

BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE AS TOOLS OF ECONOMIC STRATEGY

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Abstract

The article analyzes modern vectors of application of blockchain technologies and artificial intelligence (AI) in the process of formation and implementation of economic strategy. The role of these technologies in increasing the transparency of financial transactions, optimizing business processes and developing sustainable growth models is emphasized. Particular attention is paid to the issues of integration of blockchain and AI in such areas as management, logistics, healthcare and digital finance.

Keywords: Blockchain, artificial intelligence, economic strategy, digitalization, sustainable development.

Introduction

The scientific novelty of the article lies in considering blockchain and artificial intelligence as complementary strategic instruments that enhance the transparency, efficiency, and sustainability of the economy. Unlike works that study them separately, the article reveals the synergistic effect of technologies and formulates recommendations taking into account institutional and ESG factors.

Modern transformations of the global economy are characterized by the intensive development of digital technologies, among which the key drivers of innovation are blockchain and artificial intelligence (AI). Their synergistic interaction opens up new horizons for the formation of effective economic strategies focused on the principles of transparency, automation and sustainable development. According to forecasts of the World Economic Forum, by 2030, more than 70% of companies will use a combination of blockchain and AI in strategic management, which will contribute to increased efficiency and trust in global supply chains [1].

Blockchain provides decentralized storage and protection of data, eliminating the possibility of falsification and minimizing transaction costs [2]. At the same time, AI facilitates the intelligent processing of large amounts of data, forecasting market trends, and automating strategic analysis processes [3]. Together, these technologies not only optimize corporate governance, but also form the basis for new business models that can withstand the challenges of globalization.

Blockchain and AI in the financial sector is of particular importance. According to a study by the auditing company «PricewaterhouseCoopers», the integration of these technologies will increase global GDP by \$15.7 trillion by 2030 due to increased productivity and the

development of new markets [4]. In addition, corporations such as «IBM» and «Alibaba» are already using a combination of blockchain and AI to ensure transparency in logistics operations and combat cyber threats.

Thus, the relevance of this study is due to the fact that the combination of blockchain and AI forms innovative approaches to economic strategies, ensuring increased trust, reduced risks and acceleration of digital transformation processes.

The application of blockchain and artificial intelligence (AI) in the economy is fundamental to the development and implementation of modern economic strategies. These technologies not only increase the efficiency of business processes, but also form new management models based on the principles of transparency, decentralization and intelligent data processing.

Blockchain is a distributed registry that allows transactions to be recorded in a secure and immutable form. The theoretical basis of blockchain is based on the principles of decentralization, cryptographic protection and consensus algorithms (such as Proof-of-Work, Proof-of-Stake, etc.) [5]. According to scientific research, blockchain is not just a financial technology, but an institutional innovation that can radically change the mechanisms of trust in the economy and reduce transaction costs.

Artificial intelligence in economics is based on machine learning algorithms, neural networks and big data processing. It allows predicting economic trends, automating management processes and creating intelligent decision support systems. Research by E. Brynjolfsson and A. McAfee shows that the introduction of AI contributes to productivity growth and the formation of new competitive advantages in the digital economy [6].

Blockchain Sharing and AI amplifies their potential. Blockchain ensures the reliability and transparency of data, and AI allows you to extract value from it through analytics and forecasting. In the scientific paper «Governance in the Blockchain Economy: A Framework and Research Agenda» scientists note that the combination of these technologies forms the basis for next-generation smart contracts and intelligent automation in supply chains and financial systems [7].

From the perspective of institutional economics, the integration of blockchain and AI helps reduce agency costs, minimize information asymmetry, and enhance trust between market participants [8]. This confirms their strategic importance for the formation of sustainable economic models.

Therefore, the theoretical basis for the application of blockchain and AI is to combine the advantages of decentralized technologies and intelligent data processing systems to create innovative management strategies in the context of global digital transformation.

The combined application of blockchain and artificial intelligence (AI) in corporate and government strategies is already demonstrating measurable economic impacts, including reduced transaction and operational costs, increased supply chain transparency, accelerated research and development (R&D), and increased risk resilience.

Following the 2018 E.coli outbreak, «Walmart» required leafy greens suppliers to use blockchain technology to ensure farm-to-shelf traceability [9]. The solution, developed on the IBM Food platform Trust , allows for faster investigations and targeted recalls of batches,

minimizing the volume of products withdrawn. A similar approach is used by the olive oil producer Deoleo, where the consumer, by scanning the bottle, gets access to information about the product's path, which increases confidence in its quality and sustainable origin [10].

Estonia uses the KSI blockchain (Guardtime) to ensure the provable immutability of records in digital government registries, from healthcare to land registry [11]. The «verifiable» mechanism ensures verifiable data integrity without revealing personal information. This practice serves as a benchmark for trusted e-government projects.

JP Morgan is developing its Kinexys product line, which enables real-time, 24/7 multi-currency payments. The initiatives are also testing a deposit JPMD token on a public blockchain as a «trusted» alternative to stablecoins, which reduces transaction costs for cross-border payments. In parallel, AI technologies are strengthening anti-fraud systems. According to research by PwC and Deloitte, banks are massively using machine learning (ML) models to detect anomalies, although there is an increase in risks associated with the use of generative AI for deepfake fraud.

Amazon is implementing three key AI innovations to optimize last-mile logistics: a new demand forecasting model, a service to improve addressing accuracy, and agent-based AI commands for robotic systems [12]. The strategic effect is to reduce delivery times and inventory while maintaining a high level of service.

AlphaFold program (DeepMind) has radically improved the accuracy of protein structure prediction, and AlphaFold 3 has expanded the modeling of interactions between proteins and molecules [13]. This accelerates the stages of preclinical research and design of new drug candidates, which directly affects the strategy of pharmaceutical companies and biotech startups, reducing the time and cost of R&D.

Table 1 - Blockchain and AI Application Cases

Sector	Organization/project	a technology (and)	Strategic effect
Retail/ food chain	Walmart + IBM Food Trust	Blockchain (traceability)	Speed up investigations, target recalls, increase trust
AIC/ food brand	Deoleo (EVOO)	Blockchain (traceability for consumers)	Proven origin, premium positioning
Government services	Estonia (KSI)	Blockchain Record Integrity	Trust in e-registries, verifiability without disclosing data
Finance (payments)	JP Morgan Kinexys	Blockchain - payment infrastructure; deposit token	24/7 multi-currency settlements in minutes; reduced frictions
Finance (risk)	Banks (review)	AI/ML antifraud	Reducing fraud losses, proactive monitoring
E-commerce /operations	Amazon	AI demand forecasting, agent-based AI systems	Reduced delivery times and inventory, increased OTIF
R&D/ pharma	DeepMind AlphaFold	AI (DL for protein structures)	Preclinical acceleration, target identification

Therefore, blockchain brings the greatest value where the verifiability of origin and immutability of records are critical (food chains, state registries, financial settlements). AI scales benefits through forecasting and automation of decision-making (anti-fraud, logistics, R&D). The maximum effect is achieved with synergy: reliable data from the blockchain becomes fuel for AI analytics, and AI results are automated through smart contracts.

Despite the rapid growth in adoption, the integration of blockchain and artificial intelligence (AI) faces a number of significant barriers: technological, institutional, and socio-ethical.

Blockchain technologies are characterized by low scalability and high energy consumption, especially in public networks using the Proof-of-Work (PoW) algorithm. This limits their use in high-load transaction systems. In addition, the problem of efficient storage and synchronization of large volumes of data remains relevant.

The lack of a unified regulatory framework prevents the mass implementation of these technologies in international projects. Inconsistency in legislation slows down the transformation of business models. A similar situation is typical for AI: uncertainty regarding responsibility for algorithm errors creates significant legal risks.

The high cost of infrastructure deployment, the need to attract qualified personnel and the difficulty of integration with existing IT systems slow down the spread of technologies. This is especially critical for small and medium-sized businesses.

Despite its cryptographic security, blockchain susceptible to 51% attacks and smart contract vulnerabilities. AI is prone to adversarial attacks, where models misclassify data, undermining trust in the system.

Table 2 - Key barriers and challenges to the application of blockchain and AI

Category of barriers	Specific challenges	Consequences for the economy
Technological	Low scalability of blockchain ; energy costs ; complexity of data storage	Limitation of transaction systems, increase in operating costs
Legal	Lack of unified standards; uncertainty of AI liability	Investment slows, legal risks rise
Ethical	Black Box AI; Algorithmic Bias; Blockchain Privacy	Mistrust of society, resistance to implementation
Economic	High CAPEX and OPEX of implementation; shortage of specialists	Available only to corporations, low scalability for SMEs
Cybersecurity	51% attacks and smart contract bugs; adversarial attacks on AI	Financial losses, loss of trust in digital platforms

Key challenges are related not only to technological maturity, but also to institutional frameworks, issues of trust and social acceptability. Overcoming these barriers is possible through international standardization, development of explainable AI, transition to energy-efficient consensus algorithms and the formation of new educational programs.

To successfully implement blockchain and artificial intelligence into the economic strategies of states and corporations, it is necessary to take into account systemic barriers and develop comprehensive measures to overcome them.

The creation of harmonized international standards for the use of AI and blockchain will reduce legal uncertainty and increase trust in the technologies. The European Union is already taking steps in this direction through the adoption of the AI Act and initiatives to regulate digital assets [14].

Support for national and corporate R&D centers, as well as stronger collaboration between business and academia, is needed to develop energy-efficient blockchain algorithms and explainable AI models.

The key limitation is the shortage of qualified specialists. The solution to this problem lies in the active implementation of educational programs on blockchain engineering and AI data science in universities and corporate training systems.

Developing monitoring systems and standardizing smart contract audits, as well as creating mechanisms to protect AI from adversarial attacks, are necessary to increase user trust.

It is important to support the development of energy-efficient consensus algorithms (such as Proof-of-Stake, Proof-of-Authority) and the use of AI in energy consumption optimization, which is in line with sustainable development goals.

The formation of open platforms and consortia (for example, Hyperledger, GAIA-X) will accelerate the integration of technologies in various industries through the shared use of infrastructure.

Table 3 - Recommendations for the development of blockchain and AI applications

Direction	Specific measures	Expected effect
Regulatory framework	Development of unified standards and regulation of digital assets	Reducing legal uncertainty, increasing investor confidence
Innovation and R&D	Investing in Energy-Efficient Algorithms and Explainable AI	Improving the efficiency and transparency of systems
Human resources potential	Educational programs and retraining of specialists	Elimination of personnel shortage, growth of competencies
Cyber Resilience	Standardizing Smart Contract Auditing and AI Security	Reducing the risk of attacks, increasing the reliability of platforms
Sustainable development	Transition to low-energy blockchain algorithms; applying AI for “green” purposes	Reducing carbon footprint, increasing ESG reputation of companies
Ecosystem of trust	Consortia and open platforms (Hyperledger, GAIA-X)	Scaling of technologies, synergy of industries

Therefore, strategic integration of blockchain and AI must rely not only on technological innovation, but also on institutional support, human resource development, and consideration of sustainability principles.

Blockchain and artificial intelligence are creating a new paradigm for strategic economic management. Their application in areas such as finance, logistics, healthcare, and the public sector opens up opportunities for increased transparency, trust, and efficiency. Despite existing barriers, further development of these technologies will determine the competitiveness of states and corporations in the global economy.

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