

THE MAIN TRENDS OF LOGISTICS IN THE CIRCULAR ECONOMY

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Abstract:

The important environmental problems at the planetary level require the global implementation of a new model of economic activity called the circular economy, which represents a regenerative business model in which resources are used as long as possible. Like any economic model, the circular economy needs an adequate logistic system to ensure its good functioning. Following the adaptation of logistics to the needs of the circular economy, new concepts such as green logistics (eco-logistics), sustainable logistics, and reverse logistics were developed. The application of these concepts involves the application of innovative strategies, technologies, and policies to reduce carbon emissions, energy consumption, waste generation, and other negative environmental impacts associated with the transport and logistics industries. These activities have led to important changes to ensure the sustainability of the entire component supply chain. Also, new concepts of logistics such as green logistics and sustainable logistics appeared, as well as the revision of the composition of reverse logistics.

Keywords: circular economy; green logistics; sustainable logistics; reverse logistics

JEL classification: Q01, Q56

Introduction

Since 2009, several experts have started sounding the alarm about the creation of a disastrous global ecological situation caused by human activity.

In relation to this, the author András Takács-Sánta (2022) stated: "The current ecological crisis (comprised of interwoven environmental problems such as global climate change, loss of biodiversity, soil degradation, smogs, toxic effects of synthetic chemicals etc.) is the result of excessive human transformation of the biosphere."

The basic factors of the global ecological cataclysm are the growing pollution of the planetary environment, as well as the irrational expansion of the consumption of the planet's natural resources. (15 Biggest..., n.d.).

The World Business Council for Sustainable Development has calculated that if humanity does not abandon the linear model of economic development, by 2050 the ecological resources of 2.3 planets will be needed. (Hofman, 2023).

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The global implementation of the circular economy, which in 2018 had a share of only 8.6% of the world economy, is considered by many specialists as a solution to the crisis situation. (Marino, 2022)

Therefore, the global implementation of the circular economy will require substantial efforts of a different kind.

Description of the Problem

Worldwide, an impressive development of the circular economy is expected for the coming years.

Research by Accenture shows that the circular economy could contribute to an economic development boost of USD 4.5 trillion by 2030 mainly by optimizing the consumption of natural resources. (The Circular..., n.d.)

Estimated revenues for circular economy transactions worldwide in the years 2022-2026 are set to increase from USD 338.9 billion to USD 712.7 billion. (Estimated..., n.d.)

According to the International Labor Organization, the application of circular strategies could lead to an increase of 6 million jobs by 2030. (ILO, 2023)

The global circular economy market size is expected to grow from USD 2.41 trillion in 2022 to USD 4.5 trillion by 2030. (*Unlocking...*, n.d.)

The development of the circular economy requires an important adjustment of the related logistics systems, which will be examined in this article.

This aspect is also confirmed by the information presented by DHL, according to which the global supply chain and logistics industry generates approximately 3.9 billion tons of CO₂ emissions annually, which is approximately 8% of the world's total emissions, and supply chains considered in their entirety create more than half of all global carbon emissions. (*Supply...*, n.d.).

Methodology and Data

In order to perfect this article, the reports of some specialized companies were examined, as well as the publications of experts in the field addressed. Then the synthesis of these materials was carried out to form a complex picture of the logistical aspects of the implementation of the circular economy.

Results

Following the adaptation of logistics to the needs of the circular economy, new concepts were developed (Figure 1).



Source: developed by the authors

Figure 1. Recent trends in logistics development

It is about interconnected notions, such as green logistics (eco-logistics), sustainable logistics, and reverse logistics, as well as sustainability of the supply chain.

The common element that connects them is the fact that they support a circular economy and emerges from environmental, social, or corporate governance considerations as raw materials are taken, converted into products, and delivered to the market.

In the context addressed, Leonidas Milios (2018) mentions three policy areas:

- (1) policies for reuse, repair and remanufacturing;
- (2) green public procurement and innovation procurement;
- (3) policies for improving secondary materials markets.

The notion of green logistics refers to the implementation of sustainable practices in logistics activities to reduce the impact on the environment. (*Green Logistics...*, n.d.)

The basic peculiarity of green logistics consists in placing emphasis on more ecological and sustainable processes in order to reduce the impact of logistics on the environment. Green logistics tends to minimize the environmental impact of logistics activities, including the activities of direct and reverse flows of products, information and services between the point of origin and the point of consumption. Green logistics implements innovative strategies, technologies, and policies to reduce carbon emissions, energy consumption, waste generation, and other negative environmental impacts associated with the transportation and logistics industries. (*Green logistics*, n.d.), (*Green logistics...*, n.d.), (*What is...*, n.d.)

In this context, the expert Hans Dekker (2023) states: “Also known as eco logistics, green logistics is a set of sustainable logistics practises and measures in supply chain management and transportation operations. It aims at minimising the negative impact of logistics operations such as transportation, warehousing, inventory management, and distribution on the environment. It encompasses various strategies and initiatives emphasising carbon footprint, energy consumption, waste generation, and resource depletion throughout the supply chain processes.”

After studying the forecasts related to the evolution of the global ecological logistics market, we can speak of growth from USD 1.0 trillion in 2021 and USD 1.3 trillion in 2022, to USD 1.5 trillion in 2028 and USD 2.9 trillion in 2032. market. (*Global Green...*, 2023), (*Green Logistics...*, n.d.)

At the same time, experts estimate the volume of the global logistics market at the level of USD 7.98-10.68 trillion in 2022 and expect it to grow to USD 18.23 trillion by 2032. (*Logistics Market*, n.d.), (*Logistics Market...*, n.d.)

This means that the share of the ecological logistics market has a share of 12.2%-16.3% in the total volume of the respective market in 2022, which will constitute 15.9% in 2032.

Implementing green logistics can bring a number of benefits (Dekker, 2023), (Champion,

2021), (*What are...*, n.d.):

1. *Reducing gas emissions* by following green best practices to reduce the carbon footprint of the supply chain. This includes everything from reducing energy consumption to streamlining logistics operations for greater efficiency.

2. *Optimizing the supply chain* by applying sustainability principles in the choice of suppliers, companies can choose partners with ecological practices and ethical sourcing policies.

3. *Mode shifting and route optimization* by changing the prioritization in the choice of long-distance transport solutions. For example, companies may prefer rail or sea transport over road transport, as these modes typically have smaller carbon footprints. In addition, optimizing delivery routes can reduce mileage, fuel consumption and emissions while improving on-time delivery performance.

4. *Reduced costs and losses in different ways*. One of the ways is the use of biodegradable or reusable packaging or materials. They are more expensive to buy than single-use materials and components, but recyclable materials can save companies money in the long run. These include: cardboard instead of wooden pallets, reusable plastic wrap, etc. It can also be about reducing losses of goods or raw materials in the warehouse. Avoiding throwing away unused raw materials by directing them towards recycling or reuse saves money on replacing raw materials.

5. *Technology integration*. Using real-time data tracking and analysis systems can help optimize fleet management, monitor fuel consumption and identify areas for improvement. In addition, implementing automated warehouse systems and using cloud-based logistics platforms can streamline operations, improve efficiency and reduce paperwork, resulting in significant resource and cost savings.

6. *Collaboration and partnerships*. Partnerships between green transport providers and logistics service providers can also help reduce emissions and promote sustainable practices throughout the supply chain.

7. *Promoting energy efficiency and the use of alternative fuels*. Companies can invest in energy-efficient vehicles and equipment, such as electric or hybrid trucks, and optimize fuel consumption through driver training and vehicle maintenance programs. Companies can also optimize warehouse activity to reduce energy consumption and improve space utilization. The use of alternative fuels (biodiesel, natural gas or hydrogen) can further reduce carbon emissions and dependence on fossil fuels.

8. *Continuous improvement and performance measurement* against indicators related to carbon emissions, energy consumption, waste reduction and cost savings should be established and tracked. By analyzing the data and comparing it to established standards, companies can identify areas for improvement and implement continuous optimization strategies.

9. *Regulatory compliance and certification*. Companies must ensure compliance with local and international environmental regulations, such as emission standards and waste disposal requirements.

10. *Employee involvement and training*. It is about increasing workers' awareness of the environmental impact of logistics activities and involving employees in finding innovative solutions can generate valuable ideas. Also of great importance are programs to train employees with the skills and knowledge to effectively implement green practices.

11. *A better business image*. Companies that have adopted green logistics present themselves in the market as eco-responsible, which is beneficial for their image in the eyes of suppliers, customers or stakeholders in general. In some countries consumers have become aware of

their carbon footprint. They want to know which brands align with their values and their ultimate environmental impact. When brands implement green logistics in their business, communicating this information to customers raises awareness and gives them guidance on how they can carry out their own sustainability efforts.

Green distribution is related to the notion of ecological logistics, which presents the totality of activities and practices of transporting goods from supplier to customer and vice versa in an ecological way, i.e. ensuring the minimization of damage to the environment. It's green improvements across the entire supply chain, including warehousing, order processing, packaging, and final-mile delivery. Green logistics reduce waste and emissions—ideal for businesses that hope to shrink their carbon footprint. (*Green Distribution...*, n.d.), (*What is...*, n.d.)

Likewise, as an important part of green logistics is *green packaging* (which is also called sustainable packaging or eco-friendly packaging), which provides for the important reduction of packaging on the environment and the ecological footprint. It is about ecological packaging (also called sustainable packaging), which uses materials and manufacturing techniques to reduce energy consumption and reduce the harmful impact of packaging on the environment. Green packaging solutions often include biodegradable and recyclable materials, which reduce the demand, energy, emissions and resources spent on materials that are ultimately wasted. (*Sustainable...*, n.d.) (*What is...*, n.d.)

The following can be mentioned as forms of green packaging (Nicasio, 2021):

- 1.Compostable packaging, which provides for the use of plant-based, renewable, and recyclable materials;
- 2.Recycled packaging, which is related to materials that can be used again, mostly after processing;
- 3.Corrugated packaging, which refers to box fibers made mainly from trees and old corrugated containers.

Sustainable logistics is the practice of integrating environmental concerns into logistics and consists in order to minimize their impact on the environment and promote sustainability.

It is a set of practices that look to limit the environmental impact of operations such as transport and warehousing. (*The road...*, n.d.)

The experts at Glaube Logistics presented the following vision: “Sustainable logistics is the efficient and environmentally friendly movement of goods and resources. It encompasses all aspects of the supply chain, from procurement and production to transportation and distribution. Sustainable logistics practices help businesses reduce their environmental impact while improving efficiency and lowering costs.” (Glaube Logistics, 2023)

On the other hand, Mecalux experts say: “The concept of sustainable logistics is key in the development of a circular economy, a production, distribution and consumption model that involves recycling and reusing materials to prolong their usefulness as far as possible and generate less waste.” (*The road...*, n.d.)

There are many benefits of sustainable logistics for businesses, including (Glaube Logistics, 2023):

- Reduction of greenhouse gas emissions by up to 50%;
- Improving overall business efficiency by up to 30%;
- Reduce shipping costs by up to 15%.

The main objectives of sustainable logistics are the following (*The road...*, n.d.):

- Quantifying the carbon footprint of logistics operations and implementing actions to reduce greenhouse gas emissions;
- Planning logistics and transport operations to optimize the use of fuel, vehicles and transport containers. Companies can reduce pollution caused by the movement of goods by integrating strategies such as intermodal transport and electric trucks into their logistics planning.
- Promoting sustainability throughout the supply chain. Sustainability should be applied in all phases: from product design and distribution of materials to delivery of goods to end customers.

Some authors promote the concept of *circular economy based reverse logistics*. (Fernando et al., 2022)

Reverse logistics includes (*Reverse Logistics...*, n.d.):

- Processing returned merchandise due to damage, seasonal inventory, restock, salvage, recalls, and excess inventory;
- Recycling programs, hazardous material programs, obsolete equipment disposition, and asset recovery.

According to some experts, the connection between the circular economy and reverse logistics is expressed by the following: "Reverse logistics in the circular economy is the process of collecting and aggregating products, components or materials at the end-of-life for reuse, recycling and returns. Reverse logistics also referred to as "aftermarket supply chain," closes the loop. Take-back programs, warranties and product defect returns all require reverse logistics to get the product from the consumer back to the manufacturer." (*Reverse Logistics...*, n.d.)

In the context of the implementation of reverse logistics, it should attract more attention. For example, as the volume of online shopping increases, there are more customer returns than in-store purchases, especially when using the "subscription box" business model of brands, which is based entirely on the concept of customers selecting from a wide range of delivered goods and returning whatever they decide not to keep. The global value of returned goods in e-commerce is expected to exceed one trillion dollars in the next decade. Additionally, shipping returned goods creates over 15 million metric tons of CO₂ in the US alone each year. (*Green logistics...*, n.d.)

Supply chain sustainability means ensuring that all processes, activities and steps involved in the production, transport and delivery of goods and services within a supply chain meet ecological standards and are socially responsible. (*Supply Chain...*, n.d.)

Supply chain sustainability takes into account the environmental impact of sourcing raw materials, manufacturing products and transporting them to customers, as well as the impact of these activities on communities. This stems from environmental, social and corporate governance considerations throughout the supply chain, sourcing and logistics. (*Supply Chain...*, n.d.)

In the view of specialists from the United Nations Global Compact, the sustainability of the supply chain is broader than the notion of green logistics: "Supply-chain sustainability is the impact a company's supply chain can make in promoting human rights, fair labor practices, environmental progress and anti-corruption policies." (*Supply chain...*, n.d.)

Expert David Luther (2020) states: "Supply chain sustainability refers to companies' efforts to consider the environmental and human impact of their products' journey through the supply chain, from raw materials sourcing to production, storage, delivery and every transportation link in between. The goal is to minimize environmental harm from factors like energy usage, water consumption and waste production while having a positive impact on the people and

communities in and around their operations."

Focusing on supply chains is important in the context of circular economy implementation, as more than 90% of an organization's greenhouse gas emissions and 50% to 70% of operating costs are attributed to supply chains. (Alves, Steinberg, 2022)

Recent studies have demonstrated the main reasons for the acceptance of the concept of supply chain sustainability by companies (Alves, Steinberg, 2022): cost reduction (61%); compliance with regulatory requirements (51%); pressure from partners and suppliers (41%); increased revenue growth potential (28%); pressure from customers (26%); pressure from workforce (25%); awareness of ethical responsibility (21%).

Conclusions

Environmentalism, the concept of sustainable development and the implementation of the circular economy have become the basic progressive trends worldwide. The rational use of natural resources, the harmonious combination of the interests of business, society and the environment are their basis. A large part of the problems of the circular economy fall into the sphere of logistics. This is where the ideas of green logistics and sustainable logistics come from, which take care of transport efficiency, supply chain optimization, sustainable packaging and energy efficiency. Equally important are saving time, money and resources, increasing logistics efficiency and business reputation.

Future Directions

Due to the importance of the object of study, we consider it necessary to continue studies on the evolution of the circular economy globally and in the Republic of Moldova, as well as related logistical aspects.

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