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## GREEN LOGISTICS LANDSCAPE OF THE CENTRAL AND EASTERN EUROPEAN 3PL PROVIDERS

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### ABSTRACT

This study focuses on the challenges and strategic potential of green logistics within the third-party logistics (3PL) sector in Central Europe, a key industry segment increasingly impacted by environmental regulations and market demand for sustainability. The paper examines how medium to large-sized 3PL companies implement green governance strategies, assessing their impact on environmental and financial performance. The analysis is based on a sample of 25 logistics providers across Hungary, Slovakia, and Austria, selected based on annual revenue (above 10 million euros) and presence of ESG reporting between 2020–2023. Methodologically, the research combines qualitative content analysis of ESG reports with quantitative evaluation of sustainability KPIs (e.g., carbon footprint, fuel efficiency, packaging waste) and revenue growth. This approach enables a focused exploration of the relationship between green practices and competitive advantage. The study contributes by offering specific insights into how regulation, strategy, and technology interact to shape green transformation in the regional logistics landscape.

*Keywords: Green logistics, 3PL providers, ESG, sustainability KPIs, Central-Europe, Carbon footprint, logistics strategy*

### 1. Introduction

Global trade and commerce depend heavily on logistics, including transportation, warehousing, inventory management and packaging. Sustainability has become a strategic request in the different industrial sectors, with the logistics sector under particular scrutiny due to its environmental impact. Environmentally friendly practices are increasingly being mandated for this sector, one of the biggest contributor to global greenhouse gas emissions (Lin et al., 2015; Yang et al., 2015; Kong et al., 2016; Li et al., 2023; Nagy & Szentesi, 2024).

As the fastest growing source of greenhouse gas emissions, transportation in logistic sector has a huge impact on the environment. A green transportation system should reduce greenhouse gas emissions, air pollution, noise and space utilization, as well as promote economic growth supporting environmental sustainability (Abreha, 2007; Badami & Haider, 2007). Logistics that minimizes the negative environmental externalities as a consequences of this sector referred “green logistics” (Dieng & Yvon, 2017). While "green logistics" is widely discussed, research often lacks focus when addressing such a complex and heterogeneous field.

This study narrows the scope to third-party logistics (3PL) providers in Central Europe, a segment where operational decisions directly influence emissions, packaging waste, and transport efficiency. Recent literature highlights the importance of integrating green governance into logistics to meet regulatory requirements and shifting consumer expectations (Zhu et al., 2008; Wu & Dunn, 2015; Larina et al., 2021; Kesidou & Demirel, 2012; McKinnon, 2010; Qi, 2019; Sarkis et al., 2020). However, evidence on how these strategies transform into measurable outcomes remains fragmented, especially in the post-COVID recovery phase where digital transformation accelerated (Li et al., 2023).

This paper addresses the following research questions: a) What are the core drivers and barriers for 3PL companies in Central Europe implementing green logistics practices? b) How do these practices affect their environmental and economic performance? c) What role does government policy play in shaping strategic alignment?

By focusing on a manageable and strategically relevant segment, the paper provides comprehensive overview that are both academically robust and practically implementable.

## 2. Methodology

In this review paper, the authors had combined quantitative analysis of sustainability indicators from ESG reports with secondary policy review and benchmarking. 25 medium-to-large 3PL providers in Hungary, Slovakia, and Austria were selected based on: a) Annual income more than 10 million euro between 2020 and 2023 time-period; b) Publication of ESG reports during this period; c) Operations across at least two Central European countries.

The authors thoroughly analysed environmental performance through the following indicators: a) Carbon footprint (CO<sub>2</sub> e/ton-km); b) Fuel consumption per delivery unit (litres/km), c) Waste management ratio (Recyclable vs. non-recyclable packaging ratio), d) Return logistics efficiency. The economic indicators based on ESG and annual reports (n=25), Policy review of the EU Green Deal and national frameworks.

You can see the 25 3PL company list from Austria, Hungary and Slovakia in the below Table. These companies are active in freight forwarding, contract logistics, and distribution services, and are known to have substantial regional or international operations—some also publish ESG/sustainability reports. The selection criteria were: a) Medium to large 3PL firms with cross-border operations; b) Active in logistics, warehousing, or freight services; c) Known public presence or participation in sustainability and ESG initiatives

These companies are frequently cited in logistics rankings (e.g., Top 100 Logistics Europe) and represent the professional landscape relevant to Central Europe's green logistics transformation.

Table 1. List of 3PL companies included in this study

| No. | Company name                                                        | Country | Services                               |
|-----|---------------------------------------------------------------------|---------|----------------------------------------|
| 1.  | Gebrüder Weiss GmbH (Gesellschaft mit beschränkter Haftung)         | Austria | Freight forwarding, contract logistics |
| 2   | Quehenberger Logistics GmbH (Gesellschaft mit beschränkter Haftung) | Austria | Transport, warehousing, value-added    |
| 3   | Cargo-partner GmbH Gesellschaft mit beschränkter Haftung)           | Austria | Air & sea freight, logistics, IT       |

|     |                                                                              |          |                                               |
|-----|------------------------------------------------------------------------------|----------|-----------------------------------------------|
| 4   | Lagermax Logistics Austria GmbH<br>(Gesellschaft mit beschränkter Haftung)   | Austria  | Automotive, warehouse, forwarding             |
| 5   | Rail Cargo Group (ÖBB)                                                       | Austria  | Rail freight and intermodal logistics         |
| 6   | DB Schenker Austria                                                          | Austria  | Land, air, sea logistics                      |
| 7   | Kühne - Nagel GmbH (Gesellschaft mit<br>beschränkter Haftung) Austria        | Austria  | Global forwarding, contract logistics         |
| 8.  | Waberer's International Ltd.                                                 | Hungary  | Full truckload (FTL), freight,<br>warehousing |
| 9.  | Trans-Sped Ltd.                                                              | Hungary  | Regional transport & contract<br>logistics    |
| 10. | Fiege Ltd..                                                                  | Hungary  | Warehousing and distribution                  |
| 11. | Révész Group                                                                 | Hungary  | Tanker and road transport                     |
| 12. | Delta-Sped Ltd.                                                              | Hungary  | National freight & warehouse<br>logistics     |
| 13. | DHL Supply Chain Hungary                                                     | Hungary  | Distribution, contract logistics              |
| 14. | Kühne Nagel Ltd. Hungary                                                     | Hungary  | Integrated logistics services                 |
| 15. | DSV Road Ltd..                                                               | Hungary  | European road freight, supply chain           |
| 16. | Nagel Hungaria Ltd.                                                          | Hungary  | Food logistics                                |
| 17. | Dachser Slovakia.                                                            | Slovakia | Transport, warehousing                        |
| 18. | Gebrüder Weiss s.r.o. (Spoločnosť s<br>ručením obmedzeným" – Ltd.) Slovakia  | Slovakia | International forwarding                      |
| 19. | Raben Logistics s.r.o. (Spoločnosť s<br>ručením obmedzeným" – Ltd.) Slovakia | Slovakia | Full 3PL service provider                     |
| 20. | Express Group s.r.o. (Spoločnosť s<br>ručením obmedzeným" – Ltd.)            | Slovakia | Pallet and express freight                    |
| 21. | Slovak Parcel Service s.r.o. (SPS)                                           | Slovakia | B2B and B2C parcel delivery                   |
| 22. | GEBRÜDER WEISS Slovakia                                                      | Slovakia | Contract logistics                            |
| 23. | Hopi SK s.r.o. (Spoločnosť s ručením<br>obmedzeným" – Ltd.)                  | Slovakia | Retail and food distribution                  |

|     |                                                                         |          |                                  |
|-----|-------------------------------------------------------------------------|----------|----------------------------------|
| 24. | Kühne - Nagel s.r.o. (Spoločnosť s ručením obmedzeným" – Ltd.) Slovakia | Slovakia | Freight and contract logistics   |
| 25. | DB Schenker Slovakia                                                    | Slovakia | Road, rail, sea, and air freight |

Source: Own edition based on ESG Reports (2020-2023)

The conclusions and suggestions made by this research work in this article reflect the private professional view of the authors.

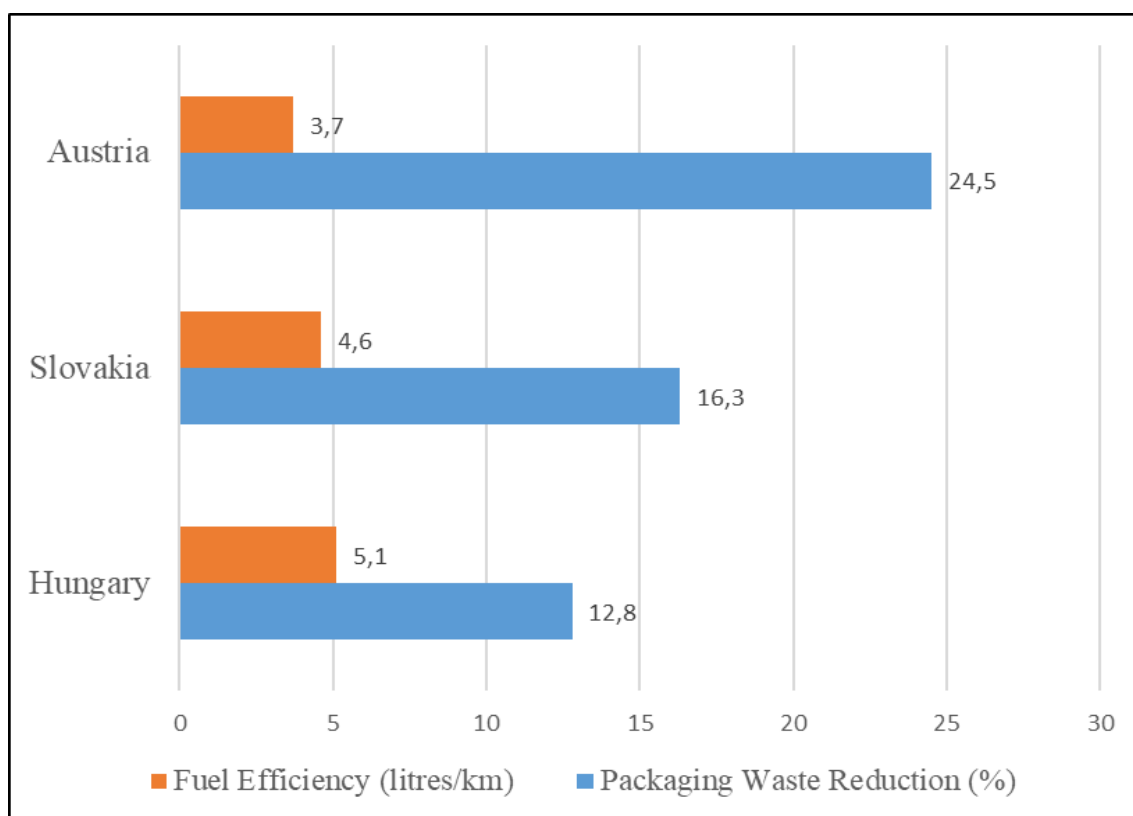
### 3. Insight of the Green Logistics

#### *Environmental performance by countries*

It was announced in 2019 that the European Green Deal (EGD) should be the “masterplan” to make transformation in the key areas of the EU countries economy after signing the Paris Agreement and the UN Sustainable Development Agenda (McKinnon, 2010; EC, 2019; EC, 2021; EC, 2023; Domorenok & Graziano, 2023; Hereu-Morales et al., 2023)

A comparative analysis of key environmental performance indicators revealed a notable disparity between countries. Austrian 3PL providers demonstrated significantly better results in terms of carbon efficiency, packaging waste reduction, and fuel use. This advantage is attributed to a more mature regulatory framework and access to green subsidies.

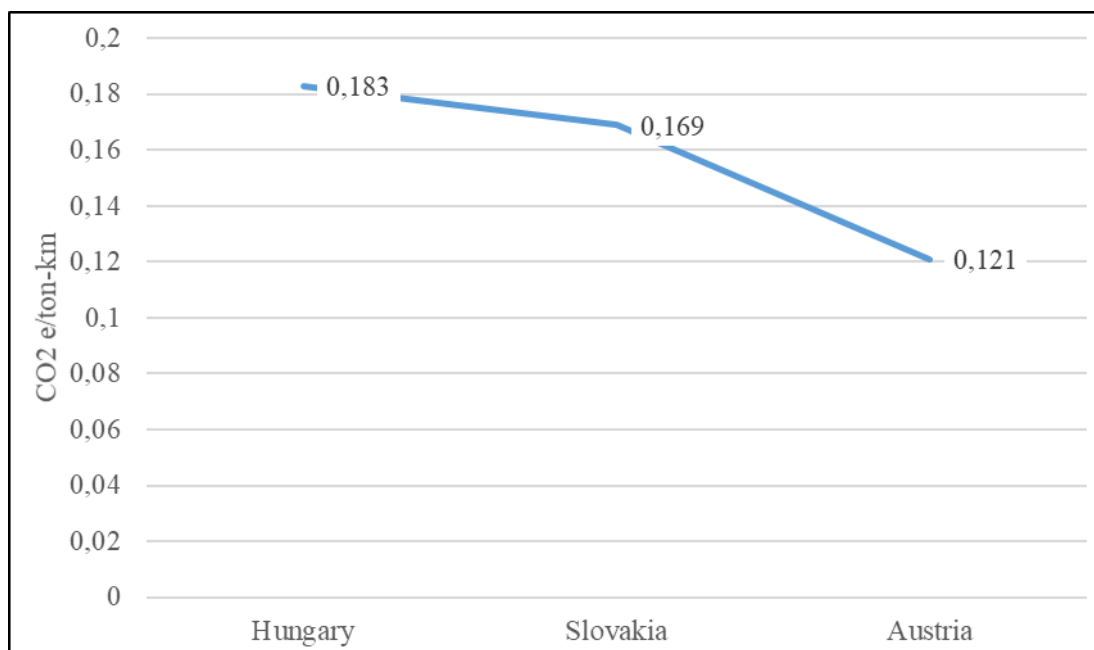
Figure 1. Average Environmental KPIs (1) by Country



Source: Own edition based on on ESG Reports (2020-2023)

These facts clearly pointed out the correlation between state-level green policy support and operational environmental performance. Austrian firms benefit from the early implementation of the EU’s Green Deal targets into national regulation, including tax incentives for electric vehicle fleets and green infrastructure.

Figure 2: Average Environmental KPI'S (2) by Country



Source: Own edition based on on ESG Reports (2020-2023)

### Key Drivers and Challenges

The research identified several internal and external factors that influence the success or failure of green logistics adoption across the analyzed companies involving in this study.

Table 2. Summary of Main Motivation Factors and Barriers

| Category         | Top 3 Drivers                                                                                                                  | Top 3 Barriers                                                                                                                                                 |
|------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| External Factors | Government subsidies (84%)<br>Pressure from multinational clients (72%)<br>EU regulatory compliance (65%)                      | Policy uncertainty in Hungary/Slovakia (40%)<br>High initial capital costs (60%)<br>Lack of harmonised ESG standards (48%)                                     |
| Internal Factors | Digitalisation & route optimisation (76%)<br>Internal green strategy alignment (60%)<br>Top-management commitment to ESG (48%) | Skills gap in sustainability (66%)<br>Lack of ESG integration into supply chain processes (42%)<br>Short-term profit focus over long-term sustainability (38%) |

Source: Own edition based the ESG Reports (2020-2023)

The findings suggest that regulatory pressure, digital infrastructure, and client expectations are the most influential drivers. Firms that aligned their internal sustainability goals with digital innovations (e.g., telematics, AI-based routing, emissions tracking) outperformed others in both carbon savings and logistics cost reduction.

### *Impact of Digital Maturity*

The presence of digital fleet management systems and AI-enabled warehouse operations correlated strongly with improvements in both efficiency and sustainability. High-digital maturity firms reached: a) 7–12% reduction in average fuel costs over three years, b) 15–20% lower packaging waste, c) Faster compliance with evolving EU emission regulations

For example, one Austrian provider using a smart routing system across three countries reduced CO<sub>2</sub>e emissions by 18% over 24 months while increasing load efficiency by 11%.

### *Reverse Logistics and Cost Impacts*

Reverse logistics—especially in B2B deliveries—proved to be a powerful lever for improving environmental performance. Firms with structured return flows and load-consolidation strategies reported: a) Up to 11% cost savings in last-mile transport; b) Reduced use of single-use packaging materials, c) Enhanced collaboration with key clients to co-design circular systems

However, smaller logistics firms struggle to implement reverse logistics due to lack of warehouse space, IT systems, or contractual arrangements with clients.

### *ESG Reporting and Compliance Gaps*

Only 9 of the 25 firms published complete ESG data, including Scope 1–3 emissions, biodiversity impact, and waste volumes. Most firms rely on voluntary frameworks, with inconsistent application of GRI (Global Reporting Initiative) or CSRD (Corporate Sustainability Reporting Directive) standards.

There is a pressing need for:

- Unified ESG reporting standards
- Uncentivised third-party auditing for credibility
- Sector-specific guidance on measuring logistics-related emissions

This gap in standardisation undermines benchmarking efforts and weakens the strategic feedback loop between ESG performance and stakeholder trust.

### *Green logistic everyday's operational practices of selected 3 PL companies*

Waberer's International Ltd. (Hungary) , Kühne - Nagel GmbH (Austria) and Raben Logistics Slovakia were selected because they represent three distinct yet complementary profiles within the European 3PL sector: a regional market leader with deep Central European embeddedness, a global integrator with advanced digital solutions with strong sustainability commitments in Eastern Europe. These facts clearly highlight a complex, relevant picture of how decarbonisation strategies are translated into everyday operational practices across different scales and market positions.

Waberer's International is the largest road freight operator in Central and Eastern Europe, making it a particularly relevant case for understanding how a regionally dominant fleet-based operator integrates modernisation of assets, rail substitution and alternative fuels into daily dispatching and route optimisation (Waberer's International, 2023; Waberer's International, 2025).

On the contrary, Kühne – Nagel GmbH is one of the largest global 3PL providers, and its case illustrates how international companies deploy digital tools for emissions visibility and customer choice while embedding low-emission fuels and modal shifts into routine supply chain management (Kuehne- Nagel, 2024a; Kuehne - Nagel, 2024b).

Raben Group, operating extensively in Slovakia and across Central and Eastern Europe, provides a valuable mid-sized example of science-based target setting and piloting of sustainable fuels (such as HVO100) in daily operations, along with enhanced EcoVadis ratings that reflect supplier engagement and day-to-day execution of sustainability strategies (Raben Group, 2024a; Raben Group, 2024b).

Operationally, these companies converge on similar everyday practices: data-driven telematics and CO<sub>2</sub> calculators for planning and customer reporting, optimisation to reduce empty mileage, renewal of tractor and trailer fleets to improve fuel efficiency, and the trial and adoption of alternative fuels where infrastructure allows. Waberer's has centralised its ESG agenda into routine vehicle renewal and subcontractor engagement, while Kühne- Nagel focuses strongly on integrating emission-based routing into customer interfaces, effectively giving clients the option to select lower-carbon alternatives at the shipment level. Raben Logistics Slovakia demonstrates the practical implementation of HVO biofuels on regional lanes and explores electric solutions for urban distribution, complementing its broader sustainability strategy. These combined case studies highlight how three different 3PL profiles systematically integrate green logistics into daily operations, reflecting scalable models for decarbonisation in European logistics (Trans.INFO, 2023; Raben Group, 2025).

The findings demonstrate that green logistics initiatives yield both environmental and economic benefits when supported by digital innovation and policy clarity. However, uneven policy enforcement, fragmented ESG reporting, and skills shortages continue to limit the scalability of green transformation—particularly among SMEs in Hungary and Slovakia.

### **Summary and conclusions**

This research provided insights into the opportunities and limitations of green logistics within the Central European 3PL sector. The findings clearly show that firms integrating sustainability into their core strategies can realize not only environmental improvements but also financial benefits and competitive advantages. However, such transformations require supportive institutional frameworks, sufficient capital, and internal capacity building.

From a strategic standpoint, companies that proactively align their logistics models with ESG goals are better positioned to capture emerging market opportunities, attract sustainability-conscious clients, and comply with tightening regulations. This strategic realignment also enables them to leverage technological tools—like digital route optimization and vehicle monitoring systems—to reduce emissions and optimize load efficiency. Conversely, firms that fail to adopt green logistics may struggle with rising compliance costs, reputation risks, and operational inefficiencies.

In terms of environmental impact, this study documented 3PL providers that actively adopted green logistics strategies succeeded in reducing their carbon emissions and waste output significantly. Especially Austrian firms, who benefit from strong government backing and clearer regulatory frameworks, demonstrated superior performance across all KPIs measured.

Nevertheless, many providers in Hungary and Slovakia face challenges related to inconsistent policy frameworks, a lack of standardised ESG reporting mechanisms, and a shortage of skilled professionals trained in sustainability practices. These structural gaps impede their ability to plan long-term and make the necessary capital investments.

## **Key Recommendations**

### *Harmonise ESG Reporting*

Governments should implement and enforce a regional ESG standard for logistics. This would enable comparability across companies and countries, improve investor confidence, and support public policy monitoring. Industry bodies could also play a role in developing shared templates and audit mechanisms.

### *Incentivise Technology Adoption*

Policymakers should offer grants and tax credits to support the transition to green fleets (e.g., electric vehicles, hydrogen trucks), low-emission warehousing, and advanced transport analytics. Particular emphasis should be placed on funding telematics, IoT-based routing, and carbon tracking systems that offer high Return on investment (ROI), which used to be calculated by dividing the profit earned on an investment by the cost of that investment.

### *Develop Talent Pipelines*

A major barrier to green transformation is the shortage of personnel with relevant sustainability skills. National education ministries, universities, and logistics firms should co-develop logistics-specific sustainability curricula to ensure a future-ready workforce.

### *Support SMEs in Green Transition*

While large firms may afford green investments, SMEs struggle without targeted support. Governments should design subsidy and low-interest loan schemes tailored to mid-sized logistics providers, especially those operating internationally or cross-border.

### *Encourage Cross-border Partnerships*

Given the transnational nature of logistics, cross-border platforms for knowledge sharing, benchmarking, and regulatory alignment should be fostered. Joint EU projects, pilot initiatives, and regional best-practice hubs can accelerate learning and standardisation.

The future competitiveness of the logistics industry in Central Europe hinges on the extent to which environmental innovation is embedded into strategy, policy, and practice. A unified and inclusive approach—spanning policy support, corporate initiative, and academic collaboration—will be crucial in achieving the dual objective of economic efficiency and environmental stewardship in the 3PL sector.

Green logistics is not merely a compliance issue, but a strategic asset. Companies that embrace this early and holistically are more likely to withstand economic volatility, meet future regulatory thresholds, and build trust with environmentally conscious stakeholders. Central Europe now stands at a crucial inflection point where leadership in green transformation will determine the long-term viability and reputation of its logistics ecosystem.

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