**Civil law and civil process**

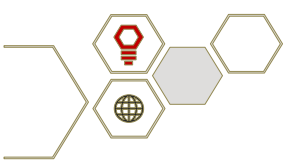
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DOI <https://doi.org/10.5281/zenodo.21072803>**Mechanisms for ensuring property rights during the tokenization of real-world assets****Yulia Leshchenko,**

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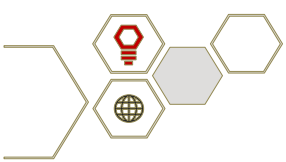
Abstract: The relevance of the study is determined by the growing adoption of real-world asset tokenization and the increasing role of digital technologies in the ownership, circulation, and management of property rights. The conversion of real estate, securities, financial claims, intellectual property, and other assets into tokenized forms creates new opportunities for enhancing liquidity, facilitating ownership fractionalization, and attracting investment. At the same time, the transformation of traditional ownership models raises important questions concerning the protection of property rights, the legal significance of tokenized representations, and the achievement of legal certainty in transactions involving digital assets. **The purpose** of the article is to substantiate the mechanisms for ensuring property rights during the conversion of real-world assets into tokenized forms and to determine directions for their improvement in the context of the digitalization of property relations. **Methods.**



The study employs systemic, formal-legal, comparative-legal, and logical-analytical methods. The conceptual and legal foundations of property rights protection in the process of asset tokenization are examined. The mechanisms for recording, transferring, and exercising ownership rights within tokenized ecosystems are analyzed, together with the relationship between digital tokens and underlying assets as a prerequisite for legal certainty. It is revealed that the effective protection of property rights depends on the existence of a legally recognized connection between a tokenized representation and a real-world asset, ensuring the verification, exercise, and protection of rights regardless of their digital form. It is demonstrated that blockchain technologies and smart contracts enhance the efficiency of asset circulation but do not eliminate the need for legal mechanisms of verification, supervision, control, and enforcement. **Results.** It is established that the most significant risks for holders of tokenized assets are associated with the uncertain legal status of tokens, fragmented regulatory frameworks, difficulties in the cross-border protection of rights, challenges in substantiating claims to underlying assets, and the limited harmonization of dispute resolution approaches. **Conclusions.** The necessity of improving asset verification procedures, audit mechanisms, disclosure requirements, digital identity solutions, and the harmonization of international regulatory approaches is substantiated. It is concluded that the effectiveness of tokenization depends not only on the technological capabilities of digital platforms but primarily on the ability of legal systems to maintain a stable and legally enforceable connection between a token and its underlying asset. Future research should focus on the development of legal mechanisms for controlling digital assets, improving models for the protection of token holders, and establishing international standards for the regulation of tokenized ownership.

Keywords: digital assets, blockchain technology, proprietary interests, digital economy, smart contracts, legal certainty, property rights protection, digital registries, fractional ownership, legal regulation.

Механізми забезпечення прав власності під час конвертації реальних активів у токеновані форми



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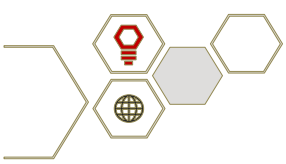
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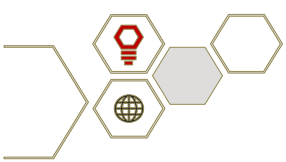
Анотація: Актуальність дослідження зумовлена поширенням практики токенизації реальних активів та зростанням ролі цифрових технологій у процесах володіння, обігу й управління майновими правами. Конвертація нерухомості, цінних паперів, фінансових вимог, об'єктів інтелектуальної власності та інших активів у токенизовані форми створює нові можливості для підвищення ліквідності, фракціонування власності та залучення інвестицій. Водночас трансформація традиційних моделей володіння актуалізує питання належного забезпечення прав власності, визначення юридичного значення токенизованих представлень та гарантування правової визначеності під час здійснення операцій із цифровими активами. **Метою статті** є обґрунтування механізмів забезпечення прав власності під час конвертації реальних активів у токенизовані форми та визначення напрямів їх удосконалення в умовах цифровізації майнових відносин. **Методи.** У дослідженні використано системний, формально-юридичний, порівняльно-правовий та логіко-аналітичний методи. Досліджено концептуально-правові засади забезпечення прав власності в процесі токенизації активів. Проаналізовано механізми фіксації, передачі та реалізації прав власності в токенизованих екосистемах, а також особливості взаємозв'язку між цифровими токенами та базовими активами як передумови юридичної визначеності. Виявлено, що ключовою умовою ефективного захисту прав власності є



існування належного правового зв'язку між токенизованим представленням і реальним активом, який забезпечує можливість підтвердження, реалізації та захисту відповідних прав незалежно від форми їх існування. Доведено, що технологічні механізми блокчейну та смарт-контрактів підвищують ефективність обігу активів, проте не усувають потреби в правових інструментах верифікації, контролю, нагляду та правозастосування. **Результати.** Встановлено, що найбільші ризики для власників токенизованих активів пов'язані з недостатньою визначеністю правового статусу токенів, фрагментарністю регулювання, складністю транскордонного захисту прав, проблемами підтвердження правомірності вимог на базовий актив та обмеженою уніфікацією підходів до вирішення спорів. **Висновки.** Обґрунтовано доцільність удосконалення процедур верифікації активів, механізмів аудиту, розкриття інформації, цифрової ідентифікації учасників та гармонізації міжнародних регуляторних підходів. Зроблено висновок, що ефективність токенизації визначається не лише технологічними можливостями цифрових платформ, а насамперед здатністю правової системи забезпечувати стабільний і юридично захищений зв'язок між токеном та активом. Перспективи подальших досліджень пов'язані з розвитком механізмів правового контролю над цифровими активами, удосконаленням моделей захисту прав токенодержателів та формуванням міжнародних стандартів регулювання токенизованої власності.

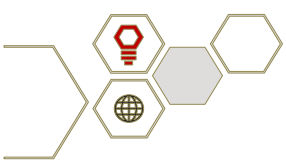
Ключові слова: цифрові активи, блокчейн-технології, майнові інтереси, цифрова економіка, смарт-контракти, юридична визначеність, захист прав, цифрові реєстри, фракціонована власність, правове регулювання.

Problem statement. The rapid expansion of asset tokenization is reshaping traditional approaches to the exercise and transfer of property rights by enabling the conversion of tangible and intangible assets into digital tokens recorded on distributed ledger infrastructures. While tokenization creates new opportunities for investment accessibility, liquidity enhancement, and transaction efficiency, it simultaneously



raises complex legal questions concerning the recognition, transferability, enforceability, and protection of rights associated with tokenized assets. Existing legal frameworks continue to rely primarily on conventional concepts of ownership and registration, which were not designed for digital environments where economic rights may circulate independently of the underlying asset. As a result, uncertainties emerge regarding the legal relationship between the token, the underlying asset, and the rights of token holders, particularly in cross-border transactions and decentralized ecosystems. These challenges acquire increasing practical significance as governments, financial institutions, and private enterprises expand the use of tokenization mechanisms in real estate, securities, intellectual property, and investment markets. Consequently, the development of effective mechanisms for ensuring property rights during the conversion of real-world assets into tokenized forms represents an important scientific and practical task aimed at strengthening legal certainty, protecting market participants, and facilitating the sustainable development of the digital economy.

Analysis of recent research and publications. A review of contemporary scholarship demonstrates that the protection of property rights during the conversion of real-world assets into tokenized forms is examined through interconnected legal, financial, technological, and institutional perspectives. R. Bondarchuk et al. analyze financial and credit mechanisms supporting innovation-oriented enterprises, emphasizing the role of modern financial instruments in strengthening asset ownership structures and enhancing the investment attractiveness of digitalized economic models [1]. Y. Tuholukov investigates the prospects for legalizing decentralized prediction markets through the case of Polymarket, highlighting the need for legal mechanisms capable of recognizing and protecting digital property rights within decentralized ecosystems [2]. L. Artyshuk-Bereziuk examines international legal mechanisms for protecting digital identity in cross-border legal relations, arguing that reliable identification of participants constitutes a prerequisite for the exercise and enforcement of ownership rights over tokenized assets [3]. A. V. Zakablukivskyi develops

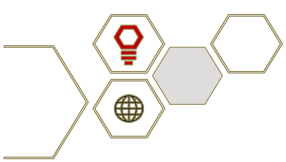


conceptual approaches to the legal identification and classification of digital assets [4] and further explores economic models for their accounting and taxation [5], thereby contributing to the establishment of legal certainty regarding the ownership and circulation of tokenized property.

A separate stream of research focuses on succession and transfer mechanisms for digital assets. V. I. Trach studies the implementation of notarial information systems for recording and transferring digital assets to heirs, emphasizing the importance of formal legal procedures for validating ownership transfers in digital environments [6]. D. I. Liushenko et al. analyze information systems designed for digital inheritance management and their integration into legal processes, stressing the necessity of ensuring continuity of ownership rights following changes in asset holders [7].

Significant contributions to the understanding of real-world asset tokenization have been made by international scholars. A. Baum examines tokenization as a transformative mechanism for real estate investment and underscores the importance of maintaining a legally enforceable connection between the digital token and the underlying asset to safeguard investors' ownership rights [8]. K. Oloke proposes an end-to-end asset tokenization framework based on artificial intelligence-enhanced valuation models and decentralized infrastructure, highlighting transparency, asset verification, and secure rights management as key components of tokenized ecosystems [9]. A. El Jaouhari et al. conceptualize tokenization as a new paradigm of property investment, demonstrating how digital tokens reshape traditional mechanisms of ownership, transfer, and exercise of property rights in real estate markets [10]. K. Alnabulsi explores theoretical and empirical dimensions of real estate tokenization, emphasizing the need to align technological innovation with established legal frameworks governing ownership protection and asset transactions [11].

Particular attention to regulatory and legal dimensions of tokenization is evident in recent studies. R. Mirdala provides a comprehensive analysis of legal frameworks, market dynamics, and policy pathways for real-world asset tokenization, identifying



legal certainty and enforceability of ownership rights as critical prerequisites for the sustainable development of decentralized financial systems [12]. N. Xia et al. investigate the concept of real-world assets and the mechanisms of their tokenization, revealing the challenges associated with linking physical assets to digital representations and ensuring the legal validity of rights embodied in tokens [13].

Identification of previously unresolved parts of the general problem.

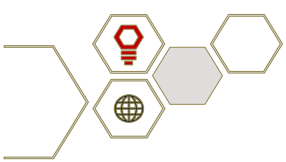
Despite the growing scholarly interest in asset tokenization, the legal nature of the relationship between tokenized representations and underlying assets remains insufficiently defined. Existing research predominantly addresses technological and regulatory aspects of tokenization, while issues of legal certainty, ownership protection, and enforceability of rights in tokenized environments have not received comprehensive consideration.

The unresolved nature of these issues creates obstacles to the effective protection of proprietary interests and the sustainable development of tokenized asset markets. Their further examination is therefore necessary for improving legal mechanisms that ensure a reliable connection between digital tokens and real-world assets within the evolving digital economy.

Formulation of the article's objective (research purpose). Purpose of the article is to substantiate the legal mechanisms for ensuring property rights in the process of converting real-world assets into tokenized forms and to determine directions for their improvement in the context of digital transformation.

Objectives of the article:

1. To determine the conceptual and legal foundations of property rights in the context of asset tokenization.
2. To analyze the mechanisms for recording, transferring, and exercising ownership rights in tokenized environments.
3. To identify key challenges and substantiate directions for improving the protection of property rights in the process of asset tokenization.

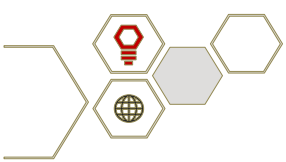


Main material. The conversion of real-world assets into tokenized forms has generated a new framework for the organization and circulation of property rights within digital environments. Unlike traditional asset transactions, tokenization combines legal, economic, and technological elements into a unified mechanism through which rights can be represented, transferred, and exercised. The effectiveness of such arrangements depends on the legal relationship established between the underlying asset and its digital representation. Consequently, the conceptual and legal foundations of tokenized property rights form the basis for ensuring legal certainty, ownership verification, and the protection of participants in tokenized asset ecosystems (table 1).

Table 1

Conceptual and legal foundations of property rights in real-world asset tokenization

Conceptual element	Legal content	Significance for property rights	Manifestation in tokenized environments
Property right	Legally protected entitlement to possess, use, dispose of, or benefit from an asset	Establishes the legal basis of ownership and control	Represented through digital tokens linked to specific assets
Real-world asset (RWA)	Tangible or intangible asset existing outside the blockchain environment	Serves as the object of the underlying legal relationship	Real estate, securities, intellectual property, commodities, receivables
Tokenized representation	Digital expression of rights associated with an underlying asset	Facilitates recording and transfer of economic interests	Blockchain-based tokens evidencing ownership, participation, or claims
Legal title	Formal legal recognition of ownership under applicable law	Determines enforceability of rights against third parties	Maintained through registries, contracts, or statutory mechanisms
Beneficial (economic) interest	Economic entitlement connected to an asset without direct legal title	Expands investment and participation opportunities	Fractional ownership and investment tokens
Transfer mechanism	Legal and technical process through which rights move between holders	Ensures continuity and legitimacy of transactions	Smart contracts and blockchain-based transfers



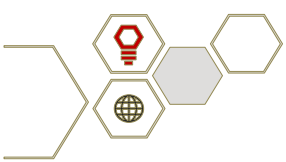
Legal protection	System of remedies safeguarding property interests	Supports legal certainty and market confidence	Judicial enforcement, contractual remedies, regulatory oversight
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Source: developed by the author based on [4; 8, p. 44; 10, p. 300; 11, p. 156; 12, p. 289; 13].

Asset tokenization does not replace traditional property rights but changes the way in which they are identified, transferred, and exercised. The legal value of a token arises not from its existence within a blockchain network but from its verifiable connection to an underlying asset and the rights attached to that asset [4]. Consequently, the effectiveness of tokenized ownership structures depends on the ability to integrate digital records with legally recognized mechanisms of ownership verification and enforcement.

This relationship is particularly evident in real estate tokenization, where blockchain-based tokens may represent ownership interests, revenue-sharing rights, or investment participation in a property. Although token transactions can be executed almost instantly through distributed ledger technologies, the enforceability of the corresponding rights continues to depend on contractual arrangements, asset custody structures, and compliance with property registration requirements established by applicable law [8, p. 44]. Similar mechanisms are increasingly employed in the tokenization of securities, investment funds, receivables, commodities, and intellectual property assets, where digital tokens facilitate market access while preserving the legal status of the underlying asset [14].

The growing institutionalization of tokenized markets demonstrates that technological innovation alone cannot ensure legal certainty. Regulatory initiatives increasingly focus on establishing a clear legal relationship between digital tokens and the proprietary interests they represent, thereby reducing risks associated with ownership disputes, unauthorized transfers, and investor protection failures [15]. In this context, the legal distinction between formal title and beneficial interest acquires particular significance, especially in fractional ownership models where multiple



investors may hold economic rights linked to a single asset without directly possessing legal title.

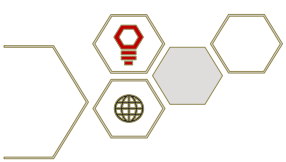
From a practical perspective, the sustainability of tokenized asset ecosystems depends on the coexistence of blockchain infrastructure and traditional legal safeguards. Smart contracts can automate transfers and record transactions, yet dispute resolution, ownership recognition, insolvency protection, and the enforcement of claims remain largely dependent on legal institutions operating outside the blockchain environment [16]. As a result, the development of effective tokenization frameworks requires not only technological interoperability but also coherent legal mechanisms capable of ensuring the continuity, legitimacy, and protection of property rights throughout the entire lifecycle of tokenized assets.

The functioning of tokenized asset ecosystems depends on the mechanisms through which ownership rights are recorded, transferred, and exercised throughout the lifecycle of a digital asset. Unlike conventional asset markets, where these processes are often separated among multiple intermediaries, tokenized environments combine transactional, informational, and governance functions within a unified digital infrastructure. This transformation creates new opportunities for efficiency, transparency, and accessibility while simultaneously increasing the importance of mechanisms that ensure the continuity and legitimacy of ownership-related actions (table 2).

Table 2

Mechanisms for recording, transferring, and exercising ownership rights in tokenized asset ecosystems

Mechanism	Functional purpose	Legal and operational significance	Practical implementation
Token issuance	Creation of a digital representation of asset-related rights	Establishes the initial link between the asset and the token	Issuance of asset-backed or ownership-linked tokens
Distributed ledger recording	Registration of transactions and ownership changes	Provides transparency and immutability of records	Blockchain-based transaction histories

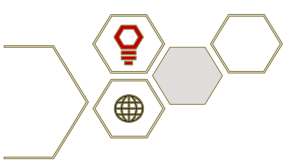


Digital identity verification	Confirmation of participant identity and legal capacity	Supports compliance and ownership authentication	KYC and digital verification procedures
Smart contract execution	Automated implementation of predefined conditions	Reduces reliance on intermediaries and manual processing	Automated transfers, payments, and distributions
Secondary market transfer	Movement of tokenized rights between holders	Facilitates liquidity and market circulation	Trading platforms and digital asset exchanges
Rights exercise mechanisms	Realization of economic or governance entitlements	Enables holders to benefit from asset ownership	Revenue distribution, voting, access rights
Compliance and monitoring procedures	Oversight of transactions and participant activities	Supports regulatory conformity and risk management	AML controls, transaction screening, reporting systems

Source: developed by the author based on [3; 6; 7; 9, p. 824; 10, p. 305; 13].

The transition from traditional ownership administration to digitally coordinated rights management has significantly altered the manner in which proprietary interests circulate within modern markets. In tokenized ecosystems, ownership records are updated through distributed ledger technologies, allowing market participants to verify transaction histories and asset-related rights in near real time [10, p. 305]. Such functionality is particularly valuable in transactions involving geographically dispersed participants, where conventional verification and settlement procedures often increase costs and transaction complexity.

The practical benefits of these mechanisms are especially visible in the tokenization of investment assets. In real estate projects, for example, token holders may acquire fractional interests in income-generating properties and receive periodic revenue distributions through automated execution mechanisms. Similar approaches are increasingly employed in renewable energy projects, private debt instruments, infrastructure financing, and intellectual property commercialization, where tokenization expands access to investment opportunities that were traditionally reserved for institutional or high-net-worth investors [14].

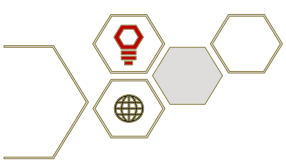


The growing adoption of smart contracts has also transformed the exercise of ownership-related powers. Rather than relying exclusively on manual administration, predefined contractual conditions may trigger the distribution of dividends, royalties, rental income, or governance rights automatically once specific criteria are satisfied. This reduces operational delays and increases transparency for market participants. At the same time, automated execution does not eliminate legal obligations, making regulatory oversight and compliance procedures essential components of tokenized ownership structures [16].

Another notable development concerns the integration of tokenized assets into regulated financial market infrastructures. The emergence of distributed ledger-based trading and settlement environments demonstrates a shift toward institutional adoption of tokenization technologies. Regulatory initiatives increasingly seek to combine the efficiency of blockchain systems with investor protection requirements, market integrity safeguards, and financial stability objectives, thereby creating conditions for the broader use of tokenized assets within established capital markets [17].

Consequently, the effectiveness of ownership rights within tokenized ecosystems is determined not only by the technological capacity to record and transfer information but also by the ability to ensure continuous access to economic benefits, governance participation, compliance controls, and legal remedies. The interaction between digital infrastructure and legal institutions therefore becomes a defining factor in the sustainable development of tokenized asset markets and the practical realization of ownership rights in digital environments [15; 18].

The legal effectiveness of tokenization depends not only on the existence of ownership rights or the mechanisms through which they are transferred, but also on the extent to which a digital token remains legally connected to the underlying asset it represents. In tokenized markets, legal certainty arises from the ability to establish a verifiable relationship between the digital representation and a specific economic asset, ensuring that rights associated with the asset can be identified, exercised, and enforced regardless of the technological environment in which the token circulates (table 3).

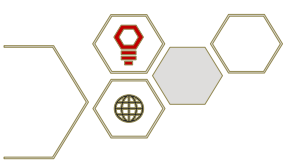
**Table 3**

Relationship between tokenized representations and underlying assets in ensuring legal certainty

Linking component	Function within the tokenization structure	Contribution to legal certainty	Potential legal outcome
Asset identification framework	Establishes the specific asset associated with the token	Eliminates ambiguity regarding the object of rights	Verifiable connection between token and asset
Documentation of asset backing	Confirms the existence and characteristics of the underlying asset	Supports evidentiary reliability	Reduced risk of fraudulent issuance
Custodial or holding arrangement	Defines control over the underlying asset	Clarifies responsibility for asset management	Improved protection of token holders
Rights attribution model	Specifies the rights embedded in the token	Determines the legal position of token holders	Greater predictability of legal claims
Verification and audit procedures	Assess consistency between token records and asset status	Strengthen trust and transparency	Enhanced market confidence
Enforcement interface	Connects digital records with legal dispute resolution mechanisms	Enables practical realization of rights	More effective legal protection
Redemption or conversion mechanism	Regulates the relationship between tokenized and non-tokenized forms	Facilitates legal continuity of ownership interests	Reduced uncertainty during exit or liquidation events

Source: developed by the author based on [4; 6; 8, p. 49; 10, p. 308; 12, p. 294; 13].

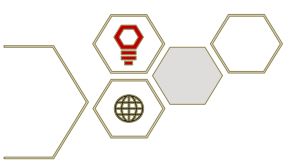
The practical significance of the relationship between a token and its underlying asset becomes particularly evident when ownership rights must be asserted beyond the blockchain environment. Possession of a token does not automatically guarantee entitlement to the asset unless the legal framework clearly establishes the consequences attached to that digital representation [12, p. 294]. Consequently, the enforceability of rights depends on a combination of legal documentation, asset segregation mechanisms, governance arrangements, and verification procedures that collectively confirm the existence and legal relevance of the underlying asset [15].



This issue is especially important in structures where the underlying asset and the token circulate within different legal and operational environments. For example, a token may represent an economic interest in a commercial property, a portfolio of intellectual property rights, a private investment fund, or a commodity reserve, while the asset itself remains subject to traditional ownership, registration, and management rules. In such cases, legal certainty is achieved not through the token alone but through the institutional arrangements that define how revenues, voting rights, liquidation proceeds, or other proprietary interests are linked to the asset represented by the token [6]. The stronger this linkage, the lower the probability of disputes regarding entitlement, priority of claims, or distribution of benefits.

The growing international attention to digital assets has also highlighted the importance of legal control and asset attribution. Contemporary regulatory and private law initiatives increasingly focus on determining whether control over a digital representation can serve as a basis for asserting legally protected interests in an underlying asset [7]. This approach is particularly relevant in cross-border transactions where asset holders, token issuers, custodians, and investors may be located in different jurisdictions. Under such conditions, legal certainty requires mechanisms capable of maintaining continuity between digital records and proprietary interests despite differences in applicable legal regimes [19].

An additional challenge concerns situations in which token holders seek to convert digital representations into conventional legal or economic claims. Redemption mechanisms, asset withdrawal procedures, and liquidation arrangements therefore play an important role in preserving ownership continuity throughout the lifecycle of a tokenized asset. Their practical value lies in reducing uncertainty regarding the legal consequences of entering or exiting a tokenized structure. As tokenization expands into increasingly complex asset classes, the sustainability of digital asset ecosystems will depend less on technological innovation itself and more on the ability to maintain a legally enforceable connection between digital representations and the real-world assets they are intended to reflect [14; 20].

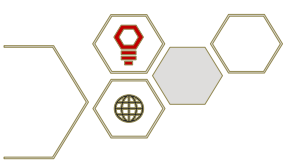


Despite the growing adoption of asset tokenization across investment, financial, and commercial markets, the protection of property rights within tokenized environments remains accompanied by a range of unresolved legal and practical challenges. The rapid development of blockchain-based infrastructures has substantially outpaced the evolution of legal frameworks, creating situations in which technologically valid transactions may produce uncertain legal consequences. As a result, questions concerning ownership verification, legal recognition of tokenized claims, priority of competing interests, and the enforceability of rights continue to generate considerable regulatory and judicial uncertainty.

One of the most significant challenges arises from the coexistence of decentralized technological systems and territorially limited legal regimes. While tokenized assets may circulate across multiple jurisdictions without geographical constraints, the underlying assets remain subject to national rules governing ownership, registration, inheritance, insolvency, and creditor protection [11, p. 157]. This divergence complicates the determination of applicable law and may weaken the legal position of token holders in cross-border disputes.

Additional risks stem from the separation between economic participation and legal ownership frequently observed in tokenization structures. In many cases, investors obtain exposure to the value or income generated by an asset without acquiring direct legal title. Although such arrangements enhance market accessibility and liquidity, they may also create uncertainty regarding voting rights, access to information, priority in insolvency proceedings, and the scope of available legal remedies [4]. The complexity of these relationships increases further where custodians, issuers, special-purpose entities, and platform operators participate simultaneously in the management of a tokenized asset.

The protection of property rights is further complicated by cybersecurity threats, smart contract vulnerabilities, operational failures, and deficiencies in governance mechanisms. Unauthorized access to digital wallets, coding errors, inaccurate asset disclosures, or inadequate segregation of underlying assets may undermine the

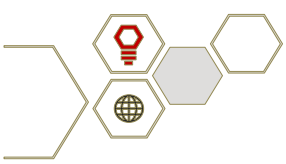


reliability of tokenized ownership structures even where the underlying technology functions as intended. These challenges demonstrate that the sustainable development of tokenized markets depends not only on technological innovation but also on the establishment of coherent legal standards capable of ensuring certainty, accountability, and effective protection of proprietary interests in digital environments.

The effective protection of property rights in tokenized environments requires the gradual adaptation of legal frameworks to the realities of digital asset circulation while preserving the fundamental principles of property law. Regulatory approaches should focus on establishing a clear legal relationship between tokenized representations and underlying assets, thereby reducing uncertainty regarding ownership, control, and the enforceability of rights. Greater legal certainty may be achieved through the development of uniform criteria for classifying tokenized assets and determining the legal consequences associated with their issuance, transfer, and redemption.

An important direction for improvement involves strengthening institutional mechanisms that ensure the reliability of asset-backed tokenization structures. This includes the introduction of enhanced disclosure requirements concerning the characteristics of underlying assets, mandatory verification procedures, independent audits, and transparent governance arrangements governing the interaction between issuers, custodians, platform operators, and token holders. Such measures would contribute to increasing investor confidence and reducing risks associated with information asymmetry and asset misrepresentation.

Particular attention should also be given to the harmonization of regulatory approaches across jurisdictions. Given the inherently cross-border nature of tokenized asset markets, differences in national legal regimes may create barriers to enforcement and increase transaction costs. The development of internationally compatible standards governing digital asset ownership, custody, transfer, and dispute resolution would facilitate legal interoperability and improve the protection of proprietary interests in global tokenized ecosystems.

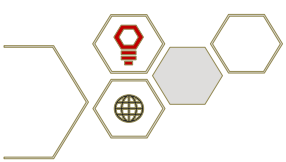


The effectiveness of property rights protection further depends on the integration of technological and legal safeguards. Smart contract auditing, cybersecurity requirements, digital identity verification, and asset segregation mechanisms should be complemented by accessible judicial and alternative dispute resolution procedures capable of addressing conflicts arising from tokenized transactions. Such an approach would strengthen the practical enforceability of rights while reducing legal uncertainty in complex digital environments.

Ultimately, the sustainable development of asset tokenization requires a balanced regulatory model that encourages innovation without weakening legal protection. The combination of clear legal qualification, transparent institutional governance, technological accountability, and effective enforcement mechanisms can create the conditions necessary for the secure circulation of tokenized assets and the long-term protection of property rights within the digital economy.

Conclusions. The study demonstrated that the protection of property rights during the conversion of real-world assets into tokenized forms constitutes a critical prerequisite for the legal sustainability of tokenized markets. It was established that the legal effectiveness of tokenization depends on the existence of a legally enforceable connection between a tokenized representation and the underlying asset, ensuring the identification, transfer, exercise, and protection of proprietary interests throughout the asset lifecycle. The findings indicate that tokenization expands opportunities for asset fractionalization, investment accessibility, and transaction efficiency while simultaneously transforming traditional mechanisms of ownership administration.

The principal challenges were found to arise from regulatory fragmentation, the absence of unified approaches to the legal qualification of tokenized assets, difficulties associated with cross-border enforcement, and uncertainties concerning the legal status and protection of token holders. Additional risks stem from the separation of economic interests from formal legal title, as well as from the growing reliance on digital infrastructures for the management of proprietary rights.

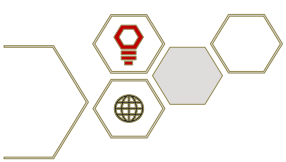


To address these challenges, it is advisable to strengthen legal mechanisms linking tokens to underlying assets, improve asset verification and disclosure procedures, expand the use of independent audit mechanisms, and promote greater international harmonization of digital asset regulation. Particular attention should be devoted to the development of institutional safeguards capable of ensuring legal certainty and effective remedies within tokenized environments.

Future research should focus on the evolution of ownership concepts in digital economies, the legal implications of tokenized control over assets, the interaction between smart contracts and property law, and the formation of internationally coordinated frameworks for the protection of tokenized property rights.

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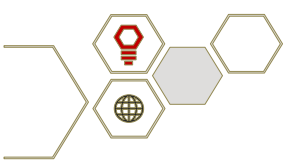
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