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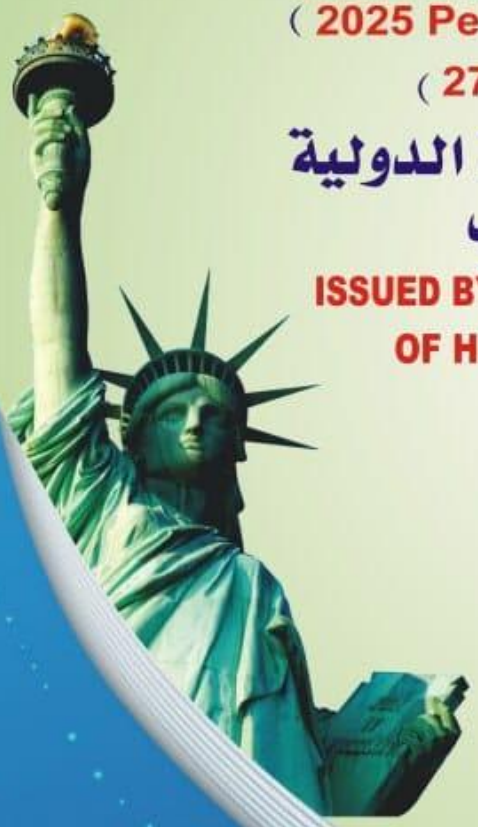

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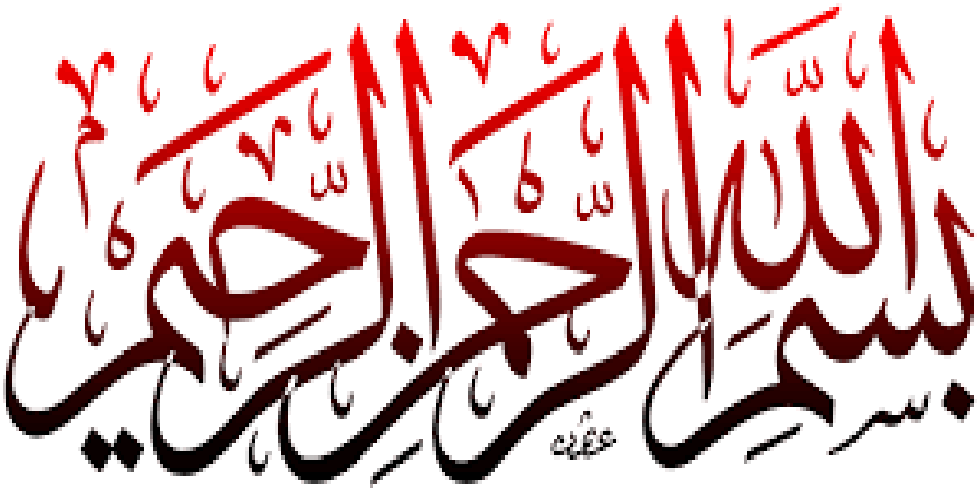
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مقال العدد

بسم الله الرحمن الرحيم،

الحمد لله رب العالمين، والصلاة والسلام على خاتم الانبياء والمرسلين، وآله وصحبه أجمعين، أما بعد:

في المشهد المعرفي المتجدد، يطلّ علينا **العدد الثامن والعشرون (الجزء الأول)** من **المجلة الأمريكية الدولية المحكمة للعلوم الإنسانية والاجتماعية**، ليحمل في طياته باقةً من الدراسات والبحوث المتميزة التي خطّتها أقلام نخبة من الباحثين والأكاديميين ممن حفروا أسماءهم بمداد الجدّ والعطاء في مختلف حقول المعرفة.

لقد حرصت هيئة التحرير في هذا العدد – كما دأبت دائماً – على ترجيح كفة **النوع والكيف** على الكمّ والعدد؛ فالغاية الأسمى لمجلتنا ليست تكديس الصفحات، بل إثراء المكتبة العربية والعالمية بالأفكار العلمية الأصيلة، والرؤى المنهجية الرصينة التي تمثل إضافة حقيقية للبحث العلمي الرصين.

وانطلاقاً من التزامنا الصارم بأعلى معايير النشر العالمي، فقد خضعت كافة البحوث الواردة إلى مسار تحكيمي دقيق وصارم، شأنها في ذلك شأن أعرق المجلات المحكمة في العالم؛ حيث تم عرض البحوث على محكمين أكفّاء ذوي مكانة علمية رفيعة ينتمون إلى مدارس وجامعات ومؤسسات أكاديمية متعددة الجنسيات، ما بين حكومية وخاصة، أثبتوا جدارة تامة في تقييم المادة العلمية والحكم على صلاحيتها للنشر بموضوعية وحياد.

وقد سلكت هيئة التحرير منهجاً مؤسسياً ثابتاً في آلية القبول والتحكيم؛ إذ يُعرض البحث على محكمين اثنين بالتوازي، فإن توافقا على الصلاحية، انتقل البحث فوراً إلى مرحلة التنضيد والإخراج الفني تمهيداً للنشر، شريطة استيفائه الكامل لتعليمات النشر الخاصة بالمجلة. أما في حال اختلاف التقييم بينهما، فيُحال البحث إلى محكم ثالث مرجعيّ، ليُصار إلى اعتماد رأيه حاسماً في قبول البحث أو استبعاده، صيانةً لجهود الباحثين وضماناً لأعلى درجات النزاهة الأكاديمية.

إنّ ما يميّز إصدارات مجلتنا هو حرصها الدائم على استيعاب التيارات الفكرية والموضوعات الإنسانية والاجتماعية المتنوعة ضمن إطار التخصص، مع ترك المساحة الرحبة للباحثين للتعبير عن رؤاهم ونظرياتهم العلمية دون تدخل في جوهر أفكارهم، شريطة التزامها بالمعايير الأخلاقية والعلمية التي تنأى عن الفوضى الفكرية أو التحريض بكل أشكاله، لتبقى منارةً للفكر الهادف والحوار البنّاء.

وختاماً.. لا يسعنا إلا أن نتقدم بخالص الشكر والتقدير وعظيم العرفان، مكللاً بأريج الود والامتنان، إلى كافة الجهود العلمية، والفنية، والإدارية المتضافرة التي أسهمت في إخراج هذا العدد إلى النور؛ من باحثين أفاضل، ومحكمين أطهار، وأسرة تحرير لا تلين عزيمتها.

والسلام عليكم ورحمة الله وبركاته.

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هيئة تحرير المجلة

الناشر:

الأكاديمية الأمريكية الدولية للتعليم العالي والتدريب

فهرس الموضوعات

The legal aspects of the content of smart contracts

-An analytical study-

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Abstract

In today's digital era, smart contracts—self-executing agreements based on blockchain technology—are reshaping the traditional concept of contractual content. Unlike conventional contracts, which are written in flexible legal language and interpreted by courts, smart contracts are defined by rigid, automated code that executes without human intervention. This shift poses significant legal challenges concerning the notions of intent, consent, and fairness.

The research highlights two contrasting frameworks: traditional contracts, rooted in mutual intention and interpretive flexibility, and smart contracts, which rely on deterministic code, often disregarding context or unforeseen circumstances. Classical legal systems allow judges to interpret, modify, or invalidate contracts based on equity or public policy. However, smart contracts lack this adaptability, as demonstrated in cases like The DAO Hack (2016), where code was executed strictly despite ethical concerns, embodying the principle that "code is law."

The study further analyzes how smart contracts redefine the function of contractual content—from a legal expression to a technical enforcement

mechanism. While this enhances operational efficiency, it eliminates judicial oversight and risks unjust outcomes for weaker parties.

Key findings include the transformation of content into executable code, the erosion of judicial roles, and the need to adapt classical legal concepts. To address these issues, the study recommends legislative reforms that recognize smart contracts as a distinct legal category, the integration of algorithmic fairness, and the creation of digital arbitration platforms. Ultimately, it calls for a reimagining of legal actors and norms in light of emerging technologies, balancing innovation with fundamental legal protection.

Keywords: Smart Contracts, Legal Interpretation, Blockchain, Algorithmic Fairness, Judicial Oversight

الجوانب القانونية لمحتوى العقود الذكية

-دراسة تحليلية-

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الملخص :

في العصر الرقمي الحالي، تُعيد العقود الذكية — وهي اتفاقيات ذاتية التنفيذ قائمة على تكنولوجيا سلسلة الكتل (البلوكتشين) — صياغة المفاهيم التقليدية لمضمون العقد. فعلى عكس العقود التقليدية المكتوبة بلغة قانونية مرنة والتي تفسرها المحاكم، تتميز العقود الذكية بتعريفها عبر كود برمجي صارم ومؤتمت يتم تنفيذه دون تدخل بشري. ويطرح هذا التحول تحديات قانونية جمة تتعلق بمفاهيم النية، والرضا، والعدالة.

يسلط البحث الضوء على إطارين متناقضين: العقود التقليدية المتجذرة في النية المتبادلة والمرونة التفسيرية، والعقود الذكية التي تعتمد على أكواد حتمية غالباً ما تتجاهل السياق أو الظروف غير المتوقعة. تتيح الأنظمة القانونية الكلاسيكية للقضاة تفسير العقود، أو تعديلها، أو إبطالها استناداً إلى مبادئ العدالة أو النظام العام. ومع ذلك، تفتقر العقود الذكية إلى هذه القابلية للتكيف، كما يتضح في حالات مثل اختراق منظومة (The DAO Hack) في عام 2016، حيث تم تنفيذ الكود بصرامة متناهية بغض النظر عن المخاوف الأخلاقية، متجسداً في مبدأ "الكود هو القانون."

يحلل البحث كذلك كيف تعيد العقود الذكية تعريف وظيفة مضمون العقد — من تعبير قانوني إلى آلية إنفاذ تقنية. وفي حين يعزز ذلك الكفاءة التشغيلية، فإنه يلغي الرقابة القضائية ويخلق مخاطر تؤدي إلى نتائج غير منصفة للطرف الأضعف.

وتشمل النتائج الرئيسية تحول مضمون العقد إلى كود قابل للتنفيذ، وتراجع الدور القضائي، والحاجة الملحة لتكييف المفاهيم القانونية الكلاسيكية. ولمعالجة هذه الإشكالات، يوصي البحث بإصلاحات تشريعية تعترف بالعقود الذكية كفئة قانونية مستقلة، ودمج معايير العدالة الخوارزمية، وإنشاء منصات تحكيم رقمية. وفي نهاية المطاف، يدعو البحث إلى إعادة تصور الفاعلين والقواعد القانونية في ضوء التقنيات الناشئة، بما يحقق التوازن بين الابتكار والحماية القانونية الأساسية.

الكلمات المفتاحية :العقود الذكية، التفسير القانوني، سلسلة الكتل (البلوكتشين)، العدالة الخوارزمية، الرقابة القضائية.

Introduction

In the digital era we inhabit today, we are witnessing a fundamental shift in numerous aspects of life. One of the most significant of these shifts is the rise of smart contracts, which represent a paradigm change in how contractual relationships are structured and executed. Built upon blockchain technology, smart contracts depart from the traditional form of contracts—written in flexible legal language and executed under human supervision—towards a model where agreements are implemented via automated algorithms, operating independently without direct human intervention. This shift raises multiple legal challenges concerning the compatibility of these contracts with traditional legal concepts that have long served as the foundation of the legal system, such as “intent,” “consent,” “causation,” and “contractual fairness.”

It is indisputable that traditional contracts have proven effective over the centuries in regulating contractual relationships. However, the implementation of smart contracts has the potential to redefine the substance of contracts and introduce new legal complexities related to the integrity of the contracting process and ensuring fairness between parties. While traditional contracts depend on judicial interpretation and the protection of the rights of the weaker party, smart contracts operate through rigid programming mechanisms, potentially lacking the flexibility to adapt to unforeseen changes or accommodate exceptional circumstances encountered by parties during contract execution.

This research aims to examine the transformations introduced by smart contracts into contractual content through a detailed comparison between the traditional legal framework—relying on textual language and human interpretation—and the automated programming framework governing smart contracts. The study will explore how this shift impacts existing legal models and identify areas where legislative reforms may be necessary to strike a balance between legal fairness and technical efficiency in implementing these contracts in the modern context.

Additionally, the research will discuss the challenges faced by the legal system in adapting to these modern contracts and examine future prospects for regulatory frameworks that safeguard parties’ rights while mitigating the risks arising from such contracts.

So it's important to ask: Do the traditional general rules for contract formation under the Iraqi Civil Code (Law No. 40 of 1951) apply to smart contracts?

Yes, in theory, the general rules of contract formation outlined in Articles 73 to 85 of the Iraqi Civil Code No. 40 of 1951 may apply to smart contracts, provided that key legal and technical requirements are met:

1. Consent: Smart contracts involve cryptographic or biometric expressions of intent, such as digital signatures, which may qualify as valid consent under Article 73—so long as awareness and volition are clearly present.

2. Subject Matter: The contract's object—be it tokens, digital assets, or services—must be lawful and determinable, thus falling within the acceptable scope of a contract's subject as per traditional civil law.

3. Cause: Although not always explicit in digital contracts, cause can be inferred from the contract's technical or economic rationale, satisfying the requirement for a lawful and serious motive under civil law.

In practice, applying these classical elements to smart contracts requires embracing a functional equivalence approach. This involves treating digital mechanisms (such as automated performance, blockchain-based records, and cryptographic authentication) as equivalent to the civil law concepts of offer, acceptance, and signature—consistent with Article 9 of the UNCITRAL Model Law on Electronic Commerce (1996).

Branch one: Transformations in the Structural Composition of Contractual Content Between Voluntary Interaction and Programmatic Design

The law of contracts remains one of the most dynamic areas of jurisprudence, constantly adapting to the complex shifting needs of both private entities and public governance. This legal framework is in a state of perpetual refinement, driven by the necessity to reconcile traditional concepts of party autonomy with the realities of the digital age. In our contemporary technological landscape, the role of human agency in the drafting, execution, and interpretation of contractual obligations is rapidly diminishing. We are witnessing the emergence of autonomous legal instruments formed without direct human oversight, facilitated instead by computational agents. The 'smart

contract' represents the paradigm of this shift: a self-executing protocol residing on a decentralised, distributed ledger. These automated mechanisms possess the unique capacity to manage and effectuate asset transfers independently, triggering performance the moment pre-programmed conditions are met (Al-Kooh 2024, 1328).

This reality confirms that contracts are no longer confined to traditional or electronic forms but now encompass a smart paradigm. Consequently, they require an interpretive methodology aligned with their technical nature, necessitating in-depth exploration of this issue. The need to understand contractual content arises from:

First: Ascertaining the Bona Fide Intent of the Parties

The translation of mutual assent into machine-readable code presents a fundamental challenge to the traditional doctrine of intent. Unlike conventional agreements, where the meeting of minds is memorialised in natural language, smart contracts rely on rigid programming logic that may fail to capture the nuances of the parties' true objectives. A significant informational asymmetry arises, as contracting parties often lack the technical fluency to interpret the code or foresee its legal ramifications. In traditional contract law, ambiguity is resolved through established hermeneutic principles—courts examine the written instrument or extrinsic evidence to reconstruct the parties' "true will." Smart contracts, however, bypass this judicial safety net. Because they execute automatically upon the satisfaction of binary conditions, there is an inherent risk that the "declared will" (the code) diverges from the "true intent" (the actual consensus), reviving age-old legal debates regarding the supremacy of internal volition over external manifestation (Ibrahim 2020, 70 et seq.).

A profound dissonance exists between the fluidity of legal reasoning and the binary rigidity of computer programming. Traditional contract law operates within a framework of nuance, relying on equitable principles such as good faith, usage of trade, and judicial interpretation to resolve ambiguities. In stark contrast, smart contracts are governed by the unyielding determinism of code. This divergence creates significant peril: a smart contract executes only what is written in its syntax, blind to the parties' actual intent. For example, a valid oral side agreement or a term inadvertently omitted from the code is effectively nonexistent to the blockchain. The gravity of this limitation is compounded by

the technology's immutability; once deployed, the contract is technically irreversible, rendering it impossible to amend the code to reflect the true agreement, even where the counterparty acknowledges the error (Youssef 2022, 13), rendering unintended outcomes irreversible (Suwar n.d., 205 et seq.).

So we can describe the idea when we say that The Role of Immutable Blockchain Records in Interpreting Opaque Code so The blockchain ledger functions as an unfailing digital witness, immutably capturing every transaction within a smart contract's lifecycle. In disputes involving ambiguous or proprietary ("closed") code, courts rely on this immutable record to reconstruct execution timelines and infer original intent, much like examining a detailed diary stored across sequential blocks. This methodology is increasingly acknowledged by legal scholars who advocate for using blockchain artefacts as admissible objective evidence (Nicolosi 2023, 112–15).

The Smart-contract intent is multidimensional and must be inferred through a tripartite legal lens (Grinhaus 2024, 78–82):

In his seminal analysis within Blockchain and the Law, Michael Nicolosi underscores the profound probative value of blockchain records, positing that the immutable ledger serves as a critical instrument for preserving and reconstructing contractual intent. However, deciphering the true intent behind a smart contract is rarely a linear process; rather, it demands a multidimensional inquiry through a tripartite legal lens that synthesises technical execution with human conduct. This analysis begins with digital actions, where the law increasingly recognises cryptographic proofs—such as ECDSA or Schnorr signatures—as the functional equivalent of a handwritten signature, thereby establishing a voluntary and legally binding commitment. This foundation is reinforced by the behavioural record, a forensic trail of pre-execution events including the payment of gas fees, collateral deposits, and off-chain encrypted communications, which collectively demonstrate that the user was not merely passive but actively engaged in the transaction. Finally, this technical evidence must be harmonised with the human context, a standard rigorously applied in civil law jurisdictions. As exemplified by the Paris Commercial Court's 2022 ruling, the principle of good faith mandates that code execution be interpreted in alignment with off-chain realities, such as verbal agreements and electronic correspondence. This integrative methodology resonates strongly with Aaron Grinhaus's comprehensive framework for Web3 intent formation, suggesting

that binding consensus is ultimately found at the intersection of immutable code and human negotiation."

Second: Addressing Programming Errors (Bugs) and Their Legal Impact on Smart Contracts

The autonomous nature of smart contracts, while ensuring unprecedented transparency and efficiency, inevitably introduces a spectrum of legal ambiguities centred on the friction between rigid code and the fluidity of real-world events. A primary source of this friction is the inherent difficulty in anticipating every potential deviation from the standard execution path; unlike traditional agreements where human judgment can adapt to unforeseen circumstances, a smart contract operates on strict, predefined conditions. Consequently, a delivery delay caused by force majeure may be misread by the code as a simple breach, triggering a premature termination or penalty because the algorithm lacks the interpretive flexibility to recognise the valid excuse for non-performance. This rigidity is compounded by the ever-present risk of programming errors or coordination gaps, where even meticulously drafted protocols may contain latent bugs that erroneously execute payments or shipments due to unanticipated transactional states. These vulnerabilities highlight a decisive conceptual shift in the digital age: the 'content' of a contract is no longer merely a static expression of intent within a linguistic framework, but has evolved into dynamic, algorithmic coding that acts independently of human volition. This transition represents a profound transformation in the very ontology of contractual formation, moving law from a discipline of interpretation to one of automated execution:

Section 1: Mechanisms for Generating Contractual Content Between Consensual Drafting and Rigid Coding :we'll study it according to**:**

Subsection 1: Contractual Content as a Reflection of Mutual Intent in Traditional Contracts

In traditional paper-based contracts, content is formed through a voluntary convergence of the parties' intentions, typically through a series of negotiations, discussions, and amendments. The final agreement is then drafted in legal language that permits flexible interpretation based on the parties' intent and the temporal and economic context in which the contract was formed (Gabriel 2021, 47–49).

The French Court of Cassation, in its ruling dated December 15, 1993, affirmed that "the decisive criterion in interpreting contractual terms lies not in the literal wording but in the mutual intent of the parties (Beale 2021, paras. 13-045–13-048)." This judicial principle emphasises the primacy of internal intent over literal expression when interpretations conflict, establishing a foundation for understanding how contractual content is shaped within the traditional framework, where the legal text serves as a tool to embody intent rather than replace it (Valcke 2015, 328).

So Minor coding flaws—like "a fly in a Swiss watch"—can have catastrophic ramifications. In 2022, Wormhole's cross-chain bridge suffered a $320 million exploit originating from a forgotten line in verification code. Beyond the financial loss, this incident reveals systemic weaknesses (Nikolic et al. 2018, 42–45):

1- Multi-Eye Audits: Pre-deployment, full-spectrum reviews—combining legal oversight and technical analysis—are essential. Chainalysis and others deploy tools like Slither and MAIAN to proactively detect vulnerabilities.
2- Circuit Breakers: Smart contracts increasingly include halting mechanisms activated when risk thresholds are breached to prevent runaway transactions.

Ivica Nikolic and colleagues have documented these practices, highlighting the necessity of integrated safety architecture.

Subsection 2: Contractual Content as Executable Closed Code in Smart Contracts

In smart contracts, contractual content does not emerge through the traditional process of discussion, bargaining, or negotiated exchange between the parties. Rather, it is translated into programming code—often in languages such as Solidity—deployed on blockchain platforms like Ethereum, and permanently recorded on an immutable distributed ledger. In this setting, the contract is no longer merely a legal text intended for reading, interpretation, and later enforcement. Instead, it becomes a self-executing coded structure that automatically performs its functions once the predetermined conditions are satisfied, without requiring further human intervention, party cooperation, or prior recourse to judicial authority (Werbach 2018, 102–5).

This was evident in The DAO Hack (2016), where a user exploited a vulnerability in a smart contract's code to transfer millions of dollars in Ethereum to their wallet (De Filippi and Wright 2018, 89–93). Despite the profound shock it caused within the digital community, no effective legal remedy was available to argue that the act had violated the parties' contractual intention. The smart contract had operated exactly as the code was written, rather than in accordance with the meaning the parties may have subjectively intended. This episode illustrates a central principle of the blockchain environment—namely, that "Code is Law"—and reflects a clear philosophical departure from the traditional legal approach, which is grounded in interpretation, intention, and contextual evaluation (Buterin 2014, 6–8). This case shows that, once a smart contract is deployed, its content becomes largely self-contained and operates independently of the parties' intentions or any later need for flexibility. From that moment onward, its functioning is governed by binary code and predetermined logical commands rather than by interpretive legal reasoning. As a result, the role of judicial interpretation becomes significantly more difficult and, in some situations, may be practically excluded altogether (Fairfield 2014, 42–45).

Section 2: Between the Subjective Nature of Intent at the Stage of Formation and the Objective Logic of Algorithms at the Stage of Execution :
This section examines the relationship between the subjective will of the parties at the moment of contract formation and the objective, automated logic that governs performance in technologically driven contractual models. It will be discussed through the following subsection:

Subsection 1: Balancing Intent and Public Policy in the Traditional Structure of Contractual Content

In traditional contract law, contractual content is founded on the principle of party autonomy, yet that autonomy is never regarded as absolute. Although contractual obligations originate in the parties' intent, their content remains subject to statutory restrictions, considerations of public policy, and the need to protect the weaker party in the contractual relationship. Moreover, where circumstances change fundamentally, or the performance of the contract causes serious hardship to one party, the courts may intervene to reassess the contractual content in order to restore fairness and preserve the contractual equilibrium (Beale 2021, paras. 1-015–1-020). This principle was affirmed by

the Egyptian Court of Cassation in its Civil Circuit judgment in Appeal No. 1344 of the 71st Judicial Year, where it held that a substantial change in economic circumstances may justify reconsidering the contractual obligations of the parties under the doctrine of unforeseen circumstances (Taylor v Caldwell (1863) 3 B & S 826, 122 ER 309). This allows courts to reinterpret the contract to ensure justice, rather than adhering strictly to the literal text (McKendrick 2020, 412–15).

Subsection 2: The Exclusion of Interpretive Flexibility and Subsequent Intent in Smart Contract Structures : By contrast, smart contracts mark a clear departure from this balanced legal model. Their coded architecture generally leaves no room for unforeseen circumstances, later modifications, or interpretive adjustment unless such possibilities have been expressly embedded in the code from the outset. As a result, contractual content takes on a purely computational character, operating through automated mechanisms that execute instructions without human intervention. This structural rigidity may, in certain unexpected situations, produce outcomes that conflict with fairness and lead to forms of practical injustice (Raskin 2017, 330–35). A striking example can be seen in a dispute submitted to the decentralised arbitration platform Aragon Court, where a smart contract automatically withheld payment from a developer because of a delay in delivery, even though there was evidence that the delay resulted from a network malfunction. Although the tribunal expressed sympathy for the developer's position, it ultimately held that "the code leaves no room for discretion; fairness must be pre-programmed into the system, or smart contracts lose their essence." This case clearly demonstrates the rigid nature of smart contract enforcement, where equitable considerations may be acknowledged in principle but remain ineffective unless they have already been incorporated into the code itself. (De Filippi and Wright 2018, 117–21; Finck 2018, 139–42)

This ruling raises a profound legal and philosophical dilemma: To what extent can we trust contracts that do not interpret or consider human circumstances? What role remains for judges—or arbitrators—in a system that recognises only automated execution (UK Jurisdiction Taskforce 2019, paras. 5.7–5.9)?

Branch Two: Functional Characteristics of Contractual Content Between Legal Adaptation and Digital Operation

The digital revolution has profoundly unsettled the classical concepts on which contract theory has long been built, particularly with respect to the functional role of contractual content. In traditional legal thought, contractual content is primarily understood as a normative framework through which rights and obligations are defined, and risks are allocated between the parties. In the context of smart contracts, however, this content is no longer confined to a purely legal function. It is transformed into an operational and technical instrument, capable of automatic execution and immediate digital verification. This development raises unprecedented questions regarding the boundaries of party liability, as well as the extent to which legal oversight remains possible when contractual content is expressed in machine-readable code rather than ordinary legal language.

Section 1: Contractual Content as a Regulatory Instrument in Traditional Contracts : This section will be examined through the following subsection:

Subsection 1: Textual Clarity and Judicial Authority in Interpretation and Modification

In traditional contracts, contractual content performs a regulatory function by identifying the scope of the parties' obligations and determining the limits of their liability. At the same time, the courts retain discretionary authority to interpret ambiguous provisions and to fill gaps in the parties' expressed will by relying on custom, supplementary legal rules, and the principle of good faith. In its decision of 24 November 1999, the French Court of Cassation affirmed that judges may ascertain the parties' true intention even where it does not fully coincide with the literal wording of the contract, provided that the text is ambiguous or inconclusive. This demonstrates that contractual content in the traditional legal model does not rigidly confine the judge; rather, it leaves room for the interpretive flexibility required to achieve justice (UK Jurisdiction Taskforce 2019, paras. 5.7–5.9) .This is unattainable in smart environments, where no room for intent or equity exists.

Subsection 2: Adaptation to Changing Circumstances and Responsiveness to New Developments in Traditional Contracts

One of the defining features of contractual content in traditional contracts is its capacity for adaptation. Such content is not fixed in an inflexible manner; rather, it may evolve through renegotiation between the parties or through

judicial intervention in situations involving breach, hardship, or unforeseen events. In this sense, the traditional contract is not a rigid structure but a legal framework capable of adjustment, whether expressly or implicitly, so that it may remain consistent with changing circumstances and the practical realities surrounding its performance (Beale 2021, paras. 13-045–13-048). This principle was clearly illustrated in a judgment of the Casablanca Commercial Court of Appeal, which revised the terms of a contract following an unexpected rise in material prices, even though the contract itself contained no provision addressing such a contingency. The court reasoned that enforcing the agreement under such unforeseen circumstances would upset the contractual equilibrium and transform contractual content from a regulatory mechanism into an instrument of coercion. This line of reasoning highlights the inherent flexibility of traditional contracts and stands in marked contrast to the structural rigidity that characterises smart contracts.(UNIDROIT 2016, art. 6.2.2, cmt. 3)

Traditional rules of contractual interpretation remain both relevant and necessary alongside the logic-based automation of smart contracts. Although smart contracts seek to reduce ambiguity through deterministic code, interpretation continues to play an important role in several situations, particularly where the coded terms do not fully reflect the parties' actual agreement, where disputes arise over the legal effect of automated performance, or where external circumstances require the contract to be understood within a broader legal and commercial context. In this sense, automation does not eliminate interpretation; rather, it reshapes the occasions on which interpretive reasoning becomes necessary, particularly when (Terré, Simler, and Lequette 2022, 491–98):

1- Code is Ambiguous or Incomplete: Even if the contract is coded, unclear variable definitions, functional dependencies, or unintended behaviours can arise, especially in complex DeFi arrangements.
2- Off-Chain Context Matters: Courts often look beyond code to the parties' conduct, negotiation history, or industry practice—mirroring Article 1156 of the French Civil Code, which stresses that intent must be sought wherever the terms are unclear.
3- Disputes Involving Implied Terms: Legal doctrines such as contra proferentem (interpretation against the drafter) and the principle of good faith are used when the code is silent or one-sided.

Thus, even in algorithmically executed contracts, interpretive principles from civil law systems (e.g., Cass. civ. 1re, 24 nov. 1998) and common law (e.g., Investors Compensation Scheme Ltd. v. West Bromwich Building Society, [1998) provide a crucial legal safety net.

Section 2: Contractual Content as an Executory Mechanism in Smart Contracts : This section may be examined through the following subsection:

Subsection 1: Automated Enforcement of Obligations Through Software : In smart contracts, contractual content no longer functions merely as a vehicle for legal expression; instead, it takes the form of executable code that automatically enforces obligations once predefined conditions are fulfilled. In this way, obligations are transformed from legal commitments articulated in words into programmed commands carried out without the need for human intermediaries.
A clear example can be found on the Ethereum platform, where a smart contract designed for flight-delay insurance may automatically release compensation once a delay exceeds two hours. In such a model, the contractual content operates entirely through code, without requiring the insured party to submit a claim or the company to take any further action. Although this structure offers a high degree of practical efficiency, it also raises important legal questions concerning dispute resolution, the possibility of appeal, and the correction of technical or factual errors (Norton Rose Fulbright 2019, sec. 2).

Subsection 2: Complete Closure to Judicial Oversight and Legal Adaptation

One of the central dilemmas of contractual content in smart contracts lies in its near-total exclusion of judicial supervision and corrective legal intervention. Once the predefined conditions of execution are satisfied, the code performs automatically and without prior review, thereby weakening the protections ordinarily available to the weaker party and reducing legal control to a reactive—and sometimes ineffective—stage. This problem was illustrated in a dispute brought before the decentralised arbitration platform Kleros, where a smart contract automatically released payment for a counterfeit NFT. Even though there was evidence of fraud, reversing the transaction or obtaining a refund proved impossible because of the contract's "closed code" structure. In addressing the matter, the tribunal observed that "smart contracts adjudicate execution, not equity; those who fail to program fairness are excluded from

protection." This example reveals the serious limitations of smart contracts when confronted with fraud, human error, or unforeseen injustice. It also raises a profound legal and ethical question: can the logic of automated execution truly coexist with the demands of human fairness, and is it possible to design ethical algorithms capable of preserving the legal balance that traditional contract law seeks to protect (Kleros 2022, 4–6; Raskin 2017, 330–35)?

The Objectives Achieved Upon Determining the Content of a Smart Contract Can Be Outlined as Follows:

First: Analysing the Programming Code and Understanding the Mechanisms of Execution : Smart contracts are generally written in programming languages such as Solidity, which is commonly used on Ethereum, or Rust, which is often used on Solana. Accordingly, the first step in examining a smart contract is to analyse its code in order to understand how it operates and executes automatically. In this context, a number of code-analysis tools may be used, including MythX, which assists in the security and legal assessment of Ethereum-based contracts, and Slither, which is designed to detect security flaws and structural vulnerabilities that may also carry legal significance. This form of interpretation is primarily concerned with the contract's programmed functions, including payment mechanisms, the allocation of parties' rights, and the procedures governing modification or termination (Cappiello and Carullo 2020, 28).

Historical experience offers a powerful illustration of the risks associated with inadequate code review in smart contracts. In 2016, the launch of The DAO, a decentralized investment fund built on the Ethereum blockchain, exposed the serious consequences of technical vulnerabilities embedded in contractual code. One of its smart contracts contained a flaw that enabled an attacker to carry out a reentrancy attack, resulting in the withdrawal of approximately 3.6 million ETH, valued at around USD 50 million at the time. The absence of a clear legal mechanism for invalidating or reversing the transaction revealed the extent to which, in this environment, code effectively functioned as the governing rule. The incident ultimately triggered a highly controversial division within the Ethereum network, leading to the emergence of Ethereum and Ethereum Classic after an intervention designed to recover the stolen funds. This episode demonstrated that smart contracts cannot be approached as purely technical instruments; rather, they require rigorous legal

and technical scrutiny before being deployed on a public blockchain. It follows that the use of analytical tools such as MythX and Slither should be regarded as an essential precaution for identifying vulnerabilities at an early stage and reducing the risk of harmful or irreversible consequences (Herian 2019, 188).

Second: Comparing the Code with Applicable Legal Rules : The code of a smart contract must be examined in light of the relevant legal framework, including rules of contract law, company law, and financial regulation. This comparison is essential because technical validity does not necessarily guarantee legal compliance. In this context, legal-technology tools such as Clause, developed by OpenLaw, can help translate legal language into digital clauses that correspond to the logic of smart contract code, thereby making the parties' obligations clearer and more legally traceable. For instance, where a smart contract is designed to execute automatic payments, it is necessary to verify whether that mechanism complies with the laws governing electronic payments, taxation, and financial reporting. A significant example arose in 2022, when the U.S. Commodity Futures Trading Commission (CFTC) brought an action against Ooki DAO, a decentralized organization operating through smart contracts. The Commission argued that the DAO had been running an unlawful trading platform for financial contracts without complying with U.S. regulatory requirements. A comparison between the platform's smart contracts and the applicable financial regulations showed that the system enabled automated unlawful trading while failing to verify users' identities in accordance with regulatory standards. As a result, the CFTC imposed sanctions on the founders and ordered the cessation of the DAO's operations. This case demonstrates that many regulatory failures in smart contract systems could be prevented if legal compliance were assessed before deployment through smart legal review mechanisms. The broader lesson is that smart contracts should be tested against financial and regulatory rules before execution and should incorporate built-in compliance measures, including KYC and AML procedures.

Third: Using Artificial Intelligence to Identify Legal Risks : Artificial intelligence can also be employed to review smart contracts and detect potential legal risks, loopholes, or instances of regulatory non-compliance. Among the better-known examples are ROSS Intelligence, which can assist in analysing legal rules and assessing whether contractual arrangements conform to them, and Deloitte's Smart Contract Review, which uses AI-based methods to identify legal and operational risks in smart contract structures. These systems are

particularly useful in detecting legal grey areas, such as clauses that may be regarded as unlawful in one jurisdiction, or provisions that may generate different legal interpretations across multiple legal systems. In this respect, AI does not replace legal reasoning, but it can serve as an important support tool in anticipating legal uncertainty and reducing the risk of defective digital contracting (Madir 2024, 171).

Fifth: Adoption of the Smart Contract Post-Interpretation

Once the contract has been verified for legal compliance by attorneys and technical auditors, it is published on the blockchain. Certain organisations use smart legal notarization systems that link smart contracts to official legal registries. Examples include IBM Blockchain for Contracts (used by some government entities) and Chainlink's Smart Contract Auditing (which uses AI to audit smart contracts). After deployment, smart contracts are integrated with intelligent monitoring systems to ensure ongoing legal compliance (Redress Compliance 2025).

Conclusion

Traditionally, contractual content has been understood as one of the clearest expressions of the parties' will and as a legal framework that reflects the balance reached through negotiation. In that classical model, the contract is not merely a set of obligations; it is also part of a broader legal value system built on consent, good faith, fairness, and judicial protection. Smart contracts, however, have significantly altered this understanding. They recast contractual content in the form of code rather than legal language and replace dialogue, interpretation, and judicial mediation with automated execution. The comparison between traditional contracts and smart contracts shows that the shift is not simply technical. It is a deeper conceptual transformation that affects the very nature of contractual obligations, the ability of the contract to respond to changing circumstances, and the relationship between intention, law, and execution. What was once a flexible legal structure is increasingly becoming a rigid digital mechanism. Traditional contracts preserve room for interpretation, adaptation, and judicial intervention whenever fairness or contractual equilibrium requires it. Smart contracts, by contrast, tend to eliminate that space by relying on automatic and often irreversible execution. This creates serious concerns about

justice, the protection of weaker parties, and the future of legal security in digitally automated transactions.

Results

1- First, contractual content has been transformed from a legal expression into an operational mechanism. In smart contracts, content is no longer primarily drafted for interpretation by lawyers or judges; instead, it is written as executable code designed to perform automatically.
2- Second, the judicial role has been significantly reduced, and immediate legal oversight has become weaker. Because execution occurs automatically, courts are often left to intervene only after the fact, which deprives the legal system of many of its preventive and corrective functions.
3- Third, smart contracts may increase risks for weaker or vulnerable parties. Their rigid logic applies programmed terms exactly as written, even where the outcome becomes unfair, unless safeguards for equity and exceptional circumstances have already been built into the code.
4- Fourth, the digital environment requires a reconsideration of classical contractual principles. Foundational ideas such as pacta sunt servanda, good faith, and the adaptation of obligations to unforeseen events cannot operate effectively unless they are reimagined in forms compatible with digital execution.

Recommendations

1- First, there is a need for clear legislative regulation of smart contracts. They should be recognised as a distinct legal source of obligations, separate from ordinary electronic contracts, with specific rules governing code-based contractual content and allowing legal challenges where automated execution results from fraud, deception, or serious error.
2- Second, the principle of algorithmic fairness should be integrated into smart contract design. This means translating legal values such as good faith, balance of interests, and equity into programmable standards. This may be achieved through several mechanisms. One is the use of algorithmic constraints that prevent clearly disproportionate outcomes. Another is the inclusion of self-adjusting clauses inspired by doctrines such as hardship, allowing the contract to respond to severe economic changes or systemic disruptions. A third is the requirement of auditability

and transparency, so that the logic of the contract can be reviewed by humans whenever automated outcomes conflict with justice or legal policy.

3- Third, digitally supervised arbitration platforms should be established under legal oversight. Such platforms could review smart contract content, resolve disputes, and prevent coded execution from becoming a means of abuse or exploitation.

4- Fourth, the role of the judge must be redefined in the digital age. Judges should be equipped with both legal and technical tools enabling them to understand the language of smart contracts, assess their effects, and intervene effectively before automated execution produces irreversible consequences.

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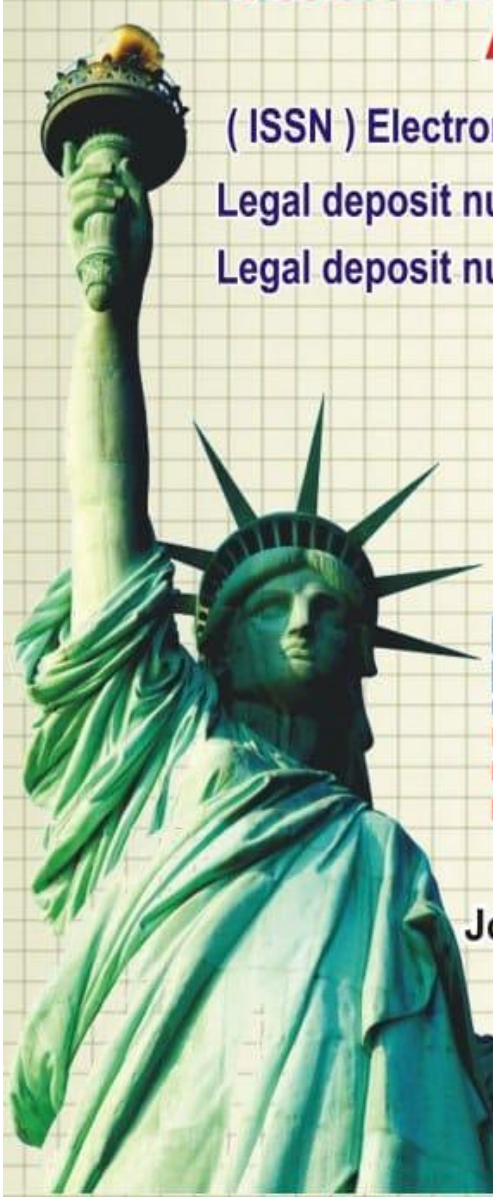

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