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INFORMATION SYSTEMS IN FINANCE: CHALLENGES AND PERSPECTIVES

Олена Галушко, Геннадій Чобану. ІНФОРМАЦІЙНІ СИСТЕМИ У ФІНАНСАХ: ВИКЛИКИ ТА ПЕРСПЕКТИВИ. Інформаційні системи у фінансах відіграють ключову роль у забезпеченні ефективного управління фінансовими процесами, прийнятті стратегічних рішень та забезпеченні конкурентоспроможності фінансових установ. Вони дозволяють збирати, обробляти, аналізувати та використовувати великі обсяги даних для прийняття обґрунтованих рішень.

З розвитком штучного інтелекту та аналізу великих даних інформаційні системи у фінансах стають все більш потужними і здатними до прогнозування та оптимізації фінансових процесів. Одним із викликів, який стоїть перед інформаційними системами у фінансах, є необхідність забезпечення високого рівня кібербезпеки. Тому інформаційні системи повинні бути надійно захищені від кіберзагроз шляхом використання сучасних методів шифрування та моніторингу безпеки. Іншим важливим аспектом є потреба в постійному оновленні та модернізації інформаційних систем у фінансах для забезпечення їх ефективності та відповідності сучасним технологічним стандартам.

В майбутньому інформаційні системи у фінансах можуть стати ключовим інструментом для побудови цифрових фінансових екосистем, які сприятимуть розвитку нових фінансових послуг та покращенню їх доступності.

Ключові слова: *інформаційні системи, управління фінансами, фінтех, кібербезпека, фінансова екосистема.*

Relevance of the study. Economic and financial processes are closely related to digital solutions, the active development of which began in the 1980^{s} and 1990^{s}. Currently, digital technologies are penetrating all spheres of business and social life, and this has led to the intensification of information and financial flows, increased efficiency, increased competitiveness and the creation of new opportunities for development. The beginning of active digitization of the economy can be attributed to the end of the 20th century, when computers and the Internet became widely available for use. Financial information systems began to develop with the advent of the first computers in the middle of the 20th century. At the beginning of their development, they were focused on automation of accounting and processing of primary accounting information. However, with the development of technology and the emergence of new data processing methods, financial information systems have become increasingly complex and more functional [1].

The development of ERP-systems made it possible to integrate financial management into a full-fledged multifunctional system of automated enterprise management. With the development of the Internet and the emergence of cloud technologies, financial information systems have become more accessible and flexible. They are now widely used in all areas of business to automate financial processes, risk management, data analysis and strategic decision

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making. Thus, the development of financial information systems went from simple automated accounting systems to complex integrated ERP systems that play an important role in modern business. The further direction of the development of financial information systems is the transition to financial ecosystems that combine various financial institutions, technologies and services. Such ecosystems provide effective interaction between financial market participants, contributing to the development of innovations and improving the availability of financial services. Therefore, the development of financial ecosystems is important for ensuring sustainable economic growth of the state, but it is necessary to ensure adequate regulatory control and risk management to prevent possible negative consequences.

Recent publications review. Research on financial information systems was carried out, on the one hand, by economists and financiers, who considered the issue from the point of management and finance [2-5]. And also by scientists in the field of computer sciences, who paid the attention to the technical solutions for management and finance automation [6].

The issues of using software products in the work of a professional financial analyst are considered in the works of V. Sytnyk and N. Yeromin. V. Antonyuk, A. Oliynyk, I. Rogach, N. Kholyavko, V. Shatska and others studied the theoretical and practical aspects of the formation of banking information systems. I. Androschuk, G. Karpenko, V. Krotyuk, S. Naumenkova, I. Shumylo and others made a significant contribution to the development of the theoretical and methodological foundations of financial innovations. The works of S. Ustenko, S. Ramazanov, V. Vovk, P. Hryhoruk and others are devoted to the issue of information technologies and management systems [6]. But interdisciplinary issues that combine financial and managerial and technical components require further consideration.

The article's objective is to discuss the perspectives of financial information systems development, their impact on economy, and related issues of data protection, big data analysis etc.

Discussion. Information systems in finance are becoming increasingly important in today's world, where the speed of data processing and the accuracy of information are crucial for the successful functioning of financial institutions and companies. A financial information system (FIS) is a set of software and hardware that is designed to collect, process, analyze and present financial information about the activities of an organization. FIS includes accounting systems, budgeting, financial analysis, planning, reporting and other tools necessary to effectively manage a company's finances. The main objective of a financial information system is to ensure the accuracy, timeliness and reliability of financial reporting, as well as to assist management in making informed financial decisions [1-3].

A financial information system (FIS) plays an important role in managing a company's finances by ensuring the accuracy and reliability of financial reporting, automating accounting and data analysis processes, and increasing the efficiency of management decisions. It helps businesses make informed financial decisions, improve budgeting, optimize capital and risk management, and comply with legal requirements and reporting standards. Financial information systems can be customized to meet a company's specific needs and integrated with other business applications to provide a unified information environment.

Financial information systems have common features underlying the construction and use of automated management systems:

1) FIS are developed in order to ensure effective management of financial resources and optimization of financial processes.

2) FIS combine data from various sources and allow them to be integrated to obtain a complete picture of the financial situation.

3) FIS help to automate many routine financial operations, which allows you to work faster, more efficiently and reduce the likelihood of errors.

4) FIS provide opportunities for financial data analysis, reporting and forecasting of financial results.

5) FIS have a high level of protection of confidential information and ensure compliance with data protection requirements.

6) FIS must be ready to scale so that they can cope with the growth in the volume of financial transactions and user needs.

7) It is important that the FIS interface is convenient and understandable for users, which contributes to quick learning and effective use of the system.

8) FIS need constant updating and improvement to meet modern requirements and technological trends.

Financial information systems typically include components of Controlling, Financial Accounting, Fund management. But it's configuration depends from class it belongs. FIS can be classified according to various criteria, such as [1-4, 6]:

1) By functionality:

– Accounting systems (accounting and tax accounting, financial accounting);

– Management accounting systems (budgeting, planning, analysis);

– Reporting and analytics systems;

– Financial management systems (financial planning, cash management, accounts receivable and payable management);

– Market forecasting systems.

2) By scale of application:

– Corporate financial information systems for big companies;

– Small and medium financial information systems for small businesses;

– Cloud financial information systems for remote work and data sharing.

3) By industry:

– Financial information systems for the banking sector;

– Financial information systems for insurance companies;

– Financial information systems for manufacturing enterprises;

– Financial information systems for retail trade;

– Financial information systems for the stock market.

4) By data type:

– Financial information systems for accounting of funds and transactions;

– Financial information systems for accounting of assets and liabilities;

– Financial information systems for analyzing financial indicators.

5) By data access method:

– Local financial information systems installed and maintained on the organization's computers;

– Cloud financial information systems provided via the Internet and storing data on remote servers;

– Hybrid financial information systems combining local and cloud data storage.

6) On integration with other systems:

– Standard financial information systems operating separately from other systems;

– Integrated financial information systems that interact with other accounting and management systems.

7) By technology platform:

– Financial information systems developed on the basis of certain technologies (for example, ERP systems);

– Financial information systems based on open and free technologies (Linux);

– Financial information systems developed for a specific operating system (Windows, macOS).

The presented classification methods help to understand the diversity of financial information systems.

The key advantage of financial information systems is not only the automation of processes, but the processing and analysis of big data that is stored in finance. Processing big data in financial information systems can be complex and require several specific steps. Big data often requires the use of machine learning algorithms to identify patterns, predict trends, and make management decisions. Financial information systems using big data analysis and artificial intelligence are most developed in the following segments of the financial market [6-8]. Banks and investment companies actively use financial information systems to analyze market data, forecast trends in the stock market, optimize asset portfolios and risk management. Insurance companies use analytical systems to assess risks, determine tariffs, build models of insurance products and detect fraudsters. Stock market exchanges and stock brokers use artificial intelligence algorithms to automate trading, analyze market data and predict price movements. Financial analysts and consultants use big data analysis systems to conduct fundamental and technical analysis, assess the financial stability of companies and forecast their financial results. E-commerce companies use customer data, shopping analytics and other information to personalize services, forecast demand and manage inventory. Funds and other financial institutions that manage clients' assets use information systems to optimize portfolio management, risk management and profitability forecasting. In these segments of the

financial market, artificial intelligence and big data analytics capabilities help improve decision-making, reduce risk, and optimize financial performance.

The transition from financial information systems to financial ecosystems can occur gradually and include several key stages. The first step is the integration of the financial information system with various external services, such as banking systems, payment platforms, fintech startups, etc. This allows you to expand the functionality of the system and gain access to new features. To build a financial ecosystem, it is important to develop an API (Application Programming Interface) to simplify and standardize data exchange between various applications and services. This allows to integrate new applications and services into the ecosystem easily and quickly. Forming partnerships with other companies and service providers can help expand the functionality of the financial ecosystem and empower users.

For a successful transition to financial ecosystems, it is important to adopt new technologies such as artificial intelligence, blockchain, big data analytics, etc. This will help improve the efficiency and security of the ecosystem. The transition to financial ecosystems also involves ensuring a high level of security and privacy of user data. This may include the use of encryption, two-factor authentication, security auditing, and more. For the successful development of the financial ecosystem, it is important to involve users and third-party developers to create new applications and services that will expand the functionality and value of the ecosystem. This process can be complex and sometimes take a certain transition period, but as a result, it allows you to create a powerful and innovative financial ecosystem that meets the needs of users and businesses.

Blockchain-based financial information systems open up new opportunities to ensure security, transparency and efficiency of financial transactions. Blockchain is a distributed database that provides security and immutability for changes to data recorded in blocks. The main advantages of blockchain technology in financial systems are: blockchain provides a high level of data security and protection thanks to cryptographic encryption methods and a distributed structure; all transactions in the blockchain are publicly available and inviolable, allowing for a high level of transparency and trust; blockchain allows to perform financial transactions quickly and efficiently, minimizing the time and costs of conducting transactions.

The following are examples of financial information systems based on blockchain technology.

Ripple (XRP) – Ripple is a payment network that uses blockchain to conduct real-time customs payments. The Ripple system allows banks and financial institutions to efficiently exchange money and make customs payments directly through the blockchain.

Stellar (XLM) – Stellar is a blockchain platform that aims to facilitate international money transfers and currency exchanges. The Stellar system allows users to make money transfers quickly and cost-effectively through the blockchain.

Ethereum (ETH) – Ethereum is a decentralized platform for creating smart contracts and applications on the blockchain. Ethereum uses the technology of "smart contracts", which allows you to automate the execution of agreements and operations without intermediaries.

Financial ecosystems are complex systems that combine various financial institutions, technologies and services. These ecosystems enable effective interaction between financial market participants, contributing to the development of innovations and improving the availability of financial services.

Financial ecosystems can significantly influence the economy of the state, providing quick access to financial services for businesses and citizens. For example, the introduction of digital payment systems and online banking helps to reduce transaction costs and accelerate the circulation of funds, which contributes to the growth of the economy. One example of a successful financial ecosystem is the Chinese payment system Alipay, which combines an electronic wallet, payment services, lending and other financial services. Alipay has become an integral part of Chinese people’s lives, promoting the development of e-commerce and providing convenient access to financial services.

Financial ecosystems can also facilitate the development of small and medium-sized enterprises by providing access to financing through alternative sources such as crowdfunding or capital exchange platforms. This helps support innovation and drive economic growth. On the other hand, insufficient regulation of financial ecosystems can lead to risks for the financial stability of the state. For example, insufficient cyber security can lead to the theft of funds or the leakage of confidential information, which threatens the functioning of financial institutions and trust in them.

Financial information systems are often a target for various types of cyber threats because they contain a large amount of confidential and financial information. To protect financial information systems, it is important to use a comprehensive approach to cyber security, which includes the application of protection measures at various levels (network, additional, physical), regular training of personnel on cyber security and the use of modern data protection technologies.

The main types of cyber threats to financial information systems may include the following [6, 7]. Cyberattacks on the network layer (Network Layer Attacks) – this is a type of attack that targets network layer vulnerabilities, such as DDoS attacks (network flooding attacks), interception of data packets, and hacking of network devices. These attacks can lead to denial of service, data loss, and system security breaches. Application Layer Attacks – these are attacks that target software vulnerabilities, such as SQL injection, cross-site scripting, and buffer overflows. These attacks can lead to the leakage of confidential information, loss of access to systems and breach of data integrity. Fishing – this is a social type of attack where an attacker tries to obtain sensitive information, such as passwords or credit card details, by misleading the user through an email or fake web page. Data Breaches – this is when hackers gain unauthorized access to a system and steal confidential information such as customer personal data, financial information, or bank details. Malware – this is malicious software that can damage the system, steal data, or load additional malicious code. Examples of malware are viruses, worms, Trojans, and spyware. Social Engineering – this is an attack method where attackers use manipulation and deception to gain access to sensitive information by manipulating people.

Cyber threats to the financial ecosystem and financial information system vary in scope, scale and impact on the financial sector. The financial ecosystem covers all financial market participants, such as banks, insurance companies, stock exchanges, payment systems and other financial institutions. Cyber threats to the financial ecosystem can be aimed at disrupting financial stability, disrupting the functioning of the market, or causing damage to the entire sector.

The financial information system includes specific information technologies and systems used by financial institutions to process, store and transmit financial data. Cyber threats to a financial information system can be aimed at stealing confidential information, interfering with operations, or exploiting vulnerabilities to gain access to financial resources. Cyber threats to the financial ecosystem can be global in scope and lead to significant financial losses for the entire sector. While cyber-threats to a financial information system can be targeted at a single institution or system, they are usually smaller in scope but can lead to serious consequences for a specific organization. For the financial ecosystem, it is necessary to develop specialized monitoring mechanisms, cooperate with regulators and other market participants to prevent and respond to crisis situations. It is important for a financial information system to use technological protection measures such as data encryption, intrusion detection systems and strict access control. In any case, if cyber threat affects the financial sector, it can have serious consequences both for the functioning of individual institutions and for the entire global financial market.

In our opinion, the further development of financial ecosystems will be influenced by two important factors: artificial intelligence (software) and quantum processors (hardware).

Quantum processors could pose cyber threats to financial ecosystems due to their potential ability to break the cryptographic algorithms used to protect blockchain technology and cryptocurrencies. In particular, quantum computers can be used to quickly reveal the private keys used to sign transactions in blockchain networks. This can lead to fake transactions and loss of trust in the system. Also, quantum processors can be used to perform attacks on consensus protocols of blockchain networks, such as Proof of Work or Proof of Stake. This can lead to the loss of control over the network and the alteration of transaction history. Quantum computing can be used to reveal sensitive information in blockchain networks, such as wallet addresses or transaction details. This may violate user privacy and lead to leakage of personal information. Attackers can also use quantum processors to create new types of cryptographic attacks that can be difficult to detect and prevent.

Artificial intelligence can be used both to create cyber threats to financial ecosystems and to protect them. For example, artificial intelligence can be used by attackers to automate attacks on financial systems. Machine learning algorithms can be used to develop malware that quickly adapts to security measures and finds vulnerabilities in systems. Also, artificial

intelligence can be used to improve the security systems of financial institutions by automating the process of detecting and responding to threats. For example, machine learning systems can analyze intrusion data and learn to recognize new types of attacks. Artificial intelligence can help financial institutions predict potential cyber threats and risks, helping to prepare for and prevent them from occurring. So, while AI can be used to create cyber threats to financial ecosystems, it can also be a powerful tool in combating these threats and improving the security of financial systems.

Conclusions. Development of financial ecosystems is important for ensuring sustainable economic growth of the state, but it is necessary to ensure adequate regulatory control and risk management to prevent possible negative consequences.

The transformation of financial information systems into financial ecosystems reflects modern trends in the field of financial technologies. This transformation means a transition from isolated systems to integrated network structures that unite various financial market participants.

This opens up new opportunities for the convenience and speed of financial transactions, promotes innovations in the field of payments, lending, investment and other financial services. Financial ecosystems make it possible to reduce costs, improve the availability of financial services and ensure a faster response to changes in the market.

However, along with these opportunities, financial ecosystems also carry certain threats, such as cybercrime, loss of data privacy, and the risk of financial fraud. Therefore, it is important to develop effective cyber security measures and monitor new threats emerging in financial ecosystems.

Conflict of Interest and other Ethics Statements

The authors declare no conflict of interest.

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ABSTRACT

Information systems in finance play a key role in ensuring effective management of financial processes, making strategic decisions and ensuring the competitiveness of financial institutions. They allow you to collect, process, analyze and use large amounts of data to make informed decisions.

With the development of artificial intelligence and big data analysis, information systems in finance are becoming increasingly powerful and capable of forecasting and optimizing financial processes. One of the challenges facing information systems in finance is the need to ensure a high level of cyber security. Therefore, information systems must be reliably protected from cyber threats by using modern methods of encryption and security monitoring. Another important aspect is the need for constant updating and modernization of information systems in finance to ensure their efficiency and compliance with modern technological standards.

In the future, information systems in finance can become a key tool for building digital financial ecosystems that will promote the development of new financial services and improve their accessibility.

Keywords: *information systems, financial management, fintech, cyber security, financial ecosystem.*