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How Blockchain Applications Affect Accounting Information Quality

-- A Longitudinal Case Study of SF Holding's "Fengsu" Project

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Abstract

This paper examines how blockchain applications influence accounting information quality through a longitudinal case study of SF Holding's "Fengsu" project. Rather than assuming that blockchain automatically improves reporting quality, the study investigates how technological changes are connected with business processes and accounting outcomes. Based on annual reports from 2016–2020 and related data sources, the analysis evaluates seven aspects of accounting information quality, including reliability, conservatism, comparability, timeliness, internal-control assurance, external audit, and earnings predictability. The results indicate that blockchain adoption was associated with improvements in several areas. Discretionary accruals remained at a relatively low level, comparability gradually improved, and analyst forecast errors declined in the later period. However, improvements were not observed in every dimension: annual-report timeliness, audit opinions, and audit costs did not show the expected changes. The findings suggest that blockchain contributes mainly by improving data recording, process coordination, and evidence traceability, while its effects are limited by chain coverage, initial data quality, system integration, and organisational capabilities. Therefore, blockchain should be viewed as a supporting technology whose value depends on how closely it is connected with financial processes.

Keywords

Blockchain; Accounting Information Quality; SF Holding; Case Study; Supply-Chain Traceability.

1. Introduction

Reliable accounting information plays an important role in market decisions, financing activities, and internal management. In traditional information systems, transaction data usually move between different departments, such as operations, finance, taxation, logistics, and auditing. Because these systems often use different data standards and update processes, inconsistencies may occur during transmission and verification. Blockchain introduces distributed records, timestamps, verification mechanisms, and smart contracts into business processes. These functions provide another way to preserve transaction evidence and improve the traceability of accounting-related information.

Previous research on blockchain and accounting information quality can generally be divided into two directions. One group of studies focuses on the technical characteristics of blockchain and discusses its possible influence on document management, bookkeeping, reporting, and auditing[1][2]. Another group evaluates accounting information quality through measurable

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indicators such as reliability, conservatism, comparability, and timeliness. However, many theoretical discussions assume that information entering the blockchain is accurate and that the technology is already integrated with accounting activities. In actual business environments, blockchain projects are often first introduced for traceability, logistics management, or supply-chain cooperation. Therefore, whether these applications can improve accounting information quality still requires evidence from specific companies.

SF Holding offers a suitable case for examining this issue because logistics activities involve many participants, locations, and frequent transactions. The company has applied blockchain together with technologies such as the Internet of Things and big data in areas including pharmaceutical traceability, food traceability, cross-border logistics, and supply-chain finance[3]. These applications are closely related to accounting information sources because they involve orders, transportation records, warehousing information, inspections, and settlement activities.

This study narrows the discussion from general blockchain concepts to the specific development process and outcomes of SF Holding's application. It focuses on three questions: which dimensions of accounting information quality changed after blockchain adoption, through what mechanisms these changes occurred, and why some expected improvements did not appear[4]. The contribution of this research lies in connecting technological applications with business processes and observed accounting results while recognising the limitations of a single-case analysis.

2. Literature Review and Analytical Framework

2.1. Dimensions of Accounting Information Quality

Accounting information quality contains several related dimensions rather than a single measurement. Previous studies have proposed evaluation systems covering reliability, relevance, conservatism, comparability, and timeliness. For a case study, the selection of indicators must also consider whether long-term company data are available. Based on the SF Holding case, this study examines accounting information quality from two perspectives: the generation and disclosure of information, and the later assurance and use of information. The first perspective includes reliability, conservatism, comparability, and timeliness, while the second includes internal-control assurance, external audit, and earnings predictability[5].

Reliability captures the extent to which accounting information faithfully represents actual transactions and their economic substance. The case materials use the modified Jones model to estimate discretionary accruals and the Roychowdhury model to measure real activities manipulation through abnormal operating cash flows, abnormal production costs, and abnormal discretionary expenses[6][9]. Conservatism reflects whether adverse economic news is recognised in a timely manner and is measured using the firm-year C-Score developed by Khan and Watts[8]. Comparability indicates whether similar economic events processed through different firms' accounting systems generate similar outcomes and is assessed using the earnings–returns mapping approach proposed by De Franco et al. [7]. Timeliness is measured by the lag between the end of the fiscal year and the annual-report disclosure date, together with whether the scheduled disclosure date was met. Internal and external assurance are observed through internal-control evaluation and assurance results, financial-statement audit opinions, and audit fees[10]. Earnings predictability is measured by the error between analysts' forecast earnings per share and actual earnings per share; a smaller error generally indicates greater decision usefulness.

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Table 1. Framework for Evaluating Accounting Information Quality

Stage	Evaluation dimension	Indicator or observation basis	Preferred direction
Internal generation and disclosure	Reliability	Absolute discretionary accruals; real earnings management indicator	Lower manipulation is preferable
Internal generation and disclosure	Conservatism	Firm-year C-Score	Higher values are preferable
Internal generation and disclosure	Comparability	Mean CompAcct relative to the top four and top ten firms in the industry	Values closer to zero are preferable
Internal generation and disclosure	Timeliness	Annual-report disclosure lag and compliance with the scheduled date	Shorter lag or on-time disclosure
External assurance and use	Internal-control assurance	Internal-control evaluation and assurance opinion	Fewer deficiencies and improved opinions
External assurance and use	External audit	Annual-report audit opinion and audit fees	Improved opinion; lower cost under comparable conditions
External assurance and use	Earnings predictability	Analyst earnings-per-share forecast error	Smaller errors are preferable

Source: Compiled from the indicator systems of Li Qing and Ma Zehan (2022) and Mao Qingyuan (2022).

2.2. Mechanisms Through Which Blockchain Affects Accounting Information Quality

Blockchain itself does not directly create high-quality accounting information. Its influence depends on whether it changes the way business information is collected, verified, and used. In the SF Holding case, four possible mechanisms explain the relationship between blockchain applications and accounting information quality.

The first mechanism is related to data preservation. Business records such as orders, transportation information, warehouse activities, inspection results, and settlement documents can be recorded with timestamps and verification information. Once recorded, later changes become traceable, which may reduce opportunities for unsupported adjustments and improve the reliability of transaction evidence.

The second mechanism concerns multi-party verification. In supply-chain applications, different participants may provide and confirm parts of the same transaction information. This distributed verification process reduces dependence on a single information provider and improves the completeness of evidence available for later accounting and auditing.

The third mechanism is process standardisation. Smart contracts and predefined rules can make repeated business activities follow consistent procedures. This may reduce differences caused by manual judgement and provide more stable data inputs for accounting treatment.

The fourth mechanism relates to information use. Blockchain records may provide auditors and managers with more traceable evidence. However, the practical benefits depend on system access, staff knowledge, and whether blockchain data can be effectively connected with existing accounting systems.

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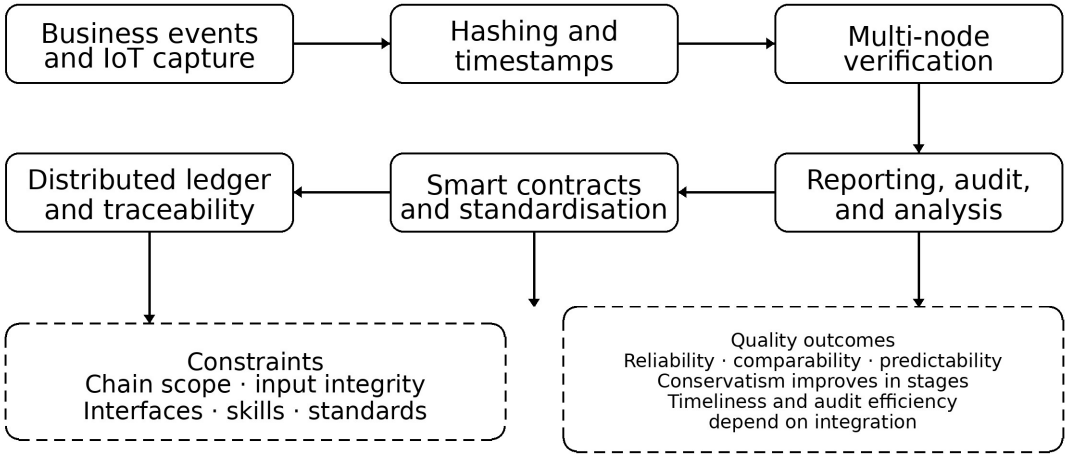

Source: Developed by the authors based on blockchain features and SF Holding's application scenarios.

Figure 1. The "Technology–Process–Outcome" Mechanism Linking Blockchain to Accounting Information Quality

2.3. Analytical Expectations

The preceding logic leads to three analytical expectations. First, the real-time fixation and multi-node verification of business transaction records should reduce the scope for ex post manipulation and thus improve reliability indicators. Second, smart contracts and standardised data structures should stabilise accounting treatment and may therefore improve comparability and information usefulness. Third, improvements in timeliness and audit efficiency require the technology to be deeply embedded in financial-reporting and audit processes. If the application remains centred on private chains and business traceability, the relevant indicators may remain unchanged or even deteriorate temporarily because of parallel systems and learning costs.

3. Research Design

3.1. Case Selection and Research Method

This study adopts a longitudinal single-case method. SF Holding was selected for three reasons. First, the logistics industry is characterised by networked operations and multi-party coordination, giving blockchain a high degree of fit with the underlying business structure. Second, SF Holding's blockchain applications cover product traceability, cross-border logistics, and supply-chain finance, allowing observation of the technology's progression from data notarisation to business collaboration. Third, existing case materials provide continuous estimates of seven accounting information quality indicators for 2016–2020, making before-and-after comparison possible.

The year 2018 is treated as the key temporal boundary. The years 2016–2017 represent the period before the large-scale deployment of blockchain-enabled business applications, 2018 is treated as the introduction and transition stage, and 2019–2020 as the stage of deeper application. This classification is used only for descriptive comparison and does not treat 2018 as a strictly exogenous shock. SF Holding completed a backdoor listing and subsequent business separation in 2017, while business expansion, changes in accounting standards, and the COVID-19 pandemic also affected the company in 2019–2020. Each of these factors may have influenced accounting information quality. The analysis therefore combines indicator changes, process evidence, and alternative explanations and interprets the results cautiously.

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3.2. Data Sources and Processing Principles

The study uses SF Holding's annual reports from 2016–2020, CSMAR information, and analyst forecast data to organise the relevant indicators. No additional unverified company information is introduced, and the original measurement approaches are retained. The analysis mainly reorganises existing evidence and examines how blockchain-related changes correspond with accounting information quality.

Three principles guide the analysis. First, changes after blockchain adoption are treated as associations rather than definite causal effects. Second, attention is given to whether changes continue over time instead of relying on a single-year movement. Third, unexpected results, such as higher audit fees or unchanged disclosure speed, are also considered because they help reveal the practical limitations of blockchain adoption.

4. Case Background: SF Holding's Blockchain Applications

4.1. Business Characteristics and Technological Needs

SF Holding provides integrated logistics services through a business chain that includes collection, warehousing, line-haul transportation, transfer, delivery, receipt confirmation, and settlement. These nodes are geographically dispersed, transactions are frequent, and responsibility is distributed among multiple parties. Under conventional systems, order information, logistics trajectories, quality-inspection data, and financial documents are stored separately. When cargo damage, loss, returns, or cross-border customs disputes arise, evidence must be traced across systems and supplied by several parties. This structure generates three information problems: lengthy chains delay data transmission; individual parties hold only partial information, creating information asymmetry; and repeated reconciliation between documents and physical flows increases costs and slows settlement.

SF Holding positioned blockchain as part of its digital supply-chain infrastructure rather than building a stand-alone accounting blockchain. Its technology platform is based on blockchain-as-a-service (BaaS) and combines public, private, and hybrid clouds to provide privacy protection, chain management, and development support. It has supported applications such as "Fengsu," supply-chain finance, and document notarisation. From the perspective of accounting information quality, the principal value of this arrangement is that information previously dispersed across logistics, warehousing, inspection, and transaction parties is captured closer to the occurrence of the underlying business event, creating a trace that can subsequently be used in accounting and assurance.

4.2. Major Application Scenarios and Their Evolution

SF Holding's blockchain applications evolved from single-product traceability towards broader supply-chain coordination. Early pharmaceutical traceability connected drug codes, warehouse management, and logistics data to record the entire movement of medicines from production to end users. Food traceability linked agricultural production, harvesting, transportation, and sales, allowing users to scan codes for origin and logistics information. In the cross-border "Fengsu GO" scenario, overseas production, packaging, warehousing, transportation, customs declaration, quality inspection, and retail were incorporated into a traceability chain, with third-party testing introduced for cross-verification. Around 2019, SF Holding further extended blockchain to supply-chain finance and document notarisation, attempting to use traceable transaction records to support customs clearance, settlement, and financing services.

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Table 2. SF Holding's Blockchain Application Scenarios and Their Accounting-Information Implications

Period	Application scenario	Principal approach	Potential implication for accounting information
Around 2014	Pharmaceutical traceability pilot	Connected drug codes, warehouse management, and logistics data to record product movement	Strengthened the completeness and traceability of inventory and performance evidence
September 2018	Food and agricultural-product traceability	Recorded production, harvesting, transportation, and sales nodes and supported QR-code enquiries	Reduced breaks in business information and strengthened reconciliation between cost and inventory records
Around 2018	"Fengsu GO" cross-border traceability	Covered overseas production, warehousing, transportation, customs declaration, quality inspection, and retail, with third-party testing	Created multi-party cross-verification and strengthened the authenticity of transactions and documents
Around 2019	Supply-chain finance and document notarisation	Used traceable transaction records to support customs clearance, settlement, and financing services	Improved the verifiability of receivables confirmation, settlement evidence, and credit information

From an accounting-process perspective, these applications form a chain connecting business events, data collection, verification, recording, and settlement. Their primary purpose is to improve logistics efficiency rather than directly redesign accounting systems. Improvements in accounting information quality therefore appear as an indirect outcome of business digitalisation. This also explains why source-data-related dimensions may improve more easily than reporting and auditing processes.

5. Changes in Accounting Information Quality before and after Blockchain Adoption

5.1. Reliability: Overall Improvement in Earnings-Management Indicators

Reliability is first assessed through discretionary accruals. The absolute value of SF Holding's discretionary accruals fell from 0.23 in 2016 to 0.03 in 2017 and remained at 0.01 from 2018 to 2020. The sharp decline in 2016–2017 mainly reflected the separation of the original business after the backdoor listing and cannot be attributed to blockchain. More relevant is the fact that, after the introduction of blockchain applications in 2018, the indicator remained at a low level for three consecutive years. Under the modified Jones model, a low and stable level of discretionary accruals suggests that management had less scope or incentive to adjust earnings through accrual items.

The real earnings management indicator declined from −0.0051 in 2016 to −0.3026 in 2020. Based on the construction of the measure, the original case study interpreted the continuing decline as a reduction in real activities manipulation. Process evidence is broadly consistent with this interpretation. When order, logistics, warehouse, and settlement records are reconciled with one another, fabricating transactions or shifting the timing of actual business activities requires coordinated changes across multiple nodes, thereby increasing the cost of manipulation. In cross-border and food-traceability applications in particular, third-party inspection, logistics trajectories, and product information jointly form an evidence chain, making it more difficult for a single participant to control the complete transaction record.

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The sign and absolute magnitude of the real earnings management measure must nevertheless be interpreted cautiously. Different constructions assign different directions to abnormal cash flows, abnormal costs, and abnormal expenses, and a simple inference that a lower value necessarily represents improvement may be sensitive to model specification. This study therefore treats the measure as supporting evidence and places greater weight on the combined evidence of persistently low discretionary accruals, traceable business records, and the subsequent decline in forecast errors.

Table 3. Core Quantitative Indicators of SF Holding's Accounting Information Quality

Year	Absolute discretionary accruals	Real earnings management indicator	C-Score	Mean comparability with top four firms	Analyst forecast error
2016	0.23	-0.0051	-0.1033	-0.0210	0.979229
2017	0.03	-0.2019	0.0894	-0.0175	0.052009
2018	0.01	-0.2386	0.2991	-0.0167	0.070730
2019	0.01	-0.2571	0.2262	-0.0143	0.036301
2020	0.01	-0.3026	0.1373	-0.0037	0.005488

5.2. Conservatism: A Sharp Increase in 2018 Followed by a Gradual Decline

SF Holding's C-Score increased from −0.1033 in 2016 to 0.0894 in 2017 and reached 0.2991 in 2018, before declining to 0.2262 in 2019 and 0.1373 in 2020. A higher C-Score indicates more timely recognition of bad news. The marked rise in 2018 coincides with the introduction of blockchain applications, suggesting that data fixation and greater process transparency may have accelerated the incorporation of adverse information into the accounting system. Although the indicator declined in 2019–2020, it remained positive, implying that the company maintained a degree of accounting conservatism.

The absence of a continuing upward trend also reveals the boundaries of blockchain's influence. SF Holding's applications were mainly enterprise-led, and private chains or company-controlled platforms continued to give management substantial discretion over data selection and access rights. Blockchain can ensure that data already recorded on-chain are difficult to alter, but it cannot guarantee that all material events are recorded completely and promptly. Changes in accounting policies, including the adoption of new financial-instrument standards in 2019 and new revenue standards in 2020, may also have affected recognition and measurement. The conservatism result is therefore more appropriately described as an initial improvement followed by a sustained positive level, rather than a monotonic increase.

5.3. Comparability: A More Evident Cumulative Effect of Standardised Processing

The closer the accounting comparability measure is to zero, the more closely the firm's accounting mapping of similar economic events resembles that of its industry peers. SF Holding's mean comparability with the four largest firms in the industry improved from −0.0210 in 2016 to −0.0037 in 2020. Its comparability with the ten largest firms also improved, from −0.0228 to −0.0042. By contrast, the overall industry mean fluctuated in 2019, indicating that improvement was not linear under every benchmark.

Blockchain's effect on comparability appears cumulative. The indicator changed little in 2018, the year of introduction, but improved more clearly in 2019–2020 as business rules, data fields, and node operations became more stable. This pattern is consistent with the process-

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standardisation mechanism. When similar logistics orders are recorded under uniform codes, timestamps, and status rules, the accounting system receives more consistent inputs and cross-period differences in treatment are reduced. Smart contracts and predefined rules may further stabilise the conditions under which business events are recognised, thereby lowering inconsistencies arising from human judgement.

Comparability may also have benefited from growth in firm size, upgrades to information systems, and convergence in industry accounting practices. A single-case design cannot fully separate these effects. The evidence therefore indicates strong consistency between blockchain adoption and the observed improvement in comparability, but it remains explanatory rather than causal.

5.4. Timeliness: No Clear Improvement in Line with Theoretical Expectations

SF Holding generally disclosed its annual reports on or before the scheduled dates between 2016 and 2020. After 2018, however, the reporting lag did not shorten. The lag reached 84 days for the 2019 annual report and 77 days for the 2020 report. The 2019 report was affected by the outbreak of COVID-19 in early 2020 and is therefore unusual; even after excluding that year, the 2020 disclosure lag was not materially shorter than before blockchain adoption. Real-time recording of business data therefore did not translate directly into earlier annual-report disclosure.

This result shows that timeliness depends on the complete financial-reporting process. On-chain business data must still undergo accounting recognition, estimation, elimination, consolidation, impairment testing, and audit review before they can be incorporated into the annual report. When blockchain covers only selected logistics or traceability activities, substantial processing remains necessary in conventional enterprise-resource-planning and financial systems. Running old and new systems in parallel also creates data-mapping, access-verification, and employee-learning costs. Moreover, listed companies operate within a relatively stable regulatory reporting cycle and have limited long-term incentive to accelerate disclosure merely to demonstrate a technological effect. Blockchain may therefore improve the timeliness of internal management information and individual settlements before it affects the public annual-report date.

5.5. Internal Control and External Audit: Stable Opinions but No Reduction in Cost

The case materials show that SF Holding received unmodified financial-statement audit opinions throughout the study period, and its internal-control assurance results did not change materially after blockchain adoption. Because the company had already established relatively mature internal-control and audit systems before implementation, opinion types were subject to a clear ceiling effect and offered little room for further improvement. Stable audit opinions should therefore be interpreted neither as evidence that blockchain was ineffective nor as direct evidence of its effectiveness.

Audit fees provide a more revealing result. They increased from RMB 14.95 million in 2017 to RMB 18.517 million in 2018, RMB 22.7093 million in 2019, and RMB 24.2378 million in 2020. This upward trend is inconsistent with the theoretical expectation that blockchain lowers audit costs. Possible explanations include rapid growth in the scale and complexity of the company, the early stage of blockchain adoption, auditors' limited capability to analyse on-chain data, and the additional verification work created by parallel on-chain and off-chain systems. The technology can reduce sampling and replace some confirmation procedures only when auditors can directly access trusted on-chain evidence, understand controls embedded in smart contracts, and incorporate those controls into audit procedures. Otherwise, blockchain data simply become an additional category of audit object.

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Table 4. Annual-Report Timeliness and External Audit

Year	Preliminary reporting lag (days)	Audit-signature lag (days)	Disclosure status	Annual-report audit opinion	Audit fee (RMB million)
2016	74	68	Early or on time	Standard unmodified opinion	16.20
2017	73	71	On time	Standard unmodified opinion	14.95
2018	75	73	On time	Standard unmodified opinion	18.52
2019	84	84	On time	Unmodified opinion	22.71
2020	77	76	On time	Unmodified opinion	24.24

5.6. Earnings Predictability: Improvement in Information Use at a Later Stage

Analyst earnings-forecast errors declined from 0.070730 in 2018 to 0.036301 in 2019 and 0.005488 in 2020, showing a marked improvement in the latter two years. The 2016 error of 0.979229 was heavily affected by the backdoor listing and an unusual earnings-per-share basis and is not an appropriate stable benchmark. The error was relatively low in 2017 but rose slightly in 2018, indicating that blockchain introduction did not immediately improve forecast accuracy. The error fell only as the applications deepened.

Forecast accuracy reflects the combined effect of multiple information sources. Analysts use not only financial statements but also business volume, customer structure, supply-chain stability, and operating risks. Blockchain traceability improves the continuity and verifiability of logistics and product information and may reduce the cost of screening non-financial information. Greater reliability and comparability also support more stable forecasting models. The decline in forecast errors in 2019–2020 can therefore be viewed as an external manifestation of improved decision usefulness.

Forecast accuracy is also affected by analyst coverage, the macroeconomic environment, management guidance, and business maturity. In 2020 in particular, demand from e-commerce and instant logistics may have made SF Holding's operating trend easier to identify. The indicator is consequently treated as evidence of an overall information effect and is interpreted together with the other quality dimensions rather than being attributed to blockchain alone.

5.7. Overall Assessment

The seven dimensions exhibit clearly uneven changes, with distinct variations in the extent and nature of their evolution. Reliability, comparability, and earnings predictability show relatively clear signs of improvement, demonstrating enhanced consistency in data recording, more meaningful period-to-period financial comparisons, and a greater alignment between reported earnings and underlying economic performance. Conservatism increased in 2018, reflecting a more prudent approach to profit recognition during the initial blockchain implementation phase, and remained positive in subsequent years, though the metric did not continue its upward trajectory, suggesting the initial adjustment may have reached a plateau. In contrast, timeliness, internal-control assurance, and external audit opinions remained broadly stable, indicating these aspects were largely unaffected or saw only marginal shifts; however, audit fees increased concurrently, potentially due to the added complexity of auditing blockchain-based systems or expanded audit procedures. Overall, blockchain had a stronger and more direct effect on quality attributes intrinsically connected to transaction-source data integrity and automated processing consistency, such as reliability and comparability. Its impact was weaker on attributes like timeliness and assurance, which are jointly constrained and shaped

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by a broader ecosystem of external regulation, established organisational internal processes, and the professional judgments inherent in third-party audit verification.

Table 5. Overall Assessment of Accounting Information Quality After Blockchain Adoption

Evaluation dimension	Overall assessment	Main evidence	Interpretation of evidence
Reliability	Overall improvement	Absolute discretionary accruals remained at 0.01 during 2018–2020	Consistent with the business-record notarisation mechanism, but also affected by the listing restructuring
Conservatism	Stage-specific improvement	C-Score rose to 0.2991 in 2018 and subsequently declined but remained positive	Alternative explanations include changes in accounting policies
Comparability	Relatively clear improvement	Measures relative to the top four and top ten industry firms continued to approach zero	Strong cumulative effect of process standardisation
Timeliness	Broadly stable	The annual-report disclosure lag did not shorten	On-chain business processes did not cover the complete financial-reporting process
Internal-control assurance	No clear change	Evaluation and assurance results remained broadly stable	Mature pre-existing controls created a ceiling effect
External audit	No clear efficiency gain	Opinions remained stable while audit fees continued to rise	Firm expansion, parallel systems, and audit-learning costs operated jointly
Earnings predictability	Improvement at a later stage	Analyst forecast errors fell substantially in 2019–2020	A combined information effect that cannot be attributed to blockchain alone

6. Mechanism Discussion: From Business Traceability to Accounting Information Quality

6.1. Trustworthy Source Data as the Foundation of Improved Reliability

The SF Holding case suggests that blockchain affects accounting information quality mainly through improvements in the reliability of original business data. When information from logistics, warehousing, and settlement activities is captured closer to the time of occurrence, later accounting procedures can rely on a clearer evidence trail.

However, blockchain's immutability has limits. It can prevent unauthorised changes after information is recorded, but it cannot guarantee that the original input is complete or accurate. The quality of accounting information still depends on data governance, business procedures, and management controls.

6.2. Process Standardisation as a Driver of Improved Comparability

The improvement in SF Holding's comparability indicators at the later stage suggests that technological effects require time for rules to become embedded. The blockchain platform standardises business fields, status transitions, and access boundaries so that similar transactions at different outlets and in different years are recorded under relatively consistent logic. For the accounting system, standardised inputs reduce manual classification and

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secondary interpretation and improve consistency in recognition. This mechanism accords with the "consensus first, recording second" approach proposed in prior theoretical work.

Business rules and accounting rules are not identical. A logistics status of "delivered" does not necessarily satisfy the accounting criteria for revenue recognition, and cross-border transactions may also involve customs clearance, rights of return, and assessments of performance obligations. Smart contracts therefore need to define the mapping between business events and accounting treatments and be supported by approval procedures for rule changes, version histories, and accounting-policy reviews. Process standardisation can be translated into sustained gains in comparability and accuracy only when technical standards are properly aligned with accounting standards.

6.3. The Private-Chain Structure as a Constraint on External Assurance Benefits

SF Holding's early applications were mainly built on enterprise-led platforms and limited business chains. The company retained substantial control over node admission, data scope, and access rights. Although this structure can optimise internal processes, it does not fully realise the benefits of a ledger jointly maintained by multiple parties. If external auditors cannot participate as trusted nodes, they can only obtain company-exported on-chain data at year end and must reverify interface completeness and off-chain inputs. Blockchain then cannot replace conventional audit procedures and may instead add technical-understanding and system-testing work.

Multiparty computation and privacy-preserving technologies can facilitate broader audit participation. Secret sharing, zero-knowledge proofs, and tiered access rights allow audit firms and financial institutions to verify specified transaction conditions without obtaining all commercially sensitive information. The critical objective is not to disclose every item of accounting data, but to design audit interfaces that are verifiable, disclose only the minimum necessary information, and preserve responsibility tracing.

6.4. Organisational Learning and the Speed at Which Technological Benefits Emerge

The indicator changes show that the 2018 introduction did not produce immediate effects across all dimensions. Comparability and forecast accuracy became more apparent only in 2019–2020. Blockchain adoption requires simultaneous adaptation by outlet employees, operating personnel, finance staff, and auditors. Irregular operation at logistics nodes weakens data quality, while finance personnel who lack the ability to screen data and understand smart contracts continue to depend on manual processing. The alignment of the technology platform, process rules, and employee capabilities therefore determines how quickly the potential benefits are realised.

7. Practical Constraints and Improvement Paths

7.1. Deepening Integration from Business Traceability to Financial Processes

SF Holding's current applications are primarily intended to improve logistics services and supply-chain coordination, with better accounting information quality arising as a secondary benefit. The next stage should focus on financial scenarios closely connected to the business chain, including revenue recognition, transportation-cost allocation, compensation liability, receivables settlement, and asset management, and should establish explicit mappings among business events, contract terms, and accounting rules. The company can first pilot a closed loop of "order–performance–delivery–settlement–recording" in highly standardised business units and then extend the approach to group consolidation and external reporting. Before rules are

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deployed, they should be jointly reviewed by business, finance, legal, and audit personnel so that inappropriate accounting judgements are not embedded in code.

7.2. Expanding from an Enterprise Private Chain to an Industry Consortium Chain

Private chains help control costs and protect commercial secrets, but their multi-centre verification capacity is limited. Leveraging its central position in the logistics network, SF Holding could gradually admit major customers, suppliers, inspection agencies, banks, and audit firms as consortium-chain nodes. A consortium chain need not require every participant to share all data. Instead, it should establish the minimum necessary consensus on critical facts such as order authenticity, title to goods, inspection results, delivery status, and confirmation of receivables. Research on supply-chain finance shows that blockchain can improve the accuracy of credit information and support financing across supply-chain tiers, but limited participation and access costs can weaken network value. A reasonable mechanism for allocating costs, governing data use, and distributing benefits is therefore needed to prevent control by a single core enterprise from discouraging participation by other parties.

7.3. Strengthening On-Chain Data Governance and Error Correction

Blockchain immutability does not mean that data cannot be corrected. Firms should establish data classifications, collection responsibilities, validation rules, and correction procedures. Automatically captured data should be subject to device calibration and anomaly comparison, while manually entered data should be accompanied by verifiable contracts, invoices, inspection reports, or similar evidence. When an error is identified, the original record should not be deleted; instead, a correcting transaction should be appended so that the complete trail is preserved. Sensitive data may be stored in encrypted form off-chain, with hash digests retained on-chain, and combined with access controls and privacy-preserving computation to meet both audit and commercial-confidentiality requirements. Studies of carbon trading and supply-chain finance similarly emphasise the importance of disclosure standards, regulatory interfaces, and third-party verification for trustworthy blockchain applications.

7.4. Developing Standardised Audit-Oriented Interfaces

For blockchain to reduce audit costs, audit requirements must be incorporated into platform design. Firms should provide interfaces for node-identity management, data-integrity verification, smart-contract version records, anomalous-transaction screening, and audit logs so that auditors can verify the integrity of the chain and perform continuous auditing. Audit firms should develop interdisciplinary teams that understand both accounting standards and distributed ledgers and data analytics, and they should incorporate tests of on-chain controls into risk assessment. Regulators and professional associations can reduce technological barriers across platforms by establishing standards for on-chain accounting-data formats, smart-contract controls, the legal validity of electronic evidence, and audit interfaces.

7.5. Establishing a Staged Performance-Evaluation System

Blockchain projects should not be evaluated solely by the number of technical deployments. Indicators should be established at four levels: business efficiency, data quality, financial quality, and external governance. Business indicators may include traceability time, dispute handling, and settlement cycles; data indicators may include automated capture rates, error rates, and multi-party confirmation rates; financial indicators may include accrual adjustments, reconciliation differences, closing time, and comparability; and governance indicators may include audit coverage, time required to obtain evidence, and financing costs. Continuous evaluation can determine whether the technology is genuinely improving accounting information quality and identify additional costs created by parallel systems.

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8. Conclusion and Research Limitations

This study uses SF Holding's "Fengsu" blockchain application to examine the relationship between blockchain technology and accounting information quality. The evidence shows that blockchain adoption is linked with improvements in reliability, comparability, and forecast usefulness, but the effects are not uniform across all dimensions. The technology provides stronger support for business data management than for immediate changes in financial reporting and auditing.

The case indicates that enterprises should avoid viewing blockchain as a standalone solution. The value of blockchain depends on its integration with financial processes, data governance systems, and audit requirements. Future applications should focus on improving connections between operational data and accounting activities.

This research has several limitations. First, the study relies on a before-and-after single-case comparison, making it difficult to separate blockchain effects from other organisational or environmental changes. Second, the analysis depends on available public data and does not include internal company information. Third, the findings from SF Holding may not apply directly to all industries or blockchain models.

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