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**ARTIFICIAL INTELLIGENCE IN THE FINANCIAL SECTOR OF UKRAINE:  
A DRIVER OF DEVELOPMENT AND A FACTOR OF MODERNIZATION**

*It has been studied that the trigger of the transformation of the financial sector of Ukraine and its dynamic digitalization is artificial intelligence (AI), which plays the role of a driver of development and acts as a factor of modernization. It was established that innovations with the help of AI in the financial sector consist in the system's ability to automate data processing and calculations, which leads to acceleration, increased efficiency and expansion of financial operations. It has been established that AI can analyze large volumes of financial data, identify complex dependencies and forecast trends, facilitating strategic decision-making and management. It is noted that the use of AI in the financial sector of Ukraine allows to increase the precision of financial analysis and optimize a wide range of routine operations, which significantly reduces the time and resources of companies due to the automation of tasks, contributes to increasing the reliability of investment decisions and the efficiency of financial processes, identifying anomalies and patterns in financial data, as well as improving the cyber security system to protect against fraud and abuse. The advantages are outlined and certain shortcomings and risks that prevent the spread and use of AI in the financial sector of Ukraine are highlighted. This concerns, first of all, issues of ethics, transparency, unfair or discriminatory use of AI, as well as issues of confidentiality and protection of personal data. It was found that AI has limited capabilities in working with unstructured data and cannot always capture human emotions and context. It found that AI, despite its limitations in understanding context, is a powerful tool for Ukraine's financial sector, helping to increase the sector's competitiveness and efficiency by accelerating customer service, improving risk management and accurately forecasting economic trends.*

**Keywords:** artificial intelligence, financial sector, artificial intelligence products

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**1. STATEMENT OF THE PROBLEM  
IN A GENERAL APPEARANCE AND ITS  
CONNECTION WITH IMPORTANT  
SCIENTIFIC OR PRACTICAL TASKS**

In At the current stage of development of the latest technologies and robotics, a key place is given to artificial intelligence (AI), which is a powerful tool for developing solutions that are of decisive importance for the progressive scientific and technical development of the country. According to analysts' forecasts, AI opens up

prospects for the financial sector by automating processes, improving risk management, providing more accurate forecasts and opening up new opportunities to improve security in various areas through automatic data processing and detection of potential threats. The implementation of AI in the financial sphere can help reduce costs, increase the efficiency of financial institutions and ensure higher competitiveness of the country. However, the realities indicate that questions regarding the

formulation of responses to risks or threats to the domestic financial system, which may be caused by the rapid development of AI in this area, in particular in the development of the financial sector of the state, are still debatable.

The use of AI as a means of digitizing the country's economy has encountered certain problems. First, the complexity of integrating AI into existing economic systems and processes requires significant changes in both internal procedures and infrastructure. Secondly, the development and implementation of AI requires large-scale investments, which is a heavy burden for a country with limited resources. Finally, ethical and legal issues related to the use of AI, including the protection of personal data, the impact on the labor market, unequal access to technology, and disparities in the distribution of benefits from its use, can create social and economic inequalities.

## 2. ANALYSIS OF LATEST RESEARCH AND PUBLICATIONS

The research of the role of AI in the financial sector of Ukraine is devoted to the scientific works of Ukrainian and foreign scientists and specialists working in leading laboratories and institutes for research and improvement of AI. This issue is also actively dealt with by entrepreneurs who today form the technological component of world development – Elon Musk, Stephen Hawking, Mark Zuckerberg, Joseph Bezos, and others. In particular, Yin Shi, Xiaoni Li [1] in their publications emphasize that scientific developments on the use of AI in the financial sphere take the form of interdisciplinary research. Based on a bibliometric analysis conducted over the past five decades, it has been proven that AI has become an important alternative to statistical methods and shows the advantages of its use for predicting the bankruptcy of financial institutions. In the work of G. Kou, X. Chao, Y. Peng, F. Alsaadi, & E. Herrera-Viedma [18], the use of machine learning methods to study the mechanisms of detection, prevention, and reduction of systemic risks in the financial sphere was investigated and proved that it will allow to improve the management of the financial system and contribute to the optimization of its structure. The authors also note the need to use machine learning to develop effective financial policies. N. R. Moşteanu [3] explores how AI can combine

financial information with technological capabilities, accelerate the digitalization of the financial sector and help create a safer business and economic environment by reducing the likelihood of human error.

In 2009, M. D. Fethi, F. Pasiouras [11] presented a comprehensive review of 196 studies devoted to the use of operational research (OR) and AI methods to evaluate bank performance. In 2010, A. Bahrammirzaee [12] conducted a comparative analysis of three well-known AI technologies: artificial neural, expert and hybrid intelligent systems in the financial market. The study, which focused on three main areas: credit evaluation, portfolio management, and financial forecasting and planning, showed that artificial intelligence methods in the accuracy of solving financial problems, in particular nonlinear models, prevail over traditional statistical methods. In the works of Jon Truby, Rafael Brown and Andrew Dahdal [10], the relationship between the development of banking operations and AI was investigated and the need to provide a proactive approach to the regulation of AI in the financial sector was proven.

Among the Ukrainian authors who pay great attention to the study of AI, we should note the publications of such scientists as: M. Hlybovets [20], who investigates how the use of AI methods contributes to increasing the efficiency of financial transactions and pattern recognition in financial data; M. Efremov [22] who focused on the use of neural networks and management algorithms Genetic Forecasting of Financial Markets and Portfolio Management; G. Ivanchenko [24] who proposed AI-based decision-making methods for risk management and assessing the financial stability of companies; A. Matviychuk [28], which highlights the use of hybrid intelligent systems in the financial market for forecasting economic trends; G. Mashlii [29], who investigated the importance of AI in the credit sector, in particular for assessing credit risk and supporting decision-making; M. Pelcher [29], who focused on the use of AI methods for financial forecasting and planning; O. Pizhuk [33] and O. Shvyrykov [39], whose research is devoted to the development of AI for the automation of financial processes and reducing the risks of its application for risk management and improvement of financial operations; O. Pidgaetskyi [32], who described the use of expert systems for decision-making in

the financial sector; M. Shakhovska [38], who investigated the importance of AI in increasing the accuracy of forecasting economic indicators; N. Panteleeva [30], who believes that AI technologies contribute to positive changes in the banking sector, however, leaves the issue of dehumanization of decisions made by financial algorithms controversial.

Overall, the research by the aforementioned authors shows that the application of AI in the financial sector can have significant benefits. The use of AI techniques and algorithms, such as neural networks, genetic algorithms, pattern recognition and decision making, has proven effective in many financial tasks, including financial market forecasting, risk management, financial transaction automation and decision support. These scientists confirmed that the adaptation of AI can help reduce human errors and improve the efficiency of financial transactions. Their research has paved the way for further implementation of AI in the financial sector to improve financial stability and increase profitability.

### **3. SELECTION OF PREVIOUSLY UNSOLVED PARTS OF THE GENERAL PROBLEM TO WHICH THIS ARTICLE IS DEDICATED**

Today, despite the value of scientific results, many issues of organizational, legal, financial, information support, economic stimulation of the use of AI, as well as its impact on the state of the financial sector of Ukraine remain unresolved. Methodological approaches to solving problems of functioning and integral assessment of the effectiveness of AI development in the financial sphere are insufficiently developed. In this context, there is a need for theoretical substantiation and formation of a holistic view of the role of AI in the process of modernization of the domestic financial system, which determines the relevance of this study.

The financial sector is one of the elements of the market economy, which is 100% dependent on the use of quality digital products. Digital finance has the potential to ensure a sustainable global investment flow and effective international cooperation in making managerial decisions to solve global market problems. Undoubtedly, the digital transformations of the globalization of the financial sector create

opportunities for conducting transactions at the international level, facilitating access to financial services, expanding financing opportunities, etc. On the other hand, the globalization of the financial sector creates difficulties and risks, in particular with regard to financial stability, vulnerability to crises, and the possibility of market manipulation. Therefore, effective management and regulation of the globalized financial sector is an important task for ensuring stability and balanced development of the world economy. The digital transformation of the world is having a major impact on the financial sector, and AI is a key technology and modernization factor to realize this transformation. Effective integration of the financial sector of Ukraine into the global economic space is possible only if digital transformations are implemented in a timely manner.

### **4. FORMULATION OF THE OBJECTIVES OF THE ARTICLE**

The purpose of the study is to investigate the state of application and identify the main problems of using the powerful capabilities of AI as a factor of modernization and driver of the development of the financial sector of Ukraine, to determine its impact on the functioning of the financial system and the activities of financial and credit institutions.

The adaptation mechanism of AI in the conditions of the digital economy was investigated using a system analysis. Knowledge of the given problem was carried out using a multi-level concept, which includes a combination of various scientific methods, in particular, dialectical and general scientific principles of complex research, which include: empirical (to identify approaches available in global and domestic practice, assessment of AI trends in the financial sector – observation, comparison, description); theoretical-cognitive (to consider the essence and substantiation of features of AI – formalization, proposal and testing of hypotheses); general logic (to identify methodological problems of AI integration into the financial system and differentiation of approaches to the concept of AI in the financial sector – analysis, synthesis, scientific abstraction, generalization, induction, deduction, analogy).

### **5. PRESENTATION OF THE MAIN MATERIAL OF THE RESEARCH WITH**

## FULL JUSTIFICATION OF THE OBTAINED SCIENTIFIC RESULTS

Due to the advantages and opportunities of the digital age, information technologies are now gaining rapid development and a much wider scope of application, due to which the study of the prospects for the use of artificial intelligence acquires special importance from both a scientific and a practical point of view.

Among many countries, there is a tendency to include the use of AI in their strategic development programs, which makes it possible to achieve successful results in their implementation. "Layed the first stone" in the development and regulation of AI and Ukraine, approving on December 2, 2020 under number 1556 the "Concept for the Development of Artificial Intelligence in Ukraine" [25].

AI is a key driver of the digital transformation of the economy. It is an integral part of the public and private sectors and belongs to the category of "disruptive" technologies that lay the foundation of the Fourth Industrial Revolution and can lead to technological development in various industries. Already now, AI allows to increase the efficiency of the work of state bodies at individual levels of developing solutions aimed at ensuring the well-being of citizens. In addition to a number of advantages, AI, like any breakthrough technology, carries new risks for society.

The concept of intelligence comes from the Latin *intellectus*, which means mind, mental abilities of a person. AI is interpreted as the property of automated systems to take over certain functions of human intelligence, for example, to choose and make optimal decisions based on previously acquired experience and rational analysis of external actions [36].

The term "*artificial intelligence*" was first introduced by Professor John McCarthy at a scientific conference at Dartmouth College (New Hampshire, USA) in 1956. At the conference, the program "Logic Theorist" was presented, which imitated the human approach to solving problems and became the first successful result in the field of AI. According to the researcher, "artificial intelligence is a branch of computer linguistics and informatics that formalizes tasks similar to those performed by humans. In other words, the computer will do what we did until recently" [40]. The Oxford English Dictionary defines AI as "the theory and development of computer systems

capable of performing tasks that normally require human intelligence, such as visual perception, speech recognition, decision making, and translation between languages" [5]. A. Turing's well-known definition is based on a specially organized "imitation game" between people and a machine, which are in different rooms but have the opportunity to exchange information. If people cannot prove that one of the participants is a machine in the process of dialogue between the participants of the game, then such a machine can be considered endowed with intelligence [40]. The disadvantage of A. Turing's definition is that it is possible to build a robot with a set of solutions for all possible problems – and pretended intelligence will be reduced to a simple selection of the appropriate solution in memory.

Despite the long history of the development of AI, there is still no unified understanding of its essence. There are a number of different approaches to the definition of AI, according to which AI can be considered as a complex system, a special type of digital technology, a separate field of active research, etc. (see Fig. 1). Scientists interpret AI as a branch of computer science focused on creating imitation of human intelligence and cognitive abilities in digital systems [20; 34].

In a broad sense, AI is considered as: systems that can operate with knowledge and, more importantly, learn; the ability to learn methods for solving problems for which there is no solution or they are incorrect (due to time, memory, etc.); the possibility of studying methods of solving problems that require human understanding; a number of algorithms and software systems that are distinguished by the ability to replace a person in any activity, performing his functions and making the best decision based on the analysis of external factors, taking into account the life experience of mankind; software capable of learning and making decisions almost as well as people [20; 24]. In a narrow sense, AI is designed to perform a single task or a set of specific tasks. AI allows machines, devices, programs, systems and services to function in the light of understanding a certain task or situation [36].

In domestic scientific literature, there are also many definitions of AI as a separate field of science, according to which AI is: science and technology capable of reproducing the thinking processes of the human brain and directing them

to the creation and processing of various computer programs and intelligent machines capable of completely replacing and simplify human work; the branch of computer science that

deals with the development of intelligent computer systems, that is, systems with capabilities traditionally associated with the human mind.

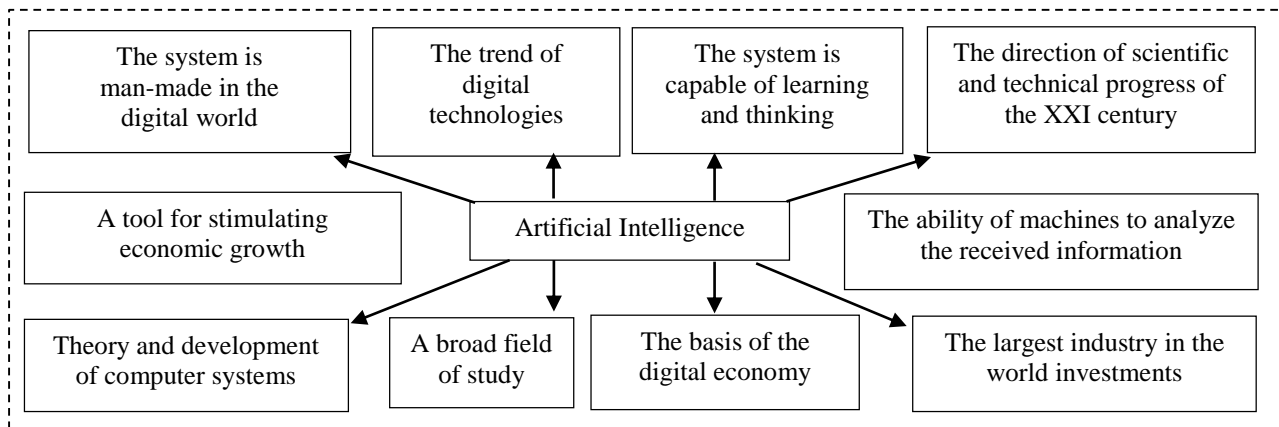


Fig. 1. Definitions of AI (developed on the basis of [22; 29; 34])

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The main technological prerequisites for the

emergence of AI as a science were the events (Table 1), which became the impetus for the appearance of the first commercial technologies with an intelligent agent.

AI develops algorithms and techniques that enable systems to learn from data, make decisions, recognize patterns and speech, and perform a variety of tasks previously considered the prerogative of human intelligence. AI has become an important field of scientific research and technology development, providing many opportunities for automation and optimization of various areas of human activity.

The current legislation of Ukraine enshrines the legal understanding of the concept of artificial intelligence, according to which AI is an organized set of information technologies, with the use of which it is possible to perform complex Dell tasks by using a system of scientific research methods and algorithms for processing information obtained or independently created during work, and also create and use their own knowledge bases, decision-making models, algorithms for working with information and determine ways to achieve set goals [25]. From the content of this definition, it follows that the studied term combines innovations in the field of technologies that allow solving extremely complex intellectual tasks using a system of methods and algorithms. AI is the ability of automatic systems to take over certain functions of human intelligence. For intellectual activity, the system needs knowledge about the environment, that is, a model of the subject field.

Table 1

**Prerequisites for the emergence of AI (developed on the basis of [2; 17; 18; 24; 37])**

Period	Characteristic
1623	Wilhelm Schickard built the first mechanical digital computing machine, his work was continued by Blaise Pascal and Gottfried Leibniz
1750	Friedrich von Knaus created a series of machines that were able to write rather long texts with a pen
1830	Charles Babbage came up with the concept of a digital calculator – an analytical machine that could calculate moves for a game of chess
1910-1913	Bertrand Russell and A.N. Whitehead published the work "Principles of Mathematics", which revolutionized formal logic
1940	The first electronic computing machines with high (by the standards of that time) productivity appeared
1943	Warren McCulloch and Walter Pitts published the work "A Logical Calculus of the Ideas Immanent in Nervous Activity", which laid the foundations for the concept of "neural networks"
1950	Alan Turing, in his published article "Computing Machines and Intelligence", stated that the interest in "thinking machines" arose due to a special type of machine called an "electronic or digital computer"
1954-1957	Allen Newell, along with analysts from the RAND Corporation and a group of Dutch psychologists led by De Groot, developed a program for playing chess. At the same time, the IPL1 programming language was created – the first symbolic language for list processing, and later the first program that can be counted among the achievements in the field of artificial intelligence was created
1956	The term "artificial intelligence" was used for the first time at a seminar at Stanford University
1976	Allen Newell and Herbert Simon formulated a hypothesis about a physical symbol system known as the Newell-Simon hypothesis. According to this hypothesis, the provision and sufficient means for the implementation of basic intellectual actions in a broad sense has a physical symbolic system
beginning 1980	Jaron Lanier first coined and popularized the term "virtual reality" and founded the company "VPL Research" to sell virtual reality products

The history of the development of AI research can be divided into three main stages.

The first stage (the end of the 1950s of the 20th century) is the beginning of research, attention is focused on the use of the heuristic method of solving problems inherent in human thinking. At this stage, a universal method of problem solving was developed. Research has been done mainly on puzzles and games.

The II stage (beginning of the 70s of the 20th century) is a qualitative leap in research, the center of attention shifted to real subject areas, integrated robots were developed.

Stage III (from the mid-70s of the 20th century) is characterized by a focus on human-machine systems, where the focus is not only on independent systems, but also on the creation of integrated systems that combine human intelligence with the ability of a machine to focus on achieving a common goal.

There are three main approaches to AI modeling [14; 24]:

- modeling of the structure and mechanisms of the human brain;

- simulation of intellectual activity;
- creation of mixed man-machine systems.

Taking into account the views of the above-mentioned scientists, we believe that AI is a significant result of the achievements of technological civilization and represents a complex system of interrelationships that form the basis for the creation of information system entities.

AI is, first of all, technologies used for the development of systems and products to which we refer (see Fig. 2) [20].

These AI technologies can serve as a basis for the development of various systems and products. They provide tools for data analysis, pattern recognition, natural language understanding, decision making, and process optimization. In addition, they can work individually or combine to create powerful intelligent systems that can learn from experience, adapt to changing environments, and solve complex problems.

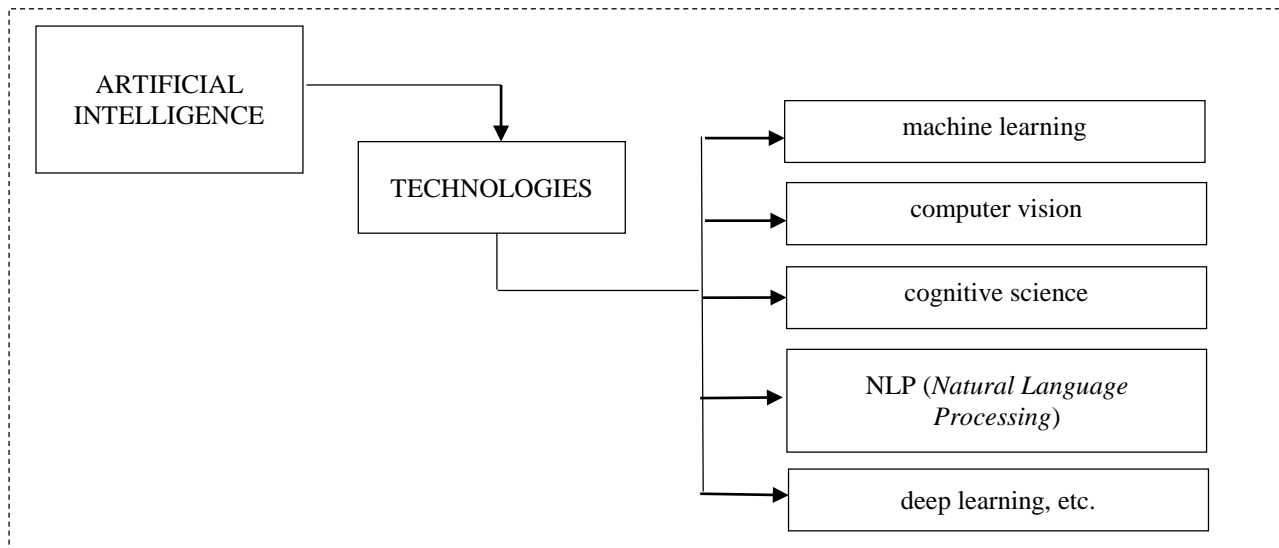


Fig. 2. Basic AI technologies (developed on the basis of [14; 17; 20])

To create various systems and products in the modern world, other technologies are also used, which, in our opinion, complement AI technologies, namely:

- process automation (*Robotic Process Automation – RPA*): used to automate repetitive and routine tasks, which reduces manual work and increases process efficiency;
- data analytics (*Data Analytics*): necessary for collecting, analyzing and using large volumes of data, identifying regularities and patterns;
- Internet of Things (*IoT*): used to collect and exchange data between physical objects and systems using sensors and connections, which allows to increase automation and optimize processes;
- autonomous systems (*Autonomous Systems*): development of modeling systems that can make decisions and perform actions without human intervention;
- virtual reality and augmented reality (*Virtual Reality and Augmented Reality*): used to create immersive interactive experiences and training;
- genetic algorithms (*Genetic Algorithms*): methods simulating the evolution process for solving optimization problems;
- automatic planning (*Automated Planning*): used for automatic planning and sequence of actions to achieve goals;
- self-learning (*Self-Supervised Learning*): approaches by which the system learns from unverified data without the need for manual classification;
- intelligent agents (*Intelligent Agents*):

systems that can act autonomously and make decisions based on received data, capable of analyzing, perceiving and responding to changes in conditions;

- neural networks (*Neural Networks*): networks simulating the structure and functioning of human neural systems. These complex algorithms allow computers to perform complex tasks such as speech recognition, pattern recognition, can detect inconsistencies to the human eye, patterns and relationships in huge amounts of data, performing calculations with neural networks very quickly thanks to the use of hardware acceleration such as graphics processing units (*GPU*) or specialized chips;
- expert systems (*Expert Systems*): this technology models the knowledge and expert capabilities of specialists in a specific field. Expert systems help solve complex problems and make recommendations.

Each of the above technologies has its own unique application and creates powerful innovative solutions that are widely used in many areas for speech recognition and synthesis; in intelligent decision support systems; in promising approaches to artificial intelligence [27].

AI systems are based on the field of modern technologies for solving tasks (creating automated systems, robots, controlling machines, translating or structuring text, etc.). This forces AI systems to self-learn and work with large data sets. Such AI systems should include [34; 36]:

- 1) information and search systems that work in an interactive mode in professional languages of users;

2) calculation and logic systems that allow solving complex problems with the help of complex mathematical methods and application programs;

3) systems of design and scientific research;

4) educational systems (education system, intellectual simulators);

5) expert systems, which provide for effective computerization of fields of knowledge for which it is difficult to use mathematical models.

The significant branching of AI systems is due to the specifics of the tasks that are solved for the construction and operation of a certain industry. Solving problems in AI systems is related to the implementation of research activities and the creation of intelligent mechanisms for the autonomization of activities.

Let's outline the differences between artificial intelligence systems and technologies, which are interconnected, but differ in their

essence and purpose (Fig. 3).

The speed of development and implementation of AI depends primarily on the amount of funding. The volume of public and private investments aimed at the development and implementation of AI in individual countries of the world for 2020-2022 is illustrated in Fig. 4.

As we can see from fig. 4, the US, China and EU countries are the clear leaders in AI funding, but other countries are also starting to make significant investments. In particular, France, the UK, Germany, India and Canada are showing signs of significant growth in AI funding. There are no uniform strategies in the ambitious competition, as each country focuses on different aspects of AI, such as: research, talent and skills development, training, adaptation to the public and private sectors, ethics and inclusion, creation of standards and regulatory requirements, and data and digital infrastructure [3; 32; 35].

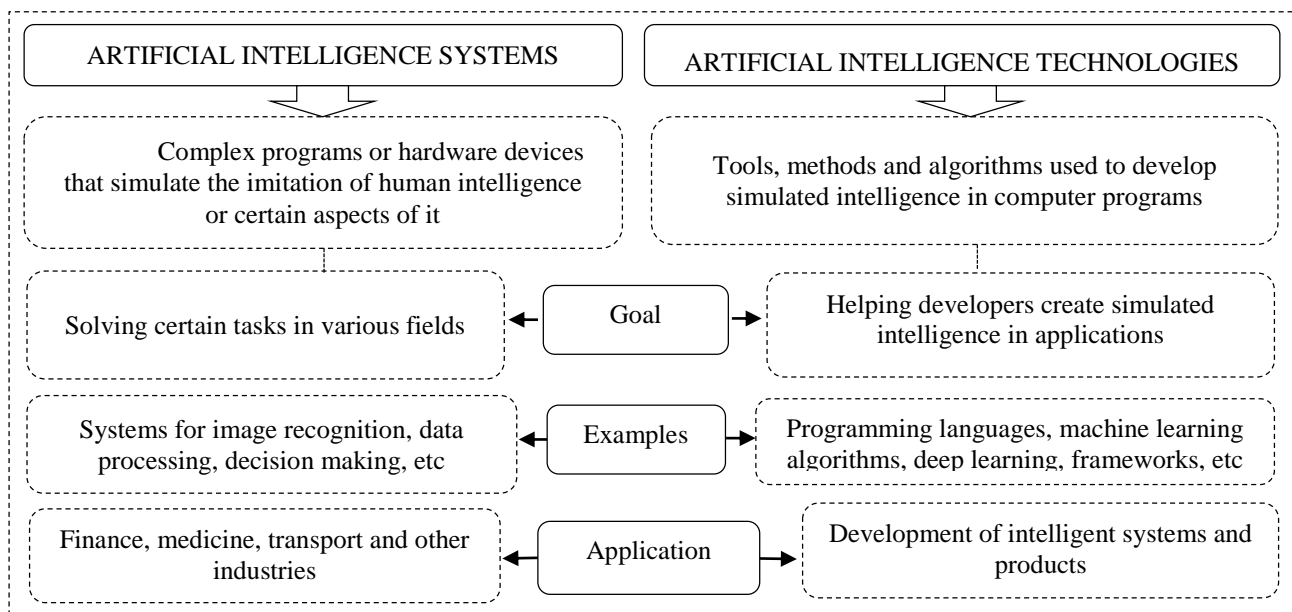


Fig. 3. Differences between AI systems and technologies (developed on the basis of [3; 37])

Thanks to its powerful algorithms and systems, AI is capable of transforming various industries, including the financial sector. It provides enormous potential for improving financial system management processes, developing new products and services, improving decision-making efficiency, and reducing risks. Artificial intelligence in the financial sector refers to the application of various AI technologies, algorithms and methods to optimize and automate various processes and tasks related to finance, investments, banking, insurance and other industries [23]. The use of AI

can contribute to a significant increase in the competitiveness of the financial sector of Ukraine on the world market and help its modernization in the conditions of the constant development of the digital economy.

Recently, the financial sector, which includes a collection of financial institutions, companies, markets, products and services that contribute to financial stability and efficient movement of capital in the economy, has undergone significant changes, namely:

- in ways of providing financial services. Thanks to technological progress and digital



transformations, fintech companies are emerging that offer new payment methods, online lending, automated portfolio managers and blockchain technologies for the implementation of cryptocurrencies and smart contracts;

- in the regulation of the financial sector. In order to ensure stability and prevent similar crises in the future, since the global financial crisis of 2008, financial regulation has been greatly improved;

- greater attention was paid to socially responsible investments (SRI) and environmental, social and corporate responsibility (ESG) in financial transactions;

- cryptocurrencies such as Bitcoin emerged, new opportunities for digital payments appeared, which created problems for their regulation and protection against cyber attacks;

- easier access to financial services for all segments of the population, including those previously excluded from the financial system, etc.

These trends have contributed to the emergence of new products and services, changed the way customers interact with financial institutions, and increased competition in the financial sector.

Among the AI technologies, the most common in the financial sector of Ukraine are

chatbots, robo-advising, collector robots, scoring systems, microcredit services, authentication of consumers of financial services, compliance, fraud detection, etc. Note that AI interacts quite effectively with such modern technologies as blockchain, big data, electronic wallet, crowdfunding platforms, Internet acquiring, online trading of financial products and services, p2r platforms, etc.

O. M. Parubets, D. O. Sugonyako, I. O. Seredyuk [31] note the problems caused by the use of AI in the financial sector. This is, in particular, the opacity of algorithmic decision-making, the problem of preserving the confidentiality of data that underlies smart robotics programs. According to D. Ryabokon [35], along with new technologies, new obstacles have appeared, and AI is considered one of the main cyber threats, as it can be used for targeted automatic attacks. The scientist refers to the forecasts of *Cybersecurity Ventures* researchers, according to which global losses due to cybercrime will grow by 15% annually until 2025 and reach 10.5 trillion. dollars, while in 2015 this figure was 3 trillion. dollars The author also draws attention to the fact that the confrontation with deep fakes (*DeepFakes*) continues in the world.

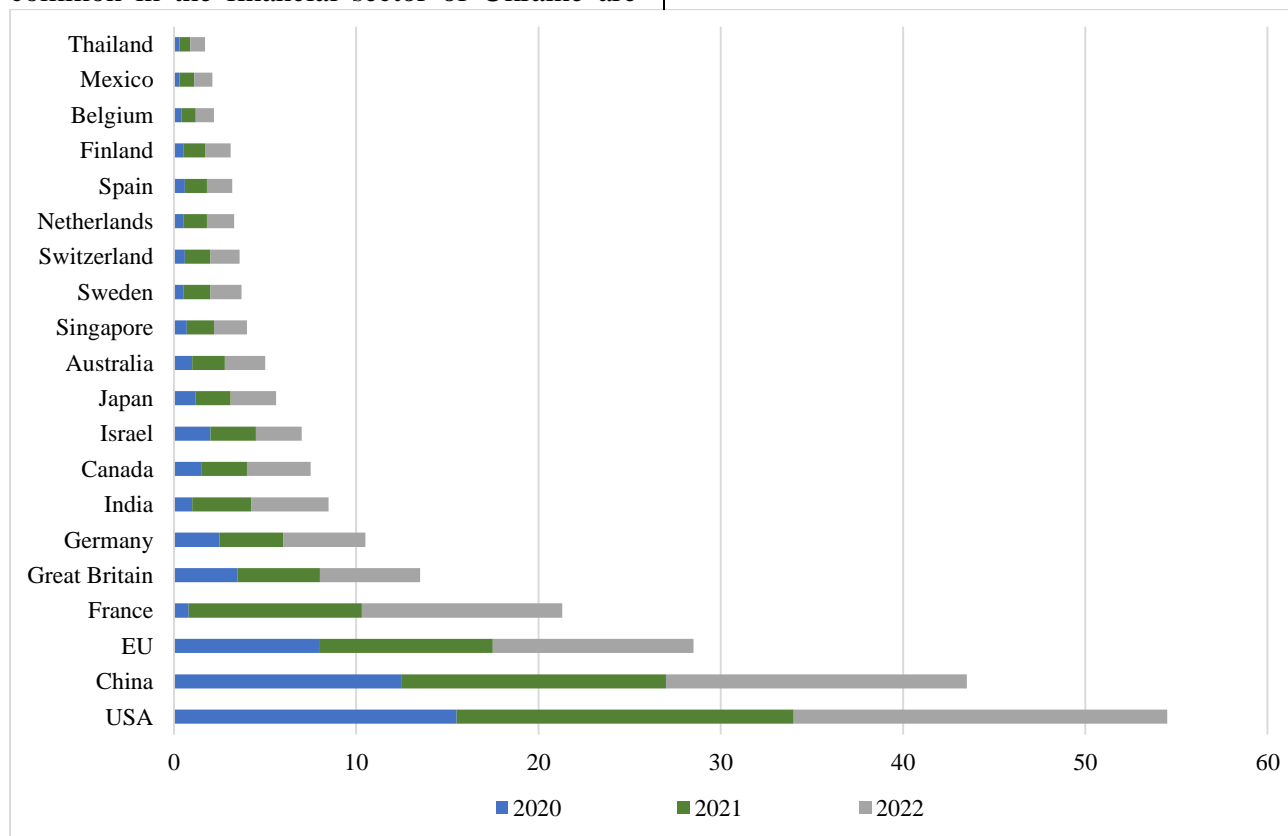


Fig. 4. The volume of public and private investments in the development and implementation of AI by individual countries of the world for 2020-2022, billion dollars. USA (developed on the basis of [41; 42; 43])

AI systems are designed to automate clerical and routine tasks and process large volumes of data. With these computer tools, employees have access to the financial, manufacturing and other basic operations of the company, as well as the ability to interact with customers in real time. This approach allows you to quickly respond to events and effectively adapt to changing circumstances.

An AI product is a software or hardware solution capable of performing certain tasks or functions that previously required human intelligence. AI products provide automation and optimization of various processes, increase the speed and accuracy of decisions, and also solve complex tasks that were previously unattainable for traditional software. The main AI products in the financial sector are listed in the table 2.

The implementation of AI in the financial sector contributes to improving the efficiency and quality of financial services by: reducing corruption and preventing money laundering; forecasting, personalization and automation of the provision of financial services; development of online marketing with accurate definition of customer needs and opportunities to satisfy them; processing of payment documents.

The main areas of application of the AI product in the financial sector of Ukraine are shown in the table 3.

The use of AI in the financial sector creates a number of risks and requires the use of risk management systems. Among the main threats of the impact of AI on the financial sector, we will single out the following:

- erroneous algorithm for selecting financial indicators;
- threat to national and financial security in case of cyber attacks;
- loss of control over the activities of financial market entities;
- reduction in the number of employees of financial and credit institutions.

The main types of risks associated with the introduction of AI in the financial sector of Ukraine and the directions for their reduction are given in the table 4.

In the conditions of an increase in the number of financial transactions, the introduction of AI in the financial sphere will allow to improve the quality of the provision of financial services, shorten the terms of their provision and diversify these services, which will positively affect the

state of financial and credit relations and promote effective interaction between the spheres and links of the financial system.

Table 2  
**The main AI products in the financial sector of Ukraine (developed by the authors)**

Purpose	Examples of AI products
Speech Recognition and Synthesis	Voice assistants, chatbots, machine translation
Intelligent Decision Support Systems	Analytical systems, automated decision-making systems
Computer Vision	Anomaly detection, image recognition, automated transaction monitoring
Deep Learning	Currency rate forecasting, risk analysis, financial modeling
Natural Language Processing (NLP)	Automated processing of financial reports, text document analysis
Cognitive Science	Applying psychological principles to create effective financial products
Data Analysis	Identifying trends, predicting risks and opportunities for financial decision-making
Automated Trading	Executing trading operations automatically in financial markets
Risk Management	Identifying and controlling risks in financial operations
Customer Query Processing	Automated processing of customer inquiries
Credit Scoring Analysis	Determining customer credit risk
Fraud Detection	Identifying fraudulent transactions and malicious activities in financial markets

At the same time, the introduction of AI will lead to a decrease in the number of employees at these enterprises, which, of course, will require the development of an effective state policy of social protection for persons of working age. It should be noted that the development of AI in the financial sector can have ambiguous consequences (Fig. 5).

AI is rapidly revolutionizing the financial sector. Startups in this space are using AI to develop new products and services that improve the efficiency, transparency and accessibility of financial services, and help solve financial problems through innovative solutions. Startups in the financial sector have a number of advantages over traditional financial institutions. They are more flexible and innovative, can quickly adapt to changes in the market. In

addition, startups often use new technologies to offer better and more affordable services to customers. The leading startups in the field of AI

of the financial sector of some countries of the world and Ukraine are listed in the table 5.

Table 3

**The main areas of application of the AI product in the financial sector of Ukraine (developed by the authors)**

Field	Technology	Applications of AI Product
Customer Service and Support	Chatbots	Using chatbots for customer queries and 24/7 support
Financial Data Analytics	Machine Learning	Currency rate forecasting, market analysis, investment advice
Risk Management	Data Analytics	Identifying risks, anomaly detection, financial monitoring
Credit Sector	Credit Scoring	Assessing credit risk and making lending decisions
Demand Forecasting	Artificial Neural Networks	Predicting demand for financial services and optimizing inventory
Operations Automation	Robotic Process Automation	Automating accounting, internal operations, and payment tasks
Financial Monitoring	Big Data Analysis	Detecting financial crimes, fraud prevention, money laundering
Personalized Financial Solutions	Recommender Systems	Providing personalized recommendations and financial plans
Fraud Detection	Patterns and Analytics	Utilizing patterns and data analytics for fraudulent operations
Data Analysis	Machine Learning	Automated analysis of financial reports
	Neural Networks	Market trend forecasting
	Text Analysis (NLP)	Detecting anomalous activities
Credit Scoring	Decision Trees	Determining credit risk
	Genetic Algorithms	Optimizing credit products
Virtual Assistants	Chatbots	Customer support and consulting
	Voice Assistants	Voice-activated financial transactions
Customer Identification	Biometric Technologies	Voice or facial-based customer identification
	Image Recognition Models	Automated user identification
Trading	Algorithmic Trading (Machine Learning for Forex Analysis)	Alternative to traditional financial advisory for portfolio management and investment in securities and other assets
Risk Management	ocial Media Content Analysis	Evaluating risks associated with social media content
	Clustering Models	Segmenting risk groups of customers
	Automated Decision Systems	Detecting and managing risk events

Table 4

**Risks of introducing AI technologies into the financial sector of Ukraine and ways to reduce them (developed by the authors)**

Risk Category	Risk Mitigation Strategies
Cyber Risks	Developing cyber insurance systems to protect financial institutions from cyberattacks
Risks of Social Vulnerability	Implementing state programs for social protection and retraining of unemployed workers in financial and credit institutions through AI development
Risks of Qualified Personnel	Implementing personnel risk management systems, increasing technical and financial literacy of financial institution staff
Risks of Insufficient Data for Processing	Expanding the database for selection, monitoring, and decision-making in financial matters
Risks of Selling AI Technology	Building an effective system to protect intellectual property, improving control efficiency, and expanding the liability of AI technology developers
Risks of Non-repayment of Investments	Expanding cooperation between financial sector entities and FinTech companies, investing in startup projects, using collaborative funding for AI implementation
Compliance Risks	Complying with international standards for financial monitoring
Risks of Unforeseen Consequences	Careful analysis of outcomes and developing risk minimization strategies
Legal Security Risks	Developing and implementing policies and procedures to ensure compliance with AI legislation

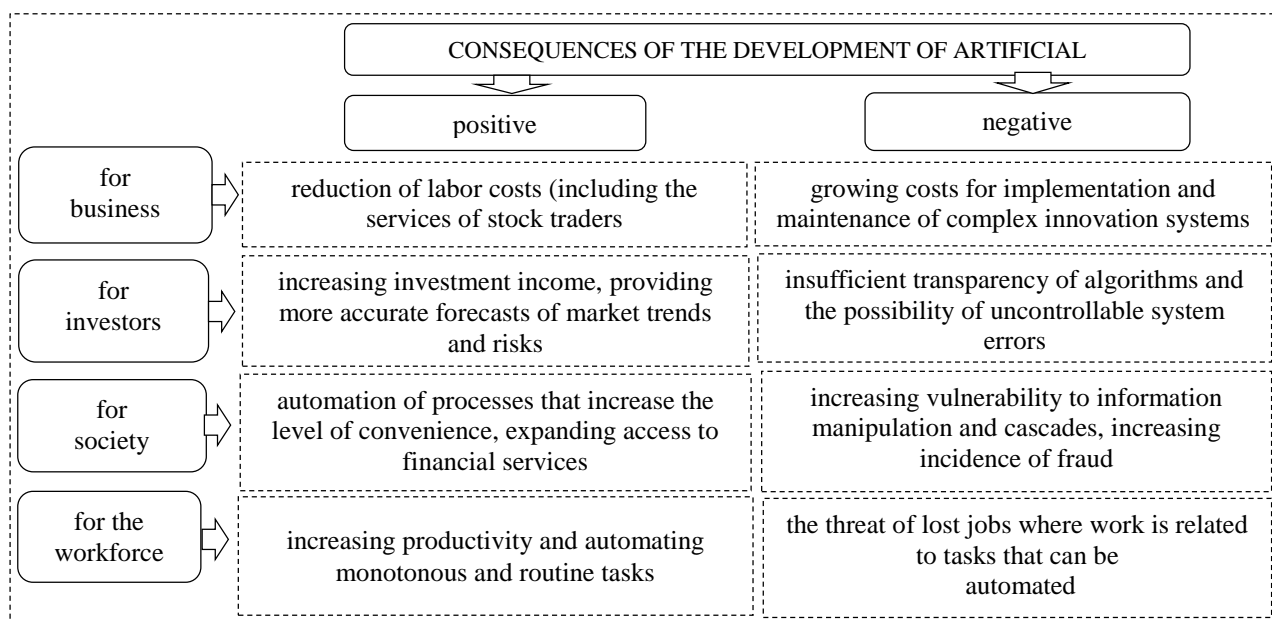


Fig. 5. Positive and negative consequences of the development of AI in the financial sector (developed on the basis of [19; 21; 31; 41])

Table 5  
**Leading startups in the field of AI of the financial sector of some countries of the world and Ukraine for 2020-2023 (developed on the basis of [6; 7; 8; 9])**

Startup	Country	Funding Amount (USD)	Financial Sector	Startup Description
Airon	Ukraine	100,000	Data Analysis	A platform that uses AI for financial data analysis and fraud detection
Cream Finance	Ukraine	500,000	Lending	A platform that allows users to borrow and save money using AI
Easy Finance	Ukraine	1 million	Investment	A platform that offers users loans and other financial services using AI
FinAI	Ukraine	2 million	Process Automation	A platform that uses AI for automating financial processes
Integriti	Ukraine	3 million	Fraud Detection	A platform that uses AI for detecting fraud in financial systems
Finn AI	USA	100 million	Data Analysis	A platform that helps people make financial decisions with AI
N26	Germany	900 million	Digital Banking	A digital bank that offers banking services to clients through a mobile app
Acorns	USA	800 million	Investment	An investment platform that helps people save money through small regular contributions using AI
Betterment	USA	700 million	Investment	An investment platform that helps people save money with AI
SoFi	USA	500 million	Lending	A company that offers various financial services to clients, such as loans, credit cards, and investments
Monobank	Ukraine	1.2 billion	Digital Banking	A digital bank that offers banking services to clients through a mobile app and website

Startups listed in table. 5, use AI to solve a wide range of tasks in the financial sector, in particular, such as:

- data analysis: AI can be used to analyze large amounts of financial data to identify patterns and trends that can be used to make better decisions;

- detection of fraudulent activities in financial systems. AI that can help protect customers from financial losses;

- personalized service. With the help of AI, it is possible to personalize financial services for each client;

- automation of tasks. AI is used to

automate tasks in financial services, which can save time and money;

– improving security. AI improves the security of financial systems by, for example, detecting malicious code and preventing fraudulent transactions.

AI has the potential to revolutionize the financial sector of Ukraine. AI startups already have a significant impact on the industry, and analysts predict their influence will grow in the coming years.

Therefore, the implementation of AI in the financial sector of Ukraine becomes a driver of its development, as it provides a number of advantages and opportunities for optimizing processes. AI improves the analysis of financial data, contributes to more accurate forecasting of risks and market trends, improving the automation of operations and reducing costs, modernizing the domestic financial sector and increasing its competitiveness in the global market.

## 6. CONCLUSIONS FROM THIS STUDY AND PROSPECTS FOR FURTHER INVESTIGATION IN THIS DIRECTION

According to the results of the study of theoretical aspects and pragmatic approaches in the context of Ukrainian realities and global trends regarding the adaptation of the AI mechanism to the financial sector of the state in the process of digitalization of the financial system, the following can be stated:

1. In modern conditions, AI plays a key role in the financial sector of Ukraine, providing automation and optimization of processes. It helps analyze large volumes of financial data and make predictions for more accurate decisions. The use of AI in risk management allows detecting anomalies and reduces the likelihood of financial risks. AI supports the development of personalized financial products and services that contribute to better customer service. The implementation of AI leads to innovations in the financial sector and increases the efficiency of financial institutions.

2. Thanks to AI, new systems are created and developed, capable of performing tasks that previously required human intellectual activity. AI combines various methods, algorithms, and approaches, such as machine learning, deep learning, computer vision, natural language

processing, and others, to create simulations of human intelligence and behavior.

3. The prerequisites for the emergence of AI were scientific research and development of information technologies, which became the basis for the creation of computer systems with intellectual capabilities. The emergence of powerful computing systems, the development of machine learning algorithms, and the development of large data sets contributed to the growing interest in the implementation of AI. These prerequisites made it possible for the first time to realize the practical application of AI in various fields, including the financial sector.

4. AI technologies are a set of algorithms, methods, and tools that allow computer systems to perform thought processes, improve based on data, and make intelligent decisions. They are known for a growing number of applications in various industries, from the development of self-driving cars to financial data analysis and risk management.

5. AI systems are complex software solutions that include various methods of achieving certain goals. They can be used to automate processes, analyze data, make decisions and interact with users. AI systems find applications in many industries, such as finance, medicine, transportation, etc., helping to improve and expand the capabilities of individuals and organizations. They provide speed, accuracy and efficiency in the performance of tasks, which makes them an effective tool for modern society.

6. AI in the financial sector is the application of various technologies, algorithms and methods, with the help of which optimization and automation of various processes and tasks related to finance, investments, banking, insurance and other industries is carried out.

7. Among the AI technologies, the most common in the financial sector of Ukraine are chatbots, roboadvising, collector robots, scoring systems, microcredit services, authentication of consumers of financial services, compliance, fraud detection, etc. AI interacts quite effectively with such modern technologies as blockchain, big data, electronic wallet, crowdfunding platforms, Internet acquiring, online trading of financial products and services, p2r platforms, etc.

8. The volume of public and private investments in the development and implementation of AI is evidence of the countries' interest in the development of this technology.

Growing investments in the US, China and the European Union indicate that countries are investing significant resources in the development and application of AI in various fields, including finance. These countries can be considered pioneers in the development and application of this technology and consider AI as a strategic field for achieving their economic and technological goals. On the other hand, low levels of investment in some countries may indicate a lack of support or awareness of AI, which may limit their ability in a competitive world.

9. The use of AI technologies in the financial sector of Ukraine carries certain risks, such as the possibility of failures and errors in systems, security threats, loss of control over processes with a high level of automation. An additional risk is the possibility of using AI for illegitimate purposes, such as fraud and cyber attacks. To reduce the risks associated with the use of AI technologies, financial institutions can implement effective control and monitoring systems, conduct regular security and reliability checks of algorithms. An important step for the effective implementation and operation of AI technologies is to improve the skills of the personnel who work with these technologies.

10. The development of AI in the financial sector can have positive consequences, such as increasing the efficiency of financial services, reducing risks and optimizing decision-making processes. Implementing AI can help financial institutions improve data analysis, detect fraud and improve customer service. However, the development of AI can also have negative

consequences, in particular, the strengthening of cyber security, the uncontrollability of operations, and the increase of inequality of access to financial services. Therefore, it is necessary to ensure effective regulatory oversight and compliance with ethical principles in the use of AI in order to minimize the negative consequences of its development in the financial sector.

11. Leading startups in the field of AI in the financial sector, such as Airon, Cream Finance, Easy Finance, FinAI, Integriti, Finn AI, N26, Acorns, Betterment, SoFi, Monobank, which emerged in 2020-2023 and are currently developing successfully, use AI to solve various problems in the financial sector related to lending, investing, financial management and insurance. This helps to provide more efficient and innovative financial solutions for customers. These startups are driving change in finance by introducing new approaches to data processing, risk analysis and customer engagement. Thanks to their growth and innovation, the financial sector becomes dynamic and helps to better meet the needs of the modern market.

12. AI in the financial sector, as a driver of development and a factor of modernization, changes the ways of providing financial services, accelerates decision-making, reduces risks and creates a personalized approach to clients. The use of AI opens up new opportunities for automating processes, analyzing large volumes of data and developing innovative products, which contributes to the development of a more efficient and competitive financial sector.

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#### Анотація

### **ЗЯНЬКО Віталій Володимирович, НЕЧИПОРЕНКО Тетяна Дмитрівна** **Штучний інтелект у фінансовому секторі України: драйвер розвитку та фактор модернізації**

Досліджено, що тригером трансформації фінансового сектору України та його динамічної цифровізації є штучний інтелект (ШІ), який відіграє роль драйвера розвитку та виступає фактором модернізації. Встановлено, що інновації за допомогою ШІ у фінансовому секторі полягають у здатності системи автоматизувати обробку даних і розрахунки, що призводить до прискорення, підвищення ефективності та розширення фінансових операцій. Встановлено, що ШІ може аналізувати великі обсяги фінансових даних, виявляти складні залежності та прогнозувати тенденції, сприяючи прийняттю стратегічних рішень та управлінню. Зазначається, що використання ШІ у фінансовому секторі України дозволяє підвищити точність фінансового аналізу та оптимізувати широкий спектр рутинних операцій, що значно скорочує час та ресурси компаній за рахунок автоматизації завдань, сприяє збільшенню надійності інвестиційних рішень та ефективності фінансових процесів, виявлення аномалій і закономірностей у фінансових даних, а також вдосконалення системи кібербезпеки для захисту від шахрайства та зловживань. Окреслено переваги та виділено певні недоліки та ризики, які перешикоджають поширенню та використанню ШІ у фінансовому секторі України. Це стосується, насамперед, питань етики, прозорості, недобросовісного чи дискримінаційного використання ШІ, а також питань конфіденційності та захисту персональних даних. Виявилося, що ШІ має обмежені можливості в роботі з неструктурованими даними і не завжди може вловити людські емоції та контекст. Було виявлено, що штучний інтелект, незважаючи на його обмеження в розумінні контексту, є потужним інструментом для фінансового сектору України, який допомагає підвищити конкурентоспроможність та ефективність сектору шляхом прискорення обслуговування клієнтів, покращення управління ризиками та точного прогнозування економічних тенденцій.

**Ключові слова:** штучний інтелект, фінансовий сектор, продукти штучного інтелекту

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