovtsev, T. Tambovtseva, R. Tibbu-Lembke, D. Waters, L.A. Sosunova, T.N. Skorobahatova, D.V. Chernovova, etc. are devoted to the problem of *ecologically oriented logistics management.*

The convergence of logistics and ecological management in logistics is associated with the use of a logistics approach in waste management and secondary material resources, the integration of efforts of suppliers and customers to produce environmentally friendly products. A significant influence on the development of ecological management in logistics was made by the publication in 1992 by the Board of Logistics Management of the USA of J. Stoke's monograph "Revers Logistics" [44].

The basis of the modern period in the development of logistics is the integration paradigm, which is based on the unification of all performers of logistics functions into a single logistics chain. The integration paradigm takes into account, in addition to economic, ecological issues, the functioning of logistics systems.

Thus, summarizing the above, it can be argued that conceptually the development of *ecologistic* is based on a change in logistics paradigms. Due to the convergence of economic and ecological values, to the basic seven rules of logistics it is necessary to add a minimal eco-destructive impact on the environment, which will jointly make up the "rules of ecologistics" (fig. 5).

The concept of ecological logistics arose due to the convergence of two scientific areas - logistics and ecology. "Green logistics", "ecological logistics", "ecologistics" or " ecologically responsible logistics" are synonyms and have the same essence, as can be seen from the following definitions (table 9).

RULES OF ECOLOGISTICS

- **minimal eco-destructive impact on the environment**

RULES OF LOGISTICS

– **the required product (product)** – **in the required place**
– **of the required quality** – **at the required time**
– **in the required amount** – **to the required consumer**
– **with the required level of costs**

Fig. 5. Rules of ecological logistics

The analysis of the definitions of the terms "green logistics", "ecologistics", "ecological logistics", "ecologically responsible logistics" showed that today in general has already formed an understanding of the essence of these concepts, and there are significant differences. Most authors agree that logistics, taking into account the ecological factor, aims to minimize the negative impact on the environment from the implementation of logistics activities [45, 48, 50] and propose the application of measures for the movement of energy resources [47, 48] for the ecologization of supply chains [46] to achieve the goals of sustainable development [49].

Table 9

Definition of logistics taking into account the ecological factor

Green logistics
Ds. Rogers, R. Tibben-lembke [45] A set of actions to assess and minimize the environmental consequences of logistics activities.
J.-P. Rodrigue, B. Slack, C. Comtois [46] Practice and strategy in supply chain activities that reduce the negative ecological and energy consequences of the distribution of goods and focus on cargo processing, waste flow management, packaging and packaging.
Li Yanbo, Liu Songxian [47] A new scientific direction, which involves the use of advanced logistics technologies and modern equipment in order to minimize pollution and increase the efficiency of logistics resources.
Ecologistics
Yu. Chortok [48] Subsystem for managing product flows from the original source to the final consumer with a minimum level of eco-destructive impact on the environment.
V.D. Gerami [49] Logistics activities based on the principles of sustainable development and taking into account the factors of environmental pollution, resource consumption, security.
Ecological logistics
Li Yanbo, Liu Songxian [47] System of planning, design and management with the use of advanced logistics technologies and methods of ecological design in the field of pollution reduction and resource consumption, which are dictated by ecological principles.
Ecologically responsible logistics
Haw-Jan Wu, Steven C. Dunn [50] Ecologically friendly logistics approach, in which the tasks of minimizing the overall environmental impact of the logistics system on the environment are added to the traditional management tasks.

The most complete and reflecting the convergence of logistics and environmentally-oriented management is the definition given in [51]: *ecologically-oriented logistics* - scientific and practical activities aimed at optimization and effective management of direct and reverse material and related flows (informational, financial, waste streams, harmful emissions, various natural resources and energy) in order to minimize the negative impact on the environment.

The main principles of *ecological logistics* are: rationalization of the use of natural resources and enterprise resources; maximum use of production waste, containers and packaging; reduction of consumption of raw materials and materials with low possibility of processing or safe utilization; application of modern science-intensive technologies and recycling technologies; increasing the level of ecological orientation and responsibility of logistics personnel [52].

Comparative characteristics of logistics and ecologistics are given in table 10.

Table 10

Comparison of logistics and ecologistics

Characteristics	**Logistics**	**Ecologistics**
Object	logistics flows - material (direct) and related	logistics flows - material (direct, rotary, reverse) and related
Subject	optimization of logistics flows from the standpoint of systematization	optimization of logistics flows from the standpoint of system and environmental friendliness
Methodological basis	system, process, functional, logistical approaches	system, process, functional, logistical, ecological approaches
Logistics system	linear	closed
Economic system	brown economy	green economy

Based on the principles of ecologistics, its contour is defined within the Concept of Sustainable Development, which reflects the goals aimed at the convergence of economic, social and ecological values:

- *economic* - improvement of values of economic indicators of functioning of the enterprises owing to application of tools of ecological logistics;
- *social* - the formation of conditions for safe production for society, distribution and use of products;
- *ecological* - reduction of eco-destructive impact of logistics activities on the environment (fig. 6).

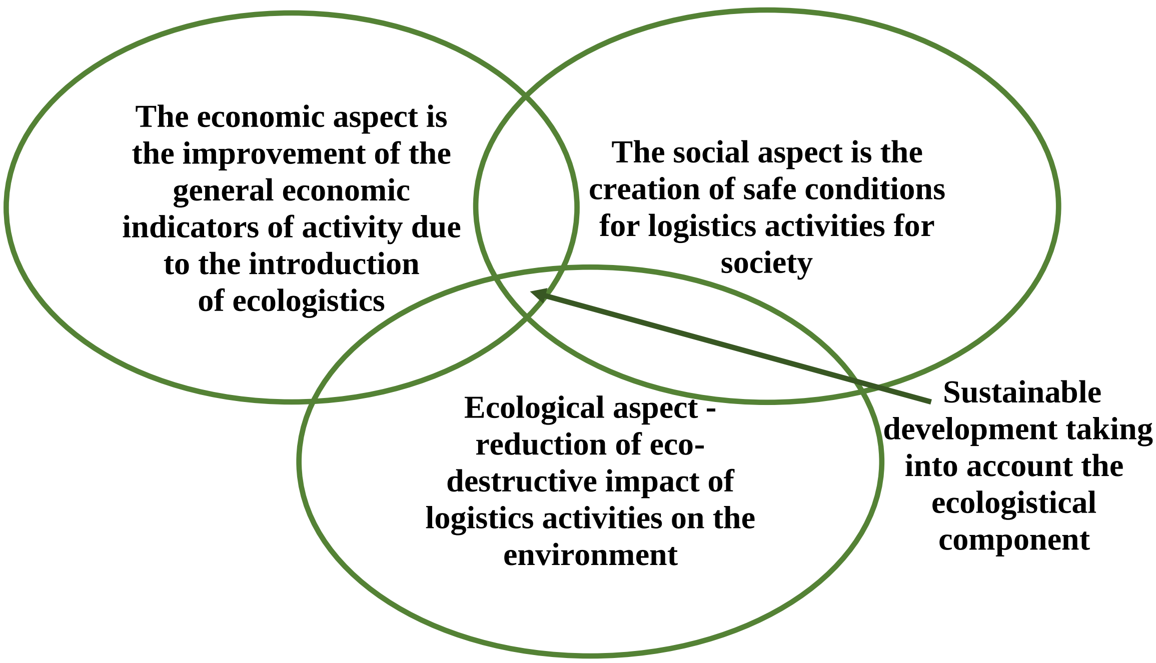


Fig. 6. Outline of ecologistics within the Concept of Sustainable Development

Thus, modern logistics within the Concept of Sustainable Development should be considered as an effective approach to the management of logistics flows in order to reduce the ecological damage to society and the environment, and can ensure the improvement of economic activities.

From the standpoint of a systems approach, ecologistics is both an element of a higher-level system of the hierarchy and includes lower-level systems. Namely, ecological or green logistics is a subsystem of green economy and sustainable logistics, on the one hand, and includes in its composition such subsystems as resource conservation logistics, reversible logistics, logistics of waste resources, and other logistics.

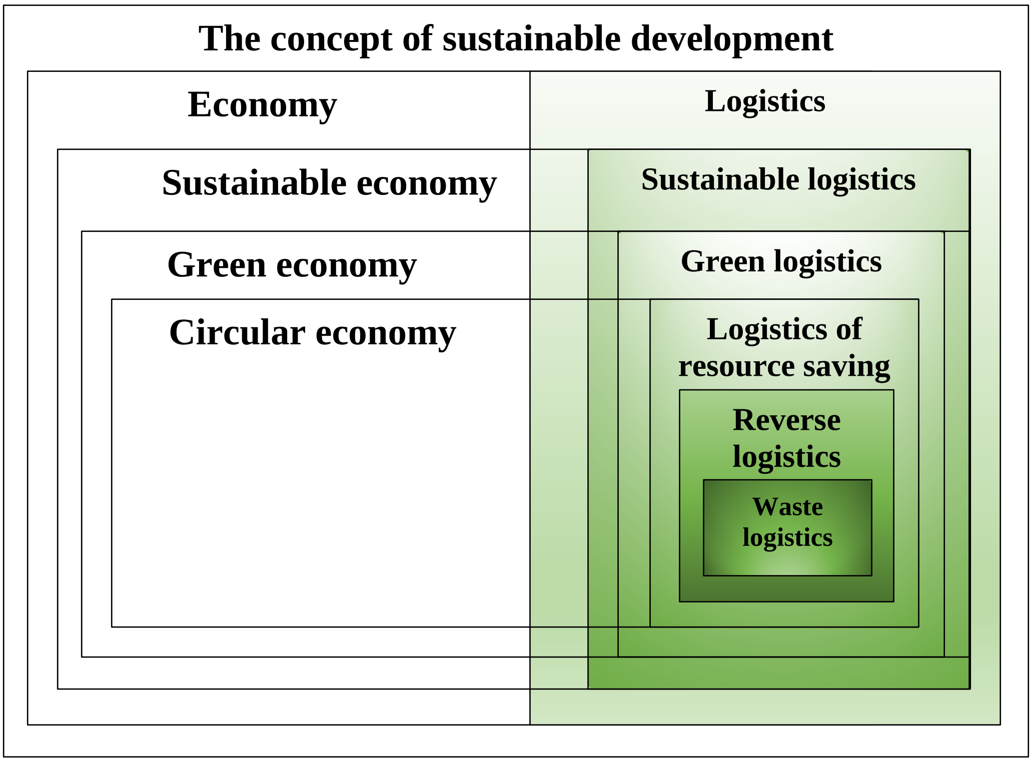


Fig. 7. System representation of ecologistics

Ecologically-oriented types of logistics differ in the objects of management. Since the object of management in logistics is always flows (material and related), and environmentally-oriented areas of logistics focus on managing the relevant material flows (table 11).

Table 11

Ecologically-oriented directions of logistics

Direction of logistics	Material flows are objects of management
Resource saving logistics	- resource flows (direct and reverse)
Reversible logistics	- return (including return) flows
Logistics of return flows	- return flows
Waste logistics	- waste streams
Logistics of secondary resources	- flows of secondary material resources

Changes in the worldview of humanity, which are expressed in the implementation of the Concept of Sustainable Development, have led to a change in the logistics paradigm to an ecologistical one. There have been changes in the definition of a new type of logistics systems - ecologistical in the hierarchy of higher order systems.

At the structural level, the ecologistical system is a subsystem of the system of a higher level of hierarchy, namely the ecological and economic system (Fig. 8).

If the logistics system is an element of the anthroposphere - man-made environment, part of the biosphere, transformed by man for their own needs, the ecological system is part of the anthroposphere and noosphere, which covers the interaction of man-made environment with natural resource potential of bioresources.

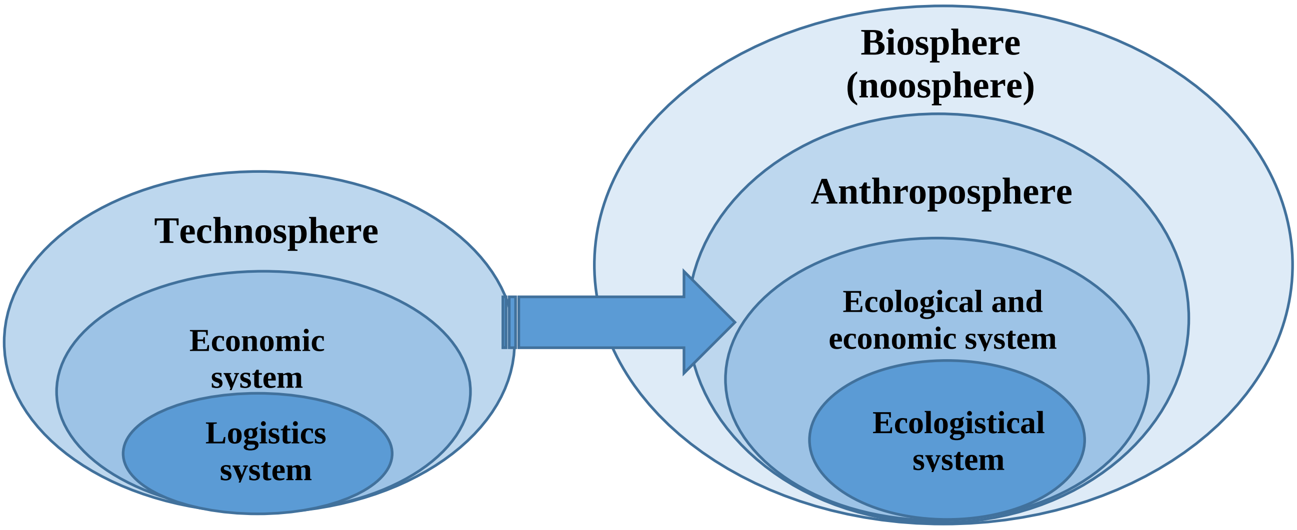


Fig. 8. Transformation of the logistics system into an ecologistical

It is obvious that such a transformation is impossible without the creation of a qualitatively new model of human development, which will be based on a high level of spirituality and knowledge of the laws of existence and development of the universe.

The modern concept of logistics, which is actively developing and has recently been influenced by ecologization and corresponds to the model of the circular economy, is the management of supply chains (logistics chains, Supply Chain

Management) [53]. One of the directions of development of convergent ecologistic management is management of ecologistic chains.

In a general sense, the logistics chain is a system of business processes that are implemented in the system of relations of interacting partner companies, integrated in the direction of flow from the source of raw materials to the final consumer [54]. As an object of management, the logistics chain is a complex meso- or macro-logistics system, which includes micro-logistics systems of enterprises - participants in the chain, which are integrated with each other.

Scientists such as Yu.V. Varenko, M.Yu. Hryhorak, L.M. Zaretska, E.V. Krykavskyy, I.I. Muhyna, A.V. Smirnova, C. Comtois, Robert D. Klassen, Su-Yol Lee, J.-P. Rodrigue, B. Slack, etc. Models of logistics chains with reverse material flows are presented in the works of such researchers as S.S. Ali, V.V. Bezkorovainy, E.M. Bukrinska, D.O. Gobov, M.N. Grigoriev, K.O. Dziubina, A.V. Dziubina, O.P. Dolgov, D.A. Karkh, O.W. Myasnykova, S.V. Potapova, A. Tambovtsev, T. Tambovtseva, S.O. Uvarov, V.A. Falovich, S.A. Shahnazaryan and others.

According to the needs of logistics ecologization, it is necessary:

First, to extend the logistics chain from the primary supplier and the final consumer to the natural environment, where waste products that have no further consumer value, even as a secondary material or energy source, must be returned to the environment [54];

Second, to take into account the reverse flows at each stage of the logistics chain from the extraction and processing of raw materials through production and distribution of finished products to their final use or disposal, considering the logistics chain as a feedback system [55].

Under the influence of the convergence of logistics and environmentally-oriented management, the logistics chain will change its linear structure and turn into a Closed-loop Supply Chain, which is a complete supply chain with feedback.

To successfully achieve the goals of design and operation of environmental systems, the use of convergent logistics and environmental management is not enough, it is necessary to use the tools of modern project management methodology.

Methodological principles of project management are presented in the works of famous domestic scientists: A.O. Biloshchytski, S.D. Bushuyev, N.S. Bushuyeva, O.S. Vanyushkin, V.O. Weismann, W.D. Gogunsky, A.B. Danchenko, Ye.A. Druzhinin, O.B. Zachka, K.V. Kolesnikov, I.V. Kononenko, K.V. Koshkin, I.O. Lapkin, O.M. Medvedev, V.A. Rach, S.V. Rudenko, S.K. Chernov, I.V. Chumachenko, A.V. Shahov, etc.

A significant contribution to the development of project management methodology was made by the following foreign scientists: V.M. Anshin, R. Archibald, I.A. Babayev, V.N. Burkov, V.I. Voropaeva, O.F. Kwon, H. Tanaka, J.R. Turner, I.I. Mazur, D.A. Novikov, N.G. Olderogge, W.D. Shapiro, L.A. Tsitovich and others.

Traditionally, project management was seen as a process of achieving a set goal for a certain period of time in accordance with the planned budget and the quality of the end result [56]. This approach reflects the historically formed sources of project management as one of the areas of solving local management problems. A modern view of project management as a methodology (art) of organization, planning, management, coordination of labour, financial and logistical resources during the project cycle, aimed at effectively achieving its goals, design and satisfaction of students 57 operating under the influence of a turbulent design environment.

Project management methodology is a clearly defined and scientifically proven combination of logically related practices and methods that allow you to effectively plan, implement, monitor and control, as well as bring the project to success. The purpose of the project methodology is to allow you to manage a specific project by making effective management decisions.

Currently, there are a significant number of types of project management methodologies, which can be both universal (PMI, IPMA, ISO 21500, Agile, P2M, PRUNCE2) and applied in project management of almost all types, as well as environmental).

The choice of project management methodology is a difficult task, as the use of the "right" methodology is one of the key factors in the success of the project [58]. Scientists see the solution of such a complex task in the convergence of project management methodologies. This question has recently been considered by such scientists as S.D. Bushuyev, N.S. Bushuyeva, S.I. Unknown, V.M. Burkov, M.S. Dorosh and others. In [59] it is determined that the main purpose of applying the convergence of methodologies is the synergy of elements of methodologies that are converted during the development of project management methodology, programs and portfolios. It is argued that an effective convergence mechanism can be the combination of the best elements of methodologies, which provides a good level of requirements for the quality of the management process (PRINCE-2; ISO 9001; ISO 10004; ISO 10006; PMBOK; PMI) with methodologies that provide level requirements. competencies of project participants (ICB IPMA, NTC).

In [60] convergence and integration are compared, it is argued that in contrast to the term "convergence" (convergence), "integration" (Latin integratio - restoration, filling) - is the unification of any elements or processes. In [61] it was determined that the integration and convergence of systems have common goals, but differ in their approaches. In the first case, the systems merge, retaining their independence, and in the second - they seem to merge and become an inseparable whole. In project management, integration is used in several subject areas, each of which has a specificity.

The convergence of methodologies in project management is proposed to mean a systemically verified merger, integration of methodologies in compliance with the conditions of consistency of the elements of the combined methodologies [62].

An example of the convergence of project and environmental management methodologies is the GPM P5 Standard "GPM® Global P5TM" [63] (Personnel, Planet, Prosperity, Processes, Products).

The GPM P5 standard is a tool that allows you to bring portfolios, programs and projects in line with the organization's strategy in the field of sustainable development. The focus of the standard is the impact of project processes and results on the environment, society, financial performance of the organization and the local economy [63].

The main reason for creating the standard was the realization that projects and business processes are not implemented exclusively within the environment for which they are launched. Their impact on society and the environment in which they are implemented should be recorded as one of the dimensions of project success. The GPM P5 standard is a tool that allows organizations to achieve their goals of sustainable development during project implementation.

The GPM P5 standard includes an "iron triangle", harmonizes it with social, economic and environmental aspects, as factors of the project environment, as well as processes and products with their relationships.

Thus, it is reasonable to say that *for the successful operation of ecologistical systems projects in order to achieve the goals of sustainable development requires convergence of methodologies of design, logistics and ecological management* (fig. 9).

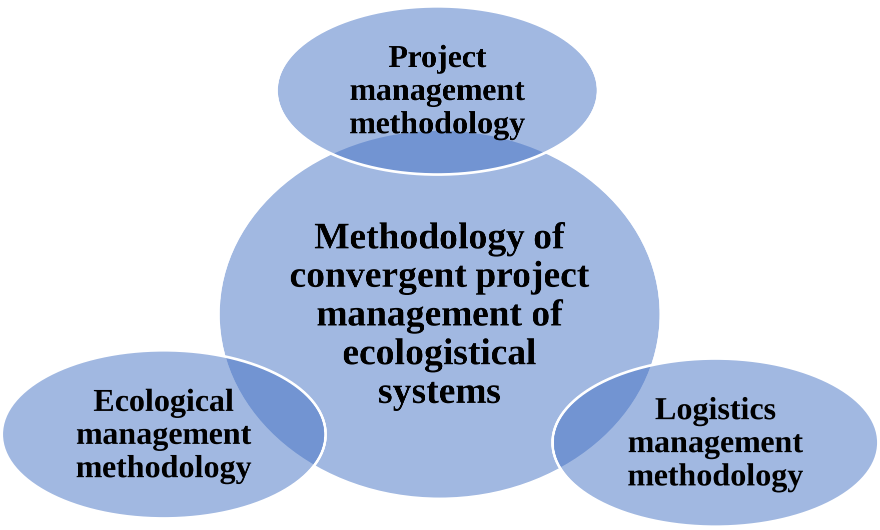


Fig. 9. Convergence of project, logistics and ecological management methodologies

Analysis of scientific research on the issues of logistics systems project management, which were performed in the works of V.O. Andrievska, A.V. Bondar, K.I. Berezovskaya, T.A. Vorkut, T.A. Kovtun, I.O. Lapkina, N.M. Piddubna, S.V. Rudenko, K..L Semenchuk, V.I. Zyuzun, T.N. Shutenko, etc., showed, unfortunately, insufficient attention to ecological aspects in the implementation of logistics systems projects.

The problem can be solved through the application of convergent project management, which is expressed in the convergence of values, systems, methodologies and approaches.

CONVERGENCE OF SCIENTIFIC APPROACHES IN PROJECT MANAGEMENT ECOLOGISTICAL SYSTEMS

Convergence of scientific approaches in project management of ecologistical systems is considered as convergence of management (system, process, scenario) and natural-scientific (physical, biological) approaches (fig. 10).

Systematicity is a general property of matter, a form of its existence, and, therefore, an integral property of human activity, its results. *The system approach* presents the project as a being, object, economic unit, and not only as a management task aimed at achieving the set goals, given the constraints.

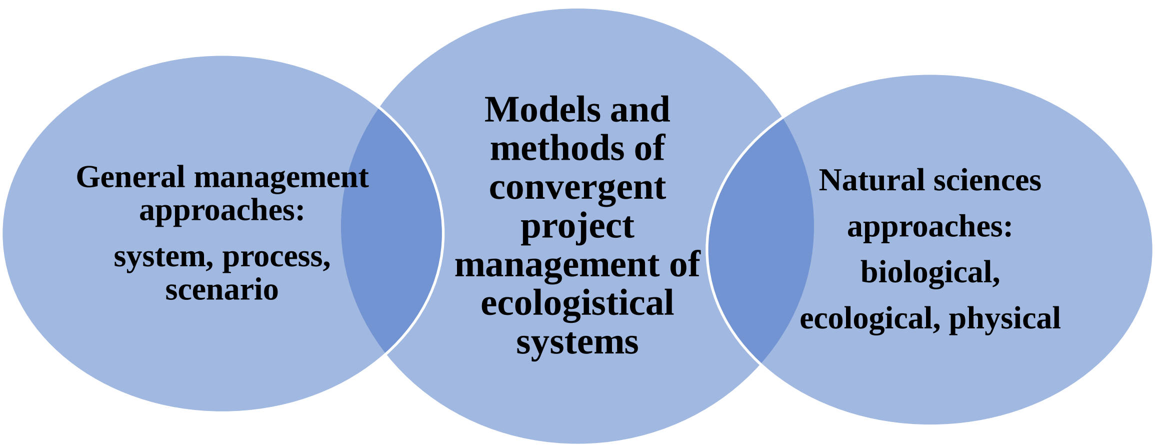


Fig. 10. Convergence of scientific approaches in project management of ecologistical systems

Many scientific works are devoted to the study of systems, the authors of which offer different interpretations of the concept of "system", which in one way or another reflect the universality of the concept. One of the most successful is the definition proposed by M. Mesarovich and J. Takahara [64], according to which the system has many elements together with the connections between these elements and their features. Thus, it becomes obvious that the key words in the concept of "system" are "element" and "connection".

An element is the simplest indivisible part of the system, considered from the point of view of the set goal and a specific task; connections are a connection between the elements that influence the behavior of the elements and the system as a whole. Types of functional elements and connections can be different. A system can consist of different local systems (subsystems) and at the same time be a subsystem of another or many other systems of a higher level of hierarchy. The elements of the system can be considered as subsystems, if their structure is studied [65].

There are many scientific publications, the authors of which focus on the application of a systematic approach to project management. The systems approach is characterized by the most complete view of the project and allows us to consider it as a set of interconnected elements that form a system that lives in a dynamically changing environment that changes both under the influence of the project and independently of it. In addition, the systems approach is one of the components of the knowledge structure of project management.

The project is considered as a controlled system of actions to change the state of the object of influence during the life cycle of the system in [66], and also emphasizes that the project must be presented explicitly as a system generated by human activity.

It is proposed to consider the task of project management as a complex active system [67]. In active project management systems, management entities have the properties of activity, including the freedom to purposefully choose their state.

In [68] the basic principles of systemicity in project management are investigated, and the content of basic concepts "system" and "project" is compared by semantic analysis of these concepts and selection of the most essential general characteristics of definitions. Due to the use of the principles of the systems approach, a number of categories of systems analysis are identified with the categories from the knowledge base of project management.

From the standpoint of a systems approach, the project of ecologistical system is presented as a system, because it has all the properties characteristic of systems.

First, it consists of elements and subsystems that form the internal environment. The internal environment of the ecologistical system project includes project participants (customers, investors, initiators, project team, etc.), primary and secondary and project resource potential, etc.

Second, the elements of the system are organized into a structure by creating links between them. The project structures of the ecologistical system can include organizational structures (OBS-structures) of the project and its products, structures of works (WBS-structures) of the project, structure of project states, etc.

Third, the design of the ecologistical system is located in the environment and interacts with it. The external environment of the project is divided into the environment of direct and indirect influence. The environment of direct influence includes competitors, partners (resource providers and consumers of services), controlling state bodies and public organizations, the environment of indirect influence - political, economic, social, demographic, climatic and other conditions in which.

In [69] the internal and external environment of the project is divided into the project potential and the project environment, respectively. The design of an ecologistical system as a complex system has a large number of elements in the internal environment, between which connections are established. In addition, such projects are characterized by the presence of a large number of elements of the external environment, which form numerical links with the elements of the internal environment of the project.

Fourth, the project of ecologistical system has a system property - emergence, due to which it becomes possible to get the result - the products of the project.

The process approach in project management along with system, project and scenario approaches will form the basis of the methodological basis of project management. The project is considered as a set of interconnected processes - a series of actions that lead to a certain result.

The expediency of using the process approach follows from the definitions of the project itself, which are used in documents that are normative in nature or have the status of an international or national system of requirements (standards) in the field of project management, quality management processes.

The process approach is recommended by the methodology PRINCE (Projects in a Controlled Environment) [70] and ISO 10006 "International quality control procedure for project management" [71]. The process concept of project management is that a complex integrated project management process is described by the processes of which it consists and their relationships. In this case, the processes are understood as actions and procedures related to the implementation of management functions, which corresponds to the interpretation of the concept of "process" by the International Organization for Standardization ISO [71].

The process approach is associated with the need to regulate and unify the actions of project managers, lead them to repetitive processes with a description of the input and output parameters (resources), as well as a set of actions that will turn the input into output. The process approach is tied to a specific subject area and allows formalizing the actions of the project manager [72].

Depending on the area of effort, project processes are divided into two groups:

– project management processes that focus on the description and organization of work in the project and are identical for most projects;

– product-oriented processes focused on the defined and product creation of the project, which are determined according to the life cycle of the project and vary depending on the applied area [73].

Project management processes and product-oriented processes are superimposed and interact throughout the project. For example, the content of a project cannot be given in isolation from some basic concepts of how to create a product [73].

With regard to ecologistical systems projects, the first group of processes includes project management processes - the processes of initialization, planning, execution, control and closure, and the second group includes processes focused on the product of a particular phase of the project: project documentation, ecologistical system, services promotion of material flow (direct, reverse), a set of services for the revival of the ecosystem.

The analysis of scientific research on the issues of process approach in project management showed the presence of different opinions on the identification of processes that make up a single contour of project management, and an ambiguous understanding of the essence of the project management processes themselves. However, it can be argued that, regardless of the differences in the identification of processes, they are all aimed at changing the state of the project. The process of changing the state of the project is characterized by such properties as irreversibility, direction, regularity.

Irreversibility is the property of processes to proceed in a certain direction without the possibility of returning to the initial state. A project is a system that cannot return to its original state without some effort (additional work) and a change in one's life path. The project is asymmetric and non-cyclical over time and at every moment of time is at a certain stage of the life cycle.

Orientation presupposes the possibility of the system to change in a certain direction. The direction of changes in the project follows from its definition as a task with certain initial data and the necessary results (goals), which determine the way to solve it. The very purpose of the project determines the direction of change of its states during the life cycle.

Regularity is the property of the system to change in accordance with certain laws. The pattern of changes in the project can be traced in the action of the law of causation, when under the same initial conditions, the same conditions of implementation and the same development of events, the same result is achieved. The presence of patterns allows us to make assumptions about the future effectiveness of the project.

Thus, the process of changing the state of the project is its development. This statement follows from the definition of development as an irreversible, directed, regular change of material and ideal systems [74].

Project management of the ecologistical system can be represented as a set of management influences that ensure the development of the project in accordance with its life path or trajectory of development. Each impact must be directed (subordinated to the common goal of the project), irreversible (transfer the project to a new state) and natural (lead to certain consequences).

It is possible to take into account the uncertainty of the future conditions of the project implementation due to the application of a scenario approach, which is related to the management decision-making processes in the project and assumes the presence of many alternative project options.

The scenario approach has become especially popular in the last decade, which is due to the need to predict the results of economic activity of economic objects in a turbulent environment.

The scenario approach is an approach in which the theoretical analysis of the system is carried out, which aims to identify possible variants of the development of events and to determine their consequences. The scenario is understood as a predictable or possible course of events, it differs from the forecast in that it is not a prediction of the future, based on already known trends and facts.

The application of the scenario approach in project management allows to take into account the variety of project development trajectories by forming sets of parameters of the project states, different combinations of which allow to synthesize alternative variants (scenarios). Analysis of the effectiveness of project scenarios helps to increase the amount of information about the project, which, in turn, reduces the uncertainty of the conditions of its implementation.

Uncertainty implies the presence of incomplete and inaccurate information about the conditions of the project, including the related results. Changes in the conditions of implementation can lead to deviations from the determined trajectory of project development, ie to the emergence of risk situations.

The application of natural science approaches in project management is due to the evolutionary development of human worldview, awareness of the universality of the laws of nature. "Nature is the great first organizer; and the man himself is only one of its organizational works", wrote A. Bogdanov. "The simplest of living cells, perhaps only at thousands of magnifications, far surpasses everything that can be organized by a person who is a student of nature and still very weak in terms of complexity and perfection of organization" [75].

The system approach is fundamental in the use of the *biological approach* in project management, the essence of which is to apply the principles and mechanisms of biological systems (creatures, organisms, populations, etc.) in the management of non-biological systems (projects), organizations.

The founder of systems theory, Ludwig von Bertalanffy, singled out the general characteristics of any complex organization, both biological and social in nature, and defined the system as a complex of interacting elements. A.A. Bogdanov dealt with similar issues, creating a theory of organization.

The application of the biological approach is observed in various spheres of human life, especially in the design of complex technical systems (for example, aircraft, helicopters, ships), the mechanisms of functioning of living beings (birds, insects, insects, fish) are used. The principles of construction of the elements of flora and fauna are applied to architectural objects.

A clear manifestation of the biological approach to management is the concept of industrial metabolism. The basis of the synergetic approach is also samples of behavior of living beings and organisms.

Scientists such as S.A. Podolinsky, V.I. Vernadsky, N.D. Kondratiev, N.F. Reimers, W.L. Inozemtsev , etc. The application of a biological approach to the management of an organization, the main postulate of which is the view of the organization (enterprise) as a living being, is proposed in [76]. The similarity of the organization with a living organism and the expediency of the transformation of the laws and rules of life of living organisms into systems of the suprabiological level of the organization is emphasized in [77].

Recently, the application of different directions of the biological approach in project management has been observed. In the works of I.A. Babayev, S.D. Bushcheeva, G.D. Bushuyev, T.A. Kovtun considers the issues of the genetic approach as a kind of biological approach in project management. In [78] S.D. Bushuyev, D.A. Bushuyev, N.S. Bushuyeva, L.S. Chernova proposed a benchmarking model based on genetic mechanisms in project management.

In [79] it is emphasized that the genetic approach is to apply biological analogy to projects, which is manifested in the use of terms, definitions, models and methods of genetics in project management. Through the prism of the genetic approach, the view of project management expands. The work [80] of D.A. Bushuyev is devoted to the study of immune mechanisms of management of projects for the development of organizations, which is carried out by analogy with living organisms.

The natural-scientific approaches used in the convergent management of environmental systems projects include the *physical approach*, which involves the application of physical laws in the process of project activities.

An attempt to combine physics and economics took place in the late 90's of the twentieth century, resulting in a new discipline "econophysics", the basics of which are described in the book "An Introduction to Econophysics" [81]. By that time, the economy had accumulated tasks that could not be solved within these sciences. To solve such problems, it was envisaged to use the apparatus and methodology of theoretical physics. In ecophysics, the main emphasis is on mathematical modeling of development and evolution, which in the long run can lead to the construction of the economy in the image and likeness of the exact and natural sciences.

The application of the universal laws of physics to describe economic phenomena and patterns is a new, little-studied scientific direction, but it allows researchers to understand those aspects of organizational management that were previously incomprehensible. Since the design of the ecologistical system is a complex stationary system of the suprabiological level of the organization, it can be assumed that the process of its management is subject to some general laws of system management, reflected in the physical approach.

Thus, to increase the success of ecologistical systems projects, it is proposed to use the types of convergence presented in table 12.

Table 12

Types of convergence in projects of ecologistical systems

Type of convergence	**Elements of convergence**	**Convergence result**
Convergence of values	Economic, social and environmental values	The concept of sustainable development
Convergence of systems	Logistic, ecological system	Ecologistical system
Convergence of methodologies	Methodologies of project, logistics, ecological management	Methodology of convergent project management of ecologistical systems
Convergence of approaches	General management and natural science approaches	Models and methods of convergent project management of ecologistical systems

Each type of convergence leads to a certain result:

– the convergence of values, which arose due to the change of the worldview paradigm of mankind, led to the emergence of the Concept of sustainable development,

– convergence of systems based on the principles of logistics and ecological management has led to the creation of ecological systems,

– the convergence of methodologies of design, logistics and ecological management has led to the creation of a new methodology of convergent project management of ecologistical systems,

– convergence of general management and natural science approaches allows to develop models and methods of convergent management of projects of ecological systems.

The types of convergence presented in environmental systems projects are interrelated. The convergence of economic and ecological values, which is the basis of the Concept of Sustainable Development, encourages the creation of a new type of systems - ecologistical. When managing ecologistical systems projects, it is proposed to apply a new methodology of convergent project management, which is based on the convergence of methodologies of project, logistics and economic management, within which the convergence of general economic approaches is carried out. (fig. 11).

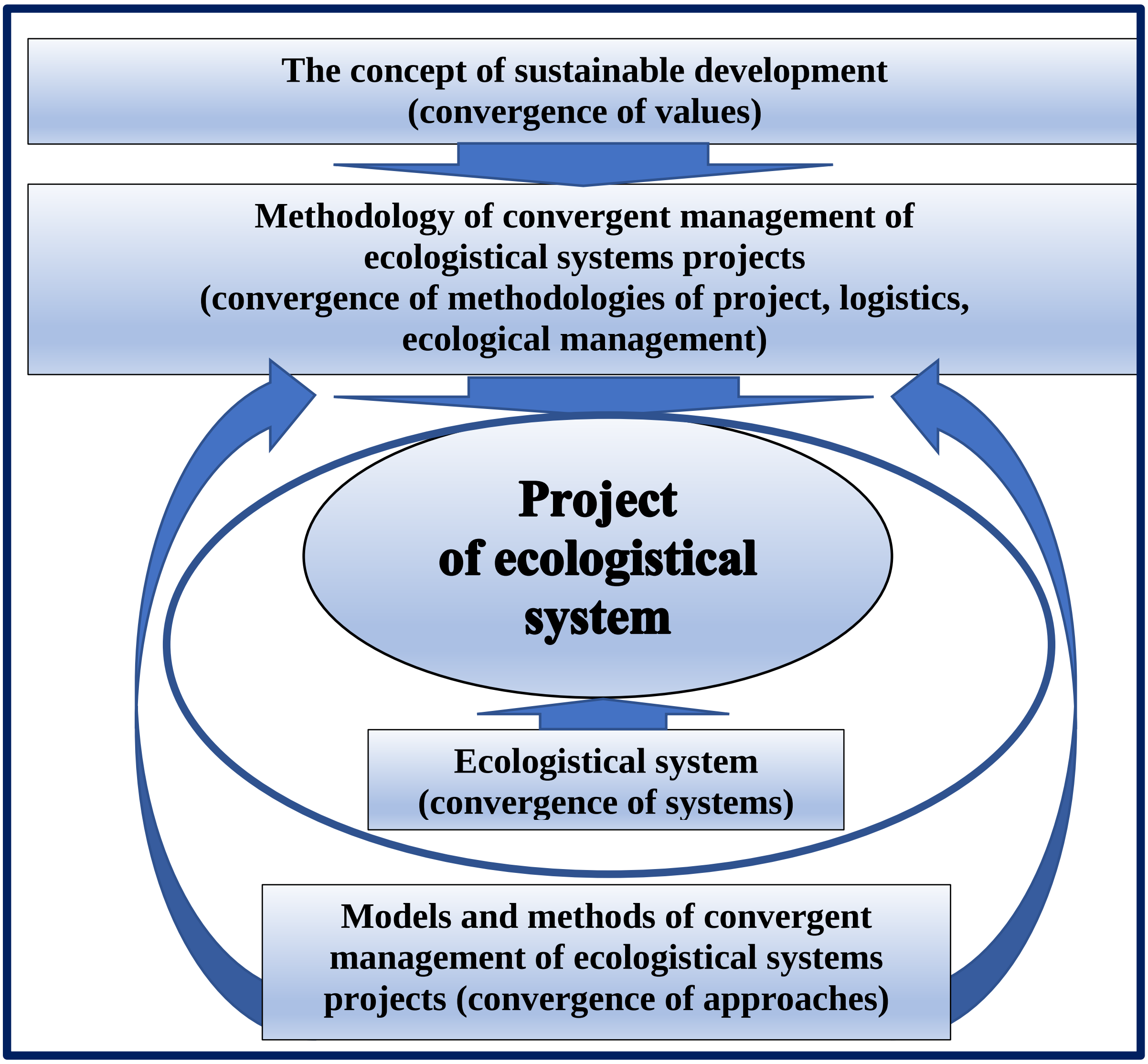


Fig. 11. Convergence in project management of ecologistical systems

CONCLUSIONS

Today's realities require the application of convergent project management of ecologistical systems based on the convergence of values, systems, methodologies and approaches. The convergence of economic and ecological values is due to changes in the worldview of mankind from consumer attitudes to nature to ecologically oriented development, which meets the objectives of the Concept of Sustainable Development. Achieving the goals of sustainable development is possible due to the change of the linear model of the economy to a circular one, which aims to maintain the value of products, materials and resources for as long as possible by returning them to the production cycle while minimizing waste generation.

The outline of ecologistics within the Concept of Sustainable Development reflects the goals aimed at the convergence of economic, social and ecological values: economic - improving the values of economic indicators of enterprises through the use of ecological logistics tools; social - the formation of conditions for safe production for society, distribution and use of products; environmental - reducing the eco-destructive impact of logistics activities on the environment.

Convergence at the level of values has led to convergence at the level of systems, which has led to the emergence of complex eco-oriented economic systems, which include ecologistical systems - logistics systems, which consist of elements interconnected through circular processes in the direction of management logistics flows. Ecologistic systems are a tool for implementing the principles of the circular economy in order to achieve the goals of sustainable development.

Successful management of ecologistic systems requires the application of a new methodology based on the convergence of methodologies of design, logistics and ecological management, as well as models and management methods based on the convergence of general, natural and natural) approaches.

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