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Olena Minakova
Department of Management, Finance and Administration of the Odessa Institute of IAPM, Ukraine
ORCID ID: https://orcid.org/0000-0003-3298-4107
Svitlana Minakova
Department of Mechanical Engineering of the Odessa State Academy of Civil Engineering and Architecture, Ukraine
ORCID ID: https://orcid.org/0000-0001-7241-0859
Vitaliy Minakov
Department of Mechanical Engineering of the Odessa State Academy of Civil Engineering and Architecture, Ukraine
ORCID ID: https://orcid.org/0000-0002-6951-8399

"GREEN" LOGISTICS: ESSENCE, ADVANTAGES AND DISADVANTAGES

Introduction

In today's world, where the problems of environmental pollution and depletion of natural resources are becoming increasingly important, the concept of "Green Logistics" is becoming an important tool for those who seek to combine successful logistics operations with a responsible attitude towards nature. Green logistics is not only defined by effective supply chain management, but also takes into account its environmental impact.

This concept aims to reduce the footprint of freight transport and optimize resource use, from vehicle selection to inventory management and packaging recycling. In light of the growing attention to environmental issues, considering green logistics aspects is determined not only by strategic business benefits, but also by a commitment to society and the environment.

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Analysis and research of publications.
The issue of "green" logistics is actively considered by both Ukrainian and international scientists and organizations. In Ukraine, this issue has been addressed by such researchers as Boychenko M. V. (2020), Margita N. O., Bilonizhka U. Z. (2021), Burenko Ya. O. (2019), Salo Ya. V. (2022), Solomnikov I. V., Zhernova E. V. (2023). At the same time, international literature significantly expands the scientific discourse: a systematic review of key drivers of green logistics was presented by Rastegardehbidi and Su (2022); innovative approaches to the development of green logistics in developing countries are highlighted in a report by the World Economic Forum and the Boston Consulting Group (2023); and a comprehensive analysis of the impact of environmental practices on business sustainability was carried out in an international study (2024). Thus, modern scientific works demonstrate the integration of Ukrainian experience into the global context, which allows us to more fully assess the prospects for the development of "green" logistics.

Purpose of the article

The purpose of this article is to consider the essence of "green" logistics, study the advantages and disadvantages, clarify the goals, form a comparative characteristic of logistics and "green" logistics, and present measures to minimize the negative impact on the environment.

Presentation of the main material

Global climate change can negatively affect logistics, which in turn leads to disruptions in production and supply processes, requiring time for recovery, as well as affecting the operation of transport vehicles. The spread of adverse natural phenomena cannot be ignored, as they demand additional financial resources.

The transport sector has a significant negative impact on the environment, as confirmed by Burenko Ya. O., who emphasizes its role in consuming approximately 20–25% of global energy and emitting a similar share of greenhouse gases. Emissions from transport vehicles are rapidly increasing compared to other sources of energy consumption, while road transport is one of the main air pollutants, causing the formation of smog over cities. Traditional transport planning is primarily focused on improving traffic flow, particularly for private cars, which only exacerbates environmental problems.

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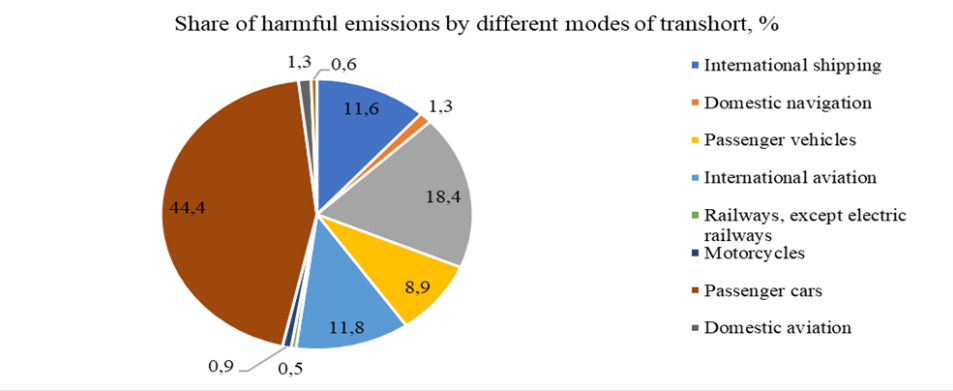

Fig. 1. Share of harmful emissions by different modes of transport
Source: compiled by the author based on (Boychenko M.V., 2021)

In addition, transport logistics has a negative impact on the environment due to significant emissions of harmful substances from vehicles, such as carbon, sulfur, and nitrogen oxides, lead compounds, and soot. This has an adverse effect on the ecological situation and human health.

According to the International Energy Agency (IEA, 2025), the transport sector worldwide accounts for approximately 24% of global CO_2 emissions from energy use, of which more than 70% comes from road transport. In Ukraine, the Ministry of Environmental Protection and Natural Resources (2023) reports that transport annually generates about 12–15 million tons of CO_2, as well as significant volumes of nitrogen oxides (NOx), sulfur oxides (SO_2), and particulate matter (PM2.5).

Main pollutants:

- Carbon oxides (CO) – more than 40% of urban emissions.
- Nitrogen oxides (NOx) – about 30% of total emissions in cities.
- Particulate matter (PM2.5, soot) – up to 25% of air pollution sources in transport hubs.

According to the World Health Organization (WHO, 2025), air pollution from transport causes about 250,000 premature deaths annually in Europe, and in Ukraine it significantly increases the incidence of respiratory and cardiovascular diseases.

To strengthen the argument, it is advisable to provide statistical data in Table 1, which demonstrates the share of different modes of transport in global emissions and their carbon footprint.

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Table 1. Quantitative distribution of emissions by transport mode

Type of transport	Share in global CO_2 emissions	Carbon footprint (g CO_2/ton-kilometer)
Road transport	~70% of transport emissions	62–150
Rail transport	~2%	14–30
Air transport	~12%	500–600
Maritime transport	~16%	10–40

Source: Compiled by the author based on International Energy Agency (IEA, 2025).

Below are measures to minimize this impact (Fig. 2) (Burenko Ya.O., 2023).

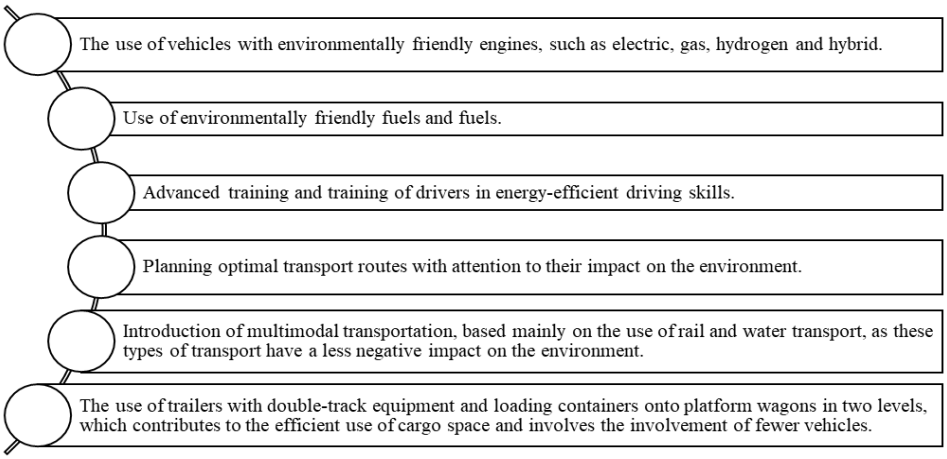

Fig. 2. Measures to minimize negative impact on the environment
Source: Compiled by the author based on the Law of Ukraine (2019, February 28).

Road transport, air transport, water transport and rail transport are particularly popular due to their efficient delivery times (Fig. 1) (Boychenko M.V., 2021). Therefore, transport companies, understanding the importance of this aspect, should calculate the emissions for each type of transport and offer customers alternative transportation options. Fig. 3 presents the projects of some companies in the field of "green" logistics (Margita N.O., Bilonizhka U.Z., 2014).

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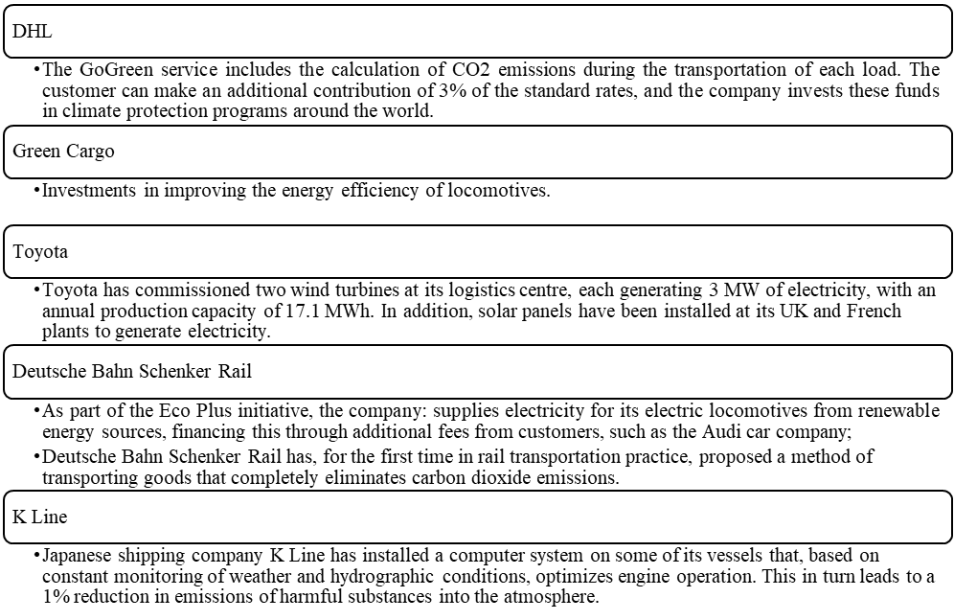

Fig. 3. Projects of companies in the field of "green" logistics
Source: compiled by the author based on (Margita N.O., Bilonizhka U.Z. 2014)

In the context of global trends in the greening of the transport sector, the Ukrainian example deserves particular attention. In 2024, the company Nova Poshta implemented a pilot project introducing electric trucks in the city of Kyiv. The aim of the project was to test the efficiency of using electric transport under conditions of intensive urban traffic and to assess its ecological and economic advantages.

The results of the first year of operation recorded a 28% reduction in CO_2 emissions compared to diesel equivalents. This confirms the data of the International Energy Agency (IEA, 2024), which notes that the introduction of electric transport in cities generally reduces emissions by 25–30%. Thus, the Ukrainian case aligns with international trends and demonstrates the real effectiveness of the technology.

In addition, fuel costs decreased by 35%, which corresponds to the estimates of the European Commission (2023), according to which the use of electric transport allows energy costs to be reduced by 35–40%. In the case of Nova Poshta, savings were achieved through route optimization and the use of proprietary charging infrastructure.

It is important to note that the company also invested in personnel training and maintenance of new vehicles. According to the World Bank (Unlocking Green Logistics for Development, 2023), such expenses at the initial stage may amount

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to 10–15% of additional operating costs, but in the long term they are offset by reduced fuel and maintenance expenses.
Thus, the Nova Poshta case confirms that the introduction of electric trucks in urban transport is not only environmentally sound but also economically beneficial. It demonstrates a synergistic effect—simultaneous reduction of emissions and optimization of costs—which corresponds to global practices and can serve as an example for other Ukrainian companies in the logistics sector.
Modern logistics companies are faced with increasing complexity and diversity of tasks. They operate in an environment of constant change, which requires finding new ways to improve efficiency.
Environmental issues are becoming increasingly important for society, which is putting forward social, political and economic demands for sustainable transport. These demands include reducing the environmental impact of the entire supply chain. There is a close interaction between logistics, environmental protection and natural resources (Burenko Ya.O., 2023).
In the Law of Ukraine "On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period Until 2030", it is advisable to identify among the root causes of environmental problems those that affect the development and implementation of "green" logistics concepts:
<…1. Environmental priorities are subordinated to economic considerations; environmental impact is not taken into account in legislative and regulatory acts, including decisions of the Cabinet of Ministers of Ukraine and other executive bodies;
2. The predominance of sectors of the economy that consume a lot of resources and energy, which mostly have a negative impact on the environment. This impact is significantly exacerbated by the lack of regulation of legislation in the context of the transition to a market economy;
3. Depreciation of fixed assets, both physical and moral, in all sectors of the national economy;
4. Ineffective system of state governance in the field of environmental protection and regulation of the use of natural resources, which includes the lack of coordinated actions between central and local executive authorities and local self-government bodies, as well as the unsatisfactory state of state environmental monitoring;
5. Low awareness among society of the importance of environmental protection and the benefits of sustainable development, as well as the imperfection of the system of environmental education and enlightenment;
6. Unsatisfactory compliance with environmental legislation and the rights and obligations of citizens in the field of nature protection;
7. Insufficient control over compliance with environmental legislation and the lack of ensuring the inevitability of liability for its violation;

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8. Insufficient financing of environmental measures from state and local budgets, with such financing being carried out on a residual principle...> (Law of Ukraine dated 2019, February 28).

Scientist Salo Ya.V. considers the term "Green" logistics as a series of measures aimed at combating environmental hazards that allow optimizing the use of resources. The main goal of "Green" logistics is to reduce the negative impact of transport on the environment and promote an ecological business model (Salo Y.V., 2023).

The goals of "Green" logistics are presented below (Fig. 4).

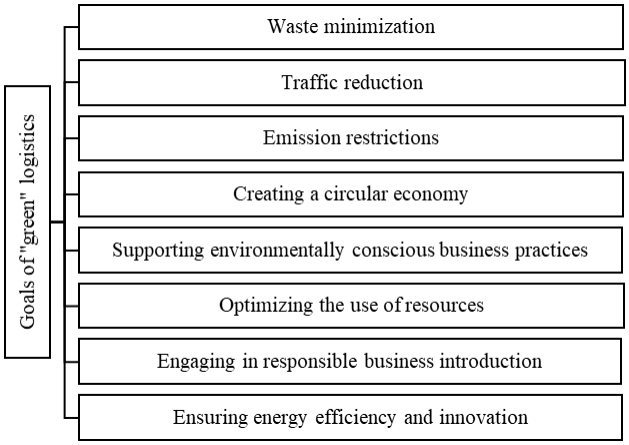

Fig. 4. Goals of “Green” logistics
Source: compiled by the author based on (Margita N.O., Bilonizhka U.Z. 2014)

Green logistics has many advantages, and their proper use can lead to an improvement in the environmental situation. The goals of green logistics are presented below:

• Minimizing waste and considering recycling policies is one of the most important goals of green logistics. The end result of recycling can be used in other industries, which will help reduce the negative impact on the environment and, equally important, reduce costs.

• The next goal is to reduce traffic, which implies the application of measures aimed at reducing traffic intensity, especially in a large city where population density poses a significant challenge.

• Reducing emissions is also an important goal of green logistics, which requires limiting harmful gas emissions. Many countries do not take into account limits on nitrogen dioxide emissions from vehicles and their combustion. The solution to this could be the creation of electric or industrial parks - areas designated for industrial development (Salo Y.V., 2023).

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• Creating a circular economy, which means striving to implement an economic model in which resources are used with maximum efficiency and cyclicality of use is a key aspect.

• Supporting environmentally conscious business practices promotes the implementation and development of business practices that support environmental standards and sustainable development principles.

• Resource optimization means ensuring the efficient and cost-effective use of resources, including energy, water, vehicles, and other materials.

• Engaging in responsible business conduct includes raising awareness among businesses and consumers about the environmental aspects of logistics and supporting a responsible approach to business practices.

• Ensuring energy efficiency and innovation includes the development and implementation of new technologies and innovations aimed at reducing energy consumption and increasing the overall energy efficiency of logistics processes.

Table 2 presents a comparative description of logistics and green logistics.

Table 2. Comparative characteristics of logistics and "green" logistics

Aspect	**Logistics**	**"Green" logistics**
Purpose and orientation	Focused on optimizing supply chain efficiency and meeting customer needs.	Aimed at reducing the negative impact of logistics operations on the environment and implementing sustainable practices.
Use of resources	Aimed at optimizing resource use, reducing costs and increasing efficiency.	Considers the use of environmentally friendly technologies and resources, minimizing the impact on the natural environment.
Transport	Focused on optimizing transportation solutions for speed and cost of transportation.	Aimed at using more environmentally friendly modes of transport and optimizing routes to reduce emissions of harmful substances.
Packaging and waste	Often emphasizes effective and protective packaging to ensure cargo safety	Aims to use environmentally friendly packaging materials and minimize waste through recycling policies.
goals	Focused on financial performance, speed and quality of customer service.	Evaluated by the degree of emission reduction, optimization of resource use and implementation of environmental initiatives.

Source: compiled by the author based on (Burenko Ya.O. 2023)

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According to the opinion of Solomnikov and Zhernova, modern measures and technologies aimed at ensuring environmental friendliness in logistics include the following aspects (Solomnikov I.V., Zhernova E.V., 2023):

1. Minimization of stocks and optimization of warehouse space. This contributes to the exclusion of intermediate storage and transshipment points from the logistics chain.

2. Transition to more environmentally friendly modes of transport. Includes the use of sea, water and rail transport, as well as reducing road transport and optimizing routes to reduce emissions of harmful substances.

3. Choosing environmentally conscious raw material suppliers. Preference given to suppliers who do not use non-renewable resources.

4. Reducing the use of paper in document circulation. Aimed at reducing the paper circulation of documents and minimizing the use of natural resources.

Table 3 discusses the advantages and disadvantages of "green logistics.

Table 3. Advantages and disadvantages of "green" logistics

Advantages	**Disadvantages**
Reducing environmental impact. It consists in reducing the negative impact of logistics operations on the environment.	High costs. The implementation of green technologies and practices is often associated with high costs for new technologies and personnel training.
Promoting sustainable development. Green logistics promotes sustainable development and helps implement the principles of green business.	Limited technological capabilities. Currently, there are limited technological solutions for some aspects of green logistics, which may make their large-scale implementation difficult.
Resource conservation. The use of environmentally friendly technologies and practices allows for more efficient use of resources, reducing costs.	The need for changes in production. Some environmentally friendly practices may require significant changes in production and supply chain.
Improved reputation: Businesses that focus on green logistics can benefit from a positive reputation and consumer favorability.	Complexity of logistics management. Taking into account new aspects, such as choosing environmentally friendly vehicles or optimizing routes, can complicate logistics management.
Regulatory compliance: Some regional and international regulations address environmental standards, and implementing green practices can help meet these requirements.	Lack of standards. There are currently no standardized protocols for assessing the sustainability of logistics practices, which can make it difficult to assess and compare the impact of different initiatives.

Source: compiled by the author based on (Salo Y.V. 2023)

The development of "green" logistics in Ukraine cannot be considered in isolation from global trends. International organizations and leading countries are shaping

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regulatory frameworks that define guidelines for the greening of transport processes and the integration of national strategies into the global context.
The European Green Deal (European Commission, 2019) has become the strategic foundation for achieving climate neutrality by 2050. Within its framework, the Fit for 55 package (European Commission, 2021) was adopted, which provides for a 55% reduction in greenhouse gas emissions by 2030. An important element is the Alternative Fuels Infrastructure Directive (European Commission, 2014/94/EU), which stimulates the development of infrastructure for electric transport and hydrogen technologies.
The U.S. Environmental Protection Agency (EPA, 2025) introduced Phase-3 Standards for freight transport aimed at reducing greenhouse gas emissions. In addition, federal tax incentives are in place for businesses transitioning to electric trucks and vans, as well as municipal zero-emission zone programs in major cities.
The World Bank (2023), in its report Unlocking Green Logistics for Development, recommends that developing countries integrate ecological principles into national transport strategies. The main directions include the development of multimodal transport, investment in clean technologies, and the removal of barriers in international trade.
The International Organization for Standardization (ISO, 2015) developed the ISO 14001:2015 Environmental Management Systems standard, which is widely applied in logistics companies to implement environmental management systems. In addition, the Paris Climate Agreement (UNFCCC, 2015) and the United Nations Sustainable Development Goals (UN, 2015) set global frameworks for emission reduction and the development of sustainable transport systems.
The scientific discourse on “green” logistics is actively expanding thanks to international publications. For example, Rastegardehbidi and Su (2022) conducted a systematic review of key drivers of green logistics and proposed a conceptual model for its development. The report by the World Economic Forum and Boston Consulting Group (2025) highlighted innovative approaches to implementing green logistics in developing countries, with an emphasis on competitiveness and creating shared value. Furthermore, an international study (2025) provided a comprehensive analysis of the impact of ecological practices on business sustainability, confirming the significance of green logistics as a tool for ensuring long-term company efficiency.
Therefore, for Ukraine, green logistics is not only an environmental challenge, but also a strategic opportunity to integrate into global supply chains, increase the competitiveness of the economy, and ensure sustainable development in accordance with international standards.
The implementation of green logistics is complex and accompanied by a dual effect: on the one hand, significant initial costs for infrastructure, technology, and personnel training; on the other hand, long-term benefits manifested in reducing

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environmental impact, saving resources, increasing competitiveness, and building a positive corporate image.

1. Main Costs of Implementing Green Logistics

• Investment in transport vehicles. The purchase of electric trucks, hybrid vehicles, and hydrogen technologies requires substantial financial resources. According to the European Automobile Manufacturers' Association (ACEA, 2024), the average cost of an electric truck is 25–35% higher than that of a diesel equivalent.

• Infrastructure. The construction of charging stations and hydrogen refueling facilities is a capital-intensive process. For example, in Germany, the cost of creating a network of 1,000 stations for freight transport is estimated at over €5 billion (Ponent Car, 2023).

• Personnel training. According to the World Bank (Unlocking Green Logistics for Development, 2023), training drivers and logistics managers in new technologies increases company expenses by 10–15% during the first years of implementation.

• Changes in packaging and logistics processes. Transitioning to biodegradable materials increases packaging costs by 20–30%, but in the long term reduces disposal expenses.

2. Benefits of Implementing Green Logistics

• Economic benefits. According to the European Commission (2023), the use of electric transport reduces fuel costs by 35–40%. Energy-efficient warehouses lower electricity expenses by up to 30%.

• Environmental benefits. Data from the IEA (2024) indicate that the introduction of electric transport in cities reduces CO_2 emissions by 25–30% within the first five years. In Kyiv, a pilot project by the company Nova Poshta using electric trucks demonstrated a 28% reduction in emissions compared to diesel equivalents.

• Competitive advantages. Companies that implement green logistics gain access to new markets. For instance, in the EU, compliance with the Fit for 55 package and the AFID directive is a prerequisite for participation in international tenders.

• Social and reputational benefits. According to Boston Consulting Group (2023), 65% of consumers in Europe prefer companies that declare environmental responsibility. This directly influences customer loyalty and investment attractiveness.

Despite high initial expenses, the long-term benefits of implementing green logistics significantly outweigh the costs. Empirical studies (EU, USA, Ukraine) confirm that economic efficiency is combined with ecological and social outcomes, creating a synergistic effect for both business and society. For Ukraine, this issue is particularly relevant in the context of integration into the European market, where compliance with environmental standards is a key condition for

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competitiveness. Green logistics can become a strategic factor in sustainable development and in strengthening the international position of Ukrainian companies.

Conclusions

Thus, considering the essence, advantages and disadvantages of "green" logistics, one can understand the level of relevance and importance of this area of modern supply chain management. "Green" logistics is a key element for achieving sustainable development in the field of transport and logistics. Summing up the consideration of this topic, several key conclusions can be noted.

First, green logistics aims to minimize the negative impact of logistics processes on the environment. This is achieved through the implementation of environmentally friendly technologies, route optimization, the use of renewable energy sources, and other measures.

Secondly, the benefits of green logistics include reducing emissions of harmful substances, optimizing fuel and resource costs, improving the company's image through a responsible attitude towards the environment, as well as the opportunity to attract new customers who prefer environmentally friendly products and services.

Third, while green logistics has many advantages, it also faces a number of challenges and disadvantages. These include the high costs of implementing green technologies, the complexity of managing green supply chains, and the uncertainty of standards and legislative regulation in this area.

In conclusion, green logistics is an important tool for improving sustainability in logistics systems. Its implementation helps companies reduce their environmental impact, secure competitive advantages and contribute to the creation of environmentally responsible businesses. However, the success of green logistics requires a comprehensive approach, active participation of supply chain participants and continuous improvement of sustainability strategies.

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Abstract

The essence of "green" logistics is considered in the article.

The share of harmful emissions by various types of transport, including road transport, air transport, water and rail transport, is indicated.

The projects of the companies DHL, Green Cargo, Toyota, Deutsche Bahn Schenker Rail, K Line in the field of "green" logistics were considered.

The root causes of environmental problems that affect the development and implementation of green logistics concepts in Ukraine have been clarified, among which we can note: subordination of environmental priorities to economic expediency, failure to take into account the consequences for the environment in legislative and regulatory acts; the predominance of resource- and energy-intensive industries in the structure of the economy with a mostly negative impact on the environment; physical and moral wear and tear of fixed assets in all branches of the national economy; inefficient state management system in the field of environmental protection and regulation of the use of natural resources; a low level of understanding in society of the priorities of environmental protection and the benefits of balanced (sustainable) development, the imperfection of the system of environmental education and enlightenment; unsatisfactory level of compliance with environmental legislation and environmental rights and responsibilities of citizens; unsatisfactory control over compliance with environmental legislation and failure to ensure the inevitability of liability for its violation; insufficient financing from the state

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and local budgets of environmental protection measures, financing of such measures on a residual basis.

The goals of "Green" logistics are characterized, which include: waste minimization and consideration of the recycling policy; reducing traffic; reduction of emissions; creating a circular economy; support of environmentally conscious business practices; optimization of resource use; involvement in responsible business conduct; ensuring energy efficiency and innovation.

The comparative characteristics of logistics and "green" logistics are considered, the main aspects of the comparison of which are: purpose and orientation; use of resources; transport; packaging and waste; objectives.

The advantages and disadvantages of "green" logistics are formulated. Among the advantages, the following were highlighted: reduction of environmental impact, promotion of sustainable development, saving of resources, improvement of reputation, compliance with regulations. Among the shortcomings, the following were highlighted: high costs, limited technological capabilities, the need for changes in production, the complexity of logistics management, and the lack of standards.

Measures to minimize the negative impact on the environment are presented..

Keywords: "green" logistics, logistics, essence, advantages, disadvantages, sustainable development, environmental management, emissions reduction, circular economy, eco-innovation, resource efficiency, waste minimization, renewable energy

JEL Classification: Q56, L91, R41, M 11