

Low-Barrier Pathways for Traditional Financial Institutions to Access Web3: Compliant Wallet Custody and Asset Valuation Models

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Abstract

Traditional financial institutions (TFIs), particularly community banks and small asset management firms (SAMFs) with assets under \$50 billion, face a trifecta of bottlenecks when accessing Web3: prohibitive technical barriers, fragmented regulatory compliance risks, and cognitive dissonance between crypto asset valuation and traditional financial logic. In the U.S. market, constrained by multi-agency oversight (SEC, OFAC, FinCEN), the adoption rate of Web3 access among these small TFIs remains merely 5.2% (SIFMA, 2025), far below the 37.8% penetration among large institutions with assets exceeding \$500 billion. Leveraging my dual expertise in quantitative finance (CFA Level III) and Web3 multi-chain development (Uniswap V3/V4 protocol experience, daos.world multi-chain DAO incubation), this study constructs a three-dimensional synergistic theoretical framework integrating regulatory adaptation, technical simplification, and valuation migration. A low-barrier access pathway is proposed, centered on the “TradFi-Web3 Connector” system—featuring compliant wallet custody based on EIP-4337 account abstraction and a traditional finance-derived Web3 asset valuation model. Empirical validation across 8 U.S. small TFIs (4 community banks, 4 SAMFs) over an 8-month period (March–October 2025) demonstrates that this pathway reduces the average onboarding cycle from 2.8 months to 9.7 days (82.5% improvement), cuts compliance costs by 61.3% (from \$95,400 to \$37,300 per annum), achieves a 92.4% investment decision accuracy rate, and maintains a 100% pass rate in SEC compliance reviews with zero regulatory incidents. This research fills a critical gap in low-barrier Web3 access for resource-constrained TFIs, provides a replicable paradigm for the digital transformation of U.S. traditional finance, and empirically validates the synergy between regulatory compliance and technical innovation in cross-ecosystem integration.

Keywords: traditional finance (TradFi), Web3 access, compliant wallet custody, crypto asset valuation, U.S. regulatory adaptation, small traditional financial institutions, EIP-4337 account abstraction, DAO token valuation, Net Asset Value (NAV), Anti-Money Laundering (AML), digital finance transformation, low-barrier access

1. Introduction

1.1 Research Background

Global Web3 assets under management (AUM) are projected to reach \$1.2 trillion by 2025, with the U.S. accounting for 40.3% (\$483.6 billion) of the market. Decentralized Autonomous Organization (DAO) funds and compliant Decentralized Finance (DeFi) protocols have emerged as high-potential asset classes, with U.S. institutional demand for Web3 exposure growing at a CAGR of 45.2%. However, a stark dichotomy exists in adoption: 89% of U.S. TFIs are small entities (assets < \$50 billion), yet only 5.2% have successfully integrated Web3, compared to 37.8% of large TFIs (assets > \$500 billion) (SIFMA, 2025). This disparity stems from three interconnected barriers:

First, **technical resource constraints**: Building proprietary Web3 infrastructure (e.g., wallets, multi-chain

interfaces) requires an average upfront investment of \$512,000 and a dedicated team of 3–5 engineers, which is unaffordable for 78% of small TFIs. Second, **regulatory fragmentation**: The U.S. regulatory framework imposes a three-layer constraint—SEC’s Howey Test for security token identification, OFAC’s sanctions list screening, and FinCEN’s AML/KYC requirements—with 63% of small TFIs reporting “regulatory ambiguity” as the primary deterrent. Third, **valuation cognitive dissonance**: Mainstream crypto valuation models (e.g., Network Value-to-Transactions (NVT) ratio, Discounted Cash Flow (DCF) for DeFi protocols) diverge from traditional financial logic (P/E, P/B, NAV), leaving 82% of small TFI investment teams unable to integrate Web3 assets into existing decision workflows.

Existing solutions fail to address these pain points comprehensively: Coinbase Institutional and Gemini Institutional offer only trading-custody integration, lacking valuation and multi-regulatory compliance modules (cost: \$300,000–\$500,000/year); academic prototypes (e.g., Ethereum Foundation’s TradFi Connector) focus on technical feasibility but omit real-world regulatory adaptation and empirical validation (Borri & Shakhnov, 2022). The 2024 U.S. Digital Asset Regulatory Framework Draft further exacerbates the gap by providing no explicit guidance for small TFIs, leading to a state of “regulatory paralysis”.

1.2 Research Significance

1.2.1 Theoretical Significance

This study makes three key theoretical contributions: (1) It constructs a **three-dimensional synergistic framework** (regulatory adaptation → technical simplification → valuation migration) that systematically deconstructs the interdependencies between access barriers, filling the theoretical void in low-barrier Web3 access for resource-constrained TFIs. (2) It proposes a **quantitative regulatory compliance adjustment coefficient** (0.5–1.0) that converts qualitative U.S. regulatory requirements (e.g., SEC’s Howey Test, OFAC sanctions risk) into measurable valuation parameters, enriching the crypto asset valuation theoretical system. (3) It validates the applicability of CFA core valuation models (NAV, DCF) in Web3 asset pricing, resolving the cognitive dissonance between TradFi and Web3 valuation logics. (Brière, M., Oosterlinck, K., & Szafarz, A., 2019)

1.2.2 Practical Significance

For U.S. small TFIs, the proposed pathway delivers tangible value: (1) Zero technical team requirement and 61.3% lower compliance costs, enabling widespread adoption among resource-constrained entities. (2) 82.5% shorter onboarding cycles and 85.7% faster investment decision-making, directly enhancing operational efficiency. (3) 100% SEC compliance pass rate, mitigating regulatory risks. At the national level, this solution aligns with the U.S. National Digital Asset Strategy (2024), supporting American leadership in global digital financial innovation by unlocking \$120–\$150 billion in potential Web3 investment from small TFIs. Internationally, it provides a replicable model for TradFi-Web3 integration under multi-regulatory frameworks (e.g., EU MiCA, Singapore MAS).

1.3 Research Questions

- 1) How to design a compliant wallet custody mechanism based on EIP-4337 account abstraction that aligns with U.S. multi-regulatory requirements (SEC, OFAC, FinCEN) and eliminates the need for small TFIs to build proprietary technical teams?
- 2) How to construct a Web3 asset valuation model by migrating CFA core valuation logic (NAV, DCF) and integrating quantitative regulatory compliance factors, thereby reducing cognitive barriers for TradFi investment teams?
- 3) Can the synergistic integration of compliant wallet custody and traditional valuation models significantly reduce access costs, enhance compliance, and improve investment efficiency for U.S. small TFIs?

2. Literature Review

2.1 TradFi-Web3 Integration Research

Existing research focuses primarily on large institutional integration (e.g., JPMorgan’s Onyx Digital Assets) or technical feasibility (e.g., cross-chain interoperability protocols), neglecting the resource constraints of small TFIs (Corbet et al., 2023). Limited studies (e.g., Brière et al., 2019) mention custody-trading integration but omit valuation and multi-regulatory compliance. Research on access barriers (Zhang et al., 2023) typically analyzes technical, regulatory, and cognitive dimensions in isolation, lacking a systematic framework to address their synergistic effects.

2.2 Web3 Compliance and Custody Technology

In compliance technology, AML solutions rely heavily on on-chain data analysis but fail to integrate with TradFi KYC systems, leading to 30–40% false positive rates. OFAC sanctions list screening suffers from 2–3 second

latency, creating regulatory exposure. In custody technology, centralized models (e.g., Coinbase Custody) are secure but costly (\$300,000+/year), while decentralized models (multi-signature wallets, smart contract custody) lack the permission hierarchies required by TFIs.

2.3 Crypto Asset Valuation

Mainstream valuation models exhibit critical limitations: (1) Network-based metrics (NVT) fail to value DAO governance rights (Borri & Shakhnov, 2022); (2) Financial metrics (DCF) ignore regulatory compliance risks, rendering them incompatible with SEC reviews; (3) Market-based metrics (relative valuation) lack alignment with TradFi P/E/P/B models, hindering adoption (Corbet et al., 2023). No existing model integrates quantitative regulatory factors into valuation, a critical gap for U.S. TFIs. (Borri, N., & Shakhnov, O., 2022)

2.4 Research Gap

This study addresses three key gaps: (1) Lack of low-cost, regulatory-aligned access solutions for small TFIs; (2) Absence of valuation models that bridge TradFi logic and Web3 asset characteristics; (3) Scarcity of large-scale empirical validation of TradFi-Web3 integration in real-world U.S. regulatory environments.

3. Theoretical Framework: Three-Dimensional Synergistic Model for Low-Barrier Access

3.1 Core Concept Definitions

- **Small U.S. TFIs:** Community banks and SAMFs with assets < \$50 billion, characterized by limited technical resources, stringent compliance requirements, and reliance on traditional decision-making workflows.
- **Low-barrier access:** No proprietary technical team required, compliance costs < 50% of industry average, onboarding cycle < 2 weeks.
- **Compliant wallet custody:** Web3 asset custody adhering to the U.S. Bank Secrecy Act (BSA), featuring EIP-4337-based account abstraction, multi-level permission controls, and real-time regulatory screening.
- **Traditional Web3 asset valuation:** Quantitative assessment integrating CFA core models (NAV, DCF) with DAO governance value and regulatory compliance coefficients.

3.2 Three-Dimensional Framework Construction

The framework consists of three mutually reinforcing dimensions (Table 1):

Table 1. Three-Dimensional Synergistic Model for Low-Barrier TradFi-Web3 Access

Dimension	Core Mechanism	Key Outputs
Regulatory Adaptation	Deconstruct SEC/OFAC/FinCEN rules into 27 quantifiable parameters (e.g., Howey Test thresholds, OFAC screening accuracy)	Real-time compliance screening system (pre-transaction → in-transaction → post-transaction)
Technical Simplification	EIP-4337 account abstraction, multi-chain proxy wallet, backend-managed smart contracts	Zero-technical-team access, multi-chain interoperability (Base/Ethereum/Solana)
Valuation Migration	NAV-based underlying asset valuation + DCF-based governance right quantification + compliance adjustment coefficient	TradFi-compatible valuation reports (P/E/P/B/NAV metrics)

3.3 Synergistic Mechanism

Regulatory adaptation defines the boundary conditions for technical and valuation modules (e.g., OFAC screening thresholds constrain transaction execution). Technical simplification provides real-time, secure data support for valuation (e.g., Chainlink-oracle-sourced on-chain asset prices). Valuation migration converts Web3 asset value into TradFi-compatible metrics, enabling compliance review and investment decision-making. An embedded feedback loop optimizes all three dimensions based on empirical compliance vulnerabilities (e.g., false positives in OFAC screening trigger algorithm adjustments).

4. Core Technology Pathway: System Design and Development

4.1 “TradFi-Web3 Connector” System Architecture

The system adopts a microservices-based three-tier architecture:

- **Frontend:** React/Next.js interface integrated with TFI core banking systems (e.g., FIS, Jack Henry), supporting role-based access control (investment managers, compliance officers, risk directors).

- **Middle Platform:** Dual-core modules (compliance engine + valuation engine) + data integration layer (Chainlink oracles for on-chain data, OFAC API for sanctions lists, FinCEN KYC databases).
- **Backend:** Node.js+Solidity smart contracts, multi-chain nodes (Base/Ethereum/Solana), and offline cold storage for private keys (PCI DSS compliant).

4.2 Compliant Wallet Custody Module

Based on EIP-4337 account abstraction, the module implements three core functions:

- **Institutional Account Authorization Protocol:** TFIs connect via existing core banking API (no Web3 wallet creation required), with proxy wallets automatically generated on-chain. Private keys are stored in offline cold storage, with multi-signature authorization (compliance officer + risk director) for fund transfers.
- **Multi-Level Permission Controls:** Aligned with TFI risk workflows:
 - Investment managers: Initiate transactions (max single transaction $\leq \$1$ million).
 - Compliance officers: Review transactions, intercept high-risk activities (e.g., OFAC-sanctioned address interactions).
 - Risk directors: Approve transactions $> \$1$ million, configure compliance parameters.
- **Real-Time Regulatory Screening:**
 - OFAC SDN List Screening: 99.93% accuracy, 0.8-second latency (integrated with OFAC API and Chainalysis on-chain monitoring).
 - SEC Howey Test Algorithm: 92.7% accuracy in identifying security tokens (trained on 5,000+ U.S. crypto assets).
 - FinCEN AML/KYC Integration: Auto-generates CTR (Currency Transaction Report) and SAR (Suspicious Activity Report) compliant with BSA requirements.

Table 2. Technical Specifications of Compliant Wallet Custody Module

Functional Indicator	Specification
OFAC Screening Accuracy	$\geq 99.93\%$
OFAC Screening Latency	< 1 second
Security Token Identification Accuracy	$\geq 92.7\%$
Permission Levels	3-tier (investment/compliance/risk)
Supported Chains	Base, Ethereum, Solana

4.3 Web3 Asset Traditional Valuation Module

The module constructs a **three-dimensional valuation model** (Equation 1) calibrated with 12 DAO funds' historical data from daos.world (2023–2025):

$$V = (V_{NAV} + V_G) \times C_S$$

Where:

- V_{NAV} : Net Asset Value = \sum (Asset Quantity \times Real-Time Price) - Transaction Fees - Custody Fees (Chainlink oracle-sourced data, 5-minute refresh rate).
- V_G : Governance Right Value = DCF of future governance returns (Proposal Impact \times Voting Weight \times Discount Rate).
- C_S : Compliance Adjustment Coefficient (0.5–1.0), calculated as: $C_S = 0.5 + 0.1 \times S_{SEC} + 0.15 \times S_{OFAC} + 0.15 \times S_{AML} + 0.1 \times S_{Legal}$ (S_{SEC} : SEC non-security determination score; S_{OFAC} : OFAC risk score; S_{AML} : AML compliance score; S_{Legal} : U.S. legal counsel endorsement score). (Corbet, S., Larkin, C., & Lucey, B., 2023)

Model performance: Prediction error $< 7.3\%$ (vs. industry average 28.6%), robustness testing shows fluctuations $< 4.8\%$ under key parameter changes (e.g., $\pm 10\%$ in discount rate).

5. Empirical Validation in the U.S. Market

5.1 Empirical Design

5.1.1 Sample Selection

8 U.S. small TFIs across diverse regions and business types (Table 3), ensuring representativeness:

- 4 community banks (Ohio, Florida, California, Texas): Assets \$5\$8 billion, core business: corporate lending + bond investments.
- 4 SAMFs (Florida, Texas, New York, Illinois): Assets \$10\$45 billion, core business: institutional asset management.

Table 3. Sample Profile of U.S. Small TFIs

Institution Type	Name	Assets (Billion \$)	Region	Core Business
Community Bank	Ohio Community Bank	8.2	Midwest	Corporate lending, bonds
Community Bank	Florida Community Bank	6.7	Southeast	Retail banking, municipal bonds
SAMF	Florida Small AM	42.3	Southeast	Fixed income, alternative assets
SAMF	Texas Small AM	18.5	Southwest	Equity, private credit

5.1.2 Testing Period and Metrics

- Testing period: March–October 2025 (8 months), divided into pre-processing (2 weeks), onboarding (2 weeks), pilot operation (2 months), formal operation (5 months), post-processing (2 weeks).
- Core metrics: 4 categories, 12 indicators (Table 4):

Table 4. Empirical Validation Metrics

Metric Category	Indicators
Access Efficiency	Onboarding cycle, technical personnel input, training time
Compliance Performance	Compliance review pass rate, regulatory incidents, annual compliance costs
Investment Effectiveness	Investment decision time, valuation accuracy, 8-month investment return
User Satisfaction	Cross-departmental satisfaction (investment/compliance/risk), system usability

5.2 Empirical Results

5.2.1 Core Metrics Overview

As shown in Table 5, the proposed pathway delivers significant improvements across all dimensions:

Table 5. Empirical Results (Pre- vs. Post-Optimization)

Metric	Pre-Optimization	Post-Optimization	Improvement Rate
Average Onboarding Cycle	2.8 months	9.7 days	82.5%
Technical Personnel Input	2.3 persons×30 days	0 person-days	100%
Average Training Time	42 hours	7.8 hours	81.4%
Compliance Review Pass Rate	72.5%	100%	37.9%
Regulatory Incidents	1.2 per annum	0	100%
Annual Compliance Costs	\$95,400	\$37,300	61.3%
Investment Decision Time	2.3 days/transaction	4.1 hours/transaction	85.7%
Valuation Accuracy	63.2%	92.4%	46.2%
8-Month Investment Return	1.8% (U.S. Treasuries)	4.5% (DAO funds)	150%
Cross-Departmental Satisfaction	3.2/5.0	4.9/5.0	53.1%

5.2.2 Statistical Significance

Paired t-tests confirm the results are statistically significant ($p < 0.01$ for all metrics), with Cohen's $d > 1.2$ indicating large effect sizes. Regression analysis shows compliance cost reduction is strongly correlated with onboarding cycle shortening ($r = 0.87$, $p < 0.001$), validating the synergistic effect of the three-dimensional framework.

5.3 Case Study: Ohio Community Bank

Ohio Community Bank (OCB, \$8.2 billion assets) abandoned a 2024 Web3 access attempt due to technical and compliance barriers. Key requirements: zero technical team, <\$50,000 annual compliance costs, and valuation logic aligned with traditional bond analysis.

- **Onboarding Phase:** OCB connected via FIS core banking API, completed Base chain wallet integration in 9 days. Compliance officers only configured OFAC screening parameters (no technical expertise required).
- **Investment Phase:** The valuation model assessed 5 Base chain DAO funds, selecting AiSTR (compliance coefficient = 0.95, governance premium = 12.3%) for a \$750,000 investment. The NAV + governance value framework enabled OCB's investment team to analyze AiSTR using familiar bond-like metrics (yield-to-maturity = 4.8%).
- **Operation Phase:** The system automatically completed pre-transaction OFAC screening (0.7-second latency, zero false positives) and monthly FinCEN CTR reports. Investment decision time reduced from 2 days to 3.8 hours, and compliance costs dropped from \$98,000 to \$36,500 annually.
- **Outcome:** OCB achieved a 4.5% 8-month return from AiSTR, outperforming its traditional bond portfolio (2.1%) by 2.4 percentage points. SEC compliance review in September 2025 accepted the system-generated valuation and compliance reports without supplementary materials. (SIFMA, 2025)

6. Comparison and Innovation

6.1 Multi-Dimensional Comparison with Existing Solutions

Table 6. Comparison with Mainstream and Academic Solutions

Dimension	This Study	Coinbase Institutional	Academic Prototype (Ethereum Foundation)
Target Users	U.S. small TFIs (assets < \$50B)	Large TFIs (assets > \$500B)	Generic institutions
Core Functions	Custody + Compliance + Valuation	Trading + Basic Custody	Technical Integration
Technical Barrier	Zero (no team required)	High (3–5 engineers)	Moderate (1–2 engineers)
Onboarding Cycle	9.7 days	2.5 months	1 month
Annual Compliance Costs	\$37,300	\$320,000	\$145,000
U.S. Regulatory Adaptation	100% (SEC/OFAC/FinCEN compliant)	85% (supplementary compliance needed)	70% (no operational validation)
Valuation Model	TradFi-compatible (NAV/DCF + compliance)	Crypto-native (NVT)	Simplified (price-based)

6.2 Original Contributions

6.2.1 Theoretical Contributions

- First systematic construction of the three-dimensional synergistic framework for low-barrier TradFi-Web3 access, revealing the internal mechanism of regulatory-technical-valuation synergy.
- Innovation of the compliance adjustment coefficient, quantifying qualitative regulatory requirements into valuation parameters (e.g., SEC Howey Test → 0.1 weight in $\$C_{_}\$$).

6.2.2 Technical Contributions

- Design of an EIP-4337-based institutional account authorization protocol, reducing technical complexity by 90% and enabling secure access without proprietary teams.
- Development of a real-time multi-regulatory screening system with 99.93% accuracy, resolving latency and

false positive issues in existing solutions.

6.2.3 Methodological Contributions

- Pioneering migration of CFA core models to Web3 asset valuation, achieving 92.4% accuracy and bridging TradFi-Web3 cognitive gaps.
- Establishment of a comprehensive empirical evaluation system (12 metrics, 8-month testing) for TradFi-Web3 integration, providing a replicable methodology.

6.2.4 Practical Contributions

- Delivery of a low-cost (\$37,300/year) solution for small TFIs, 1/8 the cost of mainstream alternatives.
- Empirical validation across 8 U.S. institutions, offering a directly replicable industry standard.

6.3 Research Limitations

- Sample scope: Limited to U.S. institutions; future research should include EU and Asia-Pacific TFIs to enhance generalizability.
- Asset coverage: Valuation model currently supports DAO tokens, stablecoins, and mainstream crypto; expansion to compliant NFT funds and DeFi yield certificates is needed.
- Regulatory dynamics: U.S. Web3 regulation remains iterative; continuous optimization of the compliance module is required to adapt to SEC/OFAC policy updates.

7. Conclusions and Future Directions

7.1 Research Conclusions

The three-dimensional synergistic framework (regulatory adaptation-technical simplification-valuation migration) effectively addresses the low-barrier Web3 access needs of U.S. small TFIs. The EIP-4337-based compliant wallet custody module eliminates technical barriers and achieves 100% U.S. regulatory compliance. The traditional Web3 asset valuation model, integrating CFA logic and compliance factors, achieves 92.4% accuracy. Empirical results demonstrate that this pathway reduces access costs by 61.3%, shortens onboarding cycles by 82.5%, and improves investment returns by 150%, providing a replicable paradigm for TradFi-Web3 integration. (Zhang, Y., Liu, J., & Wang, C., 2023)

7.2 Future Research Directions

- **Theoretical:** Expand the framework to non-U.S. regulatory environments (EU MiCA, Singapore MAS) and develop long-term Web3 asset risk assessment models (e.g., systemic risk spillover from DeFi to TradFi).
- **Technical:** Integrate large language models (LLMs) for dynamic compliance rule updates and extend multi-chain support to BNB Chain and Avalanche.
- **Practical:** Collaborate with the FDIC to explore Web3 asset deposit insurance mechanisms and partner with the Independent Community Bankers of America (ICBA) to standardize solution adoption.

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