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THE USE OF ARTIFICIAL INTELLIGENCE IN LOGISTICS ON THE EXAMPLE OF A FORWARDING COMPANY

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Purpose: Identification of artificial intelligence applications in freight forwarding and evaluation of their role as tools supporting managerial decisions in logistics.
Design/methodology/approach: The objectives are achieved through the use of three research methods: a systematic literature review, an individual in-depth interview (IDI) and an analysis of secondary data. The article is qualitative in nature, with elements of quantitative analysis. The theoretical scope includes issues related to logistics management, forwarding, digital transformation and artificial intelligence in supply chains. In contrast, the subject scope focueses on the operational applications of artificial intelligence in a forwarding company, with particular emphasis on delivery planning, rate analysis, automation of administrative processes and support of managerial decisions.
Findings: Analysis of secondary data revealed a growing level of digitalization in the transport and storage sector in the European Union, while Poland still maintaining a relatively low level of digital intensity. The study indicates that artificial intelligence is primarily applied in freight forwarding for freight rate analysis, matching loads with carriers, automating the search for offers, monitoring order execution, and controlling documentation. AI-based systems support managers in making faster and more transparent operational decisions, especially in the areas of transport planning and coordination. The qualitative study confirmed that the use of AI improves work efficiency, shortens order completion time and increases access to structured data. At the same time, significant limitations were identified, such as the lack of flexibility of algorithms, dependence on data quality, and the inability to replace interpersonal relationships and the experience of the freight forwarders.
Research limitations/implications: The main limitation of the study is its qualitative nature and the fact that only one respondent was interviewed, which limits the possibility of generalizing the results. In addition, the dynamic development of artificial intelligence may cause some applications to become outdated relatively quickly. Future research should therefore include a larger research sample and compare different types of freight forwarding companies in order to increase the representativeness of the results and deepen the analysis.
Originality/value: The article presents a new perspective on the use of artificial intelligence in freight forwarding by presenting it from the perspective of management practice in a forwarding company. Combining a literature review with a qualitative in-depth interview enables the presentation of the manager's real experience, the identification of actual areas of artificial

intelligence application, and the indication of both the benefits and barriers to its implementation.
Keywords: artificial intelligence, logistics, forwarding, supply planning, management.
Category of the paper: Case study, literature review.

1. Introduction

Logistics, and particularly freight forwarding as its specialized segment, plays a key role in the functioning of modern enterprises, directly influencing the level of customer service, operating costs, and market competitiveness (Christopher, 2016). Under conditions of increasing globalization, shortening product life cycles and growing demand volatility, decisions made by freight forwarding managers must increasingly be based on complex and dynamic data sets (Ivanov, Dolgui, 2020b). In such conditions, classical methods of analysis are increasingly proving to be insufficient in the face of the scale and complexity of modern supply chains and logistic processes (Toorajipour et al., 2021). Maintaining continuity of order fulfilment, effective delivery planning, and responding to disruptions in the short term are becoming decision-making priorities, increasing the demand for tools supporting managers' decision-making processes (Belhadi et al., 2021). In this context, increasing attention is being paid to artificial intelligence (AI)-based solutions that enable big data analysis, pattern identification, and prediction generation to support decision-making.

In response to these challenges, the literature indicates that the implementation of artificial intelligence in logistics can lead to increased operational efficiency and improved quality of managerial decisions. At the same time, the process of implementing these solutions is burdened with numerous barriers, such as insufficient data quality, high investment costs, or limited employees' analytical skills (Culot et al., 2020; Sony, Naik, 2020). This means that the technological potential of artificial intelligence does not always translate directly into organizational outcomes, and the effectiveness of its use depends on organizational structure and employee competencies of the company.

Despite the steadily increasing number of publications on the applications of artificial intelligence in logistics and supply chain management, a significant part of the research focuses on mathematical optimization, process simulation and quantitative analyses carried out in large manufacturing and retail companies. At the same time, these studies often overlook the specific characteristics of service companies, including freight forwarding companies, in which short-term operational decisions, intensive coordination of information and ongoing communication with customers and transport partners play a key role (Ivanov, Dolgui, 2020b; Pournader et al., 2021). At the same time, there is a noticeable shortage of qualitative research enables an in-depth analysis of the experiences of managers responsible for the implementation and use of AI-based solutions in organizational practice.

The aim of the article is to identify the applications of artificial intelligence in freight forwarding and to assess their role as tools supporting managerial decisions in logistics. In particular, the article focuses on assessing the impact of AI-based solutions on the quality, speed and effectiveness of decisions made by managers of freight forwarding companies. In addition, the paper identifies the key benefits resulting from the use of artificial intelligence in forwarding processes, as well as technological, organizational and competency barriers that may limit the effectiveness of implementing these solutions in business practice.

2. Research methods

A fundamental element of the study was the analysis of the available literature, the aim of which was to compare applications of artificial intelligence supporting managerial decision-making in logistics, with particular emphasis on forwarding processes. The literature review conducted in a systematic manner and in accordance with the methodology of secondary research, commonly used in the field of management and quality sciences.

Initially, the scope of the analysis was defined, focusing on publications on the use of artificial intelligence in logistics and forwarding, including in the planning and coordination of deliveries, supply chain management and in improving managerial decision-making processes. Databases were then selected to provide access to verified and reliable scientific sources. The analysis was conducted using three databases: Scopus, Web of Science and Google Scholar. The choice of these platforms was due to their wide range of topics, high-quality indexed publications and their widespread use in management and logistics research. An important criterion for the selection of literature was the date of publication. Publications from the years 2009-2025 were included in the analysis, with particular emphasis on the latest works, which made it possible to ensure that the presented findings are up-to-date and take into account the dynamic development of technologies based on artificial intelligence. The literature search was conducted using keywords such as “artificial intelligence”, “logistics”, “freight forwarding”, “decision support systems”, and “supply chain management”.

As a result of the selection, publications were identified, which were then analysed in terms of scientific quality and thematic scope. The aim of the analysis was to identify the key areas in which artificial intelligence is used in logistics and forwarding, to classify AI applications and to assess their impact on managers' decision-making processes. The results of this analysis were the basis for further theoretical considerations and analysis of the results of empirical research presented in the following parts of the article.

To obtain in-depth information on the practical use of artificial intelligence in logistics, a qualitative method in the form of an individual in-depth interview (IDI) was used. The choice of this method was justified by the need to capture subjective assessments and managerial

experiences, which would be difficult to obtain using quantitative methods (Kvale, Brinkmann, 2009; Myers, 2013). Individual in-depth interviewing is one of the most commonly used methods in qualitative research in management research, especially in the analysis of complex organizational phenomena and decision-making processes (Guest et al., 2017). This method allows for flexible interaction, adjusting the order and scope of questions to the respondent's answers, and exploring selected topics in greater depth that are relevant to the purpose of the study (Kvale, Brinkmann, 2009).

The interview was conducted on the basis of a previously prepared interview guide covering issues related to the use of IT systems and elements of artificial intelligence in logistics management and delivery planning. This form of interview allows to maintaining a balance between the comparability of the data obtained and the respondent's freedom of expression (Myers, 2013). The selection of the respondent was purposive, which is in line with the assumptions of qualitative research, in which access to expert knowledge and practical experience of the studied phenomenon is of key importance (Patton, 2015). The study included one specialist in a managerial role in a company using AI technologies in freight forwarding.

The qualitative study was complemented by a quantitative analysis of secondary data from Eurostat data on the use of artificial intelligence in enterprises in the European Union. The use of statistical data made it possible to place the results of the in-depth interview in a broader macroeconomic context and to identify general trends related to the adoption of AI technologies in the business sector.

3. Result

3.1. Key findings from previous research on the impact of AI in logistics management

An analysis of the literature indicates that the use of artificial intelligence in logistics and supply chain management focuses primarily on improving operational processes characterized by high decision-making complexity, high data variability, and the need to make decisions in near real time (Toorajjpour et al., 2021; Pournader et al., 2021; Riahi et al., 2021). Research is dominated by approaches aimed at demand forecasting, inventory optimization, transportation route planning and delivery scheduling, which in forwarding practice translate directly into decisions regarding order allocation, carrier selection and coordination of transport services (Helo, Hao, 2021).

Research on the automation of logistics processes draws attention to the growing role of AI-based systems in the management of warehouses and distribution centers. It is indicated that solutions using AI support the processes of order picking, inventory allocation, and goods flow control, leading to reduced lead times for warehouse operations and reduction of

operational errors (Min, 2019). From a forwarding perspective, these improvements indirectly affect the quality of decisions regarding delivery planning and coordination of inter-cell flows (Boysen et al., 2019). Some of the analyzed publications indicate that AI enables ongoing monitoring of transport processes, forecasting disruptions and supporting operational decisions in a dynamic logistics and forwarding environment (Bhargava et al., 2022; Rajalakshmi et al., 2024).

At the same time, the literature clearly indicates the existence of significant barriers to the implementation of artificial intelligence in logistics. The most commonly identified problems include poor data quality, integration difficulties between IT systems, high implementation costs, and limited analytical competencies of employees (Kozar, 2023). The authors emphasize that the effectiveness of AI implementations is strongly dependent on the organizational maturity of the company, decision-making culture and the active involvement of managerial staff, which is particularly important in forwarding companies based on the knowledge and experience of decision-makers (Janczewska, Janczewski, 2020; Bughin et al., 2017).

In summary, previous research indicates that artificial intelligence has significant potential in improving managerial decisions in logistics and forwarding, but its effective use requires meeting specific technological, organizational and competency conditions. These conclusions provide a basis for further empirical analyses presented in this article (Hao, Demir, 2024).

3.2. The importance of logistics and forwarding in the functioning of modern enterprises

Logistics is one of the key areas of management in modern enterprises, responsible for coordinating the flow of goods, information and financial resources within supply chains. Its importance is steadily increasing with the globalization of markets, the shortening of product life cycles and the increase in customer expectations regarding delivery time and quality of service. As defined by the Council of Supply Chain Management Professionals, logistics involves planning, implementing, and controlling the efficient and effective flow and storage of goods, services, and information from the point of origin to the point of consumption to meet customer requirements (CSCMP, 2023).

Freight forwarding is a specialized segment of logistics, whose main role is the organization and coordination of transport operations. Unlike transport, which involves the physical movement of cargo, freight forwarding focuses on making decisions regarding transport planning, carrier selection, cargo consolidation, documentation and communication with customers and logistics partners. It should first be noted that this concept is often identified with logistics and transport. In practice, this means that forwarding activities are developing dynamically, and its functional scope includes both elements of the organization of logistics processes and the transport activities themselves (Wojewoda, Škoda, 2017).

In conditions of increasing demand volatility, time pressure and disruptions in supply chains, freight forwarding managers make decisions in an environment of high uncertainty and limited availability of information. Classical analytical tools are increasingly proving to be

insufficient, which increases the demand for advanced IT solutions to support decision-making processes (Christopher, 2016; Ivanov, Dolgui, 2020b).

3.3. Digital transformation of logistics processes and the role of artificial intelligence

The digital transformation of logistics processes is a complex and multidimensional phenomenon involving the automation of operational activities, the integration of IT systems and the increasing use of real-time data in supply chain management. In the literature, this transformation is seen as a response to the increasing complexity of the market environment, the pressure to shorten delivery times, and the need to increase the flexibility and resilience of logistics processes (Christopher, 2016; Ivanov, Dolgui, 2020a; Buer et al., 2021).

One of the key elements of the digital transformation of logistics is artificial intelligence (AI), understood as a set of methods and techniques that enable IT systems to learn from data, recognize patterns and support decision-making processes by generating forecasts and recommendations for actions (Russell, Norvig, 2021). Unlike traditional IT systems, AI-based solutions are characterized by the ability to adapt to changing conditions and process large volumes of data from various sources (Nowicka, Szymczak, 2020).

In logistics and forwarding, AI applications focus primarily on operational areas where decision-making requires taking into account many variables and reacting quickly to changes in the environment. The literature indicates the use of AI in m.in in planning transport routes and schedules, demand forecasting, fleet management, monitoring of transport execution and automation of customer service (Toorajipour et al., 2021; Min, 2010). These solutions allow you to increase the transparency of logistics processes, reduce operational risk and improve the quality of decisions made.

From a management perspective, AI is not seen as a substitute for managers, but as a tool to support them in making decisions in conditions of high complexity and uncertainty. Research highlights that AI generates the greatest value when it is integrated with the experience of decision-makers and embedded in appropriate organizational and process structures (Dubey et al., 2020). This means that the effectiveness of AI implementations in logistics and freight forwarding depends not only on the availability of technology, but also on organizational maturity, data quality and managerial competencies.

3.4. Areas of AI application supporting managerial decisions in freight forwarding

The literature analysis indicates that artificial intelligence finds a variety of applications in logistics, especially in areas that require the processing of large data sets and decision-making under conditions of uncertainty.

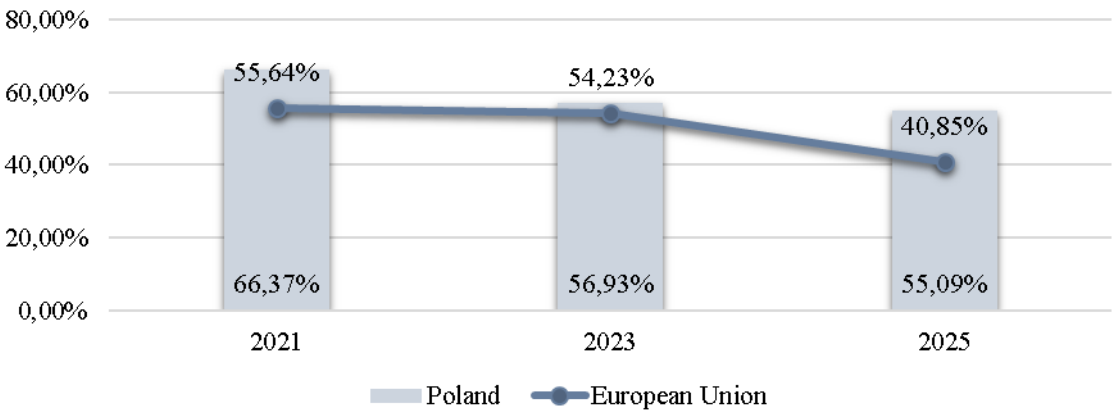

Figure 1. Companies operating in the field of transport and storage with a very low digital intensity index – Poland against the background of the European Union in the years 2021-2025.

Source: Eurostat, Digital Intensity by NACE Rev. 2 activity, [isoc_e_diin2] Digital Intensity by NACE Rev. 2 activity, 05.02.2026.

The increasing level of digitalisation is reflected in the results of a survey published every two years by Eurostat. Despite the fact that artificial intelligence is used in an increasing number of companies, still more than half of organizations (55.09%) in Poland have a very low digital intensity index. Over the past few years, there has been a downward trend in this regard, which means that more and more companies operating in the field of transport and warehousing decide to implement modern AI-based solutions to improve processes (figure 1).

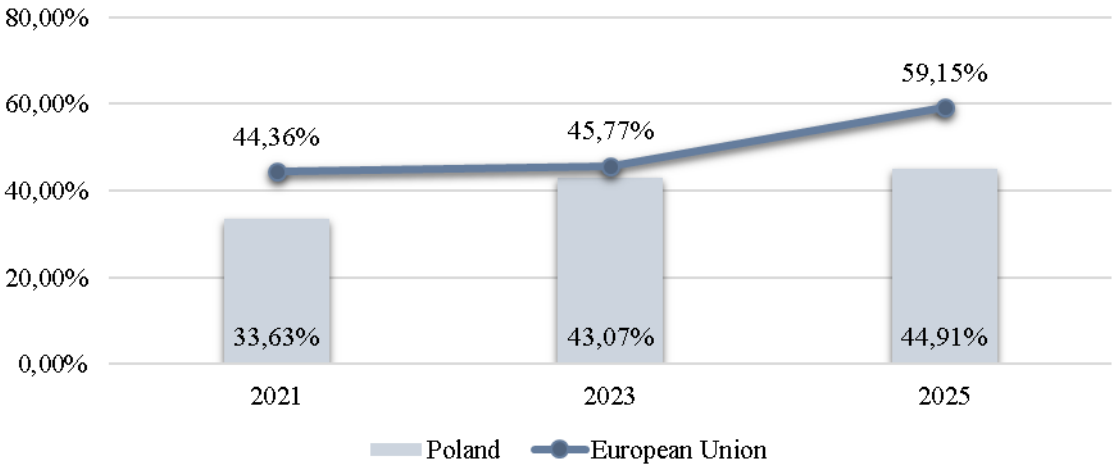

Figure 2. Companies operating in the field of transport and storage with at least a basic level of digital intensity - Poland against the background of the European Union in the years 2021-2025.

Source: Eurostat, Digital Intensity by NACE Rev. 2 activity, [isoc_e_diin2] Digital Intensity by NACE Rev. 2 activity, 05.02.2026.

Over the past few years, there has been a noticeable increase in enterprises characterized by at least a basic level of digital intensity in the European Union, including Poland. However, despite continuous development in this area, Poland still remains below the average level registered by enterprises in the European Union. In 2025, 59.15% of EU enterprises had at least a basic level of digital intensity, while in Poland the rate was 44.91% (figure 2).

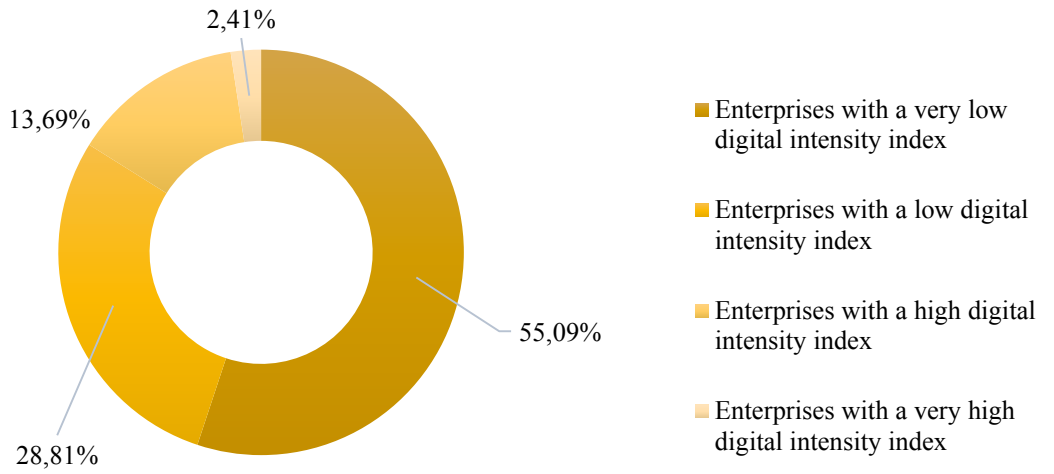

Figure 3. Companies in Poland operating in the field of transport and warehousing broken down by level of digital intensity in 2025.

Source: Eurostat, Digital Intensity by NACE Rev. 2 activity, [isoc_e_diin2] Digital Intensity by NACE Rev. 2 activity (accessed: 05.02.2026)

Among enterprises whose activities are based on transport and warehousing, as many as 55.09% have a very low digital intensity index, the rest are units with at least a basic indicator, i.e. low, high or very high. In 2025, only 2.41% of Polish enterprises achieved the highest rate. 13.69% of enterprises have a high ratio, while 28.81% of operations have a low one (figure 3).

3.5. Individual In-Depth Interview (IDI)

In the empirical part of this article, an individual in-depth interview was conducted. The respondent was a person holding a managerial position, whose role focuses on leading the organization from a strategic perspective, supporting tasks related to administration, supervision of documentation, work organization and making development decisions. The expert's tasks are mainly focused on ensuring that processes in the company are well-organized, effective and supported as best as possible by IT tools.

From the perspective of a person managing a company, the respondent perceives new technologies as an indispensable element of the functioning of modern freight forwarding. He points out that time pressure, high competition and growing customer expectations make it difficult to maintain efficiency without system support in the current market environment. In addition, the respondent notes that artificial intelligence is no longer a curiosity, but a tool that effectively supports planning, data analysis and decision-making, especially in the administrative and operational areas.

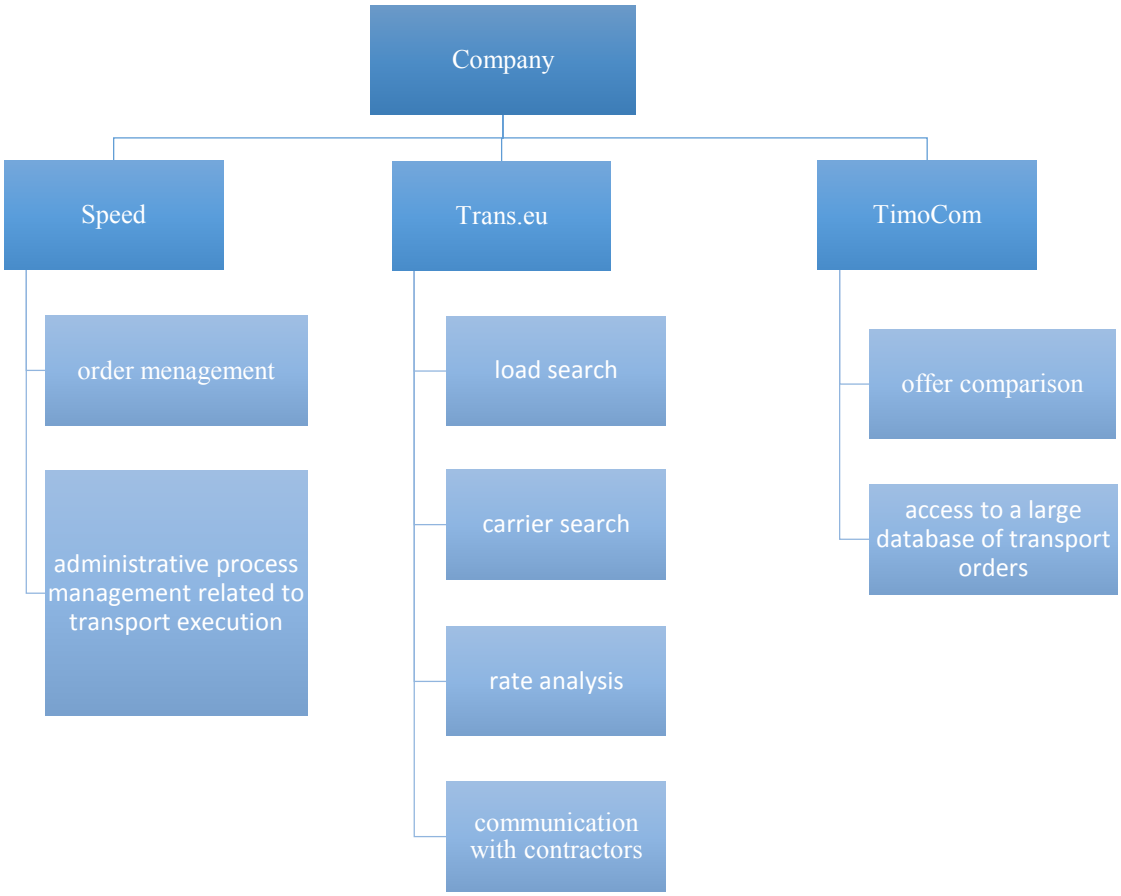

Figure 4. Systems and the scope of their use in the examined company.

Source: Own study based on an individual in-depth interview.

In its daily operations, the company uses three main systems: Speed, the Trans.eu platform and the TimoCom freight exchange. Each of them is responsible for a different area of forwarding work, but together they create a coherent operating environment. The Speed system is mainly used to handle orders, organize documentation and control administrative processes related to the transport execution. It facilitates information management within the company and ensures data consistency at the next stages of order execution. The Trans.eu platform, on the other hand, plays a key role in interaction with the market. It is used to search for loads and carriers, analyze rates and communicate with contractors. The system also develops modules based on market data analysis to support shippers in making operational decisions. TimoCom, on the other hand, functions as an international freight exchange, allowing users to quickly compare offers and access a wide database of orders. This is also where automation and intelligent recommendations come in, which streamline the process of searching and selecting offers (figure 4).

The elements of artificial intelligence and advanced automation in the systems that are used in the surveyed company are not a single, separate tool, but are built into individual functionalities supporting the daily work of freight forwarding. In the case of platforms such as Trans.eu or TimoCom, these are primarily modules that analyse large sets of market data, including historical freight rates, freight availability, transport directions and user activity. On this basis, the systems generate recommendations on the attractiveness of offers, suggest possible adjustments of orders to available resources and support forwarders in making pricing decisions. An important element is also the automation of search processes and filtering offers. Algorithms reduce the need to manually browse through hundreds of ads, indicating those that best match the set criteria. From a management perspective, this means shorter response times and more efficient use of the team's work. The Speed system, although primarily an internal organizational tool, also uses automation mechanisms in the field of organizing data, document control and monitoring the execution of orders. This allows for the ongoing detection of irregularities and improves the supervision of administrative processes. From a managerial perspective, it can be said that these modules act as a decision support – they do not replace a person, but provide them with structured information and recommendations that facilitate quick and more informed decisions in a dynamic forwarding environment.

During the conversations between by the expert with employees, it is clear that the approach to AI is more practical than enthusiastic. Employees appreciate above all the time savings, faster job search and support in the analysis of rates and routes. The so-called AI agents are currently an important support for the daily work of teams. After proper preparation, i.e. after a series of well-structured prompts, they can greatly speed up the implementation of routine tasks, such as detailed verification of documents in foreign languages, analysis of insurance policies or checking the correctness of arrangements with the contractor. At the same time, there are also voices of caution. Employees emphasize that algorithms do not always take into account the context of the relationship with the client, the specifics of cooperation or non-standard terms of orders. Therefore, AI is treated as a supportive tool, not a substitute for the freight forwarder's experience.

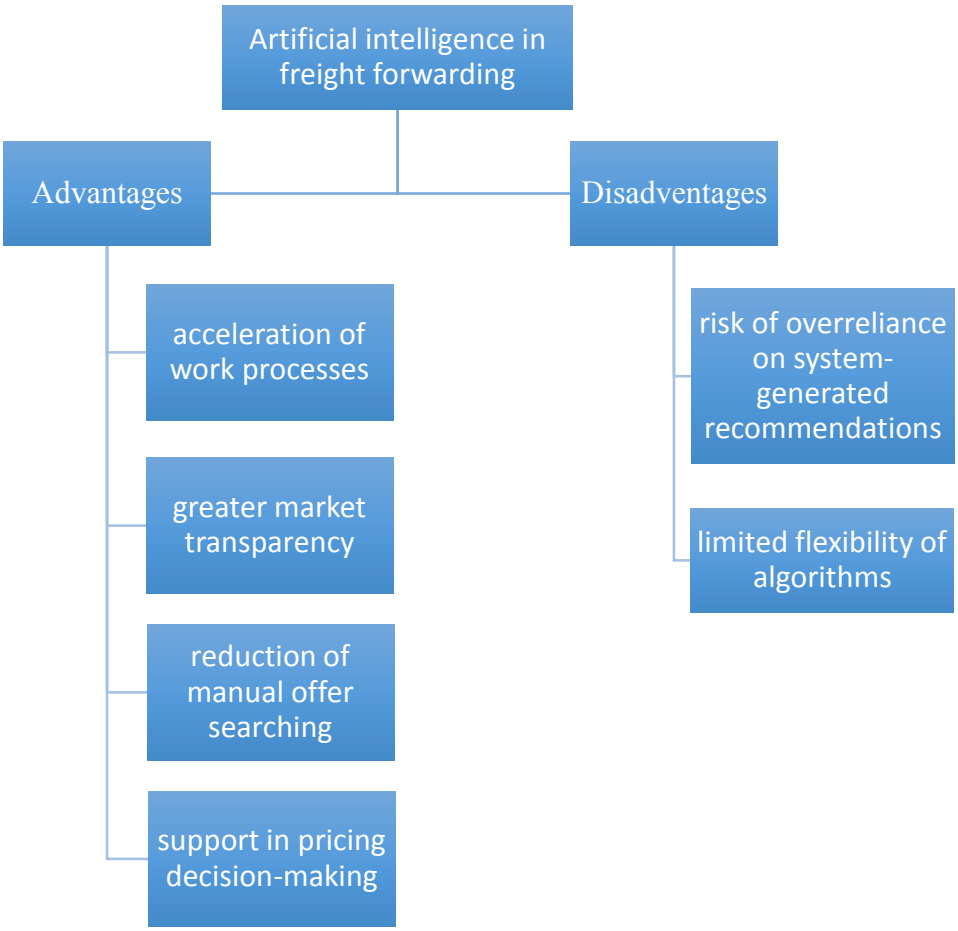

Figure 5. Advantages and disadvantages of using artificial intelligence in a freight forwarding company. Source: Own study based on an individual in-depth interview.

The most frequently mentioned advantages are speeding up work, reducing manual search for offers, greater market transparency and support in making pricing decisions. Employees point out that systems such as Trans.eu are increasingly capable of analyzing historical data and predicting trends, which makes it easier to assess the profitability of shipping orders. The most frequently cited limitations include the lack of flexibility of algorithms, which cannot cope with dynamically changing situations, such as road accidents, sudden changes in traffic volume, non-compliance of goods with the arrangements, difficult weather conditions, fluctuations in fuel prices or changes in national regulations. Another problem is the risk of over-reliance on system prompts. Employees emphasize that artificial intelligence will not replace negotiations, building interpersonal relationships, or knowledge and intuition gained from many years of experience. There is also often a concern that automation that goes too far may lead to the unification of decisions made and the loss of an individual approach to the customer (figure 5).

The expert emphasizes that artificial intelligence is developing at a dizzying pace. It learns, analyses, maps our reactions and the way we communicate. It is becoming more and more common to hear about companies that openly declare their willingness to replace freight

forwarders with AI. What's more, paradoxically, it is the forwarders themselves who teach these systems – they show them how they respond to customers, how they react in specific situations, how they build relationships. In this way, they create a tool that is theoretically supposed to replace them. From the perspective of the management team, everything looks exemplary – lower costs, no sick leave, no vacations, conflicts, greater predictability and potentially higher profits. However, this is a situation in which the human factor, which is always an unpredictable element, is not taken into account. The customer does not want to talk to the algorithm, but wants to feel that someone listens to him, understands him and approaches him in an individualized way. A freight forwarder is very rarely only a freight forwarder for the customer. Over time, trust and a relationship are born that goes beyond the framework of the contract and valuation. It cannot be programmed. The respondent believes that technology should support people, not replace them.

The use of AI in an organization causes a clear shift in roles in the team of employees. Today, some administrative and analytical tasks are supported by systems, which allows employees to focus on activities that require contact with the customer and decision-making. From a management perspective, this means greater transparency of processes and the possibility of better supervision without having to interfere with every operational stage. The biggest challenge in implementing AI-based solutions is preparing the organization for change. It's not just about implementing technology, it's about changing the way we work and think. It is crucial to convince the team that AI is to support their work, not replace it. From the owner's point of view, it is also important to rationally select tools for the scale of the business so that investments are justified. The respondent believes that AI can provide a competitive advantage for smaller freight forwarders if implemented sensibly and consciously. Well-chosen tools allow smaller organizations to operate more efficiently, without the need to expand organizational structures. From a management perspective, AI can be a way to scale your business while keeping costs under control.

According to the expert, the key managerial competencies in the context of further development of AI in logistics will be data analysis, openness to change and the ability to combine technology with operational realities. Management is increasingly based on the interpretation of information provided by systems, but the final decisions still have to belong to the human. The respondent believes that the role of artificial intelligence will grow steadily, especially in the areas of data analysis, planning and administration. At the same time, he believes that the human factor will remain crucial. The employees of the surveyed company clearly indicate that technology is a great support, but it will not replace experience, responsibility and customer relations. The most important thing will be to maintain a balance between automation and flexibility.

The results of the interviews with the expert confirmed the observations resulting from the literature review. The respondent noted that the implementation of artificial intelligence has improved the quality of decisions in planning and increased the transparency of logistics

processes. He also drew attention to the importance of data quality and the need for active participation of managers in the process of introducing solutions based on artificial intelligence.

4. Discussion

The results of the study confirm that artificial intelligence is an important tool supporting managerial decision-making in logistics, in particular in the area of freight forwarding operations. An analysis of the literature on the subject and the results of an individual in-depth interview indicate the growing importance of artificial intelligence technology in the implementation of forwarding processes, such as operational planning, coordination of information flow, and relationship management with customers and transport partners. The ability of AI-powered solutions to analyze big data in near real-time and adapt to dynamically changing market conditions is crucial.

At the same time, the results of the research indicate the existence of significant barriers in the practical use of artificial intelligence in shipping companies. The most commonly identified limitations include insufficient analytical competence of employees, difficulties in integrating AI-based solutions with existing IT systems, and poor quality of data used in decision-making processes. This points to the need for a holistic approach to the implementation of AI, including not only technological investments, but also the development of management and employee competencies and the adaptation of organizational structures to new decision-making models.

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