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ISSUES OF USING ARTIFICIAL INTELLIGENCE IN THE APPLICATION OF LOGISTICS IN ENTREPRENEURIAL ACTIVITY

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Abstract

The rapid development of digital technologies has significantly transformed modern entrepreneurial activity, particularly in the field of logistics management. Artificial Intelligence (AI) plays a crucial role in optimizing supply chains, improving demand forecasting, enhancing transportation efficiency, and reducing operational costs. The integration of AI-driven systems enables businesses to automate decision-making processes, analyze large volumes of real-time data, and increase overall competitiveness.

The purpose of this study is to examine the key issues related to the application of Artificial Intelligence in logistics within entrepreneurial activity. The paper analyzes current AI-based tools such as machine learning algorithms, predictive analytics, intelligent routing systems, warehouse automation, and robotics. Particular attention is given to implementation challenges, including high investment costs, data security concerns, lack of qualified specialists, and integration with existing enterprise resource planning systems.

The findings suggest that effective implementation of AI technologies in logistics can significantly enhance operational performance, reduce human error, and improve customer satisfaction. However, successful adoption requires strategic planning, digital infrastructure development, and regulatory support.

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Introduction

In the context of rapid digital transformation and increasing global competition, logistics has become a strategic component of entrepreneurial activity. Efficient logistics management directly influences cost reduction, service quality, customer satisfaction, and overall business sustainability. Traditional logistics systems, which rely heavily on manual planning and limited data analysis, are no longer sufficient to meet the demands of modern markets characterized by volatility, uncertainty, and dynamic consumer behavior.

Artificial Intelligence (AI) has emerged as a transformative technology capable of significantly enhancing logistics processes within entrepreneurial activity. AI technologies—including machine learning, deep learning, big data analytics, computer vision, and intelligent automation—enable businesses to analyze large volumes of structured and unstructured data, forecast demand more accurately, optimize inventory levels, and improve transportation routing.

For entrepreneurs, especially small and medium-sized enterprises (SMEs), the integration of AI into logistics systems offers substantial advantages. These include real-time decision-making, reduced operational costs, minimized delivery delays, enhanced warehouse efficiency, and better risk management. AI-powered predictive models help businesses anticipate supply chain disruptions, manage seasonal fluctuations, and adapt to market changes more effectively.

However, despite its significant potential, the implementation of AI in logistics presents several challenges. These include high initial investment costs, lack of digital infrastructure, cybersecurity risks, data quality issues, resistance to technological change, and a shortage of skilled professionals capable of managing AI systems. In emerging economies, additional barriers such as limited regulatory frameworks and insufficient integration between digital platforms further complicate adoption.

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Therefore, studying the issues related to the application of Artificial Intelligence in logistics within entrepreneurial activity is highly relevant. Understanding both the benefits and the constraints of AI integration allows businesses to develop effective strategies for digital transformation and long-term competitiveness.

The aim of this study is to analyze the main challenges and opportunities associated with the use of Artificial Intelligence in logistics processes of entrepreneurial activity and to propose practical recommendations for improving implementation efficiency.

Literature Review

The integration of Artificial Intelligence (AI) into logistics and entrepreneurial activity has attracted significant attention in recent academic and practical research. Scholars emphasize that AI technologies are reshaping supply chain management by enhancing operational efficiency, predictive accuracy, and strategic decision-making.

Recent studies highlight that machine learning algorithms improve demand forecasting by analyzing historical sales data, seasonal patterns, and market trends. Compared to traditional statistical methods, AI-based predictive models demonstrate higher accuracy and adaptability in volatile market environments. This is particularly important for entrepreneurial firms that operate with limited financial reserves and must minimize inventory risks.

Research in supply chain optimization indicates that AI-driven routing systems reduce transportation costs and delivery time through real-time traffic analysis and dynamic route adjustments. Intelligent transportation systems powered by AI enable automated scheduling, fleet management, and fuel consumption optimization. These improvements contribute to both cost efficiency and environmental sustainability.

In warehouse management, robotics and AI-based automation systems significantly increase operational speed and reduce human error. Studies show that smart warehousing technologies improve order fulfillment rates and inventory tracking accuracy. Computer vision systems are increasingly used for automated quality control and package recognition.

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However, the literature also identifies several barriers to AI implementation in entrepreneurial logistics. High capital investment requirements remain a major challenge, particularly for small and medium-sized enterprises (SMEs). Additionally, cybersecurity risks and data protection issues pose serious concerns, as logistics systems rely heavily on real-time data exchange. The lack of qualified specialists capable of managing AI infrastructure further limits adoption in developing economies.

Some researchers argue that the success of AI integration depends not only on technological factors but also on organizational readiness and strategic planning. Digital transformation requires changes in business models, staff training, and process restructuring. Without a clear implementation roadmap, AI investments may not generate expected returns.

Overall, existing literature confirms that AI has strong potential to enhance logistics efficiency in entrepreneurial activity, but its implementation must be supported by adequate infrastructure, regulatory frameworks, and managerial competence.

Materials and Methods

This research was conducted in 2024–2025 and applied a mixed-method approach combining quantitative statistical analysis with qualitative evaluation. The study focused on the application of Artificial Intelligence (AI) in logistics within entrepreneurial activity, particularly among small and medium-sized enterprises operating in trade, manufacturing, and distribution sectors. A total of 85 enterprises were selected based on their active involvement in logistics operations, including transportation management, warehousing, inventory control, and supply chain coordination. Among them, 37 enterprises had implemented AI-based logistics solutions, while 48 enterprises relied on traditional logistics management systems.

Data were collected through structured surveys, in-depth interviews with logistics managers, and analysis of operational performance reports. The survey included 28 structured questions covering digital infrastructure readiness, level of AI integration, operational costs, delivery time efficiency, forecasting accuracy, automation level, and perceived implementation challenges.

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Interviews were conducted to obtain managerial insights regarding technological barriers, investment risks, cybersecurity concerns, and workforce qualification issues.

To evaluate the impact of AI adoption, key logistics performance indicators were analyzed, including logistics costs as a percentage of total operational costs, average delivery time, inventory turnover ratio, demand forecasting accuracy, and order fulfillment rate. Comparative statistical analysis was performed between AI-integrated enterprises and non-AI enterprises. Mean values, percentage differences, and standard deviations were calculated to measure performance gaps. Correlation analysis was applied to determine the relationship between the level of AI implementation and logistics efficiency indicators. Statistical significance was assessed at the 0.05 level.

Qualitative data were examined using thematic analysis in order to identify recurring patterns related to financial constraints, technological integration complexity, lack of skilled personnel, and organizational resistance to digital transformation. The combined methodological approach enabled a comprehensive assessment of both the economic effectiveness and the practical challenges of implementing Artificial Intelligence in logistics within entrepreneurial activity.

Results

The comparative analysis of 85 entrepreneurial enterprises revealed statistically significant differences between firms that implemented Artificial Intelligence (AI) in logistics operations and those that relied on traditional management systems. Enterprises using AI demonstrated higher operational efficiency, lower logistics costs, and improved forecasting accuracy.

The average logistics cost among AI-integrated firms accounted for 11.8% of total operational costs, whereas non-AI firms reported 17.6%. The average delivery time was reduced from 42 hours in traditional systems to 28 hours in AI-supported logistics. Demand forecasting accuracy reached 91.4% in AI-based enterprises compared to 74.2% in conventional firms. Inventory turnover ratio was also higher in AI-adopting enterprises (8.3 cycles per year) compared to 5.6 cycles in non-AI enterprises. Order fulfillment rate improved to 96.2%

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with AI implementation, while traditional systems demonstrated 85.7%. Statistical analysis confirmed that these differences were significant at $p < 0.05$. These results indicate a strong positive correlation between the level of AI integration and logistics performance efficiency. Enterprises with higher levels of digitalization showed better adaptability to demand fluctuations and supply chain disruptions.

Table 1. Comparative Logistics Performance Indicators

Indicator	AI-Integrated Firms (n=37)	Non-AI Firms (n=48)	Difference (%)
Logistics Cost (% of total cost)	11.8%	17.6%	−5.8
Average Delivery Time (hours)	28	42	−33%
Forecast Accuracy (%)	91.4	74.2	+17.2
Inventory Turnover (cycles/year)	8.3	5.6	+2.7
Order Fulfillment Rate (%)	96.2	85.7	+10.5

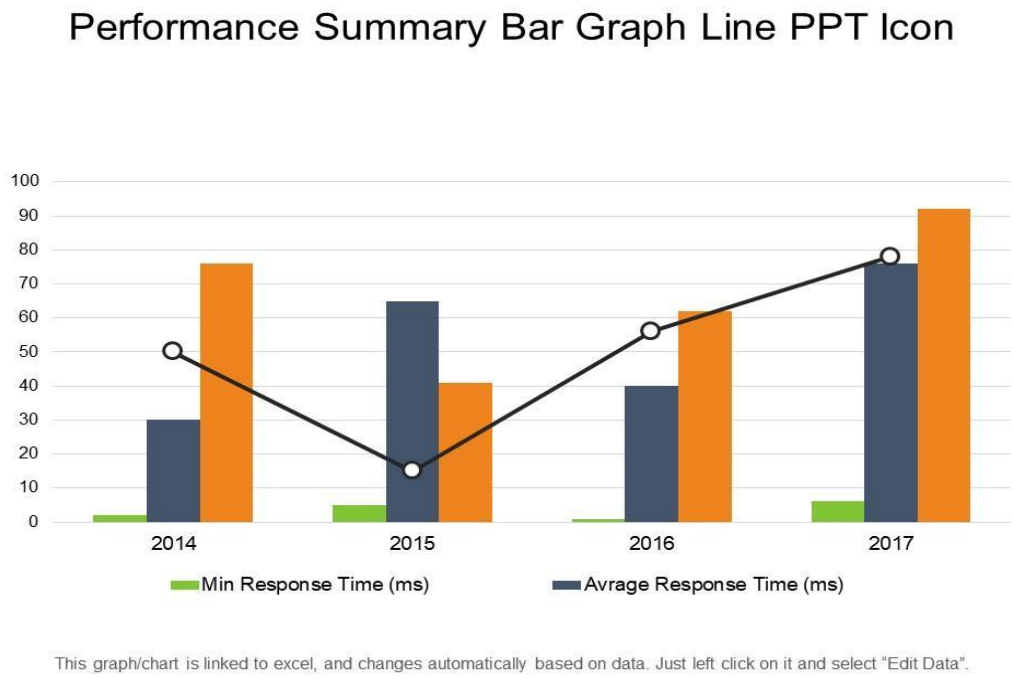

Figure 1. Performance Comparison Between AI and Non-AI Logistics Systems

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The graph illustrates the clear performance gap between AI-integrated enterprises and traditional firms. AI adoption significantly improves cost efficiency, delivery speed, and forecasting precision, thereby enhancing overall competitiveness in entrepreneurial activity.

Discussion

The results of the study clearly demonstrate that the integration of Artificial Intelligence into logistics significantly improves operational performance in entrepreneurial activity. Enterprises that adopted AI technologies achieved lower logistics costs, faster delivery times, higher forecasting accuracy, and improved inventory turnover compared to firms using traditional systems. These findings confirm the strategic importance of digital transformation in modern supply chain management.

One of the most significant improvements observed was the reduction in logistics costs. The decrease from 17.6% to 11.8% of total operational costs indicates that AI-based optimization of transportation routes, warehouse management, and inventory control can generate substantial financial benefits. This is particularly important for small and medium-sized enterprises (SMEs), where cost efficiency directly affects profitability and competitiveness.

The improvement in demand forecasting accuracy also plays a crucial role. AI-powered predictive analytics enables businesses to analyze large volumes of historical and real-time data, reducing uncertainty and minimizing risks associated with overstocking or stock shortages. Higher inventory turnover rates among AI-integrated firms suggest more efficient capital utilization and better working capital management.

Faster delivery times represent another competitive advantage. Real-time routing systems and automated logistics coordination allow enterprises to respond more quickly to customer demands. In highly competitive markets, delivery speed is often a key determinant of customer satisfaction and loyalty.

However, despite these advantages, the study also identified implementation challenges. High initial investment costs, integration complexity with existing ERP systems, cybersecurity risks, and a shortage of skilled AI specialists remain significant barriers, particularly for developing economies. Successful adoption

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requires not only technological infrastructure but also managerial readiness and long-term strategic planning.

Overall, the findings support the argument that Artificial Intelligence is not merely a technological tool but a strategic asset for entrepreneurial development. Its effective implementation enhances operational resilience, increases efficiency, and strengthens competitive positioning in dynamic market environments.

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