SMART CONTRACTS: DOCTRINAL RESTORATION AND A SYNTHESIZED THEORY OF CONTRACT LAW

BETWEEN INNOVATION AND BARTER IN THE BLOCKCHAIN ECOSYSTEM

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INTRODUCTION

Smart contracts represent a transformative development in modern contracting, operating on decentralized blockchain networks within cyberspace,[1] without reliance on human discretion or centralized enforcement.[2] They are widely hailed as having the potential to facilitate not only market expansion but also structural transformation by broadening the spectrum of potential transactions while simultaneously enhancing their efficiency.[3]

This Article argues that, in digital commerce, smart contracts offer what may be considered the "holy grail" of transactional reliability: the resolution of opportunistic breach through autonomous, simultaneous execution—free

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1 Cyberspace is typically understood as the virtual environment created by interconnected computer networks, primarily the internet, in which digital interactions, communications, and transactions take place. *See, e.g.,* David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367 (1996); JACK L. GOLDSMITH & TIM WU, WHO CONTROLS THE INTERNET? ILLUSIONS OF A BORDERLESS WORLD (2006).

2 Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 346 (2017) ("The algorithmic enforcement mechanisms, running automatically on the blockchain computing fabric, replace judicial enforcement."); *see also id.* at 348 ("The distinctive aspect of smart contracts is not that they make enforcement easier, it is that they make enforcement unavoidable."); Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305, 309 (2017) ("They are designed to automatically enforce obligations without the need for human intervention, thereby reducing the flexibility traditionally associated with contract enforcement.").

3 *See generally* PRIMAVERA DE FILIPPI & AARON WRIGHT, BLOCKCHAIN AND THE LAW: THE RULE OF CODE 27–33 (2018) (explaining how blockchain-based contracts can expand market functionality and lower barriers to trust); Anna Duke, *What Does the CISG Have to Say About Smart Contracts? A Legal Analysis*, 20 CHI. J. INT'L L. 141, 176 (2019) ("Furthermore, smart contract technology has the potential to promote international trade by reducing transactional costs, and confirming smart contracts as a valid alternative to traditional contracts would increase their use . . .").

from interpersonal trust and judicial enforcement.[4] It further argues that their broader legal importance lies not in technological futurism but in conceptual restoration. Smart contracts resurrect two foundational paradigms: the economic logic of barter and the doctrinal formalism of classical contract law.

First, smart contracts reinvigorate the logic of barter—a form of reciprocal and simultaneous exchange unmediated by state or institutional enforcement—reengineered through decentralized technology. While some blockchain platforms and scholarly commentary depict a return to barter through on-chain bilateral exchanges,[5] this Article advances a novel theoretical claim: smart contracts do not displace money but reconstruct it as an algorithmically governed unit of value.[6] In doing so, they enable a new

[4] This structural account of transactional reliability—grounded in simultaneous, trustless execution that preempts opportunistic breach—differs from functionalist accounts of certainty through automation. *See* Werbach & Cornell, *supra* note 2, at 319 (discussing smart contracts as enhancing transactional certainty); Joshua A.T. Fairfield, *Smart Contracts, Bitcoin Bots, and Consumer Protection*, 71 WASH. & LEE L. REV. 35, 36–38 (2014) (describing smart contracts as solving the trust problem through automation).

[5] *See, e.g.,* Md. Imran Alam et al., *Barterchain: A Blockchain-Based Barter System in Smart Cities*, 6 INT'L J. INFO. TECH. & ELEC. ENG'G (2025), https://link.springer.com/article/10.1007/s42521-025-00133-8 (proposing a blockchain-based bartering system designed to overcome the limitations of traditional barter and e-commerce in smart city environments); Hanyue Xu, *Research on a New Cross-Border Barter Trade Settlement Model Based on Blockchain and Smart Contracts*, PROCEDIA COMPUT. SCI. 146, 146-55 (2024), https://doi.org/10.1016/j.procs.2024.10.018 (developing a cross-border trade architecture that uses smart contracts and blockchain to simulate barter functionality in international settlements); Jianlei Qian & Napat Harnpornchai, *Online Barter Trade Model Based on Traceability by Blockchain Technology*, in 2024 IEEE 4TH INT'L CONF. ON ELEC. COMMC'NS, INTERNET OF THINGS & BIG DATA 544, 544-49 (2024), https://ieeexplore.ieee.org/document/10602688 (proposing a blockchain-based barter supply chain platform using digital identity verification, traceability, and smart contracts to enhance transactional reliability and enterprise competitiveness); SHERMIN VOSHMGIR, TOKEN ECONOMY (3d ed. 2025) (discussing Web3 market mechanisms that enable trustless, direct exchange of tokenized assets).

[6] De Filippi & Wright, *supra* note 3, at 77–78 (explaining that blockchain technology embeds rules into code, effectively turning rights and obligations into programmable value for automated exchange and observing that "[s]ome rights and obligations are easily translatable into the strict logic of code—particularly those related to the exchange of value or the transfer of title to a digitally represented asset. These promises are often binary in nature and thus naturally translatable into software.").

era of digitally mediated *monetary barter,* in which simultaneity, certainty, and autonomy are achieved not by eliminating currency but by embedding its function within code-executed bilateral exchange.[7]

Second, smart contracts resurrect the doctrinal foundations of classical contract law. They reject the contextualism, equitable flexibility, and relational norms that characterize modern contract law,[8] reviving instead a formalist vision of contract as a self-contained, deterministic, and autonomous act. Together, these restorations produce a reversion along two dimensions: from deferred, trust-dependent transactions to immediate, code-based execution, and from collaborative legal interpretation to formalist autonomy.[9]

This Article offers a new conceptual perspective on smart contracts—framing them as algorithmic promises of exchange. Drawing on classical contract theory and institutional legal history, it contends that smart contracts represent a twofold doctrinal return: to the structural immediacy of barter

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[7] This Article's model of "monetary barter" departs from barter-chain platforms, enterprise systems, and cross-border settlement protocols by retaining money as a coded unit of value rather than eliminating it. It reframes the monetary function as integral to algorithmic, trustless exchange—restoring simultaneity without relying on intermediaries or deferred enforcement.

[8] *See* GRANT GILMORE, THE DEATH OF CONTRACT 41–45 (1974) ("The elaborate structure of doctrinal machinery which we inherited from the nineteenth century is slowly being dismantled."); Ian R. Macneil, *Contracts: Adjustment of Long-Term Economic Relations under Classical, Neoclassical, and Relational Contract Law*, 72 NW. U. L. REV. 854, 862–65 (1978) (tracing the doctrinal shift from classical formalism to relational contract norms) [hereinafter Macneil, *Contracts: Adjustment*]. Gilmore and Macneil both describe the detachment from classical contract principles that marked twentieth-century legal evolution. This Article takes the opposite position: it contends that smart contracts, by design, revive the classical paradigm—reestablishing deterministic execution, simultaneity of performance, and formal autonomy. *See also* Fairfield, *supra* note 4*,* at 40 (noting that smart contracts "conflict with equitable doctrines" and challenge the flexibility of modern consumer protection law). This Article builds on that insight by making a stronger claim: that smart contracts not only resist contextualism—they represent a doctrinal reversion to nineteenth-century formalism.

[9] Werbach & Cornell, *supra* note 2, at 327–34 (describing how smart contracts automate performance and reduce the need for trust or interpretive discretion). This Article builds on those observations to argue that smart contracts effectuate a dual structural reversion: restoring the simultaneity of exchange characteristic of barter and reviving the formalist autonomy of classical contract doctrine.

and the doctrinal rigidity of nineteenth-century formalism.[10] This reframing positions smart contracts not merely as a digital tool, but as a conceptual bridge between historical and contemporary contract paradigms—substituting promissory intent with autonomous execution, and judicial discretion with formalist precision.

This Article further contends that the architecture of smart contracts—self-executing, predefined, and autonomous—mirrors the theory advanced by Peter Benson in *Justice in Transactions: A Theory of Contract Law*, who conceives of contract as a juridical scheme for the transfer of ownership entitlements through mutual assent at the moment of formation.[11] Although Benson's theory predates the advent of blockchain technology, its legal architecture mirrors the operational logic of smart contracts with striking fidelity. Once deployed, smart contracts function autonomously and immutably, insulated from discretionary human intervention during the performance phase. Code becomes the medium of mutual assent, and execution unfolds deterministically—a realization of rights and obligations that vest irrevocably at the moment of formation.[12]

More broadly, this Article reframes the regulatory and doctrinal debate over how contract law should govern smart contracts. Rather than asking how existing legal doctrine should be applied to smart contracts, this Article instead asks what smart contracts themselves reveal about the need to reform contract law to govern algorithmic exchange more effectively. This inquiry draws on the normative framework developed by Hanoch Dagan and

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[10] *See* MORTON J. HORWITZ, THE TRANSFORMATION OF AMERICAN LAW, 1870–1960: THE CRISIS OF LEGAL ORTHODOXY 9-31 (1992) (tracing the rise of classical contract law in the late nineteenth century, characterized by formalism, objectivity, and a narrow conception of legal obligation); CHARLES FRIED, CONTRACT AS PROMISE 1–16 (1981) (explaining classical contract theory as grounded in individual autonomy, voluntary promise, and rule-based enforcement); Macneil, *Contracts: Adjustment, supra* note 8, at 857–64 (describing classical contract law as discrete, temporally bounded, and institutionally minimal).

[11] PETER BENSON, JUSTICE IN TRANSACTIONS: A THEORY OF CONTRACT LAW (2019).

[12] De Filippi & Wright, *supra* note 3, at 63 ("Blockchain technology enables parties to transact without the need for a trusted intermediary, relying instead on the protocol's rules and the network's consensus mechanisms."); Werbach & Cornell, *supra* note 2, at 327–30 (describing smart contracts as self-executing scripts operating on blockchain systems without judicial enforcement).

Michael Heller in their work, *Choice Theory of Contracts,*[13] which advocates for a pluralistic legal architecture—one that tailors contractual regimes to the function, context, and values of different contracting modalities.[14] Smart contracts, as a novel and technologically autonomous mode of exchange, call for a reconsideration of a differentiated legal response that reflects their structural autonomy and technological logic.

By integrating Peter Benson's transfer theory with Dagan and Heller's pluralist framework, this Article offers a more comprehensive and context-sensitive framework for understanding smart contracts. Far from undermining the foundations of contract law, smart contracts expose the need to consider doctrinal evolution—one that preserves conceptual coherence while embracing the algorithmic architecture of modern exchange.

This Article proceeds in four Parts. Part I introduces smart contracts as a novel mechanism that reinvigorates the logic of barter, enabling a new era of digitally mediated monetary exchange. It analyzes how smart contracts displace interpersonal trust with code-based reliability and judicial enforcement with programmed performance—resolving opportunistic breach through autonomous, simultaneous execution. Part II examines how smart contracts reverse the historical shift from relational and collaborative contracting back to transactional and discrete arrangements. It identifies key functional traits—such as interpersonal detachment, quantifiability, temporal compression, sharp inception and termination, and exhaustive ex ante planning—that align smart contracts with nineteenth-century transactional and discrete transactions' logic. Part III explores how smart contracts reflect and revive classical contract law doctrines, including party autonomy, formation finality, caveat emptor, and freedom of contract. It argues that smart contracts are not doctrinal anomalies but a technological restoration of classical contract law. Part IV engages with Benson's transfer theory, Dagan's relational critique, and the Choice Theory of Contracts, developed

[13] HANOCH DAGAN & MICHAEL HELLER, THE CHOICE THEORY OF CONTRACTS (2017).

[14] *Id*. at 3 ("Put more sharply, choice theory shows that liberal states are affirmatively obligated to ensure an adequate range of contract types in each important sphere of human interaction."); *see also id.* at 103 ("Within a particular sphere of contracting, contract law should offer a sufficiently diverse range of contract types, each representing a distinct balance of values. The majority may prefer one contract type, but choice of theory requires that within each contracting sphere free individuals should be enabled to contract based on different value balance.").

by Dagan and Heller. Building on this synthesis, it proposes a pluralist and differentiated framework for algorithmic contracting—compelling a reconsideration of contract law's foundations with greater precision and clarity.

I. A U-TURN BACK TO A NEW AGE OF BARTER

Before the emergence of monetary systems, barter served as the foundational mode of economic exchange. Characterized by the simultaneous transfer of goods or services between autonomous parties, barter relied on mutual performance and temporal immediacy. It required neither institutional enforcement nor legal formalism nor deferred obligation. As Keith Hart defines it, "Barter is a simultaneous exchange of commodities, whether goods or labour services, with bargaining and without using money."[15]

Over time, this direct mode of exchange gave way to monetary economies. The introduction of currency as a standardized medium of exchange enabled more complex, multilateral, and deferred transactions—replacing the immediacy of barter in favor of scalable trade.[16] As economic life evolved, marketplace interactions were increasingly mediated by abstract instruments, legal frameworks, and temporal gaps between promise and performance.[17]

The nineteenth century witnessed the rise of classical contract law, which formalized promises, institutionalized enforcement mechanisms, and structured legal doctrine to accommodate delayed performance in monetary economies.[18] In this progression, barter appeared to recede into historical irrelevance—rendered obsolete in a world governed by credit, contracts, and courts.

Yet despite this historical shift, this Article contends that the structural logic of barter—autonomy, simultaneity, and unmediated exchange—retains

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[15] Keith Hart, *Barter*, *in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS 385, 385 (Steven N. Durlauf & Lawrence E. Blume eds., 2d ed. 2008).

[16] FRIEDRICH HAYEK, DENATIONALISATION OF MONEY 34–35 (3d ed. 1990).

[17] DAVID GRAEBER, DEBT: THE FIRST 5,000 YEARS 28–31 (2011).

[18] HORWITZ, *supra* note 10, at 9–17.

conceptual relevance, particularly in technologically mediated environments.[19] Smart contracts reintroduce a new era of digitally facilitated monetary barter, reconstructing direct exchange within a digitized, pseudonymous, and algorithmically governed framework. [20]

This Article argues that smart contracts in digital transactions offer a distinct structural breakthrough—indeed, a potential solution to the enforcement challenges of cyberspace. The global e-commerce market is characterized by two opposing and persistent trends: a significant expansion in transaction volumes, coupled with persistent structural deficits in inter-party trust.[21] While digital platforms have enabled unparalleled access to goods and services, they have also heightened vulnerabilities—particularly in cross-border, pseudonymous, or platform-mediated transactions.

From a doctrinal perspective, the most pressing concern is the risk of opportunistic breach—the strategic exploitation of information asymmetries, timing gaps, or enforcement limitations by one party at the expense of the other. In such cyberspace environments, each party bears a substantial risk

[19] De Filippi & Wright, *supra* note 3, at 44 ("One important advantage of these autonomous systems is that—if properly designed—they can handle basic economic transactions at lower costs, with higher degrees of reliability and potentially greater speeds. These blockchain-based systems can reduce or even eliminate the need for human oversight, narrowing the possibility for parties to act opportunistically in ways that benefit the few at the expense of the many."). This Article builds upon that insight by framing smart contracts as enabling a technologically advanced form of *monetary barter*.

[20] *See supra* note 5.

[21] Luis-Alberto Casado-Aranda, Angelika Dimoka & Juan Sánchez-Fernández, *Consumer Processing of Online Trust Signals: A Neuroimaging Study*, 47 J. INTERACTIVE MKTG. 159, 159 (2019) ("The growth of online transactions coupled with the worldwide expansion of Internet-based information exchange has triggered fear, distrust and risk among online consumers. Despite the well-proven benefits to retailers when they include assurance services (online trust signals) such as seals of approval, rating systems or assurance statements in their websites, there is no consensus as the most trustworthy type.").

that the counterparty will default on performance.[22] The merchant, for instance, fears delivering goods or rendering services without receiving payment; the consumer, conversely, fears paying for goods that are never delivered or that arrive defective or nonconforming.[23] These concerns are not merely theoretical. They are embedded in the architecture of internet-based commerce, which—unlike traditional face-to-face barter or simultaneous cash transactions—precludes simultaneous exchange of value.[24]

The absence of simultaneity is particularly consequential: digital transactions are typically structured as sequential exchanges, in which one party performs first—either by submitting payment or by rendering performance—while the other fulfills their obligation only later. This temporal imbalance shifts risk disproportionately onto one party—typically the consumer—and undermines marketplace trust.[25] It also exposes a foundational limitation in conventional legal frameworks, which often rely

[22] Yi Yi Thaw, P. Dhanapal Durai Dominic & Ahmad Kamil Mahmood, *A Study on the Factors That Influence the Consumers' Trust on E-Commerce Adoption*, 4 INT'L J. COMPUT. SCI. & INFO. SEC. 153, 153 (2009) ("The development of electronic commerce is characterized with anonymity, uncertainty, lack of control and potential opportunism."); Sonja Grabner-Kräuter, *Consumer Trust in Electronic Commerce: Conceptualization and Classification of Trust Building Measures*, *in* TRUST AND NEW TECHNOLOGIES 7 (Christine Legner ed., 2008) ("Online transactions and exchange relationships are not only characterized by uncertainty, but also by anonymity, lack of control and potential opportunism, making risk, and trust crucial elements of electronic commerce.").

[23] Karen Clay & Robert P. Strauss, *Trust, Risk and Electronic Commerce: Nineteenth Century Lessons for the Twenty-First Century* (paper presented at the 93rd Annual Conference on Taxation, NAT'L TAX ASS'N, Nov. 9, 2000), https://www.andrew.cmu.edu/~rs9f/nta_11_12_00_bob.pdf.

[24] Michael Froomkin, *The Essential Role of Trusted Third Parties in Electronic Commerce*, 75 OR. L. REV. 49 (1996).

[25] John Rothchild, *Protecting the Digital Consumer: The Limits of Cyberspace Utopianism*, 74 IND. L. J. 893 (1999).

on ex post legal remedies rather than ex ante mechanisms of risk prevention.[26]

This critique aligns with the foundational vision articulated by Nick Szabo,[27] who argued that many contractual provisions can be encoded into software in a manner that renders breach either prohibitively expensive or technically impossible—achieving what he termed "proactive security." In contrast to traditional "reactive security," which depends on judicial remedies applied after breach, smart contracts promise a paradigm in which performance is assured by design.[28] Smart contracts eliminate the delay, discretion, and uncertainty inherent in legal intervention.

In this context, the appeal of smart contracts becomes clearer.[29] By enabling self-executing, conditional transfers of digital assets—triggered only upon satisfaction of mutually agreed terms—smart contracts introduce a structural alternative to sequential performance, functionally synchronizing

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[26] *Id.*; *see also* Luis-Alberto Casado-Aranda, Angelika Dimoka & Juan Sánchez-Fernández, *Consumer Processing of Online Trust Signals: A Neuroimaging Study*, 47 J. INTERACTIVE MKTG. 159, 159 (2019) ("The growth of online transactions coupled with the worldwide expansion of Internet-based information exchange has triggered fear, distrust and risk among online consumers. Despite the well-proven benefits to retailers when they include assurance services (online trust signals) such as seals of approval, rating systems or assurance statements in their websites, there is no consensus as the most trustworthy type.").

[27] Nick Szabo, *Smart Contracts* (1994), https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html; Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets* (1996), https://www.truevaluemetrics.org/DBpdfs/BlockChain/Nick-Szabo-Smart-Contracts-Building-Blocks-forDigital-Markets-1996-14591.pdf [hereinafter Szabo, *Building Blocks*]; Nick Szabo, *The Idea of Smart Contracts* (1997), https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/idea.html.

[28] Szabo, *Building Blocks*, *supra* note 27.

[29] Lin William Cong & Zhiguo He, *Blockchain Disruption and Smart Contracts* 9 (NAT'L BUREAU OF ECON. RSCH., Working Paper No. 24399, 2018), https://www.nber.org/papers/w24399 ("Smart contracts can increase contractibility and facilitate exchanging money, property, shares, service, or anything of value in an algorithmically automated and conflict-free way . . . In particular, smart contracts can augment contractibility and enforceability on certain contingencies, be it the lock-in requirement for fund withdrawal or the automated payment upon an importer's successfully receiving the goods.").

obligations and execution within the same coded framework.[30] In doing so, they offer not merely technical efficiency but a conceptual response to one of the most enduring challenges in contract law, particularly in digital environments: deterring opportunistic breach in environments characterized by minimal trust, spatial and temporal distance, and limited legal enforceability.

The initial deployment of blockchain technology, as exemplified by Bitcoin, was confined to the transfer of digital currency between parties lacking mutual trust, without the need for an intermediary. However, subsequent technological advancements—particularly the introduction of Ethereum and the Solidity programming language—expanded the scope of blockchain's applications beyond mere currency exchange.[31] By embedding programmable logic into blockchain networks, parties could encode business relationships and contractual obligations into self-executing computer code, enabling the autonomous transfer of digital assets exclusively in accordance with pre-defined terms, without human intervention.

In articulating the operational model of smart contracts, Vitalik Buterin described them as "cryptographic containers" that secure valuable assets and release them only upon the satisfaction of specific, preprogrammed conditions.[32] Execution under this model is autonomous and simultaneous: the assets remain locked within the system until all specified conditions are fulfilled. Only then is the contractual performance triggered. Accordingly,

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[30] Kevin Werbach, *Trust, But Verify: Why the Blockchain Needs the Law*, 33 BERKELEY TECH. L.J. 487, 543 (2018) ("Smart contracts are good at setting forth anticipated conditions and consequences ex ante, and then ensuring the consequences occur upon fulfillment of the conditions. Legal contracts are good at cleaning up the mess when, inevitably, things do not go according to plan.").

[31] DE FILIPPI & WRIGHT, supra note 3, at 29 ("To extend the capabilities of Bitcoin, Ethereum, and other blockchains, new decentralized protocols are being developed, making it possible for blockchains to manage the transfer of additional assets (beyond just digital currency) and enabling smart contracts to interact with, and potentially control, other digital files.").

[32] Vitalik Buterin, *A Next-Generation Smart Contract and Decentralized Application Platform* 19 (Ethereum White Paper, 2014), https://www.weusecoins.com/assets/pdf/library/Ethereum_white_paper%20a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf ("Smart contracts, cryptographic 'boxes' that contain value and only unlock it if certain conditions are met.").

Buterin conceptualized smart contracts as systems that facilitate and enforce the transfer of digital assets exclusively in accordance with pre-defined terms, without human intervention.[33]

The operation of smart contracts within the blockchain environment imparts to them the feature of immutability, a defining characteristic of blockchain technology. Once a smart contract is deployed, its terms and programmed execution become unalterable.[34] This fusion of contractual obligation, computer code, and decentralized execution defines the distinctive nature of smart contracts: agreements that are autonomously and simultaneously executed, independent of human discretion, and secured by immutable technological architecture.[35]

In their most prevalent form—often referred to as the default configuration—smart contracts replicate the essential characteristics of barter through self-executing code. This configuration begins with a unilateral offer, written entirely in code and accompanied by specified digital assets, is deployed to the blockchain.[36] Upon submission, the offer becomes irrevocable due to the blockchain's immutable architecture and remains open until the expiration period encoded in the contract. The contract's terms, logic, and attached assets are publicly viewable, leading scholars to describe these arrangements as "glass-box smart contracts," emphasizing their

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[33] *Id*.

[34] Alexander Savelyev, *Contract Law 2.0: "Smart" Contracts as the Beginning of the End of Classic Contract Law*, 15 (Higher Sch. Of Econ. Basic Rsch. Program, Working Paper No. WP BRP 71/LAW/2016, 2016), https://ssrn.com/abstract=2885241 ("Once Smart contract is concluded, its further execution is no longer dependent on the will of its parties or third party, neither it requires any additional approvals or actions from their side.").

[35] *Id.* at 19 ("Not any contract performed on a computer language can be regarded as Smart contract, but only based on Blockchain technology, ensuring its self-enforcement nature.").

[36] Werbach & Cornell, *supra* note 2, at 343 ("Smart contracts, on Ethereum and presumably on other platforms, are by default unilateral, because only one party places them on the blockchain."); Gregory Klass, *How to Interpret a Vending Machine: Smart Contracts and Contract Law*, 7 GEO. L. TECH. REV. 69, 73 (2023) ("More common will be transactions in which one user programs a smart contract and then invites others to interact with it or in which two users purchase smart contract software from a third-party vendor.").

transparency and inspectability.[37] Any counterparty may accept the offer by transferring assets using their private key, thereby satisfying the pre-coded conditions and triggering automatic performance.[38] Critically, the entire exchange unfolds on-chain without negotiation, identification, or interpersonal trust. The relationship is not mediated by law or human discretion but by the operational integrity of the decentralized network.[39]

The defining characteristic of smart contracts—execution certainty—derives from their reliance on code-based logic, automated performance, and immunity from human intervention during the performance phase.[40] This form of execution is not merely efficient; it is categorical: once the encoded conditions are met, the transaction is executed deterministically, without discretionary judgment or external enforcement.[41]

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[37] Klass, *supra* note 36, at 101 ("The more common type of glass-box smart contract will be software whose code is available to non-programming users. Glass-box contracts of this type might be created by one user and then given to the other together with access to the code. Or users might obtain the software from a third-party vendor that gives both access to the code.").

[38] Werbach & Cornell, *supra* note 2, at 371 ("The parties to a smart contract, at a technical level, are not people. They are cryptographic private keys. The secret private key represents the individual, based on a mathematical relationship with the associated public key.").

[39] *Id*. at 326 ("[A] mechanism for ensuring trustworthiness without requiring trust in any particular institution or agent. That means users can have confidence that a transaction on the network is legitimate, accurate, and not duplicated."). Participants typically interact through cryptographic credentials—namely, a "public address" and "private key." The public address enables the sending and receiving of digital assets, while the private key functions as a cryptographic signature authorizing execution. *See* Alan Cohn, Travis West & Chelsea Parker, *Smart After All: Blockchain, Smart Contracts, Parametric Insurance, and Smart Energy Grids*, 1 GEO. L. TECH. REV. 273, 278 (2016).

[40] *See supra* note 34.

[41] Werbach & Cornell, *supra* note 2, at 328 ("Smart contracts are self-executing agreements, where the terms are directly written into code. This reduces, and in some cases eliminates, the need for external enforcement mechanisms."); *see also supra* note 2.

Accordingly, smart contracts are inherently limited to assets that can be autonomously transferred on-chain[42]—namely, native digital assets such as cryptocurrencies, or tokenized representations of physical or legal rights.[43] The digitization of ownership rights—particularly when integrated with blockchain-based registries[44]—enables smart contracts to function as autonomous enforcement mechanisms in both virtual and real-world marketplaces. This capability expands the scope of smart contracting beyond purely digital environments, allowing legally significant transactions to occur without reliance on traditional institutional intermediaries.[45]

One prominent application of this architecture is found in decentralized finance (DeFi), where smart contracts autonomously execute financial

[42] Werbach, *Trust, but Verify, supra* note 30, at 505 ("Bitcoin takes advantage of smart contracts to execute transactions, and smart contracts take advantage of Bitcoin's distributed ledger to operate with autonomy. Smart contracts are essentially autonomous software agents.").

[43] A digital asset is any binary content with usage rights, including documents, media, and data. A token is a digital asset transferred via blockchain. Unlike fungible cryptocurrencies, unique tokens represent specific rights and are inherently non-interchangeable, making them non-fungible. *See* Lital Helman & Ofer Tur-Sinai, *Bracing Scarcity: Can NFTs Save Digital Art?*, 51 FLA. ST. U. L. REV. (2024).

[44] For tokenized physical assets like real estate, ownership can be digitally recorded, and if the land registry operates on blockchain, transferred via a smart contract. *See, e.g.*, Joshua A.T. Fairfield, *BitProperty*, 88 S. CAL. L. REV. 805, 828 (2014) ("The power of the smart contract is, however, limited to those assets which can be incorporated or controlled by a blockchain. A smart contract for construction of a house could not force the builder to perform, for example, nor could a smart contract to purchase a painting physically move it to the buyer's home. With techniques such as "smart property," however, more assets will be susceptible to blockchain control."); Paul Catchlove, *Smart Contracts: A New Era of Contract Use* (Research Paper, 2017), https://www.ssrn.com/abstract=3090226; John Ream, Yang Chu & David Schatsky, *Upgrading Blockchains: Smart Contract Use Cases in Industry*, DELOITTE INSIGHTS (June 8, 2016), https://www.deloitte/signals-for-strategists/using-blockchain-for-smart-contracts.html; Kayvan Ghaffari & Craig de Ridder, *Real Estate Tokenization: Recent Developments in New Jersey and Dubai*, PILLSBURY WINTHROP SHAW PITTMAN LLP (July 17, 2025), https://www.jdsupra.com/legalnews/real-estate-tokenization-recent-9719979/.

[45] Werbach & Cornell, *supra* note 2, at 321–28 (arguing that smart contracts shift trust from legal institutions to technological execution, eliminating the need for interpersonal or identity-based risk assessments); De Filippi & Wright, *supra* note 3, at 71–74 (arguing that the finality and determinism of blockchain-based execution should be preserved and not routinely subject to judicial override based on subjective party claims).

transactions—such as lending, trading, and collateralization—without the involvement of banks or regulatory intermediaries.[46]

Moreover, the creation—known as minting—of non-fungible tokens (NFTs) demonstrates how blockchain infrastructure enables the automated creation, allocation, and enforcement of complex digital ownership rights.[47] NFTs are unique, non-interchangeable tokens recorded on a blockchain that represent ownership rights to either digital assets—such as images, videos, music files, collectibles, and virtual properties within digital worlds (metaverses)—or physical assets with a digital representation.[48] Each NFT is immutably recorded on-chain and assigned a unique, verifiable identity, ensuring transparency, traceability, and resistance to tampering.[49]

NFTs are widely used across blockchain-based digital asset platforms, including OpenSea, currently the world's largest marketplace for NFTs.[50] When implemented through smart contracts, NFTs enable programmable control over the licensing, transfer, and resale of ownership rights. For example, they are increasingly deployed in smart licensing frameworks for intellectual property, allowing creators to automate the conditions under which their digital works are accessed, reused, or monetized. These

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[46] Caroline A. Crenshaw, *Statement on DeFi Risks, Regulations, and Opportunities*, U.S. SEC. & EXCH. COMM'N (Nov. 9, 2021), https://www.sec.gov/newsroom/speeches-statements/crenshaw-defi-20211109.

[47] *Non-Fungible Token (NFT)*, WEX, LEGAL INFO. INST. (last updated Oct. 2024), https://www.law.cornell.edu/ wex/non-fungible_token ("The process of creating a new non-fungible token is called minting. When a new non-fungible token is created or minted, it will have a unique identifier, which links directly to an address of a blockchain. Each minted non-fungible token can be listed in an online platform, often referred to as a marketplace. In a marketplace, interested buyers can purchase or trade a variety of non-fungible tokens based on the rules established by the underlying smart contracts that govern non-fungible tokens ownership transfer."); *see also supra* note 43.

[48] For example, ownership rights in real estate may be digitally represented in a blockchain-based land registry. *See supra* note 44.

[49] *See, e.g., NFT Use Cases: 8 Innovative Ways to Use Non-Fungible Tokens*, BRITANNICA (Apr. 2025), https://www.britannica.com/money/nft-use-cases (discussing various applications of NFTs, including digital art, music, videos, collectibles, and virtual real estate within digital worlds (metaverses)).

[50] Emily Tonelli, *NFT Marketplace OpenSea Hits $10B in Total Volume*, DECRYPT (Nov. 8, 2021), https://decrypt.co/85507/nft-marketplace-opensea-hits-10b-total-volume.

transactions occur without the need for trusted intermediaries and are executed with predictability, transparency, and precision.[51]

The integration of NFTs with smart contracts illustrates how blockchain-based legal and commercial infrastructure extends beyond financial transfers to support trustless, automated transactions in cultural, creative, and legal domains—further expanding the functional reach of decentralized systems.[52]

By contrast, transactions involving fiat currency, personal services, physical goods, or the performance of work depend on off-chain processes that necessitate human action, legal discretion, or institutional infrastructure.[53] For example, fiat-based transactions may be declined due to credit limits, regulatory compliance, or institutional discretion.[54] Because such processes cannot be autonomously verified or executed on-chain, they lie beyond the functional scope of smart contracting and remain dependent on traditional legal and institutional enforcement mechanisms. These elements reintroduce precisely the types of uncertainty—temporal delay,

[51] For further discussion on copyright in the blockchain era and smart licensing contracts, *see, e.g.,* Alexander Savelyev, *Copyright in the Blockchain Era: Promises and Challenges*, 34 COMPUT. L. & SEC. REV. 550 (2018); Balázs Bodó, Daniel Gervais & João Pedro Quintais, *Blockchain and Smart Contracts: The Missing Link in Copyright Licensing?*, 26 INT'L J.L. & INFO. TECH. 311, 316 (2018); Helman & Tur-Sinai, *supra* note 43.

[52] *See supra* note 49; Hassan Maishera, *DappRadar's Industry Report Highlights Massive Growth in 2021*, YAHOO! FIN. (Dec. 17, 2021), https://finance.yahoo.com/news/dappradar-industry-report-highlights-massive-191558971.html.

[53] *ChainLink: Solving the Smart Contract Fiat Money Problem,* ARTIFICIAL LAWYER (Sept. 3, 2018), https://www.artificiallawyer.com/2018/09/03/chainlink-solving-the-smart-contract-fiat-money-problem/ (discussing the limitations of smart contracts in handling fiat currencies and the role of oracles in bridging this gap); *Is It Possible to Use Smart Contracts to Do Money Transfers? If So, How?*, ETHEREUM STACK EXCHANGE (Apr. 27, 2021), https://ethereum.stackexchange.com/questions/97803/is-it-possible-to-use-smart-contracts-to-do-money-transfers-if-so-how (highlighting the self-contained nature of blockchains and the necessity of oracles for interacting with off-chain data, including fiat transactions).

[54] *See* Primavera De Filippi, Chris Wray & Giovanni Sileno, *Smart Contracts*, 10 INTERNET POL'Y REV., no. 2, Apr. 2021, at 5–6, https://doi.org/10.14763/2021.2.1549 (noting that smart contracts cannot administer off-chain obligations and cannot guarantee performance when external intervention is required); *see also id.* at 6 ("If the contractual obligation itself requires an external intervention, no blockchain-based infrastructure will ever be able to guarantee the proper performance thereof.").

interpretive ambiguity, and enforcement risk—that smart contracts are designed to eliminate.

As a result, only assets that are fully compatible with blockchain-based execution can serve as viable subject matter for smart contracting. This constraint is not incidental; it reflects the very logic of algorithmic enforcement and the structural conditions necessary for its reliable operation.

Smart contracts thus effectuate a return to the structural essence of barter. They facilitate the immediate, irrevocable, and simultaneous transfer of digital assets between pseudonymous parties without reliance on legal enforcement.[55]

In doing so, they reverse the historical arc from barter to monetized legal formalism, offering instead a technologically sophisticated mode of exchange rooted in autonomy, simultaneity, and finality. The blockchain functions as a modern-day agora: a virtual marketplace in which resources are autonomously transferred under algorithmic conditions, echoing the decentralized, pre-legal logic of early barter.[56]

This transformation is not merely technical—it is conceptual. It reflects a broader shift from relational, trust-based transactions to the determinacy of conditional, code-based exchange.

Viewed through this lens, smart contracts do not simply automate existing legal forms—they reconfigure the underlying structure of contractual obligation. The reemergence of barter logic through smart contracts is not a historical accident, but a doctrinal reversal that reveals a deeper realignment within the foundations of contract law.

Chapter II explores this reversal in greater depth, analyzing how smart contracts revive the transactional model that underpinned classical contract law while departing from the relational and collaborative paradigms that

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[55] Werbach & Cornell, *supra* note 2, at 339 ("Smart contracts are designed to eliminate the need for legal enforcement. The central feature of a smart contract, what supposedly makes them smart, is that legal enforcement will not be necessary, or even possible. In a very real way, smart contracts are not intended to be legally enforceable.").

[56] The Bank for International Settlements has explicitly invoked the Greek *agorá*—the classical public marketplace—to describe its initiative for integrating tokenized commercial and central bank money on programmable platforms. BANK FOR INT'L SETTLEMENTS, PROJECT AGORÁ: EXPLORING TOKENISED COMMERCIAL BANK DEPOSITS AND WHOLESALE CENTRAL BANK MONEY (Apr. 2024), https://www.bis.org/about/bisih/topics/fmis/ agora.html.

dominate modern contracting. This transformation unfolds within a digital, algorithmic environment, where code replaces context and simultaneity supplants sequential trust.

II. FROM TRANSACTIONAL TO COLLABORATION—AND BACK

The advent of algorithmic monetary barter through smart contracts does more than reconfigure the medium of exchange—it resurrects the transactional model that underpinned classical contract law. That model conceived of the contract as a mechanism for the exchange of resources and risks,[57] defined by discrete, impersonal, and bilateral engagements. Its paradigm form was a contract grounded in detailed ex ante planning and meticulous execution during the performance phase.[58] Smart contracts align more closely with this transactional logic, while diverging from the relational or collaborative paradigms that dominate much of modern doctrine.

As Ian Macneil emphasized, contractual relationships exist along a spectrum. At one end are transactional contracts—short-term, impersonal, and economically bounded exchanges—and at the other are relational contracts, embedded in trust, cooperation, and social norms.[59] Smart contracts replicate the structure of transactional contracts with remarkable precision. They eliminate open-ended negotiation and ongoing relational adjustment, replacing them with pre-programmed terms that execute autonomously, without interpretive flexibility or judicial discretion. In doing so, smart contracts reanimate a classical legal logic: one rooted in autonomy, predictability, and sharp temporal rigidity between formation and performance. This section analyzes six key parameters that demonstrate the functional alignment between smart contracts and discrete, transactional agreements.

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[57] GILMORE, supra note 8, at 14 (describing classical contract law as facilitating exchange of goods and services in market society).

[58] Macneil, *Contracts: Adjustment*, *supra* note 8, at 860 (explaining the classical model's emphasis on detailed ex ante planning and discrete exchanges).

[59] Ian R. Macneil, *The Many Futures of Contracts*, 47 S. CAL. L. REV. 691, 744-805 (1974) [hereinafter Macneil, *The Many Futures*]; IAN R. MACNEIL, THE NEW SOCIAL CONTRACT: AN INQUIRY INTO MODERN CONTRACTUAL RELATIONS 68 (1980).

A. Personal Detachment.

Transactional contracts are defined by the absence of personal relationships—they are structured around discrete, impersonal economic exchanges between parties who interact solely for instrumental purposes.[60] Smart contracts replicate this logic: they are typically executed between pseudonymous parties, with no knowledge of or connection to real-world identities.[61] Trust resides not in reputation or relational history, but in code and protocol.[62] The transaction becomes a context-free interaction between economically rational actors, severed from ethical or social considerations.

For example, in the decentralized finance (DeFi) ecosystem, smart contracts govern cryptocurrency lending by bypassing traditional verification mechanisms such as borrower identity and creditworthiness. Instead, they autonomously manage interest payments and principal repayments through pre-programmed execution.[63]

B. Quantifiability and Precision

A hallmark of transactional contracts is the precise quantification of obligations at the time of formation. Smart contracts mirror this structure. They are encoded in deterministic, binary logic, enforceable only when performance is objectively verifiable.[64] Ambiguous or discretionary

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[60] Macneil, *The Many Futures*, *supra* note 59, at 722–23.

[61] Werbach & Cornell, *supra* note 2, at 371 ("The parties to a smart contract, at a technical level, are not people. They are cryptographic private keys. The secret private key represents the individual, based on a mathematical relationship with the associated public key."); Werbach, *Trust, but Verify*, *supra* note 30, at 499 ("The magic of distributed ledgers is to make certain activities trustworthy without the need to trust anyone in particular.").

[62] Werbach & Cornell, *supra* note 2, at 326 ("[A] mechanism for ensuring trustworthiness without requiring trust in any particular institution or agent. That means users can have confidence that a transaction on the network is legitimate, accurate, and not duplicated.").

[63] *See supra* note 46 and the accompanying text.

[64] Savelyev, *supra* note 34, at 13-14 ("Computer language does not allow discretion in its interpretation by machine. Smart contract terms are interpreted by machine based on Boolean logic, in contrast to classic contract . . .").

obligations are categorically excluded.[65] Because smart contracts must operate without human discretion, all performance conditions must be reduced to verifiable, binary criteria—precluding any reliance on subjective standards, fairness, or ex post adjustment. The subject matter is limited to digital assets or tokenized rights, and execution occurs through autonomous scripts that admit no ambiguity. Personal services or bespoke goods fall outside the effective reach of smart contracting.[66] This precision aligns with the transactional contract as a closed, complete bargain—where parties allocate risk in advance, and enforceability depends on formal compliance, not contextual interpretation. For instance, automated token swaps on decentralized exchanges require exact input and output values, encoded in advance, and execute only when conditions—such as price thresholds or liquidity minimums—are met.

C. Temporal Compression

Smart contracts reproduce and intensify the temporal structure of classical transactions. Formation and execution often occur in immediate or tightly compressed succession. A unilateral on-chain offer is accepted through a responsive transfer of assets, triggering automated performance. Even in extended scenarios—such as decentralized lending or escrow—the execution parameters remain hard-coded and non-adaptive, permitting no ex post modification.[67] This sequencing enforces temporal rigidity, closure, and predictability, leaving little room for legal intervention.[68] As Macneil

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[65] *Id*. (explaining that in smart contracts, all values are reduced to binary states—"true" or "false"—with outcomes triggered solely by the satisfaction of predefined conditions).

[66] *See supra* note 53 and the accompanying text.

[67] *See* BANK OF CAN., ON THE FRAGILITY OF DEFI LENDING 6 (Staff Working Paper No. 2023-14, 2023), https://www.bankofcanada.ca/wp-content/uploads/2023/02/swp2023-14.pdf (noting that DeFi operates without human discretion by relying entirely on smart contracts. These contracts are pre-programmed to execute specific actions under defined conditions, meaning that all terms of the loan—such as interest rates, collateral requirements, and default procedures—must be specified in advance).

[68] Werbach & Cornell, *supra* note 2, at 367 ("Smart contracts eliminate the need for interpretation by performing obligations through automated execution rather than relying on parties or institutions to enforce terms.").

observes, extended duration alone does not transform a transactional arrangement into a relational one.[69]

D. Sharp Inception and Termination

The smart contract lifecycle is defined by clearly delineated initiation and conclusion points. A unilateral offer is deployed on-chain; execution is triggered by user fulfillment of predefined conditions; the agreement concludes upon completion of performance or the occurrence of a specified failure condition.

This "sharp in, sharp out" structure reflects the classical ideal of the transactional model's temporal finality and definitive obligation closure.[70]

E. Exhaustive Ex Ante Planning

Planning in smart contracts is similarly front-loaded and exhaustive. Given their immutability after deployment, parties must encode all contingencies ex ante[71]. This determinism prioritizes certainty over adaptability, predictability over evolution, and rigidity over relational flexibility. Smart contracts, like classical transactional agreements, are defined by the simplicity of their planning and the absence of ongoing negotiation. The process typically begins with a unilateral offer published on the blockchain and concludes with instantaneous acceptance—often through automated payment or token transfer.

Moreover, the digital assets exchanged are typically standardized and fungible, not subject to customization or production processes, thereby reinforcing the transactional structure. By design, smart contracts exclude any capacity for midstream adjustment or judicial gap-filling.

This rigid framework compels the parties to resolve all foreseeable issues at the outset and to rely on a fully self-executing mechanism that is

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[69] *See* Macneil, *The Many Futures*, *supra* note 59, at 749 ("A loan of money made through the money markets would seem to be a very transactional event. But when a long-term loan is made, numerous relational aspects tend to crop up.").

[70] *Id.* at 749.

[71] Werbach & Cornell, *supra* note 2, at 367 ("Parties to smart contracts can try to hedge against such changes by incorporating qualifying language or force majeure clauses, but those kinds of imprecise terms are difficult to specify in computer code.").

insulated from modification, renegotiation, or external oversight once deployed.[72]

F. Functional Orientation Toward Resource Transfer

Transactional and discrete contracts have traditionally been viewed as ideal mechanisms for resource exchange.[73] Their underlying rationale stems from non-relational engagements, prioritizing the maximization of quantifiable and measurable outcomes. Such contracts are characterized by limited cooperation and planning and instead rely on clearly defined obligations and detailed sanctions to ensure performance.

Smart contracts, by design, replicate and technologically advance this underlying motivation: efficient resource transfer. Parties adopt smart contracts for their ability to produce fast, irrevocable, and trustless outcomes—not for collaborative value creation.

The blockchain functions as a digital agora, enabling bilateral exchanges governed not by law or equity, but by deterministic code.[74]

In sum, smart contracts represent a postmodern reversion to transactional form, reversing the collaborative drift of contemporary contract doctrine. They instantiate a return—from cooperation to exchange, from equity to automation, and from contextual nuance to computational precision. Rather than destabilizing contract law, they reinvigorate its classical foundations.

Accordingly, the next chapter analyzes the doctrinal foundations of classical contract law and demonstrates their alignment with the architecture of smart contracts. Focusing on core principles such as party autonomy, formation finality, caveat emptor, and judicial restraint, it argues that smart contracts do not depart from legal tradition but technologically revive its classical logic. This analysis situates smart contracts within the historical arc of contract doctrine, revealing that they illuminate—rather than displace—law's enduring commitments to autonomy, determinacy, and transactional closure.

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[72] *Id.*

[73] Macneil, *The Many Futures, supra* note 59*,* at 744–805.

[74] *See supra* note 56.

III. TECHNOLOGICAL INNOVATION AS DOCTRINAL RESTORATION

Over the past two centuries, contract doctrine has evolved from a rigid model of discrete bargains into frameworks increasingly characterized by normative interdependence, contextualism, and regulatory cooperation. As articulated by John N. Adams and Roger Brownsword, this development can be divided into three doctrinal paradigms: the classical, the neo-classical, and the collaborative.[75]

The classical model, dominant in the nineteenth century, was grounded in the principle of freedom of contract—understood as the unrestrained ability of autonomous individuals to bind themselves through legally enforceable promises.[76] Contract was conceived as a morally neutral mechanism for exchanging value—defined by offer, acceptance, and consideration—without regard to fairness, context, or relational duty. In this framework, Grant Gilmore famously quipped that "ideally, no one should be liable to anyone for anything."[77]

By the twentieth century, this model gave way to a neo-classical understanding, in which the formal structures of classical doctrine were preserved, but courts grew more willing to imply terms—particularly those grounded in good faith and commercial reasonableness—to reflect the realities of practice.[78] Judicial intervention remained modest, but it acknowledged that pure formalism could foster opportunism. Good faith became, if not a rule, at least a limited doctrinal tool.

In contrast, Adams and Brownsword's collaborative model, proposed for the twenty-first century, reframes contract not as a static allocation of rights and obligations, but as a cooperative enterprise.[79] Under this model, contract law must support the parties' mutual commitment to shared goals—

[75] JOHN N. ADAMS & ROGER BROWNSWORD, KEY ISSUES IN CONTRACT 198–255 (1995) (outlining the classical, neo-classical, and collaborative paradigms).

[76] FRIED, *supra* note 10, at 1–14.

[77] GILMORE, *supra* note 8, at 46.

[78] PATRICK S. ATIYAH, THE RISE AND FALL OF FREEDOM OF CONTRACT 627–30 (1979) (describing the twentieth-century judicial shift toward implying relational standards such as good faith and commercial reasonableness within classical contract doctrine).

[79] ADAMS & BROWNSWORD, *supra* note 75, at 251–55 (arguing for a normatively embedded, trust-based contract model).

embedding the legal framework within norms of trust, communication, and relationship-specific investment.[80] This vision aligns with broader scholarly movements that recast contract as a vehicle for relational governance, particularly in complex, long-term, or networked transactions.[81]

Yet the emergence of smart contracts signals a striking doctrinal reversal. Rather than building upon this trajectory toward relational and collaborative norms, smart contracts reflect a technologically mediated return to classical formalism. In their default configuration, smart contracts are pseudonymous, immutable, and self-executing. They perform automatically according to coded instructions—with no regard for changing context, equitable adjustments, or relational values. They admit no duty of good faith, no scope for renegotiation, and no institutional space for interpretive discretion.[82]

Whether existing contract law is sufficient to govern smart contracts remains an open debate. Some scholars and regulators contend that existing doctrines—particularly those in the common-law tradition—are sufficiently

[80] *Id*. (describing how contract doctrine might incorporate cooperative norms).

[81] *See supra* note 8.

[82] Werbach & Cornell, *supra* note 2, at 367 (discussing the recognized limitations of smart contracts in the context of relational contracts); Harry Surden, *Computable Contracts*, 46 U.C. DAVIS L. REV. 629, 644 (2012) ("In contrast to traditional legal contracts, computable contracts can be designed so that certain actions are automatically executed by a computer system when specified conditions are met . . . Computable contracts generally do not leave room for contextual interpretation. The performance is not negotiated or interpreted after the fact; instead, it is carried out according to pre-established computational rules.").

flexible to accommodate smart contracts. Others argue that the distinctive features of smart contracts demand doctrinal recalibration.[83]

The 2021 report of the Law Commission of England and Wales exemplifies the former view, concluding that no legislative reform was necessary because the common law of England is sufficiently adaptive.[84] However, the Commission's approach emphasizes adapting smart contracts to fit within existing doctrinal frameworks.[85] It proposes two complementary solutions—one technological and one legal. The technological solution involves embedding mechanisms within the smart contract code that enable parties to terminate or override execution when necessary.[86] The legal solution recommends a non-exhaustive list of issues that parties should address in natural-language agreements prior to deployment.[87]

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[83] Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia* 40–41 (Mar. 12, 2015) (unpublished manuscript), https://ssrn.com/abstract=2580664 ("As such, the blockchain could support and facilitate the deployment of a decentralized alternative to the current legal system—a new digital common law—consisting of an interconnected system of rules interacting with one another in a reliable and predictable way, without the need of any third party institution to enforce these rules."); *id.* at 40 n.151 (citing John Henry Clippinger & David Bollier, *The Rise of Digital Common Law: An Argument for Trust Frameworks—Digital Common Law and Digital Forms of Governance*, ID3 (2012), https://idcubed.org/digital-law/the-rise-of-digital-common-law/) ("[D]igital common law . . . a bottom-up, voluntary, user-driven system that establishes context-specific norms for governing a given online community/market.").

[84] LAW COMM'N, SMART LEGAL CONTRACTS: ADVICE TO GOVERNMENT (2021), https://s3-eu-west-2.amazonaws.com/cloud-platform-e218f50a4812967ba1215eaecede923f/uploads/sites/30/2021 /11/Smart-legal-contracts-accessible.pdf.

[85] *Id*. at 6 ¶ 1.28 ("The flexibility of our common law means that the jurisdiction of England and Wales provides an ideal platform for business and innovation, without the need for statutory law reform."); *see also* Jonathan G. Rohr, *Smart Contracts and Traditional Contract Law, or: The Law of the Vending Machine*, 67 CLEV. ST. L. REV. 71, 87 (2009) ("[T]raditional contract law has been sufficiently flexible to handle a variety of technological innovations up to this point.").

[86] LAW COMM'N, *supra* note 84, at 212 ¶ 9 ("Parties would be well advised to consider designing the coded element of their smart legal contract such that performance of the code can be terminated if necessary.").

[87] *Id*. at 6 ¶ 1.29 ("Throughout the paper, we identify particular issues that parties may wish to address in their smart legal contract in order to promote certainty and party autonomy. A non-exhaustive list of these issues is set out in Appendix 3 to this paper.").

Smart contracts, however, do not follow this progressive trajectory toward relational and collaborative norms. Rather, they mark a doctrinal reversal—a technologically mediated return to classical formalism. Self-executing and pseudonymous, smart contracts operate with immutable logic and without deference to fairness, context, or trust. In this sense, they do not merely revive historical principles; they reimagine them for a digital environment. This section identifies five foundational elements of classical contract law and demonstrates how each finds renewed expression in the architecture of smart contracts.

A. Party Sovereignty and the Sanctity of Intent

Classical contract law regarded the parties as the sole authors of the contractual arrangement. Because private intent was treated as the central condition of both the contract's formation and its content, judicial intervention was restrained. The parties alone were tasked with drafting a complete contract. Courts refrained from filling gaps in the agreement, as doing so would risk imposing obligations not voluntarily undertaken.[88] If a material term was omitted, no contract was formed.

Similarly, changes in circumstances did not warrant judicial adjustment, as such alterations would contravene the original intent. Obligations were treated as absolute, with limited exceptions, such as the doctrine of frustration, which operated under the assumption of an implied condition that parties intended termination upon the occurrence of a supervening event.[89] Even doctrines such as unconscionability and substantive unfairness had little traction: so long as the parties consented, the terms were enforceable—however inequitable they may appear.[90]

Contemporary contract law diverges sharply from this view. Courts today are more willing to fill contractual gaps, applying doctrines of good

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[88] FRIED, *supra* note 10, at 1-2 (arguing that contract law is founded on the moral principle of keeping promises and that obligations arise from voluntary commitment).

[89] *Id.* at 58-59 (discussing mistake, impossibility and frustration and observing that in all three cases, the parties to a contract "though they [seem] to have agreed, have not agreed in fact").

[90] Melvin Aron Eisenberg, *The Emergence of Dynamic Contract Law*, 88 CALIF. L. REV. 1743, 1749 (2000) ("Classical contract law was a rigid, rather than a supple, instrument, which purported to employ axiomatic and deductive rather than substantive reasoning.").

faith, reasonableness, and implied terms to ensure fairness and workability.[91] Even the doctrine of frustration has been softened, allowing adjustments to preserve the contract's viability rather than automatically terminating it. As such, the modern approach limits party sovereignty and embraces equitable considerations.[92]

Smart contracts instantiate this principle with unprecedented fidelity. Their coded structure requires all operative terms to be fully specified ex ante. Once deployed, they execute deterministically, admitting no gap-filling, no contextual interpretation, and no discretionary judicial intervention during the performance phase.[93] Execution itself becomes the litmus test for enforceability: if the contract cannot execute, it fails.[94] As long as the smart

[91] *Id.* at 1796 ("Classical contract law did not recognize a duty to negotiate in good faith. On the contrary, it adopted the rule that an agreement to agree was unenforceable, which by implication precluded an obligation to negotiate in good faith."); *see also id.* at 1979 ("An even more important development in the transformation of offer and-acceptance law has been the acceptance in modern contract law of the dynamic rule that there is an obligation under appropriate circumstances to negotiate in good faith. The adoption of this rule is important not only in itself, but also because it provides a foundation for the dynamic treatment of preliminary negotiations, indefiniteness, further-document-to-follow provisions, and gaps.").

[92] *Id.* at 1813 ("Where classical contract law employed reasoning that purported to be axiomatic and deductive, modern contract law employs reasoning that is explicitly grounded in social propositions. Where classical contract law had an overriding preference for rules that were objective and standardized, modern contract law has been highly flexible in adopting rules that are individualized and even subjective. Where classical contract law rules were typically binary, modern contract law rules are often multifaceted.").

[93] *See supra* note 34; Werbach & Cornell, *supra* note 2, at 369 ("A smart contract is valid if it is accepted as part of the consensus process on the blockchain ledger. Once that happens, it is ineluctably enforced, even if fraudulently induced."); Werbach, *Trust, But Verify, supra* note 30, at 522 ("On this view, the decentralized architecture of consensus computing is a firewall against government intervention. The blockchain is not just immutable; it is 'censorship resistant.' No higher authority can command a blockchain to do something any more than it can order around the Internet.").

[94] Eliza Mik, *Don't Trust Smart Contracts*, MEDIUM (May 2021), https://elizamik.medium.com/dont-trust-smart-contracts-851e25339e72 ("The entire smart contract ideology rests on the assumption that once set in motion, their code cannot be modified, and their execution cannot be interfered with. The implementation of this ideology takes the form of a complex technological ecosystem constructed for the sole purpose of preventing the possibility of — and the necessity for — any human participation in the performance of contracts.").

contract is properly constructed and free from programming defects, its performance is expected to align precisely with the parties' shared intent. The reliance on deterministic code and automation reinforces the expectation that the contract will be executed without deviation, interruption, or discretionary intervention.[95]

Moreover, the transactional context of smart contracts supports this interpretation. These contracts typically govern discrete, short-term exchanges involving quantifiable and measurable terms.[96] They require minimal cooperation and are often executed between pseudonymous or geographically distant parties.[97] In this context, party autonomy is not only possible but desirable—and judicial restraint aligns with both the functional structure and normative expectations of the transaction. [98]

Second, the completeness of smart contracts negates the need for judicial supplementation. Because the code operates in strict if-then logic, it cannot execute an agreement unless all essential conditions have been pre-defined. If key parameters are missing, the contract fails to deploy and is void.[99] In this way, the contract's execution serves as a practical proxy for legal sufficiency. If a contract performs, it is by definition sufficiently

[95] Raskin, *supra* note 2, at 309 ("Because these agreements are enforced by code, there is no opportunity for judicial interpretation, equitable relief, or contractual discretion once performance begins.").

[96] *See supra* note 64.

[97] *See supra* note 61.

[98] Jenny Szabo, Charles Bernard & Laurent Philip, *Legal Implications and Challenges of Blockchain Technology and Smart Contracts*, 12 COMPUT. LIFE 6, 7 (2024) ("The decentralized and pseudonymous nature of many blockchain systems may impede the identification of parties for enforcement or adjudication purposes, . . . making it difficult to identify and locate parties for enforcement or adjudication purposes."); João Pedro Quintais et al., *Blockchain and the Law: A Critical Evaluation*, 2 STAN. J. BLOCKCHAIN L. & POL'Y 86, 92 (2019) ("Third, the pseudonymous nature of parties to the contract, which raises difficulties vis-à-vis error correction and enforcement.").

[99] Law Commission, *supra* note 84, at 51 ¶ 3.49 ("In the case of solely code agreements, we suggested in the call for evidence that the behavior of the code may be a strong indication as to whether the agreement is certain and complete. We said: A piece of code which contains vague or inconsistent instructions, or omits certain essential instructions, will not be performed by a computer. Conversely, code which is expressed with correct syntax, and which contains all essential instructions will be performed by a computer. Accordingly, where a piece of code has been performed by a computer, we consider that there may be little scope to argue that the agreement is uncertain or incomplete.").

definite and complete.[100] Thus, the very nature of smart contract code obviates the question of whether courts should complete a deficient contract.

In sum, the principle of judicial restraint—central to classical contract law—finds renewed expression in the architecture of smart contracts. Their design reflects and reinforces the classical commitment to party sovereignty, leaving no role for ex post supplementation or equitable modification. This doctrinal logic not only supports restraint in addressing contractual incompleteness but also aligns with the parties' ex ante expectations of deterministic, algorithmic enforcement. Moreover, it underscores the structural autonomy of smart contract transactions, which are deliberately constructed to operate independently of institutional oversight.[101]

B. Formation as the Singular Point of Legal Determination

Classical contract law treated the moment of contract formation as the exclusive point at which legal obligations were crystallized.[102] Once offer, acceptance, and consideration were present, rights and duties were deemed fixed, and the agreement was treated as complete—insulated from subsequent renegotiation or judicial recalibration. This doctrinal posture reflected the classical values of predictability, autonomy, and formal sufficiency: once a contract was validly formed, courts were not to alter its terms in response to later developments.[103]

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[100] *Id*.

[101] Primavera De Filippi & Samer Hassan, B*lockchain Technology as a Regulatory Technology: From Code Is Law to Law Is Code,* ARXIV (JAN. 8 , 2018), https://arxiv.org/abs/1801.02507 ("This means that the actual performance of a smart contract does not depend on the subjective expectation of the parties, based on their interpretation of the source code, but merely on the operations dictated by the compiled bytecode deployed to the blockchain.").

[102] Eisenberg, *supra* note 90, at 1768 ("Instead, the rules of classical contract law were centered on a single abstraction, the reasonable person; on a single kind of promise, the bargain promise; and on a single moment in time, the moment of contract formation.").

[103] *Id.* at 1770 ("In short, modern contract law has appropriately moved from a static conception of interpretation, that tended to focus on the text as of the moment of contract formation, to a dynamic conception, that encompasses events before and after that moment. To put this differently, under modern contract law the text of a contract runs through time.").

Modern contract doctrine, by contrast, allows obligations to evolve during performance. Courts imply terms, apply good faith doctrines, and invoke relational norms to treat contracts as living instruments—responsive to context, cooperation, and economic change.[104]

Smart contracts, however, realign with the classical conception of formation as finality. The relevant moment is the deployment of the contract on the blockchain, at which point all conditions, contingencies, and executable logic are embedded in immutable code. From that moment, execution proceeds deterministically and autonomously, without the possibility of discretionary modification.[105] Human and institutional intervention is structurally excluded. The smart contract cannot be interpreted, adjusted, or amended post-deployment—it either performs or fails according to its internal code.[106]

This sharply bounded temporal logic revives the classical ideal that contractual obligations arise from ex ante consent rather than from evolving ex post interpretation. The entire contract lifecycle is front-loaded: performance becomes the mechanical execution of a pre-coded plan. Accordingly, it is functionally impossible to treat performance as a phase in which obligations develop.

Moreover, the kinds of transactions typically governed by smart contracts—short-term, pseudonymous, and asset-based—provide little justification for relational flexibility.[107] These are not cooperative arrangements that benefit from interpretive discretion. Instead, parties rely on precise, predictable enforcement of the terms fixed at inception.

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[104] *Id.* at 1749 ("Accordingly, classical contract law doctrines lay almost wholly at the objective, standardized, and static poles, and also tended to be binary. In contrast, modern contract law employs substantive rather than formal reasoning, and pervasively (although not completely) consists of principles that are individualized, dynamic, multi-faceted, and, in appropriate cases, subjective."); *see also id.* at 1813–14 ("The paradigm at the center of classical contract law was a snapshot taken at the moment a bargain was made. In contrast, modern contract law recognizes that contract is a process, so that the picture we see at the time of contract formation, however important, is only one of a series of frames. Unless contract law responds to the whole moving picture, it cannot capture the reality of contract.").

[105] *See supra* notes 9 and 95.

[106] *See supra* notes 93–94.

[107] *See supra* note 8; *see also supra* note 71 and the accompanying text.

Accordingly, the classical doctrine that rights and duties are determined at formation—rather than molded during the course of performance—offers the most appropriate legal framework for understanding smart contracts.

C. Oppositional Party Positioning and Passive Expectation

Under classical contract doctrine, the parties to a transaction were conceived as rational actors positioned "face-to-face," each pursuing their own interests without assuming cooperative duties.[108] This adversarial orientation presupposed that each party would focus on performing its own obligations, while passively expecting reciprocal performance from the other. There was no duty to assist the counterparty in fulfilling its expectations, nor any presumption of good faith. Courts did not impose relational norms or equitable duties absent express agreement. Autonomy—not cooperation—structured the legal landscape.[109]

Modern contract theory, by contrast, advances a relational and collaborative model. In this framework, the parties stand "side-by-side," aiming not merely to fulfill fixed promises but to maximize joint surplus through ongoing engagement. Obligations evolve dynamically as parties cooperate to adjust expectations over time. Good faith, reasonableness, and

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[108] ADAM SMITH, THE WEALTH OF NATIONS 745 (Edwin Cannan ed., Modern Library 2000) (1776) ("Every man, [so] long as he does not violate the laws of justice, is left perfectly free to pursue his own interest [in] his own way.").

[109] WARREN SWAIN, THE LAW OF CONTRACT 1670–1870 200 (2014) ("The courts were more interested in putting in place a series of black and white rules which limited the scope of liability in the interests of promoting entrepreneurial activity.") (noting that classical contract law remained "insulated from substantive review," focusing instead on procedural validity—offer, acceptance, and consideration—with minimal judicial interference).

mutual support are no longer peripheral—they become central organizing principles of the contractual relationship.[110]

Smart contracts, however, intensify the classical model while introducing a novel twist. These digital agreements replicate the oppositional posture of classical doctrine: the parties interact at arm's length, expecting precise and autonomous enforcement of pre-specified obligations. But smart contracts go further by eliminating the possibility of deviation—even where deviation might be equitable or economically beneficial. Because execution is automated and pre-coded, there is no mechanism during the performance phase for interpreting intent, adapting to unforeseen events, or adjusting for relational cooperation.

Each party operates within a narrow, literal framework defined solely by code. There is no expectation—nor possibility—of discretionary engagement beyond what is explicitly encoded. Any opportunity to increase joint surplus, accommodate changed circumstances, or interpret ambiguous terms is foreclosed. If a condition is omitted, the contract either fails or produces unintended but nonetheless binding results.

Yet this extreme formalism gives rise to an unconventional form of trust: not trust in the other party, but trust in the code. Performance is guaranteed not by social norms or legal enforcement, but by technological determinism. Each party may remain passive precisely because the architecture of the smart contract assures autonomous, exact execution. In this sense, smart contracts displace the fragile human trust of classical contracts with a system-level trust in algorithmic certainty, guaranteeing computerized performance.

[110] *See* Macneil, *The Many Futures*, *supra* note 59, at 791 ("Similarly, both the length of relations and the nature of limitations on relational planning make simple transfers of relations difficult to achieve. The possibility of future planning altering relations, the absence of bindingness of planning, and the great need for future cooperation and relational development of future obligations all make simple exchange transfer of relations an anomalous concept, particularly since burdens and benefits tend to be shared rather than divided and parceled out. Finally, the elements of trust demanded by participant views of relations make identity important, and simple transfer therefore unlikely.").

D. Caveat Emptor and Risk Allocation

The fourth principle revived by smart contracting is the doctrine of *caveat emptor*—"let the buyer beware." In classical contract law, this maxim embodied a laissez-faire economic ethic that privileged procedural over substantive justice. Courts in the nineteenth century imposed minimal duties of disclosure, treating the contracting process as an adversarial arena in which each party bore the burden of safeguarding their own interests. Absent explicit contractual language to the contrary, parties were expected to conduct their own due diligence. The obligor bore no responsibility for the conformity of performance unless express representations or warranties had been made.[111] The underlying logic was straightforward: risk followed informational asymmetry, and silence carried no legal consequence.[112]

Modern contract law, however, has shifted toward a more interventionist and cooperative model. Influenced by social justice values and the rise of consumer protection, contemporary doctrine embraces *caveat venditor*—"let the seller beware"—as its governing maxim.[113] This evolution imposes on the seller a duty to account for the buyer's reasonable expectations, to

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[111] Richard Craswell, *Taking Information Seriously: Misrepresentation and Nondisclosure in Contract Law and Elsewhere*, 92 VA. L. REV. 565, 580 (2006) ("The nondisclosure doctrine is a recent development in contract law: Until the middle of the twentieth century, it was often said that parties to a contract had no duty at all to disclose information to each other, as long as they did not affirmatively misrepresent anything."); Richard A. Epstein, *Contract Law and the Theory of Efficient Breach*, 1 J. LEGAL STUD. 265, 275-77 (1972) (explaining how classical contract doctrine prioritized express terms and minimized duties absent explicit language). Laissez-faire is a French term meaning "let do" or "let go," referring to a doctrine of minimal government interference in the economic affairs of individuals and society. For an explanation of laissez-faire principles in law and economics, *see* RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN 111–112 (1985).

[112] Anthony T. Kronman, *Mistake, Disclosure, Information, and the Law of Contracts*, 7 J. LEGAL STUD. 1, 9–10 (1978) (arguing that contract law historically allowed parties to remain silent and imposed disclosure duties only in limited circumstances); Gilmore, *supra* note 8, at 19–24 (discussing how classical doctrine embraced caveat emptor and resisted the judicial implication of substantive fairness).

[113] Eisenberg, *supra* note 90, at 1753 ("Accordingly, in modern times many of the most firmly rooted doctrines of classical contract law have been either radically transformed or wholly uprooted because the courts have come to perceive the doctrines as not normatively justified.").

disclose material information, and to act with fairness, reasonableness, and good faith.[114]

Smart contracts, by contrast, constitute a partial reversion to the cautionary ethos of classical contract doctrine. Once deployed, a smart contract performs obligations automatically and immutably through blockchain-based code. In this rigid technical environment, the burden of foresight on each party is substantial. Parties must anticipate, specify, and encode all contingencies ex ante and avoid errors or unforeseen events not explicitly covered in the contract's code.[115] Such occurrences could result in parties being bound to an autonomously enforced contract that fails to reflect their original intent. Consequently, smart contracting revives a digital variant of *caveat emptor*.

This revival is partially mitigated, as the blockchain network functions, at least in part, as a solution to the issue of informational asymmetry that pervades most contractual relationships. In most cases, the blockchain network underlying smart contracts enables the parties—through a simple click and in real time, prior to contract formation—to access a comprehensive and reliable repository of information.[116] This repository includes, among other things, the capacity to check the digital asset, evaluate the complete transaction history related to that asset, and assess the financial

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[114] *Id*. ("In contrast to the formal reasoning of classical contract law, modern contract law reasoning is substantive. That is, modern contract law seeks to justify doctrines on the basis of social propositions. Of course, doctrines have a role to play in substantive legal reasoning, but that is because of the social values that underlie doctrinal stability, not because doctrines are either self-evident or established by deduction.").

[115] Eliza Mik, *Smart Contracts: Terminology, Technical Limitations and Real-World Complexity*, 9 LAW INNOVATION & TECH. 269, 281–87 (2017) (noting that smart contracts may execute outcomes inconsistent with the parties' intent unless contingencies are fully encoded ex ante).

[116] Despite the blockchain's transparency and immutability, flawed information may still be uploaded—for example, when a seller lists a digital asset that they do not actually own. *See* DYLAN YAGA ET AL., NAT'L INST. OF STANDARDS & TECH., NISTIR 8202, BLOCKCHAIN TECHNOLOGY OVERVIEW 46 (2018), https://nvlpubs.nist.gov/nistpubs/ir/2018/nist.ir.8202.pdf ("The transaction history efficiently and securely records a chain of events in a way that any attempt to edit or change a past transaction will also require a recalculation of all subsequent blocks of transactions.").

activity history of the counterparty.[117] A reasonable and objective understanding of a party entering into a smart contract is that the transparent blockchain network affords them access to this comprehensive information prior to their contractual engagement.[118]

Yet this is not a wholesale return to classical formalism. The risks of smart contracting do not fall solely on the buyer. Instead, the technological architecture of blockchain-based agreements imposes heightened responsibilities on both parties.

The buyer must verify the code and its effects; the seller must ensure accurate and functional deployment. Performance is deterministic, but the risk is bilateral. This dynamic invites a reconceptualization of duty of care under what I term "mutual caution." This concept reflects a heightened standard of care, akin to "strict diligence," under which the parties must exercise an enhanced degree of caution throughout the course of contractual formation.[119] The foundation for this distinctive approach rests on the structural and functional characteristics of smart contracts.

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[117] While online participants also access substantial information, it differs in scope and reliability from blockchain data, which includes transparent transaction histories and financial details. In contrast, internet data is centrally controlled and thus more prone to dispute.

[118] Lin William Cong & Zhiguo He, *Blockchain Disruption and Smart Contracts*, 32 REV. FIN. STUD. 1754, 1754 (2019) ("Smart contracts can mitigate informational asymmetry and improve welfare and consumer surplus through enhanced entry and competition, yet the irreducible distribution of information during consensus generation may encourage greater collusion."); *see also id.* at 1757 ("This eliminates information asymmetry as a barrier for entry and greater competition, enhancing welfare and consumer surplus in this "blockchain world." Beyond authenticity and delivery, we further show that in an extension with privately observed seller qualities, blockchain consensus can also mitigate informational asymmetry over service qualities, thereby improving consumer surplus and welfare.").

[119] Hogan Lovells, *Blockchain Smart Contracts Need a New Kind of Due Diligence*, LEXOLOGY (Mar. 21, 2018), https://www.lexology.com/library/detail.aspx?g=bebe2353-69c3-425b-89ad-d22ffd7b469c ("Many issues can arise when recording smart contracts in an immutable system, meaning that enhanced due diligence may be necessary before any transactions are written in 'blockchain stone.'").

E. Freedom of Contract

The fifth principle implicated by smart contracts is the doctrine of freedom of contract—a foundational tenet of classical legal thought. In nineteenth-century contract doctrine, freedom of contract held supreme normative authority.[120] It was not merely the right to enter into agreements, but the right to be bound—without equitable interference.[121] Courts were to respect party autonomy, enforce agreements as written, and refrain from importing external moral or distributive values into private arrangements.[122]

As Justice Sir George Jessel famously declared: "If there is one thing more than another which public policy requires, it is that men of full age and competent understanding shall have the utmost liberty in contracting."[123]

Classical legal theory held freedom of contract as sacred—an expression of autonomous will to be upheld uncritically. Yet, the idea that parties could contract without limitation was never permanent. By the late nineteenth century, as Patrick S. Atiyah argues, the unfettered doctrine of freedom of contract began to lose its dominance; judicial and legislative attention turned toward mitigating its harshest effects.[124]

Contemporary contract doctrine reflects this tension. Eyal Zamir explains that while classical doctrine was shaped by a "fundamentally individualistic ethos … suspiciousness of—and even hostility to—governmental regulation," modern scholarship now focuses intensely on standard-form agreements precisely because of concerns over unfair terms and regulatory oversight.[125] As Melvin A. Eisenberg has observed, contract law today must mediate between competing ideals—freedom, fairness,

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[120] ATIYAH, *supra* note 78, at 681–715.

[121] *Id*. at 455–505.

[122] HORWITZ, *supra* note 10, at 221 (observing that in the early 20th century, reformers increasingly criticized common-law courts as insensitive and inefficient—particularly in efforts to remove workplace injury cases from judicial jurisdiction).

[123] Printing & Numerical Registering Co. v. Sampson, 19 L.R. Eq. 462, 465 (Ch. 1875) (Jessel, M.R.).

[124] ATIYAH, *supra* note 78, at 681–715 (detailing the shift between 1870 and 1970 in response to perceived injustices of absolute contractual freedom).

[125] Eyal Zamir, *Contract Law and Theory: Three Views of the Cathedral*, 81 U. CHI. L. REV. 2077, 2096 (2014).

cooperation, and solidarity. Freedom of contract no longer functions as an absolute shield, but as a principle subject to normative and regulatory counterweights, including doctrines of good faith, unconscionability, and mandatory regulation.[126]

Smart contracts reanimate this classical freedom in its most literal and rigid form. Once deployed, these contracts execute autonomously on blockchain infrastructure. They exclude judicial supervision, eliminate interpretive flexibility, and preclude remedial discretion during the performance phase.[127] The legal implication of this technological innovation is profound: the distinction between valid and enforceable contracts collapses within the realm of smart contracts.[128] Even where enforcement would be normatively undesirable—such as where the contract contravenes legal norms—a smart contract will still execute if the code so dictates.[129] The contract enforces itself, without regard to fairness, mistake, hardship, or good faith.[130]

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[126] MELVIN A. EISENBERG, FOUNDATIONAL PRINCIPLES OF CONTRACT LAW 25–28 (2018) ("Over the last seventy or eighty years, contract law has been transformed from classical to modern. One area of transformation concerns the nature of contract-law reasoning. Reasoning in classical contract law was formal; . . . In contrast, the objective of modern contract law is to craft rules that are justified by social propositions . . . . Doctrines have an important role to play even in modern legal reasoning because of the social value of doctrinal stability.").

[127] Raskin, *supra* note 2, at 309 ("They are designed to automatically enforce obligations without the need for human intervention, thereby reducing the flexibility traditionally associated with contract enforcement.").

[128] Werbach & Cornell, *supra* note 2, at 369 ("Yet, the distinction between validity and enforceability is precisely the one that smart contracts elide.").

[129] *Id*. at 369 ("A smart contract is valid if it is accepted as part of the consensus process on the blockchain ledger. Once that happens, it is ineluctably enforced, even if fraudulently induced.").

[130] Jeremy M. Sklaroff, *Smart Contracts and the Cost of Inflexibility*, 166 U. PA. L. REV. 263, 264 (2017) ("These two forms of flexibility—linguistic ambiguity, and enforcement discretion—create important efficiencies in the contracting process. By eliminating this flexibility, smart contracting will impose costs that are more severe and intractable than the ones it seeks to solve.").

The architecture of smart contracting reflects not only a strong preference for autonomy, but a structural exclusion of external norms—whether public policy, equitable standards, or judicial conscience.[131]

This Article argues that smart contracts represent a structural instantiation of core values historically associated with classical freedom of contract. Most notably, smart contracts operationalize *pacta sunt servanda*, promise-keeping, legal certainty and stability, party autonomy, and the protection of reliance and expectation interests.[132] These values are not merely encouraged; they are technologically and autonomously enforced, eliminating the need for judicial oversight and producing a degree of determinism that exceeds that offered by traditional legal instruments, which remain vulnerable to opportunistic breach and subject to judicial discretion.

The result is a technological reversion to nineteenth-century formalism, in which party choice is sovereign and enforcement is automatic, even where substantive injustice may arise.

This literalized freedom of contract is not without cost. In privileging ex ante design over ex post correction, smart contracts impose a burden of exhaustive foresight and expose parties, among other things, to the risks of coding error or transactional rigidity. But this is also their ideological power. They render visible what classical doctrine posits: that the law will uphold the will of competent parties—even when doing so is inconvenient, costly, or unforgiving.

In this sense, smart contracts do not depart from legal tradition but rather restore its most austere and autonomous nineteenth-century vision—recasting classical formalism through code in the architecture of the digital age.

While this chapter contended that smart contracts represent a return to nineteenth-century classical contract law, the next chapter will argue that certain modern contract law theories underpin the unique features and operational mode of smart contracts.

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[131] *See supra* note 101.

[132] Daniel Markovits & Emad H. Atiq, *Philosophy of Contract Law*, STAN. ENCYC. PHIL. § 1 (Nov. 23, 2021), https://plato.stanford.edu/entries/contract-law/ ("The first, and most famous, holds that contract law enforces the basic moral duty to keep promises."); *see also id.* § 1.2 ("Historically, the common law's *pacta sunt servanda* ('agreements must be kept') principle used to be enforced quite unforgivingly . . .").

IV. BENSON, DAGAN & HELLER AND THE ARCHITECTURE OF SMART CONTRACTS

A. Benson's Transfer Theory

Notwithstanding the conclusion of the previous chapter—that smart contracts recast nineteenth-century classical formalism through code—they also reanimate a modern theory of contract law: Peter Benson's conception of contract as a transfer of ownership. In his seminal work *Justice in Transactions: A Theory of Contract Law*, Benson develops a comprehensive theory in which contract law is conceived not as a normative framework for promise enforcement, but as a juridical scheme for the transfer of entitlements through mutual assent.[133]

Benson's theory rests on two foundational claims. First, through mutual assent, contract formation involves the complete juridical acquisition of exclusive rights and transfers ownership independent of actual performance or detrimental reliance.[134] Second, the legal force of the contract is established through the mutual recognition of the parties' respective entitlements, such that ownership is transferred by virtue of consent—not physical delivery.[135]

This framework distinguishes contract from barter. In barter, ownership is transferred simultaneously with physical delivery; in contract, by contrast, the transfer occurs at the moment of formation, and performance is merely the means by which the promisee takes possession of what they already

[133] BENSON, *supra* note 11, at 21 ("analysis of contract formation that explains how the parties' mutual assents can transfer an ownership right from one to the other prior to and independently of performance, and on this basis show that breach of contract is an interference with a protected interest, making the expectation remedy compensatory in character.").

[134] *Id.* at 28–32; *see also id.* at 32 ("Second, it must be possible for parties mutually to alienate and appropriate ownership simply through their mutually related expressions of assent prior to and independent of delivery.").

[135] *Id.* at 32 ("[t]hat the preceding analysis of a physical transfer already contains the idea that it is possible for parties mutually to alienate and appropriate ownership simply through their mutually related expressions of assent prior to and independent of delivery.").

legally own.[136] Therefore, in accordance with his theory, a contract crystallizes the rights and duties of the parties at the moment of formation, and performance merely realizes what is already vested.[137]

Furthermore, in Benson's framework, breach is not simply a failure to deliver a benefit but a wrongful interference with the promisee's vested entitlement. The duty to perform is thus best understood as a negative prohibition—not to interfere with what already lies under the rightful control of the other party.[138]

Although Benson's theory predates the advent of blockchain technology, its legal architecture mirrors the distinctive operational features of smart contracts with remarkable fidelity. Once deployed, smart contracts operate autonomously and immutably, insulated from human discretion and intervention during the performance phase. Code becomes the medium of mutual assent, and execution unfolds deterministically—a realization of what is already vested irrevocably by the parties at the moment of formation.

Benson's conceptualization of breach aligns seamlessly with the technical immutability of human intervention during the performance phase of smart contracts: once conditions are met, execution is not optional. Any attempt to obstruct performance becomes technologically impossible because the contract is immutable during the performance phase. Therefore, the transfer theory is being implemented rigidly by the technical design and features of smart contracts.

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[136] *Id.* at 31 ("The central difference between a physical transfer and contract is that contract distinguishes and separates in time the two aspects which coincide in the physical transfer: rightful acquisition and physical delivery. In a physical transfer, the transfer of ownership coincides with physical delivery. The latter is the vehicle of the former. By contrast, the parties' entitlements in a contract are fully and completely established by their agreement, prior to and independently of performance through which physical delivery is affected. On this view, the constitutive acts of alienation and appropriation in a contract transfer ownership before the change in physical occupancy, in this way providing the needed basis for construing the expectation remedy as compensatory.").

[137] *Id.* at 34 ("The duty to perform is simply the normative meaning of the transfer of ownership that has already taken place at the moment of agreement.").

[138] *Id.* ("Breach is thus an interference with the promisee's ownership interest acquired at contract formation. It constitutes an injury in the legal sense. The expectation remedies may now be understood as correcting this injury and as ensuring that the promisee's ownership interest is respected.").

B. Dagan's Relational Critique

This Article simultaneously embraces Peter Benson's theory and Hanoch Dagan's critique—not as contradictory, but as complementary when situated within the analytical context of smart contracts. Dagan, in his *Two Visions of Contract*, offers a compelling criticism of transfer theory's limitations.[139] While Benson's model preserves juridical independence and formal equality, Dagan argues that it suppresses contract's intertemporal and relational dimensions.[140] On his view, contract is not merely a mechanism for transferring entitlements, but a planning device for coordinating future-oriented, cooperative endeavors.[141] This dimension, Dagan argues, is largely overlooked by transfer theory. As Dagan observes, "Benson's model of contract as an extension of barter may be the best we can do" for such domains.[142]

C. Synthesizing Benson's Theory with Dagan's Critique

Nonetheless, this Article maintains that Dagan's critique of that theory ultimately underscores the limited but precise applicability of Benson's model to smart contracts. As algorithmic instruments of exchange, smart contracts are poorly suited for adaptive, relational, or interpretive engagements. They are ideal for transactional and discrete exchanges, where precision, predictability, and autonomy are paramount. In this restricted

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[139] Hanoch Dagan, *Two Visions of Contract*, 119 MICH. L. REV. 1247 (2021).

[140] *Id*. at 1248 ("Transfer theory, I will argue, misrepresents law's facilitation of contract as an exercise of implication; it marginalizes contract law's robust commitment to relational justice; and it understates the way law's regard to the parties' future selves limits the range of enforceable commitments people can undertake. These pitfalls are manifestations of a deeper difficulty of transfer theory. It relies on an overly restrictive justificatory premise, which leads it to obscure the full implications of contract's intertemporal dimension.").

[141] *Id*. at 1267 ("Transfer theory, I've argued, offers either partial or unsatisfactory answers to many of the specific questions contract law must resolve. Contract, I've claimed, should not be understood as a transfer of exclusive control over a determinate object, and contract law need not settle with the protection of our interpersonal independence. Rather, as a joint undertaking of a cooperative arrangement, contract is a planning device that enhances people's autonomy.").

[142] *Id*. at 1252–53.

domain, Benson's theory offers the most accurate and normatively coherent framework.

Smart contracts instantiate a distinct and limited mode of contracting—reviving classical formation logic and mirroring the formal structure of technologically mediated monetary barter, aptly described by Dagan as an "extension of barter."[143] In this respect, Benson's theory remains doctrinally coherent and exceptionally well-suited to the transactional, autonomous nature of smart contracts and the utility-oriented contractual domain they are designed to serve.

D. Choice Theory and Doctrinal Pluralism

This pluralist vision finds further grounding in Hanoch Dagan and Michael Heller's *Choice Theory of Contracts*,[144] which advocates for a legal infrastructure that accommodates multiple types of contracts.[145] They argue that the contractual landscape should be conceptualized as comprising multiple "spheres" and "sub-spheres" of contracting—such as family, labor, real estate, and commerce—each serving distinct normative purposes, ranging from utility to community, and often combining both.[146]

In the spirit of Karl N. Llewellyn's realist insight—that legal doctrines must reflect the specific factual patterns they govern[147]—this framework supports a differentiated approach to legal regulation. A liberal state, Dagan

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[143] *Id.*

[144] *See supra* note 13.

[145] DAGAN & HELLER, *supra* note 13, at 103 ("Within a particular sphere of contracting, contract law should offer a sufficiently diverse range of contract types, each representing a distinct balance of values. The majority may prefer one contract type, but choice of theory requires that within each contracting sphere free individuals should be enabled to contract based on different value balance.").

[146] DAGAN & HELLER, *supra* note 13, at 32–33 (outlining the division of the contract landscape into spheres and sub-spheres, including family, labor, real estate, and commerce, and further subdividing the commercial sphere. For example, the commercial sphere is subdivided into four sub-spheres: (1) consumer transactions—including routine purchases as well as software licensing; (2) credit and insurance—including mortgages, credit cards, and insurance contracts; (3) sales and business-to-business transactions—primarily involving firms and corporations; and (4) finance and risk—encompassing derivatives and guarantees).

[147] KARL N. LLEWELLYN, THE COMMON LAW TRADITION: DECIDING APPEALS 121 (1960).

and Heller contend, must ensure the availability of diverse contract types within each domain of human activity,[148] even when market demand is limited.[149]

The commercial sphere, in particular, gives rise to new types of contracts shaped by entrepreneurial innovation and market dynamics. Motivated by profit maximization, commercial actors have both the incentive and the capacity to design contracts that best serve their transactional objectives.[150] Smart contracts, and their growing range of applications, exemplify this development: they are the product of supply-and-demand forces and private initiative.[151]

Drawing on postmodern legal theory, Dagan and Heller urge that contract law should abandon a one-size-fits-all model—warning that such uniformity leads to doctrinal confusion and normative incoherence.[152] Instead, they advocate for a system of tailored legal regimes, calibrated to the values and functions specific to each sphere and contract type. General

[148] DAGAN & HELLER, *supra* note 13, at 3 ("Put more sharply, choice theory shows that liberal states are affirmatively obligated to ensure an adequate range of contract types in each important sphere of human interaction.").

[149] *Id*. at 99 ("[E]ven moderate demand can justify creation of a new type, so long as the type responds to the balance of contract goods that enough people seek.").

[150] *Id*. at 15 ("[I]n the sphere of commerce, we often see market demand driving the creation of 'new' business contract types. Sophisticated commercial parties are likely to be best type-developers in this sphere. They share a wealth-maximizing metric for evaluating terms and they are motivated to do a good design job because they can directly capture much of the surplus they generate.").

[151] Thus, for example, the Ethereum blockchain network and the Solidity programming language (used to write smart contracts) were launched as an entrepreneurial initiative by Vitalik Buterin. *See supra* note 32. The various applications built on blockchain using smart contracts—such as NFT marketplaces and decentralized finance (DeFi) platforms—are likewise the result of commercial enterprise, *see supra* notes 46–47 and the accompanying text.

[152] DAGAN & HELLER, *supra* note 13, at 7 ("We show that the application of familiar contract concepts-including, for example, liquidated damages, efficient breach, and the duty of good faith and fair dealing – should vary depending on the normative concerns driving different contract types. Even voluntariness, the most trans-substantive contract concern, should be understood differently in different types, and the doctrinal tools used to protect this concern should vary accordingly. Further, we show how universal application of "general" contract law doctrines has led to doctrinal confusion in long-standing contract types.").

doctrines—such as good faith, efficient breach, or voluntariness—should not be applied universally but rather evaluated in light of the social and economic context that animates each contractual form.[153]

Smart contracts represent a distinct and defined mode of contractual interaction—one that diverges in both structure and purpose from traditional agreements. In line with Llewellyn's jurisprudential legacy, smart contracts warrant their own tailored normative regime. According to Dagan and Heller, they belong firmly within the commercial sphere and, more precisely, within its sub-spheres concerning sales of goods, licensing, and lending. Given their unique operational features, smart contracts occupy the utilitarian end of the contractual spectrum and should be governed accordingly.[154]

E. The Synthesized Theory of Smart Contracts

This Part advances a novel claim that remains underexplored in both contract theory and the emerging scholarly literature on smart contracts: the reciprocal relationship between smart contracts and the theoretical foundations of contract law.

The findings of this Article lead, at the theoretical level, to two seemingly contradictory yet coexisting conclusions. On the one hand, smart contracts revive and, in many respects, technologically modernize the classical contract theory—which originated in the nineteenth century and centers on the principle of freedom of contract. On the other hand, their emergence necessitates a reassessment of the departure from the unified

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[153] DAGAN & HELLER, *supra* note 13, at 3 ("By contrast, choice theory suggests that each of these doctrines, and many others, may be better understood as clues to and reflections of the divergent normative concerns of a particular contract type. By stabilizing their respective types, by making them more available and attractive to contracting parties, and by making available distinct choices about the structure of important relation-ships, such doctrinal rules can enhance contractual freedom."); *see also id.* at 104 ("The duty of good faith and fair dealing is nice example of shift in the law that builds a safety net for contracting parties in their contractual community – but maybe takes the law away from what parties to business contracts want and need. Although this is general duty is frequently said to inhere in in all contracts, in practice it is highly context- dependent, as it should be.").

[154] DAGAN & HELLER, *supra* note 13, at 7 ("A consistent commitment to autonomy as the normative foundation of contract implies that doctrinal interpretation and evaluation should, by and large, look to the 'local' animating principles of existing contract types rather than to any 'core' principle of contract law.").

framework that has traditionally characterized classical contract law, prompting a reconsideration—through the lens of postmodern legal theory—of whether smart contracts warrant a distinct legal regime.

By synthesizing Benson's transfer theory with Dagan's relational critique and Choice Theory of Contracts, developed by Dagan and Michael Heller, this Article advances a more comprehensive and context-sensitive account of smart contracts—one that offers both a descriptive analysis of existing doctrinal alignment and a normative argument for legal adaptation in light of technological innovation. These contracts do not erode the foundations of contract law; rather, they reinforce its pluralism and postmodern vision, demonstrating the necessity to consider doctrinal differentiation that accounts for common contract theories while accommodating technological innovation.

CONCLUSION

Smart contracts do not merely represent a technological innovation—they revive foundational paradigms of economic exchange and legal doctrine. By enabling autonomous, algorithmic execution of reciprocal obligations, smart contracts reconstruct the structural logic of barter within a digitally mediated environment. This new form of barter is neither regressive nor symbolic; rather, it is monetary, decentralized, and technologically instantiated, reframing exchange as an immediate, code-enforced act rather than a deferred, trust-dependent obligation.

In this respect, smart contracts—functioning as a new form of digitally mediated monetary barter—achieve what this Article identifies as the "holy grail" of transactional reliability: the resolution of opportunistic breach through autonomous, simultaneous execution, unmediated by trust, interpretation, or judicial enforcement.

Rather than force-fitting smart contracts into inherited legal categories, the more coherent response is recognition: they constitute a distinct type of contractual engagement. They do not mark a retrogression, but a doctrinal realignment—a technological rearticulation of classical contract law in the digital age.

Their deterministic design encodes the classical ideals of legal determinacy, party autonomy, and restricted institutional intervention, while also highlighting that contextualist and relational frameworks are ill-suited to govern code-based exchange.

This Article advocates for a pluralistic legal framework. Smart contracts should not be forced into a monolithic theory; instead, they reflect a pluralistic synthesis of classical and modern contract law theories, combining Benson's transfer theory, Dagan's relational critique of that theory, and the Choice Theory of Contracts that calls for tailored legal regimes.

Through this theoretical synthesis, the Article develops a richer and more precise legal understanding of algorithmic contracting.

Smart contracts do not undermine the foundations of contract law; they compel us to consider those foundations anew—with greater precision and clarity. The task ahead is not to resist this evolution, but to guide its course.