

Why “Code Is Law” Fails for Real-World Assets

Why Institutional Markets Require Discretion That Code Cannot Provide

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Abstract

The proposition that "code is law" has been central to the development of blockchain-based markets, promising automated enforcement, reduced transaction costs, and trustless coordination. While this paradigm has shown partial success in digital-native environments, its application to real-world assets has proven structurally incompatible with the requirements of institutional finance.

This paper argues that the primary barrier to real-world asset tokenization is not technological maturity, but a fundamental mismatch between on-chain execution and the discretion, legal enforceability, and fiduciary accountability that institutional markets depend on. Real-world assets are embedded in incomplete contracts and layered governance structures that cannot be fully specified ex ante in code. The paper reframes tokenization as an institutional design challenge — one in which automation serves established governance structures rather than replacing them — with implications for policymakers, regulators, and institutional investors.

Keywords: real-world asset; tokenization; institutional governance; fiduciary duty; smart contracts; incomplete contracts; market infrastructure; institutional adoption; blockchain regulation; financial market design.

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1. Introduction

The principle that "code is law" has become a foundational idea in blockchain discussions. At its strongest, the phrase captures a simple insight: software systems embed rules that constrain behavior, often more effectively than formal legal mechanisms. In purely digital environments, automated execution can substitute for enforcement, and technical design can meaningfully shape economic outcomes.

Yet as tokenization efforts move beyond native digital assets and into real-world assets, this principle begins to break down. Projects attempting to extend smart-contract logic to financial securities, infrastructure assets, and regulated instruments have repeatedly encountered friction — not primarily from technological limitations, but from institutional resistance. These frictions are often described as transitional problems: regulatory uncertainty, immature infrastructure, or risk-averse incumbents. This paper shows that this view is incomplete.

The failure of "code is law" in real-world asset tokenization is structural. Real-world assets are embedded in legal, institutional, and fiduciary frameworks that cannot be replaced by automated execution without undermining the very properties that make those assets investable at scale. Governance, discretion, and accountability are not residual inefficiencies waiting to be engineered away; they are core features of institutional markets.

This paper examines why the logic of autonomous execution, while effective in narrow digital contexts, fails when applied to assets whose value depends on enforceability, judgment, and ex post intervention. It argues that successful tokenization requires a reframing: from software replacing institutions to software operating within them.

2. The Origins and Limits of "Code Is Law"

The phrase "code is law" originated as an observation about how technical architectures regulate behavior. In its original formulation, it was descriptive rather than prescriptive: software systems constrain what users can do, shaping outcomes in ways similar to legal rules. Over time, this observation was transformed — particularly within blockchain communities — into a normative claim that code should function as law itself, displacing legal institutions rather than complementing them.

This shift was reinforced by early blockchain successes. Native digital assets operate in environments where ownership is purely informational, disputes are internalized, and participation is voluntary. Losses from bugs, exploits, or poor design are often treated as part of the system's risk model rather than as governance failures. In these settings, automated execution can reasonably serve as a primary organizing principle.

The problem arises when this logic is extrapolated beyond its original domain. Real-world assets do not exist in closed systems. They are governed by contracts, regulated by public authorities, and held by institutions with fiduciary obligations. Ownership claims rely on legal enforceability,

not merely on cryptographic proof. Participants in these markets cannot waive recourse to courts or regulators, nor can they outsource responsibility to code.

The prescriptive interpretation of "code is law" therefore rests on a category error. It assumes that the absence of legal recourse is a feature of efficiency rather than a condition tolerated only under specific circumstances. When applied to real-world assets, the metaphor ceases to describe reality and instead obscures the sources of authority and accountability that institutions depend on.

The failure, then, is not one of implementation but of framing. Treating code as a substitute for law may simplify system design, but it does so by ignoring the institutional conditions under which real-world assets are created, valued, and governed. This distinction between technical feasibility and institutional viability has been examined in detail in the context of the broader tokenization stack, where legal enforceability, governance authority, and regulatory compatibility form higher-order constraints that code cannot substitute (Sing, 2023a).

3. Why Real-World Assets Resist Full Codification

At the core of this mismatch lies the problem of incomplete contracts. Many real-world assets cannot be fully specified *ex ante*. Uncertainty, complexity, and the cost of foresight ensure that some contingencies will remain undefined. Financial instruments, infrastructure projects, and regulated securities are designed with this reality in mind. Their governance structures allocate discretion precisely because not all future states of the world can be anticipated.

Value in these assets depends not only on mechanical execution but on the allocation of residual control rights — the authority to interpret, intervene, and adjust when circumstances deviate from expectation. This discretion is not a design flaw; it is a risk-absorbing feature that allows institutions to manage uncertainty without resorting to constant renegotiation or systemic failure.

Efforts to fully codify these relationships through smart contracts do not eliminate discretion. They displace it. When unforeseen events occur — regulatory intervention, asset impairment, force majeure, covenant breaches — decisions are still made by trustees, boards, regulators, or courts. Rigid execution logic may constrain the timing or form of intervention, but it does not remove the need for it.

This displacement becomes problematic in institutional contexts. Fiduciaries are accountable for outcomes, not for adherence to code. If automated execution produces results that conflict with fiduciary duty, responsibility does not dissolve; it reasserts itself through governance intervention, legal challenge, or regulatory inquiry (Sing, 2023b). In such cases, the opacity created by rigid automation can exacerbate rather than reduce risk.

The resistance of real-world assets to full codification is therefore structural, not transitional. These assets exist within systems designed to manage uncertainty through layered authority and human judgment. Tokenization architectures that treat discretion as an inefficiency to be

eliminated will eventually confront the limits of that assumption. Sustainable adoption requires recognizing that governance is not the opposite of automation, but its necessary counterpart.

4. Institutional Adoption Requirements

Institutional adoption of real-world asset tokenization is constrained less by technological capability than by requirements that are largely non-negotiable. Asset managers, banks, pension funds, and insurers operate within fiduciary and regulatory frameworks that prioritize legal enforceability, governance clarity, and accountability over execution efficiency. These requirements determine not only what institutions are willing to adopt, but the sequence and form that adoption can take.

They reflect the structural conditions under which institutions are permitted to operate — and they will not be waived in exchange for technical convenience. The asymmetric pace of adoption across asset structures — with tokenized funds attracting earlier and more sustained institutional participation than project-level assets — reflects precisely these constraints in operation (Sing, 2024).

First, institutions require clear legal authority and enforceable claims. Ownership interests in real-world assets must be anchored in recognized legal structures that courts and regulators can interpret and enforce. Tokenized representations that lack clear linkage to contractual rights, custodial arrangements, or statutory frameworks introduce ambiguity that institutions are structurally constrained to avoid. Cryptographic certainty does not substitute for legal certainty when capital is deployed on behalf of beneficiaries.

Second, institutions require defined governance and decision authority. Someone must be accountable for interpreting rules, exercising discretion, and intervening when conditions deviate from expectation. Boards, trustees, and investment committees are not optional features of institutional finance; they are the mechanisms through which responsibility is allocated and monitored — and through which fiduciary duty is operationalized in practice (Sing, 2023b). Systems that obscure where authority resides — or claim authority resides nowhere — are incompatible with institutional decision-making.

Third, institutions require ex post accountability and auditability. Investment decisions are subject to review by internal risk committees, external auditors, regulators, and, in some cases, courts. Automated execution that cannot be explained, justified, or overridden undermines this accountability chain. The question institutions ask is not whether a system executed as programmed, but whether outcomes can be defended under fiduciary and regulatory scrutiny.

Finally, institutions need reliable ways to handle situations that fall outside predefined rules. Real-world assets are exposed to regulatory change, operational disruptions, market dislocations, and political intervention. Institutional systems are designed to absorb these shocks through discretion, escalation, and judgment. Tokenization frameworks that assume away exceptions in the name of efficiency fail precisely where institutions place the highest value.

Tokenization efforts that ignore these constraints may achieve technical success in pilot settings. They will struggle to attract sustained institutional capital at scale.

5. Governance, Not Execution, as the Binding Constraint

Much of the discussion surrounding real-world asset tokenization focuses on execution: settlement speed, automation, composability, and cost reduction. While these attributes matter at the margin, they are rarely the binding constraint on institutional adoption. The decisive constraint is governance.

Execution failures are generally manageable. Software bugs can be patched, throughput can be improved, and infrastructure can be upgraded. Governance failures are qualitatively different. They arise when authority is unclear, responsibility is diffused, or intervention mechanisms are absent. In institutional contexts, these failures are not tolerated as technical glitches; they are treated as systemic risks.

The appeal of autonomous execution rests on the idea that removing discretion reduces uncertainty. In practice, the opposite is often true. When systems lack clearly defined override mechanisms, uncertainty is shifted rather than eliminated. Market participants are left unsure who can intervene, under what conditions, and with what legitimacy. This uncertainty is particularly severe during stress events, when rigid execution can amplify rather than dampen instability.

Institutional systems are built around the expectation that human judgment will be exercised when rules prove insufficient. Emergency powers, discretionary waivers, and governance escalation are not failures of design; they are safeguards against incomplete specification. Tokenization architectures that treat these features as regressions fail to account for how institutional trust is actually built and sustained.

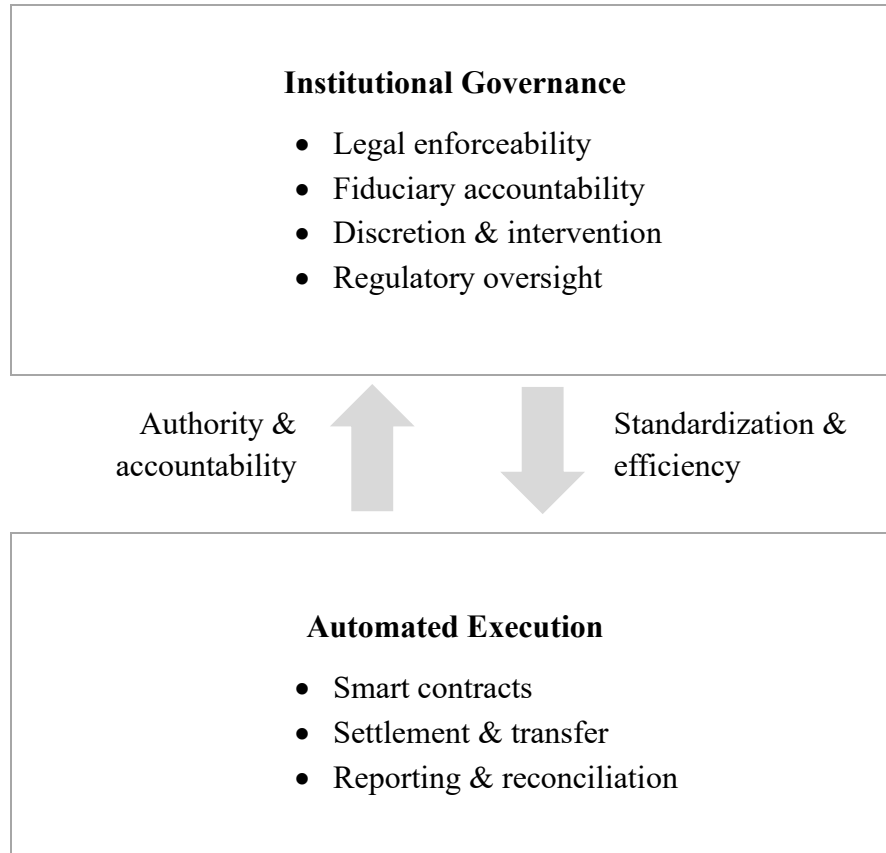
This does not imply that automation is incompatible with institutional finance. It implies that automation must be embedded within governance structures rather than positioned as a substitute for them. The role of code is to standardize routine processes, reduce operational friction, and improve transparency — not to eliminate authority or responsibility.

What many high-profile failures in real-world asset tokenization reveal, on closer inspection, are governance breakdowns misdiagnosed as technical problems. A system that executes flawlessly but lacks credible governance does not inspire confidence; it raises a more fundamental question: who bears responsibility when outcomes diverge from intent?

For institutions, governance is not a secondary consideration to be layered on after technical deployment. It is the foundation upon which adoption decisions are made. Until tokenization frameworks internalize this reality, execution improvements alone will not unlock institutional scale.

6. Reframing Tokenization as Institutional Design

Figure 1. Execution and Governance in Real-World Asset Tokenization



The two quadrants in Figure 1 are not in tension — they operate at different levels of institutional function. Automated execution handles what can be fully specified; governance handles what cannot. Conflating them is the source of most adoption failures.

If "code is law" fails as a governing principle for real-world assets, the implication is not that automation is misguided, but that its role has been mischaracterized. Tokenization should be understood not as a mechanism for replacing institutions, but as a tool for augmenting institutional design. This reframing aligns with a lifecycle view of tokenization, where institutional viability is determined across stages including structuring, governance, issuance, and servicing (Sing, 2025).

In institutional markets, value is created through a combination of standardized processes and discretionary judgment. Automation is most effective when applied to the former: settlement, reconciliation, reporting, and routine enforcement. These functions benefit from clarity, repeatability, and speed. Governance addresses the latter: exception handling, interpretation,

intervention, and accountability. Attempting to automate both simultaneously conflates fundamentally different institutional functions.

A more productive framing treats tokenization as an infrastructure layer that formalizes and clarifies existing institutional arrangements. Under this approach, code encodes procedures, not authority. Legal agreements, governance bodies, and regulatory oversight continue to define who can act, when they can act, and under what conditions their actions are legitimate. Automation reduces friction, but discretion remains grounded in established institutional decision-making processes.

This reframing also clarifies why many early tokenization efforts appear successful in pilot settings but struggle to scale. Proof-of-concept deployments often abstract away governance complexity, either by assuming benign conditions or by relying on informal intervention. At scale, these assumptions no longer hold. Institutional adoption requires that governance be explicit, auditable, and resilient under stress.

The challenge of real-world asset tokenization is therefore not one of technical maturity, but of institutional alignment. Systems that respect the division between automated execution and governed discretion are more likely to earn trust, attract capital, and endure over time.

7. Implications for Policymakers, Institutions, and Technologists

The structural limits of "code is law" have distinct implications for different stakeholders involved in real-world asset tokenization.

For policymakers and regulators, the analysis suggests that regulatory frameworks should focus less on the novelty of distributed ledgers and more on the governance arrangements that surround them. Tokenization does not eliminate the need for supervision; it reshapes where risks appear. Clear standards around accountability, control, and intervention are likely to matter more than prescriptive rules about technical architecture.

For institutional investors, the key implication is that adoption should be evaluated through a governance lens rather than a technological one. The relevant questions are not whether execution is automated, but whether authority is clearly allocated, fiduciary duties are preserved, and exception mechanisms are credible. Tokenized structures that mirror familiar institutional safeguards are more likely to integrate into portfolios than those that prioritize novelty over transparency and accountability.

For technologists and system designers, the implication is more corrective. Success in institutional markets depends less on eliminating trust than on formalizing it. Systems should be designed with explicit governance hooks: defined roles, override mechanisms, and clear interfaces between code and legal authority. Treating these as first-class design constraints — rather than compromises — increases the likelihood of real adoption at institutional scale.

The broader implication, across all stakeholders, is that tokenization is not a shortcut around institutional complexity. It is a discipline for making that complexity explicit, structured, and, where possible, more efficient. That is a harder and more valuable problem than the one "code is law" was meant to solve.

8. Conclusion

The idea that "code is law" captures an important insight about how technical systems shape behavior. But when elevated from metaphor to governing principle, it hides more than it explains — particularly in the context of real-world assets.

Real-world asset markets are built on incomplete contracts, discretionary judgment, and layered accountability. These features are not inefficiencies to be engineered away; they are the mechanisms through which uncertainty is managed and trust is sustained. Attempts to replace them with autonomous execution overlook the institutional conditions under which real-world asset value is created and protected.

The future of real-world asset tokenization lies not in eliminating governance, but in integrating automation within it. Code can enhance transparency, reduce friction, and improve operational efficiency. Law and governance determine legitimacy, responsibility, and resilience. Sustainable tokenization requires recognizing the distinct roles each plays — and designing systems that respect that distinction.

The failure of "code is law" is instructive rather than discouraging. It points toward a more realistic and durable path forward — one in which tokenization succeeds not by replacing institutions, but by working within them.

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