Research Note

Blockchain Trust Infrastructure for Contract Management

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This research note explores blockchain's potential as trust infrastructure that enables sustainable value exchange through stakeholder-driven validation. Current blockchain applications often emphasize speculation over practical utility. Our approach eliminates speculative elements by limiting participation to contract stakeholders, achieving alignment of interests called the user-as-stakeholder. We implement this model through Proof of Authority consensus combined with custom staking mechanisms. Experimental results demonstrate that contract parties can effectively validate their own transactions while maintaining security and reducing intermediary dependence. This approach provides a foundation for blockchain's original vision as a "shared foundation for co-creative society," where participants act simultaneously as stakeholders and users of the infrastructure they maintain.

1. Blockchain Industry Issues and Need for Return to Origins

1.1 Current Dependency on Third-Party Validation

Digital contracts have become mainstream. Companies worldwide have moved from paper to digital systems. Yet something fundamental hasn't changed: we still ask third parties for permission to validate our own agreements.

The question is straightforward: when a freelancer and client agree on project milestones, why can't they verify completion themselves? Why must the people who care most about successful collaboration depend on platforms that profit from processing volume, not successful outcomes? This fundamental disconnect—between those with the strongest incentive for accuracy and those who actually perform validation—reveals the core problem with our current approach to digital trust.

The digital transformation wave has accelerated adoption of digital contract systems across industries, yet beneath this digital veneer, the fundamental structure remains unchanged: contract parties still depend on third-party intermediaries for validation and trust. We have digitized the process without addressing the core inefficiency.

1.2 The Blockchain Industry's Similar Mistake

The blockchain industry faces the same fundamental issue. As @ohmzeus points out in "Web3: Crypto's Biggest Mistake"[1], the industry has shifted toward speculation and away from solving real-world problems. The proliferation of complex protocols and unnecessary financialization represents self-indulgent technology rather than genuine innovation.

Social infrastructure should be simple, understandable, and robust. The most powerful technologies often appear deceptively simple because they solve fundamental problems without creating new ones. TCP/IP protocols that form the internet's foundation exemplify this principle—their simple, open design enabled countless innovative applications to flourish. Blockchain can achieve true value by removing excessive complexity rather than adding more layers of abstraction.

Current blockchain faces structural problems that mirror traditional systems: infrastructure centralization creates bottlenecks that contradict decentralization ideals, with transaction processing concentrated among specific operators in some Layer 2 and rollup solutions. Major networks prioritize token value over user needs, and persistent tension exists between trustless ideals and practical compliance requirements.

1.3 The user-as-stakeholder Solution

The answer lies in returning to blockchain's original purpose: creating a shared foundation where stakeholders validate their own transactions. This isn't about building more complex technology—it's about rebuilding trust through proper incentive alignment.

Our research demonstrates this return to origins through the user-as-stakeholder model, implemented via Proof of Authority (PoA) consensus[2]. This model addresses a fundamental question: why should we trust external validators when the people with the most at stake—the actual contract parties—have the strongest incentives for honest validation?

Traditional third-party models create a fundamental misalignment because validators profit from processing volume rather than outcome quality, while their economic incentives remain disconnected from user needs. These systems also create single points of failure with potential censorship risks, and their processes remain opaque with limited user control. In contrast, the User-As-Stakeholder solution ensures that validators bear direct consequences of contract outcomes, creating natural economic alignment with accuracy and fairness through distributed validation without central bottlenecks, while maintaining transparent and auditable processes with full user control.

Figure 1 illustrates the traditional approach where contract parties (User A, User B) must rely on centralized institutions such as banks, escrow services, and notaries for validation, creating bottlenecks and single points of failure. In contrast, Figure 2 demonstrates our proposed architecture where contract parties become their own validators (User A=Validator A, User B=Validator B) through PoA consensus with aligned economic incentives.

These architectural differences (Figures 1 and 2) illustrate how traditional systems create bottlenecks through mandatory third-party validation, while our system enables direct stakeholder validation with properly aligned incentives.

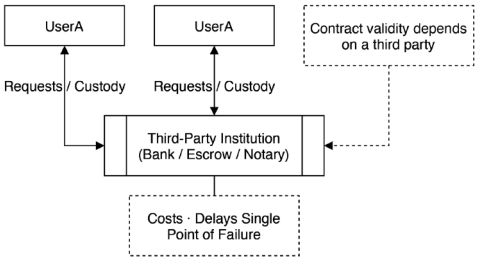

Figure 1: Traditional contract validation structure

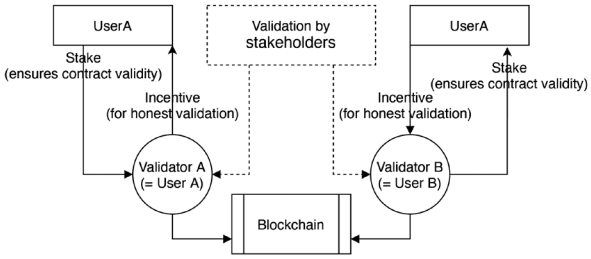

Figure 2: Proposed stakeholder-driven validation architecture

2. Technical Implementation and Results

2.1 Proof of Authority Architecture and Custom Staking

Our system implements this vision through Proof of Authority (PoA) consensus[2], which assigns validation rights to pre-approved stakeholders rather than anonymous miners. This approach provides three essential advantages. First, validators are known contract participants with reputational stakes, not anonymous entities optimizing for different goals. Second, the system requires no energy waste or speculative token economics, enabling straightforward validation by people who care about the outcomes. Third, it offers fast and predictable transaction processing without complex proof systems.

The fundamental difference lies in trust alignment. Instead of trusting unknown third parties, you trust the people who actually have direct stakes in successful outcomes. A freelancer and their client both want the contract to succeed and have every incentive to validate honestly, unlike traditional escrow services that profit regardless of contract success or failure.

2.2 Experimental Results and Validation

Our proof-of-concept experiments[4][5] demonstrated three critical capabilities that confirm the practical viability of stakeholder-driven validation.

The system proved its reliability and sustainability by successfully managing validator network changes without service interruption. Contract parties could join or leave the validation network seamlessly, demonstrating that the system maintains integrity even as its validator composition changes over time[4]. This addresses concerns about system availability and long-term operational stability.

Through custom smart contracts, the system demonstrated separation between consensus-layer validation and application-layer reward distribution. Stakeholders received validation rewards independent of the underlying PoA consensus mechanism, confirming the flexibility of the dual-layer architecture[4]. This separation allows for customized incentive structures tailored to specific business requirements.

The object-oriented smart contract design successfully created multiple contract instances from shared logic templates, demonstrating both code reusability and maintenance efficiency superior to monolithic approaches[4]. This modular architecture enables scalable deployment across different contract types and business contexts.

These results confirm that the approach is both technically sound and practically viable. Stakeholders can effectively validate their own transactions while maintaining system security and integrity. The system naturally prevents gaming because validators bear direct consequences of outcomes, eliminating the need for complex anti-fraud mechanisms.

2.3 Practical Application Example

Consider an international contract between a US client and Japanese developer. The traditional process requires multi-platform registration, cross-platform coordination, third-party authentication, complex escrow arrangements, and sequential approvals with potential delays at each stage. In contrast, the stakeholder-validated process enables direct contract creation on shared platform, permanent recording of terms and participants, and milestone-based validation without intermediary delays.

Figure 3 shows the traditional process requiring multi-platform registration, cross-platform coordination, third-party authentication, complex escrow arrangements, and sequential approvals with potential delays at each stage. In contrast, Figure 4 demonstrates our proposed approach where US clients and Japanese developers can create contracts directly on a shared platform and validate milestones without intermediary delays.

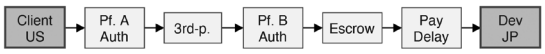

Figure 3: Traditional contract workflow for international freelance contracts

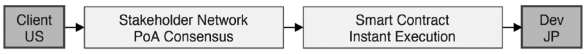

Figure 4: Proposed stakeholder validation workflow

This workflow comparison (Figures 3 and 4) illustrates how eliminating intermediary coordination reduces process complexity while maintaining security through stakeholder alignment and blockchain-based validation. This represents structural transformation that returns control to the people who actually care about the outcomes, rather than mere process optimization.

3. Toward Shared Foundation for Co-creative Society

3.1 Beyond Contract Management: Universal Application

The user-as-stakeholder model extends far beyond contract management. This approach applies wherever participants bear direct consequences of outcomes and can benefit from eliminating intermediary dependencies.

In supply chain verification, manufacturers, distributors, and retailers can validate product authenticity and compliance directly,

without relying on external certification bodies that may have different priorities. For professional services, lawyers, consultants, and clients can manage project deliverables and payments collaboratively, eliminating traditional billing disputes through transparent milestone validation. In international trade, exporters, importers, and logistics providers can coordinate complex multi-party transactions without traditional banking delays or excessive documentation requirements. For community governance, local stakeholder groups can manage shared resources through collective validation and decision-making processes, eliminating the need for external administrators.

When validators have direct stakes in successful outcomes, they naturally optimize for quality over quantity. This creates more reliable and efficient systems than traditional intermediary-based approaches, as validators' success directly depends on the success of the processes they validate.

3.2 The Vision: Shared Foundation for Co-creative Society

This approach represents more than technological innovation—it offers a pathway to genuine co-creative society. When stakeholders directly control validation of their own interactions, we eliminate the extractive intermediaries that currently profit from managing trust. Instead, trust becomes a shared resource maintained by those who benefit from its integrity.

The ultimate evolution envisions stakeholder communities forming Decentralized Autonomous Organization (DAO)[6] to govern validation processes collectively. This could fundamentally reshape how trust operates in digital commerce, moving away from dependency on extractive intermediaries toward systems where participants serve simultaneously as stakeholders and users.

3.3 Research Implications and Social Impact

Our proof-of-concept validates a core premise: contract parties can effectively validate their own transactions without sacrificing security[3][4][5]. This validation carries important implications for understanding how trust mechanisms can be restructured in digital systems.

The key insight is economic rather than technological: when validators are also contract beneficiaries, they optimize for successful outcomes rather than processing volume. This alignment creates natural incentives for accurate validation without requiring complex enforcement mechanisms.

This research demonstrates blockchain's potential to fulfill its foundational promise: enabling direct peer-to-peer collaboration without extractive intermediaries[3][4][5]. The significance lies not in technical innovation, but in social transformation—returning agency to the people who have the greatest stake in successful outcomes.

By proving that stakeholder-driven validation works in practice, this research challenges the assumption that trust requires neutral third parties. Instead, it suggests that the most trustworthy validators are often those with the most to gain from honest validation and the most to lose from failure. This insight has profound implications for how we design collaborative systems across industries and societies.

The success of such systems depends not on overcoming technical challenges, but on addressing institutional inertia that favors established intermediary systems. The path forward requires demonstrating practical value that stakeholders can directly experience, rather than promising theoretical benefits that may never materialize.

References

[1] Ohmzeus: "Web3: Crypto's Biggest Mistake," X (2024) https://x.com/ohmzeus/status/1919119965858521100 (Accessed 2025-08-27).

[2] G. Wood: "Kovan PoA Consensus Engine," GitHub Wiki https://github.com/kovan-testnet/kovan-scenarios/wiki/Kovan-PoA-Consensus-Engine (Accessed 2025-08-27).

[3] H. Fujimoto, A. Inoue, and K. Mitsubuchi: "Development of a Contract Management System Using Blockchain," IPSJ SIG Technical Report (2025), vol.2025-DPS-202, no.16 / vol.2025-CSEC-108, no.16, pp.1-8.

[4] H. Fujimoto, A. Inoue, and K. Mitsubuchi, "PoA-based Contract Management System with Custom Staking Mechanisms," CSS Conference, to appear, (2025).

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[6] S. Hassan and P. De Filippi: "Decentralized Autonomous Organization," Internet Policy Review (2021), vol.10, no.2, pp.1-10.