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TRANSFORMATION OF CONTRACT LAW IN THE CONTEXT OF DIGITALIZATION OF CIVIL CIRCULATION: A COMPARATIVE ANALYSIS OF NATIONAL AND INTERNATIONAL LAW

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ABSTRACT

This article analyzes the transformation of contract law under the conditions of digitalization through doctrinal and comparative legal approaches and examines the emerging normative model shaped by digital contractual relations. The study systematically evaluates the impact of smart contracts, automated enforcement mechanisms, platform-based governance, and algorithmic decision-making on the principles of freedom of contract, expression of intent, legal certainty, liability, and evidentiary institutions. By applying normative-doctrinal methodology and comparative legal analysis, the article explores the interaction between national legislation and international model legal instruments. Particular attention is devoted to the ex-ante enforcement model, in which legal consequences are executed automatically on the basis of pre-programmed conditions. The research demonstrates that this model transforms the classical ex-post mechanism of legal assessment by shifting normative control from judicial interpretation to codified legal architecture. Digital contractual relations enhance transactional efficiency, they also generate new risks related to algorithmic errors, legal uncertainty, cross-border enforcement issues, and the protection of consumer rights. The article substantiates the necessity of developing hybrid legal approaches in contract law based on risk allocation and technological liability.

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INTRODUCTION

The examination of the transformation of contract law under the conditions of the digitalization of civil circulation primarily requires the establishment of a coherent theoretical framework for the subject matter. In classical civil law doctrine, contract law has traditionally been founded upon the principles of party autonomy, freedom of contract, legal certainty, and legal equality of the parties. However, as a consequence of the integration of digital technologies into economic and legal relations, the nature of civil circulation is undergoing a transformation from a traditional model of legal relations into a techno-legal model. Within this framework, a contract is no longer regarded solely as a legal act formed through the mutual consent of the parties, but also as a complex legal construct operating in interaction with digital platforms, software systems, algorithms, artificial intelligence technologies, and automated enforcement mechanisms. In contemporary legal theory, this process is explained through the concepts of the

technologization of law, the "code as law" doctrine, platform law, and approaches related to digital normativity. Consequently, digitalization necessitates not only the reconsideration of the mechanisms for the implementation of contract law, but also the re-evaluation of its conceptual foundations, the model of formation of legal intent, and the very nature of the institution of legal liability.

This article has been prepared within the aforementioned theoretical framework on the basis of systematic interpretation, comparative legal analysis, and a functional methodological approach. The study analyzes, from both normative and doctrinal perspectives, the manner in which classical institutions of contract law are transformed within the digital environment, while newly emerging legal approaches in national and international legal systems are examined through comparative analysis. By means of the method of systematic interpretation, the possibilities and limitations of applying traditional principles of contract law within the system of digital legal relations have been identified, whereas the functional approach has been employed to assess the capacity of legal institutions to adapt to technological developments. Furthermore, the research is not confined to formal normative analysis alone; it also incorporates an interdisciplinary approach aimed at explaining the interaction between law and technology. In this context, electronic contracts, smart contracts, automated legal enforcement mechanisms, the platform economy, and digital identification systems have been considered as the principal technological factors shaping the transformation of contract law.

The principal context of the research concerns the impact of the digitalization of civil circulation on contractual relations and the normative challenges arising from this impact within both national and international legal systems. In this regard, issues such as the form of contracts, electronic expression of intent, authentication and identification mechanisms, electronic evidence, algorithmic decision-making, and automated enforcement have been evaluated as the core elements of legal transformation. At the same time, matters including the determination of the applicable law in the context of cross-border digital contracts, jurisdictional issues, the legal status of platform operators, and the allocation of liability have been analyzed as major sources of legal uncertainty. The conceptual approach of the article is based on the premise that digital transformation does not entirely negate the classical institutions of contract law; rather, it transforms them in accordance with new technological realities. Therefore, modern contract law should be evaluated not only through the theory of will and agreement, but also within the broader context of digital infrastructure, technological governance, and algorithmic normativity.

1. DIGITALIZATION OF CIVIL CIRCULATION

1.1. Reinterpretation of the Concept of Civil Circulation in the Context of Digitalization

In civil law scholarship, civil circulation is characterized as the legally recognized and normatively regulated movement of material and immaterial goods possessing proprietary and non-proprietary value that constitute the objects of civil law relations. In classical civil law theory, civil circulation encompasses not only money–commodity and commodity–commodity exchange, but also the legal circulation of labor and capital. The emergence, modification, and termination of civil circulation are conditioned by the existence of legal facts, among which juridical acts occupy a central position. Powers of attorney, contracts, and wills are regarded in classical civil law doctrine as forms through which the will of the parties is expressed in a manner capable of producing legal consequences. The legal validity of juridical acts is grounded

in fundamental principles such as freedom of will, freedom of contract, equality of legal subjects, and equivalence of legal relations. These principles not only ensure the legal stability and predictability of civil circulation but also define the regulatory function of civil law within the framework of a market economy.

The transfer of civil law relations from the traditional legal environment to the digital sphere leads to a structural and functional transformation of civil circulation. The model of civil circulation developed within the framework of classical civil law scholarship presupposed the realization of legal relations primarily within a physical space, through written documents, and by means of the direct expression of the parties' will. In the digital environment, however, these relations are carried out via electronic communication tools, digital platforms, and automated processes, which necessitates the reinterpretation of traditional institutions of contract law within a new legal context. This transformation affects the mechanisms through which the principles of freedom of will and freedom of contract are realized. In the digital environment the expression of will manifests less through direct declarations and more through technical operations, interface selections, and the acceptance of standardized platform terms. This shift requires a reassessment of traditional evidentiary and evaluative criteria for identifying defects of consent, such as fraud, mistake, coercion, and undue influence.

The reinterpretation of civil circulation in the context of digitalization necessitates its understanding not merely as an abstract legal category, but as a complex techno-legal system operating through the interaction of legal norms and technological mechanisms. Whereas in classical civil law doctrine civil circulation has been conceived primarily as a set of legal relations formed through normative regulation, in the digital environment the realization of these relations becomes inseparable from technological infrastructure. In the digital environment, legal regulation is no longer limited to the application of normative legal acts alone; rather, it operates in conjunction with technological architecture, the internal rules of digital platforms, and algorithmic decision-making mechanisms. From this perspective, civil circulation at the present stage functions as a sphere of socio-economic relations shaped by the synthesis of algorithms and law. Digital technologies structure the mechanisms of the formation, performance, and termination of legal relations, thereby exerting a direct influence on the traditional institutions of contract law. In such circumstances, the reinterpretation of civil circulation serves as a conceptual foundation for the transformation of contract law and necessitates an interpretation of the core principles of classical civil law theory that is responsive to contemporary digital realities [23].

1.2. The Principle of Freedom of Contract and Its Functional Transformation in the Digital Environment

The principle of freedom of contract, as developed within classical civil law doctrine, retains its normative significance during the transition to the digital environment; however, its mechanisms of realization and functional content undergo substantial changes. In traditional legal relations, freedom of contract relied on the personal participation of the parties, individual negotiations, and the formation of contractual terms through mutual agreement. In the digital environment, these processes are frequently conducted through electronic interfaces, standardized terms, and automated contract models. A characteristic feature of the digital environment is the massification and platform-based organization of contractual relations. Whereas classical civil law theory envisages freedom of contract as the real autonomy of the parties and an equal bargaining position, in the digital context this principle is often replaced by a "take-it-or-leave-it"

model. Such a transformation reflects the adaptation of the mechanisms for implementing the fundamental principles of civil law to the requirements of the digital era [24].

In the digital environment, however, the contracting process is often conducted through electronic systems within predefined technical parameters. In this context, the manner in which the principle of freedom of contract is exercised differs significantly from the classical model. Whereas classical civil law theory conceives freedom of contract as encompassing the parties' ability to negotiate each term of the agreement, in the digital environment this capacity is frequently technically precluded. These changes require a reassessment of the notion of autonomy that lies at the core of contractual freedom in the digital context. In classical doctrine, the will was recognized as a subjective decision producing legal effects; in digital settings, it is often expressed through technical actions, automated processes, and standardized selections. The transformation of the principle of freedom of contract in the digital environment does not negate its legal essence but represents an interpretation of classical civil law principles in accordance with new technological realities. This adaptation provides a critical doctrinal foundation for the future development of contract law, ensuring that its traditional normative objectives—autonomy, equality of parties, and predictability—are maintained while accommodating the structural and procedural characteristics of digital contracting platforms [16].

The transformation of freedom of contract in the digital environment is not limited merely to changes in contracting techniques or legal forms; it also reflects profound institutional shifts within the structure of civil law relations. Under the platform economy, contractual relations no longer primarily involve the mutual alignment of individual wills but operate within pre-established normative-technical frameworks that define legally significant behavior. Large platforms, by unilaterally determining contractual terms, can effectively become "norm-creating" actors, while weaker parties are often limited to accepting or rejecting these terms. From this perspective, the transformation of freedom of contract does not represent a repudiation of the foundations of civil law. Rather, it should be understood as a necessary conceptual adaptation that allows civil law to maintain its regulatory function amid evolving social and technological conditions. By reconciling traditional legal principles with digital realities, this transformation ensures that contractual freedom continues to serve its core objectives of fairness, predictability, and equitable treatment of parties within modern, technology-mediated legal interactions [16].

1.3. Expression of will (offer and acceptance) and its functional transformation in the digital environment.

In classical contract law, the declaration of will constitutes the fundamental legal fact through which the parties express their intention to produce legal effects. From a doctrinal perspective, the declaration of will is understood as a "manifested will," meaning that the internal intention of the parties must be expressed externally—through conduct, spoken words, or written form—with the purpose of generating legal consequences. This concept ensures the objective manifestation of subjective intent in the process of contract formation and serves as a preliminary condition for the emergence of legal effects. In traditional civil law theory, the legal validity of a declaration of will depends on its being expressed in a clear and specific manner capable of creating mutual understanding between the parties. An offer constitutes one of the essential elements of contract formation in classical doctrine and defines the core terms of the contract, including the parties' obligations and the manner of performance. The offer is regarded as a

specific form of declaration of will directed toward the conclusion of a contract, and only its acceptance gives rise to the formation of the contract. Acceptance, in turn, is defined as the unqualified assent to the offer and the legal act that brings the contract into existence. In classical contract law, acceptance is viewed as the result of the mutual alignment of the parties' wills and constitutes the final stage in the contract's entry into force [6].

In the digital environment, the concept of a declaration of will is realized in a manner that differs from the classical contract law. In electronic contracts, the declaration of will is often manifested through mechanical actions such as clicking a button, tapping a screen, or confirming consent via a digital interface. This weakens the traditional notion of will as a subjective, conscious act formed through the active participation of the parties, transforming its functional content into a technical procedure. In the digital context, the legal effects of a declaration of will arise merely from the factual performance of an action by a party, while the explicit manifestation of internal intention no longer plays the decisive role it once did. The transformation of these concepts in civil circulation necessitates the development of new conceptual approaches to ensure that legal relations produce objective legal effects while preserving the principle of freedom of contract [26].

The determination of the moment of contract formation in the digital environment raises new issues when compared with classical contract law. In traditional legal doctrine, the conclusion of a contract is identified through the clear and explicit expression of the parties' reciprocal declarations of will, typically embodied in a written instrument or manifested in a physical setting. In the digital environment, by contrast, the moment of contract formation is directly linked to technical actions and the operation of electronic systems. In electronic contracts, the making of an offer and the execution of acceptance are carried out through specific interface operations. In this case, the time of conclusion and the legal validity of the contract are recorded by the technical system, while the actual manifestation of human will assumes a procedural character. As a result, in digital civil circulation, the legal nature of the concepts of declaration of will, offer, and acceptance extends beyond their technical forms and requires broader doctrinal adaptation. Since the precise determination of the moment of contract formation is decisive for the emergence of legal consequences and the performance of the parties' obligations, the principles of classical contract law must be reinterpreted in accordance with the realities of the digital environment. This approach serves to preserve the principles of legal certainty and stability within the context of the transformation of contract law [3].

2. MECHANISMS FOR THE FORMATION AND PERFORMANCE OF CONTRACTS IN THE DIGITAL ENVIRONMENT

2.1. Electronic Contracts and Smart Contracts: Concept, Legal Nature, and Criteria of Distinction

Electronic contracts represent a form of modern civil circulation implemented through digital technologies, preserving the fundamental principles of classical contract law while significantly transforming their technical mechanisms of application. According to classical doctrine, a contract is an obligation arising from the mutual and corresponding expression of will of the parties (offer and acceptance), which may be expressed in written or oral form; the conclusion and performance of the contract are accompanied by the parties' active legal conduct, their initiative aimed at fulfilling agreed terms, and an awareness of legal responsibility. Within this

model, the legal validity of a contract is grounded in such classical criteria as freedom of contract, certainty of agreement, and compliance with legal norms. By contrast, in electronic contracts these legal relationships are established through the Internet and other electronic communication means, and the parties' will is expressed through formal technical operations such as clicking, interface-based confirmations, electronic messaging, or the acceptance of terms selected on digital platforms. In this context, the legal nature of electronic contracts depends not only on the existence of a valid expression of will, but also on the reliability of identification and authentication mechanisms, as well as on the assurance of data security as integral techno-legal elements [8].

While classical contract doctrine grounds the legal validity of a contract in the freedom of will and mutual agreement of the parties, in electronic contracts these principles are realized through technological procedures, resulting in a transformation in the form of the expression of will. Although electronic contracts do not differ from traditional contracts in terms of their legal nature, their formation and performance mechanisms are primarily carried out through technical actions—such as click-based consent, interface confirmations, or electronic signatures—which render the manifestation of will more formal and procedural in character. In this context, the criteria for distinguishing electronic from traditional contracts are based on elements such as the execution mechanism, the technical infrastructure employed, and the methods used to confirm the parties' consent. From a practical perspective, for example, a user's act of clicking an "I agree" button on an online platform or confirming a contract through an electronic signature is generally considered sufficient for the conclusion and legal validity of the contract. At the same time, the moment of contract formation and the emergence of legal effects are recorded by technical systems, thereby transforming evidentiary mechanisms and increasing the legal significance of electronic logs, timestamps, and other digital traces. Consequently, these differences do not alter the legal essence of contracts, but necessitate a doctrinal reinterpretation of the manner in which they are formed and performed in the digital environment, while also contributing to the enhancement of legal certainty and predictability [9].

Smart contracts, as a more advanced form of electronic contracts, ensure the automatic generation of legal effects upon the occurrence of pre-programmed conditions, thereby replacing traditional mechanisms of contractual performance with algorithmic processes. From the perspective of classical contract law, this model gives rise to a number of doctrinal challenges, as the expression of will no longer appears solely as a subjective and conscious legal act, but rather as the outcome of programmed code, while the parties' freedom of conduct is constrained by predetermined technical parameters. In this respect, the legal nature of smart contracts is defined by the interaction between normative and technological components: the codification of will, the automation of performance, and the dependence of outcomes on technical infrastructure significantly distinguish these arrangements from the classical model of contractual relations. This situation necessitates a doctrinal reconsideration of the core institutions of contract law—namely, freedom of will, contractual performance, and liability mechanisms—within the digital environment. Consequently, smart contracts emerge as a hybrid legal phenomenon that reflects the ongoing transformation of contract law and calls for the development of new normative approaches to ensure legal certainty, stability, and the effective regulation of digital civil circulation [9].

2.2. The Form of the Contract, and Issues of Identification and Authentication (Electronic Signatures, Platforms, Algorithms)

In classical contract law, the form of a contract constitutes one of the fundamental conditions for the establishment of a legal relationship and is ensured through a written document, a physical signature, and compliance with formal requirements prescribed by law; within this framework, the written form plays a decisive role in objectifying the parties' will, ensuring legal certainty, and facilitating evidentiary assessment. The execution of a contract on a physical medium with a handwritten signature functions as a comprehensive mechanism that enables the identification of the parties, guarantees the authenticity of the expression of will, and allows for the reliable proof of legal consequences in the event of a dispute, thereby conferring both substantive and procedural functions upon the notion of form. In the digital environment, however, this concept undergoes a significant transformation, being replaced by the institutions of electronic documents and electronic signatures; consequently, legal effect is no longer dependent on a material carrier but rather on criteria such as the integrity, immutability, and technical traceability of data. Although the use of electronic signatures, particularly advanced electronic signatures, establishes a functional equivalent of the traditional written form requirement, the dependence of identification and authentication processes on certification infrastructures and platform-based mechanisms expands the scope of legal regulation, and in this context, issues of identification and authentication emerge as central elements in the transformation of contract law, with the result that the form of a contract evolves from a purely legal category into a techno-legal mechanism shaped by the interaction between law and technology [17].

In the classical doctrine, the form of a contract serves not only as a fundamental guarantee for the emergence of legal effects but also as objective evidence of the conscious and free expression of the parties' will, a function traditionally realized through written documents and physical signatures; thus, form operates as an integrated legal institution ensuring the validity of the contract, the stability of its content, and the certainty of the parties' identity. In the digital environment, these functions are performed through electronic documents and electronic signatures, which, under contemporary legal approaches, are considered functionally equivalent to the written form; in particular, cryptography-based electronic signature mechanisms enable both the identification of the signatory and the preservation of data integrity, thereby allowing classical legal functions to be effectively replicated in a technological context. At the same time, because identification and authentication processes are no longer governed solely by normative requirements but are increasingly dependent on certification authorities, cryptographic algorithms, and platform-based technical solutions, the legal validity of a contract becomes contingent not merely upon the existence of a document but upon its compliance with technical reliability criteria, and consequently, the concepts of contract form, identification, and authentication are reinterpreted through a synthesis of legal-normative and technological elements in the transition from classical contract law to the digital environment [25].

In classical contract law, identification and authentication are ensured through the physical presence of the parties, the affixing of handwritten signatures, and the submission of written documents, within which the signature functions not merely as a technical attribute but as legal evidence confirming the authenticity of the expression of will and the conscious intention to enter into a contractual relationship. In the digital environment, however, these functions are carried out through more complex technological mechanisms; since the expression of will in electronic contracts is often manifested through actions such as clicking, interface confirmation,

or platform-based operations, additional authentication tools are required to verify that such actions can indeed be attributed to a specific individual. In this regard, electronic signature systems, particularly advanced and qualified electronic signatures, ensure identity verification through cryptographic methods and contribute to the objectification of the intention to enter into a contract, thereby functionally replacing the role performed by handwritten signatures in classical legal doctrine. Consequently, a new functional relationship emerges between contract form and the institutions of identification and authentication in the digital environment, and the legal validity of a contract becomes conditioned not only upon the existence of an expression of will but also upon its reliable technical verification, demonstrating that contract law in the context of digitalization requires new normative approaches and doctrinal adaptation.

2.3. Automated Execution and Liability Issues: The Collision Between Human Intent and Algorithmic Decision-Making

Automated execution mechanisms in the digital environment transform the performance of contractual obligations from a model based on active human conduct into a technical-legal system operated through pre-programmed algorithms. In this context, execution no longer depends on subsequent acts of will of the parties but on the automatic operation of coded conditions, thereby shifting legal regulation structurally from conduct to code. Whereas in classical contract law the performance of obligations is shaped by the party's will, the principle of good faith, and the legal assessment of specific circumstances, in smart contracts this stage is predetermined in technical terms, and once the stipulated conditions are met, legal effects are realized automatically without human intervention. As a result, the execution mechanism evolves from an interpretatively open and flexible model into a rigid functional process governed by algorithmic conditionality. This transformation creates a fundamental tension with the classical legal construction of contractual liability, since traditional doctrine links liability to fault, breach of the principle of freedom of will, or non-performance, whereas under automated execution legal consequences arise not directly from human conduct but from the decisions of a technical system. This, in turn, generates uncertainty as to the attribution of liability and reinforces a shift from the classical notion of fault toward new categories such as functional control and risk allocation. Consequently, automated execution cannot be regarded as either a purely legal or a purely technical process; rather, it constitutes a hybrid mechanism formed at the intersection of human will and algorithmic decision-making, requiring the reconstruction of contractual liability on the basis of new doctrinal models [31].

The implementation of automated execution mechanisms systematically weakens the traditional subjective foundations of the liability regime in contract law and shifts the focus of legal assessment from human conduct to technological processes. In the classical model, liability is grounded in the party's will, fault, and unlawful conduct; however, under algorithmic execution, both the performance of the contract and the emergence of legal effects occur through the automatic application of pre-established technical rules, with subsequent human intent no longer playing a decisive role. This situation limits the functional effectiveness of the traditional "will–fault–breach" triad and necessitates the development of new approaches to determining liability. In particular, within smart contracts, the party's will is expressed only at the initial stage—through acceptance or adoption of the code—while subsequent outcomes are determined by the internal logic of the software. This complicates the attribution of harm or unlawful consequences and raises the issue of allocating liability among the contracting party, the software developer, the platform operator, or the technological risk itself. In such a framework, the concept of liability

moves away from subjective criteria and is reconstituted on the basis of objective factors such as risk allocation, functional control, and the predictability of outcomes. Thus, automated execution does not abolish the classical notion of liability but reshapes it in accordance with the realities of the digital civil circulation [18].

The widespread application of automated execution mechanisms turns the interaction between human will and algorithmic decision-making into one of the central doctrinal challenges of contract law and necessitates its reassessment within a new normative framework. In classical contract law, performance is dynamic in nature and remains open to legal interpretation in light of the parties' conduct and changing circumstances, whereas in smart contracts legal will is primarily expressed at the initial stage—during the coding of contractual terms—and thereafter execution proceeds automatically on the basis of algorithmic determinism. This significantly reduces the role of the human factor in the performance process and narrows the scope for traditional legal mechanisms, including interpretation, adaptation, and intervention. As a consequence, the normative foundations of liability are also transformed, since legal effects arise not from subsequent human conduct but from the operation of a pre-defined technical structure. This leads to a weakening of the subjective character of liability and its reassessment on the basis of objective criteria such as functional control, technological risk allocation, and the capacity to influence algorithmic design. Thus, the classical model of liability based on human will loses its full explanatory adequacy in an algorithmic environment. Ultimately, automated execution can be regarded neither as a purely technical process nor as a legal act in the traditional sense; it operates as a hybrid legal mechanism formed at the intersection of human will and algorithmic decision-making, thereby requiring new normative approaches and doctrinal adaptation in the context of the digitalization of contract law [21].

3. NORMATIVE ADAPTATION OF CONTRACT LAW AND FUTURE DIRECTIONS

3.1. Problems in the Regulation of Digital Contractual Relations in National Civil Legislation

In national civil legislation, the regulation of digital contractual relations primarily emerges as a pressing issue against the backdrop of tensions between the classical legal meaning of contractual form and contemporary technological realities. Under traditional civil law doctrine, the written form is regarded as the principal guarantee of legal validity, evidentiary force, and the objective manifestation of the parties' will, with a physical document and a handwritten signature performing these functions. In the digital environment, however, the notion of written form is functionally reconfigured through electronic documents, electronic communications, and electronic signature regimes. Although statutory equivalence between electronic and paper-based form may be established in certain cases, practical implementation frequently exposes frictions between formalistic legal requirements and technological flexibility. Problems relating to contract form are therefore inseparable from the rules of proof: whereas the classical system relies on a written instrument as the superior means of proof that stabilizes the content of the parties' intent, evidentiation in digital contracts turns on authenticity, immutability, and reliable attribution to a particular subject. The legal effect of an electronic signature, the status of certification authorities, the trustworthiness of time-stamping, and the integrity of data carriers become key criteria for assessing evidentiary weight, thereby extending proof procedures

beyond traditional judicial reasoning into the domain of technical expertise and algorithmic verification. Doctrinally, this transformation of form and evidentiary regimes necessitates a rearticulation of the principles of legal security and predictability: parties must be able to rely on the stability and enforceability of their digital agreements, while regulation must avoid ossifying into a formalism that unduly impedes technological innovation. The central challenge for national civil law is therefore to preserve the protective functions of written form and proof while conceptually recognizing their functional digital equivalents — an approach that secures contractual validity and, at the same time, affords the normative flexibility required by a dynamic digital economy [22].

Legislative and jurisdictional issues governing cross-border contracts concluded on digital platforms can be resolved only through international cooperation and a measure of harmonisation among national legal systems. Contracting parties are typically subject to choice-clauses embedded in online platforms' terms of use, but the validity of such selections is limited from the perspectives of coercion, transparency and consumer protection—particularly where a weaker party (a consumer or small supplier) accepts standard terms without genuine negotiation. Moreover, because servers, operators and data are located in different states with divergent judicial systems and procedural rules, determinations as to which court has jurisdiction and which substantive law applies (choice of forum / choice of law) demand decisions that are not merely theoretical but grounded in enforceability and practical execution. Arbitration may offer a partial solution—its awards benefit from relatively reliable recognition and enforcement under the *Convention on the Recognition and Enforcement of Foreign Arbitral Awards (*United Nations, 1958) [35] - but arbitration is not always suitable given the need for judicial oversight, cross-border enforcement challenges, and the protection of consumer rights. Allocating liability for platforms and third parties (cloud providers, oracles, developers, certification authorities) is even more complex because the execution of smart contracts and algorithmic decisions often operates as a "black box." Technical standards for judicial expert appraisal of code and behaviour remain underdeveloped: how and on what basis will courts evaluate source code or blockchain logs, who will detect programming defects and by what procedures, and by which criteria will the fairness of an algorithmic outcome be assessed—these questions complicate evidentiary value and expert testimony. At the same time, personal data processing and cybersecurity breaches can directly affect contractual performance: unlawful data transfers, sudden unavailability of servers, or corrupted oracle inputs may frustrate performance and therefore require special rules for allocating liability. Principles of intermediary immunity can further complicate matters by limiting platform accountability and potentially weakening effective remedies for injured parties. Addressing these problems requires coordinated investment in normative, technical and procedural instruments. At the normative level, national legislation should provide clear rules on choice of law and forum selection, a special legal status for smart contracts and mechanisms for treating code as admissible legal evidence, and principles for platform responsibility and third-party risk allocation, while mandatory protective rules should apply to consumer contracts. Technically, robust time-stamping, immutable audit logs, certified oracles and independent third-party audits will strengthen proof and enhance the objectivity of expert analyses. Procedurally, standardised protocols for judicial technical experts, secure mechanisms for confidential in-camera examination of source code, availability of interim relief, and expedited channels for cross-border legal assistance will facilitate practical enforcement. Finally, international coordination (based on UNCITRAL model laws, eIDAS and other

regional instruments) and the development of industry standards will situate national measures in a comparative context; market-based instruments such as insurance schemes and "liability-by-design" conditions may also allocate risks more equitably. Together, these measures can substantially improve the predictability and enforceability of cross-border digital contracts [7].

In the Republic of Azerbaijan, the choice of the substantive law applicable to cross-border contracts concluded via digital platforms and the determination of the court competent to adjudicate related disputes are governed by statute. The principal normative basis is the **Law on Private International Law** [5], which expressly recognises the parties' autonomy to choose the municipal law applicable to their contract: Article 24 permits the parties to agree that "the rights and obligations arising from the contract, its interpretation, performance, non-performance, termination, consequences of improper performance and invalidity, as well as remedies and assignment of claims related to the contract, shall be regulated by the law of the country chosen by the parties" (Art. 24.1), and further provides that parties may choose the law applicable to the contract as a whole or to specific parts of it (Art. 24.2) and that such choice may be made at any time, including at or after conclusion of the contract, or be subsequently modified by mutual agreement (Art. 24.3). This autonomy extends to contracts concluded on digital platforms and thus permits platform-mediated choice-of-law clauses, but the legal effectiveness of any such choice presupposes the genuine and express manifestation of the user's will; otherwise the selection may be merely formal. Complementary to this rule, **Article 390 of the Civil Code** [2] affirms the fundamental principle of freedom of contract—providing legal support for party autonomy in selecting the applicable substantive law—while doctrinally distinguishing between genuine contractual autonomy and adhesion contracts (standard form contracts) commonly used in platform settings, a distinction that frequently underpins challenges to the validity of party-made choice-of-law clauses in cross-border electronic contracts. The primacy of **mandatory rules** is addressed in Article 5 of the Law on Private International Law, which provides that, irrespective of the law chosen, the overriding mandatory norms of the Republic of Azerbaijan shall apply (Art. 5.1) and that, where appropriate, the mandatory rules of another State with a close connection to the case may be given effect to the extent possible (Art. 5.2); this rule is particularly important in consumer settings, since a foreign law chosen by a platform that would diminish a consumer's protection may be disregarded by Azerbaijani courts—an approach analogous to the EU doctrine of "overriding mandatory provisions." Further protective norms are found in the **Law on Protection of Consumer Rights** [19]: Articles 3 and 8 secure the consumer's right to full and clear information about contractual terms and render void contractual clauses that unduly restrict consumer rights; in the context of click-wrap platform agreements, lengthy, opaque or non-negotiated clauses must therefore be scrutinised for compliance with these provisions. Finally, the **Law on Arbitration** [1] provides a practical procedural mechanism: in the absence of an agreement governing the law applicable to an arbitration agreement, the arbitral tribunal is free to determine the law governing the arbitration agreement (Art. 25.5), a rule that means tribunals may apply an alternative law where platform choice-of-law clauses are absent or their validity is doubtful. So, these provisions form a normative framework that recognises party autonomy while subjecting cross-border digital contracts to consumer protection, mandatory rule, and public-policy constraints and providing procedural means (including arbitration) for resolving choice-of-law and enforcement issues.

The regulation of digital contractual relations is beset by a range of systemic problems at both the national and international/model-law levels. In the domestic legal order of the Republic of

Azerbaijan a principal difficulty stems from the fact that the Civil Code remains rooted in classical contract law concepts—written form, handwritten signature and a document embodied on a physical medium—and the legal qualification of contracts concluded in the electronic environment is not always specified with sufficient normative precision. Questions such as the legal nature of electronic offer and acceptance, the determination of the moment of contract formation, the time of receipt of electronic notices, and the characterization of manifestations of will produced by automated systems therefore require interpretive clarification and a consistent doctrinal approach. Moreover, procedural assessment of electronic evidence, the reliability of identification and authentication mechanisms, and choice-of-law and jurisdictional conflicts in cross-border digital contracts raise complex private-international law issues. At the international level, the UNCITRAL Model Law on Electronic Commerce (1996) [32] and the UNCITRAL Model Law on Electronic Signatures (2001) [33] promoted the principles of functional equivalence and technological neutrality and recognised the legal force of electronic records and signatures; however, their implementation has taken diverse transpositional forms across States, producing fragmented harmonisation. Divergent national regimes for types of electronic signatures and their legal consequences, varying interpretations of the "written form" requirement, and differences in approaches to the "original" status and evidentiary value of electronic information generate legal uncertainty in transnational contractual relations. The non-mandatory (dispositive) character of these model laws means there is no single binding international standard, and UNCITRAL's Model Law on Electronic Transferable Records (MLETR) [34] — which seeks to secure legal recognition for electronic transferable documents (e.g. electronic bills of lading, negotiable instruments) — confronts practical divergences in the operationalisation of its "reliable control" concept and in the technical criteria adopted by States, thereby complicating legal recognition in areas such as finance and transport. Similarly, while the EU's eIDAS Regulation [12] establishes a legal framework for electronic identification and trust services, practical mutual recognition, conformity assessment and the application of technical standards among Member States remain problematic, and the regional scope of eIDAS limits its automatic applicability in other legal systems. In sum, at both the national and international levels the core challenge is the absence of a unified legal approach, terminological clarity and coordinated techno-legal standards sufficient to secure legal certainty and interoperability in digital contracting.

3.2. A Comparative Analysis of International and Regional Legal Approaches

The regulation of digital contractual relations in the sphere of international law is aimed at the formation of common legal standards under conditions where states possess different legal systems and varying levels of technological development. Since contracts concluded via the Internet frequently involve the legal jurisdictions of more than one state, it is essential that their legal validity be recognized in a consistent manner across different legal systems. For this reason, international organizations adopt model and framework instruments that guide states in developing national legislation. Unlike classical international treaties, these instruments do not create directly binding legal obligations; rather, they establish normative frameworks that influence the development of domestic legal systems. For instance, the model law adopted by the United Nations Commission on International Trade Law on electronic commerce [32] promotes the legal recognition of electronic records in commercial transactions, the model law on electronic signatures [33] establishes the principal legal criteria for recognizing the legal validity of electronic signatures, and the model law on electronic transferable records [34] provides a

framework for the legal recognition of transferable electronic documents such as electronic bills of lading and electronic promissory notes. In legal practice, the influence of these instruments has led many states to introduce specific legislative provisions governing the conclusion of electronic contracts, the use of electronic signatures, and the legal validity of electronic documents. The central objective of the international legal approach is to preserve the classical principles of contract law regardless of technological change. These principles include equality of the parties, freedom of will, and freedom of contract. For example, when two companies conclude a contract via the Internet, their legal rights and obligations are regarded as equivalent to those arising from a contract concluded in written paper form. The theoretical foundation of this approach is the doctrine of functional equivalence [15]. According to this doctrine, the law evaluates not the technical form of a tool but the legal function it performs. Thus, if traditional contract law requires a written form, in the digital environment this requirement may be satisfied when information is preserved with integrity and remains accessible for subsequent reference. The same reasoning applies to signatures: if an electronic signature reliably identifies a person and confirms that person's intention to agree to the contract, it may legally perform the same function as a handwritten signature. Practical examples include contracts concluded through electronic signatures in online banking systems or the acceptance of contractual terms by users through electronic confirmation in online commerce platforms. Digitalization also enables states to employ different technological mechanisms, such as certified electronic signatures, biometric authentication methods, or blockchain-based smart contracts. However, this technological diversity may also generate legal uncertainty, as states regulate these mechanisms in different ways, which can create difficulties in cross-border contractual relations. Consequently, the international legal approach seeks to maintain a balance between two objectives: preserving technological neutrality and regulatory flexibility on the one hand, while ensuring a minimum level of legal certainty on the other. The UNCITRAL model laws were developed precisely for this purpose; they do not comprehensively regulate all aspects of digital contracts but rather establish a minimum set of legal standards that states may adopt. As a result, digital contract law at the international level should not be viewed as a fully closed and uniform normative system, but rather as an evolving legal framework that is gradually shaped and supplemented by national legal systems. This approach corresponds to the global nature of the digital economy, where legal regulation is based less on rigid uniformity and more on functional compatibility and shared legal principles [28].

The European Union's legal approach to digital contractual relations is structured around normative specificity, legal harmonization [10], and institutional coordination, reflecting the logic of regional legal integration. The primary objective for the EU is not only the legal recognition of electronic contracts but also the establishment of a unified digital market (Digital Single Market) among its member states. Consequently, while EU legislation does not entirely abandon technological neutrality, unlike the UNCITRAL approach, it provides a more detailed regulatory model with enforcement mechanisms. Central to this regional approach are legal certainty, mutual recognition, and institutional mechanisms that ensure the effective exercise of rights, thereby fostering trust in digital contract transactions. Within this framework, the eIDAS Regulation [12] serves as a fundamental normative pillar for EU digital contract law, explicitly defining the legal validity of electronic identification tools, electronic signatures, electronic seals, and time stamps, and establishing that advanced and qualified electronic signatures produce the same legal effects as written form. A key regional feature is that eIDAS institutionalizes the

principle of mutual recognition: an electronic identification tool deemed valid in one member state must produce legal effects in other member states, minimizing issues related to form, identification, and evidentiary requirements in cross-border electronic contracts and creating a more predictable legal environment for courts. Simultaneously, the EU's new-generation digital regulations—the Digital Services Act [14] and the Digital Markets [13], expand the regulatory scope of contract law in the context of platform economies and algorithmic governance. Although these Acts do not directly establish contract law norms, they provide a normative framework for the role of digital platforms in contractual relations, the transparency of algorithmic decision-making, the allocation of responsibilities, and the protection of user rights. Thus, the EU approach evaluates contractual relations not solely based on the parties' intentions but also in conjunction with platform power, information asymmetries, and algorithmic influence. Nevertheless, the high level of normative detail and strict compliance requirements may create tensions between agile technological innovation and legal regulation, representing the principal doctrinal dilemma of the EU model [27].

3.3. The Transition of Contract Law towards the "Dynamic Law" Model: Risks, Opportunities, and Prospective Legal Assessment

The transition of contract law to the model of "dynamic law" signifies a movement beyond the framework of traditional text-centred legal regulation—comprising legislation, contractual instruments, and judicial decisions—towards the formation of a legal environment that is integrated with technology, adaptive in nature, and capable of being programmed. Within this model, legal consequences are determined not only "ex post", that is, through legal assessment after the relevant event has occurred, but may also be predetermined and implemented through ex ante execution, a feature that is particularly evident in the context of smart contracts. By ex ante execution is meant the prior codification of contractual terms whereby, upon the occurrence of specified conditions, legal consequences are automatically effected; for example, the automatic activation of a penalty mechanism in the event of delayed payment. This approach is grounded in the principle of functional equivalence: where classical legal functions such as the expression of intent, signature, document retention, and performance are reliably ensured through technological means, they should be regarded as legally equivalent to their traditional forms. As a consequence, law manifests itself not merely in textual form but also as a "codified norm", while platform rules, algorithmic systems, and digital protocols acquire normative force. This model gives rise to significant practical advantages: automation reduces transaction costs, accelerates contractual performance, enhances reliability in cross-border transactions, and establishes a stronger evidentiary basis through mechanisms such as audit logs and cryptographic signatures. Nevertheless, this transformation also generates new legal challenges, the resolution of which requires code audits—namely, the independent verification of the legal and technical compliance of software systems—as well as the human-in-the-loop approach, that is, the preservation of human oversight at critical stages of decision-making. At the same time, explainable algorithms and legal-technical certification mechanisms play a fundamental role in ensuring legal certainty and reliability. Accordingly, the dynamic law model constitutes not merely a technological innovation, but a complex hybrid legal system that necessitates the reconstruction of legal institutions, procedural frameworks, and liability mechanisms [29].

The implementation of the dynamic law model gives rise to a wide range of novel legal and practical risks, the conceptual, doctrinal, and operational dimensions of which are closely interconnected; at the core of these risks lies the weakening of the principles of legal certainty

and stability. This is primarily because automated execution mechanisms perform contractual obligations on the basis of pre-programmed rules while minimizing human intervention, meaning that legal consequences are structured around an ex ante execution model—namely, the automatic application of obligations in accordance with rules predetermined in advance—which correspondingly restricts the scope for subsequent legal interpretation and judicial construction. Consequently, in situations involving indeterminate contractual terms, force majeure events, or commercial customs and usages, the necessity of applying legal analogy and judicial interpretation creates an inherent tension between rigid algorithmic execution and the classical flexibility of legal doctrine. At the same time, the issue of compensating damages arising from algorithmic errors—such as programming defects or unforeseen system behaviour—and technical malfunctions significantly complicates the choice between competing liability principles, particularly fault-based liability (negligence) and strict liability, thereby generating both doctrinal debate and practical uncertainty and making the prediction of legal risks considerably more difficult. From the perspective of evidence and expert assessment, smart contracts and algorithmic systems frequently operate as a "black box", in the sense that their internal logic lacks transparency, which complicates the explanation of source code, audit logs (immutable digital records), and algorithmic decisions in judicial proceedings; this, in turn, necessitates the development of new evidentiary standards and procedural frameworks, including rules governing the appointment of technical experts, the protection of source code as a trade secret, and the admissibility of blockchain-based audit logs as judicial evidence. Risks relating to cross-border application and socio-economic fairness are equally significant, since the location of digital infrastructures across multiple jurisdictions complicates issues of choice of law and enforcement, while algorithmic bias—namely, unfair outcomes affecting particular user groups as a result of systematic flaws in training data or system design—information asymmetry, meaning that one party possesses more or better-quality information than the other, and the dominant position of digital platforms, whereby market superiority restricts effective alternative choices, collectively weaken contractual freedom in practical terms and, in particular, undermine the effective protection of consumer rights. In order to mitigate these risks, it is necessary to adopt a комплекс approach involving algorithmic impact assessments, explainable algorithms (explainability), the broader application of platform liability, mandatory consumer protection rules, insurance mechanisms, code audits, and instruments of international legal harmonization, including model laws, mutual recognition regimes, and arbitral mechanisms; absent such measures, the large-scale implementation of dynamic law models may seriously affect the principles of legal justice, economic predictability, and social protection [36].

The implementation of the dynamic law model in contract law is not confined solely to theoretical transformations; rather, it also functions as a complex mechanism serving the more efficient, flexible, and reliable realization of legal relationships in practice. The principal advantage of this model lies in the acceleration of contract formation and performance, the reduction of transaction costs, and the higher degree of predictability of legal consequences. In particular, through smart contracts—namely, contractual mechanisms that ensure the automatic performance of obligations upon the occurrence of predetermined conditions—the execution process is carried out more expeditiously than under traditional judicial and enforcement procedures, while the need for additional legal intervention by the parties is minimized; for example, it becomes possible for payment to be executed automatically upon the fulfilment of a specific condition or for resources to be immediately placed at the disposal of the counterparty.

Within this framework, the recording of transactions conducted in the digital environment in a sequential and immutable form enables the reliable tracing of the history of contractual relations and provides the parties with a strong evidentiary basis, while the precise determination of the time and source of transactions further enhances legal certainty. Electronic signatures and other authentication mechanisms provide the technical foundation of legal validity by safeguarding the authenticity and immutability of documents, thereby strengthening confidence in contractual relations. At the same time, the prior verification of contractual terms and the use of standardized models reduce legal risks for the parties and lower the likelihood of disputes arising, with the result that the resolution of potential disputes also becomes simpler and more expeditious. From an evidentiary perspective, digital records and electronic authentication instruments not only serve as an alternative to traditional written documents but may, in many cases, function as more reliable means of proof. Nevertheless, the effective implementation of this model cannot be limited solely to technological capabilities and requires the preservation of legal oversight; in this respect, the retention of human participation in significant decision-making processes, the explainability of the systems employed, and the prior assessment of their legal impact are of particular importance. Furthermore, the application of specialized expert mechanisms for the proper assessment of technical issues in judicial and arbitral proceedings, the protection of data confidentiality, and the establishment of uniform standards further strengthen the level of legal protection. The harmonization of these mechanisms with international legal approaches, in turn, facilitates the cross-border application of digital contracts and enhances their practical effectiveness. Consequently, the dynamic law model functions as a hybrid system that, while ensuring the integration of technology into law, also requires the reconfiguration of legal institutions, evidentiary mechanisms, and approaches to liability, and the principal objective of this system is to ensure a balance between innovation and legal certainty and justice [4].

CONCLUSION

The findings of the research demonstrate that the digitalization of civil circulation is not merely a technological adaptation of classical civil law institutions, but rather a fundamental transformation of their structural and functional essence. At the present stage, civil circulation operates as a hybrid system formed through the interaction between legal norms and technological architecture (algorithms). Within this process, the transformation of the principle of freedom of contract from a model based on individual negotiations to a platform-based "contract of adhesion" model substantially limits the mechanisms through which the parties' autonomy of will is exercised. Nevertheless, this change should not be interpreted as a denial of the fundamental principles of civil law, but rather as their conceptual adaptation to the realities of the digital era. The sustainability of civil circulation within the digital environment directly depends on the establishment of a new normative balance between classical legal interpretation and algorithmic enforcement mechanisms. The analysis conducted in the first section of the article demonstrates that the traditional model of civil circulation, grounded in physical space, written documents, and direct declarations of intent, has been transformed under the influence of digital technologies into a complex system operating through electronic communication tools, platform-based relations, and automated mechanisms. Although this transformation does not eliminate the legal significance of such fundamental principles as freedom of contract and autonomy of will, it substantially alters their modes of realization by embedding them within technical procedures and standardized contractual frameworks.

Within the context of this transformation, the subjective elements of contractual liability, particularly the notion of "fault," partially lose their original regulatory significance; legal liability is increasingly reconstructed on the basis of objective criteria such as the allocation of technological risks, control over algorithmic design, and mechanisms of functional governance rather than the individual conduct of the parties. Automated enforcement mechanisms create a hybrid liability regime situated at the intersection of human intention and algorithmic decision-making, thereby making the modernization of classical civil law doctrine on the basis of new objective criteria inevitable for ensuring legal certainty in digital civil circulation. The analysis conducted in the second section demonstrates that smart contracts advance this process even further by transferring contractual performance into the algorithmic sphere and enabling the automatic generation of legal consequences. This development necessitates the reconsideration of the classical institutions of contract law, including freedom of will, contractual performance, and liability mechanisms.

The final conclusion of the research is that, although the civil and private international law legislation of the Republic of Azerbaijan provides fundamental legal grounds for digital circulation, the deeper integration of UNCITRAL Model Laws and regional standards such as eIDAS into national law has become unavoidable for resolving issues of jurisdiction and evidentiary regulation in cross-border platform contracts. The transformation of contract law into a "dynamic law" model entails the transition of legal control from ex post evaluation toward ex ante algorithmic enforcement, which in turn requires the establishment of new procedural safeguards through "human-in-the-loop" mechanisms and explainable algorithms in order to preserve the principle of fairness. Although the automated performance of obligations through smart contracts creates substantial advantages in terms of efficiency, economic effectiveness, and the strengthening of evidentiary reliability, it simultaneously generates new challenges for fundamental legal principles, including legal certainty, judicial interpretation, and the allocation of liability. Therefore, the effectiveness of the dynamic law model can only be ensured not merely through the implementation of technological innovation, but also through the preservation of legal oversight mechanisms, the retention of human intervention at critical stages, the guarantee of algorithmic transparency, and the institutionalization of code auditing at the normative level.

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