



Structured Abstracts of 'Supply Chain Challenges in the Turbulent World II.' session

Who is the "Missing Hero" in Sustainable Freight Transport? Identifying Leading Stakeholders in Europe's Electric Freight Corridor

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Background and introduction: As global freight transport comes under increasing pressure to decarbonize, innovative technological solutions must be matched by effective governance and sustainable financing mechanisms. The ECORE project explores the potential of ERS—based on pantograph-equipped vehicles—as a viable solution for long-distance, low-emission freight corridors in Europe. While technical feasibility is promising, systemic barriers remain, particularly concerning stakeholder coordination and investment risk-sharing.

Objective: This study assesses the feasibility of deploying an Electric Road System (ERS) for heavy-duty freight transport along the Rotterdam–Budapest corridor, with specific focus on the financial and governance frameworks required for implementation in the Hungarian section (M1 highway). We also seek to identify a key stakeholder capable of initiating commitment—what we term the "missing hero"—and define possible incentives for them.

Methodology: We employ a multi-dimensional feasibility assessment combining technical analysis, stakeholder mapping, and review of potential financing models. To explain persistent inaction, we apply the concept of a social fence—a collective action dilemma in which all parties wait for others to act. We use this framework to introduce the metaphor of the "missing hero": the stakeholder needed to catalyze commitment.

Results: Our findings highlight significant long-term benefits of ERS for logistics efficiency, emission reduction, and infrastructure modernization. However, the current absence of a lead actor reflects a governance gap where no stakeholder has yet assumed the risk of initial investment. Preliminary financial pathways such as public-private partnerships and EU-level funding mechanisms offer partial solutions, but require stronger leadership and coordination.

Conclusions: Overcoming this "social fence" scenario requires identifying a viable initiator, creating incentives for leadership, and implementing robust governance structures. ECORE offers a European pilot framework for converting shared potential into coordinated action through structured stakeholder engagement and integrated planning. The integration of technology, finance, and policy must be synchronized to realize the vision of sustainable freight transport.

Limitations and future research directions: The study is in an early stage of exploring financial models and institutional designs. Future research should conduct in-depth scenario analysis of funding structures, refine stakeholder engagement strategies, and model the long-term economic and environmental impacts of ERS deployment across multiple corridors.

Keywords: Electric Road System (ERS), freight transport, sustainable governance, social fence, collective action dilemma



Impact of Green Logistics Practices on Environmental Sustainability Within Manufacturing Supply Chains in Nairobi County, Kenya

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Background and introduction: This study investigates the impact of green logistics practices on environmental sustainability within manufacturing supply chains in Nairobi County, Kenya. Despite the increasing global emphasis on sustainable development, the adoption of eco-friendly logistics in Kenya's manufacturing sector remains limited. This is largely due to high operational costs, inadequate infrastructure, and low levels of awareness among key stakeholders.

Objective: The main objective of the research is to examine how green logistics contribute to environmental sustainability and to identify the challenges that hinder their implementation.

Methodology: The study adopts a mixed-methods approach, using both statistical data from industry and government sources and qualitative insights from case studies of selected manufacturers in Nairobi.

Results: The results reveal that green logistics practices have a positive effect on environmental sustainability by enhancing resource efficiency and reducing waste and emissions. However, widespread adoption is constrained by financial, infrastructural, and institutional barriers.

Conclusions: The study concludes that collaborative efforts between government agencies and manufacturing firms are crucial to overcoming these challenges and enhancing sustainable supply chain practices.

Limitations and future research directions: One limitation of this research is its focus on Nairobi County alone; future studies should expand to other regions and explore long-term effects of green logistics on industrial sustainability.

Keywords: Green logistics, environmental sustainability, manufacturing, supply chains, Nairobi County



Energy Price Shocks and Food Price Dynamics during Geopolitical Crises in the European Union

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Background and introduction: The post-COVID period and war in Ukraine led to a record increase in the food price index. Vulnerable consumers and countries face reduced purchasing power due to rising food prices and rising fuel prices. Fertilizer prices are also rising. This can lead to reduced fertilizer use and lower yields. The sharp rise in food prices is due to adverse weather conditions, rising energy and transport costs, as well as rising fertilizer prices and high international demand.

Objective: The article's purpose is identifying key factors that influence food prices and determine the relationship between food prices and energy prices changes during geopolitical crisis periods. Using advanced econometric modelling techniques, the study investigates effects of these factors on food prices. It further examines the time-varying nature of these relationships, offering insights into how external shocks – such as global conflicts or energy crises – reshape the food market landscape.

Methodology: The research implements the analysis of 27 European Union countries for the period 1995–2021 using panel data model. This study is approximated specifically to EU countries because EU countries are highly integrated into global supply chains for food and energy.

Results: Our modeling results show that an increase in gas and oil prices leads to an increase in food prices. Moreover, gas prices have a greater impact on food prices than oil prices. The simulation results also demonstrate that geopolitical threats have a greater impact than geopolitical actions. Geopolitical threats are based on perceptions of potential events, such as rumors of trade embargoes or political instability.

Conclusions: The findings of this study highlight the intricate relationship between food prices, geopolitical risks, and energy uncertainty. The evidence suggests that fluctuations in food prices are not merely dictated by supply and demand but are also heavily influenced by global geopolitical events and energy market volatility. These interdependencies have significant implications for food security, economic stability, and policy planning.

Limitations and future research directions: During the research, the following limitations were identified. Firstly, we should be skeptical about the reliability and applicability of the "geopolitical risk index" when analyzing its impact on the price index. In 2001, the index was 500, but there was no real danger to international supply chains. The terrorist attack in London had nothing to do with food supply chains. As part of further research, we plan to examine the geopolitical implications of changes in energy supply chains.

Keywords: agricultural markets, geopolitical crises; energy uncertainty; food prices; food security



Societal and Industrial Expectations for the Future of Road Freight Transport Vehicles

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Background and introduction: As our world changes, so do the expectations toward road freight transport. People increasingly care about cleaner air, safer roads, and smarter technology, while industries look for efficiency, cost-effectiveness, and ways to meet growing environmental regulations.

Objective: This presentation takes a closer look at what both society and the transport sector expect from the next generation of freight vehicles. We expect big changes in freight transport, from automation and digital tracking to bodywork design to the increasing use of electric and alternative fuel trucks.

Methodology: In this talk, we aim to articulate from an industrial and societal perspective where there is a need and where there can and should be transformation in the freight transport of tomorrow.

Results: We also ask a simple but important question: what do people and industry experts really want from these vehicles – and where do their expectations match or diverge? Fast chargers must be installed along logistics hubs and major transport routes, e.g. TEN corridors, in accordance with mandatory EU guidelines and with the involvement of private capital.

Conclusions: Our goal is to understand the challenges and opportunities ahead, and how we can design freight transport solutions that make sense not only for business, but also for society and the environment. We recommend axle load relief only for zero-emission vehicles, compensating for the weight of the batteries and complying with the load limits of the physical road infrastructure.

Limitations and future research directions: From a technological point of view, developments have already reached a level where commercial application is realistic. Autonomous vehicles, for example, are already capable of safe transportation in certain environments. However, society remains skeptical in many cases: a lack of trust and technophobia may slow down acceptance.

Keywords: Road freight transport, Societal expectations, Industrial needs, Sustainability, Automation, Alternative fuels



Sustainable transport in China and Europe: Strategic and regional approaches

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Background and introduction: Freight transportation is one of the most important contributors to global greenhouse gas (GHG) emissions. This study analyzes and compares how sustainability targets and practices are being implemented in road freight across three key regions: Europe, China, and North America.

Objective: The aim is to evaluate the challenges, opportunities, and lessons learnt. Multiple approaches were applied: (1) a comprehensive literature review of sustainability regulations and technological trends; (2) secondary data collection from sustainability reports in the automotive industry; and (3) a primary survey distributed to international forwarders and service providers.

Methodology: The results indicate that Europe is mainly driven by regulatory decarbonization with strong commitments to electrification and intermodal freight, though infrastructure gaps remain. China demonstrates fast and strong progress in electrification and digital logistics platforms, but faces challenges in implementation across regions. North America shows slower regulatory adoption but strong industry-driven initiatives in efficiency and alternative fuels.

Results: Results from the questionnaire indicate that cost pressures, service reliability, and infrastructure readiness are the most well-known challenges, while collaboration and digital transparency tools are seen as key points toward sustainability.

Conclusions: The study forecasts a clear route that can give direction to political decision-makers and to industry leaders for creating strong procurement strategies and a stable base for creating and implementing sustainable solutions within the local and global supply chains.

Limitations and future research directions: It is confirmed within the study that even though each region takes a different path, the key drivers of success are similar: using new technologies, working together across industries, and keeping government rules in line with market needs (Ministry of Transport of China, Council of the EU 2024/AFIR). These points confirm what earlier studies also found (McKinsey) and can guide both future research and practical steps in making freight procurement more sustainable.

Keywords: Carbon neutrality, CO₂ reduction, Cross region study, Decarbonization, Freight transport, Road freight, Sustainability

Adapting DIGCOMP 2.1 for Logistics 4.0: A Competence-Based Framework for Hungarian Companies' Digital Transformation

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Background and introduction: The rapid digital transformation in logistics requires systematic assessment of human competencies. A knowledge gap exists regarding the applicability of the European Digital Competence Framework (DIGCOMP 2.1) in Hungarian logistics companies. This study investigates how DIGCOMP 2.1 can evaluate digital readiness in the context of Industry 4.0 and Logistics 4.0 implementation.

Objective: To determine the extent to which the DIGCOMP 2.1 framework is applicable for mapping and assessing digital competencies of Hungarian logistics service providers. The study aims to identify competency profiles, reveal sector-specific gaps, validate triangulation methodology, and provide recommendations for supporting digital transformation in logistics.

Methodology: Triangulation methodology combining qualitative and quantitative approaches. Semi-structured interviews with three Hungarian logistics companies (Simon Trans, Gebrüder Weiss, Raben Trans) were conducted. Python-based Computer-Assisted Text Analysis (CTA) processed 82 coded text excerpts. Statistical validation used coefficient of variation and inferential tests.

Results: Four of five DIGCOMP 2.1 competency areas showed relevance (80% coverage). "Information and data literacy" dominated (58.5%), followed by "Problem-solving" (28.0%). "Digital content creation" was completely absent (0%). Triangulation validation revealed medium reliability for data literacy (CV=47.2%) but weak for other competencies (CV>50%).

Conclusions: Hungarian logistics companies act as "digital consumers" rather than "digital creators." DIGCOMP 2.1 provides a solid foundation but requires sector-specific adaptation. Critical gaps in digital content creation and cybersecurity competencies pose strategic vulnerabilities. Educational institutions and policymakers must develop targeted training programs.

Limitations and future research directions: Small sample size (n=3 companies) limits generalizability. Future research should include comprehensive sector-wide surveys and longitudinal studies tracking digital competency investments over time. Validation with larger SME samples recommended. Investigation of which specific competency developments yield measurable performance improvements needed.

Keywords: digital competencies, DIGCOMP 2.1, Industry 4.0, logistics sector, triangulation methodology