STUDY OF THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN BUSINESS PROCESSES OF NOVA POSHTA LLC

by

Andrii Ohiievskyi

A thesis submitted in partial fulfillment of the requirements for the degree of

MA in Business and Financial Economics

Kyiv School of Economics

2024

Thesis Supervisor: _____ Professor Olena Besedina

Approved by _____
Head of the KSE Defense Committee, Professor

_____

_____

_____

Date _____

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Professor Besedina for the helpful recommendations and continuous support with preparing this thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AI Artificial intelligence

KVED Classification of Economic Activities

GDP Gross Domestic Product

KIT Kyiv Innovation Terminal

QMS Quality Management System

CHAPTER 1. INTRODUCTION

Relevance of the topic. In today's world, artificial intelligence (AI) is becoming increasingly popular and widespread every year. AI-based systems are becoming more accessible and are frequently used to solve business problems across various organisations. The use of AI now extends to tasks that typically require human intelligence. Many modern researchers highlight the numerous benefits AI can provide, such as increasing production speed, simplifying processes, improving decision-making and task performance, reducing the strain on human resources, and optimising various operations according to Turing (1950), Halbtsova (2017), Hrebenuyk (2020). Additionally, recent studies demonstrate how AI can automate communication during crises, ensuring that all participants receive accurate information promptly as said by Hadedtska (2022), Halbtsova (2017) and Tur (2018). After a crisis, AI can also be used to analyse events to improve future responses. By learning from past mistakes, companies become more resilient and better prepared for future challenges.

This study hypothesises that AI implementation in enterprise business processes should have well-justified limitations. These limitations may be based on various factors within business processes. Identifying the restriction factors and the necessary conditions for applying them is the core objective of this hypothesis analysis.

The aim of the study is to establish a ranking sequence for business processes based on the factors of 'maximum feasibility of AI implementation' and 'economic efficiency of AI implementation.'

To achieve this aim, the following tasks were identified:

Systematising the theoretical foundations of the term 'artificial intelligence.'

Systematising the list of business processes within an enterprise.

Identifying the optimal set of economic indicators for assessing the effectiveness of AI in business processes.

Studying the business processes of enterprises classified under KVED 52.

Exploring the specifics of AI applications in the business processes of enterprises, using Nova Poshta as a case study.

Evaluating the effectiveness of AI in the business processes of the enterprise.

The subject of the study is artificial intelligence in relation to business processes in enterprises.

The object of the study is the assessment of AI implementation effectiveness within business processes.

Research methods. The study employs the following methods:

Bibliographic method for selecting scientific sources relevant to the study topic.

Critical source analysis to systematise scientific perspectives on the nature and theory of AI.

Theoretical and typological methods for characterising AI applications in business processes.

Structural and semantic analysis to explore business processes and their level of automation, and to organise the findings from the analysis.

Scientific novelty: This work attempts to systematise business processes within enterprises to determine a ranking for AI implementation.

Practical value: The study identifies potential opportunities for implementing artificial intelligence into the business processes of Nova Poshta LLC, highlights implementation challenges, and proposes solutions.

CHAPTER 2. INDUSTRY OVERVIEW AND RELATED STUDIES

The concept of artificial intelligence (AI) emerged in the mid-twentieth century (late 1940s - early 1950s), when the English mathematician Alan Turing, in his article "Computers and the Mind," (Turing (1950) proposed the idea that a computer could eventually think like a human being . To support his claim, he developed an empirical test, now known as the Turing Test, which demonstrated that a person interacting with both a human and a computer would be unable to distinguish the computer from the human.

Although the term "artificial intelligence" has been in use for over 60 years, there is still no universally accepted definition. For instance, in the 1980s, Edward Albert Feigenbaum and Barr, prominent scientists in computer systems theory, defined AI as "a branch of computer science that develops intelligent computer systems with capabilities traditionally associated with the human mind—learning, problem-solving, language comprehension, reasoning, etc." .

In another definition, Turing (1950) describe AI as "the ability of intelligent systems to perform creative functions traditionally considered the prerogative of humans." Similarly, participants in the 2017 UN Conference on Trade and Development proposed a definition: "the ability of machines to imitate human intellectual behaviour".

The key properties of artificial intelligence include self-learning, language comprehension, and the ability to think and make decisions . In 2016, at the World Economic Forum in Davos, Klaus Schwab, the forum's founder and CEO, identified artificial intelligence as one of the key driving forces of the Fourth Industrial Revolution.

Since 2015, AI research has expanded rapidly across the globe, with AI applications covering an increasingly wide array of fields. However, as in any research domain, there are both leading countries and those striving to catch up. Most global market participants recognise that developing advanced technologies is crucial for maintaining a strong position in the global market. The study of trends in the global economy shapes the dynamics of such development models (see Table 1).

The research revealed that scientific and technological advancements triggered the shift from a bipolar to a multipolar world economic system . Consequently, the development of the global economy has become more multifaceted. These wide-ranging opportunities demand the creation of an active analytical framework, where large-scale business growth is supported by rapid advancements in analytical tools and decision-making processes.

The digital economy is fundamentally based on AI development. According to , by 2030, up to 70% of the value created will come from digital products. In 2023, digitised enterprises accounted for 50% of the nominal global GDP.

Thus, the active investment in AI technologies to improve business processes aims to achieve organisational goals while enhancing competitiveness, labour productivity, and overall global economic growth.

The implementation of AI tools in various business processes begins with the collection, processing, and systematisation of data in a structured format. The next step involves the development of AI algorithms capable of self-learning. It is worth noting that there are currently many ready-made AI solutions available on the market , which enable the efficient and swift implementation of blocks and algorithms. Studies have shown that AI can even assist in optimising its integration into business processes . Based on AI-derived insights, all business processes and technological operations related to AI algorithms can be configured. While human intervention is initially required at this stage, AI, through neural networks, can later independently adjust and optimise operations .

Table 1. Dynamics of changes in global economic models

Economic model, title	Period of time in force	Authors
Internationalisation of the economy	XIX-XX centuries	C. Chugrov, V. Anderson

Global economy	From the 70s of the twentieth century to the beginning of the twenty-first century.	P. Rabbertson, M. Waters, G. Terborn, F. Brodel, L. Thurlow, A. Maslow, O. Bilous, A. Gayetz
Economics of sustainable development	XXI century	Adam Smith, Herman Dale, Peter Victor
Digital economy	Since 1995	Don Telscott,
Circular economy	Since 2010	H. Millar, P. Van Leeuwen, T. Berger, , Z. Yuan, A. Babak, M. Geisdorfer, N. Bocken, F. Krausman, M. Hynes, I. Zwarych

Source: based on [6].

Thus, AI is a set of tools that facilitates the digital transformation of businesses. The advancement of AI technologies is reshaping business operations, intensifying competition in the global market, and leading to further differentiation among countries based on their levels of technological and economic development .

A logistics business process refers to an interconnected set of logistics operations and functions, the implementation of which achieves the goals set by the company's logistics strategy . A logistics operation involves any action (or set of actions) related to the execution of key or supplementary flows within the existing supply chain .

Logistics business processes include goods management, supplier relationship management, customer relationship management, and returns management . These processes directly impact the logistics flow objects passing through the logistics centre and add value to the final product. In their operation, logistics centres perform various functions related to products, such as receiving, processing, storage, order preparation, and shipment . The main logistics operations include transportation, warehousing, storage, consolidation, disaggregation, sorting, labelling, packaging, and repacking .

Artificial intelligence plays a crucial role in logistics by enhancing efficiency and accuracy in goods delivery, reducing costs, and speeding up processes . One of AI's primary tasks in logistics is route optimisation . Machine learning algorithms analyse data related to traffic, weather, distance, and other factors to optimise routes, reducing delivery time, costs, and related challenges.

AI also significantly contributes to planning. By analysing large data sets, AI systems can forecast how changes in the production cycle or demand for goods will affect warehousing and delivery needs. Additionally, AI assists with resource management, such as vehicles and labour. Machine learning algorithms can predict when and what resources will be needed, enabling efficient allocation and reducing downtime .

Implementing AI in logistics enhances delivery quality and accuracy, increases efficiency, and lowers costs. Companies adopting such technologies gain a competitive advantage and can offer higher levels of service to their customers. The key advantage of AI over automation is its dynamic adaptability and flexibility in responding to changes and trends. Automated systems follow fixed patterns, requiring reconfiguration and process halts to adjust rhythms or cycles, although they reduce operating costs. Automation enables the optimisation and coordination of business processes by delegating labour-intensive tasks to automated systems (computers). Specialised systems are available for automating business processes . A modern approach to automation is robotic process automation (RPA) .

A comparison of the application areas of robotic process automation and AI is shown in Table 2.

Table 2. Comparative analysis of RAS and AI application areas [38]

Areas of application of AI	Areas of application of RAS
Predictive analysis	Adaptation of clients and employees
Autonomous vehicles	Report generation
Face recognition software	Data entry and migration
Personalisation	Automated software testing
Pharmaceutical drug design	Employment or credit checks
Fraud detection	Applicant tracking systems
Chatbots for customer service	KYC automation

The study showed that business processes where the use of AI is considered appropriate are characterised by the presence of large databases, and these databases are dynamic over time.

An important area of artificial intelligence application in logistics is the optimal management of stock materials and semi-finished products. The Internet of Things (IoT)

and sensors allow data collection on stock levels, the duration of storage, and the speed of stock turnover. This information helps to determine the popularity of goods over time and plan orders to avoid shortages or overproduction.

AI can also enhance the security of enterprises, both overall and specifically in logistics. Systems using computer vision and deep learning can monitor security areas to detect suspicious activities and trigger alert systems or automatic security measures. This reduces theft, damage to goods, and ensures the safety of workers.

It is important to note that AI usage in logistics requires large amounts of data and complex algorithms to ensure system reliability. As a result, logistics employees need to have skills in data science and software development.

AI in logistics serves as a powerful tool for improving business efficiency, optimising delivery routes, managing inventory, and enhancing security. By integrating AI, companies can reduce costs and improve customer service quality.

AI can also create more accurate demand forecasts, which is particularly vital for online retailers struggling to maintain optimal stock levels in virtual stores. Predicting demand by analysing data from social media, search queries, trends, and buying behaviour helps improve inventory management and boost sales.

In addition to AI, robotics is becoming increasingly popular in logistics, with companies adopting autonomous systems and robotic warehouses. These technologies accelerate the processes of picking and delivering goods while improving customer service. Even small businesses are implementing such technologies, demonstrating their accessibility.

AI not only boosts efficiency but also delivers cost savings, including in legal matters. Experts predict that companies using AI in logistics will significantly reduce labour costs and lost profits due to delivery delays.

In general, integrating AI into logistics allows companies to maintain their competitive edge, improve customer service, and reduce costs. In the future, logistics systems enhanced by AI and IoT will become more optimised and capable of higher levels of automation.

Some companies are already automating warehouse management processes using AI. Machine learning-based systems compare current inventory with projected demand to rearrange stock as needed, reducing both time and costs associated with warehousing.

More broadly, AI helps companies identify the most efficient and cost-effective methods of delivery. Machine learning algorithms can analyse data on product quality, detect irregularities, and determine the causes of deficiencies.

Additionally, AI can assist with real-time decision-making, allowing companies to respond quickly to changing external conditions. For instance, data leak detection systems can prevent the loss of confidential customer information.

AI also facilitates the optimisation of freight management. Machine learning systems assess variables like distance, volume, and product type to find the most efficient delivery routes and calculate associated costs.

Artificial intelligence significantly improves customer service. Automated customer support systems can quickly address issues, answer questions, and provide a higher quality of service.

AI's role in logistics includes boosting process efficiency, lowering costs, and improving customer service. The future of logistics will depend on the full integration of AI into all business aspects.

AI also enhances the safety of transportation and warehousing. Machine learning and big data analytics can detect and address potential problems, such as temperature fluctuations and environmental factors that affect product quality.

In terms of demand forecasting, AI allows companies to plan and stock their warehouses more efficiently. Automated inventory management systems, powered by deep learning, process and analyse vast amounts of data to predict demand and optimise stock levels.

AI can further improve routing efficiency, reducing delivery times and increasing the number of orders processed by optimising routes.

AI technologies also help companies resolve logistical disputes, such as those involving aviation or international shipping, more effectively.

Overall, AI makes logistics processes more efficient, convenient, and secure. It improves tracking, control, and safety in goods transportation, helping companies save time and gain a competitive edge.

AI can also reduce time spent on tasks related to regulatory compliance, tax authorities, and certification organisations. By speeding up the approval process for certificates and licences, companies can improve operational efficiency.

Furthermore, AI optimises workforce management. Some companies use AI to screen job candidates, while others use it to manage employee schedules, predict workloads, and organise shifts.

Using AI in management helps businesses cut costs and boost efficiency. Automation allows companies to focus on higher-priority tasks, increasing profitability.

Modern AI technologies are useful for businesses of all sizes. By speeding up processes, optimising resources, and increasing profitability, AI gives managers a significant competitive advantage.

One key benefit of AI is its highly accurate forecasting capabilities. Traditional forecasting methods often contain errors, but AI provides more precise predictions, reducing risk and aiding better decision-making.

AI helps identify customer needs, analyse preferences, and enhance customer-company interaction.

Let's systematise the areas of AI application in logistics discussed above in Tables 3 and 4.

Table 3. Systematisation of business processes in logistics

Business process	Business operation	
Product management	warehousing storage consolidation, disaggregation, sorting,	labelling, packaging, packaging, filling
Supplier relationship management	transport unbundling	sorting
Customer relationship management	consolidation unbundling	labelling packaging

	transport	
Returns management	sorting	labelling

Source: compiled by the authors based on data from [30-40].

Table 4. Systematisation of logistics business operations and areas of AI implementation

Business operation	Areas of application of AI	
1	2	3
warehousing	Demand planning Demand planning Forecasting Optimisation of inventory management Inventory turnover rate Enterprise security	Inventory management Reducing labour costs Cost optimisation when working with staff Reduced time when working with certification centres
storage	Reducing costs Security of valuables Reliability of systems Improving the quality of customer service Demand planning	Real-time decision-making Automation of dispute resolution processes Reduced time spent working with certification centres
consolidation	Speed up processes Cost-effectiveness Planning of resource requirements	Reduced labour costs Real-time decision-making
disaggregation	Speed up processes Inventory management	Real-time decision-making
sorting	Speed up processes Quality and accuracy Inventory management Reduced labour costs	Reduce time spent working with tax authorities and certification centres
labelling	Quality and accuracy Inventory management Reduced labour costs	Reduced time spent working with tax authorities and certification centres
packaging	Security of valuables Inventory management Reducing labour costs	Improving the quality of customer service
choice of packaging	Accelerating processes Planning resource requirements	Inventory management
filling	Quality and precision Reduce costs Planning resource requirements	Inventory management Improve the quality of customer service
transporting	Reducing costs Speed up processes Route optimisation	Automation of dispute resolution processes

	Resource management Improving the quality of customer service	Cost optimisation when working with staff Reduced time spent working with regulators

Source: compiled by the authors based on data from [30-40].

The analysis of current AI applications in logistics reveals that the primary business operations for implementing AI are warehousing, storage, sorting, consolidation, and transportation. The key business process for utilizing AI is goods management. This encompasses using AI to automatically process customer requests (thereby reducing response time and improving service quality), analyze large volumes of customer data (such as preferences and website behavior), and create personalized offers to enhance customer satisfaction.

The analysis and systematization of AI applications in logistics have demonstrated that AI technologies can be employed both universally (for tasks such as planning needs and costs, and reducing time) and specifically (for tasks such as inventory management and route optimization).

Businesses should decide on implementing AI based on their unique needs and capabilities, while also considering ethical and data privacy factors. For example, AI can be used to monitor employees, which may lead to dissatisfaction and potential breaches of confidentiality.

In [41], the authors discuss the most significant risks and limitations of AI applications:

1. **Insufficient data reliability**: Errors or missing information in customer order data can lead to AI recommending suboptimal delivery routes or failing to fulfill orders on time.
2. **Data privacy and security risks**: Logistics companies store substantial amounts of data about orders, customers, suppliers, etc., which could be misused for competitive or other interests.

3. **Significant implementation costs**: Small and medium-sized companies may find the costs of AI technologies prohibitive.
4. **Scaling limitations**: AI technologies rely on predefined algorithms that may lack adaptability and could slow down systems due to their complexity.
5. **Risk of job losses**: This could negatively impact regional economies and increase unemployment.

Artificial intelligence technologies have become integral to logistics, aiding companies in addressing modern business challenges. However, they also present risks and limitations and require specialized knowledge and skills.

In [42-44], the authors identify areas of rapid AI development:

1. **Automation of warehouse and logistics processes**: This includes tracking sales volumes, forecasting orders, and optimizing order fulfillment for commodity items in warehouses.
2. **Use of robots in logistics operations**: This involves controlling robotic systems in logistics tasks.
3. **Deployment of autonomous vehicles**: This includes gathering information about road conditions and other road users.
4. **Enhancing customer service**: Finding optimal solutions for individual clients.
5. **Application of blockchain in logistics**: Improving transparency in cargo delivery processes, providing access to reliable databases, and enhancing personal data security.

The study indicates that logistics is a rapidly evolving field for artificial intelligence systems. Business processes and operations in logistics rely on extensive databases and can be both universal and specialized. The interaction of various market participants in logistics necessitates careful consideration of ethical and security aspects in AI-based optimizations.

CHAPTER 3. METHODOLOGY

Artificial intelligence is playing an increasingly important role in the development of modern business, transforming traditional management methods and strategies into more efficient and innovative ones [45].

The author of the article 'The Impact of Artificial Intelligence on Business Efficiency and Competitiveness' [45] systematised the prospects of using AI for successful business development (Table 5).

Table 5. Prospects for the use of AI for successful business development

№	Process	Features of AI's impact on the process
1	2	3
1	Process automation	First of all, AI allows automating the work with various platforms such as Instagram, Facebook, etc. and optimising tasks and operations that previously required significant efforts from employees. As a result, companies can significantly increase efficiency and reduce staff costs
2	Data analysis	Artificial intelligence can process large amounts of data much faster and more efficiently than a human being. As a result, businesses gain a lot of valuable insights from data, which allows them to make more informed and correct decisions
3	Personalised service	AI helps to create personalised offers and recommendations for customers based on their individual needs and behaviour. This significantly increases customer satisfaction and improves their overall relationship with the brand
4	Forecasting	AI allows businesses to make more accurate predictions about future trends and events based on data analysis. Therefore, businesses that use this technology are more flexible and adaptive to market changes
5	Reduction of errors	AI can not only detect but also eliminate errors in the company's work, which helps to reduce risks and increase the reliability of various processes
6	Competitive advantage	Businesses that successfully use artificial intelligence are able to react faster to market changes and introduce new ideas and products before competitors
7	Global availability	Thanks to the development of AI, even small businesses can gain access to advanced technologies and tools that were previously available only to large corporations

8	Increase marketing and sales efficiency	Artificial intelligence allows automating marketing and sales processes, selecting optimal strategies, and providing greater accuracy in forecasting demand for goods and services
9	Creating new markets and opportunities	With the help of AI, businesses can create new products and services that were previously impossible, or improve existing ones, responding to changing consumer needs
10	Innovative development	The use of artificial intelligence promotes innovation in all areas of business, creating new opportunities for development and growth

Source: [55].

To assess the effectiveness of the processes listed in Table 5 and other processes, there is not enough research in the Ukrainian research community. Let's try to systematise the indicators and tools for assessing the effectiveness of artificial intelligence based on the processes given in Table 5 (Table 6).

Table 6. Indicators for assessing the effectiveness of artificial intelligence

№	Process	Performance evaluation indicators
1	Process automation	- analysis based on KPIs; - functional and cost analysis; - analysis of process automation (assessment of the degree of use of self-regulating technical means, economic and mathematical methods and control systems in the implementation of the business process) B = GP / Pid where Cf is the positive cash flow after the process is automated; P - financial result from operating activities
2	Data analysis	- visualisation (charts, graphs, heat maps); - clustering algorithms (to segment users based on their behaviour or preferences), regression models (to predict the impact of changes on your product) - A/B testing (to compare the effectiveness of different product variants and determine the most effective changes)
3	Personalised service	SQ=P-E where SQ is the quality of personalised service; P - customer perception; E - expectations from the service.
4	Forecasting	The forecasting model has the formula: F = T + S ± E, where F is the forecast value; T - trend; S - seasonal component; E - model error.
5	Reducing errors	OEE = A(%) × P(%) × Q(%)

		where A (Availability) is an indicator of equipment availability in %. This is the ratio of actual production time to planned production time; P (Performance) is a performance indicator in %, which takes into account all the reasons that make the process operate at a speed lower than the maximum possible; Q (Quality) - a quality indicator that takes into account the output of suitable products from the production process, i.e. those that meet all the requirements from the first pass (without defects and without requiring rework).
6	Increase marketing and sales efficiency	ROAS will tell you about the return on advertising costs. It is not difficult to calculate, so marketers are in a hurry to calculate ROAS, ROAS = revenue/advertising costs. ROMI is the highest marketing efficiency indicator ROMI = Received amount / Amount you paid to get it
7	Creating new markets and opportunities	C = PF / PI where PF - positive cash flow after process automation; PI - financial result from operating activities
8	Innovative development	The return on innovation ($R_{ІД}$) shows how much profit the company receives from 1 hryvnia invested in innovation and is calculated using the following formula: $$R_{ІД} = \frac{П_{ІД}}{В_{ІД}} * 100$$ where $П_{ІД}$ is the profit from innovation activities; $В_{ІД}$ - innovation activity costs. To evaluate from the perspective of an innovative enterprise, instead of the innovation profitability indicator, the innovation development effectiveness indicator ($К_{НІР}$) can be used: $$К_{НІР} = \frac{\sum_{i=1}^{T} Е * (1+r)^{-1}}{\sum_{i=1}^{T} ІК * (1+r)^{-1}}$$ where E is the expected effect from the introduction and implementation of the direction in the t-th period, UAH; IC is the expected innovation capital for the introduction and implementation of the direction in the t-th period, UAH; r - discount rate, %; T is the period of time from the beginning of the innovation cycle to the end of the life cycle of innovative products, years.

Source: compiled by the authors based on data from [44-51].

Table 6 shows that not all business processes in the Ukrainian literature have indicators and formulas for assessing the effectiveness of artificial intelligence application. However, in our view, a generalized efficiency formula can always be applied, and an objective result of efficiency assessment can be obtained by using economic and

mathematical modeling methods, such as developing a correlation and regression analysis model.

Let's consider the 5 criteria for assessing the impact of AI implementation given in [52], each of which can be quantified in specific figures and amounts:

1. **Business Effect**: The increase in profits is achieved by reducing the costs associated with a particular process or its stages.
2. **Acceleration of Business Processes**: After AI implementation, the time required for operations is significantly reduced.
3. **Influence of the Human Factor**: AI reduces the risk of human errors. It does not experience fatigue, cognitive distortions, illness, vacations, or potential temptation from competitors.
4. **Personalization**: AI functions as a co-pilot in business processes. It understands the information field it operates within and provides accurate recommendations tailored to the specific needs of each company.
5. **Self-Learning**: The AI system learns and improves itself over time. This process is analogous to hiring a new employee who, after an initial adaptation period, becomes proficient in their role.

Using these criteria, businesses can evaluate the accuracy of document processing, savings on consumables, fines and penalties, and training costs for new employees. AI helps manage increased workloads that would otherwise overwhelm the previous staff.

There are also less obvious advantages: in companies with reduced routine tasks, employee turnover tends to decrease, and the organization saves resources on recruiting and training new employees. Additionally, streamlined and efficient processes provide a significant competitive advantage. However, such tools have associated risks if not used correctly, namely:

1. **Security of Sensitive Corporate Information**: Using cloud-based models like ChatGPT poses risks as the content of documents may be transmitted to the

neural network provider, such as OpenAI, Yandex, or Sberbank, if their AI products are implemented. A potential solution is to deploy local models on the company's servers without internet access.

2. **Impact on Employee Morale**: Replacing employees with AI can pose a real threat to team dynamics, potentially leading to resistance or sabotage of the AI systems.
3. **Incorrect Training**: Insufficient data or errors in result verification can affect the quality of the AI tool. This risk falls under the responsibility of the developer, so companies should partner with reliable vendors.
4. **Improper Use of Technology**: It is crucial for users to understand how AI operates and what it does. At a minimum, any information added by AI should be verified for accuracy.

CHAPTER 4. DATA

Nova Poshta LLC was founded in accordance with Ukrainian laws on January 19, 2001 (entry in the Unified State Register of Legal Entities and Individual Entrepreneurs No. 5881200000001718).

Nova Poshta LLC is a postal and freight company that provides convenient delivery to customers—whether to a post office, a parcel locker, or an address. The company offers logistics and distribution services, handling both small parcels and large cargo. Nova Poshta enables thousands of entrepreneurs to establish and expand businesses not only in Ukraine but also internationally [53]. As of 2022, Nova Poshta's network includes over 10,000 branches throughout Ukraine and more than 13,000 post offices. The number of shipments in 2022 increased by 14%, exceeding 372 million parcels and cargoes [53].

Nova Poshta is a Ukrainian company founded in 2001 that provides express delivery of documents, cargo, and parcels for individuals and businesses. Today, Nova Poshta is the leader in the country's logistics market, offering affordable and convenient delivery services to all customers" [57].

The company's mission is to make delivery easy for both life and business. To achieve this mission, the team at Nova Poshta introduces new products and services, drawing on the best international practices and standards and utilizing the latest technologies and innovative solutions [53].

The main activity of Nova Poshta LLC is classified under 52.29: other auxiliary activities in the field of transport [53].

Divisions within the company are typically organized into departments, which concentrate two or more functions [53]. If departments encompass several divisions, it is advisable to combine individual divisions into directorates with similar functions [53]. A directorate may be formed if it includes at least one department and one division not within that department [53].

Based on the financial statements of Nova Poshta LLC, we will analyze the company's financial condition in the following areas:

Table 7 shows that in 2023, the ratio of current to non-current assets of Nova Poshta LLC was UAH 1,638,807 thousand (59.05%) and shows a tendency to increase.

Nova Poshta LLC also relies on the automation and robotization of its sorting infrastructure to manage a large volume of shipments and continually accelerate delivery speeds. The company has advanced its sorting infrastructure with the launch of the second stage of the Kyiv Innovation Terminal (KIT), which has increased sorting capacity to 50,000 parcels per hour. Additionally, 17 new automated sorting terminals were opened in regional centers (Mykolaiv, Vinnytsia, Rivne, Sievierodonetsk, Sloviansk, Uzhhorod, Cherkasy, Chernivtsi, Chernihiv, Lutsk, Ivano-Frankivsk, Ternopil) over the past year [53].

Table 7. Indicators of the property status of Nova Poshta LLC for the period 2021-2023

Indicator	Year			Deviations			
				absolute, +/-		relative, %	
	2021	2022	2023	2022/ 2021	2023/ 2022	2022/ 2021	2023/ 2022
Average annual value of property, UAH thousand	5857096	5793443	5889058	-63653	95615	98.91	101.65
Average annual value of non-current assets, thousand UAH	4693164	4386805	4154636	-306359	-232169	93.47	94.71
Average annual value of current assets, thousand UAH	1163932	1502253	1638807	338321	136554	129.07	109.09
Ratio of current and non-current assets	0.25	0.34	0.39	0.09	0.05	136.00	114.71
Ratio of real value of fixed assets in the	0.80	0.76	0.71	-0.04	-0.05	95.00	93.42

company's property							
The coefficient of disposal	0.03	0.05	0.08	0.02	0.03	166.67	160.00
Renewal coefficient	0.07	0.02	0.02	-0.05	0	28.57	100.00
Depreciation coefficient	0.11	0.12	0.14	0.01	0.02	109.09	116.67
The coefficient of fitness	0.86	0.85	0.82	-0.01	-0.03	98.84	96.47

Source: calculated by the author according to [53].

The robots are used to transport cargo and sort small parcels weighing up to 2 kg. The company was the first in Ukraine to successfully test parcel delivery using unmanned aerial vehicles (UAVs). Test shipments were conducted between Kyiv and Kharkiv, and between Kyiv and Lviv [53].

A new parcel management service has been introduced on the website, allowing customers to manage their deliveries independently. They can extend the storage period at the post office, arrange forwarding, refuse a parcel, pay for services, or track the location of their parcel [58]. Unfortunately, open sources do not provide data on the cost of maintaining this system.

Despite the war in 2022, the company continued its innovative development, implementing digitalization and automation at all levels [55]. Customers benefit from convenient postal and financial services, fast delivery, and enhanced tracking capabilities [53]. The company also expanded its services abroad, entering the Polish market in October 2022, and in 2023, it continued its expansion by opening offices in nine additional European countries under the Nova Post brand [53].

To ensure that every customer receives their parcel within 24 hours, Nova Poshta is automating its processes and investing in innovative terminals. During the two years of war, shelling and bombing damaged sorting terminals and depots in Kharkiv, Mykolaiv, Dnipro, Chernihiv, Poltava, and dozens of branches were destroyed. The terminal in Mariupol, which is currently occupied, was completely destroyed [53].

Nevertheless, Nova Poshta is committed to restoring and building new automated terminals. In 2022, innovative terminals were opened in Dnipro and Zaporizhzhia. In 2023, the construction of new logistics complexes in Kyiv and Odesa continued [53, 54].

In 2023, Nova Poshta opened 1,674 branches, installed 1,853 postal machines, and established hundreds of PUDO (Pick-Up and Drop-Off) points at existing businesses such as pharmacies, shops, and petrol stations. These points allow customers to send or receive pre-paid parcels weighing up to 10 kg [53, 54]. Let us analyse the automation processes of Nova Poshta LLC (Table 8).

Table 8. Automation processes of Nova Poshta LLC (compiled according to [54])

№	Areas of automation	Features
1	2	3
1	Terminal automation	They are equipped with high-tech lines where boxed parcels are sorted in seconds. The parcels are automatically weighed, and scanners mounted on the sorting belts read the labels on all sides of the box. The system then determines the direction to which the parcel should be sent
1.1	Automated terminal of DAO in Dnipro city	With a total area of 16,000 m², the terminal is capable of processing 26,000 parcels per hour to double the speed of parcel processing for 108 settlements in the Dnipro, Kharkiv and Donetsk regions. The terminal is equipped with automated equipment from the Netherlands' MHS Global, Lithuania's Equinox and Ukrainian-made SBR robots: the main, two-tiered line for sorting parcels in boxes up to 30 kg; spiral vertical chutes, that move parcels downward; telescopic conveyors that take parcels directly into the car; a separate automated line for sorting small parcels; robot trucks: they carry 300 kg
1.2	Automated terminal SICH in Zaporizhzhya Zaporizhzhia	The terminal's throughput capacity is 16,000 shipments per hour, or 384,000 per day. Terminal area 8224 m2 of terminal area, 78 ramp spaces for vehicles of all formats for loading and unloading. Automatic sorting systems Shoe Sorter and Konsort 176 employees
1.3	Kyiv	Terminal throughput capacity of 50 parcels per hour. Terminal area 23900 m2 terminal area. Equipment from the Dutch company Vanderlande
1.4	Innovative terminal in Khmelnytskyi	Terminal capacity of 14 thousand parcels per hour. Terminal area 7700 m2 terminal area. The terminal is equipped with equipment from the Dutch company Vanderlande (with a capacity of 8.5 thousand parcels per hour); conveyors, sorting equipment from the Ukrainian company SMS

1.5	Innovative terminal in Lviv Lviv	The terminal's throughput capacity is 15 thousand parcels per hour. The terminal area is 15000 m2. The terminal is equipped with equipment from the Dutch company Vanderlande (with a capacity of 8.5 thousand parcels per hour); conveyors and sorting equipment from the Ukrainian company SMS
1.6	Innovative terminal in Kharkiv	The terminal's throughput capacity is 20 thousand parcels per hour. The terminal area is 19000 m2. The terminal is equipped with equipment from the Dutch company Vanderlande (with a capacity of 8.5 thousand parcels per hour); conveyors and sorting equipment from the Ukrainian company SMS
2.1	New mail API	a set of business tools designed to automate work with Nova Poshta. The API functionality allows you to quickly integrate logistics processes into any business and is a single point of entry for all customers and services. API integrations with our own CRM speed up order processing
2.2	Business office	a personal page on the company's corporate website, where you can manage your shipments, create invoices, and call a courier 24/7
2.3	Mobile application	in the phone allows you to manage shipments 24/7
2.4	Tracking	allows the customer to independently monitor the movement of the parcel and manage the delivery: find out the location of the parcel, redirect it, extend the storage period in the branch and pay for delivery services.
3	Packaging	The packaging fully meets the increased requirements for it, as the parcels go through a complex path through sorting centres, where they are processed automatically
4	APS Smart procurement management system	Nova Poshta has implemented the APS Smart automated procurement management system. This solution ensures the principles of transparency and trust in cooperation with partners and suppliers.

Source: calculated by the author according to [54].

Next, we will analyse the costs of Nova Poshta LLC for business process automation (Table 9). Since there is no separate data on the costs of automation of Nova Poshta LLC in open sources, we took the volume of capital investments for 2018-2023.

Table 9. Dynamics of expenses of Nova Poshta LLC for business process automation

Indicator	Year						Deviations (2023/2018)	
	2018	2019	2020	2021	2022	2023	absolute, +/-	relative, %
Capital investments,	330256	437370	701136	1544921	2835272	3528058	3197802	968.28

thousand UAH								

Source: calculated by the author according to [53].

Thus, Nova Poshta LLC invests in its own infrastructure, automation, and robotics, which simultaneously increases the efficiency of logistics processes. In 2023, the company's capital investment expenditures amounted to UAH 352,805.8 thousand, which is UAH 3,197.8 thousand more than in 2018 and UAH 692.8 thousand more than in 2022.

The company has also launched a project to use artificial intelligence to simplify employees' access to internal information. This initiative aims to improve the use of the company's knowledge base, document management, and overall information accessibility [56]. According to Nova Poshta LLC, the cost of implementing artificial intelligence at the end of 2023 was UAH 490,400.1 thousand.

The main business processes of Nova Poshta LLC include providing a range of logistics services such as express delivery of documents, parcels, and bulky goods; postal and courier services for legal entities and individuals; packaging services; loading and unloading services; warehousing and storage; and other auxiliary transport activities.

We have examined the cargo transportation process of Nova Poshta LLC and identified a need for greater automation. It has been observed that document flow constitutes a significant portion of the cargo transportation process. Automating this process will substantially improve the exchange of documentation and reduce the number of errors.

CHAPTER 5. RESULTS

5.1. Limitations and opportunities for the development of the enterprise

Nova Poshta is one of the leading transport companies. This is determined by the following factors: freight volumes; financial ratings; qualifications of specialists in all areas of transport; scientific and technical base; design and construction capacities; and experience of international cooperation. An assessment of the impact of internal environment factors on the activities of Nova Poshta LLC is presented in Table 10.

Table 10. Assessment of the impact of internal environment factors on the activities of Nova Poshta LLC

Factors of the internal environment	Advantages	Disadvantages
Technologies	Environmental strategy Work on the creation of a QMS. Implementation of resource-saving technologies. Reconstruction of facilities. Updating the technology park. Implementation of information technologies.	A large amount of investment.
Personnel	High competence, stable team. Competitive social package. Measures to support young staff and pensioners. Labour protection measures.	Reduction of staff due to structure optimisation.
Management organisation	Electronic document management, control of business processes through reorganisation of the management system and setting common goals and objectives.	The risk of losing control over remote divisions.
Marketing	Rebranding. Modern methods of sales promotion. Use of Internet communications.	Development of intra- and inter-industry competition.
Finance	The company is profitable and financially stable.	Dependence on investments.

Source: compiled by the author according to [53].

The SWOT analysis allowed us to identify the strengths and weaknesses of the internal environment of Nova Poshta LLC.

Strengths:

- High level of responsibility among the management of Nova Poshta LLC.
- Effective operational management.

Weaknesses:

- Insufficient qualification levels among branch managers.
- Lack of management flexibility.
- Information overload for managers due to insufficient horizontal communication.
- High costs associated with maintaining the management apparatus.

Opportunities:

- Professional human resources.
- Stable financial position.
- Advanced technologies.
- Potential for growth in transport service volumes.
- Development of new technologies, including service and automation projects.
- Opportunities for partnerships with freight forwarders.
- Ukrainian government projects related to the reconstruction of the transport industry and financing for these projects.

Threats:

- Increasing competition from other transport service providers.
- Changes in tariff structures for transport services.
- Economic risks due to the ongoing war.

Rising prices for raw materials and supplies used in transport services.

The freight sector is currently assessed as quite favorable, with growth primarily driven by increased traffic.

A special focus of Nova Poshta's strategy is on ensuring environmental safety in its production and transport operations. The company's environmental strategy includes several key points: planned reduction of environmental impact, introduction of resource-saving technologies, rational use of natural resources, and the active use of environmentally friendly materials.

The company has also developed and is implementing an innovation strategy that outlines key development guidelines. This strategy includes defining key performance indicators for practical implementation and a phased (medium-term) plan for its execution. The plan features measures related to the development of new technologies and techniques aimed at increasing labor productivity and creating and modernizing high-performance workplaces.

Nova Poshta adheres to principles of social responsibility in its HR management. Social responsibility is a mandatory aspect of the company's operations, with principles designed to ensure stable and effective functioning of its workforce. Table 11 presents the SWOT analysis.

Table 11. Summary SWOT-analysis of the external and internal environment of Nova Poshta LLC

Advantages	Disadvantages
Modern technologies, updated technology park. High competence of the staff. A stable team. Modern technologies of management organisation. Modern methods of sales promotion. Diversification of services. Financial stability.	Dependence on investments. Increased labour costs due to production expansion. Risk of reduced control over business processes of remote units.
Opportunities	Threats
Increase in market share. Serving additional consumer groups. Maintaining the optimal cost of services. Expanding the types of services. Maintaining and increasing sales volumes. Implementing innovations and saving resources.	Increased competition in existing market segments. Increased intersectoral competition. Slowdown in economic growth. Rising energy prices. Insufficient demand due to uneven growth in household incomes.

Source: compiled by the author according to [53].

The SWOT analysis of the company's activities has identified key factors impeding further socio-economic growth. Firstly, there is insufficient renewal of transport means and a technological lag in the country's transport development. Secondly, there is a clear

lack of investment resources and insufficient improvements in transport safety. Addressing these factors is crucial to overcoming or significantly minimizing these issues.

Additionally, based on the SWOT analysis, it is concluded that prioritizing the use of the latest information and logistics technologies is essential for Nova Poshta LLC. Implementing these technologies will significantly reduce transportation costs and improve the efficiency of the rolling stock.

In 2022, Nova Poshta became the top logistics company in Ukraine in terms of accessibility. The company also relies on the automation and robotization of its sorting infrastructure to manage a high volume of shipments and continually accelerate delivery rates [54].

The automation of the sorting infrastructure has continued, with the second stage of the Kyiv Innovation Terminal (KIT) increasing sorting capacity to 50,000 parcels per hour. Additionally, 17 new automated sorting terminals were opened in regional centers (Mykolaiv, Vinnytsia, Rivne, Sievierodonetsk, Sloviansk, Uzhhorod, Cherkasy, Chernivtsi, Chernihiv, Lutsk, Ivano-Frankivsk, Ternopil).

The robotization of terminal infrastructure involves using robots to transport cargo and sort small parcels weighing up to 2 kg [54].

Nova Poshta was the first company in Ukraine to successfully test parcel delivery using unmanned aerial vehicles (UAVs). These test shipments were conducted between Kyiv and Kharkiv, as well as Kyiv and Lviv.

A new parcel management service has been introduced on the website, allowing customers to independently manage their deliveries. This service includes options to extend the storage period at the branch, arrange forwarding, refuse a parcel, pay for services, or track the parcel's location.

5.2. Analysis of the AI impact on the profitability of Nova Poshta LLC

Correlation and regression analysis is a classical method of stochastic modeling for economic activity. It is used to study the relationships between business performance indicators when the dependence between them is not strictly functional and is influenced by external, random factors. The method involves constructing correlation and regression models of economic activity that distinguish between factor and performance indicators.

Correlation analysis measures the strength of the relationship between variables and evaluates which factors have the greatest impact on the performance indicator.

For our analysis, we have chosen multivariate regression as the model. The main factors influencing the outcome variable include:

1. **Factor X_1:** The amount of spending on the introduction of artificial intelligence into business processes, reflecting the financial resources invested in automation.
2. **Factor X_2:** The amount of costs associated with business process automation.
3. **Factor X_3:** Other non-current assets.
4. **Y:** The resultant variable, such as net income of Nova Poshta LLC.

Using this regression equation, we can forecast changes in the net profit of Nova Poshta LLC as a result of implementing the project to modify advertising activities and its financial support.

Table 12 presents the initial data to be used for creating the model. To build this model, we will perform the necessary calculations using R Studio and Excel.

To determine the main factors affecting the net profit of Nova Poshta LLC through advertising activities, a correlation analysis of the company's financial indicators was conducted using MS Excel (with the Data Analysis/Correlation add-in). The results of this analysis are presented in Table 13.

Table 12. Initial data for creating a regression model of Nova Poshta LLC in 2019-2023, annualised

Indicators	Years					
	2018	2019	2020	2021	2022	2023
Expenditures on the introduction of artificial intelligence into business processes, UAH thousand	3632.8	8310.0	37861.3	182300.7	379926.4	490400.1
Total expenditures on business process automation, thousand UAH	330256	437370	701136	1544921	2835272	3528058
Other non-current assets, thousand UAH	36668.0	38995.0	190460.0	27591.0	789466.0	1009063.0
Net income (revenue), thousand UAH	10515739	13453318	16902857	20843502	28461964	43645219

Source: calculated by the author according to [53].

Table 13. Results of the correlation analysis of the profitability of Nova Poshta LLC depending on the identified factors

Indicators	Expenditures on the introduction of artificial intelligence into business processes, UAH thousand	Total expenditures on business process automation, thousand UAH	Other non-current assets, thousand UAH	Net income (revenue), thousand UAH
Expenditures on the introduction of artificial intelligence into business processes, UAH thousand	1.00			
Total expenditures on business process automation, thousand UAH	0.96	1.00		
Other non-current assets, thousand UAH	0.87	0.96	1.00	
Net income (revenue), thousand UAH	0.92	0.93	0.88	1.00

Source: calculated by the author according to [53].

The level of relationship between the identified indicators was assessed using the Chaddock scale, as a result of which the resulting correlation characteristics are presented in Table 14.

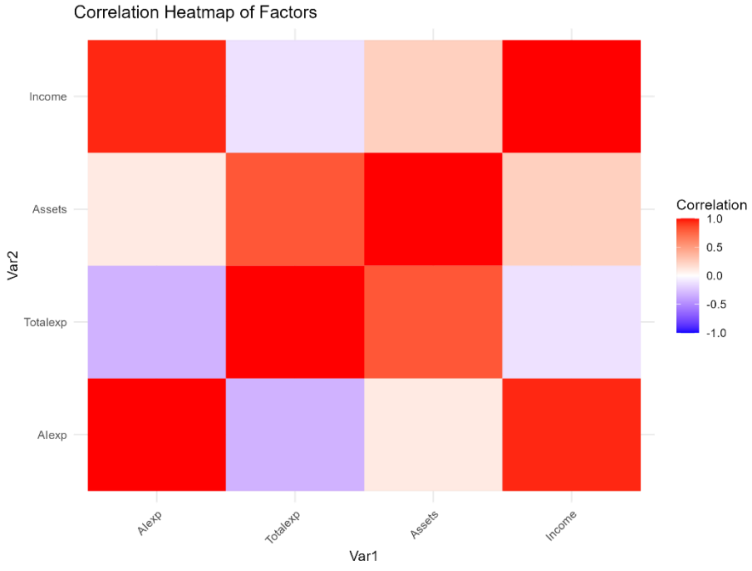
Table 14. Characteristics of the closeness of the relationship between the net income of Nova Poshta LLC and the factor attributes

Indicators	The amount of expenditures on the implementation of artificial intelligence in business processes, UAH thousand	Total expenditures on business process automation, UAH thousand	Automation level, %
Net income, thousand UAH	Very tight	Very tight	Very tight

Source: calculated by the author according to [53].

The results of the correlation analysis show that there is a very close relationship between net income (revenue) and all other analysed indicators.

Fig. 1. Characteristics of the closeness of the relationship between the net income of Nova Poshta LLC and the amount of expenses for the implementation of artificial intelligence in business processes, UAH thousand



The results of the correlation analysis show that there is a strong correlation or high interdependence between the amount of spending on artificial intelligence implementation and total automation costs in the data. That is, when one factor changes,

it is likely that the other will also change in a corresponding way. This can make it difficult to analyze and clarify the impact of each factor on the dependent variable under study.

In order to determine the specific type of relationship between the various variables, a regression analysis was performed using Excel and R Studio functionality. The results of this analysis can be found in Table 15 and Table 16.

Table 15. Regression statistics

Indicators	Meaning
Multiple R	0.968787
R-squared	0.968352
Normalised R-squared	0.846372
Standard error	4774666

Source: calculated by the author according to [53].

The adjusted coefficient of determination R^2 is ≈ 0.97 (from Table 15), which shows that the change in the resultant attribute is 97% explained by changes in the factor attributes.

The results of the analysis of variance indicate that the resulting model is reliable: according to the Fisher's criterion $f^* = 10{,}18 > f_{\text{табл}} = 0{,}08$, where $f_{\text{табл}} = F(1 - 0.95; m; n - m - 1)$, it can be argued that the regression equation and its coefficients are significant at the 95% reliability level, i.e. the influence of random factors is insignificant.

Table 16. Results of the analysis of variance

	df	SS	MS	F	Significance F
Regression	3	6.96E+14	2.32E+14	10.18208	0.090746
Residual	2	4.56E+13	2.28E+13		
Summary	5	7.42E+14			

Source: calculated by the author according to [53].

In order to determine the impact of the spending factors on the net income of Nova Poshta a regression analysis has been performed using R Studio. The results of the regression analysis are presented in Figs. 2 - 4.

Fig. 2. Results of regression analysis

==========

	Dependent variable:
	Income
AIexp	661.800***
	(40.753)
Totalexp	25.861***
	(7.676)
Assets	-39.100*
	(22.656)
Constant	8,729,534.000
	(5,209,797.000)
Observations	24
R2	0.956
Adjusted R2	0.950
Residual Std. Error	6,676,317.000 (df = 20)
F Statistic	145.830*** (df = 3; 20)
Note:	*p<0.1; **p<0.05; ***p<0.01

The regression analysis examines the impact of such variables as AI expenditures, total expenditures, and other non-current assets on net profit. The results show that AI expenditures variable has a strong positive effect on net profit, with an estimated increase of 661.800 in net profit for each unit increase in AI expenditures. This effect is statistically significant at the 1% level, indicating high confidence in this relationship. Similarly, total expenditures variable also has a positive and statistically significant effect on net profit, with an estimated increase of 25.861 in net profit per additional unit of total expenditures.

It is worth mentioning that the other non-current assets variable has a negative association with net profit. The model estimates that a one-unit increase in fixed assets is linked to a decrease in net profit of 39.100. This relationship is only weakly significant at the 10% level, suggesting that while there may be a negative association, it is less robust than the effects of the other variables.

The model explains about 95.6% of the variance in net profit, as indicated by the R-squared value, with an adjusted R-squared of 95.0% accounting for model complexity.

The overall fit of the model is strong, as confirmed by the significant F-statistic, suggesting that these three factors are closely related to net profit.

As a next step of analysing the impact of AI expenditures on the performance of Nova Poshta, the author has checked the portion of AI expenditures in the total spending of the company. For that purpose a Ratio Variable has been created as well as an Interaction Variable.

Fig. 3. The Ratio Variable statistics (AI expenditures as a part of total expenditures)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.0009743	0.0017012	0.0622174	0.0666072	0.1339984	0.1390000

The ratio variable shows that AI expenditures generally make up a small portion of total expenditures, with most observations below 14%. This could suggest that, while AI represents a growing expenditure, it still accounts for a relatively small part of total spending.

The average ratio is about 6.7%, indicating that AI expenditures make up only a small part of total expenditures on average. This is further supported by the median value of 6.2%, which shows that half of the data points have an AI expenditure share at or below this level.

Fig. 4. The Interaction Variable statistics (AI expenditures as a part of total expenditures)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
6.608e+08	2.295e+09	1.656e+10	3.619e+10	6.589e+10	1.368e+11

The summary statistics reveal a right-skewed distribution, meaning that most observations show a moderate combined effect. This could signify scenarios where higher investments in both categories potentially lead to an amplified effect on the outcome.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

In this paper, we have conducted a study on the topic of "Investigating the effectiveness of introducing artificial intelligence into the business processes of Nova Poshta LLC," from which the following conclusions can be drawn:

The paper systematizes the results of theoretical developments in the field of AI implementation in business processes. The characteristics of business processes in enterprises are considered, as well as the organization of business processes and operations to identify the specificities of their automation. It is shown that the concept of artificial intelligence first appeared in the 1940s-1950s in the works of mathematician A. Turing, though the main research surge began after 2015. Currently, there is no universally recognized definition of AI. However, the analysis of various interpretations has led us to adopt the following working definition for this study: AI is a set of tools that facilitate digital business transformation.

The study demonstrated that the use of artificial intelligence in logistics improves delivery quality and accuracy, increases efficiency, and reduces costs. The advantage of using AI, as compared to traditional automation processes, lies in its predictable adaptability and the dynamism of changes and trends.

An analysis of existing areas of AI application in logistics shows that the key business operations benefiting from its implementation include warehousing, storage, sorting, consolidation, and transportation. The primary business process for AI application is goods management. Furthermore, the systematization of AI use in logistics revealed that AI technologies can be both universal (such as in planning needs and costs, reducing time) and specialized (like inventory management, route optimization, etc.).

The analysis of approaches, methods, and tools for evaluating the effectiveness of AI shows that not all business processes in the Ukrainian literature are equipped with indicators and formulas for such evaluation. Nevertheless, in our opinion, a generalized efficiency formula can always be applied, and an objective assessment of efficiency can

be obtained through the method of economic and mathematical modeling, specifically by developing a correlation and regression analysis model.

The paper has met its objectives and yielded the following results: an analysis of the state of Nova Poshta LLC was carried out. The analysis of the company's economic performance revealed that its main activities include providing a range of logistics services, such as express delivery of documents, parcels, and bulky goods; postal and courier services to enterprises, organizations, and individuals; packaging services; loading and unloading; warehousing and storage; and other auxiliary transport-related services. The analysis of the company's financial condition showed that Nova Poshta LLC maintained financial independence between 2018 and 2023. Despite the ongoing war, the analysis of its business processes revealed that the company is actively automating its operations. The company is investing in infrastructure, automation, and robotics, and is exploring the use of artificial intelligence to facilitate the internal flow of information for employees.

The study also found that the company's freight transportation algorithm is complex, with document flow accounting for most of the business process duration, thereby necessitating automation. A SWOT analysis determined that the priority areas in the cargo transportation processes of Nova Poshta LLC are the use of the latest information logistics technologies to reduce transportation costs and optimize the use of rolling stock. The correlation-regression analysis showed that the company's revenue from sales significantly depends on the level of automation of its core business processes. Additionally, it was found that the factor of the amount of investment in AI implementation in business processes has a significant impact on performance.

REFERENCES

1. Turing A. M. (1950) *Computing Machinery and Intelligence*. Mind, LIX. October. N 236. P. 433–460.
2. What is Artificial Intelligence? URL: https://www.etrellium.com/ai/what-is-artificial-intelligence
3. Information Economy Report: Digitalization, Trade and Development (2017). New York, Geneva : UN, UNCTAD, 112 p.
4. Schlein L. WEF Founder: World Unprepared to Deal with 'Fourth Industrial Revolution' (2016) URL: https://www.voanews.com/a/wef-founder-world-unprepared-to-deal-with-fourth-industrial-revolution/3143406.html
5. Official Website of the World Bank. URL: www.worldbank.org
6. Official Website of the World Trade Organization. URL: www.wto.org
7. Official Website of the United Nations Industrial Development Organization (UNIDO). URL: www.unido.org
8. Kupiianyk A. *Digital Economy of Ukraine: Key Development Factors*. URL: https://voxukraine.org/tsyfrova-ekonomika-ukrayiny-osnovni-faktory-rozvytku
9. 10 Best Artificial Intelligence Programs (2024). URL: https://www.unite.ai/uk/10-%D0%BD%D0%B0%D0%B9%D0%BA%D1%80%D0%B0%D1%89%D0%B8%D1%85-%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC-%D1%88%D1%82%D1%83%D1%87%D0%BD%D0%BE%D0%B3%D0%BE-%D1%96%D0%BD%D1%82%D0%B5%D0%BB%D0%B5%D0%BA%D1%82%D1%83/
10. 10 AI-Based Business Plan Generators for Launching Any Business in 2023 (2023), URL: https://www.linkedin.com/pulse/10-%D0%B3%D0%B5%D0%BD%D0%B5%D1%80%D0%B0%D1%82%D0%BE%D1%80%D1%96%D0%B2-%D0%B1%D1%96%D0%B7%D0%BD%D0%B5%D1%81-%D0%BF%D0%BB%D0%B0%D0%BD%D1%96%D0%B2-%D0%BD%D0%B0-%D0%BE%D1%81%D0%BD%D0%BE%D0%B2%D1%96-%D1%88%D1%96-%D0%B4%D0%BB%D1%8F-%D0%B7%D0%B0%D0%BF%D1%83%D1%81%D0%BA%D1%83-%D0%BB%D1%96%D0%BF%D1%87%D0%B5%D0%B2%D1%81%D1%8C%D0%BA%D0%B8%D0%B9

11. Halbtsova O. L. (2017) *Development of the Economy of Ukraine: Transformations and Innovations*. Zaporizhzhia: Publishing House "Helvetika," Vol. 1. 324 p.
12. Open Data for Civil Servants. URL: https://osvita.diia.gov.ua/courses/open-data
13. The Impact of Artificial Intelligence on Business Operations. URL: https://londoncollegept.co.uk/The-Impact-of-Artificial-Intelligence-on-Business-Operations#:~:text=One%20of%20the%20primary%20impacts,more%20complex%20and%20strategic%20tasks
14. Hrebenuyk A.M. (2020) *Fundamentals of Information Security Management*. Dnipro: Dnipro State University of Internal Affairs, 144 p.
15. Artificial Intelligence – Worldwide. URL: https://www.statista.com/outlook/tmo/artificial-intelligence/worldwide
16. Artificial Intelligence Stocks: The 10 Best AI Companies. URL: https://money.usnews.com/investing/articles/artificial-intelligence-stocks-the-10-best-ai-companies
17. Artificial Intelligence and Machine Learning Technologies in Business. URL: https://metinvest.digital/ua/page/1017#:~:text=%D0%A2%D0%B5%D1%85%D0%BD%D0%BE%D0%BB%D0%BE%D0%B3%D1%96%D1%97%20%D1%88%D1%82%D1%83%D1%87%D0%BD%D0%BE%D0%B3%D0%BE%20%D1%96%D0%BD%D1%82%D0%B5%D0%BB%D0%B5%D0%BA%D1%82%D1%83%20(Artificial%20Intelligence,%D1%8F%D0%BA%D1%96%20%D0%B7%D0%B0%D0%B7%D0%B2%D0%B8%D1%87%D0%B0%D0%B9%20%D0%B2%D0%B8%D0%BC%D0%B0%D0%B3%D0%B0%D1%8E%D1%82%D1%8C%20%D0%BB%D1%8E%D0%B4%D1%81%D1%8C%D0%BA%D0%BE%D0%B3%D0%BE%20%D1%96%D0%BD%D1%82%D0%B5%D0%BB%D0%B5%D0%BA%D1%82%D1%83)
18. Ethical Aspects of Using Artificial Intelligence in Marketing. URL: https://www.theantmedia.com/post/etichni-aspekti-vikoristannya-shtuchnogo-intelektu-v-marketingu
19. National Defense Strategy of The United States of America. URL: https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf
20. IBM, Google, and Microsoft Lead GenAI Patent Race, IFI Claims Study Reveals. URL: https://www.thesoftwarereport.com/ibm-google-and-microsoft-lead-genai-patent-race-ifi-claims-study-reveals/
21. Analysis of Current Trends in the Development of Leading World Economies and Risks Associated with the Russian-Ukrainian Conflict. URL: https://bintel.org.ua/nash_archiv/arxiv-geopolitika/ekonom-mira/

22. Kapustian V.V., Mazhara H.A., Fartushnyi I.D. *Economic Modeling.* URL: https://ela.kpi.ua/server/api/core/bitstreams/b7935c05-0c7d-4594-9843-719f8dc9015c/content
23. Hadedtska Z.M. (2022) *Business Process Modeling of Enterprise Activities.* URL: http://www.economy.nayka.com.ua/?op=1&z=4950
24. Tur O.V. (2018) *Business Process Management in an Enterprise.* URL: http://www.economy.nayka.com.ua/pdf/6_2018/59.pdf
25. Lysenko A.O. (2021) *Classification of Business Processes in Industrial Enterprises: Theoretical Aspects.* URL: https://dspace.nuft.edu.ua/server/api/core/bitstreams/4b121a6a-5ba6-4b7f-b2a6-2397eed15d61/content
26. Pidlisna O.A. (2022)*Systematization of Approaches to Innovative Changes in the Structure of an Enterprise During Relocation* // Economic Bulletin of NTUU "Kyiv Polytechnic Institute.", No.24 – pp.63-69 DOI: https://doi.org/10.32782/2307-5651.24.2022.9
27. Chuyeshov, O.V. (2015) *The Relevance of Business Projecting of Logistics Processes in Pharmaceutical Enterprises. Professional Management in Modern Market Development Conditions*: *Proceedings of the IV Scientific-Practical Conference with International Participation*, Kharkiv, November 3, 2015. Kharkiv, pp.131-133.
28. Romanovich E.V., Kozar L.M. (2005), *Production Logistics: Educational Manual.* Kharkiv: UkrDAZT, 230 p.
29. Logistic Activity and Its Components. URL: https://elar.khmnu.edu.ua/server/api/core/bitstreams/74aa1605-db78-47d7-a38f-04afbe77eae8/content
30. The Role of Artificial Intelligence in Production – Automation and Efficiency in 2024 (2024). URL: https://mediacom.com.ua/rol-shtuchnogo-intelektu-u-virobnitstvi-avtomatizatsiya-ta-efektivnist-u-2024-rotsi/
31. How to Use Artificial Intelligence to Optimize Logistics. URL: https://6weeks.marketing/ua/yak-vykorystaty-ai-dlia-optymizatsii-lohistyky/
32. Technologies for the Ethical Use of Artificial Intelligence in the Field of Education and Science: Materials of the All-Ukrainian Scientific-Pedagogical Advanced Training, July 31 – September 10, 2023. Odessa: Publishing House "Helvetika," (2023), 276 p. URL: https://cuesc.org.ua/images/informlist/Maket_advanced_training_PSAU.pdf
33. Business Process Automation. URL: https://snov.io/glossary/ua/business-process-automation-ua/
34. RPA vs. Artificial Intelligence – Differences, Commonalities, Tools, and Overlaps/Repeats. URL: https://www.zaptest.com/uk/rpa-%D0%BF%D1%80%D0%BE%D1%82%D0%B8-%D1%88%D1%82%D1%83%D1%87%D0%BD%D0%BE%D0%B3%D0%

BE-
%D1%96%D0%BD%D1%82%D0%B5%D0%BB%D0%B5%D0%BA%D1%82%D1%83-
%D0%B2%D1%96%D0%B4%D0%BC%D1%96%D0%BD%D0%BD%D0%BE%D1%81

35. Nikolayev I.V. (2018) *Information Systems in Logistics Management: Educational Manual* / I.V. Nikolayev. – Kropyvnytskyi: Publishing Center CTNU, – 232 p.
36. Video Analytics for Business. URL: https://www.inni.tech/videoanalitika-dlya-biznesu
37. Biełova M.V., Bielov D.M. (2023) *Challenges and Threats to Personal Data Protection in Working with Artificial Intelligence.* Scientific Bulletin of Uzhhorod National University, Issue 79(2). pp.17-22.
38. Tilniak Yu.Ya., Kornaia Ya.I. (2019)*Research and Application of Blockchain Technology in Transport Logistics.* Bulletin of Zhytomyr State Technological University. No. 1 (83). pp.12–17.
39. Blockchain Technology in Logistics. URL: https://dolphincargo.com.ua/ua/texnologiya-blokchejn-v-logistici/
40. Dovhun O.S. (2017)*Automation of Logistics: Modern Solutions and Prospects* / O.S. Dovhun, K.Z. Stasyuk // Scientific Bulletin of Uzhhorod University. Series: Economy. Issue 2. pp.187-191.
41. The Impact of Artificial Intelligence on Business Efficiency and Competitiveness. URL: https://sitniks.ua/blog_post/vplyv-shtuchnogo-intelektu-na-efektyvnist-ta-konkurentospromozhnist-biznesu/
42. How to Work with Data Collection and Analyze It to Improve the Product. URL: https://www.londonproduct.academy/post/yak-pracyuvati-zi-zbirkoyu-danih-ta-analizuvati-yih-dlya-vdoskonalennya-produktu
43. Kristova S. *The Formula of Effective Service: How to Calculate Customer Expectations and Exceed Them.* URL: https://business.diia.gov.ua/cases/servis/formula-efektivnogo-servisu-ak-virahuvati-ocikuvanna-klienta-ta-pereversiti-ih
44. How to Forecast Sales: Classical Methods and Modern Tools. URL: https://elit-web.ua/ua/blog/kak-prognozirovat-prodazhi
45. Calculation of Overall Equipment Effectiveness (OEE). URL: https://bpi-group.com.ua/uk/blog/rozrahunok-zagalno%D1%97-efektivnosti-obladnannya-oee/
46. ROAS vs. ROMI: Calculating Marketing Efficiency. URL: https://mixdigital.com.ua/blog/roas-vs-romi-rahuyemo-efektivnist-marketingu-na-prikladi-prodazhu-siru/
47. Biełova M.V., Bielov D.M. (2023) *Challenges and Threats to Personal Data Protection in Working with Artificial Intelligence.* Scientific Bulletin of Uzhhorod National University, Issue 79(2). pp.17-22.

48. Assessment of the Effectiveness of an Enterprise's Innovative Activities. URL: https://learn.ztu.edu.ua/mod/resource/view.php?id=197981
49. The 5 Most Common Pricing Strategies. URL: https://www.bdc.ca/en/articles-tools/marketing-sales-export/marketing/pricing-5-common-strategies
50. Management Report of Nova Poshta LLC for 2023. URL: https://site-assets.novapost.com/80e16b00-a8d4-40b4-9695-6638924e91e2.pdf
51. Official Website of the State Statistics Service of Ukraine. URL: http://ukrstat.gov.ua/
52. Sustainable Development Report of Nova Poshta LLC. URL: https://novaposhta.ua/csr/build/pdf/NP-Report%202022_UKR_27-12-2023.pdf
53. Voice Invoices and AI Hackathon. "Nova Poshta Plans to Implement Artificial Intelligence in Operations". URL: https://newsteka.com/nakladni-golosom-ta-ai-hakaton-nova-poshta-planuye-zastosuvaty-v-roboti-shtuchnyj-intelekt/
54. Nova Poshta Launched a New Service for Managing Parcels. URL: https://novaposhta.ua/news/rubric/2/id/8625
55. Management Report of Nova Poshta LLC for 2020. URL: https://static.novaposhta.ua/sitecard/misc/doc/%D0%97%D0%B2%D1%96%D1%82%20%D0%BF%D1%80%D0%BE%20%D1%83%D0%BF%D1%80%D0%B0%D0%B2%D0%BB%D1%96%D0%BD%D0%BD%D1%8F%202020.pdf

APPENDIX

R STUDIO PRINTOUT