TRANSCOM 2025: 16th International Scientific Conference on Sustainable, Modern and Safe Transport

• Visegrad Fund

The Impact of Information and Communication Technology Adoption for Management in Road Freight

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INTRODUCTION

- Growing demand for road transport (+60% by 2050) leads to challenges like emissions, fuel costs, and congestion.
- ICT in logistics provides real-time visibility, data exchange, and flexibility.
- Road freight lacks digital uniformity and is environmentally burdensome.

Despite ICT's recognised advantages, its varied uses in road freight remain insufficiently documented, impacting transportation managers, goods carriers, logistics providers, small and medium-sized enterprises, government regulators, and end consumers.

Objectives: (1) Identify how ICT addresses inefficiencies and environmental challenges in road freight. (2) Explore barriers to adoption and summarize real-world implementations.

The **expected impact** includes informing ICT implementation strategies and driving practical, scalable digital transformation in logistics.

MATERIALS, METHODS & IMPLEMENTATION

Methodology: Qualitative content analysis of secondary data from 3 case studies.

Case Study Selection Criteria: (1) Published after 2016. (2) Focused on road freight. (3) Included ICT or intelligent systems.

Step 1: Initial screening for relevance → Step 2: Development of analytical framework → Step 3: In-depth content and comparative analysis → Step 4: Synthesis of results to match research objectives

RESULTS

Summary of ICT Implementation in Road Freight Transport

Case Study	Addressed Operational Problems	ICT Benefits	Adoption Barriers
Dynamic Platooning (Sweden)	Fuel inefficiency and emissions	Dynamic platooning using vehicle-to-vehicle communication reduced fuel usage by 10%	-
Modular ICT for Hazardous Goods (EU)	Safety compliance	Modular ICT systems improved safety and compliance	Company-related, external and technical
Smart Platform for Containerized Cargo (Egypt)	Communication gaps and resource inefficiency	Web and mobile platform enhanced communication and resource allocation in container transport	-

The key barriers to the adoption of ICT in the road freight sector

Company-related challenges include high costs, limited human resources, and organizational resistance to change	External barriers include a lack of collaboration among supply chain stakeholders and market hesitance	Technical barriers include interoperability issues, data protection concerns, and insufficient system standardization

Practical Applications

Real-time coordination and communication (platooning, tracking apps)	Improved operational efficiency and regulatory compliance	Scalable, user-centered design for ICT tools	Insights applicable to rail, maritime, and air freight sectors

CONCLUSION

Area	Impact
Strategic Value	ICT enhances fuel efficiency, safety, and communication. It enables real-time data sharing and smarter decision-making in logistics operations.
Environmental Impact	Supports environmental goals by reducing emissions and fuel use through optimized routing and efficient resource allocation.
Scalability Across Modes	Modular, scalable, and user-driven designs allow ICT solutions to be applied across different freight modes (road, rail, maritime, air).
SME Relevance	ICT improves logistics agility, lowers operational costs, and enables smaller firms to adopt digital tools with minimal investment.

Future research can expand geographic and modal scope, include quantitative methods and longitudinal studies, and explore blockchain, AI, and IoT for enhanced logistics transparency and automation.

ACKNOWLEDGEMENTS

This publication was realized with support of Operational Program Integrated Infrastructure 2014 - 2020 of the project: Intelligent operating and processing systems for UAVs, code ITMS 313011V422, co-financed by the European Regional Development Fund.