Artificial Intelligence and Blockchain Technologies as Tools for Modeling Investment Projects*

Maryna Chyzhevska[1,†], Oleksandra Kuzmenko[1,†], Vitalii Venger[2,†], Nataliia Romanovska[2,†] and Alona Desiatko[3,*,†]

[1] National University "Yuri Kondratyuk Poltava Polytechnic", 24 Pershotravnevyi ave., 36011 Poltava, Ukraine
[2] State Organization "Institute for Economics and Forecasting, NAS of Ukraine", 26 Panasa Myrnoho str., 01011 Kyiv, Ukraine
[3] State University of Trade and Economics, 19 Kyoto str., 02156 Kyiv, Ukraine

Abstract

The relevance of this study is due to the increasing role of artificial intelligence (AI) and blockchain technologies in investment project modeling. These technologies offer new opportunities for risk management and profitability forecasting by enhancing the efficiency and transparency of financial decision-making processes. The objective of the study is to analyze the impact of AI and blockchain on investment project modeling, emphasizing their role in optimizing financial strategies. The study employs analytical methods, systematic analysis, synthesis, and comparative approaches to assess the effectiveness of these technologies in financial decision-making. The study explores the integration of AI and blockchain in investment project modeling, highlighting their advantages, such as improved financial stability assessment, fraud prevention, and automation of investment agreements. Special attention is given to the role of deep learning in macroeconomic forecasting and the potential of asset tokenization in attracting capital. Additionally, the study examines challenges related to digital transformation, including high implementation costs, cybersecurity risks, and technological adaptation. Practical applications of AI and blockchain in investment projects are assessed, focusing on their impact on asset management and financial stability. The study provides recommendations for improving the efficiency of investment project modeling through digital technologies to ensure sustainable financial growth.

Keywords

artificial intelligence, blockchain, investment, investment projects, modeling, digital transformation, asset tokenization, digitalization, cybersecurity

1. Introduction

Today's conditions open up many prospects for modern enterprises. It is the use of digital technologies, in particular AI and blockchain technologies, that is driving the development of the global economy, opening up new opportunities for modeling investment projects. Integration into global digital chains creates added value, which is the basis for the emergence of new markets and the entry of products into the international arena. Thus, the introduction of innovative information technologies, including AI and blockchain, is becoming a key factor in optimizing investment decisions. Efficient and fast data processing ensures transparency of financial transactions and increases the accuracy of management decisions [1, 2].

Thus, the development and implementation of scientific and technological advancements have made the digitalization of all spheres of activity the foundation for the practical application of analytical models for investment risk forecasting, thereby enhancing the growth potential of enterprises. The advancement of digital technologies (Big Data, the Internet of Things (IoT), Smart technologies, smart contracts) has led to the transformation of traditional approaches to investment opportunity assessment and the expansion of financial instruments [3–6]. Consequently, this issue remains at the center of attention in political, business, and scientific-practical domains.

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* Corresponding author.
† These authors contributed equally.
marfin.poltava@gmail.com (M. Chyzhevska); oldrakk@gmail.com (O. Kuzmenko); vengerv@ukr.net (V. Venger); romnatalina@gmail.com (N. Romanovska); desyatko@gmail.com (A. Desiatko)
0000-0003-1637-9564 (M. Chyzhevska); 0000-0002-0660-1953 (O. Kuzmenko); 0000-0003-1018-0909 (V. Venger); 0000-0002-1377-7551 (N. Romanovska); 0000-0002-2284-3418 (A. Desiatko)

In his work Kovtunenko Y. [7] explored the challenges and potential benefits of utilizing AI technologies in enterprise management. Chernenko N. analyzed and evaluated the application of AI in investment analysis business processes, with a particular focus on financial decision optimization [8]. A research team consisting of Hnatiienko H., Hnatiienko V., Zozulya O., Ilarionov O., and Sysak K. [9] studied AI applications for enhancing the accuracy of investment risk assessment. Ostrovska H. and Ostrovskyi O. [10], as well as Brintseva O. [3], examined and systematized various aspects of AI utilization, including its impact on marketing and human resource management. Andriichuk O., Kadenko S., and Florek-Paszkowska A. investigated the use of AI in expert decision-support system modeling [11]. Mashlii H., Mosii O., and Pelcher M. conducted a survey among domestic enterprise managers regarding the readiness for adopting advanced AI-based scientific developments, as well as developed proposals for AI-driven financial project management and implementation strategies [12].

Modern scientific research focuses on the optimization and enhancement of investment processes through the implementation of AI and blockchain. Scholars such as Verbivska L. [13], Kraievska A. [14], and Yevseieva-Severina I. [15] have investigated the integration of AI tools into enterprise competitiveness management and business development strategies. The team of authors Hnatienko G., Hnatienko V., Zozulya O., Ilarionov O., Sysak K. in the work [9] investigated the main directions of possible application of modern results obtained in the field of AI for improving educational processes in agriculture. Thus, the objective of this study is a comprehensive analysis of AI and blockchain methods and tools for investment project modeling, performance evaluation, and risk management in the digital economy.

2. Materials and methods

The study is based on a comprehensive analysis of various materials, including theoretical sources, financial reports of enterprises, documentation on operational performance, and statistical reports. To examine the level of digitalization in investment modeling, financial reports of companies that actively implement AI and blockchain technologies in their business processes, particularly Nova Poshta LLC over the past six years [16], were analyzed. This analysis allowed for the identification of digitalization trends, key financial indicators of the industry, and their impact on investment strategies. Based on the review of documentation covering the core aspects of company activities, the implementation and application of AI and blockchain in financial operations, smart contracts, and investment risk assessment were noted.

The active use of open data and statistical reports has helped contextualize the research findings and determine the role of digital technologies in investment decision-making. The analysis of articles and scientific studies in the fields of finance, logistics, and the digital economy plays a crucial role in expanding the theoretical foundation of the study.

The application of the analytical method was a key stage in the research on the use of AI and blockchain in investment activities. This method not only identified the key financial indicators but also allowed for the identification of digital transformation trends and their impact on management processes. The statistical method was useful for examining the main parameters of investment efficiency. The methods of analysis, synthesis, induction, deduction, and generalization enabled the argumentation of the concept of using AI for financial risk forecasting; the graphical method was used to visually illustrate the obtained results; and correlation-regression analysis was employed to assess the impact of digital technologies on investment planning. As a result, this approach made it possible to assess the level of digitalization in investment processes, explore the use of AI and blockchain in risk modeling, and substantiate the feasibility of implementing innovative approaches to enhance the efficiency of investment decision-making. Given that financial management digitalization is currently a key prerequisite for successful investment and the strategic development of enterprises.

3. Results

Modeling investment projects based on AI and blockchain technologies opens up new opportunities for effective risk management and profitability forecasting. AI enables the analysis of large volumes of financial data, uncovering hidden patterns and generating predictive models to optimize investment strategies. Through machine learning, AI can identify potentially promising projects, assessing their financial stability based on historical data.

Blockchain, in turn, ensures transparency in financial transactions by automating the execution of investment agreements through smart contracts. The use of asset tokenization facilitates the attraction of additional capital via digital platforms, making the investment process more flexible. The combination of AI and blockchain helps reduce analytical and portfolio management costs by automating key risk assessment processes.

Deep learning algorithms can forecast macroeconomic trends, allowing investors to make more informed decisions. Blockchain reduces fraud risks by creating immutable records of all transactions and investment decisions, enhancing trust in projects. AI models can analyze market behavior and the impact of global events on investment decisions, ensuring effective strategy adaptation. Thus, the application of these technologies in investment project modeling enhances asset management efficiency and contributes to financial stability for companies.

The modern digital economy represents a prolonged process of transformation across all economic sectors, aimed at transferring information resources and knowledge into digital form.

Scholars identify three key components of the digital economy [17, pp. 51, 52]: basic infrastructure, e-business, and e-commerce. Their development ensures several advantages [18, pp. 14, 15]:

- Digital economy demonstrates a high level of adaptability to the socio-economic demands of society, enabling the rapid provision of necessary goods and services to consumers at the right time.
- Digital technologies facilitate the dissemination of knowledge, innovations, and data transmission. Simultaneously, they enhance societal productivity by optimizing and structuring business process flows, thereby improving efficiency and supporting stable economic growth.
- Digital economy operates as a model built upon digital communication platforms, which contribute to increased labor productivity, enhanced enterprise competitiveness, cost and resource optimization, and ultimately, improved quality of life for the population.

Taking into account the core concept [19, p. 74] and the principles of economic digitalization [20, p. 38, 39], it has been noted that the digital economy constitutes a complex system of social, cultural, economic, and technological interconnections among the state, businesses, and citizens operating within a global information space. It leverages network technologies for the creation and promotion of digital products and services, fostering continuous innovation in management approaches and technologies aimed at improving the efficiency of socio-economic processes [21].

Thus, digital technologies—including the Internet, mobile devices, Big Data analytics, AI, blockchain, and cloud computing—serve as the foundation of the digital economy. They facilitate digital transactions, communication, and data processing, allowing enterprises and individuals to engage in commercial activities in previously unprecedented ways.

Given that the Internet is essentially a network of local networks, it can be concluded that the IoT for each digitalized economic entity (enterprise or institution) is, in fact, a situational aggregation of local networks Mi (corporate portals) of its business partners. This is determined by the business cycle chain established at a given point in time (business period), which encompasses the following stages: “marketing business processes—consumer value creation business processes—distribution business processes” [22].

From the perspective of the digital economy concept, which is regarded as a digitalized integrated mechanism for generating economic added value through the formation of a synergistic network of IoT-based economic entities, the primary focus should be on the categories of e-commerce interactions: G2G, G2B, G2C, B2B, B2G, B2C. At the same time, a key development trend is the implementation of a digital management mechanism within enterprises as part of their IoT model realization.

Based on these principles, study [22] presents a conceptual model of the fundamental methodological components of the digital economy, which integrates the IoT network technology. This model outlines a business process chain aimed at creating business value for producers (enterprises), structured as follows: D (Define)—Create the consumer (Consumer IoT, CIoT); P (Prepare)—Prepare for the creation of consumer value (Industrial IoT, IIoT); M (Make)—Manufacture consumer value (Industrial IoT, IIoT); S (Sell)—Sell the created consumer value (Consumer IoT, CIoT).

The COVID-19 pandemic served as a catalyst for the accelerated adoption of these models, reshaping consumer behavior and compelling businesses to adapt to new realities. This shift led to changes in how enterprises interact with consumers, compete with rivals, and structure their operations. The digital revolution has thus influenced virtually all aspects of modern commerce, from market promotion strategies to distribution channels and customer service methods, effectively establishing new business paradigms. As a result, companies now need to coordinate all business processes (investment projects) and integrate advanced management methods and technologies by moving to an information-driven and virtual environment.

Now, the enterprise must implement and coordinate all its business processes (investment projects) by adopting new management methods and technologies, shifting towards an information-driven and virtual environment.

The implementation of digital technologies within enterprises follows a three-stage approach [23]:

1. Analysis of business processes and strategic assets; identifying the primary causes of value underperformance; assessing the efficiency of all departments, production, and internal & external communications.
2. Selection and integration of digital tools, deploying software platforms that enable rapid development and scaling of experimental business applications; evaluation of digital solutions' effectiveness.
3. Monitoring changes in revenue dynamics and making necessary adjustments to solution architectures if required.

This structured approach enables enterprises to effectively adapt to the evolving digital economy, ensuring competitiveness and sustainable development in the rapidly changing business environment

Digitalization Enterprise digitalization encompasses the following levels [23]:

1. Comprehensive automation of internal business processes, including production processes, financial operations, enterprise resource planning (ERP) systems, project management, budgeting, and customer relationship management (CRM) systems. At this stage, manual tasks of any complexity are digitized, and data collection and analysis are carried out to determine the next steps in the company's digital transformation.
2. Implementation of advanced IT technologies across different departments within the enterprise. This integration leads to the development of new, high-quality business models that enhance operational efficiency and competitiveness.
3. Partial integration of digitalization, where the company's management formulates a new development strategy based on digital technologies. At this level, traditional processes are

replaced with digital solutions, leading to the emergence of a new organizational culture that fosters innovation.
4. Full synchronization of the digitalization process, where a new digital platform is implemented as the foundation for the company's future operations. This phase may also involve the creation of an entirely new business model. However, there remains a risk that digitalization at this stage has not yet reached full stability, potentially leading to operational disruptions.
5. Innovation and flexibility, a stage characterized by the complete consolidation of IT solutions. The company gains the capability to develop its own digital solutions and foster an agile organizational culture that can rapidly adapt to external changes.
6. Continuous innovation, where the company achieves sustainable development and operational efficiency by integrating ongoing innovations through a flexible management system and dynamic adaptation to market shifts.

At every stage and level of digitalization, the human factor plays a crucial role. Moreover, it is essential to recognize that the pace of digitalization should align with the company's real capabilities, not only in terms of technology adoption but also in ensuring effective utilization by employees.

Thus, it can be asserted that the profound impact of digital technologies is reshaping traditional business models, production chains, and stimulating the emergence of new products and innovations. Digitalization enhances the efficiency of production processes, compelling companies to make digital transformation a central component of their development strategy.

The digital transformation of an enterprise involves the integration of modern technologies into its business processes. This approach encompasses not only the implementation of cutting-edge hardware and software but also substantial changes in management practices, corporate culture, and external communications. As a result, employee productivity increases, while customer satisfaction levels improve, contributing to the enterprise's reputation as a progressive and modern organization.

Thus, in developing a strategic development plan based on digital transformation, enterprises address a number of key technological challenges [24, p. 289]:

1. Acceleration and simplification of business processes through computational infrastructure programming, the use of automation tools, and virtualization technologies.
2. Ensuring process transparency and predictability across the enterprise's infrastructure and applications.
3. Enhancing product quality, increasing labor productivity, and optimizing resource utilization while simultaneously reducing production costs and minimizing equipment downtime.

Modern businesses can no longer afford to ignore current trends in digital technology adoption. Among the key digital tools utilized in enterprise activities, the following are distinguished [25, pp. 469–473]:

1. AI is one of the leading technologies driving digital transformation. Its application includes the automation of routine tasks, trend forecasting, and managerial decision-making based on big data analysis.
2. Big Data and analytical tools are enabling enterprises to gain deep insights into market trends, consumer behavior, and internal operational efficiency. This facilitates data-driven decision-making and the development of new growth strategies.
3. Cloud computing is allowing enterprises to store data on remote servers with real-time access, significantly reducing IT infrastructure costs and increasing flexibility in collaborations with partners and customers.

4. Augmented Reality (AR) technologies and virtual tours—creating interactive experiences for customers, thereby increasing engagement and interest in products and services.
5. IoT is enabling devices to communicate and exchange information autonomously, leading to more efficient process and resource management within enterprises.

AI has the capability to process vast amounts of data, enhancing forecast accuracy across various business domains. AI-driven optimization of supply chains, route planning, and demand forecasting allows companies to use their resources more efficiently, reduce costs, prevent delays, and improve customer service quality.

The primary AI methodologies include machine learning, neural networks, deep learning, ensemble algorithms, and clustering techniques. The accuracy of AI-driven predictions largely depends on the quality and volume of data as well as the application of regularization techniques, which help prevent overfitting. Simpler models may fail to capture the full complexity of data, while overly complex models risk overfitting, reducing their generalization ability. Thus, achieving an optimal balance is crucial for ensuring high-precision forecasting and decision-making.

Despite the fact that business management digitalization opens up new opportunities for enhancing enterprise efficiency, it is also associated with a number of significant challenges that may slow down its implementation. Among the key difficulties, the following should be highlighted: high financial costs associated with the deployment of digital technologies, employee adaptation difficulties in working with new tools, cybersecurity threats and data loss risks, as well as the rapid pace of change in technological innovations [25, pp. 471, 472].

In today's business environment, enterprises must consider the necessity of integrating innovative technologies such as blockchain into their operations. The core principle of blockchain lies in the creation of a decentralized and distributed data storage system, where information is recorded in sequentially linked blocks, each connected to the previous one through cryptographic hashes. This structure ensures a high level of security and reliability, as modifying data in a single block is impossible without altering the entire chain [26, p. 60].

The conducted research leads to the conclusion that the application of digital technologies such as AI, big data analytics, cloud computing, and the IoT provides enterprises with an opportunity to strengthen their competitive positions in the global market [27–30]. These technologies enable companies to reduce costs, accelerate decision-making processes, and improve productivity. Furthermore, they open up new prospects for in-depth data analysis and the adoption of more well-grounded managerial decisions.

Integrating the latest technologies into existing production processes is one of the most challenging tasks for enterprises. The transition to digital tools can cause technical difficulties or temporary interruptions in production, which emphasizes the importance of detailed planning and coordination to minimize possible risks [31, p. 181].

Ukrainian enterprises use different types of CRM systems (Creation, SalesDrive, LP-CRM, KeepinCRM, HugeProfit, Pipedrive, CleverBox: CRM, PERFECTUM, KeyCRM, described in [32]), which help to solve problems related to attracting new customers and retaining existing ones; ensuring the protection of personal data of customers by storing them on reliable servers; reducing costs; optimizing time for managing business processes; increasing productivity; and organizing effective remote work without losing efficiency.

When implementing digital technologies in an enterprise, managers need to take into account the possible difficulties they may face [33, p. 40]:

1. Technological innovations (driven by technology). This problem relates to the introduction and use of technologies whose potential and capabilities are not always realized by customers, stakeholders, competitors or other stakeholders. These technologies include AI, edge computing, augmented and virtual reality, and blockchain.

2. Behavior and requirements of customers (stakeholders, competitors, and other stakeholders). This problem is not always related to the use of technology and is often shaped by consumer expectations or behavior.
3. Innovations and inventions. The emergence of innovative approaches to solving business problems and meeting customer needs is an important aspect. Innovations and inventions create a new reality in the form of products, services or solutions, such as cryptocurrencies, various applications or virtual worlds.
4. Ecosystemicity. Businesses are integral parts of broader ecosystems—business, social and natural—in which they interact with consumers and other stakeholders.

To fully leverage the benefits of digital technologies, enterprises must be prepared for rapid evolution, increased flexibility of business processes, and the growing importance of data and information in their operations. Implementing digital technologies requires management to develop a comprehensive strategy that takes into account all aspects: information, data, processes, technologies, human factors, and investment projects.

Modern investment projects increasingly incorporate AI and blockchain technologies, which enhance efficiency, reduce costs, and ensure operational transparency. Blockchain is used for data security, contract automation, and reliable record-keeping, while AI helps analyze large data sets, predict risks, and optimize processes.

Thus, an enterprise's digitalization strategy should be based on six key approaches [33]:

1. Establishing a clear vision for digital transformation and innovation.
2. Developing a digital culture within the enterprise.
3. Utilizing key performance indicators.
4. Automating business processes.
5. Integrating AI.
6. Creating an analytics department.

Thus, management must ensure effective data management to avoid analytical paralysis, optimize business processes, and use information to achieve the strategic goals of the enterprise. Next, let's look at digitalization tools and the use of AI in the context of the Ukrainian logistics company Nova Post.

Back in 2022, Nova Post became the owner of sorting terminals—automated complexes that provide continuous sorting. The speed and quality of service at Nova Post is ensured by a mobile application that allows you to assess the level of occupancy of BDF containers, as well as robot-train systems used to optimize the sorting of small shipments in logistics areas; bot technologies that optimize the cost of communication processes between the company and the retail client, as well as within the company; IT information security programs [34]. NovaPay, a part of the Nova Post group of companies, provides additional financial services, as well as the expansion and renewal of logistics infrastructure in Ukraine, and the development of IT infrastructure [16].

The company uses the following basic services [35]:

Nova Post API is a modern set of tools designed to automate work with the company and integrate logistics processes into any business. The API serves as a single access point for all customers and services, ensuring efficient interaction. Its functionality significantly speeds up operations, in particular through integration with CRM systems, which allows processing large volumes of orders (147.8 million electronic waybills).

Tracking—provides customers with the ability to track the movement of parcels, change the delivery address, extend the storage period in the branch and pay for services online.

Business Cabinet is a personal account on the company's corporate website where customers can create invoices, call a courier, and manage shipments around the clock. The platform is currently used by 1.8 million active customers, and the number of electronic waybills created through it is 60.6 million.

Mobile application—allows customers to manage their shipments at any time, providing convenient access to information and making express delivery services even easier and more comfortable (13.5 million active users, 38.7 million electronic waybills).

Thus, the company, which strives for fast and high-quality service, is constantly developing by transforming the professional culture and professional competencies of its skilled workers, increasing the requirements for their personal and professional qualities.

The use of AI for Nova Post provides opportunities to predict peak order periods, determine the highest loads of delivery routes, or optimize warehousing. The use of neural networks and deep learning models also helps to predict possible delays or changes in demand, which contributes to more informed management decisions. AI helps automate workflows, including cargo sorting and tracking, which reduces the risk of human error and increases the accuracy and speed of order processing. AI-powered chatbots improve customer experience by providing timely responses to inquiries and solving problems without the need for human operators. Thus, the integration of AI into the logistics processes of a company not only allows to predict the results of its operations, but also significantly improves the overall efficiency of the enterprise.

In 2017, "Nova Post" implemented the Microsoft Dynamics AX 2012 R3 ERP platform in its operations, which met the company's needs for efficient management and covered a wide range of business processes. This decision was made to save time and reduce operational costs. At the same time, to ensure electronic document flow, the M.E.Doc service was initially selected; however, it did not meet expectations due to several drawbacks: additional costs for counterparties, limited functionality, and insufficient protection against viral attacks. As a result, the company transitioned to the "VCHASNO" service, implementing a specialized Vbox solution that enables the processing of large volumes of documents within tight deadlines—signing up to 10,000 documents in 30 minutes and processing XML documents with 100,000 rows in 3 minutes.

Subsequently, to analyze the impact of digitalization on the company's business processes, correlation-regression analysis was applied. Suppose that the model is defined by multiple regression:

$$Y = a_0 + a_1 \cdot x_1 + \ldots + a_n \cdot x_n,$$

where Y is a dependent variable, net revenue of LLC "Nova Post"; x_1 is an amount of expenses for implementing AI in business processes, invested in automation; x_2 is an amount of expenses for business process automation; x_3 is the other non-current assets.

Based on the correlation analysis of the company's financial indicators, key factors influencing the formation of LLC's net profit were identified. Using the conducted analysis, the relationship between the determined indicators was assessed with the application of Chaddock's scale. This allowed for the classification of the obtained correlation coefficient values, and the results of this assessment are presented in Table 1.

Table 1
Characteristics of the strength of the relationship between the net revenue of "Nova Post" and factor variables

Indicator	Expenses for AI implementation in business processes	Total expenses for business process automation	Level of automation, %
Net revenue	Very strong correlation (0.76)	Very strong correlation (0.978)	Very strong correlation (0.95)

The results of the correlation analysis indicate that there is a very strong relationship between net revenue and all other analyzed indicators. The strongest correlation is observed between the amount of expenses for AI implementation and total expenses for business process automation. This suggests that when one factor changes, the other is also likely to change accordingly. Such a

strong correlation may complicate the analysis and the precise determination of each factor's impact on the dependent variable under study.

To determine the specific type of relationship between different variables, a regression analysis was conducted using MS Excel's "Data Analysis/Regression" functionality. The results of this analysis are presented in Fig. 1. The adjusted coefficient of determination R^2 is 0.96, indicating that 96% of the variance in the dependent variable is explained by changes in the independent variables. The results of the variance analysis confirm that the obtained model is reliable based on Fisher's criterion Fp = 10,18 > Ftable = 0,09, where Ftable =$F(1 - 0.95; m; n - m - 1)$.

Year	X1	X2	X3	Y
2018	3632,8	330256	36668	10515739
2019	8310	437370	38995	13453318
2020	37861,3	701136	190460	16902857
2021	182300,7	1544921	27591	20843502
2022	379926,4	2835272	789466	28461964
2023	490400,1	3528058	1009063	43645219
2024	553051,6	3965485,6	1043759,7	43765164,8

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,97972027
R Square	0,959851807
Adjusted R Sq	0,919703613
Standard Error	3900385,542
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1,09113E+15	3,63708E+14	23,90772106	0,01349108
Residual	3	4,5639E+13	1,5213E+13		
Total	6	1,13676E+15			

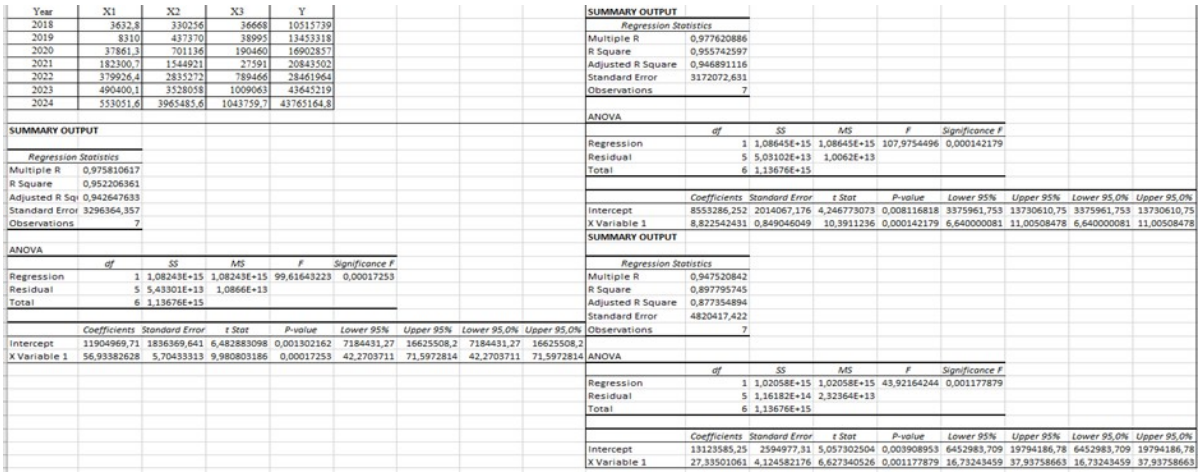
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	4303715,49	14087759,79	0,305493248	0,779961062	-40529823,6	49137254,6	-40529823,6	49137254,6
X Variable 1	-81,6926962	233,5916239	-0,34972442	0,74965634	-825,085497	661,700104	-825,085497	661,700104
X Variable 2	20,20617754	36,7960022	0,549140568	0,621141383	-96,8951237	137,307479	-96,8951237	137,307479
X Variable 3	4,177841237	11,25986346	0,371038357	0,735261933	-31,6560696	40,0117521	-31,6560696	40,0117521

Figure 1: Screenshot of the calculation of correlation-regression analysis (calculated and constructed according to [16]). Analysis of variance

So, we have that the regression equation and its coefficients are significant at the 95% confidence level, that is, the influence of random factors is insignificant.

From the regression analysis of the model factors, a correlation was found. For other factor variables, an error occurs during the analysis in Ms Excel due to the lack of a correlation relationship, which makes it impossible to obtain regression results.

Fig. 2 shows the results of the regression analysis of the resulting indicator for each of the identified factors. The results of the regression analysis show that for all indicators the P–value is less than 0.5, which allows us to conclude that the coefficients are statistically significant. This means that they are non–zero. Thus: the factorial feature of the amount of expenses for the implementation of AI in business processes has a significant impact on the resulting indicator; the factorial feature of total costs for business process automation also has an impact on the performance indicator; the factorial feature of investments in other non-current assets is another factor that affects the performance indicator. At the same time, it was found that the factorial feature of the volume of costs for the implementation of AI in business processes has a more influential result.



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2022	379926,4	2835272	789466	28461964
2023	490400,1	3528058	1009063	43645219
2024	553051,6	3965485,6	1043759,7	43765164,8

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,975810617
R Square	0,952206361
Adjusted R Sqı	0,942647633
Standard Erroı	3296364,357
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1,08243E+15	1,08243E+15	99,61643223	0,00017253
Residual	5	5,43301E+13	1,0866E+13		
Total	6	1,13676E+15			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	11904969,71	1836369,641	6,482883098	0,001302162	7184431,27	16625508,2	7184431,27	16625508,2
X Variable 1	56,93382628	5,70433313	9,980803186	0,00017253	42,2703711	71,5972814	42,2703711	71,5972814

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,977620886
R Square	0,955742597
Adjusted R Square	0,946891116
Standard Error	3172072,631
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1,08645E+15	1,08645E+15	107,9754496	0,000142179
Residual	5	5,03102E+13	1,0062E+13		
Total	6	1,13676E+15			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	8553286,252	2014067,176	4,246773073	0,008116818	3375961,753	13730610,75	3375961,753	13730610,75
X Variable 1	8,822542431	0,849046049	10,3911236	0,000142179	6,640000081	11,00508478	6,640000081	11,00508478

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,947520842
R Square	0,897795745
Adjusted R Square	0,877354894
Standard Error	4820417,422
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1,02058E+15	1,02058E+15	43,92164244	0,001177879
Residual	5	1,16182E+14	2,32364E+13		
Total	6	1,13676E+15			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	13123585,25	2594977,31	5,057302504	0,003908953	6452983,709	19794186,78	6452983,709	19794186,78
X Variable 1	27,33501061	4,124582176	6,627340526	0,001177879	16,73243459	37,93758663	16,73243459	37,93758663

Figure 2: Screenshot of the calculation (calculated by the author)

Starting in 2022, Nova Post LLC has set the goal of implementing and using AI in its activities.

Let's consider the activities of Nova Post with an emphasis on analyzing and forecasting costs related to the cost of products sold. The analysis used information obtained from the company's official website [16] and the Julius neural network.

From the research we have been able to obtain an assessment of the current state of costs, identify key factors affecting the cost, and predict their dynamics in future periods. This approach provides a deep understanding of the cost structure and contributes to the development of effective measures for their optimization.

Julius AI is a powerful tool with AI that analyzes and visualizes data in a matter of seconds, making complex information accessible to everyone. The main advantages of Julius are: data analysis becomes available to everyone; full automation of routine tasks; quick extraction of valuable information from data; processing complex data sets; ensuring data protection. Thus, using the Julius neural network to analyze the company's expenses for the period from 2019 to 2023, the results presented in Fig. 3 were obtained.

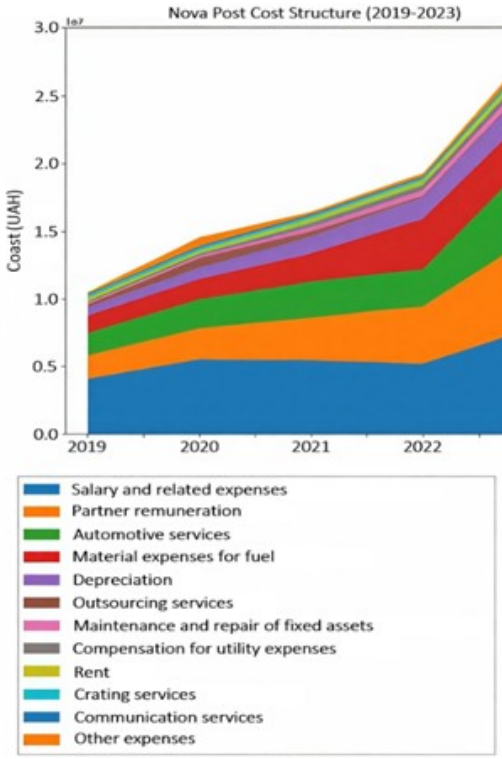

Figure 3: Cost structure for the period 2019–2023

The diagram shows the dynamics of growth in total costs with an accelerated increase in individual categories.

Based on historical data and the ARIMA model, a forecast of total costs for 2024 was developed, which is UAH 33,005,406.70. In addition, a compound annual growth rate (CAGR) was calculated for the period 2019-2023 using a neural network. It was 28.48%, which indicates that the total costs of the enterprise increased by an average of 28.48% each year. This confirms the significant expansion of the company's activities.

Analysis of the initial data allowed us to identify changes in costs by various categories for 2022–2023 (Table 2): Total costs increased by 59.13%; Expenses for maintenance and repair of fixed assets increased by 349.69%, indicating a significant focus on supporting infrastructure. On the other hand, categories such as rent and utility reimbursement showed a slight decrease. These results highlight the importance of monitoring expenses by category to identify key growth drivers and optimize resource management.

Table 2
Percentage change for each category from 2022 to 2023

	2023
Total	59.13
Maintenance and repair of fixed assets	3.50
Other expenses	2.12
Communication services	0.01
Rent	−0.10
Compensation of utility costs	−0.10
Automotive services	−0.13
Partner remuneration	−0.14
Depreciation	−0.36
Material expenses for fuel	−0.44
Processing services	−0.68
Outsourcing services	−0.97
Salary and related expenses	—

The final stage of the analysis was the use of the Julius neural network to build a forecast for 2024, the results of which are presented in Fig. 4.

In the graph, each line reflects the change in costs for a certain category. The dots on the lines correspond to the actual data for the period 2019–2023, and the asterisks located at the end of each line illustrate the forecast values for 2024.

This approach allows you to clearly see the dynamics of costs for each category, as well as assess expected changes, which helps in planning and managing the company's resources.

Analysis of the graph and forecasts allows us to draw the following conclusions: the category "Partner remuneration" demonstrates the greatest expected growth, which may indicate an active expansion of the company's partner network; "Salaries and related expenses" also demonstrate significant growth, probably due to staff expansion or salary increases; "Auto services" demonstrate stable growth, which may be a result of fleet expansion or increased transportation volumes; "Material costs and fuel" demonstrate moderate growth, which may be the result of cost optimization in these categories; "Depreciation" shows an increase, which indicates investments in

new fixed assets. Other expense categories, such as “Outsourcing services”, may demonstrate less significant growth or even a decrease.

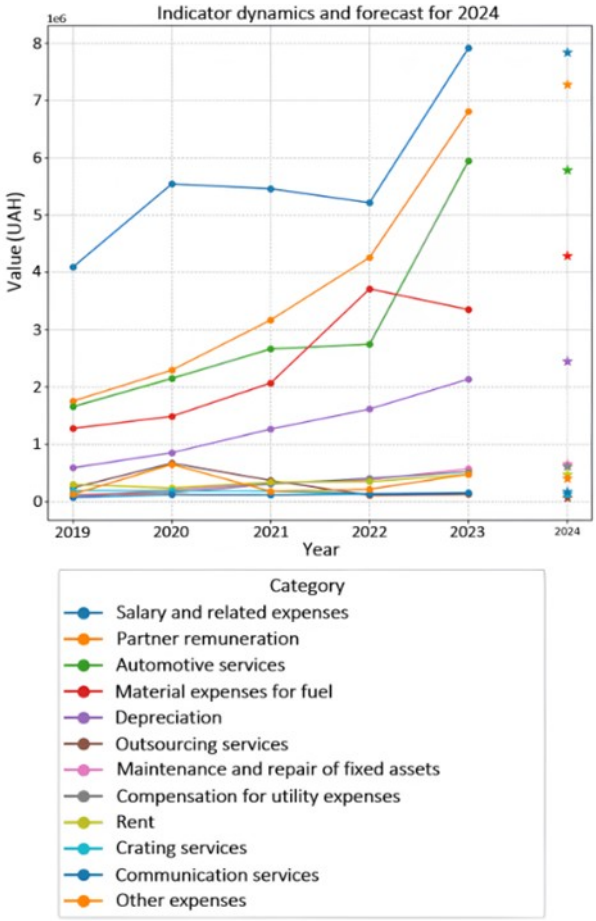

Figure 4: LLC activity dynamics and forecast for 2024

It is important to make sure that the forecast based on linear regression does not cover possible external factors, such as the economic crisis, changes in legislation, or strategic decisions of the company. Therefore, actual indicators may differ from the forecasted ones.

To increase the accuracy of competitive forecasting: reduce additional external and internal factors; use more complex forecasting models, such as neural networks or economic methods; regularly update forecasts based on new data and changes in the business environment.

Thus, constant monitoring and analysis of the activities of Nova Post remains the key to making effective management decisions.

T, the necessity of implementing AI in the management of Nova Poshta’s business processes has been proven. Since the main objective of the company is to reduce logistics costs so that its share in the total delivery cost remains minimal (currently, Nova Poshta has the highest delivery price), it is essential to implement blockchain technologies in the cargo transportation process. Incorporating blockchain into logistics operations will allow the company to optimize delivery routes, improve transparency in transactions, and enhance the security of cargo tracking. Additionally, investment projects focused on AI and blockchain will enable cost reductions, automation of documentation processes, and an overall increase in service efficiency.

The algorithm for using the platform based on blockchain technology by Nova Post is shown in Fig. 5.

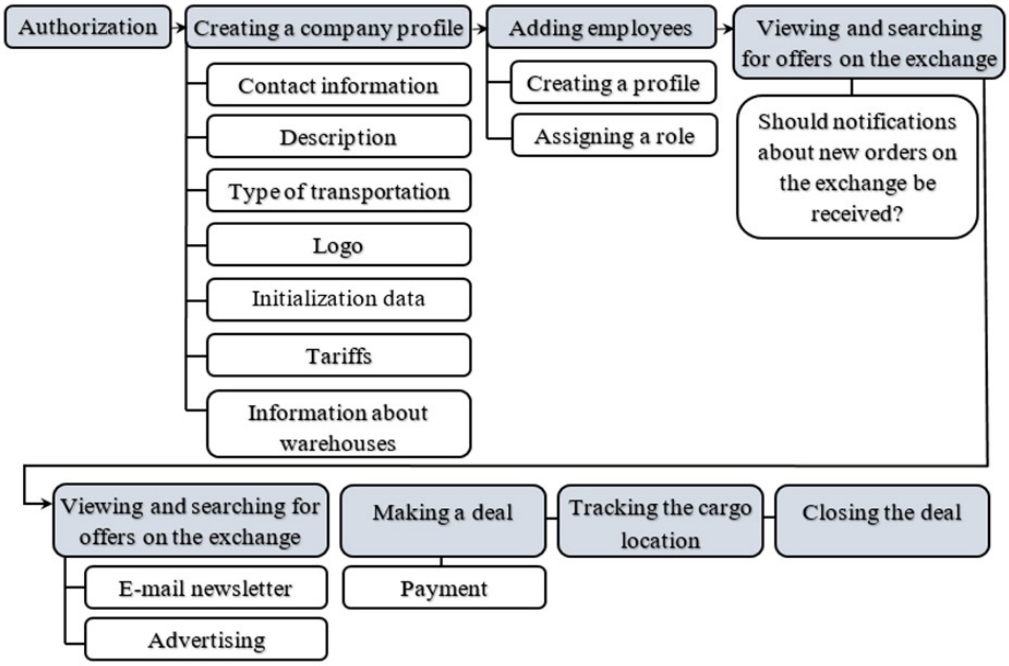

Figure 5: Algorithm for using the platform based on blockchain technology by Nova Post (compiled based on data from (https://apexfree.io/, https://www.quasa.io/, www.300cubits.tech, https://www.ibm.com))

Thus, the implementation of blockchain technology in the activities of the LLC will ensure a reduction in transportation costs; reduce data falsification; eliminate unnecessary intermediaries in logistics processes; reduce errors in labeling and discrepancies in documentation; reduce the time for document processing. At the same time, along with the advantages, the company faces a number of problems:

1. Different ways of storing data. The lack of unified database standards among developers of blockchain solutions.
2. Non-adaptability of IT algorithms. Modern software is not always ready to integrate new methods;
3. Rapid development of technology. Constant changes in the blockchain field require adaptation;
4. Data management in the international market. Difficulties arise due to the large number of participants in global logistics processes.
5. The need for technological development. Constant updating of technical knowledge and skills of employees is mandatory.

The implementation of blockchain in the activity makes a significant step towards increasing the efficiency and transparency of business processes, but requires careful preparation and a strategic approach to solving the above problems [36, 37].
The mechanism of operation of the platform based on blockchain technology for cargo delivery includes the following stages:

1. Registration of an application for cargo transportation.
2. Automatic route planning taking into account optimal logistics solutions.
3. Publication of offers of cargo exchange participants in accordance with the request.
4. Calculation of the full cost of transportation in automatic mode.
5. Determination of the winner of the auction who offered the best conditions.
6. Document flow: opening a new transport route.
7. Primary processing of payments, including prepayment or advance payment.

8. Registration of cargo insurance.
9. Tracking the delivery process in real time.
10. Registration of the route and maintenance of documentation.
11. Collection of feedback from transportation participants.
12. Final payment processing after successful completion of delivery.

The proposed mechanism for transporting goods using blockchain for Nova Post is simplified, but includes all the main stages. The use of this technology will significantly reduce the labor costs of dispatchers and accountants of the enterprise, optimize the work of drivers, which will lead to a significant reduction in time and financial resources.

Conclusions

Thus, this study shows the important role of digitalization and the use of digital technologies for modern business. For this, the essence of the concept of "digital economy" was revealed. It was confirmed that the digital economy is of strategic importance not only for the effective operation of enterprises, but also for the functioning of the global system of public consumption. Digital transformation covers all digital processes at different levels of management and regulation of socio-economic spheres, which makes it a key factor in modern development. The study confirms that digitalization is a key factor in improving the efficiency of modern enterprise management. The integration of AI and blockchain technologies opens up new opportunities for optimizing business processes, automating operations, and increasing the transparency of financial transactions.

To determine the level of enterprise digitalization, the stages and levels of enterprise digitalization were analyzed. It was found that digital technologies have a transformative impact on traditional business models and production chains, contributing to the creation of new products and the introduction of innovations. It is noted that digitalization is becoming the basis for the strategic development of enterprises, bringing production processes to a qualitatively new level. The strategic context of enterprise development management within the framework of digital transformation is presented.

The study examines information technologies and analysis tools in the digital economy. It is proven that digitalization of enterprise management is critically important for increasing their efficiency and competitiveness in the modern market. The introduction of technologies such as AI, cloud solutions and automation allows enterprises to adapt to changes more quickly, optimize processes and make informed decisions. However, attention is drawn to the high cost of implementing digital solutions and the need to ensure an adequate level of data protection. The importance of using blockchain as a tool for ensuring security, transparency and decentralization in the development of enterprises is emphasized.

The work proves the need to introduce AI into the management of business processes of Nova Post, therefore, the introduction of blockchain technologies into the freight and transport process is proposed. Blockchain will help increase transaction security, reduce logistics costs, and optimize operational processes. For this purpose, an algorithm for using a platform based on blockchain technology of Nova Post has been formed. This will allow the enterprise to significantly reduce the costs of paying dispatchers and accountants, simplify and facilitate the work of drivers, which in turn leads to a significant reduction in time and, accordingly, the enterprise's funds.

Thus, investments in digital technologies, in particular in AI and blockchain, contribute to reducing costs, increasing productivity, and ensuring the long-term competitiveness of enterprises. Nova Post has significant potential for further development in the direction of digital transformation, which will allow the company to remain a leader in the field of logistics and implement innovative solutions to optimize business processes.

Declaration on Generative AI

While preparing this work, the authors used the AI programs Grammarly Pro to correct text grammar and Strike Plagiarism to search for possible plagiarism. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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