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# INTEGRATION OF DIGITAL MEANS IN THE FINANCIAL SPHERE: THE POTENTIAL OF CLOUD COMPUTING, BLOCKCHAIN, BIG DATA AND AI

## ABSTRACT

The integration of digital means in the financial sphere nowadays is not just a necessity, but also a strategic step that determines the further development of this industry. The modern world of finance bets on high technologies, namely on such key areas as Cloud Computing, Blockchain, Big Data and Artificial Intelligence (AI). The purpose of our article is to conduct an in-depth analysis of the potential of Cloud Computing, Blockchain, Big Data and Artificial Intelligence (AI) technologies in the context of their impact on the financial sphere. The object of our article is the financial sphere, including banking, the investment sector, insurance, and other component industries that interact with finance. As a result of the conducted research: the advantages and disadvantages of the integration of digital means in the financial sphere are considered; the potential of Cloud Computing, Blockchain, Big Data and AI in the financial sphere was investigated; it is emphasized that all these technologies are already changing the financial sphere and have great potential for further development. Thanks to them, financial institutions can be more competitive, respond faster to changes in the market, and provide more innovative services for customers. Therefore, the integration of these digital means into the financial sphere is a necessity and a key direction for the further development and modernization of the industry. Cloud Computing, Blockchain, Big Data, and Artificial Intelligence (AI) technologies enable financial institutions to increase efficiency, reduce costs, and improve customer service.

The challenges of implementing new technologies in the financial sector include the absence of a unified regulatory framework, high costs associated with transitioning to digital platforms, and resistance from traditional players. These challenges can be addressed by creating clear regulations, providing financial support to companies transitioning to digital technologies, and fostering partnerships between innovative startups and large financial institutions for collaborative development and implementation of technological solutions.

**Keywords:** financial industry, innovations in the financial sector, innovations in finance, digital transformation of finance, integration of technologies

**JEL Classification:** C45, C55, G23, L86

## INTRODUCTION

The rapid development of information technology and the Internet, which became available to millions at the end of the 20th century, has taken communication to a new level and accelerated globalisation (Tkachuk et al., 2022). The conditions of the modern digital economy have significantly affected electronic services, which have become an essential part of almost any company in all areas and industries. This transformation includes not only communication and logistics but also various forms of mutual settlements between counterparties, making them more convenient and efficient. The financial sector does not stand aside from this process (Borysova, 2019).

Digital transformation in the industry has led to significant changes in the way banks, insurance companies, investment funds, and other institutions operate and deliver their

services. The adoption of Cloud Computing, Blockchain, Big Data, and Artificial Intelligence (AI) technologies has been key to improving the speed and accuracy of financial transactions, ensuring security, and reducing costs.

The digital revolution is driving rapid changes in the financial sector and opening up new opportunities for innovation, expanding global markets, and improving access to financial services for the public. However, it also raises questions about data protection and information privacy, as well as the need for education and training of professionals who are competent in the digital environment.

The main focus of the study is to reveal the impact of digital transformation on the financial sector and analyse the key technologies that drive it. The objective of this research is to study the changes in the financial sector, determine the role of Cloud Computing, Blockchain, Big Data, and AI technologies in its transformation, highlight opportunities for innovation, and identify challenges that need to be addressed.

The urgency of this issue is exacerbated by the need for the financial sector to adapt to the challenges and opportunities of the digital economy. Modern technologies, such as Cloud Computing, Blockchain, Big Data, and AI, are evolving rapidly and have the potential to transform the way financial institutions operate and serve customers. It is therefore important to explore these technologies and their impact on the financial sector in order to:

- *increase competitiveness.* Financial institutions that effectively implement modern technologies can increase their competitiveness and attract new customers;
- *improve the quality of services.* The use of Big Data and AI allows us to analyse customer data and provide more personalised financial solutions;
- *ensure security.* The financial sector involves a large amount of confidential information, so protecting this data is becoming an extremely important task;
- *respond to changing customer expectations.* Today's customers expect convenient and fast financial services, and financial institutions must be prepared to meet these needs;
- *effectively manage risks.* Blockchain technologies can help manage financial risks and provide a reliable system for recording transactions.

Given these factors, understanding the impact of digital transformation on the financial sector is critical to the further development and stability of this industry.

This article explores the impact of digital transformation on the financial sector and analyses key technologies such as Cloud Computing, Blockchain, Big Data, and AI and their impact on the industry.

We will consider different approaches to the interpretation of the term "FinTech" in the domestic and foreign literature, explore the advantages and disadvantages of integrating digital tools into the financial sector, and explore the potential of Cloud Computing, Blockchain, Big Data, and AI in the financial sector.

## LITERATURE REVIEW

The current economic environment is characterised by globalisation and integration trends that are accelerating every year (Bozhkova & Halytsia, 2022). These changes in society and business affect all areas of activity, forcing organisations to adapt to new conditions. One of the most important adaptation strategies is the use of information technology, especially in the financial sector.

As Shkarlet et al. (2019) rightly point out, the introduction of the latest financial technologies into the financial sector has led to a real revolution in the financial market. We are not talking about just any technology, but those that have become a synthesis of FinTech, and financial innovations used to provide, expand, and distribute financial services.

The modern economy is defined by a rapid pace of digitization, which, as noted by Bezrukova et al. (2022), is a key driver of both global and domestic economic growth. It is worth noting that financial technologies (FinTech) are gaining significant importance as key innovations in the financial sector. In this context, it is relevant to refer to the study by Lee and Shin (2018), which points out several factors contributing to this growth, such as the sharing economy, a favourable regulatory environment, and the progress of information technologies.

It should be emphasized that the development of financial technologies has a profound impact on the financial sector and global economic dynamics. These technologies act as catalysts for transformations, influencing the functioning of financial

institutions and contributing to the creation of new business models. The relevance of researching the impact and development of financial technologies is underscored by their role in the modern economic landscape, where they not only shape trends in the financial sector but also influence the global economic system as a whole.

The study and analysis of the scientific literature show that at the present stage, there is no consensus on the definition of the essence of financial technologies. For example, Schueffel (2016) defines financial technology as a new financial industry that uses technology to improve financial performance.

Semenog et al. (2018) argue that financial technology is a service provided by technology companies with the help of special software and focusing on the financial needs of customers. Dudinets (2018) notes that financial technology is the technology used in the financial industry. Petruk et al. (2022) define financial technology as an innovative financial industry based on digital technologies that lead to the intensification and growth of the efficiency of financial services.

In his article, Rubanov (2019) proposes to consider FinTech as an innovation in the financial industry based on the use of information technology. The introduction of such innovations leads to significant changes in financial products, processes, and business models of financial intermediaries. This approach takes into account the main characteristics of FinTech, such as the ability to create not only new financial products and processes but also innovative business models and new players in the financial market (FinTech companies). According to the researcher, FinTech refers to radical innovations that radically transform financial services and the financial services market. One of the prerequisites for recognising a product or process as FinTech is the use of specific information technology in the financial services sector.

Thus, an analysis of the views of different authors on the essence of financial technologies confirms that there are different approaches to their definition. For example, some researchers (Kholiavko, 2021) consider FinTech as an industry or a sphere, while others (Unynets-Khodakivska, 2022) consider it as a technology or a service. However, regardless of this, all definitions of FinTech have a key feature: they are technologies that are almost impossible to imagine without digital innovations.

Literature analysis indicates that digital technologies have become an integral component of the financial technology (FinTech) sector, opening broad possibilities for improving financial processes and ensuring greater accessibility to financial services (Kholiavko, 2021). In the context of FinTech, digital solutions and information technologies serve as a primary platform that helps enhance efficiency, optimize risk management, and stimulate innovation in the financial sector (Petruk et al., 2023).

According to research by Otonne et al. (2023), FinTech services such as payments, lending, and insurance impact the daily operations of companies and consumers. The use of digital technologies in these segments significantly streamlines processes, reduces execution time, and increases the overall convenience and accessibility of financial services.

It is important to note that this accelerates the pace of innovation in the financial sector, leading to increased competition (Unynets-Khodakivska, 2022). The rise in market competition may serve as a stimulus for the continuous improvement of financial services and the expansion of their range. As a result, consumers may benefit from better, more innovative, and accessible financial solutions.

In summarizing the scholarly perspectives on FinTech, several key characteristics stand out, which researchers emphasize in their studies. For example, Rubanov (2019), a researcher of FinTech technologies already mentioned in this article, identifies three main characteristics of these technologies:

- FinTech innovations include innovative financial products, technologies, and business models that are reforming the financial sector and can bring new entities to the market - FinTech companies;
- FinTech is a disruptive technology that can radically change individual financial services and the entire financial services market, most often in a negative way for traditional players;
- The main requirement for FinTech innovations is the use of information technology, and often innovative technologies that are the basis for their implementation.

Another researcher of financial services in the context of the development of the fintech industry, V. Uninets-Khodakivska, identifies a few more key characteristics of FinTech (Table 1).

**Table 1. Key characteristics of FinTech.** (Source: compiled from Unynets-Khodakivska, 2022)

No.	Characteristics	Brief description of the characteristic
1	Innovative technologies	FinTech uses advanced technologies, such as AI, blockchain, data analytics, advanced analytics, cybersecurity, and others, to ensure high efficiency, accuracy, and reliability of financial services
2	Digital solutions	FinTech uses digital channels and platforms to provide financial services, such as mobile applications, online banking, e-wallets, payment systems, etc., which enables convenient and affordable access to financial services
3	Automation	FinTech uses automated processes and robotics to optimise and accelerate financial transactions, such as lending decisions, payment processing, settlement processes, and others
4	User experience	FinTech provides a convenient, personalised, and user-centric experience of interacting with financial services, enabling customers to transact quickly, easily, and with minimal effort
5	Integration and openness	FinTech uses open APIs (application programming interfaces) to integrate with other financial services and platforms, enabling the creation of financial service ecosystems and interoperability with various financial solutions
6	Focus on efficiency and cost optimisation	FinTech focuses on cost optimisation and efficient use of resources, including reducing bureaucracy, simplifying processes, and leveraging economies of scale to deliver financial services efficiencies
7	New business models	FinTech is introducing new business models, such as peer-to-peer (P2P) lending, crowdfunding, cryptocurrencies, and others, that are redefining traditional financial services and creating new opportunities for investment, lending, and savings
8	Regulatory compliance	FinTech complies with regulatory requirements and standards, such as personal data protection, anti-money laundering, financial stability, and others, which allows it to ensure a high level of customer and partner confidence
9	Global reach	FinTech has a global reach and can operate in different countries, enabling the provision of financial services internationally and contributing to the growth of international trade and financial relations

## AIMS AND OBJECTIVES

The main purpose of the article is to explore the opportunities offered by Cloud Computing, Blockchain, Big Data, and AI for the financial sector and to determine how their integration can contribute to the modernisation and improvement of this industry.

In order to achieve this goal, the following tasks need to be addressed:

- consider the essence of the definitions of “financial technology” or “FinTech”;
- consider the potential of modern digital technologies in the financial sector;
- analyse specific examples of Cloud Computing, Blockchain, Big Data, and AI implementation in the financial sector;
- consider the advantages and disadvantages of technologies: Cloud Computing, Blockchain, Big Data, and AI.

## METHODS

The following methods were used in the study.

1. *Monographic* - when studying the literature and analysing previous studies. It should be noted that the study included 45 sources on the topic of the research. The sample includes scientific works by both domestic and foreign researchers.
2. *Systemic* - to clarify the categorical apparatus and analyse the concept of “FinTech” in order to identify and study the key aspects and characteristics of this concept in the context of financial technologies.
3. *Induction and deduction* - for formulating hypotheses, testing them based on the collected data and conclusions.
4. *Graphical and tabular methods* - for visualising research results, creating tables and figures for a better understanding of the data and research results.

To search for relevant papers on the subject of the study, we used the Web of Science scientometric system, the Open Ukrainian Citation Index search engine and database of scientific citations, and the Google Scholar international search and scientific metric system.

The selection criteria for the publications were defined:

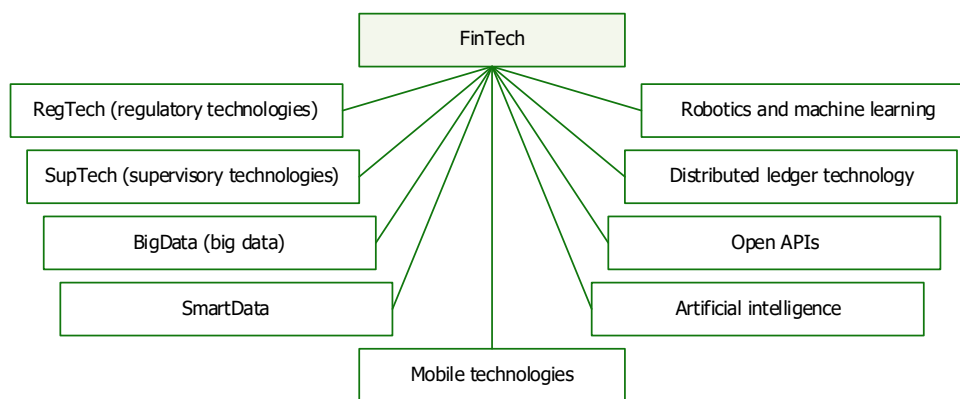
- keywords: “financial industry”, “innovations in the financial sector”, “innovations in finance”, “digital transformation of finance”, “integration of technologies”;

- year of publication. The vast majority of the selected publications are from 2018-2023. There are several publications from 2016-2017 that were included for the purpose of a more thorough and detailed study of the categorical apparatus;
- countries. This criterion was not limited to any one country, as it is necessary to study foreign experience in implementing digital tools in the financial sector in order to achieve the research goal in full.

## RESULTS

Today, financial institutions that do not use information technology in their operations face serious risks of losing customers and losing competitiveness in the market. Financial technologies, also known as FinTech, have become an essential part of this process, being most widely used in the areas of insurance, internet banking, electronic payments, and lending, including P2P lending. Modern banks and other financial institutions in the world's leading countries are actively incorporating digital solutions into their development strategies to remain competitive in this epochal period of global change.

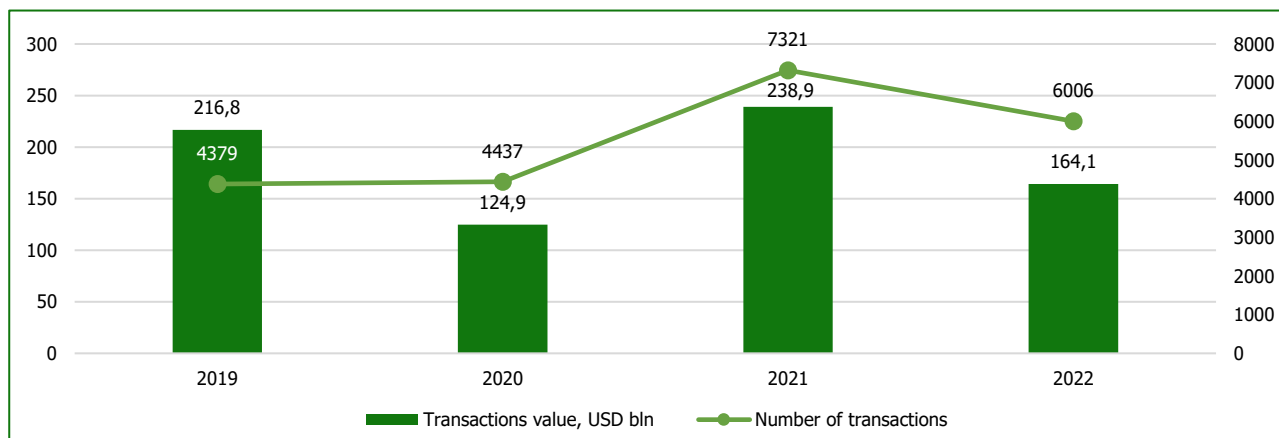
The latest financial technologies are grouped in Figure 1.



**Figure 1. The latest financial technologies.** (Source: compiled from Pestovska, 2021)

The rapid development of information technologies and their spread in the work of financial institutions make this topic extremely relevant. The scientific community has grown increasingly interested in studying these processes, identifying and describing the essence of such technologies, and analysing their impact on the digitalisation of the financial services market (Kholiavko, 2021).

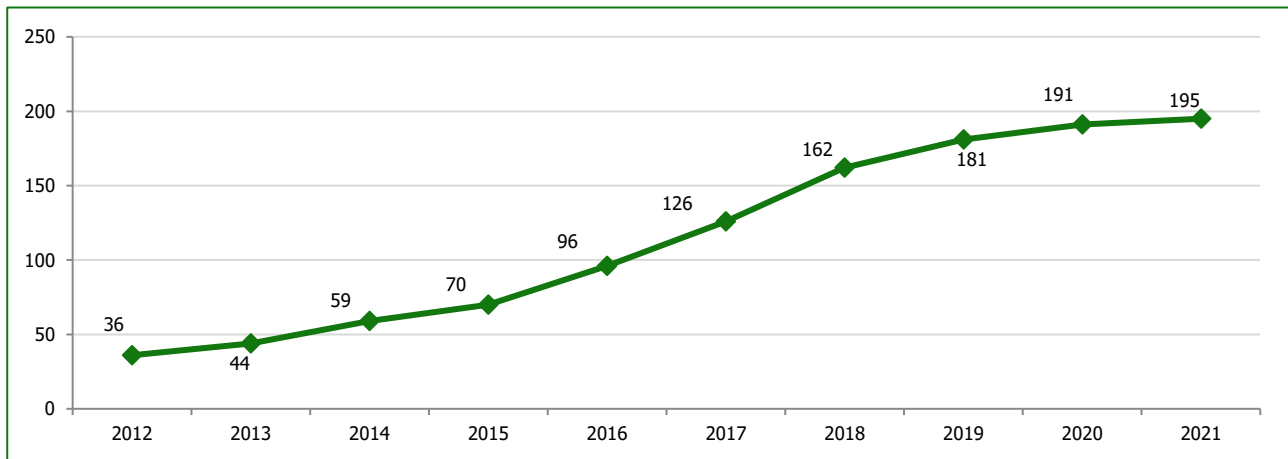
Over the past decade, financial technologies have rapidly evolved (Figure 2). For instance, according to KPMG's Pulse of FinTech research, international investments in the FinTech sector reached UAD 238.9 billion in 2021, almost doubling the 2020 figure of USD 124.9 billion. However, due to the financial crisis in 2022, this number decreased to USD 164.1 billion (KPMG, 2023).



**Figure 2. Dynamics of global fintech investment activity in 2021.** (Source: compiled from KPMG (2023))

The Ukrainian FinTech market is underdeveloped; however, with its unique characteristics, it reflects the overall dynamics of the global market. The spread of the Internet serves as a crucial indicator of the development of the domestic FinTech market. According to the Kyiv International Institute of Sociology, in 2008, only 24% of Ukraine's adult population had access to the Internet. However, in 2021, this figure increased to 30 million people (67% of the population), which is 33% more than in 2019 (UNIT.City, 2018).

Even amid stagnation in other sectors caused by COVID-19, FinTech maintains its position. In 2020, 10 new participants were added to the list of FinTech companies, and in 2021, an additional 4 companies joined (Figure 3). This is concurrent with a global trend of reducing the number of representatives in the FinTech sector.



**Figure 3. The number of FinTech companies in Ukraine by year of establishment.** (Source: UAFIC (2022))

As of the end of 2021, there were 195 FinTech companies in Ukraine. Among Ukrainian startups, the leader remains the technological infrastructure focusing on creating IT solutions for financial companies and banks. Providers of these services make up 22% of surveyed companies, representing an increase compared to 2020 when their share was 20% (UAFIC, 2022).

In general, 23% of companies founded in 2020-2021 identify themselves as representatives of the technology and infrastructure sector. Partly, this popularity growth can be explained by the second year of the pandemic, which forces businesses to transition online and contributes to the demand for companies that facilitate business operations in the digital space.

In second place are payment services and transfers, constituting 19% of the market. According to the NBU (National Bank of Ukraine) statistics, 9 out of 10 transactions are already non-cash, and online purchases account for about 25% of all non-cash transactions in the first half of 2021. Thus, this sector continues to remain at the top (UAFIC, 2022).

Companies specializing in consumer lending occupy 14% of the market, marking a significant increase compared to 2020 when this indicator was only 7%. The speed of online loans, the ability to apply for a loan 24/7, and lower scoring requirements make them popular among the population, stimulating demand and increasing competition in this segment (UAFIC, 2022).

The least developed directions remain crowdfunding and financial services comparison services. Business lending and blockchain sectors have experienced some decline, while the legal and insurance sectors have expanded their positions.

Digitalisation of the financial sector is the process of using technology and digital tools to improve the efficiency, accessibility, and quality of financial services and processes. This trend has become particularly widespread in recent years and includes many technologies, including:

- *Mobile applications and online banking.* Banks and financial institutions are developing mobile applications and web-based platforms to provide customers with convenient access to banking services, including transfers, bill payments, balance checks, and investment management.
- *FinTech companies.* FinTech start-ups develop innovative solutions such as payment systems, micro-lending platforms, robotic advisors, and many others.



- *Blockchain and cryptocurrencies.* Blockchain technology is used to create secure and decentralised payment and accounting systems. Cryptocurrencies, such as Bitcoin and Ethereum, are gaining popularity as alternative forms of investment and store of value.
- *Artificial intelligence and data analytics.* Financial institutions use artificial intelligence to analyse large amounts of data, detect fraud, manage risk, and support decision-making.
- *Internet of Things (IoT).* IoT enables the collection of data from financial devices, such as bank terminals and credit cards, to automate processes and improve security.
- *Climate finance.* Green finance markets are developing with the help of digital tools to finance projects aimed at reducing environmental impact.
- *Digital identification and security.* The use of biometrics, such as fingerprints and face scanners, helps to ensure customer safety and identification.

**Table 2. The application of digital technologies in the field of financial services.** (Source: compiled from Barabash (2021))

Digital technology	Financial activities and services							
	Payment services	Counseling, maintenance, and planning	Investment and trade	Lending and financing	Insurance	Security	Operating activities	Communication
Blockchain	+	+	+	+	+	+	+	+
Big Data	+	+	+	+	+	+	+	+
Internet of Things					+			+
Cloud computing				+			+	
Artificial intelligence	+	+	+		+			+
Biometric technology	+				+	+		
Augmented/Virtual reality		+	+					+

Based on the analysis of Table 2, the application of digital technologies in the field of financial services leads to the following conclusions:

- *Blockchain:* Using blockchain is evident in all aspects of financial activities, including payment services, investments, lending, insurance, security, operational activities, and communications.
- *Big Data:* The utilization of big data is widespread in all areas of financial services, particularly in payment services, investments, lending, insurance, security, operational activities, and communications.
- *Internet of Things (IoT):* The application of IoT is mainly observed in security and operational activities.
- *Cloud Computing:* Cloud computing is extensively used in payment services, insurance, security, operational activities, and communications.
- *Artificial Intelligence:* The application of artificial intelligence is present in all aspects of financial activities, encompassing payment services, investments, lending, insurance, and security.
- *Biometric Technologies:* The use of biometric technologies is noted in financial activities, payment services, investments, insurance, security, and operational activities.
- *Augmented/Virtual Reality:* Using augmented/virtual reality is observed in payment services, investments, and operational activities.

The overall trend is the widespread adoption of digital technologies in all aspects of financial services, enhancing efficiency, security, and service quality.

The use of these technologies enables FinTech companies to disrupt traditional financial services and offer innovative solutions to customers. These advances are significantly improving the accessibility, efficiency, and affordability of financial services while putting customers at the centre of attention (Oyewole & Adegbite, 2023).

Let us consider the potential of the most popular technologies, including Cloud Computing, Blockchain, Big Data, and AI.

### **Cloud Computing (Cloud computing or cloud technologies)**

Cloud technology is a way of using applications and server resources from a remote location via the Internet. This technology allows you to use the power of a remote server to perform complex calculations, process data, and store it without having to install applications on your device. The cloud is where all of these applications and data are stored and can be accessed via the Internet. This technology facilitates the use of applications and contributes to effective business management by centralising information and reliably storing data (Rubtsova, 2020).

Table 3 summarises the main ways in which Cloud Computing can be used in the financial sector.

<b>Table 3. Main areas of Cloud Computing application in the financial sector.</b>		
<b>No.</b>	<b>Direction</b>	<b>Characteristics</b>
1	Reduce IT infrastructure costs	Financial institutions can use cloud resources for data storage and computing, which allows them to avoid significant investments in hardware and data centres. This can save money and increase efficiency
2	Scalability	Cloud platforms allow financial institutions to instantly scale their computing resources as needed. This is especially important during peak workloads or when performing complex financial calculations
3	Availability and reliability	Large cloud providers usually guarantee a high level of availability and reliability of their services. This helps to avoid system failures and ensure uninterrupted operation of financial services
4	Data storage and analysis	Cloud computing enables financial institutions to store and analyse large amounts of data in real-time. This can be used to develop analytical tools, predict trends, and detect fraud
5	Data security	Large cloud providers are investing in data security and protection. They provide various encryption, authentication, and monitoring mechanisms to help financial institutions protect sensitive customer data and their own corporate data
6	Speed of deployment	Cloud solutions can be deployed much faster than traditional computing infrastructures. This allows financial institutions to respond more quickly to changes in market conditions and introduce new products and services
7	Remote workplaces and mobility	With cloud computing, finance professionals can access data and applications from any location and device, enabling greater mobility and productivity

The advantages of cloud technologies are the reason for the surge in the activity of companies in their use in various spheres of life. Semenog (2020) identifies the following advantages among a large number of advantages:

- the ability to independently configure the cloud configuration. Users can customise cloud parameters and resources to meet their needs and objectives;
- the universal nature of network access. Cloud services are available from any location with an Internet connection, allowing users to work with data and applications from a variety of devices;
- joint connection of a large number of people. Many users can use cloud resources simultaneously without significant restrictions;
- remote access to data. Users can access their data from anywhere using devices connected to the Internet;
- cost reduction. Subscribing to cloud services allows companies to reduce the cost of hardware, software, and maintenance of IT systems, as it is all provided in the cloud;
- technological power. Cloud platforms provide more capacity for data storage, analysis, and processing at a lower cost than traditional systems;
- easy scaling. Cloud-based IT systems can easily scale as business needs grow;
- cryptographic security. Cloud providers typically provide a high level of data protection, including cryptographic encryption, to ensure data security and integrity.

In the context of this study, it is worth noting that three models of cloud services have emerged in the world today:

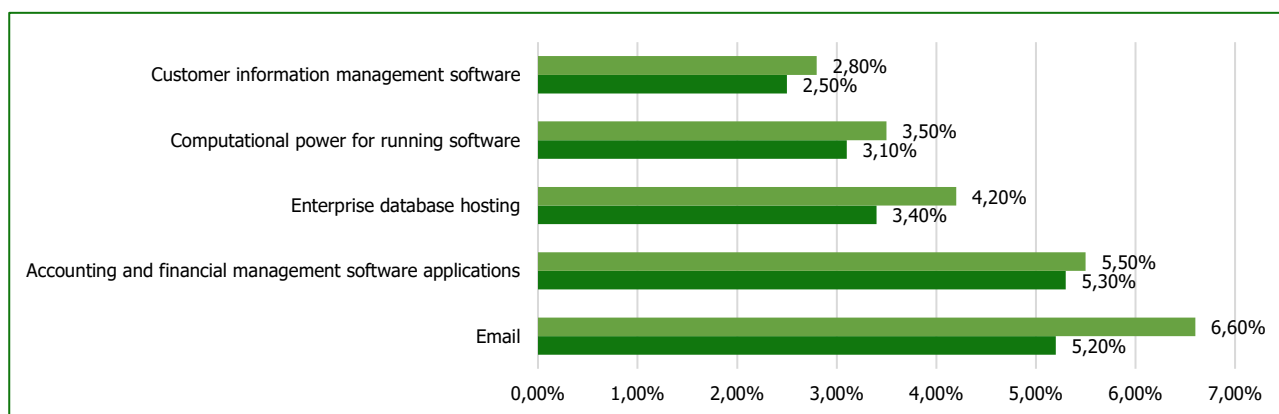
- Infrastructure as a Service (IaaS). This model provides customers with access to computing resources (servers, network connections, data storage, etc.) via the Internet. Users can flexibly configure and manage the infrastructure to suit their needs. An example of a provider of this model is Amazon Web Services (AWS);
- Platform as a Service (PaaS). In this model, customers access a platform to develop, run, and manage applications. The platform typically includes the infrastructure and services needed to develop and run applications. An example of a PaaS provider is Google Cloud Platform (GCP);



- Software as a Service (SaaS). In this model, users get access to ready-made software products via the Internet. They don't have to worry about managing the infrastructure or platform, as this is the responsibility of the supplier. Examples of SaaS products include Google Docs, Microsoft Office 365, Salesforce, and others;
- Everything as a Service (XaaS). This model is a combination of different services that can include both infrastructure and platform solutions, sometimes even additional services such as analytics or security. This model gives users more flexibility in choosing the services they need (Stamford, 2017).

At the beginning of 2021, 10.2% of enterprises in Ukraine utilized cloud computing services, indicating an increase compared to the year 2018 (9.8%). Among the sectors actively employing cloud computing, particular emphasis is placed on businesses in the tourism industry (22.8%), computer programming (21.1%), information and communication technologies (19.5%), information and telecommunications (18.7%), as well as pharmaceutical manufacturing (17.9%) [Usage of cloud information and communication technologies].

Figure 4 illustrates the structure of cloud computing services used by Ukrainian enterprises in 2021.



**Figure 4. The share of the number of enterprises purchasing cloud computing services by types of such services in 2021.** (Source: State Statistics Service of Ukraine (n.d.a))

The analysis of Figure 4 indicates a high demand for cloud computing services in modern enterprises, regardless of their industry. However, the utilization of such services raises a series of questions related to information security, protection of personal data, combating cybercrime, and ensuring compliance with current legislation regarding the protection of intellectual property rights.

In summary, we can conclude that, in general, Cloud Computing has great potential for integration into the financial sector, but its implementation should be carefully considered and well-regulated to ensure the security and stability of financial services.

### **Blockchain**

Blockchain technology appeared in 2008 and was developed by Satoshi Nakamoto (Stashchuk et al., 2022). In 2009, it was used to create the cryptocurrency Bitcoin, which led to the further development of this technology in the financial sector and banking. The main purpose of the blockchain was to ensure the anonymous and secure exchange of cryptocurrencies between strangers. In general, blockchain technology covers many sectors of economic activity and has various applications, such as asset transactions, finance, accounting in public and private organisations, public administration, fundraising, charity, capital market transactions, taxation, etc. According to Yushchenko (2018), CIOs from the telecommunications, insurance, and finance sectors show the greatest interest in blockchain.

The use of Blockchain technology has great potential to facilitate and increase efficiency in various industries, especially in the financial sector, by creating a fundamentally new financial services infrastructure (Karcheva & Karcheva, 2017).

The active use of blockchain technology in financial institutions is due to its ability to provide a high level of reliability, confidentiality, transparency, and security. All data entered into the blockchain ledger becomes available only to authorised network participants. This is important to increase the level of trust and ensure the security of operations.

In addition, Blockchain technology can significantly speed up the execution of financial transactions and move information faster. It also increases the efficiency of processes for verifying the accuracy and completeness of information (Kholiavko, 2021).

It is worth noting that the blockchain is based on DLT technology, which is designed to record transaction data in sequential blocks that are combined using cryptography and hashing methods (Li et al., 2021).

Due to its distributed, connected, verifiable properties, blockchain offers such advantages for use in various areas of public life:

- accessibility. Blockchain can be accessed by users anywhere and at any time, as it is based on a distributed network that can be connected via the Internet;
- independence. The use of blockchain makes it possible to avoid intermediaries such as notaries, banks, or other intermediaries, as the blockchain itself is capable of confirming and recording transactions;
- security. Blockchain records have a high level of security due to cryptographic protection and the distributed nature of the network;
- resistance to failure. Blockchain is resistant to failure due to the separate storage of data on many network nodes;
- the possibility of simultaneous work by a large number of users. Blockchain can serve many users simultaneously, making it practical for large-scale projects;
- data unity. Blockchain guarantees data integrity by avoiding double entries or falsification of information;
- the temporal nature of entering information. Each block of information in the blockchain has a time stamp, which helps determine the sequence of events;
- the anonymity of network participants. Participants can leave anonymous or pseudonymous records on the blockchain;
- Reduced financial and time costs. Blockchain allows you to reduce the cost of data maintenance and management due to the absence of intermediaries and process automation;
- openness and anonymity of personal data. Blockchain allows for the storage of open transaction data while ensuring the anonymity of personal information (Semenog, 2020).

However, along with the advantages, blockchain technology also has a number of disadvantages:

- the initial stage of market development. The blockchain technology market is still in its infancy, which results in low investment in its development and implementation. Many companies are not convinced of the benefits of using this technology;
- lack of a regulatory framework. The absence of clear blockchain regulation may be an obstacle to building trust in this technology. The legal status of cryptocurrencies, smart contracts, and other aspects of blockchain remains ambiguous;
- no option to cancel transactions. One of the main advantages of blockchain is the inevitability of transactions, but it can also be a disadvantage. If a user makes a mistake or becomes a victim of fraud, they cannot cancel the transaction;
- anonymity of transactions. While anonymity can be an advantage for user privacy, it can also be used by malicious actors for illegal activities, such as creating criminal marketplaces or laundering the proceeds of crime (Semenog, 2020).

In summary, Blockchain is a distributed system that enables reliable and secure financial transactions. The main key aspects that emphasise the potential of Blockchain in the financial sector are grouped in Table 4.

No.	Aspect	Characteristics
1	Safety and reliability	Blockchain uses cryptographic methods to secure and authenticate transactions. This helps to avoid fraud and ensures the reliability of financial transactions
2	Transparency	Transaction information is stored in a distributed ledger that is accessible to all network participants. This ensures a high level of transparency and can help avoid data manipulation
3	Speed and efficiency	Blockchain allows transactions to be executed almost instantly, without the need for intermediaries. This helps to speed up financial transactions and reduce costs
4	Reducing risks	Thanks to the distributed nature of Blockchain and the ability to create smart contracts, you can automate the execution of transactions and reduce the risk of errors or delays
5	Global access	Blockchain enables financial transactions across borders, making it an ideal tool for global financial transactions and international trade
6	Potential for innovation	Blockchain provides the means to develop new financial products and services

Therefore, the integration of Blockchain into the financial sector can improve the efficiency of operations, increase security, and reduce costs. At the same time, it is important to address legal and regulatory issues, as well as ensure a high level of trust from users and regulators, in order to realise the full potential of this technology.

### Big Data

Big Data is a huge amount of data of various kinds, which can be both structured and unstructured. This data requires special methods of integration and analysis due to its large volume and diversity. To process such data, scalable software tools are used, which appeared in the late 2000s and became an alternative to traditional databases and Business Intelligence solutions.

Burkina (2019) notes that Big Data follows the VVV rule, i.e., the three essential features that all big data should have:

- Volume. Big Data is defined by its sheer volume. This means that the data is usually so large that it cannot be processed and analysed using conventional methods and tools;
- Velocity. Big Data is often characterised by a high rate of volume growth. This means that data is constantly updated and arrives at a high rate, requiring immediate processing and analysis;
- Variety. Big Data can come in a variety of formats and be diverse in structure. They can be structured, such as databases, unstructured, such as texts, images, or videos, or a combination of these formats.

These three characteristics indicate the complexity and requirements of processing and analysing big data and distinguish it from traditional datasets, which may be smaller, have less variability, and may be updated less frequently.

The integration of digital tools into the financial sector also shows great potential through the use of Big Data. The key aspects that highlight the potential of Big Data in the financial sector are shown in Table 5.

No.	Aspect	Characteristics
1	Analytics and forecasting	Processing a large volume of financial data allows you to create detailed analytics and forecasting models. This helps you make more informed decisions about investments, risks, and financial planning
2	Risk assessment	Big Data enables financial institutions to identify and assess risks faster and more accurately. This helps to reduce the potential for financial losses and makes financial systems more resilient
3	Personalised financial services	Big Data analytics enables the creation of personalised financial solutions and services that meet individual customer needs
4	Preventing fraud and cybercrime	Big Data analysis helps to identify unusual and suspicious financial transactions, which helps to prevent fraud and cybercrime
5	Improving customer service	With the help of Big Data, financial institutions can better understand the needs and behaviour of customers, which will allow them to improve service and develop products that meet their requirements
6	Efficient asset portfolio management	Data analytics helps investment institutions better understand market trends and asset dynamics, enabling them to manage their portfolios more efficiently

According to 2020 data, 12.7% of enterprises in Ukraine were conducting "big data" analysis. Specifically, among large enterprises with more than 250 employees, 27.7% of them were engaged in such analysis, indicating a greater inclination and availability of resources for utilizing these technologies (Table 6).

Enterprise size	2020	2021	2022
With 10 to 49 persons employed	10.1	10.7	11.2
With 50 to 249 persons employed	20.6	22.4	26.5
With 250 or more persons employed	27.7	29.3	31.4

Among medium-sized enterprises (50 to 249 employees), these technologies were used by 26,5%, while among small enterprises (10 to 49 employees), only 11,2% utilized them.

According to the economic specifics in 2022, the highest share of enterprises employing "big data" analysis was observed in the following sectors: advertising, scientific and technical activities (24,2.6%), publishing and production of films and videos (23,4%), tourism (24,2%), and pharmaceutical production (23,8%) (Source: State Statistics Service of Ukraine (n.d.a))

The use of "big data" technologies has a significant advantage in the ability to process not only structured information (texts, tables, lists, etc.) but also unstructured data (schemes, drawings, content from social networks, websites, etc.). This enables enterprises to remain highly mobile and respond quickly to changing consumer needs (Table 7).

**Table 7. The share of enterprises conducting "big data" analysis by sources of "big data" in the years 2020-2022.** (Source: State Statistics Service of Ukraine (n.d.b))

Enterprise size	Data obtained from smart devices or sensors, %			Geolocation data obtained from portable devices, %			Data generated from social media, %		
	2020	2021	2022	2020	2021	2022	2020	2021	2022
With 10 to 49 persons employed	4,3	4,4	4,6	2,5	2,7	2,9	2,9	3,1	3,5
With 50 to 249 persons employed	9,2	9,7	10,2	5,7	6,1	6,3	4,4	4,7	5,2
With 250 or more persons employed	16,2	16,3	16,4	14,6	14,9	15,2	6,5	6,8	7,3

Across all enterprise sizes, there is a consistent growth in the percentage of those conducting "big data" analysis from smart devices or sensors from 2018 to 2020.

Similar to the trend in smart devices, there is an upward trajectory in the adoption of "big data" analysis using geolocation data from portable devices for enterprises of all sizes during the specified period.

The analysis of data generated from social media shows a continuous increase in adoption among enterprises from 2018 to 2020, with larger enterprises consistently having a higher percentage compared to smaller ones.

In summary, the overall trend suggests a positive inclination toward the integration of "big data" analysis across different sources, indicating a growing awareness and utilization of data-driven approaches among enterprises in Ukraine.

Thus, the use of Big Data in the financial sector can improve data-driven decisions, increase the security and efficiency of operations, and provide a more adaptive and personalised approach to customer service.

### **AI (Artificial Intelligence)**

Today, artificial intelligence is one of the most popular areas of research among scientists and practitioners. It acts as a key catalyst for the digital transformation of the economy and is becoming a necessary component of many organisations, both in public administration and the private sector (Pawełozsek et al., 2022). Artificial intelligence is one of the so-called "disruptive" technologies that form the basis of the Fourth Industrial Revolution. Its development can lead to a technological breakthrough for any country in different industries at the same time.

AI-based technologies are already widely used in many industries, leading to significant improvements in productivity, new product development, and a reduction in the number of routine tasks. Currently, AI is helping to improve the efficiency of government agencies, especially in the development of solutions aimed at ensuring the welfare of citizens.

It is worth noting that there is currently no single generally accepted definition of artificial intelligence. Kuzomko et al. (2021) note the three most common interpretations of this term:

1. Artificial intelligence explores methods of solving problems that usually require human understanding and develops ways to solve them using analogy, deduction, induction, and accumulates basic knowledge and skills to use them.
2. Artificial intelligence explores methods for solving problems for which other methods are not available or are too complex to be solved by other means.
3. Artificial intelligence is a system that can learn and may in the future replace intelligent systems based on human expertise.

Artificial intelligence is a technology that can perform complex tasks that require human intelligence. In addition, this technology has the potential to exceed human capabilities (Agarwal et al., 2020; Pandl et al., 2020).

Thanks to artificial intelligence, the integration of digital tools into the financial sector has great potential. The main aspects that highlight the potential of AI in the financial sector are grouped in Table 8.

Table 8. Key aspects that highlight the potential of artificial intelligence in the financial sector.		
No.	Aspect	Characteristics
1	Data analytics	AI can detect hidden connections and trends in large amounts of financial data, which helps to make better investment and risk decisions
2	Market forecasting	The use of AI allows for analysing market dynamics and forecasting future trends, which is useful for traders and investors
3	Process automation	AI can automate many financial operations, including payment processing, loan origination, and portfolio management
4	Fraud prevention	AI detects suspicious activity and can help prevent fraud and cybercrime in the financial sector in real-time
5	Personalised financial services	With the help of AI, financial institutions can provide personalised services to customers based on their individual needs and circumstances
6	Risk management	AI helps to identify risks and emergencies, enabling financial institutions to take timely action to manage them
7	Robotisation of intelligent assistants	The introduction of AI-powered intelligent assistants and chatbots simplifies communication with customers and provides them with access to information and services at any time

In other words, we can say that AI technologies open up new opportunities for financial services market players. They allow to reduce costs and provide remote access to financial services for more consumers, thus contributing to greater financial inclusion.

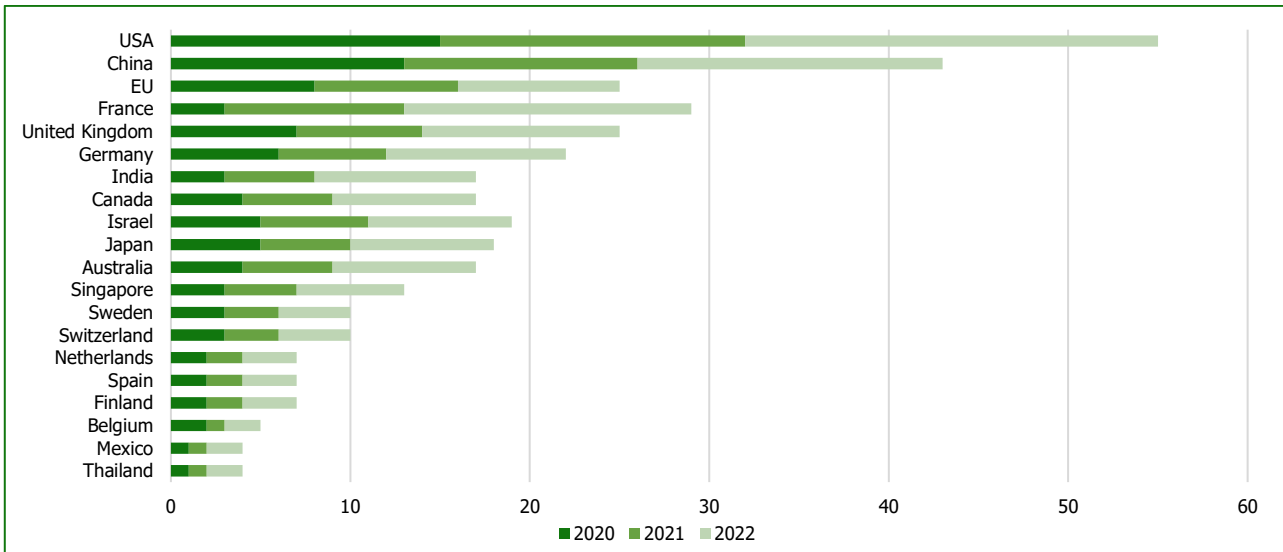
In addition, digital technologies are expanding opportunities in the financial sector for new entrants, such as mobile operators, e-commerce platforms, messengers, social networks, and other tech giants with large customer bases. This promotes competition and innovation in the financial sector, which can lead to improved accessibility and quality of financial services for all users (Yefremova, 2020).

At the same time, the use of artificial intelligence technologies in the financial services market may lead to various risks and challenges, including the following:

- misuse of data. Insufficient quality or misinterpretation of data can lead to incorrect financial decisions and strategies that can cause losses;
- Discrimination and bias. AI algorithms may exhibit bias or discrimination if the data they are trained on contains implicit biases. This can lead to the inaccessibility of financial services for certain groups of customers or non-compliance with fairness standards;
- anti-competitive behaviour. Some companies may use AI to create barriers to competitors or engage in anti-competitive behaviour that could harm the market and consumers;
- a system of governance and supervision of automated investment services and algorithmic trading. It is important to develop an effective supervisory and regulatory framework for automated investment services and trading in wholesale markets, as these technologies can lead to unpredictable market fluctuations and systemic risks;
- Liability. In the event of errors or accidents resulting from the use of AI technologies, it is important to define liability and the legal basis for compensation or litigation (Solovi & Horodyska, 2022).

The speed of development and implementation of AI primarily depends on the level of funding. The volume of state and private investments directed towards the development and implementation of AI in various countries worldwide during 2020-2022 can be observed in Figure 5.

According to the depiction in Figure 4, the United States, China, and European Union countries emerge as evident leaders in funding artificial intelligence. However, other countries also show significant interest in making substantial investments. Specifically, France, the United Kingdom, Germany, India, and Canada demonstrate signs of significant growth in funding for artificial intelligence.



**Figure 5. The amount of investments in the development and utilization of AI in individual countries worldwide for 2020-2022, USD million.** (Source: Bondarenko (2022))

In the competitive landscape, there is no single strategy, as each country focuses on different aspects of artificial intelligence. This includes research, talent and skill development, education, adaptation to the public and private sectors, ethics and inclusivity, creation of standards and regulatory requirements, as well as the development of data and digital technology infrastructure.

Understanding and addressing these risks is an important task for regulators, companies, and financial services professionals when implementing AI technologies to ensure market safety, efficiency, and fairness.

Thus, artificial intelligence can significantly improve the efficiency of financial transactions and make them more accurate and faster. However, it is important to take into account the ethical and legal aspects of using AI in the financial sector and ensure a high level of security and data protection.

At the same time, it should be noted that the financial instruments we have reviewed are not a complete list of digital tools that can currently improve the domestic financial sector. For example, crowdfunding is an example of the integration of digital tools into the financial sector, which allows raising funds through digital platforms and expanding opportunities for financial financing and investment (Tkachuk et al., 2022).

Thus, the modern world is constantly moving forward, and so is Ukraine's business environment. The transformation of business organisational forms and the gradual transition to network models is an evolutionary process that reflects the new reality of modern business (Dykan et al., 2021). In this context, the integration of digital tools into the financial sector plays a key role. The use of advanced technologies, such as cloud computing, blockchain, big data, and artificial intelligence, not only increases the efficiency and competitiveness of financial institutions but also helps them adapt to the requirements of the modern digital world.

## DISCUSSION

The study shows that the use of digital tools in the financial sector is a key factor in improving the efficiency and competitiveness of financial institutions. This conclusion is similar to the data presented in studies (Bezrukova et al., 2022; Rubtsova, 2020) in the area of digital transformation of the financial sector.

The integration of digital tools into the financial sector opens up endless opportunities to improve and optimise financial services. One of the key technologies that is revolutionising the financial sector is Cloud Computing. Studies (Rubtsova, 2020; Oyewole & Adegbite, 2023; Stamford, 2017) confirm that the use of cloud technologies allows financial institutions to increase scale, reduce IT infrastructure costs, and improve data processing efficiency.

Cloud computing is having a significant impact on the financial sector, enabling greater scale and lower IT infrastructure costs. However, it also creates new challenges in terms of cybersecurity and data privacy. Making the best use of cloud computing requires financial institutions to closely monitor and protect information.



Big Data plays an important role in financial analytics and decision-making. Processing and analysing large amounts of data allows us to identify trends, risks, and opportunities earlier than a human can. The conclusion that Big Data will contribute to more accurate forecasting and mitigation of financial risks is also confirmed by the results of Burkina (2019).

Big Data is important for financial analytics and risk management, but its processing and analysis require powerful computing resources and algorithms. It is also important to consider privacy and regulatory compliance issues when working with large volumes of financial data.

Blockchain, or distributed ledger technology, is transforming the way assets are exchanged and financial transactions are conducted. Research studies by Kraus et al. (2022), Karcheva and Karcheva (2017), Stashchuk et al. (2022), Yushchenko (2018), and Oyewole and Adegbite (2023) support the conclusion that this technology provides security, reliability, and transparency of transactions, and allows for the creation of smart contracts that automate the execution of transactions.

Artificial intelligence (AI) is used to automate portfolio management, customer service, and fraud detection processes. An analysis of studies by Yefremova (2020), Kuzomko et al. (2021), Solovi and Horodyska (2022), and Oyewole and Adegbite (2023) supports the conclusion that machine learning helps analyse data and make predictions, which is important for financial decisions.

Artificial intelligence is one of the main catalysts for industrial development, as it facilitates the integration of new technologies within the Fourth Industrial Revolution (IR 4.0) (Goodell et al., 2021; Lim, 2019; Zhang et al., 2021; Kumar et al., 2023), such as blockchain (Ehrenberg & King, 2020), cryptocurrency (Li & Whinston, 2020), cloud computing (Hsu, 2020), and the Internet of Things (IoT) (Ghaleb et al., 2021).

In addition, it can be argued that digital technologies can expand the availability of financial services and increase financial inclusion. This conclusion is supported by the data presented in Yefremova's (2020) study, which examined the specifics of artificial intelligence in financial services.

Thus, AI plays a key role in the financial sector, helping to automate portfolio management, customer service, and fraud detection. The use of machine learning in financial analysis can provide more accurate forecasts and facilitate decision-making processes. However, it is important to consider ethical aspects and data privacy when implementing AI in the financial sector.

Blockchain and artificial intelligence are considered to be revolutionary technologies, the integration of which is quite promising for solving various problems, including those in the financial sector (Sadri et al., 2023).

Artificial intelligence "and blockchain are key technologies that are driving the wave of digital transformation. The convergence of both of these technologies can improve current business practices and introduce new business models that can act as independent economic entities that make their own decisions" (Kumar et al., 2023). Blockchain can increase transparency, trust, confidentiality, and security of business processes (Mao et al., 2018), while AI can detect patterns in data and optimise business practices (Salah et al., 2019). Both of these technologies are complementary, and their true potential can only be unlocked if they are integrated (Sandner et al., 2020).

"When AI and blockchain are used in isolation, they can cause a number of problems. On the one hand, AI has its own challenges, such as reliability, privacy, and explainability. On the other hand, blockchain also has its drawbacks, such as security and scalability. Combining these two technologies can help overcome these challenges and benefit businesses through secure data exchange and business process automation" (Kumar et al., 2023; Sandner et al., 2020).

Blockchain can effectively combat business fraud due to its reliability, and artificial intelligence, in turn, can create data classifiers and filters that allow authenticating processes and users in the decentralised blockchain infrastructure (Salah et al., 2019).

The combination of artificial intelligence and blockchain has enormous potential to create new business models through digitalisation (Kumar et al., 2023).

This study also found evidence that the use of artificial intelligence and other digital technologies in the financial sector can lead to various risks and challenges. The same conclusion was reached by Semenog (2020), Rubanov (2019), and Kholiavko (2021), who emphasise the importance of ethical and legal regulation of the use of these technologies to ensure safety and fairness in the financial services market.

Thus, the integration of these technologies into the financial sector has undoubted potential to improve efficiency and competitiveness but requires careful risk management, security, and compliance with ethical and legal standards.

Therefore, based on the analysis of scholarly works, we have concluded that financial technologies are innovative solutions that leverage digital technologies to provide financial services. They open up new opportunities and transform the financial sector, offering more efficient and accessible financial solutions for users. In contrast, digital transformation is the process of integrating new and emerging digital technologies into all aspects of business. The goal is to leverage the advantages of these technologies to improve the safety and working conditions of employees, work efficiency, flexibility, and business management.

In our opinion, the integration of artificial intelligence and blockchain has significant potential to address issues and create new business models in the financial sector. In this regard, we align with the findings of Bezrukova et al. (2022) and Rubtsova (2020) and conclude that the use of digital tools in the financial sector is arguably the most critical factor in enhancing the efficiency and competitiveness of financial institutions.

### ***Limitations of the Study***

The limitations of this study can be seen in the context of several key circumstances:

1. *A limited sample of sources.* It is important to note that the sample of sources is limited to 45 sources. This limitation may affect the completeness and relevance of the information presented in the study. Other sources and studies may contain additional important information that was not taken into account in our research. It should be noted that there is a risk of omission of important information or insufficient representation of different points of view.
2. *Dynamics of digital technologies.* It is worth remembering that digital technologies are constantly evolving. As the financial services market is very dynamic, new innovations and solutions appear quite quickly. This means that a study can quickly become outdated and not take into account the latest trends and developments in digital technologies in the financial sector.
3. *Limited space.* The scope of the text limits the depth of the analysis of each of the technologies discussed and their impact on the financial sector. A detailed consideration of each aspect may require more information and discussion.
4. *The global nature of the financial sector.* Finally, given the global nature of the financial sector, the study may not take into account contextual differences and specificities across countries and regions. This may limit the universality of the findings and their applicability across geographical areas.

Given all these limitations, it is important to pay particular attention to the relevance and validity of the data and findings and to consider their context when interpreting them. It is important to consider these limitations as part of the overall context of the study and to understand that they may affect the validity and overall significance of the results.

## **CONCLUSIONS**

The integration of digital tools into the financial sector has great potential to transform and improve financial services. One of the key components of this integration is the use of Cloud Computing. This allows financial institutions to store and process large amounts of data, ensuring high availability and scalability. Blockchain, as a distributed ledger technology, ensures the security and reliability of financial transactions, reducing the risk of manipulation and fraud. It also helps to improve the efficiency of internal audit processes and reduce the cost of intermediary services. Big Data opens up opportunities for analysing large volumes of data, enabling financial institutions to gain valuable insights into market trends, risks, and their asset management portfolios. They can improve their strategies and make more informed decisions. Artificial intelligence helps automate a number of financial processes, including customer credit assessment, risk analysis, and customer service. AI is also used to detect anomalies and fraud, which makes financial transactions more secure and reliable.

The key trends in the world of financial technologies indicate that digital tools are already reshaping the landscape of the financial sector. However, there are some challenges and issues that should be taken into account.

1. The increasing volume of data processing and storage poses a higher risk of confidentiality and security breaches.
2. The lack of a unified regulatory framework for blockchain applications in the financial sector may hinder its development.
3. Some countries adopt fintech innovations more quickly, leading to global disparities.
4. The absence of clear regulations can impede innovation and lead to legal collisions.

To address these issues in Ukraine and globally, we believe the following steps should be taken:

1. Develop and implement clear regulations to safeguard data confidentiality and ensure cybersecurity.
2. Participate in international initiatives and collaborate with other countries to develop standards.
3. Promote the development of technical skills and scientific research to ensure competitiveness in the digital era.
4. Ensure equal access to fintech tools and technologies in all regions.
5. Engage in dialogue with international and local regulators to develop flexible rules that consider the innovative nature of fintech projects.

In our opinion, these steps will help create a more secure, efficient, and resilient financial environment that takes into account the challenges and opportunities brought by digital innovations. Ukraine can take the initiative in this direction, considering its unique needs and capabilities.

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## ADDITIONAL INFORMATION

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### AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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### CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

## REFERENCES

1. Agarwal, Y., Jain, M., Sinha, S., & Dhir, S. (2020). Delivering high-tech, AI-based health care at Apollo Hospitals. *Global Business and Organizational Excellence*, 39(2), 20–30. <https://doi.org/10.1002/joe.21981>
2. Barabash, Yu. (2021, November 12). *Managing the digital: How different countries implement FinTech solutions. And what prospects does Ukraine have in this area*. Mind.ua. <https://mind.ua/openmind/20233048-keruvati-cifroyu-yakrizni-krayini-vprovadzhuvt-finteh-rishennya>
3. Bezrukova, N., Huk, L., Chmil, H., Verbivska, L., Komchatnykh, O., & Kozlovskiy, Y. (2022). Digitalization as a trend of modern development of the world economy. *WSEAS Transactions on Environment and Development*, 18, 120–129. <https://doi.org/10.37394/232015.2022.18.13>
4. Bondarenko, O. V. (2022). Artificial intelligence in the world: Problems and development prospects. *Scientific Bulletin of Chernivtsi University. Series: Economics and Management*, 307(1), 23–28.
5. Borysova, L. E. (2019). Shliakhy intehratsii tsyfrovikh tekhnolohii u vitchnianu bankivsku systemu. In *Problemnii aspekti funktsionuvannya finansovoi sistemi Ukraini v umovakh destabilizatsiinih protsesiv* (pp. 11–14). Odesa Institute of Trade and Economics of Kyiv National University of Trade and Economics. <http://dspace.onu.edu.ua:8080/handle/123456789/26195>
6. Bozhkova, V., & Halysia, I. (2022). Mechanisms to ensure the development of the economy of the future in the context of global change. *Futurity Economics & Law*, 2(2), 4–13. <https://doi.org/10.57125/FEL.2022.06.25.01>
7. Burkina, N. V. (2019) Osoblivosti vikoristannya Big Data v umovakh tsifrovoi yekonomiki. *Strategichni prioriteti transformatsii yekonomiki v umovakh tsifrovizatsii* (pp. 48–51). FOP Mokshanov V. V. [https://zp.edu.ua/uploads/dept\\_s&r/2019/conf/8/Materialy\\_MNPK\\_SPTeVUTs\\_NUJP.pdf](https://zp.edu.ua/uploads/dept_s&r/2019/conf/8/Materialy_MNPK_SPTeVUTs_NUJP.pdf)
8. Dudinets, L. A. (2018). Rozvitok finansovikh tekhnologii yak faktor modernizatsii finansovoi sistemi. *Global and National Problems of Economy*, 22, 794–798. <http://global-national.in.ua/archive/22-2018/149.pdf>
9. Dykan, V., Pakharenko, O., Saienko, V., Skomorovskyi, A., & Neskuba, T. (2021). Evaluating the efficiency of the synergistic effect in the business network. *Journal of Eastern European and Central Asian Research*, 8(1), 51–61. <https://doi.org/10.15549/jeeecar.v8i1.646>
10. Ehrenberg, A. J., & King, J. L. (2022). Blockchain in context. *Information Systems Frontiers*, 22(1), 29–35. <https://doi.org/10.1007/s10796-019-09946-6>
11. Ghaleb, T. A., da Costa, D. A., & Zou, Y. (2021). On the popularity of internet of things projects in online communities. *Information Systems Frontiers*, 24, 1601–1634. <https://doi.org/10.1007/s10796-021-10157-1>
12. Goodell, J., Kumar, S., Lim, W., & Pattnaik, D. (2021). Artificial intelligence and machine learning in finance: Identifying foundations, themes, and research clusters from

- bibliometric analysis. *Journal of Behavioral and Experimental Finance*, 32, Article 100577. <https://doi.org/10.1016/j.jbef.2021.100577>.
13. Hsu, P. F. (2020). A deeper look at cloud adoption trajectory and dilemma. *Information Systems Frontiers*, 24, 177–194. <https://doi.org/10.1007/s10796-020-10049-w>
  14. Karcheva, G. T., & Karcheva, I. Ya. (2017). Innovatsiini blokchein-tehnologii yak faktor pidvishchennya yefektivnosti finansovoi sferi ta yekonomiki. *RFI Scientific Papers*, 4(81), 39–42. [http://nbuv.gov.ua/UJRN/Npndfi\\_2017\\_4\\_10](http://nbuv.gov.ua/UJRN/Npndfi_2017_4_10)
  15. Kholiavko, N. I. (2021). Suchasni informatsiini tehnologii v roboti finansovikh ustanov. *Business Inform*, 5, 152–161. <https://doi.org/10.32983/2222-4459-2021-5-152-161>
  16. KPMG. (2023, February). *Pulse of FinTech H2'22: Global analysis of FinTech investment*. <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2023/02/pulse-of-fintech-h2-22-web-file.pdf>
  17. Kraus, K. M., Kraus, N. M., & Manzhura O. V. (2022). Blockchain yak novitnii finansovyi instytut: Protsesy, stratehii, tehnologii ta praktyka zastosuvannia v umovakh tsyfrovizatsii ekonomiky. *Efektivna Ekonomika*, 1. <http://www.economy.nayka.com.ua/?op=1&z=9883>
  18. Kumar, S., Lim, W. M., Sivarajah, U., & Kaur, J. (2023). Artificial intelligence and blockchain integration in business: Trends from a bibliometric-content analysis. *Information Systems Frontiers*, 25(2), 871–896. <https://doi.org/10.1007/s10796-022-10279-0>
  19. Kuzomko, V., Buranholova, V., & Buranholova, V. (2021). Mozhlyvosti vykorystannia shtuchnoho intelektu v diialnosti suchasnykh pidpriemstv. *Economy and Society*, 32. <https://doi.org/10.32782/2524-0072/2021-32-67>
  20. OECD. (2018). *Financial markets, insurance and private pensions: Digitalisation and finance*. <https://www.oecd.org/finance/private-pensions/Financial-markets-insurance-pensions-digitalisation-and-finance.pdf>
  21. Lee, I., & Shin, Y. J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. *Business horizons*, 61(1), 35–46. <https://doi.org/10.1016/j.bushor.2017.09.003>
  22. Li, X., & Whinston, A. (2020). Analyzing cryptocurrencies. *Information Systems Frontiers*, 22(1), 17–22. <https://doi.org/10.1007/s10796-019-09966-2>
  23. Li, X., Wu, L., Zhao, R. Lu, W., & Xue, F. (2021). Two-layer Adaptive Blockchain-based Supervision model for off-site modular housing production. *Computers in Industry*, 128, Article 103437. <https://doi.org/10.1016/j.compind.2021.103437>
  24. Lim, W. M. (2019). To what degree is the Fourth Industrial Revolution an opportunity or a threat for the ASEAN community and region?. *Modern Applied Science*, 13(9), 105–106. <https://doi.org/10.5539/mas.v13n9p105>
  25. Mao, D., Wang, F., Hao, Z., & Li, H. (2018). Credit evaluation system based on blockchain for multiple stakeholders in the food supply chain. *International Journal of Environmental Research and Public Health*, 15(8), Article 1627. <https://doi.org/10.3390/ijerph15081627>
  26. Otonne, A., Melikam, W., & Ige, O. T. (2023). Adoption of financial technology and performance of deposit money banks in Nigeria. *Futurity Economics & Law*, 3(2), 95–114. <https://doi.org/10.57125/FEL.2023.06.25.07>
  27. Oyewole, A. & Adegbite, M. (2023, June 22). *The impact of Artificial Intelligence (AI), Blockchain, Cloud Computing and Data Analytics on the future of the Fintech Industry in the US*. SSRN. <http://dx.doi.org/10.2139/ssrn.4487815>
  28. Pandl, K., Thiebes, S., Schmidt-Kraepelin, M., & Sunyaev, A. (2020). On the convergence of artificial intelligence and distributed ledger technology: A scoping review and future research agenda. *IEEE Access*, 8, 57075–57095. <https://doi.org/10.1109/ACCESS.2020.2981447>
  29. Pawełoszek, I., Kumar, N., & Solanki, U. (2022). Artificial intelligence, digital technologies and the future of law. *Futurity Economics & Law*, 2(2), 22–32. <https://doi.org/10.57125/FEL.2022.06.25.03>
  30. Pestovska, Z. S. (2021). (R)evoliutsiia bankinhu: Dyskusii ta perspektyvy. *Academy review*, 1(54), 37–47. <https://doi.org/10.32342/2074-5354-2021-1-54-4>
  31. Petruk, O. M., Burtsev, Ya. I., Zashchipas, S. M., & Popov, O. G. (2023). Fintekh yak poniattia funktsionalnoi ekonomichnoi nauky. *Problems of Theory and Methodology of Accounting, Control and Analysis*, 3(53), 48–53. [https://doi.org/10.26642/pbo-2022-3\(53\)-48-53](https://doi.org/10.26642/pbo-2022-3(53)-48-53)
  32. Rubanov, P. M. (2019). Analiz sutnosti FinTech innovatsii. *Herald of Khmelnytskyi National University*, 2(4), 73–76. <https://doi.org/10.31891/2307-5740-2019-272-4-2-73-76>
  33. Rubtsova, M. Yu. (2020). Khmarni tehnologii yak instrument pohlyblennia virtualizatsii finansovoho sektoru. *Efektivna Ekonomika*, 5. <https://doi.org/10.32702/2307-2105-2020.5.110>
  34. Sadri, H., Yitmen, I., Tagliabue, L. C., Westphal, F., Tezel, A., Taheri, A., & Sibenik, G. (2023). Integration of blockchain and digital twins in the smart built environment adopting disruptive technologies – A systematic review. *Sustainability*, 15(4), Article 3713. <https://doi.org/10.3390/su15043713>
  35. Salah, K., Rehman, M., Nizamuddin, N., & Al-Fuqaha, A. (2019). Blockchain for AI: Review and open research challenges. *IEEE Access*, 7, 10127–10149. <https://doi.org/10.1109/ACCESS.2018.2890507>
  36. Sandner, P., Gross, J., & Richter, R. (2020). Convergence of blockchain, IoT, and AI. *Frontiers in Blockchain*, 3, 522600. <https://doi.org/10.3389/fbloc.2020.522600>
  37. Schueffel, P. (2016). Taming the beast: A scientific definition of fintech. *Journal of Innovation Management*, 4(4), 32–54. [https://doi.org/10.24840/2183-0606\\_004.004\\_0004](https://doi.org/10.24840/2183-0606_004.004_0004)
  38. Semenog, A. Yu. (2020). Tsyfrovii tehnologii v umovakh formuvannia tsyfrovoy ekonomiky. *Scientific Notes of Ostroh Academy National University, "Economics" Series*, 19(47), 20–28. [https://doi.org/10.25264/2311-5149-2020-19\(47\)-20-28](https://doi.org/10.25264/2311-5149-2020-19(47)-20-28)

39. Semenog, A. Yu., Krivich, Ya. M., & Tsirulik S. V. (2018). FinTech-posluhy: Sutnist, rol i znachennia dlia ekonomiky krainy. *Odessa National University Herald. Economy*, 23(2(67)), 100–105. [http://www.visnyk-onu.od.ua/journal/2018\\_23\\_2/22.pdf](http://www.visnyk-onu.od.ua/journal/2018_23_2/22.pdf)
40. Shkarlet, S. M., Dubyna, M. V., & Zhuk, O. S. (2019). Teoretichni aspekty viznachennya sutnosti kategorii «FinTech». *Scientific Bulletin of Polissia*, 1(17), 148–157. <http://nvp.stu.cn.ua/article/view/179902>
41. Solovii, Kh., & Horodyska, N. (2022). Viktorystannya shtuchnogo intelektu u sferi finansovikh poslug. *Filosofski vimiri tekhniki [Philosophical dimensions of technology]*, (pp. 87–89). Ternopil Ivan Puluj National Technical University. <http://elartu.tntu.edu.ua/handle/lib/39709>
42. Stamford, C. (2017, February 22). *Gartner says worldwide public cloud services market to grow 18 percent in 2017*. Gartner, Inc. <https://www.gartner.com/en/newsroom/press-releases/2017-02-22-gartner-says-worldwide-public-cloud-services-market-to-grow-18-percent-in-2017>
43. Stashchuk, O., Teslyuk, S., & Kuzmich, I. (2022). Perspektyvy vykorystannia tekhnologii blokchein u finansovomu sektori. *Economy and Society*, 40. <https://economyandsociety.in.ua/index.php/journal/article/view/1562>
44. State Statistics Service of Ukraine. (n.d.a). *Use of information and communication technologies at enterprises: e-Commerce, analysis of "big data", experts and skills in the field of ICT, use of 3D printing*. <https://ukrstat.gov.ua>
45. State Statistics Service of Ukraine. (n.d.b). *Use of information and communication technologies at enterprises: use of the Internet, cloud computing services, robotics*. <https://ukrstat.gov.ua>
46. Tkachuk, S., Vidomenko, O., Levchenko, Y., Zhuzhukina, N., & Lukianykhin, V. (2022). Features and economics of electronic crowdfunding in the face of global challenges. *Futurity Economics & Law*, 2(4), 12–22. <https://doi.org/10.57125/FEL.2022.12.25.02>
47. UAFIC. (2022). *Catalog of FinTech companies of Ukraine 2021*. <https://drive.google.com/file/d/1muA2397xKPsBQEM86Ws8fTame-3jplif/view>
48. UNIT.City. (2018). Fintech in Ukraine: Trends, market overview and catalogue. [http://www.fst-ua.info/wp-content/uploads/2019/02/FinTech\\_Catalogue\\_feb2018\\_en\\_ua.pdf](http://www.fst-ua.info/wp-content/uploads/2019/02/FinTech_Catalogue_feb2018_en_ua.pdf)
49. Unynets-Khodakivska, V.P. (2022). Tsifrova transformatsiya rinku finansovikh poslug v konteksti rozvitku fintech-industrii. *Naukovi perspektivi*, 10(28), 208–218. [https://doi.org/10.52058/2708-7530-2022-10\(28\)-208-218](https://doi.org/10.52058/2708-7530-2022-10(28)-208-218)
50. Yefremova, K. (2020). Osoblyvosti zastosuvannia shtuchnogo intelektu u sferi finansovykh poslug: dosvid YeS. *Law and Innovation Society*, 1(14), 66–71. <https://openarchive.nure.ua/handle/document/16389>
51. Yushchenko, N. L. (2018). Rozvitok blokchein-tekhnologii v Ukraini ta sviti. *Economy and Society*, 19, 269–275. [https://economyandsociety.in.ua/journals/19\\_ukr/40.pdf](https://economyandsociety.in.ua/journals/19_ukr/40.pdf)
52. Zhang, C., Chen, Y., Chen, H., & Chong, D. (2021). Industry 4.0 and its implementation: A review. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-021-10153-5>

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## ІНТЕГРАЦІЯ ЦИФРОВИХ ЗАСОБІВ У ФІНАНСОВУ СФЕРУ: ПОТЕНЦІАЛ CLOUD COMPUTING, BLOCKCHAIN, BIG DATA Й AI

Інтеграція цифрових засобів у фінансову сферу в наш час – це не просто необхідність, але й стратегічний крок, який визначає подальший розвиток цієї галузі. Сучасний світ фінансів робить ставки на високі технології, а саме на такі ключові напрями, як Cloud Computing, Blockchain, Big Data та Artificial Intelligence. Метою статті є проведення системного аналізу потенціалу технологій Cloud Computing, Blockchain, Big Data й Artificial Intelligence у контексті їхнього впливу на фінансову сферу. Об'єктом дослідження є фінансова сфера, яка включає банківську діяльність, інвестиційний сектор, страхування та інші складові галузі, що взаємодіють із фінансами. У ході проведеного дослідження розглянуто переваги та недоліки інтеграції цифрових засобів у фінансову сферу; досліджено потенціал використання Cloud Computing, Blockchain, Big Data й Artificial Intelligence у фінансовій сфері; встановлено, що всі ці технології вже зараз змінюють фінансову сферу та мають великий потенціал для подальшого розвитку. Тому інтеграція цих цифрових засобів у фінансову сферу є необхідністю й ключовим напрямом для подальшого розвитку та модернізації галузі.

Проблеми впровадження нових технологій у фінансовий сектор включають відсутність єдиної регуляторної рамки, високі витрати на перехід до цифрових платформ та опір із боку традиційних гравців. Ці проблеми можна вирішити шляхом створення чітких нормативів, фінансової підтримки для компаній, що переходять до цифрових технологій, та сприяння партнерству між інноваційними стартапами й великими фінансовими установами для спільного розвитку та впровадження технологічних рішень.

**Ключові слова:** фінансова індустрія, інновації у фінансовому секторі, інновації у фінансах, цифрова трансформація фінансів, інтеграція технологій

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