Fiduciary Duty Fulfillment in Web3: A DAO Investment Framework for U.S. Financial Advisors

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Abstract: *U.S. financial advisors face significant challenges in fulfilling their fiduciary duties under the SEC's Regulation Best Interest (Reg BI) when recommending DAO investments. The core pain points concentrate on three aspects: the lack of specialized DAO risk assessment tools, difficulties in regulatory compliance verification, and the absence of standardized methods for client profile matching. Integrating insights from traditional finance-Web3 convergence, DAO governance practices, and professional financial qualifications, this study constructs a Web3 fiduciary duty framework encompassing DAO risk quantification, regulatory compliance verification, client profile matching, and asset custody transparency. The framework generates a standardized score ranging from 1 to 10 through 27 exclusive risk indicators, integrates a multi-agency regulatory requirement verification mechanism, achieves precise alignment between DAO investments and clients' risk profiles, and ensures full-process transparency via on-chain tracking. Empirical testing across 6 U.S. financial advisory firms and 10 client investment portfolios over 5 months demonstrates that the framework increases DAO risk assessment accuracy by 47.2%, reduces fiduciary duty risk by 68.3%, improves client satisfaction by 35.6%, and shortens due diligence time from 21 days to 5 days. This research fills the theoretical and practical gaps in fiduciary duty fulfillment for Web3 investments, realizes the organic integration of traditional financial fiduciary standards with Web3 technical characteristics, and provides deployable technical solutions and operational guidelines. It aims to unlock $50-60 billion in potential retail capital for DAOs, promote DAO ecosystem innovation while strengthening investor protection, and align with the U.S. orientation toward Web3 retailization.*

Keywords: Fiduciary Duty; U.S. Financial Advisors; DAO Investment; SEC Regulation Best Interest; Retail Web3.

1. Introduction

1.1 Research Background

DAOs have emerged as mainstream alternative investment vehicles. By 2025, 23% of high-net-worth clients in the United States will request their financial advisors to recommend DAO investments, yet 78% of advisors decline due to fiduciary duty concerns. [1] Among these, 62% lack risk assessment tools, 58% cannot confirm compliance with regulators such as the SEC and OFAC, and 53% struggle to match client risk profiles. Despite top investment DAOs managing over \$^{12} billion in assets under management (AUM), the mandatory requirements of the SEC's Regulation Best Interest and 17 enforcement actions in 2024 with an average penalty of $1.2 million continue to deter advisors. The lack of governance accountability exposed by "The DAO incident" in 2016 persists, and of the projected $180 billion in retail

capital available for DAO investments by 2026, $50-60 billion remains idle due to advisor inaction.[2]

1.2 Research Gaps

Existing studies focus on traditional investments or general crypto assets, failing to address the unique challenges posed by DAOs, such as governance centralization risk, smart contract vulnerabilities, ambiguous regulatory classification, and pseudo-decentralization. [3] No research has systematically integrated the four core obligations of SEC rules—disclosure, prudence, conflict of interest mitigation, and compliance—with DAO governance mechanisms. Technically, there is a lack of quantitative tools for dimensions like voting concentration, audit status, and liquidity, as well as standardized frameworks for verifying cross-agency regulatory compliance. Empirically, no data confirms the practical effects of structured frameworks on advisors' compliance rates, client satisfaction, or reduction in fiduciary risk, particularly across different DAO types.[4]

1.3 Research Questions and Contributions

This study focuses on three key questions: How to construct a Web3 fiduciary duty framework integrating regulatory requirements, DAO risk quantification, compliance verification, and client profile matching? Can this framework improve advisors' risk assessment accuracy, reduce fiduciary risk, and apply to different DAO types? What are the implementation barriers and best practices for U.S. financial advisors adopting this framework? [5] Theoretically, it is the first to propose an integrated framework for operationalizing regulatory rules and quantifying DAO risks into actionable indicators. Technically, it develops an on-chain risk assessment engine with 27 indicators and compliance verification tools. Empirically, it quantifies the framework's effects through testing across multiple advisory firms and investment portfolios. Practically, it provides deployable solutions to protect investors while unlocking potential retail capital.[6]

2. Literature Review

2.1 Fiduciary Duty of U.S. Financial Advisors: From Traditional Finance to Web3

The SEC's Regulation Best Interest explicitly mandates that financial advisors fulfill four core obligations: disclosure, prudence, conflict of interest mitigation, and compliance. [7] Existing studies primarily focus on traditional investments and fail to fully cover DAO-specific risks such as smart contract failures and governance deadlocks. While CFA Standards provide an ethical foundation for bridging traditional finance and Web3, current research on crypto asset fiduciary duty does not address DAO's core pain points—including the lack of governance accountability exposed by The DAO incident, the complexity of token economic mechanisms, and the ambiguous regulatory distinction between security and utility tokens. [8]

2.2 DAO Governance, Risk, and Regulatory Compliance

DAOs rely on smart contracts to implement decentralized decision-making, with mainstream models including token voting, multi-signature treasuries, and proposal-based governance. [9] Core risks concentrate on power centralization, excessive team liquidity, and pseudo-decentralization. Existing studies categorize DAO risks into four types: governance risks (power centralization and lack of accountability), contract risks (code vulnerabilities and insufficient audits), regulatory risks (securities classification via the Howey Test, OFAC sanctions, and anti-money laundering requirements), and liquidity risks (low trading volume and liquidity pool collapse). The SEC uses the Howey Test to

determine if DAO tokens qualify as securities, while OFAC sanction screenings and FinCEN anti-money laundering (AML) requirements further complicate compliance. [10] However, the market lacks standardized verification frameworks directly applicable to financial advisors.[11]

2.3 Theoretical Foundations and Practical Barriers of Web3 Fiduciary Duty

Web3's "read/write/own" paradigm reconstructs the connotation of fiduciary duty, requiring advisors to balance clients' digital asset ownership, on-chain transparency, and governance participation rights.[12] Modern Portfolio Theory (MPT) provides a methodological basis for matching DAO investments with clients' risk-return profiles, but in practice, advisors face three key barriers: the lack of specialized DAO risk quantification tools, difficulties in multi-dimensional regulatory verification, and investment adaptation challenges due to insufficient client awareness. These issues are further exacerbated by technical complexity and regulatory uncertainty.[13] The reconstruction of fiduciary duty in Web3 requires not only legal interpretation but also technical observability of decentralized activities. Sun & Ortiz (2024) demonstrate how AI-based systems utilizing IoT sensors and Large Language Models (LLMs) can achieve precise tracking of complex activities in physical environments [14]. Similarly, the fiduciary framework proposed in this study adopts a 'digital governance sensor' logic, utilizing automated triggers to monitor DAO proposal anomalies and treasury flows, thereby bridging the gap between raw on-chain data and actionable fiduciary oversight.

3. Theoretical Framework: A Fiduciary Duty System for DAO Investments in Web3

3.1 Core Concept Definition

Web3 fiduciary duty refers to the obligations of financial advisors under the SEC's Regulation Best Interest when recommending DAO investments, covering four dimensions: DAO risk quantification, regulatory compliance verification, client profile matching, and asset custody transparency. Risk quantification converts governance centralization, contract vulnerabilities, regulatory, and liquidity risks into standardized scores through exclusive indicators. Compliance verification checks SEC securities classification, OFAC sanctions, and FinCEN AML requirements via standardized processes. Client profile matching achieves precise alignment based on risk tolerance, investment objectives, and time horizons. Asset custody transparency ensures full-process traceability through on-chain tracking.

3.2 Theoretical Foundations

The framework is supported by SEC rule adaptation, DAO governance theory, risk management theory, and Modern Portfolio Theory. SEC rule adaptation translates the obligations of disclosure, prudence, conflict of interest mitigation, and compliance into specific requirements for DAO investments. DAO governance theory incorporates decentralized decision-making and accountability to address historically exposed governance flaws. Risk management theory adopts mature frameworks to quantify risks and develop mitigation measures. Modern Portfolio Theory integrates DAOs into overall portfolios for scientific allocation based on risk-return characteristics.

3.3 Construction of the Four-Dimensional Framework

The risk quantification dimension covers four categories of indicators: governance, smart contract, regulatory, and liquidity. The integration of quantitative indicators is essential for translating DAO volatility into professional risk metrics. This methodology aligns with recent advancements in AI-driven economic applications, where machine learning models have significantly optimized stock trading,

market trend analysis, and institutional risk management [15]. By extending the predictive capabilities of AI—similar to those used in traditional equity markets—this framework empowers U.S. financial advisors to anticipate DAO liquidity collapses or governance deadlocks before they result in client capital loss. Weights are assigned using the Analytic Hierarchy Process (AHP). Governance risk focuses on voting concentration and core team stability; smart contract risk emphasizes audit quality and vulnerability severity; regulatory risk verifies securities classification, sanction associations, and AML compliance; liquidity risk assesses trading volume, Total Value Locked (TVL) volatility, and lock-up periods. The final output is a three-tier scoring system (low, medium, high). [16] The compliance verification dimension integrates professional tools and on-chain analysis to standardize checks against SEC, OFAC, and FinCEN requirements, with only DAOs with high pass rates entering the recommendation list. The client profile matching dimension aligns risk scores with client characteristics: low-risk clients are matched with low-score DAOs with strict position limits, medium-risk clients with balanced allocations, high-risk clients with moderate exposure to innovative DAOs (e.g., AI, meme), and extremely high-score DAOs are excluded. To ensure the reliability of the 10-point risk score, this study incorporates a multi-dimensional weighting logic. The use of ensemble learning and diagnostic modeling—successfully applied by Yin (2025) in semiconductor manufacturing for fault detection and severity classification [17]—provides a robust template for our DAO risk engine. By adapting Stacking Classifier principles and Explainable AI (XAI), our framework ensures that 'High-Risk' DAO classifications are not only accurate but also fully explainable to regulators, meeting the 'Disclosure' and 'Prudence' obligations under SEC Reg BI.The asset custody transparency dimension enables on-chain tracking of fund flows, regular disclosure of governance votes and return reports, and provision of compliant monthly reports.

3.4 Dynamic Operation Mechanism

The framework operates as follows: Upon entering a DAO address, the system automatically retrieves on-chain data to generate a risk score, conducts three regulatory compliance checks to output a pass rate, generates recommendation conclusions based on client profile data, enables full-process investment tracking via smart contracts and automatic generation of compliant reports, and real-time updates risk and compliance status with immediate alerts for significant changes—ensuring ongoing alignment with regulatory requirements and client interests.[18]

4. Technical Solution Design

4.1 System Architecture

The system adopts a three-tier architecture to ensure functional completeness and operational efficiency. [19] The front-end, developed using the React/TypeScript tech stack, includes an advisor dashboard (integrating risk assessment, compliance verification, client management, and report generation with multi-dimensional data visualization and one-click operations) and a client portal (focused on investment tracking, performance queries, and educational resources, with an intuitive interface supporting multi-device access). [20] The middle layer comprises four core modules (Risk Quantification Engine, Compliance Verification Engine, Client Matching Engine, Transparency Reporting Engine) and a unified data integration layer that synchronizes with six key data sources (professional compliance tool APIs, regulatory rule databases, client CRM systems, on-chain data platforms, audit databases, etc.) to ensure comprehensive and real-time data access. The back-end uses a dual-server architecture (Node.js and Flask) for algorithm execution and business processing, combined with Solidity smart contracts for on-chain tracking and multi-signature verification. Compliance documents and client reports are stored in the IPFS distributed system, while structured

data is managed via PostgreSQL. Data read/write response time is ≤ 0.5 seconds, supporting over 100 concurrent requests per second.[21]

Module/Component	Core Functions/Features
Application Servers	Algorithm execution and business processing
Smart Contract Layer	On-chain tracking and multi-signature verification
Distributed Storage	Storage of compliance documents and client reports
Structured Database	Management of structured business data

4.2 Core Technical Modules

4.2.1 DAO Risk Quantification Engine

The engine constructs a comprehensive evaluation system covering 27 indicators across four categories: governance (7 indicators including voting Gini coefficient, core team holdings ratio, and proposal approval rate), smart contract (6 indicators including audit firm reputation, number of vulnerabilities, and bug bounty program scale), regulatory (5 indicators including Howey Test compatibility score and compliance history), and liquidity (9 indicators including trading volume trends, TVL volatility, and liquidity pool composition). [22] Data sources include on-chain analytics platforms (for governance and liquidity data), professional audit databases (for audit information), compliance analysis tools (for regulatory risk data), and exclusive APIs (for DAO operational data), with real-time synchronization to ensure timeliness. The engine outputs a precise risk score (1-10), detailed sub-dimensional reports, and customized risk mitigation recommendations for high-risk indicators, with a scoring error rate ≤ 2.3%.[23]

4.2.2 Regulatory Compliance Verification Engine

The engine automates end-to-end verification for three key regulatory requirements: For SEC compliance, it uses deep learning algorithms to analyze three core dimensions (token functionality, governance rights, profit expectations) and generate a Howey Test compatibility score (0-100) with 93.7% accuracy, enabling precise distinction between security and non-security DAO tokens.[24] For OFAC compliance, it integrates SDN List APIs and on-chain address screening tools to conduct comprehensive verification of DAO transaction addresses, achieving 99.9% screening accuracy for real-time identification of transactions involving sanctioned entities. For FinCEN compliance, it verifies the completeness of DAO AML processes and investor identity verification rates via professional compliance tool APIs to ensure adherence to AML regulations. The final output includes a compliance pass rate (100-point scale) and a detailed SEC compliance report highlighting strengths and potential risks, with report generation time ≤ 15 minutes.[25]

4.2.3 Client Profile Matching Engine

The engine is based on three core client data dimensions: risk tolerance (1-5 levels), investment objectives (growth/income/preservation), and investment horizon (short-term: <2 years, medium-term: 2-10 years, long-term: >10 years). Data is seamlessly integrated with client CRM systems with a synchronization delay ≤ 30 seconds. Leveraging Modern Portfolio Theory, it develops an adaptation algorithm to conduct multi-dimensional matching between client profile data and DAO risk scores, outputting three clear conclusions: "Recommend," "Recommend with Disclosure," or "Do Not Recommend." It also automatically identifies potential conflicts of interest for advisors (e.g., holding

tokens of recommended DAOs, collaborative relationships with DAO projects) and generates standardized disclosure templates. The algorithm achieves 91.5% adaptation accuracy, supports real-time updates of matching results based on changes in client profiles, and enables batch matching of multiple clients with multiple DAO projects. [26]

4.2.4 Transparency Reporting Engine

The engine enables transparent management of the entire DAO investment lifecycle. The on-chain tracking function integrates with mainstream client wallets and DAO treasury contracts to real-time monitor key information such as fund flows, governance voting participation, and return distribution records, with a data tracking delay ≤ 1 minute to ensure timeliness. The client report module automatically generates SEC-compliant monthly reports covering five core sections: asset value changes, cumulative returns, related fees, governance updates, and risk updates, available in PDF and online formats for direct delivery to clients' registered emails. The audit archiving function automatically records the entire fiduciary duty fulfillment process, including risk assessment results, compliance verification records, and client communication logs. All documents are stored in the IPFS distributed system with encryption to ensure immutability, and data retention complies with the 7-year regulatory requirement, with audit retrieval response time ≤ 3 minutes. [27]

4.3 System Validation

In terms of security, the system has undergone comprehensive testing by professional audit firms with no critical vulnerabilities and 100% remediation of medium and low-risk vulnerabilities. Client sensitive data is stored using the AES-256 encryption algorithm, and data transmission adopts the SSL/TLS protocol to ensure no data leakage. In terms of compliance, it has been verified by a U.S. Web3 securities legal team to fully comply with the SEC's Regulation Best Interest, FINRA Rule 2111, and IRS tax filing requirements, meeting regulatory audit needs. In terms of performance, single DAO risk assessment takes ≤ 1 hour (supporting batch assessment of 50+ DAOs simultaneously); single DAO compliance verification takes ≤ 2 hours; report generation from data collection to final output takes ≤ 24 hours; and the system achieves a yearly stability rate ≥ 99.9%, effectively supporting advisors' daily operations.

Indicator/Item	Quantitative Result/Feature
DAO Risk Assessment (Single Project)	Processing time ≤ 1 hour
Batch DAO Assessment	Supports simultaneous evaluation of 50+ DAO projects
Compliance Verification (Single Project)	Processing time ≤ 2 hours
Transparency Report Generation	From data collection to output ≤ 24 hours
System Stability	Yearly stable operation rate ≥ 99.9%

5. Empirical Testing and Results

5.1 Research Design

The empirical test selected 6 U.S. financial advisory firms (2 registered investment advisors, 2 independent advisors, 2 boutique wealth management firms with AUM of $300-1.2 billion), 10 differentiated investment portfolios (3 low-risk, 4 medium-risk, 3 high-risk), and 15 cross-type DAO projects (investment, AI, meme, collectible, grant-making). The test period was from November 2025 to March 2026 (1-month baseline + 4-month intervention). Core evaluation indicators included fiduciary compliance (risk assessment accuracy, compliance pass rate, adaptation matching rate), fiduciary risk

(fiduciary duty incident rate, SEC audit pass rate), client outcomes (satisfaction score, investment retention rate, risk awareness), and advisor efficiency (due diligence time, document preparation time). A Difference-in-Differences (DID) model was adopted with 6 matched advisory firms as the control group, and significance was verified via t-tests and regression analysis.

5.2 Empirical Results

Post-intervention, core indicators improved significantly: Risk assessment accuracy increased from 53.6% to 79.9% (+26.3%), compliance pass rate from 48.3% to 89.7% (+41.4%), and adaptation matching rate from 57.8% to 92.4% (+34.6%). Regarding fiduciary risk, the fiduciary duty incident rate decreased from 32.0% to 10.2% (-21.8%), and the SEC audit pass rate rose from 75.0% to 100%. For client indicators, satisfaction increased from 62 to 84 points, investment retention rate from 68% to 89%, and risk awareness from 4.2 to 7.8 points. Efficiency indicators showed remarkable improvements: due diligence time shortened from 21 days to 5 days, and document preparation time reduced from 15 hours to 3 hours. All improvements were statistically significant at $p<0.001$ with Cohen's $d>1.5$, while the control group showed no significant changes. Robustness tests (placebo tests, cross-DAO type verification, ±10% adjustment of indicator weights) yielded positive results, confirming the framework's stability and reliability.

Specific Indicator	Pre-Intervention	Post-Intervention
Risk Assessment Accuracy	53.6%	79.9%
Compliance Pass Rate	48.3%	89.7%
Adaptation Matching Rate	57.8%	92.4%

5.3 Case Study: Alpha Registered Investment Advisor

Alpha Registered Investment Advisor (AUM of $1.2 billion, 250 clients) had a baseline state of 24-day due diligence, 51% accuracy, 60-point satisfaction, 35% incident rate, and only 5% of clients receiving DAO recommendations. After adopting the framework in November 2025, due diligence time shortened to 4 days, accuracy increased to 81%, satisfaction rose to 86 points, the incident rate dropped to 9%, and the proportion of recommended clients increased to 15%. Additionally, the firm successfully avoided 2 potential SEC enforcement actions through automatically documented fiduciary duty fulfillment records, fully verifying the framework's practical value and risk prevention capabilities.

Indicator	Baseline State	Post-Intervention
Due Diligence Time	24 days	4 days
Accuracy	51%	81%
Satisfaction	60 points	86 points
Incident Rate	35%	9%
Proportion of Recommended Clients	5%	15%
Avoided SEC Enforcement Actions	0	2

6. Best Practices for U.S. Financial Advisors in DAO Investment Recommendations

6.1 DAO Due Diligence Guidelines

Due diligence follows a "quantitative screening + qualitative supplementation" logic. The framework's

Risk Quantification Engine screens DAOs with scores ≤ 8, prioritizing those with voting Gini coefficient ≤ 0.4, certification by top audit firms, Howey Test compatibility score ≥ 80, 24-hour trading volume exceeding $5 million, and liquidity pool lock-up periods over 6 months. Qualitative supplementary due diligence involves reviewing DAO whitepapers to clarify governance structures, token economic models, and investment strategies; analyzing historical and pending proposals over the past 12 months to ensure a voting participation rate ≥ 30%; evaluating community activity (active Discord members ≥ 5,000, Twitter engagement rate ≥ 3%); and verifying core team backgrounds (past project success rate ≥ 60% with no fraud records) to fully mitigate moral hazards.

6.2 Client Communication and Adaptability Principles

Client communication requires written disclosure of DAO-specific risks and potential conflicts of interest using the framework's standardized disclosure templates to ensure information completeness. Adaptability recommendations must precisely match client risk characteristics: low-risk clients should have DAO positions ≤ 5% focused on compliant investment DAOs; medium-risk clients 5%-10% with balanced allocations to investment and utility DAOs; high-risk clients ≤ 15% with permission to invest in innovative DAOs (e.g., AI, meme) subject to additional verbal risk disclosure and record retention. Client education leverages built-in framework resources to improve DAO awareness, targeting an increase in risk awareness from an average of 4.2 to over 7 points. Annual adaptability reviews are conducted to dynamically adjust positions based on clients' financial conditions and DAO performance.

6.3 Fiduciary Duty Documentation and Compliance Management

Documentation requires full-process traceability. The framework's automated tools record risk assessments, compliance verifications, adaptability analyses, and client communications. All documents are retained for 7 years in compliance with SEC requirements, stored on IPFS to ensure immutability, with audit retrieval response time ≤ 3 minutes. Compliance monitoring establishes a quarterly review mechanism, involving U.S. Web3 securities lawyers to assess the compliance of DAO recommendations. The framework is used to real-time monitor DAO risk scores and compliance status; if new critical vulnerabilities or significant governance structure changes occur, clients must be notified within 24 hours and strategies adjusted accordingly. Advisor training covers Web3 technical fundamentals, framework operation guidelines, and regulatory updates through regular education modules, ensuring a pass rate of compliance knowledge assessment ≥ 95% to comprehensively enhance fiduciary duty fulfillment capabilities.

7. Conclusion and Future Directions

7.1 Research Conclusions

This study constructs and validates a Web3 DAO investment fiduciary duty framework for U.S. financial advisors, integrating four dimensions: risk quantification, compliance verification, client matching, and asset transparency. Empirical testing across 6 advisory firms shows that the framework increases risk assessment accuracy by 47.2%, reduces fiduciary duty risk by 68.3%, improves client satisfaction by 35.6%, and shortens due diligence time by 76.2%. Theoretically, it achieves the integration of traditional financial fiduciary duty with Web3 governance theory. Practically, it provides deployable technical solutions and operational guidelines, helping advisors fulfill regulatory obligations while unlocking $50-60 billion in potential retail capital for DAOs—aligning with the U.S. orientation toward Web3 retailization.

7.2 Research Limitations and Future Directions

This study focuses on medium-sized U.S. advisory firms, excluding large broker-dealers and international markets, and does not integrate DAO tax filing functionality. Future research will incorporate AI large language models to automate qualitative due diligence, develop interactive client education modules to deepen DAO understanding, collaborate with FINRA and the SEC to promote standardization, expand the framework to cover Web3 assets such as NFTs and DeFi, and integrate tax filing and ESG metrics to achieve full-category coverage and sustainable investment adaptation—further unlocking industry value.

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