

AI-Powered Continuous Financial Reporting: Integrating Machine Learning Anomaly Detection with Blockchain-Immutable Audit Trails

Author: **Nader Abi Haidar¹**

Affiliation:

1. *Business School, Holy Spirit University of Kaslik, P.O. Box 446, Jounieh, Lebanon*
2. *CIRAME Research Center, Holy Spirit University of Kaslik, P.O. Box 446, Jounieh, Lebanon*

Abstract:

This study looks at whether combining machine learning-based anomaly detection with a permissioned blockchain ledger can make financial reporting faster, more accurate, better at catching fraud, and more efficient than the traditional manual approach. I ran a comparative case study in a mid-sized online retailer, operating two systems side by side for three months: a conventional manual reporting process and an integrated AI-blockchain platform. I analyzed about 10,000 transactions across five metrics: monthly closing duration, transaction error rate, quarterly audit hours, fraud detection accuracy, and monthly reporting cost. The technology-enabled system showed clear gains. Closing time fell from 6 days to 2 days—a drop of 66.7%. Transaction errors declined from 4.2% to 1.1%, a reduction of 73.8%. Audit hours went from 140 down to 70, a decrease of 50.0%. Fraud detection accuracy rose by 30 percentage points, climbing from 58% to 88%. Monthly reporting costs also dropped by 37.5%, from \$20,000 to \$12,500. These results suggest that an AI-blockchain system can shift financial reporting from a periodic, retrospective exercise into a more real-time, evidence-based process, which could strengthen internal controls and reduce agency costs. The study's limitations include its single-case design, the exclusion of implementation costs, and the absence of inferential statistics. Future research should replicate this work in other industries and examine how regulators might adapt IFRS and US GAAP.

Keywords:

Artificial Intelligence, Blockchain, Financial Reporting, Fraud Detection, Continuous Auditing, Accounting Automation

Introduction:

Financial reporting has used the same basic process for decades: close the books on a schedule, reconcile by hand, and audit after the fact. It was designed for a slower, simpler world. Today, business is faster. Online commerce means more transactions, tougher rules, and bigger risks when reporting is late or wrong.

AI and blockchain are each seen as fixes for reporting problems. AI can catch odd transactions instantly and sort data more consistently. Blockchain keeps a permanent, so auditors don't have to reconstruct history. But most research looks at them one at a time or just in theory.

Researchers already discuss AI and blockchain in accounting. What is missing is a real, tested model that shows them working together in the same reporting system. Most studies look at them separately, and the few that combine them stay theoretical. This study creates and tests a combined AI-blockchain system against the old manual approach.

Does AI + blockchain make financial reporting faster, more accurate, better at fraud detection, and cheaper to audit than doing it by hand?

To answer my question, I needed to:

1. Which system closes faster?
2. Which system makes fewer errors?
3. Which system catches fraud better in real time?
4. Does blockchain cut audit hours?
5. What does it cost to adopt?
6. How does it affect governance and accounting rules?

Literature Review:

Financial reporting has traditionally been done on a fixed timetable, with much of the work done manually, and with reviews focused on what already happened. Journal entries are entered by hand or with some automation. Bank accounts are matched only at the end of the month. Internal audit looks at just a sample of transactions each quarter. That system has three long-standing weaknesses: it is slow, it is prone to human error, and it leaves room for fraud. The major scandals of the early 2000s—Enron, WorldCom, and later Wirecard—showed that manual controls can be dodged, delayed, or simply missed. After Sarbanes-Oxley, governance rules became tougher on paper, but the main control still relied on human judgment.

Early AI fraud detection was rule-based: for example, “flag any transaction over \$10,000.” That was better than manual review but inflexible and easy to game. Modern approaches use unsupervised anomaly detection, meaning the AI learns what normal looks like and flags oddities without needing labelled fraud examples. It can also adapt to new fraud tactics. Combining support vector machines with gradient boosting has achieved over 93% accuracy and over 95% recall—meaning it catches most actual fraud. Attention-based LSTM neural networks have also beaten

traditional statistical methods for catching financial statement fraud. KPMG's 2026 study found 76% of organizations have put some AI into finance, with fraud detection a common use. But data quality remains a major barrier: 42% say it is the biggest obstacle to scaling AI across finance.

When blockchain first appeared in accounting, people exaggerated what it could do. Over time, research has settled on a few solid points. Blockchain is a ledger that makes tampering obvious and only allows new entries. It creates an audit trail that does not depend on the audited company to provide it. This changes the assurance model: auditors no longer have to collect evidence themselves; they can analyze evidence that is already permanent. A systematic review identifies four main uses: automated auditing, fraud prevention, secure data management, and real-time reporting.

Pilot projects in banks and supply chains report lower reconciliation costs and greater stakeholder confidence. More recent research combines blockchain audit trails with federated AI—AI that learns across multiple organizations without sharing raw data—for compliance across different jurisdictions. This shows better detection and less time spent reconciling audits. But the “garbage in, garbage out” problem remains blockchain guarantees that what is recorded cannot be changed, not that what is recorded is correct.

The study is grounded in agency theory from Jensen and Meckling (1976). The core problem is that shareholders (the principals) and managers (the agents) do not have the same information. Financial reports are supposed to reduce that information gap, but they only help if they are reliable. Blockchain and smart contracts directly tackle this conflict: they cut information asymmetry and automatically enforce the terms of agreements. When it is structurally hard to change records after they are made, the cost of acting opportunistically goes up. In other words, this is a technology-based answer to a governance problem that has usually been handled through monitoring and incentives.

The unexplored question is not whether AI, automation, or blockchain help on their own. It is what happens when all three operate together in a single reporting environment. Most of the literature examines them in isolation. This study addresses that gap by modelling an integrated system and empirically comparing it to a traditional system

Beyond traditional manual checks, the modern evolution of real-time financial reporting and automated auditing is intrinsically linked to establishing a data-driven business culture and leveraging advanced analytics to maximize organizational performance (Azoury, Subrahmanyam, & Sarkis, 2024; Subrahmanyam et al., 2024). In emerging markets, the deployment of artificial intelligence is revolutionizing auditing practices by enabling continuous verification and improving the audit of consolidated financial statements (Sawaya, Khalil, Jabbour Al Maalouf, & Kaspard, 2026). However, the practical transition toward automated reporting systems depends heavily on auditor trust and the perceived operational benefits across different professional profiles

(Jabbour Al Maalouf, Ficani, & Elia, 2026), while requiring firms to navigate the ethical considerations embedded in modern corporate culture (Diab & El Hajj, 2024). To complement AI's analytical capabilities, integrating blockchain technology creates a secure, tamper-evident framework that improves performance, particularly within small and medium-sized enterprises (Khalife, Subrahmanyam, & Farah, 2024). Furthermore, adopting smart decision support systems is essential for mitigating operational disruptions and managing technological complexity in Industry 4.0 environments (Subrahmanyam & Beainy, 2027). While automated anomaly detection and immutable ledgers significantly streamline record-keeping, preserving high financial reporting quality and preventing financial distress continue to rely on strict auditor independence, industry expertise, and transparent internal control mechanisms (Elia et al., 2021; Saber & Sassine, 2022; Sawaya, Al Maalouf, Hanoun, & Rakwi, 2025). Advanced analytical adeptness, such as vector autoregression modeling, further enables organizations to contextualize these technical reporting enhancements within broader macroeconomic shifts (Bejjani et al., 2024). Ultimately, strengthening corporate governance and institutional oversight in vulnerable environments ensures that AI-blockchain integration achieves sustainable financial transparency and long-term organizational stability (Athari, Saliba, Khalife, & Salameh-Ayanian, 2023; El-Chaarani et al., 2023).

Methodology:

According to KPMG(2026) and Grosse & Wrona(2021) , my research design was a comparative case study. I set up two accounting systems to run at the same time for three months inside a mid-sized online retailer. The company processes roughly 10,000 transactions each quarter. That volume is large enough for the comparison to be useful, but small enough that I could still gather the data manually.

In the traditional system, bookkeepers wrote journal entries manually. At the end of each month, accountants matched bank statements, accounts payable, and accounts receivable. Every quarter, internal audit looked at a sample of transactions to spot anything unusual or fraudulent.

In the technology-enabled system, transactions were sent automatically in real time through an API into an AI engine. The AI did two things. First, it used a supervised machine learning model to assign each transaction to the correct account. Second, it used an isolation forest algorithm—a method that spots outliers—with a rolling feature window to detect anomalies. Any transaction the AI flagged went to a human for review. Transactions that cleared review were recorded on a permissioned blockchain, which is a private ledger that only approved users can add to. Smart contracts—code that runs automatically—enforced payment terms, approval workflows, and accrual rules without human intervention.

If you used a public blockchain for corporate accounting, transactions would take too long to process and sensitive financial data would be visible to everyone. A permissioned ledger—a private one where only approved users can join—gives you the same tamper-proof record and audit trail, but it processes transactions quickly enough for real-time use.

Results:

The system using AI and blockchain outperformed the old manual system on every metric we compared. Table 1 shows the side-by-side results.

- Closing duration: from 6 days to 2 days, a reduction of 66.7%.
- Transaction error rate: from 4.2% to 1.1%, a reduction of 73.8%.
- Quarterly audit hours: from 140 to 70, a reduction of 50.0%.
- Fraud detection accuracy: from 58% to 88%, an increase of 30 percentage points.
- Monthly reporting cost: from \$20,000 to \$12,500, a saving of 37.5%.

The time it took to close the books dropped from a full week to just a day and a half—a reduction of almost 67%. The main reason was that the old manual tasks—matching bank statements and catching up on journal entries at period-end—basically went away. Since transactions were fed into the system automatically in real time through an API, the trial balance (the list of all account balances) was always current.

The error rate went from 4.2% down to 1.1%, a reduction of roughly 74%. The AI that classified accounts spotted mismatches right when transactions were entered, instead of waiting until the end of the period. Because of that, errors were corrected before they could flow into the financial statements and cause bigger problems.

The number of hours spent on quarterly audits went from 140 down to 70, a reduction of roughly 50%. Because the blockchain kept a permanent, tamper-evident record, auditors no longer had to spend time collecting evidence themselves. Their role shifted: instead of pulling samples of transactions to check, they reviewed exception reports—lists of flagged items—produced by the AI layer. This is consistent with what researchers describe as continuous auditing or near-real-time auditing, where checks happen all the time rather than only after the fact.

Fraud detection accuracy improved from 58% to 88%, an increase of 30 percentage points. The system monitored 100% of transactions continuously, not just a quarterly sample. Detection happened in near real time, which meant intervention could occur before fraudulent transactions were finalized.

The monthly cost of financial reporting dropped from \$20,000 to \$12,500, a saving of about 37.5%. But this figure only covers day-to-day operating costs. It does not include the one-time costs of getting the system up and running—like integrating it with existing systems, training the AI model, and upskilling staff. Leaving those out is a limitation of the study.

Discussion and Conclusion:

The study shows that using AI to spot unusual transactions together with a private blockchain made financial reporting better in every way they measured. The books closed almost 67% faster. Mistakes dropped by about 74%. Auditors spent about 50% fewer hours. Reporting costs went down nearly 38%. And the system caught fraud much more often—accuracy rose from 58% to 88%. For finance teams, this means reporting all the time—not just at month-end—is doable and beneficial. Closing the books faster gives managers trustworthy numbers earlier, so the financial statements aren't stuck in draft as long.

For auditors, because blockchain records cannot be altered, they no longer need to spend as much time collecting evidence. They can shift their effort to analyzing it instead.

For regulators, this creates a problem: the main accounting rulebooks, IFRS and US GAAP, do not yet explain how to treat transactions recorded on a blockchain or accruals created automatically by smart contracts.

Agency theory is about conflicts between owners (shareholders) and managers. One problem is information asymmetry: managers know more than owners. The integrated system helps because records cannot be changed after they are made. This does more than improve control—it changes the trade-offs managers face. If it becomes harder and riskier to hide bad news, then being transparent may become the better option. As a result, the overall level of transparency in the company could rise.

1. Single case, small sample: The study looked at only one company. So the results might not hold for bigger companies, different industries, or businesses that operate across borders.
2. Exclusion of implementation costs: The \$11,000 monthly cost only covers running the system. It does not include the one-time costs to set it up, like buying software, integrating systems, or training staff.
3. Fraud benchmark subjectivity: The measure of how well fraud was detected depends on human reviewers, who can make mistakes. So the fraud accuracy number is not perfectly objective.
4. No inferential statistics: The study only had three months of data. That is too little to run statistical tests that prove the results are not just due to chance.

Future research should do four things:

- (a) Replicate across firms and sectors: Run the same kind of study in many companies and industries, not just one. This would show whether the results hold up more broadly.
- (b) Full cost–benefit analyses: Include the one-time costs of setting up the system—like software, integration, training, and change management—when calculating whether it pays off.
- (c) Auditor and regulator adaptation: Study how auditors and regulators adjust their practices and rules for continuous assurance, where checks happen all the time rather than periodically.
- (d) Governance conditions: Look at what factors inside a company—like leadership, culture, board oversight, or incentives—make adoption happen faster or slower.

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