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The Role of the Internet of Things and Artificial Intelligence in the Development of Intelligent Transport

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Abstract:

Purpose: *The purpose of this paper is to analyze how the Internet of Things (IoT) and Artificial Intelligence (AI) jointly contribute to the development of intelligent transport systems, with particular focus on logistics decision-making, route optimization, fleet management, and safety improvement.*
Design/Methodology/Approach: *The study is based on secondary data analysis, combining literature review, case study, and comparative analysis. It examines theoretical concepts and real-world applications of IoT and AI in logistics, with particular attention to companies such as Waymo, Samsara, and Lytx. Additionally, market data on IoT adoption in transportation were analyzed to identify key factors driving its global development.*
Findings: *The research shows that integrating IoT with AI enhances logistics efficiency by enabling real-time monitoring, predictive maintenance, and dynamic route optimization. IoT technologies improve operational transparency, reduce costs, and increase safety, while AI enables data-driven decision-making and automation. Despite challenges such as high implementation costs and lack of standardization, the global IoT transportation market shows rapid growth and strong future potential.*
Practical implications: *The results highlight that IoT and AI integration supports companies in optimizing logistics operations, improving safety, and achieving sustainability goals. The presented best practices can serve as guidelines for organizations seeking to implement intelligent transport solutions.*
Originality/value: *This paper contributes to the growing body of knowledge on the digital transformation of logistics by providing a comprehensive analysis of how IoT and AI jointly enable intelligent transport. It also offers comparative insights into corporate implementations, outlining the practical and regional differences in technology adoption.*

Keywords: *Internet of Things (IoT), Artificial Intelligence (AI), Intelligent Transport Systems (ITS), Logistics, Smart Mobility, Fleet Management.*

JEL classification: *O33, L91, R41.*

Paper Type: *Research article.*

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1. Introduction

The rapid development of technology has transformed many industries worldwide, and logistics is no exception. As supply chains become increasingly complex, the ability to make quick, fact based decisions has become crucial. One of the most promising technologies supporting this change is the Internet of Things (IoT). IoT refers to the interconnection of devices that communicate with each other, transmitting data in real-time to streamline decision-making processes.

In logistics, IoT is gaining significance due to its ability to provide monitoring, tracking, and optimization of goods transportation in real-time. Intelligent transport, often conceptualized within the framework of Intelligent Transportation Systems (ITS), refers to environments in which data from distributed sensors and Internet of Things (IoT) devices are processed by Artificial Intelligence (AI) algorithms to dynamically support operational decision-making, predict disruptions, and optimize the use of transport resources in real time.

The integration of these technologies enables the transformation of traditional logistics systems into adaptive, automated, and more sustainable transport solutions (Litman, 2024). As a result, organizations shift from passive monitoring to active, adaptive fleet and traffic management — a fundamental characteristic of intelligent transport. This article discusses the application of the Internet of Things (IoT) in logistics, with a focus on how this technology — combined with AI methods — enhances operational transparency, efficiency, and safety in freight transport.

The application of IoT in logistics is rapidly evolving, with smart devices and sensors revolutionizing the way companies manage and track goods throughout the supply chain. This trend is driven by the growing demand for efficient, real-time visibility into supply chain operations, allowing companies to improve inventory management, reduce operational costs, and minimize the risks associated with delays or product damage.

Additionally, IoT provides valuable data that helps managers make informed decisions, thus enhancing the overall efficiency and sustainability of logistics operations. The use of IoT in logistics is particularly significant in the context of optimizing logistics processes, as detailed in the research by Wamba and Akter

(2019), who emphasize that the integration of IoT in supply chains improves both efficiency and the quality of logistics services.

Contemporary research highlights how IoT significantly enhances the resilience of supply chains, particularly in areas such as predictive maintenance, route optimization, and real-time inventory tracking. According to the analysis by Zhai and Bai (2021), IoT technologies combined with advanced analytical systems, such as machine learning, enable the prediction of potential disruptions in the supply chain, allowing for quicker responses and risk minimization.

Furthermore, IoT technology is increasingly integrated with other emerging technologies, such as big data analytics, providing logistics managers with essential tools to make fast, data-driven decisions. Research by Kaur and Arora (2020) indicates that the implementation of IoT in logistics opens up new opportunities for optimizing transportation processes and enhances the flexibility of supply chains, allowing companies to better adapt to changing market conditions.

The aim of this article is to examine how Internet of Things (IoT) and Artificial Intelligence (AI) technologies jointly contribute to the development of intelligent transport, with particular emphasis on their role in logistics decision-making, route optimization, fleet management, and real-time safety improvement. The article analyzes both theoretical foundations and corporate implementation cases, highlighting practical applications of Intelligent Transportation Systems (ITS) in modern supply chains.

2. Literature Review

The Internet of Things (IoT) refers to a network of physical devices that collect and exchange data through sensors, software, and other technologies. The application of IoT in logistics encompasses a wide range of activities, such as shipment tracking, monitoring the conditions of transported goods, route optimization, and inventory management automation (Mollenkopf *et al.,* 2017). These technologies have proven particularly beneficial in the transportation segment, where real-time data is crucial for optimizing delivery schedules, reducing operational costs, and increasing customer satisfaction.

Research conducted by Lee *et al.* (2019) emphasizes the importance of IoT in logistics, highlighting that IoT devices not only enable the monitoring of goods' locations but also control their condition, ensuring that they are transported under optimal conditions. As the scale and diversity of sensor data increase, AI and machine learning (ML) algorithms play an increasingly critical role in extracting patterns and generating decision-making recommendations, making transport systems progressively more "intelligent" (Zemmouchi-Ghomari, 2025; Drożdż, Redżeb, 2024). The data provided by IoT allows lo-gistics managers to respond more quickly to unexpected events, such as delays, accidents, or demand

fluctuations. Consequently, the integration of IoT into logistics operations has become a crucial step towards enhancing the resilience and flexibility of supply chains.

The research by Zhao and Chen (2018) highlights the critical importance of IoT in logistics and transportation, emphasizing that these technologies are essential for effective inventory management, monitoring the conditions of transported goods, and optimizing transport routes. The authors note that IoT enhances the precision of supply chain management, which leads to increased efficiency and a reduction in risks associated with delays or damage to goods during transportation.

Logistical operations require quick and accurate decision-making, especially when unforeseen circumstances arise. In traditional supply chains, decisions are often made based on historical data or forecasts, which can be inflexible. In contrast, IoT enables the collection and analysis of real-time data, providing logistics managers with up-to-date information on the condition of goods and transport conditions.

This allows for faster and more precise decisions regarding route changes, inventory management, and resource allocation (Sternad *et al.,* 2020). Furthermore, IoT has been integrated with Artificial Intelligence (AI) and Machine Learning (ML) systems, enabling advanced predictive analysis that can further optimize logistics decisions. For example, IoT data can be used to predict potential disruptions in the supply chain, allowing for proactive measures to minimize risks (Nguyen *et al.,* 2018).

3. Research Methodology

This article employs a research approach primarily based on secondary data analysis, which allowed for a systematic examination of the impact of Internet of Things (IoT) technology on decision-making processes and the optimization of transportation processes in logistics. The research methods chosen to achieve the goal of the paper include literature review, case study analysis, and comparative analysis. Additionally, data concerning the value of the IoT market in transportation, market segmentation by regions, and key factors influencing the global IoT market in transportation were analyzed.

The first research method employed was a literature review, which formed the foundation for gathering key information on the application of IoT in logistics, particularly in the context of its role in transportation decision-making and process optimization. A literature review is often described as a more or less permanent method of collecting and synthesizing previous research (Baumeister and Leary, 1997; Tranfield, Denyer, and Smart, 2003).

A well-conducted literature review as a research method provides the basis for the development of knowledge and supports the advancement of theory (Webster and

Watson, 2002). The literature review covered scholarly articles, industry reports, books, and conference proceedings that addressed both the theoretical and practical aspects of using IoT technology in transportation. This method enabled the identification of key trends, theories, and prior research (Donthu *et al.,* 2021) related to the impact of IoT on decision-making processes in logistics.

The next method employed was case study analysis, which involved a detailed examination of selected companies that have successfully implemented IoT technologies in their transportation processes. The case study method is one of the most frequently used research techniques in academic settings, particularly among scholars conducting qualitative research (Baskarada, 2014).

It is also one of the most commonly applied methodologies in qualitative research (Rashid *et al.,* 2019). This method allowed for an understanding of how specific organizations utilize data from IoT devices to make operational decisions and the outcomes of these implementations. The cases analyzed were drawn from both the literature and industry reports, enabling a comparison of various approaches to integrating IoT into transportation processes.

As part of the comparative analysis, different approaches to the implementation of IoT technology in transportation were compared, taking into account various regions, companies, and technological solutions. This method enabled the comparison of the effectiveness of IoT implementations in the context of different transportation management strategies, which helped identify best practices in transportation decision-making. The comparison of various cases and approaches also facilitated the identification of which IoT technologies have the greatest potential in the context of optimizing transportation processes.

Additionally, as part of the study, data on the value of the IoT market in transportation were analyzed, including market segmentation by regions and key factors influencing the development of the global IoT market in transportation. This analysis provided an understanding of the scale of IoT technology development in different parts of the world, identifying regions where the technology is being particularly dynamically implemented, as well as recognizing the main factors driving this development. The research methods used enabled the acquisition of comprehensive knowledge about the role of IoT technology in supporting decision-making and optimizing transportation processes.

4. Research Results and Discussion

In the context of the application of Internet of Things (IoT) technology in transportation, special attention should be paid to companies that effectively integrate this technology into their logistics processes, contributing to improvements in efficiency, safety, and optimization of transportation operations. This section of the article presents three companies that are leaders in this field and serve as

excellent examples of IoT applications in transportation: Waymo, Samsara, and Lytx. Each of these companies represents key areas where IoT plays an important role in optimizing logistics processes, ensuring safety, and enhancing operational efficiency.

Waymo is a leader in the field of autonomous vehicles, using IoT to improve safety and efficiency in both public and freight transportation (https://waymo.com/about/#story). Samsara, on the other hand, through advanced fleet management systems, allows transportation companies to monitor vehicles in real time, optimize routes, and reduce operational costs (https://www.samsara.com/company/about).

Meanwhile, Lytx focuses on video telematics, which, through video analysis and sensor data, improves driver safety and fleet management (https://www.lytx.com/about-us/our-technology). The examples of Waymo, Samsara, and Lytx illustrate three complementary approaches to implementing intelligent transport: vehicle autonomy, data-driven fleet management, and video-based safety analytics. All of them integrate IoT data with AI components. A detailed analysis of these companies is presented in Table 1.

Table 1. *Selected examples of companies that have effectively implemented IoT technologies in transportation processes*

Company	**Characteristics**
Waymo (Alphabet Inc.)	Waymo, a subsidiary of Alphabet Inc., is a pioneer in the field of autonomous vehicles, offering transportation solutions based on IoT technology. The company has implemented fully autonomous passenger transport services in cities such as Phoenix and San Francisco, using advanced sensors like lidar, radar, and artificial intelligence algorithms to analyze real-time data. Waymo's technology enables route optimization, reduces operational costs, and enhances road safety, aligning with the overall trend of increasing transportation automation. The use of IoT in Waymo involves collecting and analyzing vast amounts of data from sensors installed in vehicles, allowing for real-time decision-making without the need for human intervention. Thanks to this technology, the company can effectively monitor vehicles in real-time, leading to better predictability in delivery times, safety, and optimization of transportation resource utilization. In Waymo's system architecture, the integration of sensors (lidar, radar), communication technologies, and AI-based perception and planning algorithms enables autonomous decision-making in urban traffic, representing an advanced example of intelligent transport.
Samsara	Samsara is a company that offers advanced IoT solutions for fleet management. By utilizing GPS devices and AI-powered video cameras, Samsara enables real-time monitoring of vehicles, analyzing their efficiency, technical condition, and safety. The company provides solutions that assist in route optimization, fuel consumption reduction, and improving transportation safety, and its cloud platform allows fleet managers to make quick decisions based on the collected data. The use of IoT in Samsara

	involves integrating sensors in vehicles that gather data on location, speed, vehicle condition, and monitor driver behavior. With this data, the company can optimize routes, predict maintenance needs, and respond to incidents in real-time, leading to significant operational savings and improved fleet efficiency. Predictive models based on IoT data streams—such as location, operational parameters, and driving behavior—support preventive maintenance and route optimization, making the Samsara platform a tool for intelligent fleet management.
Lytx	Lytx is a company specializing in video telematics and driver behavior monitoring, utilizing IoT technologies to improve transportation safety. The company provides solutions that enable video analysis from cameras mounted in vehicles, as well as monitoring driver behaviors such as speed, driving style, and adherence to traffic rules. With these solutions, transportation companies can minimize accident risks and improve the operational efficiency of their fleets. The use of IoT in Lytx focuses on video analysis and sensor data, allowing for real-time monitoring of driving quality. Lytx's analytical systems can detect unsafe driver behaviors, such as excessive speed or aggressive maneuvers, enabling fleet managers to respond quickly and reduce the number of accidents. AI-powered video analysis identifies risky driver behaviors and generates safety-enhancing interventions—a critical module within the intelligent transport ecosystem.

Source: *Own elaboration based on: https://waymo.com/about/#story; https://www.lytx.com/about-us/our-technology; https://www.samsara.com/company/about.*

All of these companies share a common use of IoT technology to collect, analyze, and leverage real-time data to optimize transportation processes. Each of them effectively integrates IoT with other technologies, such as artificial intelligence and predictive analytics, which enables faster, more accurate operational decisions. These companies serve as excellent examples of diverse yet cohesive approaches to implementing IoT technology in transportation, offering inspiration for other organizations striving to improve the efficiency of their logistics operations on a global scale.

To better understand how these companies differ in their implementation of IoT technology, it is valuable to examine their approaches in the context of the technologies used, applications, and regions of operation. Table 2 presents the differences and similarities in their transportation management strategies and highlights which IoT technologies have the greatest potential in optimizing transportation processes.

Table 2. *Comparative Analysis of Waymo, Samsara, and Lytx*

	Waymo	**Samsara**	**Lytx**
Technology Focus	Autonomous vehicles with IoT integration for real-time decision making	Fleet management using IoT sensors for real-time monitoring, route optimization, and predictive	Telematics with video-based IoT technology for driver behavior monitoring and fleet management

		maintenance	
IoT Implementation Approach	Real-time data collection and analysis from autonomous vehicles to optimize routes, improve safety, and reduce operational costs	Integration of GPS, video cameras, and IoT sensors for fleet monitoring, predictive maintenance, and fuel optimization	IoT-based video telematics to monitor driving behavior, detect risky driving, and enhance fleet safety
Regions Implemented	Primarily in North America, with pilot projects in cities like Phoenix and San Francisco	North America, Europe, and expanding into other regions with a focus on logistics companies	Primarily North America, with some implementations in Europe and Asia
Key Benefits	Improved safety and efficiency of transportation, optimized routes, reduced operational costs, and autonomous decision-making	Optimized fleet routes, reduced fuel consumption, enhanced driver safety, and predictive maintenance leading to cost reduction	Improved driver safety, reduced accident rates, real-time feedback for drivers, and operational efficiency improvements
Technologies Used	IoT sensors, lidar, radar, AI algorithms for real-time decision making in autonomous vehicles	IoT sensors, GPS, cameras, AI for fleet management and predictive analytics	IoT sensors, cameras, AI-based video analytics for fleet safety and driver behavior monitoring

Source: *Own elaboration based on: https://waymo.com/about/#story; https://www.lytx.com/about-us/our-technology; https://www.samsara.com/company/about.*

The comparison of these three companies presented in Table 2 highlights the diversity in approaches to IoT implementation. Each company uses IoT to enhance transportation efficiency and improve safety; however, their technologies and methods differ according to the specifics of their operations. Waymo focuses on autonomous vehicles, Samsara concentrates on fleet management, and Lytx utilizes video telematics to monitor drivers.

This comparison illustrates how different technologies can be employed to optimize transportation processes based on the unique needs and goals of an organization. These examples serve as an excellent illustration of how IoT can support the development of transportation at various levels—from vehicle automation and fleet management to driver behavior monitoring. Through these solutions, organizations can achieve significant improvements in operational efficiency, safety, and the sustainability of transportation.

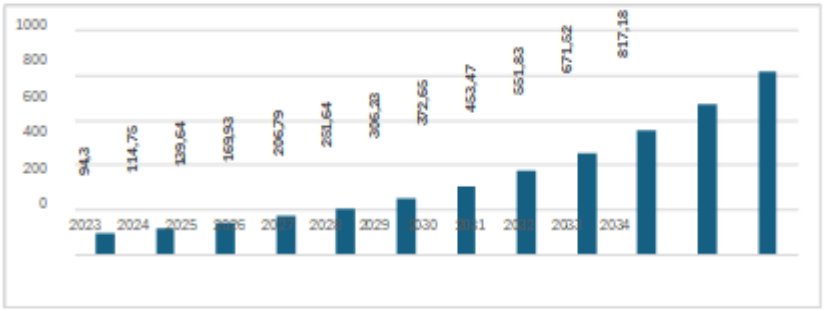
Additionally, the comparison of regions where these technologies have been implemented (North America, Europe, and Asia) highlights how different markets

adapt and develop IoT technologies in transportation, which has a significant impact on the future direction of this technology globally. These differences, influenced by the level of infrastructure development, investment policies, and readiness to adopt innovation, can significantly shape the pace of IoT adoption in different parts of the world. As these technologies become increasingly accessible, their impact on global transportation processes will continue to grow stronger.

According to forecasts, the development of the IoT market in transportation will continue to accelerate. Based on the data, the global IoT market in transportation is expected to reach a value of USD 114.75 billion in 2024, and in 2025, it will rise to USD 139.64 billion.

It is predicted that by 2034, this market will exceed a value of USD 817.18 billion (https://www.precedenceresearch.com/iot-in-transportation-market). The IoT market size in transportation and the forecast until 2034 are illustrated in Figure 1.

Figure 1. *IoT in Transportation Market Size 2023 to 2034 (USD Billion)*

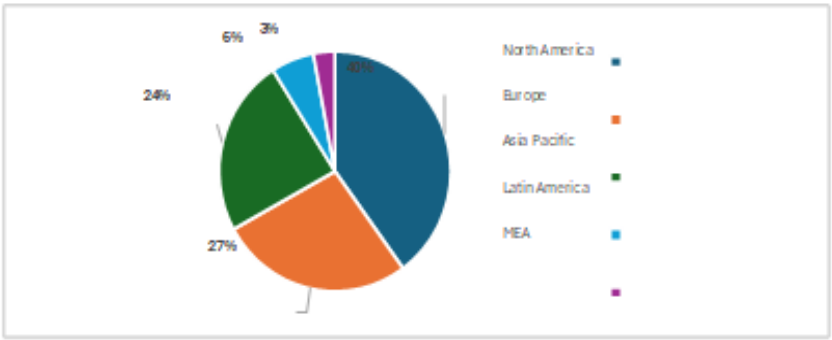


Source: *IoT in Transportation Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/iot-in-transportation-market.*

As shown in Figure 1, a significant accelerated growth occurs in 2029, when the market value reaches USD 251.64 billion, representing a 21.7% increase compared to 2028. Over the following years, until 2034, the market continues its rapid development, reaching USD 817.18 billion, which signifies a 225.9% growth compared to 2029.

Figure 1 illustrates the dynamic growth of the global IoT market in transportation, indicating the increasing role of IoT technology in optimizing logistics processes worldwide. As the market expands acros different regions, the influence of specific geographic areas on this growth is also noticeable (Figure 2).

Figure 2. *IoT in Transportation Market Share, by Region, 2023 [%]*



Source: *IoT in Transportation Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/iot-in-transportation-market.*

It is important to note that North America holds the largest share of the market and the dominant position in the IoT transportation market during the forecast period. This region not only leads in terms of investment in IoT technologies but also pioneers the implementation of innovative solutions in the transportation sector, accounting for 40% of the market share.

Europe ranks second with a share of 27%, indicating strong growth in this technology across the continent. The Asia-Pacific region holds 24% of the market, showing that this region is also rapidly adopting IoT solutions, especially with the development of the industry and transportation infrastructure in countries such as China and Japan.

Latin America has a smaller share, at 6%, which may reflect the still developing IoT market in transportation in this region. This is partly due to lower investments in technological infrastructure and a smaller degree of digitalization in logistics processes. The Middle East and Africa (MEA) hold the smallest share, just 3%, which may be due to lower investments in modern transportation technologies, less willingness to implement IoT solutions, and limited access to certain technologies.

The variation in market share across different regions can be attributed to numerous factors. In countries such as the United States and Canada, which are part of North America, the development of IoT technology in transportation is driven by significant investments in research and development, a strong transportation infrastructure, and the willingness of both the private and public sectors to embrace technological innovations. In Europe, rapid growth is also observed, primarily due to a strong emphasis on sustainability and efficiency in transportation, which fosters

the adoption of IoT technologies. In the Asia-Pacific region, countries like China and Japan are leading efforts to develop innovative logistics solutions.

However, in some other countries in the region, such as India, the pace of IoT implementation is slower due to limited technological infrastructure and a stronger focus on addressing the fundamental transportation development needs. In Latin America, the development of the IoT market in transportation is still limited, which is attributed to lower investments in technology development, insufficient infrastructure, and uneven development rates across different countries. On the other hand, in the Middle East and Africa, while some countries are beginning to invest in modern technologies, greater barriers stem from political instability, as well as less developed transportation and technological infrastructures.

These differences in the development of the IoT market in transportation across regions are therefore the result of a combination of economic, technological, social, and political factors that shape the readiness to adopt new technologies in various parts of the world. It can thus be stated that the rapid growth of investment in IoT is creating a data infrastructure upon which AI solutions for intelligent transport can be built and scaled across different regions of the world.

In light of these regional disparities, it is important to focus on the analysis of key factors influencing the global IoT market in transportation, as presented in Table 3. This table illustrates how different factors, categorized into drivers, constraints, and opportunities, can impact the market's development in different regions.

Table 3. *Analysis of Key Factors on the Global IoT in Transportation Market*

Drivers	Improving road safety and efficiency	High
	New mobility and payment trends	Very High
Restraints	High costs of implementation	Low
	Lack of standardization	Medium
Opportunities	Remote vehicle diagnosis and repair	High
	Improved traffic management	Very High

Source: *IoT in Transportation Market Size and Trends, https://www.coherentmarketinsights.com/industry-reports/iot-in-transportation-market*

The analysis presented in Table 3 illustrates how complex and multifaceted the factors influencing the development of the IoT market in transportation are. Driving factors, such as improved safety and efficiency, are crucial in regions with already developed infrastructure, such as North America and Europe, where IoT technologies can bring direct benefits in traffic management, safety, and operational efficiency.

In contrast, in regions such as Latin America and the Middle East, limitations related to the costs of implementation and the lack of standardization are significant barriers that may delay the adoption of IoT. In these areas, another key challenge is the need

for education and the development of the necessary technological infrastructure that can support the growth of such systems.

However, the identified opportunities, such as remote vehicle diagnostics and improved traffic management, provide a strong impetus for the development of IoT technologies in transportation. Remote diagnostics have the potential to reduce costs related to vehicle repairs and maintenance, particularly in regions where access to specialized workshops may be limited. Additionally, better traffic management through IoT can yield benefits in terms of reducing congestion, improving traffic flow, and enhancing safety.

From a global perspective, the integration of these technologies is not only about introducing new solutions but also requires extensive international collaboration, the development of standards, and consistent legal regulations that could accelerate the global adoption of IoT in transportation. In the future, developing regions may benefit from the experiences of more developed areas, avoiding some challenges and speeding up the process of adapting new technologies.

The conducted analyses reveal that the integration of IoT technology in logistics operations has a significant positive impact on several aspects of the supply chain. One of the key areas is the improvement of real-time monitoring and tracking of goods. Companies that have implemented IoT technologies have observed a significant improvement in the visibility of goods at every stage of transportation.

By collecting real-time data, it has become possible to precisely track shipments and monitor the conditions of transported goods, which is particularly crucial for products that require special transportation conditions, such as food or pharmaceuticals. The increased tracking accuracy helps eliminate delays and streamline the entire logistics process (Rejeb et al., 2020).

Another important aspect is the optimization of routes and resources, with the key element being the use of data from IoT systems. Analyzing this data enables route optimization, fuel consumption reduction, and shortened delivery times. IoT technologies allow for dynamic route adjustments based on changing road conditions, leading to improved transportation efficiency (Mohsen, 2024).

Additionally, predictive analytics, which is based on IoT data, allows for forecasting demand fluctuations, enabling more efficient resource management and allocation in response to these changes. The integration of IoT technology in logistics also contributes to reducing operational costs and increasing operational efficiency.

The automation of processes such as inventory management, vehicle condition monitoring, and warehouse management helps reduce human errors and lower costs associated with operations (Oladele, 2024).

Transportation safety has also improved with the implementation of IoT technology. IoT sensors enable the monitoring of goods and the detection of unauthorized access or tampering, allowing logistics managers to respond more quickly to potential threats. Additionally, predictive maintenance based on IoT data helps prevent vehicle breakdowns, minimizing disruptions in the transportation process. These technologies make risk management more effective, contributing to enhanced safety and the stability of logistics operations.

All these benefits demonstrate how the integration of IoT technology in logistics operations not only optimizes transportation processes but also contributes to increased efficiency, safety, and cost reduction. The implementation of IoT is becoming a key tool in transportation management and an essential element in the pursuit of sustainable logistics processes on a global scale. As this technology continues to evolve, its potential to optimize logistics processes will grow, becoming the foundation for future innovations in this field.

5. Conclusions

The conducted analysis indicates that the combination of the Internet of Things (IoT) and Artificial Intelligence (AI) forms the foundation for the development of Intelligent Transportation Systems (ITS), which enable dynamic, data-driven management of logistics operations.

These systems use real-time sensor data to predict disruptions, optimize routes, monitor vehicle condition, and assess driver behavior-related risks. As a result, organizations can not only improve operational efficiency and enhance safety but also reduce costs, minimize downtime, and limit the environmental impact of transport.

The case studies presented illustrate various models of ITS implementation. Waymo represents a fully autonomous vehicle approach, utilizing complex sensor systems and AI perception algorithms to make real-time driving decisions. Samsara focuses on fleet management supported by telemetry data and predictive analytics, while Lytx integrates video telematics with AI algorithms to improve driver safety.

Despite their technological differences, all three examples demonstrate that the integration of IoT and AI is a critical step in transforming logistics towards intelligent transport systems. However, the implementation of ITS involves several significant challenges.

High initial investment costs, the need to modernize IT infrastructure, lack of unified interoperability standards, and concerns over privacy and cybersecurity constitute major barriers. Additionally, the effective use of AI requires access to large, high-quality datasets — which may not be readily available to smaller logistics enterprises or in regions with underdeveloped digital infrastructure.

Despite these difficulties, global market trends point to a growing interest in intelligent transport solutions. The increasing number of connected vehicles, the expansion of 5G networks, and the decreasing cost of IoT technologies make the adoption of such systems increasingly feasible for a wider range of companies. At the same time, regulatory and societal pressures to reduce CO_2 emissions and improve road safety reinforce the need for automation and optimization in logistics.

From a research perspective, there is a justified need to develop interdisciplinary models that combine IoT, AI, complex systems theory, and behavioral economics in order to better capture interactions in transport environments. Particularly promising are approaches based on agent-based simulation modeling and reinforcement learning under dynamic and uncertain conditions. Further research is also needed on the explainability of AI models used in ITS, especially in the context of high-stakes decision-making (e.g., autonomous vehicle maneuvers, real-time hazard response).

The conclusions of this article highlight that the development of intelligent transport, based on the synergy between IoT and AI, not only enhances the operational efficiency of enterprises but also supports the achievement of sustainability goals. The future of logistics will increasingly rely on solutions that combine data, automation, and adaptability — with ITS serving as one of its core pillars.

References:

Baškarada, S. 2014. Qualitative case studies guidelines. The Qualitative Report, 19(40), 1-25.

Baumeister, R.F., Leary, M.R. 1997. Writing narrative literature reviews. Review of general psychology, 1(3), 311-320.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., Lim, W.M. 2021. How to conduct a bibliometric analysis: An overview and guidelines. Journal of business research, 133, 285-296.

Drożdż, W., Redżeb, K. 2024. Possibilities of using AI in DSO sector. In: M. Hernes, J. Wątróbski, A. Rot (Eds.). Emerging challenges in intelligent management information systems. ECAI 2024 (Lecture Notes in Networks and Systems, Vol. 1218). Springer, Cham. https://doi.org/10.1007/978-3-031-78468-2_5.

Kaur, H., Arora, A. 2020. Internet of Things (IoT) in Supply Chain Management: A Review of Trends, Challenges, and Future Directions. Journal of Manufacturing Systems, 56, 162-180.

Lee, H.L., Padmanabhan, V. 2019. Internet of Things (IoT) for Supply Chain Management: A Literature Review and Future Directions. Journal of Supply Chain Management, 55(4), 12-22.

Litman, T. 2024. Smart transportation emission reduction strategies. Victoria, B.C., Canada: Victoria Transport Policy Institute.

Mohsen, B.M. 2024. AI-driven optimization of urban logistics in smart cities: Integrating autonomous vehicles and iot for efficient delivery systems. Sustainability, 16(24), 11265.

Mollenkopf, D.A., Stolze, H. 2017. The Internet of Things in Logistics: An Overview and Future Perspectives. International Journal of Logistics Management, 28(3), 1-23.

Nguyen, S., Chang, S. 2018. Optimization of Transportation in Logistics Using IoT-Enabled Systems. Transportation Research Part C: Emerging Technologies, 90, 104-118.
Oladele, O.K. 2024. Internet of Things (IoT) in Logistics: Transforming Supply Chains with Connected Devices and Data Analytics.
Rashid, Y., Rashid, A., Warraich, M.A., Sabir, S.S., Waseem, A. 2019. Case study method: A step-by-step guide for business researchers. International journal of qualitative methods, 18, 1609406919862424.
Rejeb, A., Simske, S., Rejeb, K., Treiblmaier, H., Zailani, S. 2020. Internet of Things research in supply chain management and logistics: A bibliometric analysis. Internet of Things, 12, 100318.
Sternad, D., Juvan, J. 2020. Decision Making in Logistics with Internet of Things Technologies. European Journal of Operational Research, 280(1), 35-50.
Tranfield, D., Denyer, D., Smart, P. 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British journal of management, 14(3), 207-222.
Wamba, S.F., Akter, S. 2019. Internet of Things (IoT) Adoption and Implications for Supply Chain Management. International Journal of Production Economics, 215, 98-110.
Webster, J., Watson, R.T. 2002. Analyzing the past to prepare for the future: Writing a literature review. MIS quarterly, xiii-xxiii.
Zemmouchi-Ghomari, L. 2025. Artificial intelligence in intelligent transportation systems. Journal of Intelligent Manufacturing and Special Equipment, 6(1), 26-42.
Zhai, X., Bai, C. 2021. The Role of Internet of Things in Supply Chain Optimization. Computers & Industrial Engineering, 156, 107196.
Zhao, X., Chen, Y. 2018. The Internet of Things and its applications in logistics and transportation: A review. Computers & Industrial Engineering, 120, 66-81.

Web sites:

https://waymo.com/about/#story.
https://www.lytx.com/about-us/our-technology.
https://www.samsara.com/company/about.
IoT in Transportation Market Size and Trends. https://www.coherentmarketinsights.com/industry-reports/iot-in-transportation-market.
IoT in Transportation Market Size, Share, and Trends 2024 to 2034. https://www.precedenceresearch.com/iot-in-transportation-market.