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GREEN LOGISTICS AS A VECTOR OF SUSTAINABLE DEVELOPMENT: INTERNATIONAL PRACTICES AND PROSPECTS FOR UKRAINE

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Abstract: This article discusses the international experience of implementing the concept of green logistics as one of the key areas of sustainable development in the field of logistics. The main statistical source is the World Bank's logistics performance index 2023 report. According to this report, countries with a high level of logistics efficiency are actively implementing tools to reduce greenhouse gas emissions, energy-efficient warehouses, digitalization of processes and optimization of transportation routes. The article analyzes the most significant initiatives, including carbon regulation in maritime and air transportation, programs to promote the use of

renewable fuels, the development of green infrastructure, and public funding for environmental solutions. Particular attention is paid to the possibilities of adapting such practices in Ukraine, given the current logistical challenges caused by the armed conflict, the low level of digitalization at customs and the lack of proper demand for green logistics from businesses. Conclusions are drawn about the need to harmonize Ukrainian logistics policy with European environmental standards and to introduce public-private partnerships in the field of sustainable logistics.

Keywords: green logistics; sustainable development; greenhouse gases; transport initiatives; environmental regulation; Ukraine.

1. Introduction

In today's world, characterized by globalization, increasing demands for environmental responsibility and frequent supply chain disruptions, sustainable development in logistics is becoming a priority for governments and businesses. Traditional logistics can no longer be limited to speed and cost criteria alone - factors such as reducing emissions, optimizing resources, and digitalizing processes are becoming increasingly important. According to the World Bank's Connecting to Compete 2023 report[2], the demand for environmentally sustainable logistics solutions is constantly growing, especially in highly developed countries: more than 75% of shippers regularly request green delivery options when exporting to such countries. At the same time, in countries with a low logistics rating, this share is less than 10%.

Another important factor is the ever-increasing regulatory pressure on logistics. Most countries are introducing stricter requirements for reducing emissions in road, sea, and air transport.

Thus, the study of the prospects and challenges of sustainable development in logistics is extremely relevant - especially for Ukraine, which seeks to integrate into the global economy on equal terms.

2 Literature review

2.1 Logistics Performance Index, International Bank report [1; 2] The World Bank assesses logistics systems in most countries. The resulting international

scorecard uses six key dimensions for comparative analysis of countries' performance and also displays the overall LPI index. The scorecard allows a country to be compared with other countries (with the ability to display the best global performance), as well as with a region or income group (with the ability to display the best regional or income group performance), based on the six indicators and the overall LPI index.

2.2 Tariff regulation

Source [3], combines information on the introduction of new tariffs, fees and their purpose. For example, the introduction of a carbon tax on maritime carriers supported by the International Maritime Organization (IMO), the FuelEU initiative, and the CO2 emissions fee for air carriers introduced by the International Civil Aviation Organization (ICAO).

2.3 international initiatives and trends in green logistics

Source [4] is a scientific article that analyzes international initiatives in the field of green logistics and outlines trends in the development of environmentally friendly logistics systems in the context of globalization. It is useful for substantiating the importance of adapting international experience in Ukraine.

2.4 An example of implementing green logistics principles in Ukraine. Source: [5], a good practical example of implementing green logistics principles in the Ukrainian context. The report of Nova Poshta demonstrates the measures taken by the company in the field of emission reduction, energy efficiency and corporate social responsibility, which emphasizes the opportunities for the development of sustainable practices in Ukraine.

2.5 low-carbon technologies in logistics operations [6], A scientific publication that analyzes the impact of the introduction of electric transport in the logistics industry on the environment, economy, and social aspects. It makes it possible to argue the importance of the transition to low-carbon technologies in logistics operations.

2.6 Government Initiatives and Incentives

An overview of government initiatives and incentives aimed at supporting green

logistics in different countries. Source [7] helps to illustrate examples of effective regulatory support for environmentally sustainable transportation.

3. Key messages on sustainable development in logistics from LPI 2023. 1)

Demand for "green logistics"

- The report emphasizes the growing demand for environmentally sustainable logistics solutions.

- 75% of exporters to countries with high logistics performance often or always request "green" delivery options (less emissions, optimal routes, energy efficiency).

- In countries with low indicators, this demand is less than 10%. - This indicates the unevenness of demand and the need to develop green initiatives in less logistically developed countries.

2) The biggest delays are not at sea, but in ports and at the border -

60% of the time in the logistics chain is spent at sea.

- The biggest delays occur during cargo handling at ports, airports, or multimodal terminals.

- Investments are needed in port productivity, customs clearance, and digital systems.

3) E-commerce and digitalization are changing logistics

- Transnational e-commerce is expected to grow from $300 billion to $1-2 trillion by 2030.

- This necessitates the adaptation of logistics to new formats: efficiency, flexibility, automation.

4. Ukraine's place in the global logistics performance index: a comparative analysis with Germany

The Logistics Performance Index (LPI), an international ranking developed by the World Bank and published every 2-3 years, is important in assessing the state of logistics at the global level. The LPI measures the efficiency of logistics systems in six key components: customs clearance, infrastructure, international deliveries, quality of logistics services, tracking and control, and on-time delivery.

The Logistics Performance Index (LPI) is a weighted average of a country's

score across six key indicators:

1) The efficiency of the clearance process (i.e., the speed, simplicity, and predictability of formalities) by border control agencies, including customs; 2) Quality of trade and transport infrastructure (e.g. ports, railways, roads, information technology);

3) Ease of organizing transportation at competitive prices;

4) Competence and quality of logistics services (e.g., transport operators, customs brokers);

5) Ability to track cargo;

6) Timeliness of cargo delivery to the destination within the planned or expected delivery time.

According to the latest Logistics Performance Index (LPI) study published by the World Bank in 2023, Ukraine received an overall score of 2.7 out of 5, ranking 79th among 139 countries. This indicates that Ukraine belongs to a group of countries with relatively low logistics efficiency.

It is worth noting that the war has a rather negative impact on logistics processes, for example, according to the same assessment as of 2018, Ukraine ranked 66th with a total score of 2.83. The partial and complete blocking of some ports, restrictions on rail transit, and disruption of supplies contributed to the deterioration of the score. This is even explicitly mentioned in the report as a factor that disrupted logistics in Europe. It is also stated that the impact on Ukraine's logistics customs revenues was also caused by the suspension of container transportation through Russia and Belarus, which hit the entire regional network.

The report also indicates that the demand for environmentally friendly logistics solutions ("green logistics") in Ukraine remains low, with less than 10% of shippers declaring a need for such services. This indicates a low level of maturity of the sustainable approach in logistics processes, but at the same time creates an opportunity for further development towards sustainable logistics.

It is also worth noting that there is a company in Ukraine that not only keeps

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up with the leading European logistics companies despite all the difficulties, but even surpasses them in many aspects - Nova Poshta. This company always tries to keep up with the times. According to [4], back in 2019, Nova Poshta launched an innovative sorting terminal in Khmelnytskyi equipped with an automated sorting belt. In just the first year after the project was completed and implemented, the company managed to reduce the accident rate by as much as 26 percent. According to the company's 2022 sustainability report [5], innovation and automation have become one of the most prominent areas of the company's activities. Despite the shelling, destroyed terminals, and constant threat, Nova Poshta has invested tens of millions of euros in the latest automated logistics complexes. In particular, the DAO terminal was opened in Dnipro, the second largest after the Kyiv terminal. Thanks to robotic systems, intelligent scanners and automatic sorting, the company was able to process up to 15 million shipments per day, which allowed it to maintain the quality of service even during peak periods. Innovation has become not only a tool for efficiency, but also a means of survival and adaptation.

Development is not possible without infrastructure resilience, and here Nova Poshta has demonstrated incredible resilience. Despite the losses - more than six damaged terminals, hundreds of destroyed or looted branches - the company restored the network in a matter of weeks. At the same time, autonomous post offices were introduced that work even without electricity and the Internet, which was a real breakthrough in the war. The infrastructure expansion continued not only in Ukraine: the company opened its first offices in Poland, launched mobile outlets in the de-occupied cities, and the network of post offices became one of the largest in Europe. Nova Poshta is a true example of a super-successful Ukrainian company, because even despite the war, they managed to create their own airline, Supernova Airlines, which makes a significant contribution to logistics. Other Ukrainian carriers have a very good example to follow.

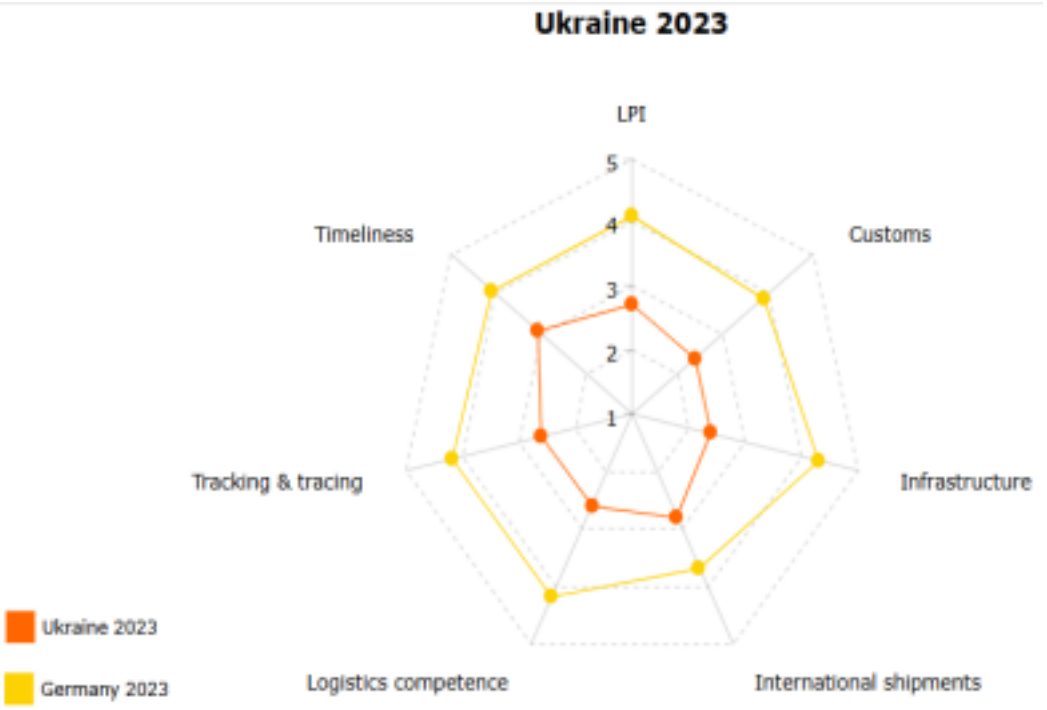

Diagram 1 - Comparison of logistics capacities of Ukraine and Germany according to the World Bank rating in the form of a petal chart

Table 1 - Comparison of logistics capacities of Ukraine and Germany according to the World Bank rating

Country	Year	LPI Rank	LPI Score	Customs Score	Infrastructure Score	Intertational shipments Score	Logistics competence Score	Tracking and tracing score	Timeliness Score
Germany	2023	3	4,10	3,90	4,30	3,70	4,20	4,20	4,10
Ukraine	2023	79	2,70	2,40	2,40	2,80	2,60	2,60	3,10

4. What Ukraine needs to do to improve logistics

1) Modernization of customs and border control

- Automation of procedures, application of risk management, reduction of manual processing.

- Implementation of digital customs clearance systems with open data exchange with business.

- Reducing delays that have the greatest impact on exports/imports in countries with low LPI.[2]

2) Investments in infrastructure (but in coordination with "soft" reforms) - Development of ports, logistics hubs, and multimodal terminals. Implementation of electronic port management systems (Port Community Systems) for transparent interaction of all logistics participants. [Logistics Performance Index, International Bank Report]

3) Development of digital monitoring systems (tracking & tracing)

- According to the World Bank, more successful countries (for example, India, which claims to be among the leaders in logistics services in Asia) have already reduced delays thanks to such systems.

- Ukraine has the potential to quickly implement real-time cargo tracking systems through mobile applications and online services.

4) Development of logistics services and zones (logistics clusters) - Creation of integrated logistics zones near ports, airports, and railway junctions.

- Support for third parties in logistics (3PL) to unload state-owned and transport enterprises.

5) Involvement of the private sector

- Providing operators with access to terminal and transshipment management. - Public-private dialog - creation of permanent cross-sectoral councils or working groups (like Dinalog in the Netherlands).

6) Stimulating "green logistics"

- Switching to less carbon-intensive modes of transportation, energy-efficient warehouses, and environmentally friendly packaging.

- Create favorable conditions for companies that implement sustainable logistics.

- Creating a national program to support sustainable carriers.

Summarizing all this, Ukraine has a great potential not only to catch up with the level of international partners, but even to surpass them by becoming a powerful logistics hub between Europe and Asia. Moreover, there is already a good example in the form of Nova Poshta, which systematically implements all the latest solutions and technologies.

5. Examples of solutions to improve the environment in the logistics sector 1)
Shift to less carbon-intensive modes of transportation

- Countries are developing rail, electric, and multimodal transportation to reduce emissions from motor vehicles.

- Particular attention is paid to air and sea transportation, where regulatory pressure to reduce emissions is constantly growing

In a scientific article [6], the importance of electric trucks for logistics was discussed.

Carbon emissions from medium- and heavy-duty trucks in the United States amount to ~438 million tons of CO_2/year. Switching to electric traction could reduce emissions by 19-43%, resulting in $8.3-18.8 billion in annual savings if a carbon tax of $100/tonne CO_2 is introduced Electric trucks have a number of advantages:

- Zero emissions - improving air quality in cities.

- Less maintenance - due to fewer moving parts.

- Lower fuel costs - electricity is cheaper than diesel.

- Possibility of obtaining government subsidies - reduces the start-up cost. -

Quietness - reduces noise pollution during night deliveries.

According to the calculations, the savings from the purchase of 25 trucks amount to as much as $300,000 per year due to the cheapness of electricity compared to traditional fuels.

A significant challenge to the introduction of electric trucks in Ukraine is the need to massively expand the network of high-speed charging stations. As for more realistic actions, there is regulatory pressure. According to [3], starting in 2023, a carbon fee of $ 2 per ton of fuel oil consumed will be introduced for maritime carriers. The initiative is being implemented with the participation of the International Maritime Organization (IMO), which is a specialized UN body and acts as a global regulator of the shipping industry.

In order to reduce CO_2 emissions and carbon footprint in maritime transportation, the EU Council approved the FuelEU Maritime initiative. This program aims to increase the share of renewable and low-carbon fuels in the European Union's maritime transport. The innovations will come into force in 2025 and will facilitate the transition to more environmentally friendly solutions in the industry.

In addition, starting from 2027, the Council of the International Civil Aviation Organization (ICAO) plans to introduce a fee for air carriers for excessive CO_2 emissions - in case of exceeding the level recorded in 2019.

2) Energy-efficient warehouses and terminals

- The use of smart lighting, automated control systems, temperature control, and green building solutions (e.g., LEED certification) is becoming more common. This helps to reduce energy consumption and maintenance costs. 3) Improving cargo utilization (capacity utilization)

- One of the key strategies is to optimize vehicle occupancy to avoid transporting half-empty containers or vehicles.

This not only saves fuel, but also reduces the overall carbon footprint of logistics activities

4) Use of digital technologies

- Many countries are introducing Big Data, artificial intelligence, and GPS logistics to predict traffic, congestion, and route optimization.

Digitalization contributes to better visibility of supply chains and reduces unnecessary trips or delays.

5) Green logistics policy at the government level

- Many governments are formulating national sustainable transport strategies that include tax breaks, grants, and regulatory incentives for carriers that adopt green

practices.

Highly developed countries demonstrate the highest level of demand for green logistics, with over 75% of shippers requesting such services.

- According to [7], we have good examples of the impact of government incentives on the development of green logistics:

- Norwegian incentives for electric vehicles

- Norway has become a world leader in the use of electric vehicles thanks to a comprehensive package of incentives. These include tax breaks, reduced road tolls, and access to bus lanes for electric vehicles. As a result, many logistics companies in Norway have quickly switched to electric vans and trucks, significantly reducing their carbon footprint.

- German truck tolling system

- Germany has introduced a distance-based truck tolling system that takes into account the emissions class of the vehicle. Vehicles with low emissions pay lower tolls, which creates a strong incentive for logistics companies to invest in environmentally friendly fleets. This system has led to a significant increase in the use of low-carbon and electric trucks on German roads.

- Subsidies for New Energy Vehicles in China

- China has introduced significant subsidies for new energy vehicles, including electric and hydrogen trucks. These incentives have accelerated the adoption of environmentally friendly vehicles in the logistics sector, and many large e-commerce and delivery companies have switched to electric fleets.

- California Low Carbon Fuel Standard

- The California Low Carbon Fuel Standard (LCFS) program provides credits to companies that use low-carbon fuels.

Conclusion

Sustainable development of logistics is not only a response to the environmental challenges of our time, but also a strategic condition for strengthening the competitiveness of countries in the global economy. The analysis of international experience shows that the integration of environmental practices into logistics processes is becoming a global standard, forming a new paradigm for organizing transportation, warehousing, and supply chain management.

The results of the study point to the need for Ukraine to actively borrow and adapt the best global practices of green logistics implementation. Successful completion of this path will require not only technical changes, but also a revision of government policy, corporate strategies, and social priorities towards long-term sustainable development.

Sustainable logistics development should be viewed as a comprehensive

process that integrates environmental, economic and social aspects. Only the synchronization of these dimensions will ensure the true sustainability of the national logistics system, integrating Ukraine into global environmental and economic trends.

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Of course. Here is the expanded article, now including detailed examples of both excellent and poor International Strategic Management.

INTERNATIONAL STRATEGIC MANAGEMENT

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In today's hyper-connected world, the business landscape is no longer confined by national borders. Companies, from tech giants to niche startups, are looking beyond their home markets for growth, efficiency, and competitive advantage. This expansion into the global arena necessitates a sophisticated approach to planning and execution, a