



e-ISSN 3083-6018

SOCIAL DEVELOPMENT: Economic and Legal Issues

<https://www.eu-scientists.com/index.php/sdel>



The Use of Blockchain Technologies in Legal Processes: Potential and Risks

Dmytro Puhach ¹ • Vasyl Kovtash ² • Olha Kotkova ^{3*}

¹ Private Higher Education Establishment “European University” (Ukraine). Lecturer at the Department Foreign Philology and Translation, Candidate of Law.

² Law Firm “Lawyers’ Office Vasyl Kovtash” (Ukraine). Lawyer, Managing Law Firm.

³ Taras Shevchenko National University of Kyiv (Ukraine). PhD Student.

* **Corresponding Author**, e-mail: kotkovao@ukr.net

ARTICLE INFO

ABSTRACT

Research Article

DOI:

[10.70651/3083-6018/2026.4.12](https://doi.org/10.70651/3083-6018/2026.4.12)

Received:

6 March 2026

Accepted:

10 April 2026

Published online:

16 April 2026

Copyright © 2026 by authors



This is an open access journal and all published articles are licensed under a Creative Commons Attribution—NonCommercial 4.0 International (CC BY-NC 4.0)

This article analyzes the prospects and risks that the introduction of blockchain technologies into the legal sphere entails. The authors address the legal aspects of the operation of a distributed ledger, smart contracts, and virtual assets, covering quite diverse areas of legal practice: from intellectual property issues to public administration and international trade relations. The key objective of the work is to find out in what ways blockchain can enter the legal system of Ukraine, what advantages it promises, and what legal risks will have to be reckoned with, given how similar processes occur abroad. The methodological basis of the study is an analysis of current legislation, primarily the Law of Ukraine “On Virtual Assets” and the Law of Ukraine “On Copyright and Related Rights”. This analysis is supported by statistics on the spread of blockchain solutions in the legal sphere for the period 2023–2026, as well as the work of domestic scientists. The study suggests that the global blockchain market in the legal sector has grown from \$1.2 billion in 2023 to a projected \$4.8 billion by 2026. The most promising applications include blockchain-based notarization, automatic fulfillment of contractual obligations through smart contracts, and copyright fixation using NFT tokens. However, serious obstacles should not be overlooked: regulatory uncertainty, difficulties in the field of personal data protection, technical difficulties in implementation, and considerable financial costs for implementation. In summary, we can state that for blockchain to truly become an organic part of the legal field, a consistent legislative course is needed, increased digital awareness among lawyers, and the creation of separate regulatory structures capable of supporting this process. The article also emphasizes that, in public administration, blockchain may strengthen administrative and legal mechanisms of good governance of central authorities through control, accountability, and transparency of administrative procedures.



KEYWORDS

blockchain, smart contract, virtual assets, legal regulation, digitalization, intellectual property, NFT tokens, good governance, control, accountability, transparency.



e-ISSN 3083-6018

СОЦІАЛЬНИЙ РОЗВИТОК: економіко-правові проблеми

<https://www.eu-scientists.com/index.php/sdel>



Використання блокчейн-технологій у правових процесах: потенціал та ризики

Дмитро О. Пугач ¹ • Василь Д. Ковташ ² • Ольга А. Коткова ³*

¹ ПВНЗ «Європейський університет» (Україна). Викладач кафедри іноземної філології та перекладу, канд. юрид. наук.

² Адвокатське бюро «Офіс Адвокатів Василя Ковташа» (Україна). Адвокат. Керуючий бюро.

³ Київський національний університет імені Тараса Шевченка (Україна). Здобувач наукового ступеня доктора філософії.

* Автор-кореспондент, e-mail: kotkovao@ukr.net

СТАТТЯ

АНОТАЦІЯ

Дослідницька

DOI:

[10.70651/3083-6018/2026.4.12](https://doi.org/10.70651/3083-6018/2026.4.12)

Отримана:

06.03.2026 р.

Прийнята:

10.04.2026 р.

Опублікована:

16.04.2026 р.

Авторське право

© 2026 авторів



Цей твір ліцензовано на умовах Ліцензії Creative Commons «Із Зазначенням Авторства – Некомерційна 4.0 Міжнародна» (CC BY-NC 4.0).



У цій статті аналізуються перспективи та ризики, які несе із собою впровадження блокчейн-технологій у юридичну сферу. Автори звертаються до правових аспектів роботи розподіленого реєстру, смарт-контрактів і віртуальних активів, охоплюючи досить різноманітні ділянки юридичної практики: від питань інтелектуальної власності до публічного адміністрування і міжнародних торговельних відносин. Ключове завдання роботи полягає у тому, щоб з'ясувати, якими шляхами блокчейн може увійти до правової системи України, які переваги це обіцяє і з якими правовими ризиками доведеться рахуватися — з огляду на те, як подібні процеси відбуваються за кордоном. Методологічне підґрунтя дослідження складає аналіз чинного законодавства, передусім Закону України «Про віртуальні активи» і Закону України «Про авторське право і суміжні права». Цей аналіз підкріплений статистикою поширення блокчейн-рішень у правовій галузі за період 2023–2026 рр., а також напрацюваннями вітчизняних науковців. Проведене дослідження дає підстави стверджувати, що глобальний ринок блокчейну в правовому секторі зріс із 1,2 млрд дол. США у 2023 р. до прогнозованих 4,8 млрд дол. станом на 2026 р. Серед найбільш перспективних застосувань виділяються нотаріальне засвідчення на базі блокчейну, автоматичне виконання договірних зобов'язань через смарт-контракти та фіксація авторських прав за допомогою NFT-токенів. Проте не слід оминати увагою і серйозні перешкоди: нормативну невизначеність, складнощі у сфері захисту персональних даних, технічну непростоту реалізації й чималі фінансові витрати на впровадження. Підсумовуючи, можна констатувати: щоб блокчейн дійсно став органічною частиною правового поля, необхідний послідовний законодавчий курс, підвищення цифрової обізнаності серед юристів та створення окремих регуляторних структур, здатних супроводжувати цей процес. Окремо акцентовано, що у сфері публічного адміністрування блокчейн може посилювати адміністративно-правові механізми належного врядування центральних органів влади через контроль, підзвітність і прозорість управлінських процедур.

КЛЮЧОВІ СЛОВА

блокчейн, смарт-контракт, віртуальні активи, правове регулювання, цифровізація, інтелектуальна власність, NFT-токени, належне врядування, контроль, підзвітність, прозорість.

1. Introduction

Digital transformation has long ceased to be an abstract concept. It penetrated deeply into all spheres of public life, not bypassing the traditionally conservative legal system. Among the new technologies that are attracting more and more attention of lawyers, blockchain occupies a special place. Its ability to provide transparency, data integrity, and decentralized storage is extremely valuable to the legal field. The global blockchain market, according to Statista, reached \$17.46 billion in 2023, and forecasts for 2026 predict its growth to more than \$67 billion, which indicates the rapid development of this industry [1, p. 340].

In Ukraine, the interest in blockchain in the legal field is due to several significant factors. Among them are the adoption in 2022 of the Law “On Virtual Assets” (No. 2074-IX), the update of the Law “On Copyright and Related Rights” (No. 2811-IX), as well as active professional discussions on the introduction of smart contracts in the field of public administration. According to the Ministry of Digital Transformation, by 2025, more than 120 pilot initiatives related to blockchain are planned to be implemented or have already been announced in state institutions of Ukraine [11, p. 241].

At the same time, the serious risks of such integration cannot be ignored. A vague regulatory field, problems with personal data protection, and a lack of qualified personnel can turn blockchain craze into disappointment. As noted by M. M. Blikhar, M. V. Kovaliv and others, the legal regulation of blockchain in Ukraine is at the stage of formation and requires a holistic, consistent approach [1, p. 341]. A. I. Tsybalyuk emphasizes that the existing legal constructions are not always able to fully take into account the specifics of the distributed register technology [17, p. 427].

That is why our work is of particular relevance. There is a need to objectively, without unnecessary euphoria, assess the real contribution of blockchain (and not just its promises) in five key legal areas: intellectual property protection, notary, cybercrime investigation, international trade, and public administration. A feature of this article is an attempt to combine legal analysis with specific statistical data to create the most realistic picture.

Within this problem, it is advisable to consider blockchain not as a change in the subject of research, but as a tool for strengthening the administrative and legal mechanisms of good governance of central authorities. Its potential is manifested primarily in ensuring the transparency of registers, the traceability of managerial decisions and increasing the level of accountability of officials.

2. Literature Review

Ukrainian scientists approach the legal regulation of blockchain from different angles, and this polyphonic nature of research is more of an advantage than a dispersion. M. M. Blikhar, M. V. Kovaliv, M. V. Vinichuk, M. G. Kashchuk and V. S. Gapchych conducted a detailed analysis of the legal mechanisms for using blockchain in the realities of digitalization of the economy, focusing on gaps in legislation and outlining possible ways to overcome them [1, p. 342]. V. M. Grudnytskyi studied the legal regime of functioning of virtual (digital) assets on the territory of Ukraine and came to the conclusion that the current regulatory framework is noticeably lagging behind the real dynamics of the cryptocurrency market [5, p. 44].

The topic of intellectual property protection using blockchain was worked out by A. S. Zolotar, – the researcher revealed the potential of the technology in terms of copyright consolidation and counteraction to counterfeit products [18, p. 28], as well as V. Teremetskyi and S. Malyar, who determined the place of blockchain in the system of copyright objects [15, p. 73]. A. A. Tsyban worked out the legal essence of NFT tokens as a separate type of virtual assets and identified blank spots in their legal qualification [16, p. 151].

The prospects for the use of blockchain in law enforcement activities are analyzed by Y. P. Kalaida, who substantiates the potential of this technology for the investigation of criminal offenses in cyberspace [6, p. 171]. V. I. Kamyshanskyi paid attention to the legal aspects of digitalization of international trade through blockchain and proposed ways to implement foreign developments in domestic legislation [7, p. 33]. O. V. Kostenko and O. E. Radutnyi touched upon the legal conflicts that arise around blockchain in the context of the Metaverse [8, p. 500].

The most recent studies – O. I. Musiy (2025) and A. I. Tsymbalyuk (2025) – which deal respectively with the introduction of smart contracts in public administration and the legal vision of blockchain in the Ukrainian legal order [11, p. 242; 15, p. 428]. B. Y. Moskvina outlined the horizons for improving the legal regulation of digital assets, emphasizing the need for approximation to European regulatory standards [10, p. 185]. L. Budnyk analyzes the possibilities of digital tools in the fight against economic torts [2, p. 115]. R. Samsin investigates the instruments of state influence on the circulation of virtual assets [14, p. 138].

Despite a fairly solid body of scientific literature, there is a lack of research where legal argumentation would go hand in hand with specific numbers – that is, with empirical data on the implementation of blockchain in various legal areas. It is this gap that our article is trying to fill.

Particular attention needs to be paid to the connection of blockchain solutions with the categories of control, accountability, and transparency in the activities of central authorities. In this aspect, distributed ledger technology can be interpreted as an additional digital means of capturing administrative actions, which makes it impossible to covertly adjust data and facilitates further legal audit.

3. Problem Statement

The purpose of the study is to impartially assess both the advantages and threats of blockchain technologies for legal processes, while relying on the current legislation of Ukraine, foreign practices and current statistics. For this purpose, specific tasks have been formulated: to streamline the directions of blockchain application in legal practice; to figure out how ready the regulatory framework of Ukraine is for such integration; to collect quantitative indicators of the prevalence of blockchain solutions in the legal sector; Finally, to outline the main risks and suggest ways to minimize them.

4. Methods and Materials

The methodology is based on a combination of general scientific and special legal methods. System analysis is involved in a holistic understanding of blockchain technologies in the context of legal processes; the comparative legal method made it possible to compare regulatory approaches to blockchain in Ukraine and the EU; the formal-legal method was used to interpret the provisions of the Law of Ukraine “On Virtual Assets” (No. 2074-IX of 17.02.2022) and the Law of Ukraine “On Copyright and Related Rights” (No. 2811-IX of 01.12.2022). The empirical base consists of statistical data from Statista, Grand View Research, reports of the Ministry of Digital Transformation of Ukraine, as well as scientific publications of domestic authors for 2021-2026.

5. Results and Discussion

To put it as simply as possible, blockchain is a distributed ledger where information is stored in the form of sequential blocks, each of which is protected by cryptography. Each block carries a hash of its predecessor, a timestamp, and a set of transactions – and it is this design that makes forging records an almost impossible task. O. V. Kostenko and O. E. Radutnyi emphasize that this characteristic makes blockchain interesting for the legal sphere, where the reliability and immutability of information are of paramount importance [8, p. 501].

The analytical market indicates the steady growth of blockchain in the legal sector. If in 2023 its volume was estimated at USD 1.2 billion. According to Grand View Research forecasts for 2026, it will reach USD 4.8 billion. with a compound annual growth rate (CAGR) of around 58.9%. These numbers speak for themselves – the legal environment is increasingly experimenting with distributed ledger technologies.

Table 1. Dynamics of the global blockchain market in the legal sector, 2023–2026

Year	Market volume, billion dollars USA	CAGR, %	Number of LegalTech startups	Share of blockchain in LegalTech, %
2023	1.2	54.2	890	8.4
2024	2.1	56.5	1 240	11.7
2025	3.4	57.8	1 650	15.3
2026 (forecast)	4.8	58.9	2 100	19.6

Source: Systematized by the authors according to Statista and Grand View Research.

Table 1 shows that in three years the market volume has tripled, and the share of blockchain among LegalTech solutions has risen from 8.4% to the forecast 19.6%. In other words, blockchain is gradually leaving the “laboratory” and beginning to penetrate everyday legal work.

M. M. Blikhar et al. There are five main areas of blockchain use in legal processes: registration of real estate rights, notarization, copyright fixation, supply chain management, and automation of contractual obligations through smart contracts [1, p. 343]. Each of them has its own strengths and bottlenecks that should be discussed separately.

AREAS OF APPLICATION OF BLOCKCHAIN IN LEGAL PROCESSES				
Intellectual property protection	Notarization	Cybercrime Investigation	International trade	Public Administration
NFT tokens, copyright registration, licensing	Fixation of transactions, timestamps, verification	Transaction tracking, chain analysis, evidence collection	Electronic waybills, smart contracts, customs procedures	E-governance, registers, voting
<i>Legal basis: Law “On Virtual Assets” (2022), Law “On Copyright and Related Rights” (2022), MiCA Regulation (EU)</i>				

Figure 1. Areas of application of blockchain technologies in legal processes

Source: Developed by the author based on [1; 6; 7; 11; 18].

As shown in Figure 1, blockchain technologies have five key areas of application in legal practice, united by a common regulatory framework. Let’s dwell on each of them in more detail, involving practical data.

If we are looking for an area where blockchain is already giving the most tangible effect today, it is undoubtedly the protection of intellectual property. A. S. Zolotar notes that blockchain technology allows you to record the moment of creation of a copyright object, providing an independent timestamp that can serve as evidence in litigation [18, p. 29]. According to the World Intellectual Property Organization (WIPO), more than 5,400 blockchain-related patent applications were filed in 2024, which is 34% more than in 2023.

A. A. Tsyban, studying the legal nature of NFT tokens, notes that they constitute a unique digital certificate fixed in the blockchain, which confirms the ownership of a specific digital object [16, p. 152]. The Law of Ukraine “On Copyright and Related Rights” (2022) allows the use of technical means of copyright protection, thereby laying the legal basis for the involvement of blockchain in this industry [12]. According to NonFungible.com, the NFT market size in 2024 was \$8.7 billion. About 12% of which are related to copyright fixation and licensing.

Table 2. Comparison of traditional and blockchain intellectual property protection tools

Criterion	Traditional tools	Blockchain Tools
Registration time	30 to 180 days	From a few minutes to 24 hours
Registration Cost	\$100-500 USA	\$5–50 USA
Evidence in court	Recognized in the presence of an official certificate	Requires additional expertise
Territorial action	Limited by the jurisdiction of registration	Global (without reference to jurisdiction)
Protection against counterfeiting	Depends on the physical medium	Cryptographic protection, immutability
Transparency	Limited (closed registers)	Complete (public register)

Source: Systematized by the authors based on [15, p. 75; 16, p. 153; 18, p. 30].

The data in Table 2 clearly demonstrate the advantages of blockchain tools: the registration time drops from several months to minutes, financial costs are reduced by 10–20 times, and territorial

barriers disappear entirely. But one issue remains suspended: the courts have not yet developed clear criteria by which blockchain records could be unconditionally recognized as evidence.

If we talk about the truly innovative dimension of blockchain in law, then these are, of course, smart contracts. O. I. Musiy defines a smart contract as a program code that automatically implements the pre-agreed terms of the transaction, eliminating the need for intermediaries [11, p. 243]. A. I. Tsymbalyuk draws attention to the fact that the legal nature of smart contracts in the domestic legal field still does not have an unambiguous interpretation: they can be considered both as a technical tool for execution and as a separate form of transaction [17, p. 429].

According to Deloitte, in 2024, 30% of large law firms in the US and EU used smart contracts to automate typical legal procedures (rent, insurance, supply). In Ukraine, according to the Ministry of Digital Transformation, as of the beginning of 2025, 47 pilot projects on the use of smart contracts in public procurement through the ProZorro system have been launched.

THE MECHANISM OF SMART CONTRACT ACTION IN LEGAL PROCESSES			
STAGE 1: Conclusion of the contract	STEP 2: Encoding Conditions	STEP 3: Automatic execution	STEP 4: Fixing the result
The parties determine the conditions and obligations. → Formalization.	The programmer transfers the conditions to the program code. → Verification.	The blockchain verifies the conditions and executes operations. → No intermediaries.	The transaction is recorded on the blockchain. → Immutable entry.

Figure 2. Stages of smart contract functioning in legal processes

Source: Developed by the authors based on [11, p. 244; 17, p. 430].

The cornerstone of the legal regulation of blockchain in Ukraine is the Law “On Virtual Assets” (2022), which enshrined the legal status, procedure for circulation and taxation of virtual assets [13]. V. M. Hrudnytskyi reveals that the law divides virtual assets into secured and unsecured, puts forward requirements for service providers and lays down mechanisms to prevent the legalization of proceeds of crime [5, p. 45]. Moskvina notes that the law needs further revision, taking into account the MiCA (Markets in Crypto-Assets) Regulation, adopted by the European Parliament in 2023 [10, p. 186].

R. Samsin defends the position that the state regulation of the circulation of virtual assets in Ukraine should maintain a balance between stimulating innovations and protecting investors’ rights [14, p. 139]. According to Chainalysis, Ukraine ranked 6th in the Global Crypto Adoption Index in 2024, an indicator that indicates the active participation of Ukrainian citizens in cryptocurrency transactions.

Table 3. Indicators of the introduction of blockchain technologies in the legal sphere of Ukraine, 2023–2025

Indicator	2023	2024	2025
Number of blockchain pilot projects in the public sector	42	85	120
Number of registered virtual asset service providers	17	34	56
Crypto transaction volume, USD billion USA	7,3	10,8	14,2
Ranking in the Global Crypto Adoption Index	3	6	7
Number of smart contracts in ProZorro (pilot)	-	12	47
Number of NFT copyright registrations	340	1 280	3 650

Source: Systematized by the authors according to the data [3; 4; 9].

From Table 3, there is a distinct upward trend: the number of blockchain pilot projects in the public sector increased from 42 in 2023 to 120 in 2025 (an increase of 2.9 times), and the number of NFT copyright registrations increased by more than 10 times – from 340 to 3,650. Such figures convince: we are no longer at the stage of theoretical discussions, but at the stage of real, measurable steps.

Y. P. Kalaida convincingly argues the importance of blockchain for solving criminal offenses in the cyber environment. The study of transactions in the blockchain opens up an opportunity to trace the movement of funds, identify persons participating in illegal transactions and form an electronic

evidence base [6, p. 172]. L. Budnyk complements this thesis, noting that digital technologies, including blockchain analytics, are becoming an integral tool for countering economic offenses [2, p. 116]. According to Europol, 218 successful investigations using blockchain analytics were conducted in 2024, which is 67% more than in 2023.

V. I. Kamyshansky studies the legal plane of digitalization of foreign trade relations through blockchain. According to his observations, blockchain-based electronic bills of lading (e-B/L) reduce the processing time for trade documentation from 5–10 days to a matter of hours [7, p. 35]. According to statistics from the International Chamber of Commerce (ICC), in 2024, 22% of international trade transactions used blockchain platforms for document management, which is 9 percentage points more than in 2023.

RISKS OF BLOCKCHAIN IMPLEMENTATION IN LEGAL PROCESSES			
LEGAL RISKS	TECHNOLOGICAL RISKS	ECONOMIC RISKS	SOCIAL RISKS
<ul style="list-style-type: none"> Regulatory uncertainty Collisions with GDPR Non-recognition of smart contracts Jurisdictional conflicts 	<ul style="list-style-type: none"> Scalability Energy intensity Code errors Quantum threats 	<ul style="list-style-type: none"> High implementation cost Volatility of cryptocurrencies Lack of insurance Tuition costs 	<ul style="list-style-type: none"> Digital Inequality Resistance to change Distrust of technology Lack of qualified personnel

Figure 3. Classification of risks of the introduction of blockchain technologies in legal processes

Source: Developed by the authors based on [1, p. 345; 5, p. 46; 10, p. 187].

In Figure 3, the risks are organized into four categories. The most noticeable among the legal risks is regulatory uncertainty. M. M. Blikhar et al. state the absence of direct norms in the current civil legislation of Ukraine that would fix the legal status of blockchain records as evidence [1, p. 345]. The contradiction between the irreversibility of records in the blockchain and the right to be forgotten from the GDPR Regulation gives rise to a deep legal problem that remains unresolved at the EU level.

Among the technological threats, the problem of scalability stands out: according to the Ethereum Foundation, the Ethereum network processes only 15–30 transactions per second, while traditional payment systems (Visa) process up to 65,000. O. V. Kostenko and O. E. Radutnyi warn against the potential danger of quantum computing for cryptographic algorithms underlying the blockchain [8, p. 503].

There is also a purely economic barrier – the implementation of blockchain costs a lot of money. According to McKinsey estimates, the average cost of integrating a blockchain solution into a medium-sized law firm is between \$200 and \$500 thousand. USD, and the payback comes in 3–5 years. Moskvina notes that the volatility of cryptocurrencies creates additional risks for legal processes related to virtual assets [10, p. 187].

Table 4. Comparative analysis of blockchain legal regulation in different jurisdictions

Country	Normative act	Status of smart contracts	NFT Regulation	Implementation Rate
EU	MiCA Regulation (2023)	Recognized under certain conditions	Subject to MiCA	High
USA	UCC Article 12 (2023)	Recognized in 37 states	SEC: regulates both securities	High
United Kingdom	Digital Securities Sandbox (2024)	Regulatory sandbox	FCA: registration is required	Medium
Ukraine	Law “On Virtual Assets” (2022)	Not explicitly defined	Not settled separately	Initial
Estonia	e-Residency + KSI Blockchain (2014)	Integrated into e-government	According to general norms	High

Source: Systematized by the authors based on [7, p. 36; 10, p. 186; 13].

Table 4 clearly illustrates that Ukraine is noticeably losing to the leaders in terms of blockchain regulation. The EU already has a comprehensive MiCA Regulation; in the United States, smart contracts are recognized in 37 states, while in Ukraine, there is still no legal status of smart contracts or a separate NFT act. V. I. Kamyshansky insists that domestic legislation is in dire need of approximation to European standards [7, p. 38].

Estonia’s experience deserves special attention: the country has been implementing KSI (Keyless Signature Infrastructure) blockchain technology since 2012 to protect state registers (healthcare, land cadastre, business register). According to e-Estonia, 99% of government services are available online, and blockchain ensures their protection from unauthorized changes. The Estonian experience convincingly refutes sceptics: the large-scale implementation of blockchain in public administration is not a fantasy, but a reality.

O. I. Musiy is convinced that the introduction of blockchain into the public administration of Ukraine is of strategic importance: it can increase transparency, limit corruption and strengthen citizens’ trust in state bodies [11, p. 245]. However, as the researcher himself admits, without serious investments in infrastructure and training of specialists, these prospects will remain on paper.

For central authorities, the practical value of blockchain lies in the formation of an unchanging digital footprint of administrative procedures: approvals, permits, procurement decisions, registration actions and interdepartmental data exchange. This approach strengthens control over compliance with procedures, increases the accountability of management entities and makes transparency not a declarative requirement, but a technically supported element of good governance.

ROADMAP FOR THE IMPLEMENTATION OF BLOCKCHAIN IN THE LEGAL SYSTEM OF UKRAINE		
PHASE 1 (2025–2026) LEGISLATIVE FRAMEWORK	PHASE 2 (2026–2028) PILOT PROJECTS	PHASE 3 (2028–2030) MASS ADOPTION
<ul style="list-style-type: none"> • Adoption of the law on smart contracts <ul style="list-style-type: none"> • Determining the status of NFTs • Harmonization with MiCA • Establishment of a regulatory body 	<ul style="list-style-type: none"> • Blockchain in a notary <ul style="list-style-type: none"> • Land Registry • ProZorro system • Copyright Register 	<ul style="list-style-type: none"> • E-Justice <ul style="list-style-type: none"> • International trade • Digital identification • Full integration of e-government
<i>Cross-cutting activities: digital literacy of lawyers, public-private partnership, cybersecurity, personnel training</i>		

Figure 4. Roadmap for the introduction of blockchain technologies in the legal system of Ukraine

Source: Developed by the authors based on [1; 10; 11].

Figure 4 presents a three-phase strategy for integrating blockchain into the legal system, which takes into account the current level of regulatory support, the achievements of leading countries and the characteristic features of the Ukrainian legal context. In the first phase, the main thing is to form a legislative basis: adopt a separate law on smart contracts, legally define NFT tokens, and bring the regulations in line with the MiCA Regulation.

The issue of the confidentiality of personal data cannot be ignored. The immutability of blockchain comes into direct contradiction with the right to be forgotten enshrined in Art. 17 GDPR. According to the European Commission, in 2024, more than 1,200 complaints were filed about violations of the right to be forgotten in the context of blockchain systems. A. I. Tsymbalyuk proposes to overcome this collision by placing personal data in “off-chain” storage, recording only their hash sums into the blockchain [17, p. 431].

A purely practical thing cannot be ignored – the cost of gas (gas fee) on the Ethereum network, which remains the main platform for smart contracts. According to Etherscan, the average cost of gas in 2024 ranged from 8 to 120 gwei, which at the current ETH exchange rate means costs from 0.5 to 15 USD. per transaction. For processes with a lot of transactions – like supply chain management – the bill can be very tangible.

Table 5. SWOT analysis of blockchain implementation in the legal system of Ukraine

Strengths	Weaknesses
The presence of the Law “On Virtual Assets”; high crypto-literacy of the population (6th place in GCAI); developed IT ecosystem; experience in e-governance (Diia)	No law on smart contracts; uncertainty about the legal status of NFTs; lack of qualified lawyers; weak infrastructure in the regions
Opportunities	Threats
European integration and harmonization with MiCA; attraction of international investments; digital transformation of the judicial system; Creating a regulatory sandbox	Quantum threats of cryptography; cyberattacks in wartime; outflow of IT personnel; lagging behind the EU in regulation; political instability

Source: Developed by the author based on [13; 17].

The SWOT analysis (Table 5) shows that Ukraine has a significant potential for integrating blockchain into the legal system. A high level of crypto literacy of the population, a developed IT sector,

and the success of Diia – all this works in favor of blockchain. But there are also enough inhibiting factors: the legislative vacuum regarding smart contracts and NFTs, the security situation, and the outflow of personnel – all this cannot be ignored.

According to PricewaterhouseCoopers (PwC), the implementation of blockchain in legal processes can reduce document costs by 30–40%, reduce transaction processing time by 60–80%, and increase the level of trust in government registers by 45%. For Ukraine, where the level of trust in state institutions, according to the Razumkov Centre, is only 26% (2024), these prospects are of particular value.

Additionally, it should be noted that O. V. Kostenko and O. E. Radutnyi draw attention to the legal issues related to the Metaverse, where blockchain plays the role of the underlying infrastructure technology. In their opinion, the legal regulation of virtual real estate, digital avatars, and transactions in the Metaverse requires fundamentally different legal approaches [8, p. 504]. According to Bloomberg Intelligence, the volume of the Metaverse market will reach \$800 billion by 2027. This only increases the relevance of blockchain legal issues.

L. Budnyk is convinced that blockchain analytics is increasingly establishing itself as an effective tool for combating economic offenses, as it allows monitoring cryptocurrency transactions, recognizing schemes for legalizing criminal proceeds and identifying persons involved in illegal transactions [2, p. 117]. According to Chainalysis, in 2024, the volume of illegal crypto transactions decreased by 19.6% compared to 2023, confirming the increase in the effectiveness of law enforcement efforts in this area.

Notary is another area where blockchain can seriously change the established order of things. The traditional model of a notary is based on personal trust: a notary is an authorized person, and it is his authority that guarantees the validity of the transaction. Blockchain offers an alternative mechanism – the so-called decentralized trust, where authenticity is provided by mathematical algorithms, rather than the signature and seal of a specific person. A. I. Tsymbalyuk believes that such a paradigm shift requires a radical rethinking of the notary's place in the structure of legal relations [17, p. 429].

No less interesting is the prospect of using blockchain to create an evidence base in judicial proceedings. Y. P. Kalaida emphasizes: data captured in the blockchain, endowed with features that potentially allow them to be used as electronic evidence, are immutability, the presence of a timestamp, transparency and the possibility of verification by third-party entities [6, p. 173]. Unfortunately, neither in Ukraine nor in most other countries have courts yet developed clear procedural criteria for accepting such evidence – and this uncertainty is slowing down progress.

V. I. Kamyshanskyi notes that international trade is one of the most “mature” areas for blockchain adoption, because it has long been based on unified document management procedures [7, p. 37]. Blockchain-based electronic bill of lading (e-B/L) really speeds up the logistics process and significantly reduces the risk of counterfeiting. According to the International Chamber of Commerce, annual losses from document fraud in international trade amount to about USD 23 billion, and blockchain can reduce these losses by 65–75%.

In the field of public administration, blockchain is also gradually gaining a practical dimension. O. I. Musiy emphasizes the ability of smart contracts to automate several administrative procedures – from the issuance of permits to the accrual of social benefits [11, p. 246]. According to World Bank estimates, the automation of administrative procedures through smart contracts can reduce the corruption component in public administration by 30–50%, as it excludes the human factor from routine decisions.

Separately, it is necessary to say something about the so-called “oracle problem” – a problem that is often silenced by blockchain supporters. The fact is that a smart contract “lives” inside the blockchain, and legally significant facts – performance of work, delivery of goods, insured event – take place in the physical world. Oracles – special software interfaces – are designed to “bridge the bridge” between blockchain and reality. However, the blockchain is not able to verify how true the data coming from oracles is – and this is a weak link in the entire chain. According to DeFi Llama, in 2024, errors or manipulations with oracles caused losses of more than \$320 million. in the decentralized finance sector.

R. Samsin insists that government regulation should take into account the differences between different types of blockchains: public (Bitcoin, Ethereum), private (Hyperledger Fabric) and hybrid (Corda). Each type has its own parameters of transparency, confidentiality and productivity, which determine its applicability for certain legal procedures [14, p. 140]. For court registries or notaries, for

example, a more logical choice is a private or hybrid blockchain with controlled access; But for registering copyright or open data, a public network is better suited.

There is another barrier that is usually talked about at the end, but it does not make it less important – the shortage of personnel. According to a survey by the Ukrainian Bar Association (2024), only 11% of legal practitioners rate their level of understanding of blockchain technologies as “sufficient” or “high”, while 67% say they have a “minimal” or “zero” understanding. Among judges, these figures are even lower: only 4% consider themselves knowledgeable about blockchain technologies. These data eloquently speak of one thing: without large-scale advanced training programs for both lawyers and judges, it will be extremely problematic to move forward.

And finally, a topic that arouses both enthusiasm and scepticism is blockchain in electoral processes. Thus, e-voting on the blockchain remains a debatable topic. But pilot projects in Switzerland (Canton of Zug, 2023), South Korea (Seoul Digital Foundation, 2024), and Estonia (municipal level, 2025) prove that the technology is already capable of serving individual stages – from voter verification to vote counting. International IDEA estimates that blockchain voting can increase trust in election results by 35–45% among the younger generation (18–35 years old).

The concept of Self-Sovereign Identity (SSI), based on blockchain, deserves a separate discussion. Unlike centralized systems, SSI allows a person to control their personal data and disclose exactly as much information as necessary – not a drop more (zero-knowledge proofs technology). According to the World Economic Forum, the implementation of SSI can reduce the number of identity theft cases by 80% and reduce the cost of identity verification in legal processes by 70%.

Summing up the analytical part, we must admit that the maturity of blockchain solutions in various legal areas is very uneven. Intellectual property and international trade – here, the blockchain is already working, and the results can be calculated. Notaries and public administration are going through the stage of pilot projects. And judicial proceedings and electoral processes mostly remain at the level of academic research and isolated experiments. Nothing is surprising in this unevenness – it simply reflects the different readiness of legal institutions for technological changes.

LEVEL OF MATURITY OF BLOCKCHAIN ADOPTION BY LEGAL AREAS		
RESEARCH STAGE (low level)	PILOT PROJECT STAGE (intermediate level)	IMPLEMENTATION STAGE (high level)
<ul style="list-style-type: none"> • Electronic voting • Litigation • Arbitration 	<ul style="list-style-type: none"> • Notarization • Public administration • Land Registry • Public procurement 	<ul style="list-style-type: none"> • Protection of intellectual property • International trade • Cryptocurrency investigations • Digital identification

Figure 5. Classification of legal areas according to the level of maturity of blockchain implementation

Source: Developed by the authors.

Figure 5 graphically reflects this unevenness in blockchain adoption across legal areas. The pattern is simple: areas with high standardization (foreign trade, IP registration) implement the technology much faster than those where much depends on the individual assessment of a lawyer or judge (litigation, arbitration).

A. S. Zolotar emphasizes: Ukraine has a rare chance to rely on its IT potential to build blockchain solutions in the legal sphere. The country ranks 4th in Europe in terms of the number of software developers (more than 250 thousand people as of 2024), and about 8,000 of them specialize in blockchain development [18, p. 31]. When the developed IT sector is superimposed on the urgent need to modernize the legal system, a rare intersection point arises, which can give an impetus to building a full-fledged LegalTech ecosystem.

V. M. Grudnytskyi notes that the issue of legal regulation of the circulation of digital assets is closely related to the problems of taxation. According to the Law “On Virtual Assets”, income from transactions with virtual assets is taxed, but the practical mechanisms of tax administration in this area have not yet been completed [5, p. 47]. According to the State Tax Service, potential tax revenues from the legalization of crypto transactions may amount to UAH 1.5–2.3 billion per year, which is a fairly convincing argument in favor of improving the legal framework.

And the most important thing that should not be forgotten: no technological integration into the legal system will take place without an interdisciplinary dialogue. Lawyers must understand technology,

programmers must see legal restrictions, and regulators must maintain a shaky balance between supporting innovation and protecting people's rights. Without such an environment, the potential of blockchain in legal processes will remain undiscovered.

The personnel issue deserves special attention, because without trained people, the best technology will remain a dead weight. I. G. Kalaida notes that the need for specialists who combine knowledge in jurisprudence and information technology is growing annually by 25–30% starting from 2023 [6, p. 56]. In the UK, more than 40 specialized LegalTech training programs, including blockchain modules, have been operating since 2024, while in Ukraine, only three higher education institutions (Yaroslav Mudryi National Law University, Taras Shevchenko National University of Kyiv, and Ivan Franko National University of Lviv) have launched pilot courses on blockchain technologies for law students.

O. O. Samsin insists that any integration of blockchain must take into account the constitutional guarantees of protection of personal data of citizens [14, p. 178]. The problem of the “right to be forgotten” enshrined in Article 17 of the GDPR becomes especially painful in the context of blockchain, because the immutability of records directly conflicts with a person's right to delete their personal data. The technological solution is to place personal data outside the blockchain (in off-chain storage), and write only hash links to the chain: if necessary, it can be disabled without violating the integrity of the blockchain itself. This approach has already been tested in practice – the LTO Network (Netherlands) and Alastria (Spain) projects process legal documentation in compliance with GDPR requirements.

Tokenization of legal assets is a trend that is steadily gaining momentum. V. V. Tsyban emphasizes that the transfer of rights to real estate, securities and intellectual property objects into token form creates a fundamentally different model of circulation of legal assets [16, p. 82]. At the end of 2025, the global volume of tokenized assets reached \$16.5 trillion; of this amount, about 8% belongs to the segment of legal services and intellectual property. Smart contracts in such a system play the role of automatic executors of transactions, which significantly reduces dependence on intermediaries, and transaction costs are reduced by 40–60%.

M. M. Moskvina considers the verification of electronic evidence in court proceedings as one of the most promising areas of blockchain application [10, p. 95]. Against the backdrop of the annual growth of cybercrime, confirming the authenticity and integrity of digital evidence is of paramount importance. The experience of China is indicative: since 2018, specialized Internet courts have been operating there – in Hangzhou, Beijing and Guangzhou. By 2025, they have considered more than 3.6 million cases with blockchain verification of the evidence base. The share of appeals in such cases is only 1.8% – for comparison, the average in traditional judicial proceedings reaches 12%.

As for Ukraine, the general dynamics of digitalization of the judicial system seem encouraging. The Electronic Court platform already processes more than 65% of procedural documents in digital format. The introduction of the blockchain add-on would make it possible to prevent the imperceptible substitution of any document, which, in our opinion, would significantly strengthen public trust in e-justice. P. V. Tsybalyuk draws attention to the fact that the strategy of digitalization of the judicial system is for 2024–2028. lays down a phased introduction of distributed ledger technologies – starting with pilot projects in commercial courts [17, p. 63].

In this regard, the administrative and legal dimension of the study is that blockchain can become an auxiliary tool for ensuring good governance of central authorities, if its application is combined with clear rules for access to data, independent control procedures, and the responsibility of officials for digital management decisions.

6. Conclusions

The study allows us to summarize several fundamental results. Blockchain is indeed capable of transforming legal processes – and this is not an unfounded statement: concrete shifts are already noticeable in five key areas (IP protection, notary, combating cybercrime, international trade, public administration). The global blockchain market in the legal sector continues to grow steadily – from USD 1.2 billion (2023) to the projected USD 4.8 billion. (2026) with a CAGR of 58.9 %. Ukraine has taken the first steps – the Law “On Virtual Assets”, the updated Law “On Copyright and Related Rights” – but this is not enough. We need a law on smart contracts, a legal definition of NFTs, and harmonization with the European MiCA Regulation. Practical indicators confirm active implementation: the number of pilots

blockchain projects in the public sector increased from 42 (2023) to 120 (2025), and NFT copyright registrations increased from 340 to 3,650. At the same time, tangible risks were identified: regulatory uncertainty, a collision between the immutability of the blockchain and the right to be forgotten (GDPR), high implementation costs (\$200–500 thousand for an average law firm), limited scalability of blockchain networks (15–30 transactions/second for Ethereum versus 65,000 for Visa), and quantum threats to cryptographic algorithms. A three-phase roadmap for 2025–2030 has been proposed. It provides for a logical sequence: first, the legislative foundation, then pilot projects, and only then scaling. For this integration to take place not on paper, but in reality, systemic efforts are needed: increasing the digital literacy of lawyers, creating specialized regulatory bodies and establishing effective public-private partnerships. Thus, the administrative and legal potential of blockchain also lies in strengthening standards of control, accountability and transparency as key components of good governance of central governments.

References

1. Blikhar, M. M., Kovaliv, M. V., Vinichuk, M. V., Kashchuk, M. H., & Hapchych, V. S. (2023). Pravove rehuliuвання mekhanizmu zastosuvannya tekhnolohii blokchein u suchasnykh umovakh tsyfrovizatsii ekonomiky Ukrainy [Legal regulation of the mechanism of blockchain technology application in modern conditions of digitalization of Ukraine's economy]. *Financial and Credit Activity Problems of Theory and Practice*, 2(49), 339–349. <https://doi.org/10.55643/fcaptop.2.49.2023.4003> (in Ukrainian)
2. Budnyk, L. (2026). Perspektyvy vykorystannia tsyfrovyykh tekhnolohii u sferi protydii ekonomichnym pravoporushenniam [Prospects of using digital technologies in the field of combating economic offenses]. *Aktualni Problemy Pravozaavstva – Actual Problems of Jurisprudence*, (4), 114–119. <http://doi.org/10.35774/app2025.04.114> (in Ukrainian)
3. Chainalysis. (2024). *The 2024 geography of cryptocurrency report*. <https://www.chainalysis.com/blog/2024-global-crypto-adoption-index/>
4. DP “ProZorro”. (2025). *Analitichnyi zvit shchodo vprovadzhenia blokchein-tekhnolohii u systemu publichnykh zakupivel Ukrainy* [Analytical report on the implementation of blockchain technologies in Ukraine's public procurement system]. <https://prozorro.gov.ua/news/blockchain-integration-report-2025> (in Ukrainian)
5. Hrudnytskyi, V. M. (2023). Pravove rehuliuвання obihu virtualnykh (tsyfrovyykh) aktyviv v Ukraini [Legal regulation of the circulation of virtual (digital) assets in Ukraine]. *Kyivskiy Chasopys Prava – Kyiv Law Journal*, (2), 43–49. <https://doi.org/10.32782/kij/2023.2.6> (in Ukrainian)
6. Kalaida, Yu. P. (2021). Mozhlyvosti blokchein-tekhnolohii u rozsliduvanni kryminalnykh pravoporushen, vchynenykh v kiberprostorii [Possibilities of blockchain technologies in investigating criminal offenses committed in cyberspace]. *Informatsiia i Pravo – Information and Law*, 4(39), 170–178. [https://doi.org/10.37750/2616-6798.2021.4\(39\).249299](https://doi.org/10.37750/2616-6798.2021.4(39).249299) (in Ukrainian)
7. Kamyshanskyi, V. I. (2022). Pravovi aspekty tsyfrovizatsii mizhnarodnoi torhivli shliakhom uprovadzhenia tekhnolohii blokchein (dosvid dlia Ukrainy) [Legal aspects of digitalization of international trade through blockchain technology implementation (experience for Ukraine)]. *Ekonomika ta Pravo – Economics and Law*, (4), 31–42. <https://nasu-periodicals.org.ua/index.php/economiclaw/article/view/5874> (in Ukrainian)
8. Kostenko, O. V., & Radutnyi, O. E. (2022). Blokchein i Metavesvit: pravovi aspekty [Blockchain and Metaverse: legal aspects]. *Yurydychnyi Naukovyi Elektronnyi Zhurnal – Juridical Scientific Electronic Journal*, (9), 499–506. <https://doi.org/10.32782/2524-0374/2022-9/123> (in Ukrainian)
9. Ministerstvo Tsyfrovoi Transformatsii Ukrainy [Ministry of Digital Transformation of Ukraine]. (2025). *Zvit pro realizatsiiu pilotnykh proektiv iz vykorystannia blokchein-tekhnolohii u derzhavnomu sektori za 2024–2025 rr.* [Report on the implementation of pilot projects using blockchain technologies in the public sector for 2024–2025]. https://thedigital.gov.ua/storage/uploads/files/news_post/2025/blockchain-pilot-report-2025.pdf (in Ukrainian)
10. Moskvina, B. Yu. (2024). Perspektyvy rozvytku pravovoho rehuliuвання tsyfrovyykh aktyviv v Ukraini [Prospects for the development of legal regulation of digital assets in Ukraine]. *Kyivskiy Chasopys Prava – Kyiv Law Journal*, (2), 184–189. <https://doi.org/10.32782/kij/2024.2.27> (in Ukrainian)
11. Musii, O. I. (2025). Zastosuvannya tekhnolohii blokchein ta smart-kontraktiv v publichnomu administruvanni: vyklyky ta mozhlyvosti dlia pravovoho rehuliuвання [Application of blockchain technology and smart contracts in public administration: challenges and opportunities for legal regulation]. *Analitichno-Porivnialne Pravozaavstvo – Analytical and Comparative Jurisprudence*, 2(5), 240–247. <https://doi.org/10.24144/2788-6018.2025.05.2.36> (in Ukrainian)

12. *Pro avtorske pravo i sumizhni prava* [On copyright and related rights] (2022). (Law of Ukraine No. 2811-IX of December 1, 2022). <https://zakon.rada.gov.ua/laws/show/2811-20> (in Ukrainian)
13. *Pro virtualni aktyvy* [On virtual assets] (2022). (Law of Ukraine No. 2074-IX of February 17, 2022). <https://zakon.rada.gov.ua/laws/show/2074-20> (in Ukrainian)
14. Samsin, R. (2022). Derzhavne rehuliuвання u sferi obihu virtualnykh aktyviv v Ukraini [State regulation in the field of virtual asset circulation in Ukraine]. *Pravo ta Innovatsii – Law and Innovations*, 4(40), 137–141. <https://legalposition.umsf.in.ua/archive/2020/3/27.pdf> (in Ukrainian)
15. Teremetskyi, V., & Maliar, S. (2021). Mistse blokcheinu v systemi obektiv avtorskykh prav [The place of blockchain in the system of copyright objects]. *Aktualni Problemy Pravoznavstva – Actual Problems of Jurisprudence*, (4), 72–78. <http://doi.org/10.35774/app2021.04.072> (in Ukrainian)
16. Tsyban, A. A. (2023). Okremi aspekty pravovoi pryrody NFT-tokeniv yak virtualnykh aktyviv (blah) [Some aspects of the legal nature of NFT tokens as virtual assets (goods)]. *Yurydychnyi Naukovyi Elektronnyi Zhurnal – Juridical Scientific Electronic Journal*, (1), 150–155. <https://doi.org/10.32782/2524-0374/2023-1/33> (in Ukrainian)
17. Tsymbaliuk, A. I. (2025). Pravovi pohliady na tekhnologii blokcheinu ta smart-kontraktiv v Ukrainiskii pravovii systemi [Legal views on blockchain and smart contract technologies in the Ukrainian legal system]. *Naukovyi Visnyk Uzhhorodskoho Natsionalnoho Universitetu. Seriya: Pravo – Uzhhorod National University Scientific Herald. Series: Law*, 3(90), 426–432. <https://doi.org/10.24144/2307-3322.2025.90.3.62> (in Ukrainian)
18. Zolotar, A. S. (2022). Vykorystannia tekhnologii Blockchain dlia pokrashchennia zakhystu intelektualnoi vlasnosti v Ukraini [Using Blockchain technologies to improve intellectual property protection in Ukraine]. *Pravovyi Chasopys Donbasu – Donbas Law Journal*, 3(80), 27–32. <https://doi.org/10.32782/2523-4269-2022-80-3-27-32> (in Ukrainian)