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INNOVATIONS IN THE DEVELOPMENT OF THE IT SECTOR: DATA PROCESSING, BLOCKCHAIN, THE IOT

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Abstract. In the context of rapid technological progress, new solutions and approaches are required to ensure competitiveness of organizations. Currently, areas such as artificial intelligence, blockchain, cloud technologies, and the Internet of Things are being widely considered, as well as their application in various aspects of our lives, from business to healthcare. This article focuses on modern innovations in information technologies and their impact on business development and societal processes. In the course of this research, special attention is paid to the risks associated with the implementation of innovations, such as data security issues and ethical concerns. Examples of technology implementation are provided to highlight the best areas for further development. In conclusion, the article emphasizes the importance of adapting educational programs and professional development for the successful integration of new technologies into practice.

Keywords: information technologies, blockchain, artificial intelligence, the Internet of Things

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ИННОВАЦИИ В РАЗВИТИИ IT-СЕКТОРА: ОБРАБОТКА ДАННЫХ, БЛОКЧЕЙН, ИНТЕРНЕТ ВЕЩЕЙ

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Аннотация. В условиях стремительного технологического прогресса требуются новые решения и подходы, способные обеспечить высокую конкурентоспособность организаций. В настоящее время в научной среде широко рассматриваются такие направления, как искусственный интеллект, блокчейн, облачные технологии и интернет вещей, а также их применение в различных сферах нашей жизни – от бизнеса до здравоохранения. Данная статья посвящена анализу современных инноваций в области информационных технологий, их влиянию на развитие бизнеса и общества в целом. Особое внимание уделяется рискам, связанным с внедрением инноваций, таким как вопросы безопасности данных и этические аспекты. Приводятся примеры внедрения технологий, которые позволяют выявить наиболее перспективные направления дальнейшего развития. В заключение подчеркивается важность адаптации образовательных программ и повышения квалификации специалистов для успешной интеграции новых технологий в практическую деятельность предприятий.

Ключевые слова: информационные технологии, блокчейн, искусственный интеллект, интернет вещей

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Introduction

Economic systems and technological progress are interconnected factors that determine socio-economic development. From agrarian societies to post-industrial eras, we can observe how economic systems not only adapted to technological systems but also actively stimulated them. Entire mechanisms are being created that ultimately lead to technological innovations, improvements in labour productivity, and enhancing living standards.

This research examines information technologies as a field related to the use of computers, software, networks, and other technologies for processing, storing, transmitting, and managing information. Information technologies encompass a wide range, including the Internet of Things, artificial intelligence, cybersecurity, and others. Technologies play a key role in modern business; their application significantly changes ways of conducting business. For example, technologies such as the Internet and mobile applications enable businesses to access new markets and attract customers from around the world.

Materials and Methods

This research relies on the existing works on the topic and author's assessment of the most promising innovations in the IT sector. The authors invited the following research methods:

evaluation, synthesis, classification, and description. These methods contributed to the wholescale examination of the theoretical and practical framework related to the experience of implementation of blockchain and the IoT in different industries.

Results and Discussion

A key element of information technologies is the information processing algorithm, which establishes a sequence of actions to obtain the information necessary for processing, while information technologies provide the means for implementing and storing this data.

Let us examine the stages of information processing (Figure 1). The first stage is the collection of specific information and its input into the system. Next, the selected data needs to be structured, sorted, and cleaned of unnecessary elements. The third stage involves the analysis and processing of the sorted data. After data analysis, it is possible to proceed to storing, exchanging, or outputting the processed data.

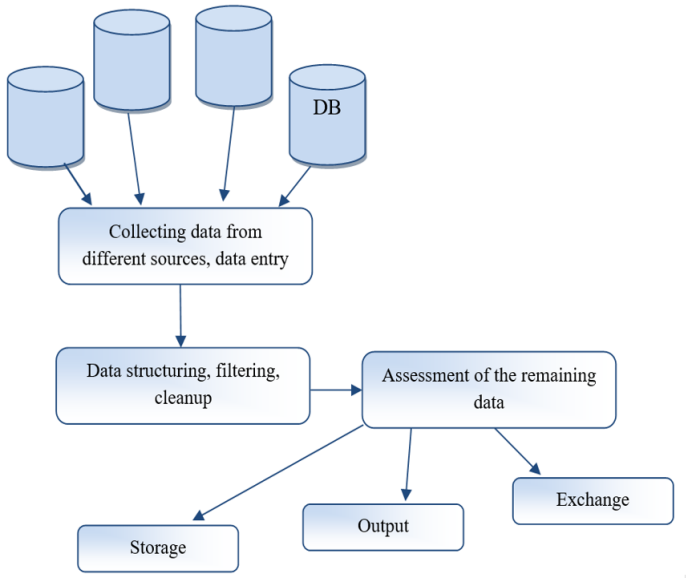


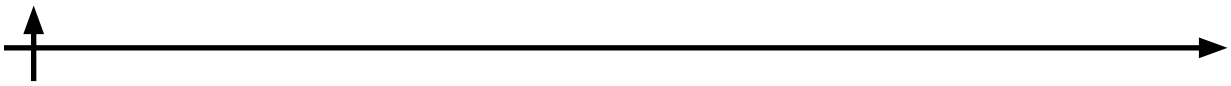
Fig. 1. Stages of Data Processing.

Digital transformation has now taken a central position in the strategic planning and operational activities of companies seeking to maintain their competitiveness. This process affects both the external and internal environments of an enterprise. Due to significant changes, digital transformation requires a comprehensive approach to adaptation and innovation.

The external ecosystem of digital development is characterized by several factors. Ongoing changes in regulatory policies are necessary, including issues related to data security and antitrust regulation, and special attention must be paid to cybersecurity concerns. Equally important are innovations that determine the pace and direction of the enterprise's development. The search for new competitive advantages and rapid adaptation to changes are integral parts of global competition (Bialetskaya, 2025; Boden, 2025; Chertkova, 2025; Churilov, 2025; Curley, 2022).

The internal environment for digital business development involves optimizing organizational processes, implementing automation systems, analytics, and machine learning, as well as retraining and upskilling personnel.

In sectors such as healthcare, financial technology, manufacturing, and energy, artificial intelligence, blockchain, and the Internet of Things are tools for achieving efficiency and im-



proving the quality of products and services.

The Internet of Things (IoT) and blockchain technologies have increasingly become integral components in the transformation of various industries, including healthcare, financial technology, manufacturing, and energy. Their convergence offers unprecedented opportunities to enhance transparency, efficiency, and security across these sectors.

In healthcare, the integration of IoT devices and blockchain has the potential to revolutionize patient care and data management. IoT enables continuous monitoring of patients through wearable medical devices, smart implants, and remote sensing technologies, thereby facilitating real-time data collection on vital signs and other health metrics. When combined with blockchain, this data can be securely stored and shared among authorized stakeholders such as healthcare providers, patients, and researchers, while ensuring data integrity and privacy.

Blockchain's decentralized ledger mitigates risks related to data tampering, unauthorized access, and fragmentation of medical records. Together, these technologies support more personalized treatment plans, improve diagnostic accuracy, and enhance healthcare delivery systems.

Within the realm of financial technology, IoT and blockchain collaborate to foster more secure, transparent, and efficient transactions. IoT devices provide real-time data streams that can inform financial decision-making, credit scoring, and asset tracking, which is particularly valuable for insurance and lending sectors. For example, IoT-enabled sensors can monitor physical assets used as collateral, providing verifiable evidence of their condition and existence. Blockchain reinforces this ecosystem by offering immutable transaction records and automating contract execution through smart contracts, thereby reducing fraud, settlement times, and operational costs. The synergy of these technologies contributes to a more resilient and transparent financial infrastructure that enhances trust among participants.

In manufacturing, IoT and blockchain contribute to the realization of Industry 4.0 by enabling smart factories characterized by automation, interconnectivity, and data-driven operations. IoT sensors embedded in machinery and production lines facilitate continuous monitoring of equipment performance, environmental conditions, and supply chain logistics. Captured data enables predictive maintenance and real-time optimization of manufacturing processes, reducing downtime and improving quality control. When blockchain technology is integrated, it ensures secure and tamper-proof tracking of components, materials, and products throughout the production and distribution lifecycle. This traceability supports compliance with regulatory standards and enhances accountability while enabling more efficient inventory management and reducing counterfeit risks (Zaramenkikh, 2025; Zudenkova, 2025).

In the energy sector, the combination of IoT and blockchain technologies promotes more sustainable, decentralized, and efficient energy management systems. IoT devices, including smart meters and sensors, monitor energy consumption patterns, production levels from renewable sources, and grid status in real time. This granular data enables dynamic demand-response strategies, grid balancing, and optimized resource allocation. Blockchain facilitates peer-to-peer energy trading platforms by recording transactions transparently and securely, allowing consumers and producers to exchange energy directly without intermediaries. Moreover, blockchain's immutable ledger can verify the provenance of renewable energy certificates and carbon credits, supporting regulatory compliance and incentivizing green energy adoption. These innovations collectively contribute to the advancement of smarter and more resilient energy ecosystems (Dawod, 2022; Ezhova, 2024; Kudryavtseva, 2025; Lunyakov, 2025; Maydanova, Ilin, 2023; Na, 2022; Narayandas, 2021).

Therefore, the integration of IoT and blockchain technologies across healthcare, financial technology, manufacturing, and energy sectors drives significant improvements in operational efficiency, transparency, security, and user empowerment. Their combined capabilities enable

real-time data acquisition, secure data management, and enhanced traceability, which are critical for addressing contemporary challenges and fostering innovation in these diverse industries.

Decentralized data storage and transmission technology, which allows recording information in the form of a chain of blocks called blockchain, is an important innovation. Each block contains a set of transactions and is linked to the previous block using cryptographic hash functions, making the data protected from modification and forgery. The main characteristics of blockchain include decentralization, transparency, security, and immutability (Prokhorov, 2025; Saranya, 2020; Shchegolyova, 2025; Smirnova, 2025; Sovetov, 2025).

Blockchain provides a high level of transparency, as all network participants can view transaction records. This can enhance trust between parties, especially in fields such as financial services, supply chain management, and government administration. In healthcare, blockchain can be used for the secure storage of medical records and ensuring their accessibility to various institutions, thereby improving the quality of patient care. Blockchain has revolutionized the financial sector through the creation of cryptocurrencies, smart contracts, and decentralized finance (DeFi). This enables faster and cheaper transactions and reduces reliance on traditional financial institutions. The core financial services of DeFi are presented below.

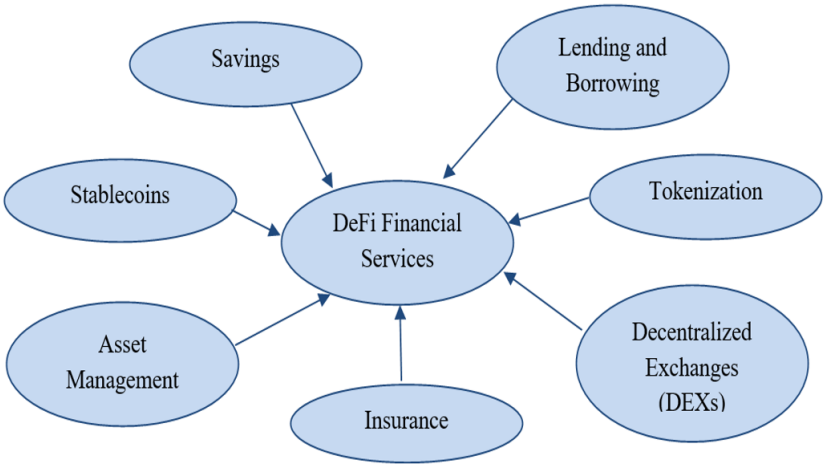
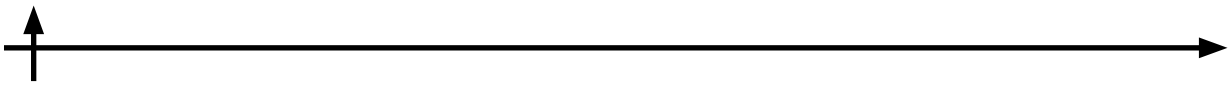


Fig. 2. DeFi Financial Services.

DeFi, or decentralized finance, represents a vast ecosystem of financial applications and services operating based on blockchain technologies. This ecosystem offers a variety of financial instruments, including lending, insurance, derivatives, and stablecoins. The main advantage of DeFi lies in its ability to make financial services more accessible: it eliminates the need for intermediaries and significantly reduces transaction costs.

Decentralized Finance (DeFi) presents a transformative shift in the provision and accessibility of financial services by leveraging blockchain technology. One of the primary benefits of DeFi is its ability to greatly enhance financial inclusion. Unlike traditional banking systems, which often require intermediaries and are restricted by geographic, regulatory, or economic barriers, DeFi platforms enable any individual with internet access to participate in a wide range of financial activities. This democratization of finance broadens the reach of services to underserved or unbanked populations globally.

Another significant advantage of DeFi lies in its potential to reduce operational costs and improve transaction efficiency. By eliminating the need for intermediaries such as banks, brokers, and payment processors, DeFi lowers transactional fees, making financial services more affordable. Moreover, the use of smart contracts automates many processes, enabling faster



execution and settlement of transactions compared to conventional financial systems. This increase in speed and reduction in cost significantly enhances the overall efficiency of financial operations.

Transparency also constitutes a core benefit of DeFi systems. Since all transactions and contractual procedures are recorded on public blockchains, users have the ability to audit and verify activities independently. This openness mitigates risks associated with fraud or manipulation and fosters greater trust among participants. Additionally, DeFi encourages financial innovation by allowing the creation of novel financial instruments such as programmable loans, yield farming, and decentralized exchanges. These innovations expand the diversity and sophistication of financial products available to users without the constraints imposed by traditional frameworks.

Furthermore, DeFi empowers users by granting them direct control over their assets through the management of private keys, thereby reducing dependence on third-party custodians and intermediaries. This enhancement in user sovereignty not only increases security but also aligns with broader trends toward decentralization and user autonomy. And finally, DeFi's global nature removes geographic boundaries, enabling seamless cross-border financial interactions and contributing to the integration of international markets.

Collectively, these characteristics illustrate how DeFi aims to create a more open, efficient, and inclusive financial ecosystem by leveraging the unique properties of blockchain technology and innovative decentralized architectures.

Nevertheless, despite all these benefits, digital finance has its drawbacks. Electronic money, which plays a key role in this system, also carries certain risks. While it provides convenience and speed, it is vulnerable to threats from hackers, fraudsters, and other cybercriminals. Additionally, the lack of clear regulation in the field of electronic money creates opportunities for illegal activities such as money laundering and terrorism financing.

Artificial intelligence (AI) is defined as a branch of computer science focused on creating systems capable of performing tasks that require intelligence, such as speech recognition, decision-making, learning, natural language understanding, and perception. AI includes various approaches and technologies, such as machine learning, neural networks, and natural language processing.

AI can improve people's quality of life through more efficient medical services, personalized learning, and enhanced living conditions. For example, AI can assist in disease diagnosis or offer individualized learning recommendations. Additionally, AI systems can analyze customer behaviour and suggest targeted advertising campaigns. For instance, algorithms determine which medications might interest patients based on their purchase history.

The Internet of Things (IoT), in turn, represents a global infrastructure in which physical and virtual objects are connected via a network. This technology has the potential to transform everything from industrial production to smart cities. The main goal of IoT development is to create an integrated and automated environment where data from various devices and systems can be collected, analyzed, and used to improve quality of life and business efficiency. For example, IoT devices such as RFID tags and GPS trackers enable companies to monitor the location and condition of goods at all stages of the supply chain. In the medical field, smartwatches and fitness trackers have gained popularity because they help collect health data.

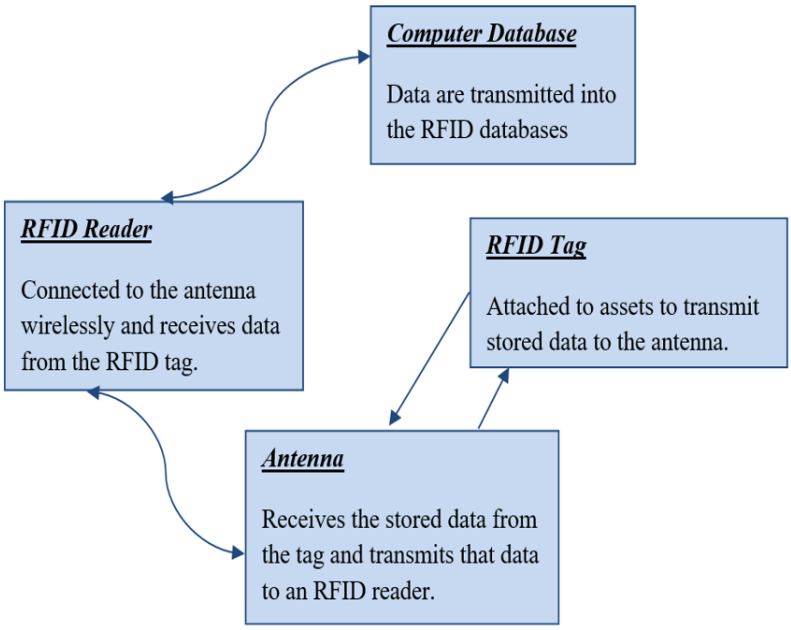


Fig. 3. How RFID works in Tech and revolutionizes industries.

Nevertheless, the adoption of new technologies is accompanied by a range of ethical and moral issues. Problems related to labour automation, replacing human participation, and the potential violation of workers' rights are becoming increasingly relevant. Additionally, there is a threat of expanding social inequality, as access to high-skilled jobs becomes limited. These aspects require a deep and multilayered analysis that encompasses sociological, psychological, and economic perspectives.

Conclusion

In the global digitalization context, modern technologies such as neural network solutions and interfaces attract particular attention. These innovations open up new opportunities for creating more intuitive and adaptive management systems that can take into account the unique characteristics and needs of each employee. Neural networks and machine learning algorithms are capable of analyzing user behaviour, preferences, and reactions, allowing for the formation of more effective and personalized workflows.

These technological advances lead to the emergence of a new type of “dream job,” where adaptive technologies create more flexible and dynamic working conditions. Employees gain the ability to customize their workspace, choose flexible schedules, and utilize resources for continuous professional development through online courses and virtual seminars.

In conclusion, we stand on the threshold of a new era where the integration of intelligent management systems, neural network technologies, and adaptive work models is shaping a new economic and social reality. However, the successful realization of this potential requires a comprehensive study of all related ethical and moral concerns. This demands an interdisciplinary approach and active collaboration among all stakeholders, from scientists and researchers to business leaders and legislators.

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