Blockchain and Accounting Fraud Prevention: A Case Study on Luckin Coffee

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ABSTRACT

Based on the case analysis of recent accounting scandal of Luckin Coffee, the paper studies whether and how the blockchain technology would help to prevent and detect accounting fraud, using the fraud triangle model. I find that the three characteristics of the blockchain technology would help to break the fraud triangle. First, the decentralization (rather than centralized authorization) will largely increase the fraud cost, discouraging fraudulent behavior in financial reporting. Second, the append-only linear form of transactional data (rather than relational database) enhances the tracking of tokenized assets, making the data much more difficult to be modified than the data in a traditional relational database with many data operation possibilities. Third, with smart-contracts serving as automatic controls, the blockchain removes the human factor, thus enhancing the control environment. My findings shed light on how blockchain, as one of the most disruptive and promising emerging technologies, will significantly cause landscape changes in the accounting and auditing fields.

Keywords: *blockchain; accounting fraud; fraud triangle; Luckin Coffee*

1.INTRODUCTION

Corporate accounting fraud continues to get widespread public attention. It causes substantial damages to stakeholders (e.g. Enron, WorldCom, and a more recently case Luckin Coffee) and undermines investors' trust in the financial market, and therefore has a detrimental effect on the markets' proper functioning (e.g. Erickson et al., 2006; Gleason et al., 2008; Goldman et al., 2012; Hung et al., 2015; Amiram et al., 2018) [1~5]. While accounting fraud, is notoriously difficult to detect and prevent, efficient and effective methods of detecting accounting fraud will be valuable to not only investors, but also the financial market. Attempts have been made to develop methodologies of fraud prediction and recent advances include using nonfinancial measures (Brazel et al., 2009) [6] and statistical models such as Benford's Law (Amiram et al., 2017) [7] and machine learning approaches (Cecchini et al. 2010; Hoberg and Lewis, 2017; Bao et al., 2020) [8~10]. The recent emergence of blockchain technology, which establishes a decentralized public ledger without centralized authority, has obtained increasing attention from the accounting profession. While the practitioners expect the evolving technology will generate landscape change in the next-generation business process by largely improving its transparency (PwC, 2016; Deloitte, 2016) [11~12], this paper aims to study with the ability of reshape the trust between parties in a transaction, whether and how the blockchain technology help to prevent and detect corporate accounting fraud.

As a shared, immutable database, blockchain facilitates the process of recording business transactions and tracking the assets in a business network. Cryptographic hashes link the "blocks" of transactional data to form a "chain" that are decentralized and has an append-only "linear" form.

Blockchain is one of the most disruptive and promising emerging technologies (Wang and Kogan, 2018) [13], and employs cryptography theory, consensus mechanisms, and other technologies to track the flow of financial data and then combines them to transport, store, verify, and exchange data, thereby providing a secure and stable, traceable, and efficient technical solution for information users. The blockchain operates by first transmitting a request for a transaction from one party to another, then storing the information in a block. After confirming its legitimacy, the block is validated, and the information is connected to the blockchain and cross-

checked with other nodes in the block to complete the transaction and record it.

The primary reasons for the persistence of financial fraud in listed companies include information asymmetry between stakeholders and managers, insufficient oversight by government and other related departments, and the inability of internal and external auditing departments to perform their assigned functions fully. External audit and internal control are critical tools for fraud prevention and detection, and as such, this paper will focus on this area and explore how blockchain technology might help prevent fraud more effectively.

This paper conducts a systematic literature review of current studies related to corporate fraud and blockchain, finding that society's intention to tackle the fraud issue is overwhelming, and blockchain's characteristics of being decentralized and tamper-resistant have the potential to deal with this urgent problem. Through the case study of Luckin Coffee's fraud, this paper analyzes the shortcomings of traditional audit procedures and how to apply blockchain technology to the company to better prevent and detect fraud from the perspective of external audit and internal control.

2.CURRENT STATE OF RESEARCH

The necessity to record transactions developed as human trading behavior evolved, and the single-entry accounting technique was established. It did, however, record transactions unilaterally, with individual records and no link between the data. The modern corporate system has given birth to double-entry bookkeeping, in which each transaction is recorded separately in "two books," with auditable transaction records. However, the prevalence of financial fraud in today's business world has cast doubt on the accuracy of double-entry accounting. Ijiri (1986) pioneered the notion of triple-entry accounting. In addition to the debit and credit entries, he advocated adding a trebit entry [14]. Grigg (2005) recommended supplementing the double-entry system with a third set of books, an independent, public, cryptographically secure ledger of transactions that no one could tamper with [15]. Bitcoin, founded in 2008 by Satoshi Nakamoto, was the first tangible incarnation of blockchain technology based on distributed ledgers. Triple-entry accounting has the potential to fundamentally alter how businesses operate in the long term and at the same time to significantly enhance accounting while also resolving the trust and transparency concerns that now plague present systems (Cai, 2021) [16]. Blockchain technology can serve as a platform for voluntary information sharing and has the potential to significantly reduce financial disclosure mistakes, improve the quality of accounting data, and eliminate information duplication (Chowdhury, 2021) [17].

In recent years, decentralized blockchain technology has been highly sought after in a variety of fields worldwide, and its compelling strategic and commercial value has compelled people from all walks of life to compete, and even entire countries have invested significant human, financial, and material resources in the research and application of blockchain technology. The United States Congress has approved several bills relating to cryptocurrencies, and the Internal Revenue Service has published guidance on determining the tax due on bitcoin holdings. Germany liberalized its digital currency regulations and promoted blockchain implementation on the ground. France established the G7 Task Force on Cryptocurrencies. ABN AMRO has established a commodity-focused blockchain platform. China has made the development of blockchain technology a national priority. As reported by Deloitte in 2018, a worldwide blockchain survey found that 74 percent of those who participated in it have joined or are planning to join the blockchain alliance soon.

According to the GONE theory of fraud (Bologna, 1993) [18], fraudulent behavior is the result of the interaction of greed, opportunity, need, and exposure, and that the individual committing fraud is motivated by his or her own needs and the belief that his or her fraudulent behavior will go undetected, and thus will commit financial fraud when the opportunity presents itself. The most typical motivations for management fraud in publicly traded firms are to fulfill their management goals, and secondly, to enhance the share price and inflate the market in order to attract more investors. Thus, when a company's actual business performance is subpar, the management will employ fabricated accounting data to bolster the company's growth. Al-Najjar (2017) found that the motivations for financial fraud in publicly traded companies are significantly related to poor business conditions, a weak internal control environment, and deception of the CPA through an empirical analysis of company profitability, expected profit, and internal control environment indicators [19]. Enhancing managers' management philosophy, increasing internal controls, internal audit, and external audit may all be useful methods of preventing fraud. This paper focus on the factor of external audit.

With the growing use of big data analytics in the financial industry, the development of new data-driven auditing technologies has been vigorously supported, and the rise of blockchain will also impact the auditing field significantly (Gepp et al., 2018) [20]. In order to enable auditors access trustworthy digital audit evidence, they created a blockchain architecture that greatly reduces the cost of replacing current information systems. Auditors can develop continuous audit programs for their customers without making major expenditures in the integration of software (Vincent et al., 2020) [21]. Due to the multi-party nature of blockchain technology and

the communal maintenance of the resultant distributed ledger, the original audit data storage mechanism is altered, further ensuring the audit data's dependability and security. However, there is a risk of leaking clients' private information. Cao et al. (2019) designed a system to increase the efficiency of cross-database auditing using zero-knowledge protocols that protect the privacy of clients by employing a federated blockchain for collaborative auditing [22].

Meanwhile, accounting firms have put the blockchain theory into reality. PWC offers audit and other assurance services to clients who own or trade cryptocurrencies. Deloitte has launched Rubix, an enterprise-grade blockchain software application development platform on which customers may design their own blockchain-based applications. EY has developed an *EY OpsChain* to help businesses with the whole business lifecycle, including contracting, ordering, fulfilling, invoicing, and payments, by using tokens and smart contracts powered by blockchain.

3.CASE STUDY OF LUCKIN COFFEE'S FRAUD

3.1 Background Information of the Luckin Coffee Scandal

Luckin Coffee (NASDAQ: LK and now OTC: LKNCY) is a fast-growing coffee chain in China founded in 2017. The Xiamen-based company operates 5,259 stores (including 4,018 self-operated stores and 1,241 partnership stores) as of June 30, 2021, growing from 4507, 2073, and 9 as of December 31, 2019, 2018 and 2017. On May 17, 2019, Luckin Coffee was officially listed on NASDAQ, only 17 months since the opening of its first store, and breaking the world's fastest IPO record. 2018 and 2019 saw Luckin's strong growth, and many expected it to "challenge Starbucks' long-held dominance". However, after its stock price almost tripled in about two months, Luckin got accused of inflating revenue by short-seller Muddy Waters Research in January 2020. Later in April 2020, Luckin announced a preliminary internal investigation showing that an estimate of $310 million worth of fabricated sales and was delisted from NASDAQ in June 2020 due to accounting fraud. It reached a $175 million settlement of shareholder class-action claims recently on October 26, 2021.

3.2 Fraudulent conducts and audit difficulties

Luckin Coffee inflated earnings primarily by intentionally inflating retail sales volume and product net selling prices. According to the Muddy Waters Research, the majority of Luckin Coffee stores exhibited the problem of "jumping orders" in which the usual invoice number should follow the natural number sequence, but

Luckin stores were labeled randomly as "271, 273, 276...", which substantially exaggerated the sales volume. The clever part is that "company management likely thought about the possibility that more and more investors and data firms were starting to track their order numbers themselves as part of the due diligence process", as Muddy Waters Research put it. Therefore, "jumping orders" is a simple way to mislead investors. Meanwhile, generous subsidies and discounts account for the majority of Luckin Coffee's sales, and customers can claim numerous coupons on the Mobile App with which Luckin Coffee partners for promotion. Individuals may pay varying prices for the same cup of coffee. Different users will receive varying discounts: the majority will receive more than 50% off, while a few may receive less than 50% off or even the whole amount. Luckin Coffee saw an opportunity to commit fraud at this stage by increasing the unit price of each cup on the books. To conceal the disparity between profit and cash flow, management said that all of this revenue was spent on advertising.

Although, Luckin's way of fabricating accounting numbers seems to be primitive, it still took the effort of the short-seller's 92 full-time and 1,418 part-time staff or running surveillance to record store traffic and gather 25,843 customer receipts from 10,119 customers to find out.

Luckin Coffee processes a large volume of daily orders, and consumers are typically not in the habit of requesting invoices. It is difficult for auditors to collect a representative sample of tiny invoices from consumers, which makes determining the legitimacy of revenues and expenditures more complex and raises audit risks.

Between April and December 2019, Luckin coffee engaged in non-commercial interactions with several other parties and raised its bogus income by 2.19 billion yuan through fictitious commodity coupon business. The group's robust cash flow and the concealed nature of the electronic vouchers, together with the fact that the third-party entities with which the transactions were conducted were unrelated, rendered such transactions undetected by external audit since they lacked commercial substance.

In general, the pace of inventory increase in retail firms is directly equal to the rate of operational revenue growth, and the difference between the two should not be excessive. Luckin Coffee's sales increased by 90% in both Q3 and Q4 of 2019, yet inventory growth was only 23% or even negative. Therefore, it is necessary for auditors to conduct supervision of physical inventory count. However, the majority of Luckin's inventory is split over many stores, and commodities are often transferred between each other. Additionally, Luckin has over 4,500 stores nationally, making it impossible to satisfy inventory inspection deadlines. Due of the limits described above, auditors often struggle to mitigate detection risk and audit risk through supervision.

3.3 Breaking the Fraud Triangle

As is shown at figure 1, the application of blockchain will benefit Luckin Coffee's fraud prevention and detection from the perspective of *Fraud Triangle*, that is, motivation, opportunity and rationalization.
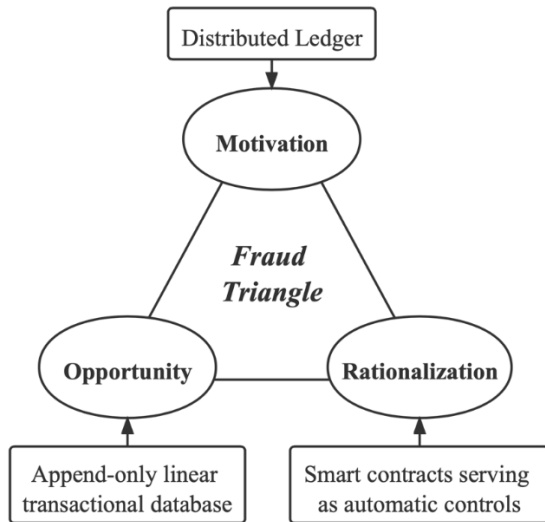

FIGURE 1 How blockchain characteristics helps to break the fraud triangle

Luckin Coffee recorded economic transactions using a typical ERP system. Because of the centralized architecture of traditional ERP systems, management was able to modify data easily. First, if blockchain, the decentralized way to store data, had been adopted to replace a typical ERP accounting system, the power of transaction verification, storage, and organization would have been distributed over a network of computers (or "nodes"), which could diminish a single point of tempering risk (Peters and Panayi, 2016). The modern ERP accounting system is often secure enough to get rid of outside cyberattacks. However, when the insider wants to fabricate the transactional data, as in Luckin's case, a traditional ERP would not be able to prevent a top executive, who is motivated by the desire to liquidate his shareholdings to gain fast money and therefore to deliver short-term performance, from conducting the fraud. To modify the data on the blockchain, managers will need more than fifty percent of the nodes to cooperate with them to make data fabrication possible (51% attack), which leads to a much higher fraud cost (they will definitely have to share the "benefit" of conducting fraud with the cooperators). Thus, weighing the benefit against the cost, the fraud motivation will be broken.

Second, blockchain is a linear transactional database that data can be only updated by appending while ERP is built on a relational database and provides for a wide range of data operations, and it has a more straightforward way for data insertion, update, and deletion. Also, the tracking of tokenized assets, for example inventory and consumable materials, will be easier under blockchain's efficient structure. This append-only linear transactional database architecture prevents "jumping orders" in Luckin stores and, to a considerable extent, ensures that all invoices inside the firm are consecutively numbered. In this way, the "opportunity" leg of the fraud triangle will be snuffed out.

Third, automated data processing capabilities linked into a triple-entry accounting information system based on blockchain technology may result in a totally automated accounting environment. In this setting, smart contracts could behave as autonomous software agents, verifying, regulating, and preventing fraud. Numerous accounting processes and auditing procedures may be automated by incorporating accounting standards or other regulatory requirements into smart contracts. The automated control system of smart contracts decreases the accounting system's reliance on humans and increases auditing efficiency, removing the excuse for accountants to rationalize fraudulent action.

3.4 Changes to external auditors

To obtain audit evidence, regular audit procedure relies excessively on financial and non-financial information provided by the clients, and therefore auditors must spend substantial portion of their time verifying the authenticity of the information. Decentralization, on the other hand, can make each node aware of what is happening in other nodes, and auditors can obtain information about inventory, costs, and detailed revenue from any Luckin's store linked on the blockchain, making "jumping orders" and "inflating revenue" impossible anymore. In addition, this could also significantly reduce the audit cost, as well as facilitate the implement of audit procedures to lower the related audit risk.

Each transaction on the blockchain is issued a unique hash and is linked chronologically from *Genesis Block* to the most updated block, and the transaction information can only be uploaded and cannot be altered without the consent of half of the nodes. Auditor may trace the origins of each Luckin Coffee transaction in order to ascertain the genuine identity of the supplier and customer involved in each transaction, therefore eliminating transactions with no commercial substance.

However, since the blockchain system is somehow completely transparent, privacy concerns may exist regarding business secrets and key business strategy on a distributed ledger. Luckily, adoption of the zero-knowledge proofs (ZKPs) will address such concerns. ZKPs are proofs that expose no information other than the truthfulness of the statement being proved, to be more specific, one can authenticate her/himself without sharing sensitive information.

3.5 Changes to the five components of COSO framework

3.5.1 Control Environment

Blockchain can record transactions without the intervention of human, thus improving the efficiency of control environment. All the information of economic transactions of Luckin can be recorded automatically and orderly. However, many human conducts like management's level of ethics and honesty cannot be detected by blockchain. Also, how to deal with the problems of integrating blockchain is still an issue that needs to be addressed.

3.5.2 Risk Assessment

By encouraging accountability, ensuring record integrity, and providing an irrefutable record, data on the blockchain is much more credible which does diminish existing risks of fraud and misrepresentation, regardless of the new risk it brings.

3.5.3 Control Activities

On the one hand, smart contracts can operate and process business automatically and effectively, hence lowering the cost of human resources, eradicating the risk of manipulation and misbehavior, and removing the excuse for accountants to rationalize fraudulent action. On the other hand, due to the decentralized nature of the blockchain, it is significantly more sophisticated to develop and operate the new blockchain system in collaboration.

3.5.4 Information & Communication

New approaches for management to communicate financial information to important stakeholders can be created because of blockchain's intrinsic transparency and usefulness of data. This largely reduces the critical issue of information asymmetry between stakeholders and management. Consequently, there is no space for management to do something ulterior.

3.5.5 Monitoring Activities

Blockchain technology has the potential to enable real-time, diversified, and precise monitoring, significantly disrupting the content and method of traditional monitoring. Therefore, it is easier to prevent accounting fraud internally.

4.CONCLUSION

Accounting fraud is a serious problem that will be tough to address with currently available technologies. Many proposed that the continuous application of blockchain in various industries may revolutionize the existing business world. Thus, based on a case study, this paper analyzes how a blockchain-based accounting and auditing system is able to break the fraud triangle, and therefore significantly facilitate the efficiency and accuracy of fraud prevention and detection. While blockchain reduces the risk of fraud, it still raises new concerns to the business world. The most obvious one is privacy issue, which can be solved by the so called ZKPs, though theoretically with unforeseeable difficulties in practical application. Hence, the aforementioned benefits of blockchain technology will take time to realize. In the long term, as technology advances, fraud prevention and detection using blockchain will become a feasible and desirable choice.

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