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GREEN LOGISTICS IN THE CONTEXT OF EUROPEAN POLICIES AND DIRECTIVES: A LEGISLATIVE AND PRACTICAL ANALYSIS

Elena CARP*[1]

Abstract: *Over the last decade, the European Union has stepped up its efforts to integrate sustainable development principles into its transport policies, placing green logistics at the heart of the ecological transition. This article analyzes the European Union's legislative framework on green logistics, focusing on the key directives, regulations, and strategies that regulate and guide Member States' practices. Through a critical analysis of legislative instruments such as Directive 2014/94/EU on alternative fuels infrastructure and Regulation (EU) 2020/1056 on the digitization of freight transport, the research highlights the role of European regulations in creating a coherent framework for promoting sustainability in the logistics sector. It also analyzes the impact of the European Green Deal and the "Fit for 55" legislative package on transport policy reform and the overall goal of climate neutrality. The paper includes examples of good practices from member states, with a focus on their applicability in Eastern Europe, where differences in administrative capacity and infrastructure pose significant challenges. The findings show that while EU Member States benefit from advanced infrastructure and financial mechanisms, the Republic of Moldova remains in a stage of partial alignment, with significant opportunities for convergence through digitalization, institutional reforms, and cross-border cooperation.*

Keywords: *green logistics, European directives, environmental policies, sustainable transport, sustainable development, European integration.*

JEL Code: *F55, K32, Q58, R41*

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Introduction

In the context of the reconfiguration of global climate policies and the European Union's increasingly ambitious commitments to climate neutrality by 2050, *green logistics* has become a central component in achieving sustainable development goals. The transformation of traditional logistics systems into an environmentally friendly and energy-efficient model is supported by a complex legislative framework, consisting of European directives, regulations, and strategies aimed at reducing greenhouse gas emissions, optimizing transport, and encouraging the use of alternative fuels (European Commission, 2019).

Green logistics refers to the integration of environmental protection principles into all stages of the logistics chain - from production, packaging, and storage to transport and distribution - in order to minimize environmental impact (Zhang et al., 2020). In this regard, EU policies are geared towards developing sustainable infrastructure in the context of updating a harmonized legislative framework to ensure the consistent implementation of these principles in Member States and candidate countries.

The Republic of Moldova, as an associated state and aspirant to European Union integration, is in an advanced process of transposing and adapting European legislation in

*[1] *Elena Carp, PhD student, USM,* elena.carp@usm.md *ORCID: https://orcid.org/0000-0003-0399-6141*

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the field of green transport and logistics. This process involves the adoption of a set of legislative and institutional measures that reflect the commitments made under the Association Agreement and the Roadmap on Integration into the European Single Market (Government of the Republic of Moldova, 2023). Furthermore, the implementation of European best practices in logistics requires operational adjustments, investments in green infrastructure, and incentives for the private sector.

The central research problem addressed in this study concerns the extent to which the Republic of Moldova's national legislation and institutional framework are aligned with the European Union's normative system on green logistics. Accordingly, the paper seeks to identify the main legal, institutional, and operational barriers that limit the full transposition of the acquis and to propose strategic measures for effective harmonization.

This paper aims to analyze, from a legislative and practical perspective, the European regulatory framework on green logistics, with a focus on the relevant directives, regulations, and policies of the European Union, as well as on the concrete ways of applying and transposing them in the national context of the Republic of Moldova. The study aims to highlight the level of alignment between the requirements by the acquis communautaire and the national legislative framework, to identify legal, institutional, and operational challenges in the implementation process, and to formulate strategic directions for the harmonization and effective integration of green logistics into the European logistics space. The objectives of the paper include: (1) analyzing the European legislative framework applicable to green logistics; (2) assessing the degree of compliance of Moldovan policies and regulations with EU standards; (3) identifying implementation barriers and enabling factors; and (4) formulating recommendations for strengthening the public policy framework in the field of sustainable logistics. The contribution of this paper is to provide an integrated perspective on the European legislative framework on green logistics by correlating the normative dimension with practical applicability in the context of the Republic of Moldova, thus highlighting both the level of convergence with European Union policies and the directions necessary for effective and sustainable harmonization of logistics systems.

Theoretical and conceptual framework

The concept of ***green logistics*** has gradually taken shape in the specialist literature at the intersection of supply chain management, sustainability, and environmental policy. Essentially, green logistics refers to the set of logistics practices and processes aimed at reducing the impact on the environment by minimizing greenhouse gas emissions, using resources efficiently, and promoting sustainable transport (Sbihi & Eglese, 2007; Zhang et al., 2020).

The literature highlights that green logistics is not limited to the application of technological solutions, but is also an essential component of a broader *green supply chain management* (GSCM) system. Sbihi and Eglese (2007) highlighted the importance of combinatorial optimization in reducing environmental impact, while Zhang, Sun, Bi, and

Liu (2020) proposed a hierarchical framework for identifying the determinants of green logistics. In addition, Herrmann, Barbosa-Póvoa, Butturi, Marinelli, and Sellitto (2021) provide a conceptual framework and analytical models for evaluating green supply chains, emphasizing the interdependence between organizational, technological, and institutional factors. Thus, the theory reveals that the success of green logistics depends on the correlation of technological dimensions with public policies and governance strategies. Theoretically, this approach derives from the ***triple bottom line*** paradigm (Elkington, 1997), which supports the balanced integration of economic, social, and environmental performance in the decision-making processes of organizations.

Recent research highlights that green logistics goes beyond daily operations, serving also as a strategic tool that helps guide public policies. (Dekker et al., 2012). This involves the implementation of mechanisms to improve transport efficiency, reduce energy consumption, use alternative fuels, and integrate smart technologies into logistics flow management (Demir et al., 2014). More than just an operational trend, green logistics has become a normative benchmark in the development of European policies on climate neutrality, reflected in the Green Deal initiatives, the Sustainable and Smart Mobility Strategy, and the "Fit for 55" legislative package (European Commission, 2021).

On the other hand, in analyzing the conceptual framework, it is important to distinguish between ***sustainable logistics*** and ***green logistics***. The former has a broader dimension, also encompassing social and economic aspects (e.g., equity in the supply chain or social inclusion), while green logistics focuses mainly on the ecological dimension—namely, reducing pollution and conserving natural resources (Sbihi & Eglese, 2007). In the European context, these concepts converge in integrated strategies for sustainable mobility development, which also justifies the integrative approach of this study.

At the same time, the theoretical analysis of green logistics must include the legal and institutional framework that allows it to function in a regulated economic space. In the European Union, Directive 2010/40/EU on intelligent transport systems, Regulation (EU) 2021/1119 on the climate neutrality objective, and the Directives on alternative fuels or emission standards form the normative basis for legislative intervention in the field of logistics (European Parliament & Council, 2010, 2021). These regulations set environmental targets and impose specific obligations on Member States and associated countries, which gives them an important role in the comparative analysis of transposition in the national context.

Methodologically, the study is grounded in a multidimensional framework that brings together regulatory theory (Majone, 1996) and multi-level governance approaches (Hooghe & Marks, 2001), offering valuable insights into how European policies are adapted and applied within diverse institutional contexts, including the Republic of Moldova. This framework allows not only for an understanding of normative transfer, but also for a critical analysis of institutional capacity for absorption and compliance. Therefore, green logistics can no longer be treated exclusively from the perspective of technical efficiency or commercial performance, but must be analyzed in relation to the

normative, political, and strategic processes that shape the infrastructure and functioning of logistics systems in contemporary Europe.

Research methodology

The methodology adopted in this research combines qualitative and comparative tools, with the central objective of investigating the European legislative framework on green logistics and its adaptation to the realities of the Republic of Moldova.

The methodological approach aims to: (a) critically analyze relevant European directives and policies; (b) identify good practices and challenges encountered by Member States in the implementation process; (c) assess the degree of compatibility of the national regulatory framework with European legislation; and (d) formulate applicable recommendations for the harmonization of national policies. To achieve these objectives, the following were applied:

- legislative and documentary analysis, by examining the directives and strategies developed by the European Union institutions (DG MOVE[2] , DG ENV[3] , TEN-T[4]), correlated with the legislation and strategies of the Republic of Moldova;
- comparative method, used to highlight the similarities and differences between good practices in Member States and the possibilities for national transposition;
- induction and deduction, applied to extract general trends from European experience and adapt them to national specificities;
- synthesis analysis and critical interpretation, by integrating the results into tables and figures and formulating coherent conclusions.

The choice of this methodology is based on the interdisciplinary nature of green logistics, which combines legislative, economic, and environmental dimensions. Thus, a qualitative and comparative approach provides the opportunity to describe the regulatory framework and critically assess its relevance and applicability in the context of the Republic of Moldova.

The main limitation of this research lies in its qualitative and documentary nature, which does not allow for direct quantitative verification of all policy outcomes. However, data reliability was ensured through triangulation of official EU documents, national legislation, and institutional reports (EEA, Eurostat, and MIDR), providing a robust empirical basis for interpretation.

[2] ***DG MOVE*** *– Directorate-General for Mobility and Transport of the European Commission, responsible for developing and implementing EU transport policies, including the promotion of sustainable and green logistics.*
[3] ***DG ENV*** *– Directorate-General for Environment of the European Commission, which is responsible for developing and implementing EU environmental policies and monitoring compliance with environmental protection directives.*
[4] ***TEN-T*** *– Trans-European Transport Network, a European initiative that aims to create an integrated transport infrastructure, focused on increasing sustainability and reducing environmental impact.*

The European regulatory framework for green logistics

In the context of the European Union's commitments to climate neutrality and the transition to a sustainable economy, green logistics has become a strategic area, regulated by a dynamic, cross-sectoral legislative framework. EU policies aim to reduce greenhouse gas emissions and restructure transport and logistics systems in an integrated, efficient, and environmentally friendly manner. Thus, green logistics is addressed as an essential component of the European Green Deal, with a focus on the transition to a sustainable, smart, and fair mobility system.

Relevant European directives and regulations

The legislative framework for green logistics is supported by a series of directives and regulations that aim to improve energy efficiency, digitization, and reduce the environmental impact of transport. Among the most important legislative instruments that structure green logistics at EU level are:

1. **Directive 2012/27/EU on energy efficiency**, which encourages the sustainable use of energy resources, including in the transport and logistics sector (European Parliament & EU Council, 2012).
2. **Regulation (EU) 2019/1242** introduces mandatory CO_2 emission standards for heavy-duty vehicles, driving the transition to cleaner road transport (European Parliament & Council of the EU, 2019).
3. **Regulation (EU) 2020/1056 on electronic freight transport information (eFTI)** promotes the digitization of logistics processes, thereby contributing to the efficiency and transparency of logistics chains, but also facilitates the electronic exchange of data between operators and authorities (European Parliament & Council, 2020).
4. **Directive 2014/94/EU on alternative fuels infrastructure**, which promotes the installation of refueling stations for electric and hydrogen vehicles, facilitating the transition to low-emission logistics.
5. **The Mobility Packages I, II, and III**, adopted between 2017 and 2020, which bring a set of legislative measures on market access, working conditions, and sustainability in road freight transport.

These instruments are integrated into **the Sustainable and Smart Mobility Strategy** (European Commission, 2020), which stipulates that by 2050, the transport sector must contribute to a 90% reduction in greenhouse gas emissions, in line with the objectives of **the European Green Deal** (European Commission, 2019).

The implementation and coordination of these regulations are ensured by a well-defined institutional architecture. **The European Commission**, through **the Directorate-General for Mobility and Transport (DG MOVE)** and **the Directorate-General for Environment (DG ENV)**, plays an important role in policy formulation, while **the European Parliament** and **the Council of the European Union** contribute to the legislative process. Compliance monitoring and environmental impact assessment are

carried out by **the European Environment Agency (EEA[5]),** and **CINEA[6] (European Climate, Infrastructure and Environment Executive Agency)** supports the implementation of programs and the financing of green projects through instruments such as *the Connecting Europe Facility (CEF), LIFE*, or *Horizon Europe.*

Application and transposition in the Republic of Moldova

The European integration process of the Republic of Moldova involves harmonising the national legislative framework with the acquis communautaire and adapting it to green logistics principles and standards. This component is highlighted in recent European policies, which aim to reduce the environmental impact of transport, promote sustainable mobility, and implement energy-efficient technologies (European Commission, 2019).

In this context, the Republic of Moldova has initiated the development of strategic instruments - such as *the National Program for the Development of Green Transport Infrastructure 2023*–2030 - which reflect the commitment to align domestic policies with European objectives on green logistics and transport infrastructure sustainability (Ministry of Infrastructure and Regional Development [MIDR], 2023).

The signing *of the Association Agreement* in 2014 marked the beginning of a gradual process of legislative transposition in the field of green logistics, with a focus on reducing greenhouse gas emissions and increasing energy efficiency in transport. The European directives on energy efficiency (*Directive 2012/27/EU)* and alternative fuels infrastructure (*Directive 2014/94/EU)* have been partially transposed into national legislation through the adoption of *Law No. 139/2018 on Energy Efficiency* and the integration of sustainable mobility objectives into *the Energy Strategy of the Republic of Moldova until 2030* (Government of the Republic of Moldova, 2018). However, the dynamics of transposition reveal a gap between the formal framework and practical application: while vehicle emission standards have been transposed relatively comprehensively, alternative fuels infrastructure and the digitization of green logistics remain underdeveloped, limiting the pace of convergence with EU policies. With regard to alternative fuel infrastructure, Directive 2014/94/EU has been repealed and replaced by *Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure (AFIR),* which sets mandatory requirements and more ambitious targets at EU level.

The transition from initial alignment to effective implementation remains uneven, largely due to institutional limitations, insufficient investment capacity, and the absence of a fully functional digital infrastructure. Although several pilot initiatives have been

[5] ***EEA*** *– European Environment Agency, the European Union agency responsible for providing independent information on the environment and climate change, with a key role in monitoring and assessing the impact of European policies on the environment.*

[6] ***CINEA*** *– European Climate, Infrastructure and Environment Executive Agency, an executive agency of the European Commission responsible for implementing EU programs in the fields of environment, infrastructure, energy, and climate change.*

launched, including electronic transport documents and preliminary steps toward interoperable data exchange systems, progress has been slower than anticipated. At the same time, the updated EU framework introduced by AFIR (2023) poses additional obligations that will require Moldova to adjust its existing regulatory instruments and accelerate investments in alternative fuels and smart transport systems.

Table 1. Alignment of EU legislation and the regulatory framework in Republic of Moldova

Field	European Union	Republic of Moldova	Level of alignment
Energy efficiency in transport	*Directive 2012/27/EU on energy efficiency*.	*Law No. 139/2018 on Energy Efficiency*.	Partially
Reduction of heavy vehicle emissions	*Regulation (EU) 2019/1242 on CO_2 standards for new heavy-duty vehicles*, amended by *Regulation (EU) 2024/1610*.	*Government Decision No. 840/2024 on periodic technical inspection of road vehicles* + draft transposition for *Regulation (EC) No. 595/2009 (Euro VI)*.	Partially, the Republic of Moldova does not yet have a national act with CO_2 targets for heavy-duty vehicles in accordance with 2019/1242
Digitization of freight transport	*Regulation (EU) 2020/1056 on electronic freight transport information (eFTI)*.	No eFTI transposition; ongoing projects (MIDR/EU) for the implementation of eFTI platforms 2024–2029.	Minimized
Alternative fuels infrastructure	*Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure (AFIR), which repealed Directive 2014/94/EU*	*Energy Strategy until 2030 (GD No. 102/2013)*; *National Integrated Energy and Climate Plan (NECP) 2025–2030, GD No. 86/2025*.	Partially
Sustainable mobility and working conditions Green networks/ TEN-T	Mobility Package I–III Regulation (EU) 2024/1679 on guidelines for the development of the TEN-T network (revised version).	Road Transport Code No. 150/2014 (as amended).	Partially

Source: Author, based on EU legislation (Regulation (EU) 2019/1242, as amended by Regulation (EU) 2024/1610; Regulation (EU) 2023/1804; Regulation (EU) 2024/1679; Regulation (EU) 2020/1056) and national legislation of the Republic of Moldova (Law No. 139/2018; Government Decision No. 840/2024; Road Transport Code No. 150/2014; Government Decision No. 102/2013; draft NECP 2025–2030).

Although the Republic of Moldova has made significant progress in transposing the EU acquis, especially after signing *the RM–EU Association Agreement* (2014), the pace of implementation remains uneven and is often marked by structural and institutional constraints (European Commission, 2023). With regard to green logistics,

the transposition of European directives and regulations is fragmented, being conditioned by the state's reduced administrative capacity and limited financial resources. The European Investment Bank report (2023/2024) highlights a significant investment gap at European level in green infrastructure and digitalization, which underscores the importance of mobilizing external financial resources for the Republic of Moldova.

An illustrative example is the adaptation of legislation on energy efficiency in transport: although the Republic of Moldova has adopted *Law No. 139/2018 on Energy Efficiency,* its effective implementation in the logistics sector faces difficulties, particularly in the development of infrastructure for alternative fuels, where private and public investment remains below the level required by European directives (Ministry of Infrastructure and Regional Development [MIDR], 2022). In addition, the alignment of emission standards for heavy-duty vehicles with EU norms (*Regulation (EU) 2019/1242)* is only partial: the Republic of Moldova continues to import a significant number of second-hand vehicles with outdated pollution standards (Euro 3 or Euro 4), which runs counter to the objectives of logistics decarbonization and slows down the transition to a sustainable transport system (Environment Agency, 2023).

Thus, the transposition of European legislation on green logistics in the Republic of Moldova reflects an asymmetrical dynamic: on the one hand, there is a clear political will to align with the EU acquis, and on the other hand, there are persistent gaps between the commitments made and their practical implementation. This situation suggests the need for more profound institutional reforms, the strengthening of monitoring mechanisms, and the attraction of European funds through instruments such as *Horizon Europe* or *the Connecting Europe Facility,* which can support green investments in infrastructure and the digitization of logistics.

Compared to EU Member States, the implementation of sustainability policies and European directives in the transport and logistics sector has led to structural changes in supply and delivery chains, which are considered essential for intra- and extra- e trade. Key instruments include *Directive 2014/94/EU* on alternative fuels infrastructure and *Regulation (EU) 2020/1056* on electronic freight transport information (eFTI), which have accelerated the integration of green logistics principles into transport flows. These regulations have increased transparency by digitizing transport documents and reducing administrative costs, estimated at approximately €20–27 billion cumulatively by 2040**,** this has been achieved primarily through the reduction of administrative burdens (European Commission, 2020; UNECE, 2021). Moreover, the standardization of data exchange between operators and authorities has enhanced interoperability and improved the monitoring of transport emissions (European Commission, 2020).

The implementation of eFTI has contributed decisively to the transition from traditional documents to integrated digital systems, thus supporting the objectives *of the European Green Deal*. The digitization of logistics has enabled route optimization, reduced delivery times, and increased the traceability of goods. A relevant example is the port of Rotterdam, where the use of the Pronto digital platform has reduced ship waiting times by

around 20% and accelerated logistics formalities; in addition, following digitization, over 95% of containers are cleared through customs in less than 36 hours (Port of Rotterdam Authority, 2019; European Court of Auditors, 2023). These advances contribute to the efficient use of resources and to achieving the goal of reducing greenhouse gas emissions by 55% by 2030 (European Environment Agency, 2024).

In the Republic of Moldova, the application of these standards is at an early stage. Pilot projects for the use of electronic transport documents have been launched, but the necessary digital and logistical infrastructure remains underdeveloped (Government of the Republic of Moldova, 2023). This discrepancy highlights the gap between the Member States of the European Union and the Republic of Moldova, where the pace of implementation depends on the availability of financial resources and institutional capacity. However, legislative harmonization and the digitization of logistics represent essential opportunities for integration into European supply chains and reducing environmental impact.

The experience of member states confirms that the success of green logistics depends on legislative alignment, investment in sustainable infrastructure, and the digitization of processes. Eurostat data (2024) confirms that road transport accounts for over 70% of the volume of goods transported in the European Union, highlighting the need for investment in intermodal infrastructure and logistics digitization, including in the Republic of Moldova. To highlight these issues, a comparative summary is presented below, covering both good practices and challenges encountered. Table 2 illustrates the main courses of action adopted in Germany, the Netherlands, France, and Romania, based on recent strategic documents and institutional reports.

The data summarized in Table 2 allow us to draw some important conclusions regarding the potential for transposing these European practices in the Republic of Moldova, highlighting both the development opportunities and the structural challenges facing the country.

An analysis of European experiences in the field of green logistics reveals a number of practices relevant to the adaptation process in the Republic of Moldova. In Germany, the focus is on developing intermodal infrastructure and investing in the digitization of logistics chains, aspects regulated by government programs dedicated to supporting combined transport (*Bundesministerium für Digitales und Verkehr*, 2022). This model can serve as a benchmark for the Republic of Moldova, where intermodal transport infrastructure is still in its infancy and the digitization of logistics processes is at a fragmented stage.

In the Netherlands, the Port of Rotterdam has become a pioneer in the green transition, implementing solutions for the electrification of terminals and the integration of alternative fuels, alongside advanced digitization systems (Port of Rotterdam Authority, 2024). For the Republic of Moldova, this approach highlights the need to invest in green logistics corridors and develop public-private partnerships capable of accelerating the adoption of sustainable technologies.

Table 2. Good practices and challenges in implementing green logistics in European Union member states

Country	Good practices in green logistics	Challenges encountered	Source
Germany	Development of infrastructure for combined (intermodal) transport, supported by national funding programs, and digitization of logistics operations (ITS, e-freight), with a focus on energy efficiency and emissions reduction.	Integration between federal states and ensuring interoperability at European level.	Bundesministerium für Digitales und Verkehr. (2022). *Förderrichtlinie von Umschlaganlagen des Kombinierten Verkehrs*
Netherlands	Port of Rotterdam – European leader in the digitization of operations (smart port, digital platforms) and in emission reduction solutions (electrification of terminals, alternative fuels/ssuch as LNG/hydrogen, energy transition projects).	High transition costs, ongoing legislative adjustments.	Port of Rotterdam Authority. (2024). *Digital Report 2024*
France	National "logistique durable" strategy focused on decarbonization and modal shift from road transport, with planning for terminals and additional capacity	Lack of coherence between national and regional levels.	Ministère de la Transition Écologique. (2024). *National Master Plan for Combined Transport*
Romania	Pilot projects for green corridors and modernization of rail infrastructure with European support.	Institutional fragmentation, digital deficit.	National Railway Company "CFR" SA. (2023–2025). *PNRR projects / Implementation status*

Source: Federal Ministry of Digital and Transport (2022); Port of Rotterdam Authority (2024); Ministry of Ecological Transition (2024); National Railway Company "CFR" SA (2023–2025).

France has adopted a national combined transport strategy aimed at decarbonization and increasing the role of rail, as highlighted in official planning documents (*Ministère de la Transition Écologique*, 2024). This orientation is particularly relevant for the Republic of Moldova, where the potential of rail transport remains untapped and its integration into logistics chains could significantly reduce emissions from freight transport.

In Romania, projects financed through the National Recovery and Resilience Plan (PNRR) aim to modernize railway infrastructure and develop green corridors with the support of European funds (Compania Națională de Căi Ferate CFR SA, 2023). For the Republic of Moldova, its geographical proximity and institutional similarities with

Romania are an advantage, facilitating the transfer of good practices and access to joint funding programs.

Overall, these experiences show that transposing European policies on green logistics in the Republic of Moldova requires both strengthening the legislative framework and mobilizing resources for infrastructure, digitization, and regional cooperation. Thus, for the Republic of Moldova, the adoption of green logistics requires a combination of investments in infrastructure, digitization, and coherent policies to harmonize with EU directives, by adapting European best practices to national specificities.

A comparative assessment of European experiences shows that the Republic of Moldova is in a transition phase in which green logistics has the potential to become a strategic tool for modernization. ***Opportunities*** arise from proximity to the European Union market, access to TEN-T corridors, and the possibility of using European partners' funding programs and expertise, including through pilot initiatives for the digitization of transport documents (European Commission, 2020; European Environment Agency, 2024).

At the same time, ***the challenges*** remain significant: insufficiently developed intermodal infrastructure, fragmented digitization and, and limited institutional capacity continue to delay the adaptation process (Environment Agency, 2023). These constraints may reduce the impact of reforms if they are not supported by substantial investment and coordination between public and private actors.

From a ***legislative*** perspective, the Republic of Moldova has taken steps towards harmonization by adopting elements of Regulation (EU) 2020/1056 and aligning itself with the objectives of the European Green Deal. Key steps toward making green logistics practical and sustainable include strengthening the regulatory framework, creating incentives for green technologies, and aligning systems with European interoperability standards.

Conclusions

The expert analysis has shown that green logistics has established itself as a strategic priority for the European Union, being regulated by a set of directives and regulations aimed at reducing transport emissions and increasing the efficiency of logistics chains. Directive 2014/94/EU on alternative fuels infrastructure, Regulation (EU) 2020/1056 on electronic information for freight transport, and the objectives of the European Green Deal confirm the shift towards a digitized and sustainable logistics system (European Commission, 2020; European Environment Agency, 2024).

Experiences in Germany, the Netherlands, France, and Romania show that the green transition cannot be achieved without a combination of modern intermodal infrastructure, interoperable digital solutions, and financial support mechanisms. In Germany and France, the focus is on multimodal transport and rail integration; in the Netherlands, digitization and technological innovation are reflected in port policies; and in Romania, European funds (PNRR, TEN-T) support the modernization of rail infrastructure.

For the Republic of Moldova, the analysis reveals real potential for convergence with these European practices, but also a significant gap in terms of logistics infrastructure, institutional capacity, and the degree of digitization. Opportunities stem from geographical proximity to the EU market, access to European logistics corridors, and the availability of financing instruments. Challenges relate to the lack of functional intermodal hubs, insufficiently modernized railway infrastructure, and limited resources for implementing European regulations.

From an economic perspective, the implementation of green logistics in the Republic of Moldova is expected to generate long-term efficiency gains through reduced fuel consumption, optimization of distribution routes, and access to EU financial mechanisms. These effects can contribute to improving national competitiveness and enhancing regional connectivity with the European market.

Recommendations

1. **Strengthening the legislative framework** – accelerating harmonization with European regulations on green logistics, including data standardization through Regulation (EU) 2020/1056 and stimulating the use of alternative fuels (European Commission, 2020).
2. **Develop intermodal infrastructure** – prioritize investments in multimodal terminals and modernize rail infrastructure, integrating it into TEN-T corridors.
3. **Digitization of logistics** – implementation of interoperable electronic platforms (ITS, e-freight) to ensure traceability, transparency, and real-time monitoring of emissions (European Court of Auditors, 2023).
4. **Public-private partnerships** – stimulating collaboration between authorities and the private sector through co-financing schemes and tax mechanisms for investments in green technologies.
5. **Regional integration** – intensifying cooperation with Romania and neighboring Member States to facilitate access to European funding programs and cross-border logistics infrastructure.
6. **Professional training** – developing educational and training programs for green logistics specialists, with a focus on digital skills and sustainable management.
7. **Monitoring and evaluation** – establishing a national framework for monitoring the progress of green logistics, aligned with European performance and sustainability indicators (European Environment Agency, 2024).

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