The use of IT Systems in Road Freight Transport Companies: a case study of the Greater Poland Voivodeship in Poland*

Ludmiła FILINA-DAWIDOWICZ, Dorota CIESIELCZYK and Kacper GAPSKI

West Pomeranian University of Technology in Szczecin, Faculty of Maritime Technology and Transport, Piastów Avenue 41, 71-065 Szczecin, Poland

Correspondence should be addressed to: Ludmiła FILINA-DAWIDOWICZ, ludmila.filina@zut.edu.pl

* Presented at the 46th IBIMA International Conference, 26-27 November 2025, Ronda, Spain

Abstract

Nowadays, the growing interest in implementation of information technology (IT) systems in road freight transport companies is observed. Managers of transport companies search for the most appropriate IT systems striving, i.e., to save time and improve companies operation, however, implementation of such systems deals with the number of problems and barriers. Understanding the needs of transport companies representatives is crucial for the development of IT systems. The aim of the article is to identify the directions of IT systems development considering practitioners' opinions. The case study of companies operating in Greater Poland Voivodeship in Poland was considered. A diagnostic survey was used to conduct the research, opinions of employee of transport companies operating in Greater Poland Voivodeship in Poland were analysed. The benefits and barriers to implement modern IT systems in transport companies were identified, and further assessed by transport companies representatives. Research results revealed that according to respondents' viewpoint cybersecurity and data protection, intelligent driver assistance systems and artificial intelligence applied for data analysis are the main expected directions of IT systems development in road freight transport companies. The article is concluded with recommendations for supporting the digital transformation of analysed transport companies.

Keywords: IT systems, road freight transport, digitalization, company, development direction.

Introduction

In recent years, the road freight transport sector has undergone significant changes impacted by the rapid development of information technology (IT). The increasing complexity of logistics operations, combined with the need to ensure high level of safety and efficiency of goods transportation, force managers of transport companies to seek for innovative IT solutions that support their core and auxiliary processes. Nowadays, these systems play a crucial role in planning, monitoring, and managing transport activities, as well as in integrating data across the supply chains (Zając et al., 2024).

Different IT systems are implemented in road transport companies to improve their operation. Using of these systems in companies can bring many benefits, such as increase of logistics operations efficiency (Cudziło et al., 2024), service quality growth, reduced number of errors, as well as contribution to sustainable logistics practices (Koliński and Śliwczyński, 2015). However, implementation of these systems may deal with the number of problems and barriers that are faced by managers of transport companies operating on domestic and international markets, including those located in Poland. Despite these challenges, managers of companies are striving to identify and apply modern IT systems that will improve companies operational efficiency, as well as create

opportunities to stand out from the competition and achieve long-term growth in an increasingly competitive environment.

According to data from Statistics Poland (Statistics Poland, 2024a; Statistics Poland, 2024b), in 2023 in Poland 2,226.3 million tons of cargo were transported by all modes of transport, i.e., 2.2% less than in the previous year, and transport performance amounted to 494.6 billion ton-kilometres, i.e., 0.7% decrease was noted compared to 2022. In 2023, the share of road transport in freight transport compared to other transport modes considering transport performance increased up to 80.9%. In the analysed year, 1,942.8 million tons of cargo were carried using road transport, i.e., 1.7% less than in the previous year. Within the structure of transported loads, the bulk solid cargo (homogeneous cargo carried in large batches without packaging) dominated in terms of mass, and constituted 41.9% of the total tons transported in 2023. While analysing the transport performance, it should be noted that palletized cargo had the largest share (45.4%) among other cargo groups in 2023 (Statistics Poland, 2024a).

The Greater Poland Voivodeship plays an important role in the transport system of Poland. In 2023, over 142.6 million tons of cargo were received by voivodeship. A significant portion of goods was transported within the voivodeship – over 84 million tons, which proves the strong logistical and economic capacity of the region. Greater Poland Voivodeship also is an essential hub for interregional exchange of goods, receiving 47 million tons of cargo from other voivodeships and approximately 11.5 million tons coming from foreign countries. In 2023, companies from this region dispatched 136.2 million tonnes of goods, including 11.6 million tonnes exported abroad (Statistics Poland, 2024a). These data confirm that the region is an active participant in both domestic and international transport market.

A number of companies operates in the transport and logistics sector in Greater Poland Voivodeship of Poland. These companies are increasingly investing in digital technologies to support logistics operations, as highlighted in the report Information Society in Poland in 2024 published by the Statistic Poland (Statistics Poland, 2024c). Based on conduced analysis of available literature, it could be stated that IT systems are essential for efficient operation of modern transport companies. These systems support core logistics processes, improve operational transparency, and enable data-driven management. However, challenges remain dealing, i.e., with high implementation costs, complicated system integration, and low digital competencies. Moreover, transport companies operate in evolving market conditions, therefore, investigation of practitioners' opinion on needed directions of IT system development may enable deeper understanding of how technological innovations shape the performance and competitiveness of road transport companies.

The aim of the article is to identify the directions of IT systems development considering practitioners' opinions. The study presents the results of a diagnostic survey conducted among employees of transport and forwarding companies, providing valuable insights into the practical use of IT systems. A novelty of this study deals with the examination of opinions of practitioners employed in road transport companies on the expected directions of IT systems development.

Literature Review

The dynamic development of information technology has significantly impacted the operation of road freight transport companies. Transport companies carry out a wide range of activities, including acquiring transport orders, planning routes, fleets managing, maintaining customer relations and other (Fig. 1). These processes implementation requires planning and coordination of activities, data integration, which can be facilitated by IT systems. These activities should be performed to achieve optimal efficiency and reliability in logistics operations (Kadłubek et al., 2022).
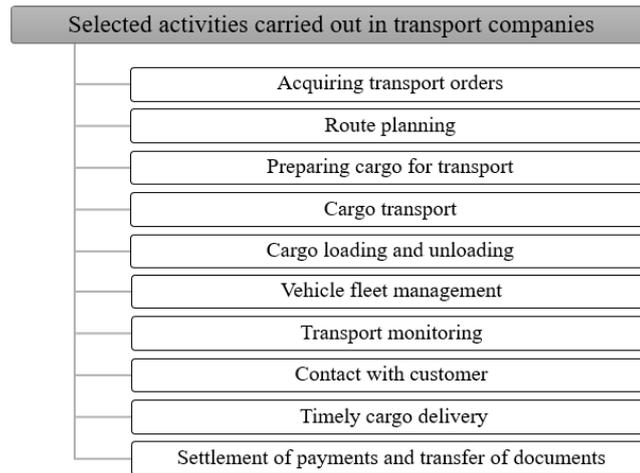
Fig. 1. Selected activities carried out in transport companies (own elaboration)

Modern transport enterprises implement various digital systems to support their core logistics functions. These systems include, i.e., route planning systems, fleet management platforms, Global Positioning Systems (GPS), Electronic Data Interchange (EDI), Transport Management Systems (TMS), and Enterprise Resource Planning (ERP) and other (Fig. 2). It was noted that application of these systems contribute, i.e., to improvement of companies operational efficiency, reduced errors, and enhanced customer service (Nowakowska, 2023; Heliosz, 2023).

Smart transportation technologies are increasingly being applied to facilitate traffic management, infrastructure monitoring, and ensure transportation efficiency and safety. Oladimeji et al. (2023) provided an overview of key innovations such as IoT, machine learning, and big data analytics, which support intelligent decision-making and predictive maintenance in transport systems. These developments reflect broader European and global trends in digital integration and automation. Meanwhile, Gonzalez-Feliu et al. (2014) noted that urban freight planning increasingly relies on integrated decision-support systems and simulation tools to enhance sustainability and operational coordination.

Despite these advancements, several challenges remain. Organizational resistance, infrastructure limitations, and financial constraints are frequently cited as barriers to digital transformation (Kamruzzaman, 2024). Evangelista et al. (2013) emphasized that small and medium-sized logistics providers face unique challenges in adopting new technologies, including limited financial resources, lack of technical expertise, and uncertainty about return on investment. In this study, a structured approach to technology implementation was proposed, taking into account organisational readiness and strategic alignment.
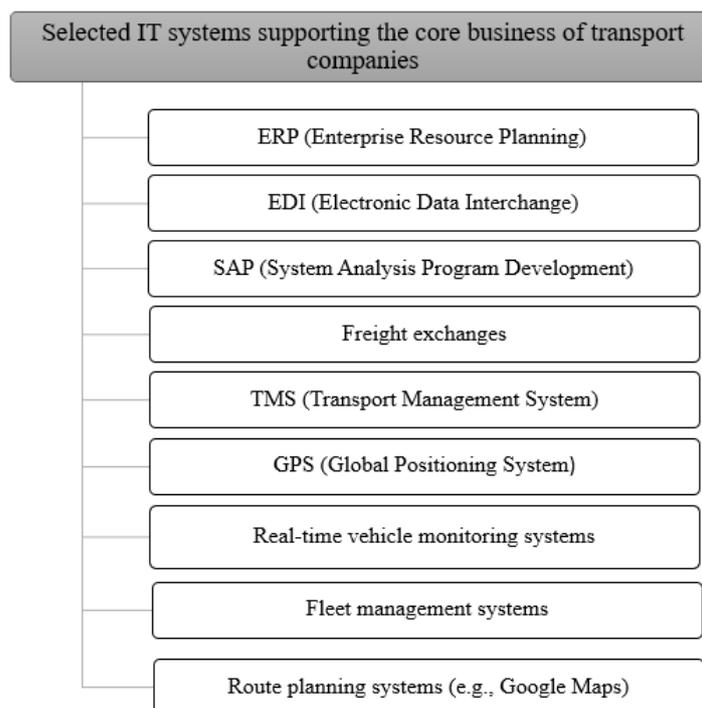
Fig. 2. Selected IT systems supporting the core business of transport companies (own elaboration)

Digital innovation is also recognized as a source of competitive advantage, enhancing agility and responsiveness in logistics operations (Manners-Bell and Lyon, 2022). IT systems allow to improve service quality, operational coordination, and data accuracy (Mohd Yusof et al., 2024), especially while applying GPS and fleet management technologies contributing to route optimization and fuel efficiency, particularly essential for small and medium-sized enterprises (Kamruzzaman, 2024).

The diverse approaches to digital transformation in European transport companies are shaped by factors such as leadership and organizational culture. In regard to this, digital platforms are playing an increasingly important role in enabling real-time communication and process automation (Fu, Avenyo and Ghauri, 2021; Dmitriev and Plastunyak, 2020). In turn, the use of information and communication technology (ICT) in logistics management is constantly expanding, especially areas such as inventory control, transport planning, and customer service (Shirgba, 2024). The role of artificial intelligence in companies operation is also emphasized (Filina-Dawidowicz et al., 2025).

The concept of e-logistics underscores the importance of integrated systems and data-driven decision-making in managing digital supply chains (Wang and Pettit, 2016). Furthermore, the integration of ERP and TMS systems has been shown to enhance coordination and service quality in freight transport operations (Tabim et al., 2021). It should be noted that measurable improvements in logistics efficiency through the use of information systems were observed in Polish transport enterprises (Witkowski, 2017).

The available literature provides extensive evidence of the growing role of IT systems in transport and logistics companies operation. Callefi et al. (2024) proposed a roadmap for prioritizing technology-enabled capabilities in freight transport management, emphasizing strategic alignment and performance improvement. The architecture and functionality of digital platforms, which facilitate real-time communication and data exchange among logistics stakeholders were explored by Heinbach et al. (2022). Kadłubek et al. (2022) highlighted the importance of intelligent transportation systems (ITS) and logistics resources in enhancing customer service and operational reliability.

Kasher et al. (2025) offered a taxonomy of digitalization technologies applicable to logistics business processes, providing a structured overview of tools used in transport enterprises. Logistics information systems in the context of Industry 4.0, focusing on digital transformation and supply chain integration were discussed by Kocaoglu (2024). In turn, Kuznetsova and Podbiralina (2022) analysed transport digitalization issues from a systems' perspective, emphasizing the role of intelligent solutions in optimizing transport networks.

Moreover, considering Polish companies operation, Heliosz (2023) and Nowakowska (2023) analysed the current state of digitalization in transport, forwarding and logistics enterprises, noting disparities in its adoption levels

between large and small companies. Puzio et al. (2025) examined the role of intelligent transport systems and smart technologies in urban traffic management, which indirectly influence freight transport operations. Furthermore, a comprehensive review of ICT applications in logistics and freight transportation, classifying research themes and proposing future directions, was provided by Perego et al. (2011).

It should be noted that the institutional and regulatory environment also plays an important role in IT systems implementation. The United Nations Economic Commission for Europe (2024) prepared a handbook on digitalization and automation in intermodal freight transport, providing guidelines for companies leaders in terms of infrastructure development and policy support.

Based on the analysis of available literature it could be stated that the issues related to benefits, barriers, problems, as well as current directions of IT systems used in road freight transport companies should be analysed in more details, especially considering the opinions of practitioners.

Methodology

In the presented study the main research question was set:

- What are the development directions of IT systems used in road freight transport companies, considering the opinions of practitioners from Greater Poland Voivodeship in Poland?

Auxiliary questions were formulated as follows:

- What types of IT systems are currently used in road freight transport companies and how do they affect the operational processes carried out in these companies?
- What are the main benefits of using IT systems in transport companies?
- What barriers are encountered during the implementation and use of IT systems?

Within the study the barriers and benefits of IT systems implementation, as well as their development directions have been identified (Fig. 3).
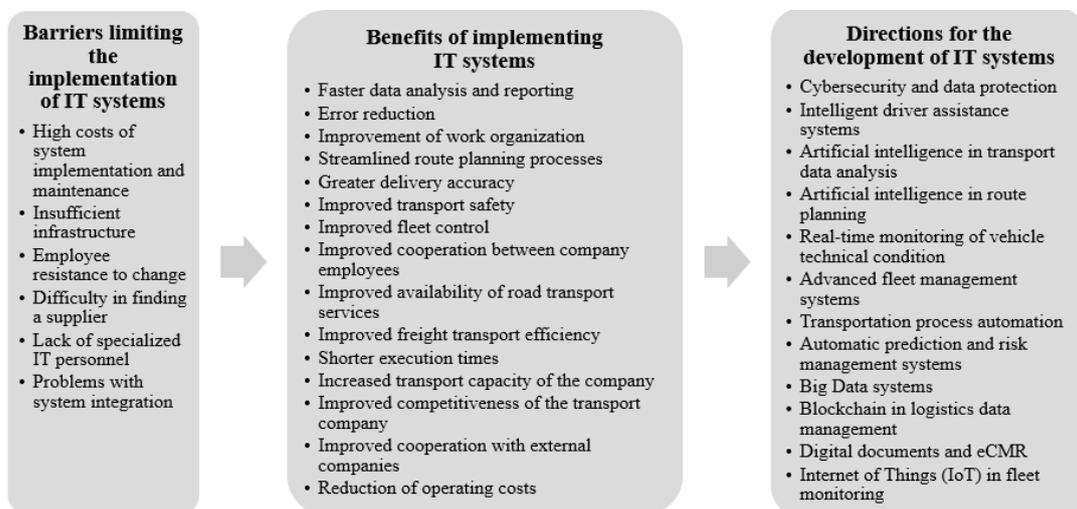

Barriers limiting the implementation of IT systems
- High costs of system implementation and maintenance
- Insufficient infrastructure
- Employee resistance to change
- Difficulty in finding a supplier
- Lack of specialized IT personnel
- Problems with system integration

Benefits of implementing IT systems
- Faster data analysis and reporting
- Error reduction
- Improvement of work organization
- Streamlined route planning processes
- Greater delivery accuracy
- Improved transport safety
- Improved fleet control
- Improved cooperation between company employees
- Improved availability of road transport services
- Improved freight transport efficiency
- Shorter execution times
- Increased transport capacity of the company
- Improved competitiveness of the transport company
- Improved cooperation with external companies
- Reduction of operating costs

Directions for the development of IT systems
- Cybersecurity and data protection
- Intelligent driver assistance systems
- Artificial intelligence in transport data analysis
- Artificial intelligence in route planning
- Real-time monitoring of vehicle technical condition
- Advanced fleet management systems
- Transportation process automation
- Automatic prediction and risk management systems
- Big Data systems
- Blockchain in logistics data management
- Digital documents and eCMR
- Internet of Things (IoT) in fleet monitoring

Fig. 3. Identified barriers, benefits and development directions of IT systems implementation in road freight transport companies (own elaboration)

A diagnostic survey was carried out among employees of road freight transport and forwarding companies operating in Greater Poland Voivodeship in Poland. A structured questionnaire, consisting of 16 questions, was developed. The questionnaire was divided into two sections addressing:

- respondent's profile, including questions about the company size, respondent's position and experience in the industry;
- thematic questions, focused on the use of IT systems in practitioners' daily operations, perceived benefits, implementation barriers, areas requiring improvements and other.

The questionnaire included multiple-choice questions with fields for additional comments, enabling respondents to express individual opinions and highlight aspects not covered by predefined options. Moreover, questionnaire contained questions, where five-point Likert scale was used (Joshi et al., 2015). To maintain data completeness and quality, all questions were designed as mandatory.

The questionnaire was developed using Google Forms. The survey was carried out between May 6 and July 2, 2025. The questionnaire was shared through various communication channels, including Facebook groups dedicated to the representatives of transport and logistics sector, online industry forums, as well as direct email invitations were sent to employees of transport companies, accompanied by a request for its further distribution.

In total, 106 valid responses were collected from individuals employed in the road freight transport sector in the Greater Poland Voivodeship in Poland. The inclusion criteria required participants to be employed in a transport or forwarding company and possess either practical or theoretical knowledge of IT systems used in road freight transport. Voluntary and anonymous participation in the survey was intended to enhance the reliability, authenticity, and impartiality of the participants' responses.

The collected data were subjected to descriptive analysis. Based on the results analysis the recommendations for supporting the digital transformation of the road freight transport companies were proposed.

Results

Analysing the responses acquired from representatives of road freight transport companies from the Greater Poland Voivodeship (Poland), the predominance of male respondents (88 individuals; 83.02%) compared to female (18 individuals; 16.98%) was noted. The observed gender disproportion probably corresponds to existing employment trends in the analysed sector, where men constitute the majority in performing operational tasks. The distribution of respondents' age is illustrated in Figure 4.
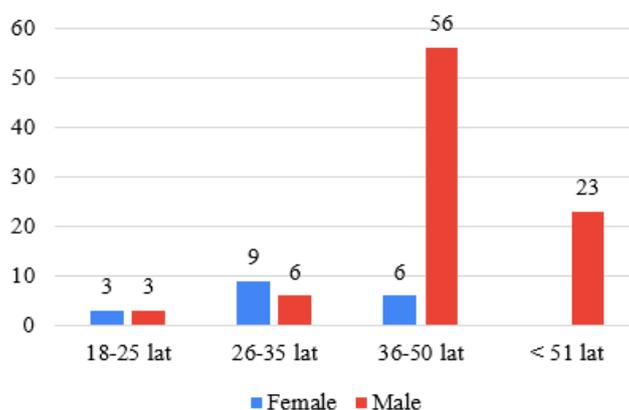

Fig. 4. Age range of respondents, number of responses (own elaboration)

The practitioners were hired in companies of different size (Fig. 5). The majority of survey participants (56.6%) were employed in enterprises with over 50 employees. 32.1% of respondents indicated employment in firms comprising 21–50 employees. Only 6.6% of participants worked in organizations with 6–20 employees, while 4.7% of interviewees were hired in micro-enterprises employing up to 5 individuals.
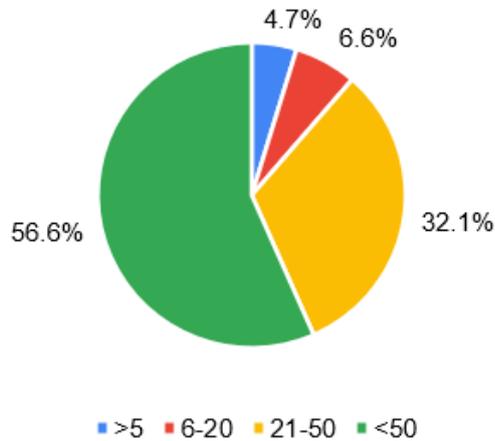
**Fig. 5. Number of employees in companies represented by respondents,
percentage of responses (own elaboration)**

The positions performed by respondents in companies are presented in Figure 6. Freight forwarders (43 individuals) constituted the largest group of respondents, followed by administrative employees (38). Department managers accounted for 12 surveyed practitioners, while drivers were represented by 9 persons. A minor share of respondents reported holding positions such as owner, director, or president (3 practitioners), whereas 1 interviewee declared position of electrician. This structure highlights the predominance of operational and administrative staff in the surveyed population.
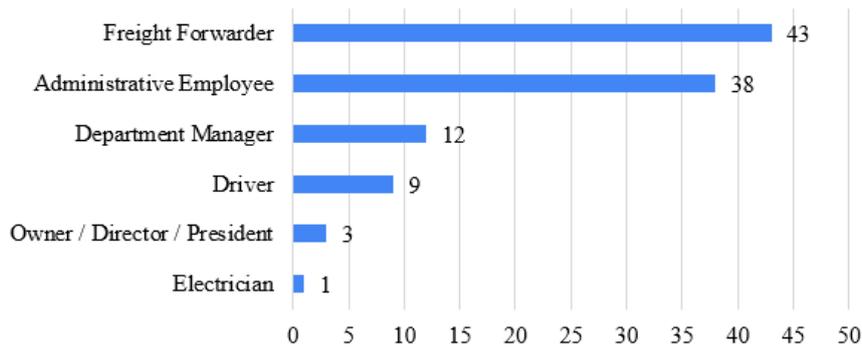
Fig. 6. Respondent's position in the enterprise, number of responses (own elaboration)

Respondents were also asked about their work experience in a given position (Fig. 7). The vast majority of interviewees (73.6%) reported that occupied their current position for over 16 years. In turn, 10.4% of practitioners have worked in the industry for 5–10 years, 8.5% of surveyed people had 11–15 years of work experience, and only 7.5% of respondents possessed less than 5 years of practice. It should be noted that experienced employees often acquire deep institutional knowledge, which can be both an asset and a challenge in the context of implementing IT systems in companies.
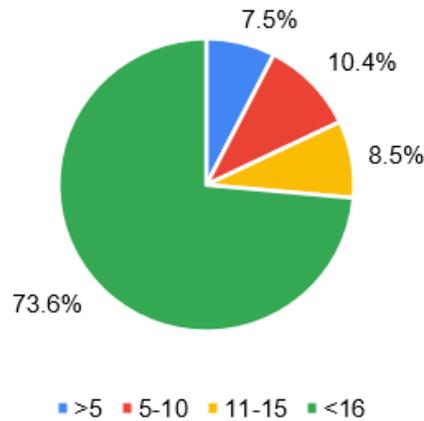
Fig. 7. Respondent's work experience in a given position, percentage of responses (own elaboration)

With regard to geographical range of activity carried out by enterprises employing the respondents (Fig. 8), a significant majority of participants (65.1%) reported working in companies engaged in international transport activities, while 34.9% indicated employment in enterprises operating exclusively within the domestic market. This distribution of answers reflects the strong presence of internationally active transport enterprises in the Greater Poland Voivodeship in Poland, that may require advanced IT solutions to support cross-border logistics, regulatory compliance, and real-time communication across diverse markets.
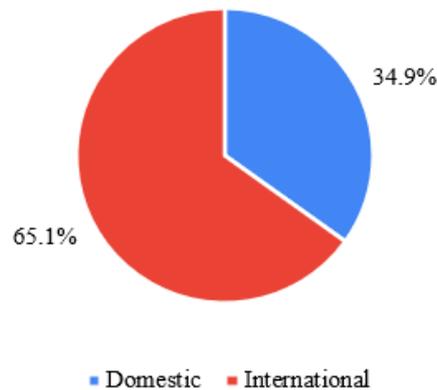
Fig. 8. Range of transport companies activity, percentage of responses (own elaboration)

The practitioners marked the types of cargo transported within activity of represented enterprises (Fig. 9). This was a multiple-choice question. General cargo (e.g., palletized or boxed goods) was the most frequently indicated cargo group (selected by 66 practitioners), followed by food products not requiring refrigeration (45 responses). Liquid bulk cargo (11), oversized cargo (10), and other types (1) were mentioned less frequently. It was found that the majority of respondents were involved in the activities related to transportation of general cargo and non-perishable goods.
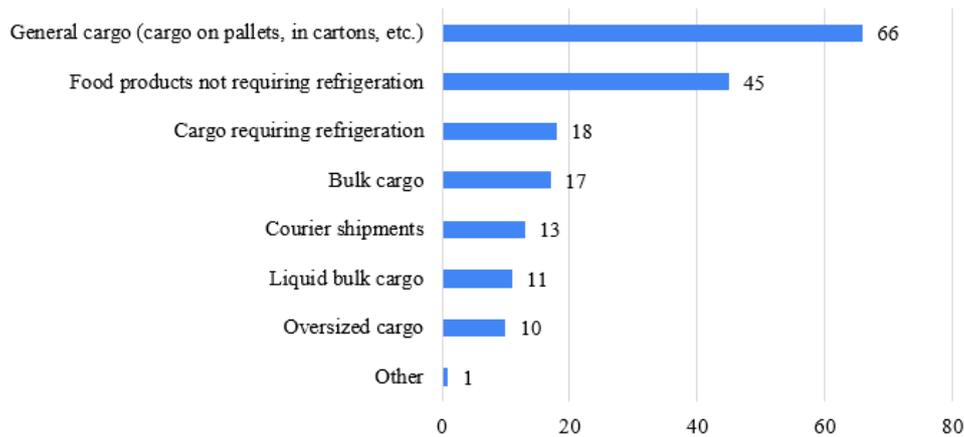
Fig. 9. Types of cargo handled by companies represented by respondents, number of responses (own elaboration)

To identify IT systems supporting transport companies operation, respondents indicated the systems used in companies they represent (Fig. 10). Route planning tools (e.g., Google Maps), indicated by 106 respondents, followed by fleet management systems and GPS technologies (each selected by 101 respondents) were selected the most frequently. A substantial number of practitioners also reported the use of EDI (97 responses) and TMS (87 responses). Transport exchanges (41 responses) and real-time vehicle condition monitoring systems (31 responses) were used less often. These results suggest a high level of digitalisation among the companies represented by practitioners.
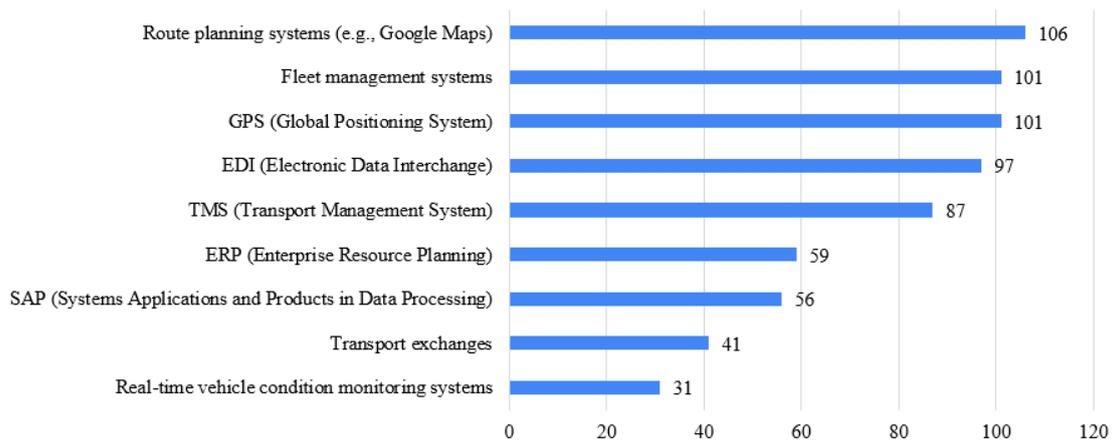

Fig. 10. IT systems used in the transport companies represented by respondents, number of responses (own elaboration)

Respondents were asked to assess a set of sixteen benefits associated with the use of IT systems, applying a five-point scale, where 1 indicated insignificant benefit, and 5 – very significant one. The mean values and standard deviations of achieved ratings are presented in Figure 11. The highest-rated benefits included: faster data analysis and reporting (arithmetic mean 4.21), error reduction (4.15), and improvement of work organization (4.11). This result may indicate that IT systems are primarily valued for their contribution to operational precision and decision-making efficiency. Unspecified benefit "Other" (2.92) and the reduction of operating costs (2.84) received the lowest mean values, suggesting that financial outcomes and indirect effects are viewed by practitioners as less significant.
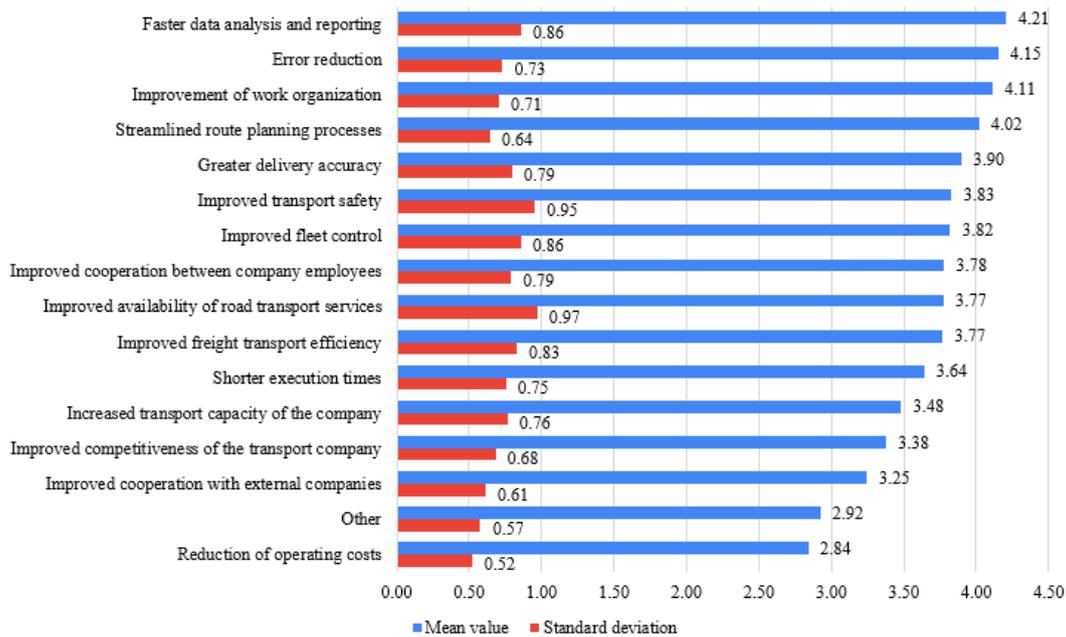
Fig. 11. Benefits of implementing IT systems in transport companies, arithmetic mean of ratings (own elaboration)

Practitioners also rated selected problems associated with IT systems currently used in transport companies using a five-point scale, where 1 indicated insignificant problem, and 5 – very significant one. The mean values and standard deviations of achieved ratings are presented in Figure 12. The high cost of system use, with an arithmetic mean 3.82, was identified as the most significant problem, suggesting that financial burden remains a key issue to broader adoption or modernization of IT systems. Other notable issues included: insufficient technical support (2.80) and low system efficiency in relation to actual expectations (2.44). Low-ranked problems were related to difficulties in IT systems operation by staff (1.66), and data processing issues (1.44), revealing that these matters did not raise any major concerns among the respondents.
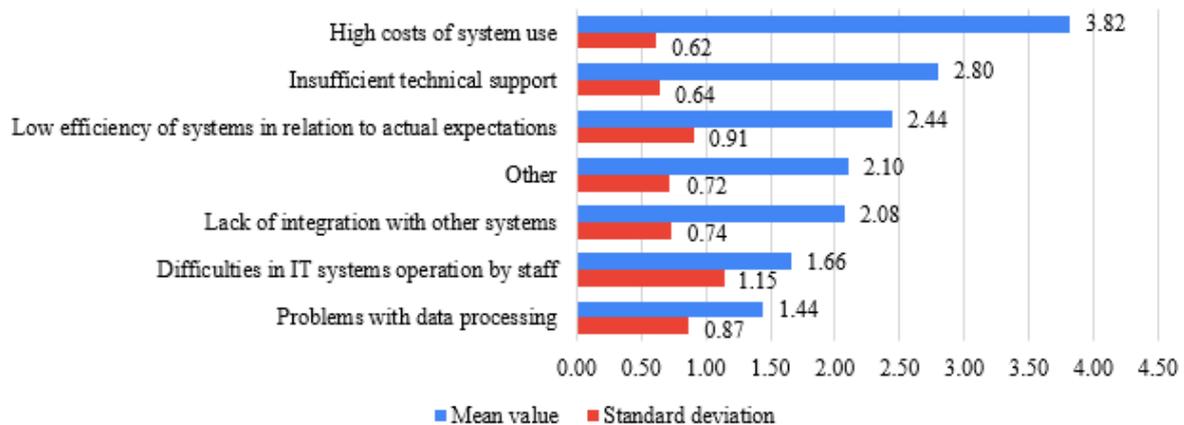

Fig. 12. Problems associated with IT systems currently used in transport companies, arithmetic mean of ratings (own elaboration)

Next question aimed to identify areas of transport companies activity that require improvement or modernization through the use of IT systems. When answering the question, practitioners could select more than one area (Fig. 13). Cooperation with external partners, such as freight forwarders and customers, was indicated most frequently by respondents (95 responses). This was followed by vehicle failure prediction systems (86 responses) and real-time transport monitoring (85 responses), highlighting a strong demand for predictive and real-time technologies needed in operational management. The less frequently selected areas were dealing with customer service and order fulfilment (7 responses), data analysis and reporting (5 responses), and order and transport documentation management (5 responses), indicating that these areas were quite well organised in the companies analysed.
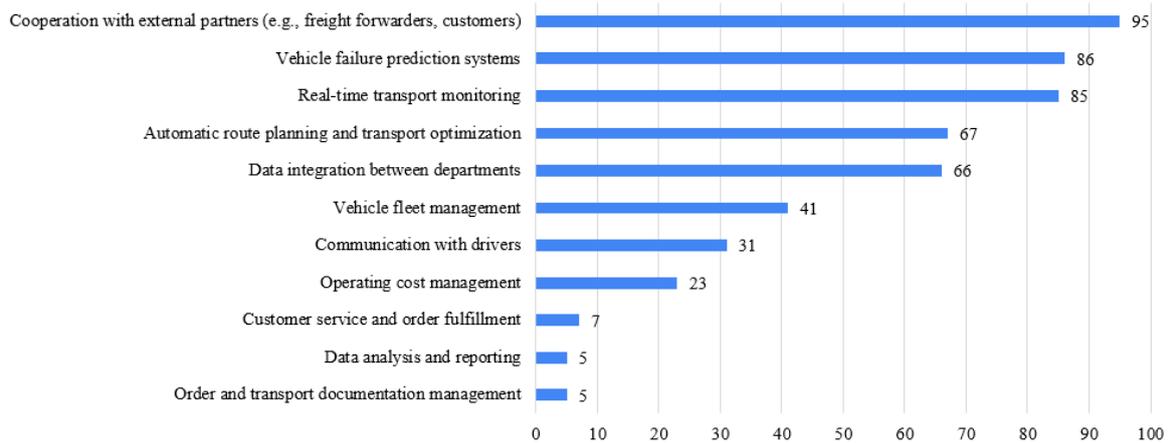
Fig. 13. Areas requiring improvement, number of responses (own elaboration)

Respondents were asked to provide their assessment of the impact of IT systems on the efficiency of transport operations within represented companies (Fig. 14). The majority of respondents (56.6%) rather positively evaluated the impact of IT systems, while 41.5% expressed a neutral viewpoint. Only 1.9% of participants considered the impact to be very positive. These findings show that, although IT systems implementation is generally perceived as positively impacting operation of companies, a certain degree of cautious optimism persists among professionals.
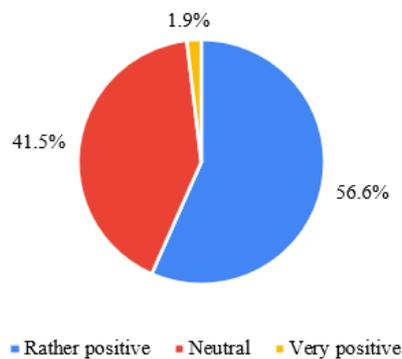

Fig. 14. Assessment of the impact of IT systems on the efficiency of transport operations within the company, percentage of responses (own elaboration)

The survey also included a question aimed at determining the investment intentions of transport companies in the development of IT systems over the next three years (Fig. 15). A significant majority of respondents (77.4%) indicated that they do not know whether there are plans to invest in IT systems development within the specified time period. Only 8.5% of practitioners confirmed investment plans. A marginal share of survey participants (0.9%) chose not to disclose their position.
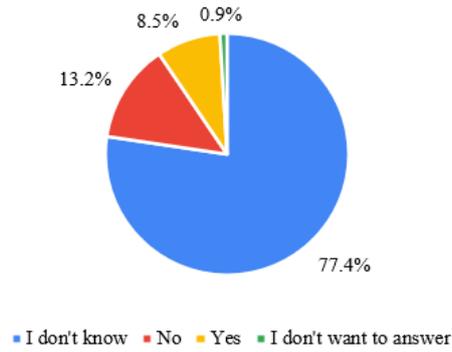
Fig. 15. Investments intention in the development of IT systems in transport companies over the next three years, percentage of responses (own elaboration)

Respondents were also asked to indicate barriers limiting the implementation of IT systems in transport companies (Fig. 16). The high costs of system implementation and maintenance (selected by 82 respondents) was selected by practitioners the most frequently, followed by insufficient infrastructure within the company (74 responses), and employee resistance to change (73 responses). That result may indicate that financial constraints, organizational readiness, and human factor play a decisive role in shaping the pace and scope of IT system implementation in road freight transport companies. The least frequently indicated barriers included lack of specialized IT personnel (22 responses), and system integration problems (2 responses).
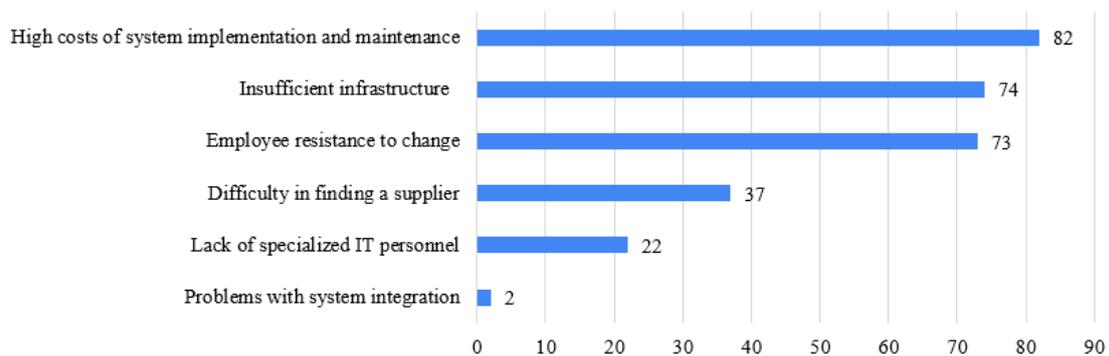

Fig. 16. Barriers limiting the implementation of IT systems in transport companies, number of responses (own elaboration)

The final question in the survey aimed to identify the key development directions for IT systems, revealing the needs of road freight transport companies (Fig. 17). The most frequently indicated priorities were: cybersecurity and data protection (92 responses), and intelligent driver assistance systems (90 responses), reflecting growing concerns about digital safety and operational support. Less frequently selected by respondents, but still relevant, were: Big Data systems (16 responses), blockchain for logistics data management (14 responses), digital documentation and eCMR (13 responses), and Internet of Things (IoT) applications in fleet monitoring (7 responses).
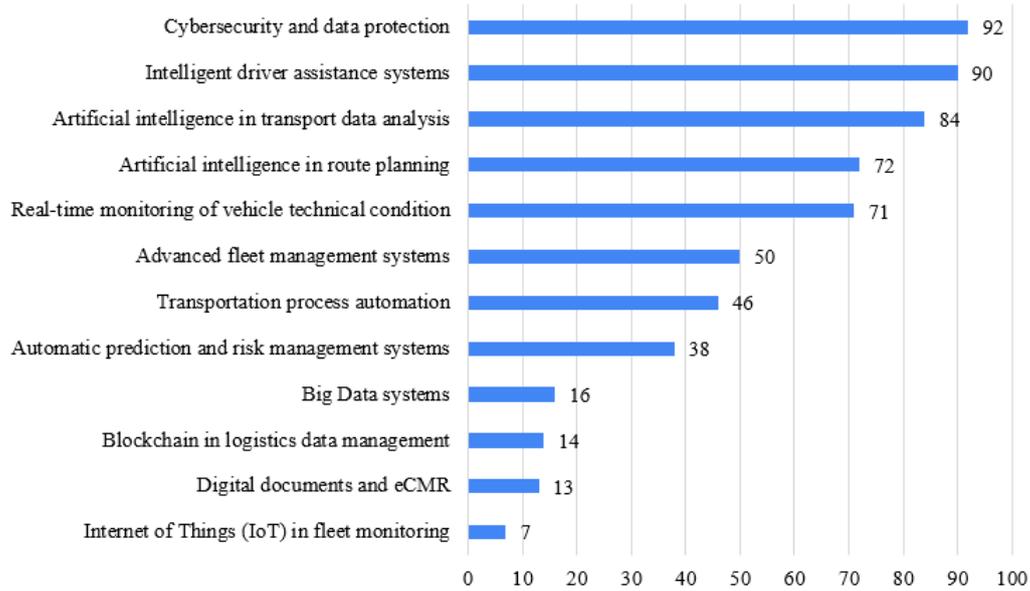
Fig. 17. Directions for the development of IT systems used by road freight transport companies, number of responses (own elaboration)

These findings provide a clear indication of the strategic directions in which IT systems may evolve to meet the operational and analytical needs of practitioners.

Conclusions

Presented study shows the directions of IT systems development in road freight transport companies, considering viewpoint of practitioners employed in the Greater Poland Voivodeship in Poland. The findings highlight both the widespread adoption of IT systems and the challenges that transport companies face in implementation of these systems.

The research results revealed that, in opinion of surveyed practitioners, digitalization is progressing steadily in the activities of the road transport companies. Respondents indicated that in companies, where they are employed, route planning systems, fleet management platforms, GPS, EDI and TMS are the most commonly used. Larger companies increasingly implement advanced systems like TMS and ERP, while smaller ones still rely on basic tools. These systems allow to streamline daily processes and increase the precision and coordination of activities.

Among the most significant benefits of implementing IT systems, respondents mentioned faster data analysis and reporting, fewer errors and improved organization of work within the company. At the same time, significant barriers of implementing IT systems in transport companies include high implementation and maintenance costs, inadequate companies infrastructure, and employee resistance to changes. These results partly confirm the research findings of Kamruzzaman (2024). It should be highlighted that cost-related problems continue to pose substantial challenges in the effective use of IT systems in transport companies.

Moreover, the achieved results indicate that respondents perceive the most significant potential for IT-driven improvements in areas such as external collaboration, predictive maintenance, and real-time operational control, whereas administrative and reporting functions are considered comparatively less essential for modernization. Importantly, the need to improve cooperation with external partners was identified by respondents as very essential. This opinion is confirmed by Heinbach et al. (2022), who indicated that the lack of effective cooperation between entities in the supply chain is a significant limitation to the full exploitation of digitalization potential.

Considering further development of IT systems in road freight transport companies, respondents mentioned the need to develop solutions in the areas of cybersecurity, intelligent driver assistance systems, and transport data analysis using artificial intelligence. These directions confirm the growing need to implement secure, intelligent, and integrated technologies that support competitiveness and operational control. Recommendations for supporting the digital transformation of the road freight transport companies are presented in Table 1.

Table 1. Recommendations for supporting the digital transformation of the road freight transport companies (own elaboration)

Recommendation	Description
Identify funding sources for technology acquisition	Explore national and EU-level funding programs, grants, and subsidies that support digital transformation in the transport sector. Assign a dedicated team, use grant application platforms, and cooperate with consultants specializing in funding acquisition
Invest in IT infrastructure	Modernize internal systems by implementing cloud-based platforms, telematics, and integrated transport management systems and developing the company's IT base. Develop step-by-step implementation plans and appoint IT project managers to oversee upgrades
Raise employee awareness of the need for innovations	Conduct internal campaigns and training to promote a culture of openness to technological change and continuous improvement, share success stories, create a safe environment for new ideas
Acquire knowledge about current solutions and technologies	Monitor trends and innovations in transport-related ICT to identify tools that can optimize transport processes and improve competitiveness. Organize internal knowledge-sharing sessions, subscribe to industry reports, and participate in webinars and trade fairs
Invest in driver training in IT tools usage	Ensure drivers are trained to use mobile apps, navigation systems, and digital reporting tools effectively
Search for potential IT solutions providers	Establish partnerships with technology vendors offering tailored solutions for transport and logistics operations, select providers, compare and decide on best option
Conduct analysis on companies needs	Perform internal audits and conduct regular discussions with staff to identify areas where digital tools can streamline workflows and reduce operational costs
Develop a digital transformation roadmap	Create a strategic plan outlining goals, timelines and key performance indicators for implementing digital technologies, review progress regularly
Monitor and evaluate the effectiveness of implemented solutions	Introduce assessment mechanisms of digital tools impact on processes performance, customer satisfaction and cost efficiency; select indicators used for assessment; compare results against baseline data; document findings and lessons learned
Establish cybersecurity protocols for digital systems	Implement robust data protection measures, including encryption, controls and regular audits to secure sensitive transport and logistics information; establish partnerships with companies specialising in cybersecurity.
Promote inter-organizational data exchange standards	Introduce standard formats and encourage employees to use platforms for data exchange between transport companies, customers and logistics partners to improve coordination and transparency. Adopt EDI standards, implement eCMR and develop integration tools based on API (Application Programming Interface).

It should be noted that research results are limited to selected case study analysis, the opinions of practitioners employed in Greater Poland Voivodeship in Poland were considered. Moreover, the size of research sample could impact the results. Therefore, it would be reasonable to repeat the research and investigate the opinions of transport companies representatives from other voivodeships in Poland and other countries.

Authors' future research will be focused on issues related to implementation of AI technology in transport and logistics companies, especially considering benefits and threats related to AI technology usage. The research results may be interesting to managers of transport and forwarding companies, as well as logistics operators who are in charge of strategic development and are involved in organization and management of freight road transport.

References

- Callefi, M.H., Devós G.M., Filho, M.G., Ribeiro da Silva, E., Osiro, L. and Reis, V. (2024), 'A roadmap for prioritising technology-enabled capabilities in road freight transportation management,' *International Journal of Logistics: Research and Applications*, 27(5), 1–25 https://doi.org/10.1080/13675567.2024.2389069.
- Cudziło, M., Koliński, A., Adamczak, M. and Domański, R. (2024), 'The impact of electronic despatch advice on the service time of a means of transport in a distribution center,' *Ekonomski Vjesnik*, 37(1), 151–159. https://doi.org/10.51680/ev.37.1.11.
- Dmitriev, A. and Plastunyak, I. A. (2020), 'Digital platforms for managing transport and logistics systems in the context of sustainable development,' *E3S Web of Conferences*, 208(1). https://doi.org/10.1051/e3sconf/202020801007.
- Evangelista, P., McKinnon, A. and Sweeney, E. (2013), 'Technology adoption in small and medium-sized logistics providers,' *Industrial Management & Data Systems*, 113(7), 967–989. https://doi.org/10.1108/IMDS-10-2012-0374.
- Filina-Dawidowicz, L., Barczak, A., Sęk, J., Trojanowski, P. and Wiktorowska-Jasik, A. (2025), 'Use of artificial intelligence technology in companies in Poland: A comparative analysis of 2023-2024 period,' Proceedings of 45th International Business Information Management Association (IBIMA) Conference, 25-26 June, Cordoba, Spain, 1846–1857.
- Fu, X., Avenyo, E. and Ghauri, P. (2021), 'Digital platforms and development: A survey of the literature,' *Innovation and Development*, 11(2–3), 303–321. https://doi.org/10.1080/2157930X.2021.1975361.
- Gonzalez-Feliu, J., Semet, F. and Routhier, J.-L. (2014), Sustainable Urban Logistics: Concepts, Methods and Information Systems, Springer Nature Link. https://doi.org/10.1007/978-3-642-31788-0.
- Heinbach, C., Beinke, J., Kammler, F. and Thomas, O. (2022), 'Data-driven forwarding: A typology of digital platforms for road freight transport management,' *Electronic Markets*, 32, 1–19. https://doi.org/10.1007/s12525-022-00540-4.
- Heliosz, P. (2023), 'Digitalization of Enterprises in the Transport-Forwarding-Logistics (TFL) Sector in Poland,' *Współczesna Gospodarka*, 17(2), 107–115. https://doi.org/10.26881/wg.2023.2.08.
- Joshi, A., Kale, S., Chandel, S.K. and Pal, D.K. (2015), 'Likert scale: Explored and explained,' *Current Journal of Applied Science and Technology*, 7, 396–403.
- Kadłubek, M., Thalassinos, E., Domagała, J., Grabowska, S. and Saniuk, S. (2022), 'Intelligent Transportation System Applications and Logistics Resources for Logistics Customer Service in Road Freight Transport Enterprises,' *Energies*, 15(13), 4668. https://doi.org/10.3390/en15134668.
- Kamruzzaman, A.K.M. (2024), 'Information Technology In Logistics And Supply Chain Management: Prospect Vis-À-Vis Challenges,' *IOSR Journal of Business and Management*, 26(3), 29–32.
- Kasher, J.-D., Sardarabady, N.J. and Durst, S. (2025), 'Towards a Taxonomy of Digitalization Technologies in Road Freight Transportation Logistics Business Processes,' Proceedings of the 58th Hawaii International Conference on System Sciences, 1463–1472. https://doi.org/10.24251/HICSS.2025.177.
- Kocaoglu, B. (2024), Logistics Information Systems: Digital Transformation and Supply Chain Applications in the 4.0 Era, Springer Information System, Cham.
- Koliński A. and Śliwczyński B. (2015), 'IT Support of Production Efficiency Analysis in Ecological Aspect,' In: Golińska, P., Kawa, A. (eds) *Technology Management for Sustainable Production and Logistics*. EcoProduction. Springer, Berlin, Heidelberg, 205–219. https://doi.org/10.1007/978-3-642-33935-6_11.
- Kuznetsova, G.V. and Podbiralina, G.V. (2022), 'Transport Digitalization,' *Lecture Notes in Networks and Systems*, 549, Springer Information System, Cham, 579–608. https://doi.org/10.1007/978-3-031-16598-6_25.
- Manners-Bell, J. and Lyon, K. (2022), Logistics and supply chain innovation: Enhancing competitive advantage (2nd ed.). Kogan Page, London.
- Mohd Yusof, W., Rashid, N., Shaharin, N. and Lam, K.X. (2024), 'The Impact of Information Technology towards Logistics Performance,' *International Journal of Academic Research in Economics and Management Sciences*, 13(3), 1–15. https://doi.org/10.6007/IJAREMS/v13-i3/22424.
- Nowakowska, P. (2023), 'New technologies in enterprise development and management,' *Zarządzanie innowacyjne w gospodarce i biznesie*, 1(36), 63–74.
- Oladimeji, D., Gupta, K., Kose, N.A., Gundogan, K., Ge, L. and Liang, F. (2023), 'Smart Transportation: An Overview of Technologies and Applications,' *Sensors*, 23(8), 3880. https://doi.org/10.3390/s23083880.

- Perego, A., Perotti, S. and Mangiaracina, R. (2011), 'ICT for logistics and freight transportation: A literature review and research agenda,' *International Journal of Physical Distribution & Logistics Management*, 41(5), 457–483, 2011. https://doi.org/10.1108/09600031111138826.

- Puzio, E., Drożdż, W. and Kolon, M. (2025), 'The Role of Intelligent Transport Systems and Smart Technologies in Urban Traffic Management in Polish Smart Cities,' *Energies*, 18(10), 2580. https://doi.org/10.3390/en18102580.

- Shirgba, T.A. (2024), 'The Role of ICT in Logistics Management: A Literature Review,' *International Journal of Novel Research and Development*, 9(8), 397–404.

- Statistics Poland (2024a), Road transport in Poland in the years 2022 and 2023. Warsaw, Szczecin. Available online: https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5511/6/8/1/td_w_pl_2022_i_2023.pdf (accessed on 7 October 2025).

- Statistics Poland (2024b), Transport – activity results in 2023. Warsaw, Szczecin. Available online: https://stat.gov.pl/obszary-tematyczne/transport-i-lacznosc/transport/transport-wyniki-dzialalnosci-w-2023-roku,9,23.html (accessed on 7 October 2025).

- Statistics Poland (2024c), Information society in Poland in 2024. Warsaw, Szczecin. Available online: https://stat.gov.pl/obszary-tematyczne/transport-i-lacznosc/transport/transport-wyniki-dzialalnosci-w-2023-roku,9,23.html (accessed on 12 October 2025).
- Tabim, V. M., Ayala, N. F. and Frank, A. G. (2021), 'Implementing Vertical Integration in the Industry 4.0 Journey: Which Factors Influence the Process of Information Systems Adoption?' *Information Systems Frontiers*, 26, 1615–1632. https://doi.org/10.1007/s10796-021-10220-x.
- United Nations Economic Commission for Europe (2024), Handbook on Digitalization and Automation in Intermodal Freight Transport, United Nations, Geneva. Available online: https://unece.org/sites/default/files/2025-01/Handbook%20on%20Digitalization%20and%20Automation%20in%20Intermodal%20Freight%20Transport%20EN.pdf (accessed on 12 October 2025).
- Wang, Y. and Pettit, S. (2016), E-Logistics: Managing Your Digital Supply Chains for Competitive Advantage, Kogan Page, London.
- Witkowski, K. (2017), 'Internet of Things, Big Data, Industry 4.0 – Innovative Solutions in Logistics and Supply Chains Management,' *Procedia Engineering*, 182, 763–769. https://doi.org/10.1016/j.proeng.2017.03.197.
- Zając, J., Dubisz, D. and Koliński, A. (2024), 'Multi-criteria analysis of road transport service providers as a method to support decision-making within sustainable supply chains,' *Scientific Journals of the Maritime University of Szczecin*, 79(151), 39–48. https://doi.org/10.17402/614.