



Finance, Banking, Insurance, and Stock Market

UDC 004.8:004.738.5:347.77

DOI <https://doi.org/10.5281/zenodo.17668728>

Economic and legal nature of digital assets managed by autonomous AI agents

Nodari Gorgiladze,

Program Director, NOTA Digital Currencies Research Center Inc.,
Sacramento, California, USA, <https://orcid.org/0009-0007-2384-0036>

Accepted: 02.11.2025 | Published: 21.11.2025

Abstract. *The article is devoted to justifying the economic and legal nature of digital assets operating under the control of autonomous AI agents. The **purpose of this study** is to develop a generalizing conceptual model that integrates the mechanisms of creating and circulating digital value with legal approaches to determining ownership, responsibility, and regulatory control in digital environments characterized by high autonomy. The **methodological basis** of the study is an interdisciplinary analysis, structural-logical generalization, a comparative legal approach, and institutional analysis of the regulatory models of the EU and Ukraine. Elements of the theory of digital capital and the concept of decentralized management are used to interpret the market behavior of AI agents. **Results.** It is determined that digital assets under the control of AI agents function as hybrid economic and legal entities, where the source of value is algorithmic processes of transaction optimization, forecasting and autonomous decision-making. It is shown that the European regulatory field forms a holistic model of harmonization of technological autonomy and responsibility (MiCA, AI Act, UNIDROIT Principles). Ukrainian legislation focuses on defining a digital asset as*



an object of civil rights and does not cover the agency of artificial intelligence. The proposed conceptual model demonstrates the interdependence of economic (creation, monetization, value circulation) and legal (ownership, accountability, enforcement) aspects of digital assets managed by artificial intelligence. **Conclusions.** The analysis made it possible to establish that digital assets managed by autonomous AI agents form a dual economic and legal regime, in which algorithmic value creation is inextricably linked to the legal consolidation of ownership and responsibility rights. The harmonization of these two dimensions is a key outcome of the study and provides a basis for the development of state policy in the digital economy field. Further research should focus on developing mechanisms for algorithmic responsibility and adapting the national regulatory framework to European standards, taking into account the participation of autonomous AI agents in market processes.

Keywords: algorithmic autonomy, tokenization, regulatory harmonization, property rights, decentralized markets, smart contract liability, innovation policy.

Економіко-правова природа цифрових активів, пов'язаних з автономними AI-агентами

Горгіладзе Нодарі Русланович,

директор програми, NOTA Digital Currencies Research Center Inc.,
м. Сакраменто, Каліфорнія, США, <https://orcid.org/0009-0007-2384-0036>

Анотація. Стаття присвячена обґрунтуванню економіко-правової природи цифрових активів, що функціонують під управлінням автономних AI-агентів. **Мета дослідження** – формування узагальнюючої концептуальної моделі, яка поєднує механізми створення й обігу цифрової вартості з правовими підходами до визначення власності, відповідальності та регуляторного контролю у цифрових середовищах із високим ступенем



автономії. **Методологічну основу** дослідження становлять міждисциплінарний аналіз, структурно-логічне узагальнення, порівняльно-правовий підхід, а також інституційний аналіз нормативних моделей ЄС та України. Для інтерпретації ринкової поведінки AI-агентів використано елементи теорії цифрового капіталу та концепції децентралізованого управління. **Результати.** Визначено, що цифрові активи під контролем AI-агентів функціонують як гібридні економіко-правові утворення, де джерелом вартості виступають алгоритмічні процеси оптимізації транзакцій, прогнозування та автономного прийняття рішень. Показано, що європейське регуляторне поле формує цілісну модель узгодження технологічної автономії та відповідальності (MiCA, AI Act, UNIDROIT Principles). Українське законодавство зосереджене на визначенні цифрового активу як об'єкта цивільних прав та не охоплює агентність штучного інтелекту. Запропонована концептуальна модель демонструє взаємозалежність економічних (створення, монетизація, обіг вартості) та правових (власність, підзвітність, забезпечення виконання) аспектів цифрових активів, що керуються штучним інтелектом. **Висновки.** Проведений аналіз дозволив встановити, що цифрові активи під управлінням автономних AI-агентів формують подвійний економіко-правовий режим, у якому алгоритмічне створення вартості невід'ємно пов'язане з юридичним закріпленням правомочностей власності та відповідальності. Узгодження цих двох вимірів є ключовим результатом дослідження та створює підґрунтя для розроблення державної політики у сфері цифрової економіки. Подальші дослідження мають бути спрямовані на розроблення механізмів алгоритмічної відповідальності та адаптацію національної нормативної бази до європейських стандартів з урахуванням участі автономних AI-агентів у ринкових процесах.



Ключові слова: *алгоритмічна автономія, токенизація, регуляторна гармонізація, право власності, децентралізовані ринки, відповідальність смарт-контрактів, інноваційна політика.*

Problem statement. Artificial intelligence is rapidly integrating into economic and financial processes, leading to a shift in traditional approaches to creating and circulating digital value. Autonomous artificial intelligence agents (hereinafter referred to as AI agents) that are capable of storing digital assets, executing smart contracts, and conducting transactions without direct human participation are of particular importance. In such an environment, digital assets act not only as a tool of economic activity but also as an object of property rights that requires a clear legal definition.

International studies indicate a trend toward integrating the technological autonomy of artificial intelligence with regulatory control mechanisms. In the EU, these issues are addressed by a set of regulatory acts, including Regulation MiCA, the Artificial Intelligence Act, and the UNIDROIT Principles. In Ukraine, the economic and legal aspects of digital assets are still considered separately: economic works focus on the nature of digital value, while legal works focus on classifying assets as objects of civil rights.

Therefore, there is a need to combine economic approaches to the analysis of digital assets managed by autonomous AI agents with legal norms that determine the order of their possession, disposal and liability for the actions taken.

Analysis of recent research and publications. International research published in recent years reflects the increased scientific interest in regulating digital assets in the context of the growing role of artificial intelligence. The literature highlights the conceptual, legal and technological aspects of how AI agents can own, manage or carry out transactions with digital assets through decentralized systems.



The work of B. Marino and A. Juels emphasizes the risks that arise when AI agents gain autonomous control over cryptocurrencies and smart contracts [1]. The authors warn that new forms of «harm caused by artificial intelligence» require regulatory safeguards. B. A. Hu, Y. Liu, and H. Rong introduce the concept of self-sustaining decentralized AI agents (DeAgents) capable of owning crypto wallets and executing transactions on the blockchain [2]. The authors formulate and develop the concept of «fiduciary autonomy», in which DeAgents retain self-ownership and control over digital assets through the use of smart contracts. This work has sparked a debate about accountability gaps and ethical and legal dilemmas. M. O. Riedl and D. R. Desai examine the legal status of AI agents and find that the law needs to rethink the categories of agency and liability when digital entities act autonomously in financial ecosystems [3]. M. M. Karim, D. H. Van, S. Khan, Q. Qu, and Y. Kholodov [4] provide a technical overview of blockchain collaboration between AI agents. The authors emphasize that tokenization provides transparency and secure verification of digital property. K. M. K. Fodouop and A. Ndiaye analyze the growing presence of AI agents in cryptocurrency markets, highlighting the uncertainty of property rights and the lack of consistent regulation for tokenized AI systems [5]. Law of the Ledger experts J. Gatto and M. Earp-Thomas [6] consider the integration of blockchain and artificial intelligence, which transforms intelligent agents into tokenized digital assets, effectively blurring the line between agent and asset. J. Wyczik examined the evolution of property rights in the digital age and proposed a legal framework for classifying digital assets that can be extended to autonomous entities controlled by artificial intelligence [7].

A. Borjigin, W. Zhou, and C. He proposed an AI-driven AI agent architecture [8]. It integrates blockchain mechanisms for tokenizing alternative assets, ensuring their traceability and compliance in a decentralized environment. L. Ante's paper [9] highlights the emergence of autonomous AI agents in decentralized finance (DeFi),



which act as independent owners of tokenized assets. The author demonstrates how their decision-making ability impacts liquidity, market efficiency, and risk.

Research on the intersection between AI agents and digital assets is virtually absent in the Ukrainian academic environment. The available publications can be divided into two separate areas: works focusing on the economic aspects of digitalization and innovation, and research devoted to the legal regulation of virtual or digital assets. At the same time, none of these works offers a comprehensive view of AI agents as active participants in the circulation of digital assets or as subjects capable of economic interaction.

Economic research addresses broader issues of digital transformation and innovative growth, and superficially reveals the value of digital assets. The works of economists do not cover the issues of AI-based ownership or autonomous asset management. For example, V. Budnyk explores the economic nature and conceptual foundations of digital assets [10]. The author thoroughly and consistently reveals their role in the formation of value, investment attractiveness, and accumulation of digital capital within Ukraine's innovative economy.

In Ukrainian legal science, in turn, digital assets are considered through the prism of civil law and property classification. The main scientific works emphasize property rights, registration of virtual assets, and compliance with the requirements of the Law of Ukraine «On Virtual Assets». This issue is addressed in the works of N. Fedosenko [11], O. Dmytryk [12] and O. B. Butnik-Siversky [13].

In summary, the reviewed studies reflect a consistent trend toward the convergence of artificial intelligence autonomy and digital asset management. In the literature, we can identify main areas of research as the legal status and responsibility of autonomous artificial intelligence entities, specifically the formation of agency, accountability, and property rights. Another area of research is the technological framework, particularly the integration of blockchain, smart contracts, and tokenization for secure asset management. Some of the works highlight the



regulatory and ethical implications, as well as certain aspects of assessing the risks of the activities of self-sufficient artificial intelligence systems as market participants.

This fundamental basis served as the basis for choosing a scientific direction of research to clarify the economic and legal nature of digital assets managed by AI agents and adapt the conclusions obtained in the context of Ukrainian law. The combination of artificial intelligence and blockchain technologies challenges existing legal definitions of ownership, liability, and legal personality. There is a need to develop a conceptual framework for analyzing the economic and legal nature of digital assets that operate with the participation of AI agents in new regulatory environments.

Highlighting previously unresolved parts of the general problem. Modern legal literature outlines the formal status of digital assets but does not adequately consider their economic functions and value creation mechanisms. At the same time, economic research rarely addresses legal definitions or ownership issues. As a result, a disciplinary gap has arisen, in which the economic and legal nature of digital assets associated with AI agents has not yet been sufficiently explored in Ukraine.

This study aims to fill this gap by combining economic analysis of the formation of digital asset value with legal considerations of ownership, liability, and regulatory consequences in the context of AI-driven autonomy, thereby contributing to the development of an interdisciplinary discourse on digital property in the post-industrial economy.

Formulation of the objectives of the article (task statement). The purpose of this study is to substantiate the economic and legal nature of digital assets associated with AI agents by defining their dual role: as tools for creating value and objects of property rights in the digital economy.

Presentation of the main material of the study. As a result of the integration of artificial intelligence into financial and digital markets, the concept of a digital asset has evolved from a static, tokenized object into a dynamic unit of algorithmic



value creation. In systems where AI agents autonomously own or manage digital assets, their economic essence lies not only in the exchange value of the token but also in data-driven processes. Such processes are production, monetization and optimization of transactions [8; 9].

From an economic perspective, digital assets under the control of AI serve as productive capital. They can generate income through autonomous trading, executing smart contracts, and market forecasting. Such assets combine the properties of information capital (data and algorithms) and financial capital (tokenized value), forming hybrid instruments that integrate the functions of ownership and utility [2]. This duality contributes to the transition to a self-regulating digital economy, in which algorithmic systems increasingly replace human intermediaries in the exchange of value.

AI agents increase market efficiency by reducing transaction costs, accelerating financial and information flows, increasing liquidity, and ensuring the continuous valuation of digital assets in decentralized environments. Ensuring such continuity requires high-performance data processing infrastructure, particularly caching mechanisms and query optimization, which allow for the real-time scaling of AI agent interaction systems [14]. However, their participation creates new economic risks that can disrupt traditional pricing mechanisms. Such risks include speculative volatility caused by algorithmic decision-making, the concentration of capital in autonomous systems, and the emergence of non-human market behavior [1].

The economic nature of digital assets associated with AI agents is characterized by algorithmic autonomy, network scalability, and data-driven productivity. These features contrast with classical theories of capital, as value is now created by intelligent systems operating without direct human control. The evolution of digital property, therefore, requires a rethinking of the relationship between asset ownership, control, and its economic function.



Digital assets managed by AI agents form a new class of autonomous economic entities, in which the source of value is not material scarcity, but the computational capacity to process, predict, and execute transactions. Understanding this nature is the basis for connecting their market dynamics with legal understanding and discussing issues of ownership and liability.

The integration of artificial intelligence into the management of digital assets has intensified discussions about their legal classification, ownership, and liability. In the European Union, this issue is regulated by a complex regulatory system that combines the Markets in Crypto-Assets Regulation (MiCA) [15], the Artificial Intelligence Act [16] and the UNIDROIT Principles on Digital Assets and Private Law [17]. Together, these documents form the legal framework for defining digital assets as objects of property and outline the limits of liability for transactions involving artificial intelligence. Tokenization processes that utilize artificial intelligence necessitate harmonized legal mechanisms to ensure transparency, investor protection, and algorithmic accountability. The MiCA regulation classifies digital assets as crypto-assets and establishes a licensing regime for their issuance and circulation. The AI Act introduces a risk-based approach to the governance of artificial intelligence, particularly in relation to liability for autonomous decision-making in financial systems. Together, they form a dual regulatory model that combines legal recognition and technological functionality of digital assets managed by artificial intelligence. Unlike the EU, Ukrainian legislation on digital assets is still in its infancy. The Law of Ukraine «On Virtual Assets» [18] establishes a general legal definition of a virtual asset and provides for state supervision through the Ministry of Digital Transformation of Ukraine. However, this legal act does not regulate issues of ownership or liability in cases where artificial intelligence systems or autonomous agents manage digital assets. The current Ukrainian regulatory framework primarily considers digital assets as objects of civil rights, focusing on issues of registration and protection, but does not address issues of agent autonomy



or algorithmic control [11]. There is a lack of terminological precision in the legislative field regarding the concepts of «virtual» and «digital» assets, which complicates the development of consistent regulatory practice [12]. Therefore, it is necessary to create an integrated economic and legal model that would link the circulation of digital assets with the development of innovations and the attraction of foreign investment.

This legal asymmetry between the EU and Ukraine reveals a systemic problem. The EU has now established a coherent regulatory framework that strikes a balance between innovation and risk. However, Ukrainian legislation still distinguishes between technological capabilities and legal personality. Due to the lack of norms that recognize AI agents as participants in digital markets, the enforcement of property rights, the traceability of assets, and accountability for algorithmic operations are limited.

Therefore, harmonization of the Ukrainian regulatory framework with the European legal space requires the inclusion of provisions on ownership structures for AI-related assets, algorithmic liability mechanisms and smart contract verification standards. Such convergence will not only align national legislation with the EU's digital policy, but also ensure that it aligns with the EU's digital policy. Still, it will also create a regulatory framework for recognizing the economic and legal duality of digital assets in the era of intelligent automation.

Digital assets managed by AI agents are characterized by a fundamental interdependence between their economic functionality and legal recognition. Economic mechanisms determine the creation and exchange of value associated with these assets. Legal norms establish the legitimacy and security of this value within the institutional environment. As a result, a hybrid economic-legal nature of digital assets is formed, within which algorithmic systems generate, own and transfer value under partial human control.



From an economic perspective, AI agents increase the efficiency of the digital asset market through automation, predictive modeling and decentralized trading. At the same time, these exact mechanisms contradict traditional legal categories of ownership and responsibility, since the entity carrying out transactions may not have legal personality. The emergence of autonomous digital entities necessitates a reevaluation of property rights in light of algorithmic control and decision-making capabilities.

From a legal perspective, the lack of a recognized entity status for AI agents creates a gap between economic nature and legal form. Economic activity is carried out autonomously; however, responsibility rests with the owners (humans or institutions). Such an asymmetry complicates the protection of property rights and the regulation of transactions based on smart contracts. These issues are partially addressed in the UNIDROIT Principles and Regulation MiCA. These legal acts recognize algorithmic mechanisms as tools under human control, but do not grant AI agents the status of rights holders.

Thus, the interaction between the economic and legal dimensions can be described through a two-level model:

- 1) the economic level, which reflects the algorithmic creation and exchange of digital value;
- 2) the legal level, which defines the boundaries of ownership, accountability and compliance.

The gap and discrepancy between these levels is most clearly manifested in jurisdictions where economic digitalization is developing faster than the legal system has time to adapt, which is also true for modern Ukraine [10; 11]. Harmonizing these dimensions requires a systemic approach that combines property law norms, innovation policy, and financial regulation. Such integration will contribute to the realization of the economic potential of digital assets managed by artificial intelligence in a transparent and accountable legal environment.



Let us proceed to justify the model of digital assets, with an economic and legal nature, managed by AI agents. The conceptual model developed based on the analysis results explains the dual structure of digital assets managed by AI agents, encompassing both economic and legal aspects. This model integrates the mechanisms of value creation, recognition of property rights and regulatory control into a single system that reflects both market logic and the legal principles of digital property.

At the heart of the model is the interaction between three elements:

- 1) AI agent, which is understood as an autonomous algorithmic entity that creates, stores or transfers digital assets in accordance with programmed goals;
- 2) Digital asset, i.e., a tokenized or data-based unit of value that simultaneously acts as an economic resource and an object of property rights;
- 3) Institutional environment, which is understood as the legal and regulatory system that defines ownership, accountability and compliance with established norms.

These components form a cyclical process where AI agents create or transform digital value, which acquires legal recognition through registration, contractual consolidation or verification of smart contracts. At the same time, the regulatory system ensures accountability and transparency of asset circulation, which creates legal certainty. The latter, in turn, strengthens trust in the market and promotes economic productivity. The proposed model (fig. 1) illustrates this two-level mechanism. The economic level encompasses the processes of production, monetization, and circulation of digital assets within systems controlled by artificial intelligence. The legal level defines property rights, distributes responsibilities, and establishes enforcement procedures that ensure the legitimacy of economic actions.

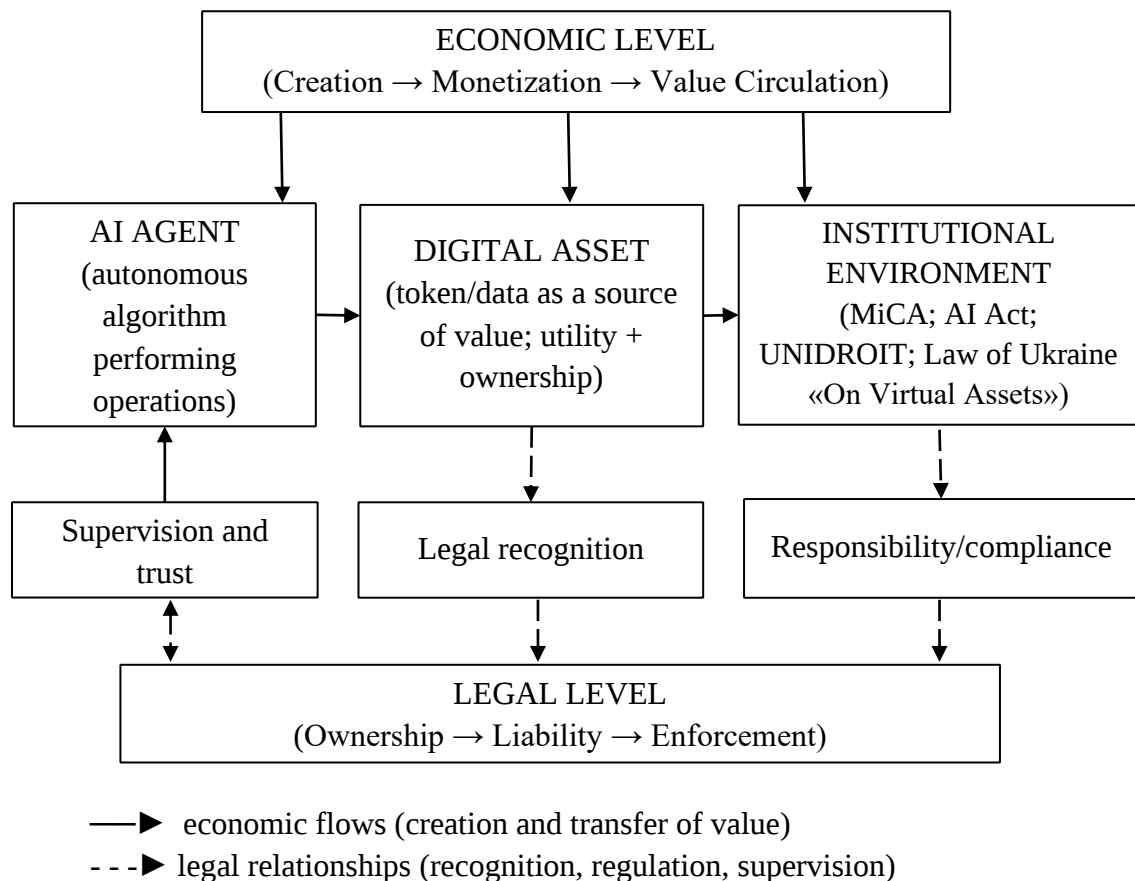


Fig. 1. Conceptual model of the economic and legal nature of digital assets operated by AI agents

Source: developed by the author based on [1-10]

This integrated approach reflects the economic and legal nature of digital assets as hybrid entities that are both products of technological innovations and objects of legal regulation. Unlike separate economic or legal interpretations, this model demonstrates that economic value cannot exist without a legal form, and legal protection loses its meaning without recognizing the value created algorithmically.

In the Ukrainian context, the model can serve as a methodological basis for the further development of national legislation on digital assets, aligning with EU standards (MiCA, AI Act, UNIDROIT Principles). Its practical significance lies in the ability to harmonize innovation policy with civil law mechanisms, ensuring the safe and transparent participation of AI agents in digital markets.



Conclusions. The study enabled the substantiation of the economic and legal nature of digital assets that operate under the management of AI agents. It was established that such assets combine the properties of an economic resource and an object of property rights. Their value is formed in the process of algorithmic creation, transmission and monetization of data.

It is determined that the autonomy of AI agents changes traditional approaches to the distribution of responsibility, ownership and control in the digital environment. The European regulatory model already contains complex mechanisms for harmonizing technological development and legal regulation. However, the national legislation of Ukraine is still in the process of formation.

A conceptual model of the economic and legal nature of digital assets operated by AI agents has been developed, which has a two-level structure. The proposed model highlights the need to synchronize economic and legal approaches in regulating digital assets. Further research should focus on developing mechanisms for the legal liability of AI agents and adapting the national regulatory framework to European standards.

References

1. Marino B., Juels A. Giving AI agents access to cryptocurrency and smart contracts creates new vectors of AI harm. 2025. arXiv:2507.08249. URL: <https://arxiv.org/abs/2507.08249> (date access: 05.09.2025).
2. Hu B. A., Liu Y., Rong H. Trustless autonomy: understanding motivations, benefits and governance dilemma in self-sovereign decentralized AI agents. 2025. arXiv:2505.09757. URL: <https://arxiv.org/abs/2505.09757> (date access: 05.09.2025).
3. Riedl M. O., Desai D. R. AI agents and the law. 2025. arXiv:2508.08544v1. URL: <https://arxiv.org/abs/2508.08544> (date access: 05.09.2025).



4. Karim M. M., Van D. H., Khan S., Qu Q., Kholodov Y. AI agents meet blockchain: a survey on secure and scalable collaboration for multi-agents. *Future Internet*. 2025. Vol. 17, № 2. Article 57. DOI: <https://doi.org/10.3390/fi17020057>.
5. Fodouop K. M. K., Ndiaye A. The AI agent revolution in crypto: looming risks and regulatory opportunities. 2025. URL: https://abdouecon.github.io/research/policy/ai_agents.pdf (date access: 05.09.2025).
6. Gatto J., Earp-Thomas M. AI and blockchain – 1+1=3. *Law of the Ledger*. 2025. URL: <https://www.lawoftheledger.com/2025/02/articles/artificial-intelligence/ai-and-blockchain-11-3/> (date access: 05.09.2025).
7. Wyczik J. Ownership in the 21st century: Property law of digital assets. *Information & Communications Technology Law*. 2024. Vol. 34, № 2. P. 187–206. DOI: <https://doi.org/10.1080/13600834.2024.2408917>.
8. Borjigin A., Zhou W., He C. AI governed agent architecture for web trustworthy tokenization of alternative assets. 2025. URL: <https://arxiv.org/html/2507.00096v1> (date access: 05.09.2025).
9. Ante L. Autonomous AI agents in decentralized finance: market dynamics, application areas, and theoretical implications. 2024. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5055677 (date access: 05.09.2025).
10. Будник В. Суть цифрових активів: концептуальні основи та сучасний контекст. *Вісник Економіки*. 2025. № 1. С. 148–160. DOI: <https://doi.org/10.35774/>.
11. Федосенко Н. Цифрові активи як об'єкт цивільних прав. *Аналітично-порівняльне правознавство*. 2025. № 3 (1). С. 335–339. DOI: <https://doi.org/10.24144/2788-6018.2025.03.1.50>.
12. Дмитрик О. Віртуальні активи і цифрові активи: до питання про співвідношення понять. *Право та інноваційне суспільство*. 2021. № 2 (17).



C. 248–254. URL: <https://apir.org.ua/lais/uk/article/view/403/353> (date access: 05.09.2025).

13. Бутнік-Сіверський О. Б. Цифрові та віртуальні активи: методологія, правові аспекти, нематеріальні ресурси. *Теорія і практика інтелектуальної власності*. 2024. № 2. С. 94–104. URI: <https://dspace.nuft.edu.ua/handle/123456789/44986> (date access: 05.09.2025).

14. Kaptosv L. Using Redis for caching optimization in high-traffic web applications. *International Journal of Advanced Multidisciplinary Research and Studies*. 2025. Vol. 5, № 4. P. 1714-1722. DOI: <https://doi.org/10.62225/2583049X.2025.5.4.4839>.

15. Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on Markets in Crypto-Assets (MiCA). *EUR-Lex*. URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R1114> (date access: 05.09.2025).

16. Regulation of the European Parliament and of the Council laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act). *EUR-Lex*. 2024. URL: <https://eur-lex.europa.eu> (date access: 05.09.2025).

17. UNIDROIT Principles on Digital Assets and Private Law (2023). *International Institute for the Unification of Private Law (UNIDROIT)*. URL: <https://www.unidroit.org/wp-content/uploads/2024/01/Principles-on-Digital-Assets-and-Private-Law-linked-1.pdf> (date access: 05.09.2025).

18. Про віртуальні активи: Закон України від 17.02.2022 р. № 2074-IX. *Верховна Рада України*. URL: <https://zakon.rada.gov.ua/laws/show/2074-20> (date access: 05.09.2025).