Integrity of Internet Finance Blockchain Technology and Its Impact on Forensic Accounting

Research Project for Emerging Issues/Advanced Topics Course

Master of Forensic Accounting Program

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1.0   INTRODUCTION

Internet Finance, also referred to as "Digital Finance"[1] or "ITFIN", is an emerging way of money transaction. Over the past ten years, China's Internet Finance industry has grown and developed at a dizzying rate. Hundreds of millions of people are now using third-party online payment services to complete money transfers, turning to peer-to-peer (P2P) lending platforms or online banks to borrow money, and moving away from traditional financial institutions like banks to invest their savings directly in online investment funds. Internet Finance, as a concept, is not a new term. Example of commonly seen Internet Finance is cashless payments, such as debit cards, credit cards, and wire transfers. The most familiar form of Internet Finance has been in existence for decades, but its technology has driven changes dramatically. The new forms of Internet Finance include Chinese Information Technology (IT) giants providing financial services such as digital wallets like WeChat e-wallet operated by Tencent and Yu'E Bao operated by Ant Financial owned by Alibaba. Traditional financial institutions like banks, insurance, and exchange platforms also willing to switch to Internet Finance by applying information technology to their traditional services, such as e-ICBC service of the Industrial and Commercial Bank of China (ICBC).

However, with the rapid evolution of Internet Finance technology and the government being slow to issue regulations on the provision of digital financial services, Internet Finance providers have had much more freedom to operate than traditional financial institutions. Illegal fundraising activities have continued to grow in recent years.[2] Since 2011, thousands of exchange platforms have gone bust, many due to fraudulent practices. Online transactions are a popular channel for

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[1] Xiao, Y. (2018, April). *Understanding Yu'E Bao: The implications of Internet Finance development in China* [Scholarly project]. In Economics Concentration Hong Kong Baptist University. Retrieved June 15, 2020, from http://lib-sca.hkbu.edu.hk/trsimage/hp/14252961.pdf

[2] Zhang, Y. (2019, January 31). *Officials warned about illegal fundraising*. Retrieved June 10, 2020, from https://www.chinadaily.com.cn/a/201901/31/WS5c524a17a3106c65c34e771f.html

crimes, as they may masquerade under complex financial concepts like peer-to-peer lending, wealth management, private equity or virtual currency, and embezzle or laundering money. Chinese regulators are increasingly concerned about how digital payment services manage users' deposits and introduce new payment methods. The regulators no longer sit back and support this innovative industry like in previous years. The government wants to bring oversight up by regulating them exactly like banks "as it is growing much bigger, the central bank is taking more control."[3] *How China's Central Bank Is Clamping Down On The Mobile Payment Industry,* 2017 August.

Things look familiar as it goes far. It appears the digital financing is just "old wine in new bottles"; however, not with the idea of implementing the blockchain technology. The virtual currency used in Internet Finance tends to be encrypted in blockchain technology. Moreover, it is being accelerated by the test of the e-Renminbi (RMB) launched by the Central Bank of China on June 1, 2020. On September 3, 2018, China's Supreme People's Court (SPC) issued a judicial interpretation on the hearing of cases by the country's newly created internet courts. "Taking effect on September 07, 2018, the SPC Provisions on the Hearing of Cases by Internet Courts allows evidence stored and verified on blockchain platforms to be used in legal disputes heard by the three internet courts in Hangzhou, Beijing, and Guangzhou."[4] *Global Legal Monitor,* 2018, September 21. The admissibility of the Blockchain-based digital forensics chain of custody made the collection, preservation, and analysis of digital evidence an essential tool for solving Internet Finance crimes and preparing court cases.

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[3] Hong, J. (2017, August 18). *How China's Central Bank Is Clamping Down On The Mobile Payment Industry.* Retrieved June 29, 2020, from https://www.forbes.com/sites/jinshanhong/2017/08/18/how-chinas-central-bank-is-clamping-down-on-the-mobile-payment-industry/

[4] Zhang, L. (2018, September 21). *Global Legal Monitor.* Retrieved June 29, 2020, from https://www.loc.gov/law/foreign-news/article/china-supreme-court-issues-rules-on-internet-courts-allowing-for-blockchain-evidence/

2.0   BACKGROUND DEFINITIONS

2.1   What is Internet Finance?

The point of the explosive development of Internet Finance in China began with the launch of Yu'E Bao, an online digital wallet for the money market established by Alibaba's Ant Financial Services in June 2013. During the past 5-6 years, digital wallet operators such as Ant Financials' Yu'E Bao and Tencent's WeChat e-Wallet have become a fever pick, receiving broader acceptance and greater usage worldwide.

According to the National Internet Finance Association of China, Internet Finance refers to "the new business model of utilizing the Internet and information communication technologies with traditional financial institutions to accomplish a wide range of financial activities, such as third-party online payment, online lending, direct sales of funds, crowdfunding, online insurance, and online banking."[5] *互联网金融的概念(the Concept of Internet Finance),* 2016, September 06. In other words, by embodying advanced information technology, traditional financial institutions can provide more efficient and lower-cost financial services to a broader range of customers.

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[5] *互联网金融的概念(the Concept of Internet Finance)* [Web log post]. (2016, September 06). Retrieved June 03, 2020, from http://www.nifa.org.cn/nifa/2955704/2955773/2957748/index.html 中国互联网金融协会(National Internet Finance Association of China)

3.0   YU'E BAO

Recent developments in digital financing are soaring. Although a variety of complex Digital Finance concepts appeared in the market, the most representative product, Yu'E Bao, has made its name as "the world's biggest money-market fund"[6], *China no longer runs the world's largest money market fund,* 2020, January 28. It started when the money market fund was added to the widely used payment service application, Alipay, in June 2013.[7]

The money market fund was initially designed for customers to place petty cash to ease the transaction for e-commerce purchases. Several factors have contributed to Yu'E Bao's success, and the most crucial reason for Yu'E Bao's popularity is the connection with Alipay.[8] It was the Internet that makes it the largest money market fund in the world. Chinese consumers began using it like a chequing account. They can pay for anything with less than five clicks on the mobile phone, from grocery purchases to nail salons.

Customers flocked to the fund because it was easy to access with no entry barriers, and they were able to get better returns than bank accounts offered. Transferring funds into Yu'E Bao means investing in a money market fund - Zeng Li Bao, managed by Tianhong Asset Management Co. When Chinese banks offer around 0.35% annual interest rate to the savings account, Yu'E Bao has an average of 4.78% 7-day annualized rate to the investors from 2013 to 2015.[9] In addition to its high return, Yu'E Bao has made it extremely easy to access as there is no minimum investment

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[6] Detrixhe, J. (2020, January 28). *China no longer runs the world's largest money market fund*. Retrieved June 03, 2020, from https://qz.com/1791778/ant-financials-yue-bao-is-no-longer-the-worlds-biggest-money-market-fund/
[7] Detrixhe, J. (2020, January 28)*. China no longer runs the world's largest money market fund.* Retrieved June 03, 2020, from https://qz.com/1791778/ant-financials-yue-bao-is-no-longer-the-worlds-biggest-money-market-fund/
[8] Zhang, C. ; Zhou, Y. (2015). *Internet Finance in China: An Event Study of Yu'e Bao.* Internet Finance in China: An Event Study of Yu'e Bao, Page 30 Para 2
[9] Zhang, C. ; Zhou, Y. (2015). *Internet Finance in China: An Event Study of Yu'e Bao.* Internet Finance in China: An Event Study of Yu'e Bao, Page 30 Para 1

requirement for Yu'E Bao, which allows low-income population to benefit from it as well. With the high return, low-entry barrier, and ease-of-use as its main feature, Yu'E Bao's launch formed a phenomenon in China's Internet Finance. The launch of Yu'E Bao was so influential that it caused substantial growth in China's Internet Finance.

Yu'E Bao contains three central bodies: Alipay, Tianhong Asset Management Co., and Alipay Registered User.

Bank Account

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Yu'E Bao ←—— Purchase and Redeem ——→ Zeng Li Bao

(Alibaba)   (Tianhong Asset Management Co.)
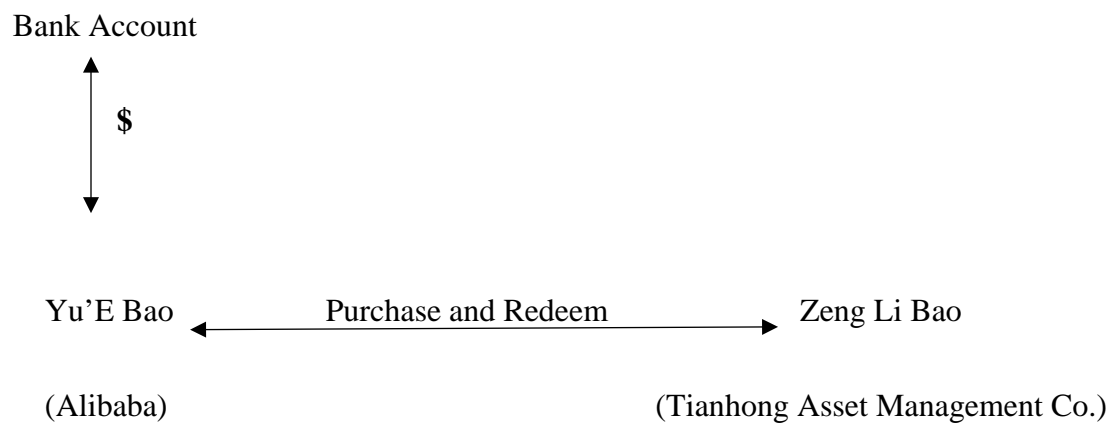
3.1   Compliance and Regulation Risks Associated to Yu'E Bao

Yu'E Bao is not a remarkable innovation. PayPal launched a money market fund in the early 2000s but shut it down on July 27, 2011. The main reason that led to the failure of the money market fund of PayPal was that the investors were worried about their accounts' safety. Yu'E Bao is a copy of the PayPal money market fund and faces the same compliance and regulation issue as PayPal.[10]

One serious risk faced by Yu'E Bao is liquidity risk. The risk represents the likelihood of the following situation when Yu'E Bao users suddenly withdraw large amounts of balance that the total withdrawals exceed expectations. There is a possibility that the money market of Yu'E Bao and Tianhong Asset Management Co. does not have enough reserves to support the number of withdrawals. Starting in 2017, the sector regulators – the People's Bank of China (PBOC) tightened their grip on third-party payment services like Alipay and WeChat Pay by issuing rules and regulations on Internet Finance providers. 100% of clients' reserve funds now have to be deposited with PBOC. Fintech companies are no longer enjoying the advantage of earning extra returns on those deposits. Therefore, more and more fintech companies position themselves as financial technology providers to traditional banks rather than operate as a bank.[11]

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[10] Yang, J. (2017). *Risk and Regulation of Chinese Online Investment Products.* Chinese Business Review, 16(5). doi:10.17265/1537-1506/2017.05.002 Page 235 Para 1

[11] Wang, F. (2019, May 14). *Tech Disruption In Retail Banking: China's Banks Are Playing Catch-Up To Big Tech.* Retrieved June 10, 2020, from https://www.spglobal.com/en/research-insights/articles/tech-disruption-in-retail-banking-china-s-banks-are-playing-catch-up-to-big-tech

In addition to liquidity risk, Yu'E Bao, and other Third-Party Payment Platforms (TPPPs) are also exposed to serious Money-Laundering and Terrorism-Financing Risk[12].

Identity Information and Know Your Client (KYC)

Opening an account through the Internet makes it more difficult to confirm the authentication of a client's identity than face-to-face registration. Different from the traditional bank's KYC method that clients are required to appear at the branch physically or register through a video camera, the registration of Yu'E Bao account requests an input of National Identity Number and front and back picture of Identity Card. Although the network guidance requires that Identity Document (ID) be uploaded, it is difficult to ensure whether the Identity Document is actually the owner of the ID, where in cases identity fraudsters steal ID from its owner.

In addition, when establishing a Payment Account like Yu'E Bao with a Bank Account, payment providers unilaterally rely on the bank's KYC result, but there is no provision between the two parties. As a result, several instances, like the customer of the Payment Account, are not the owner of the Bank Account, were exposed. The subsequent transactions in their Payment Account have no inherent relationship with the owner of the bank account.

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[12] 网络理财产品的洗钱风险与反洗钱对策(*Internet Finance Products Money Laundry Risk and Anti Money Laundry Solution*). (2020, March 04). Retrieved June 29, 2020, from https://www.mpaypass.com.cn/news/202003/04110221.html; published by: 银丰新融

Except for the lack of KYC check, Yu'E Bao also poses high Money Laundering risks due to the following reasons:

Complex Cash Flow

Yu'E Bao's easy and convenient transfer and payment function make the capital flow more complicated. Unlike traditional monetary funds, the principals and proceeds based on the Third-Party Payment Platform do not need to be transferred to the bank account. The funds can be held and transferred between different payment accounts quickly. Behind each payment account, funds were transferred between different asset pools, making it more challenging to monitor the transfer of the funds.
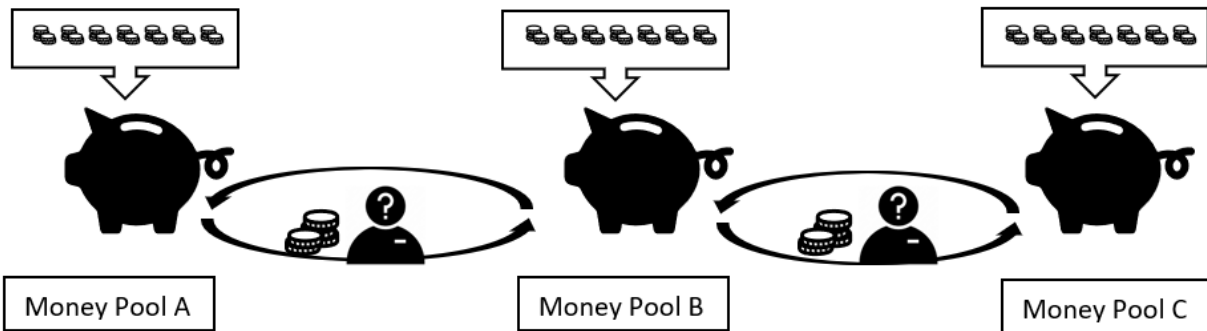
Cut-off Transaction Chain

The customer transaction chain is cut off, and it increases the difficulty of Anti-Money Laundering monitoring. When the payment institution participates in the chain of trade, the chain was interrupted and separated into two chains. In traditional bank system, the chain for individuals' daily activity is usually a simple transaction of income deposit – transfer of fund – withdrawal to

merchants. With the involve of Third-Party Payment Platforms, the completeness of the trade chain is cut-off into two pieces, where one piece is monitored and safeguarded by the bank's compliance department, while the other piece passed through Third-Party Payment Platforms is not screened against regulations because the platforms do not perform compliance screening. When money circles back to the bank account, the piece of transaction trace from outside of the bank is a black spot to the compliance investigators, and the investigators will have difficulty tracing the fund, detecting illicit fund movement and tracking the cashflow.[13]
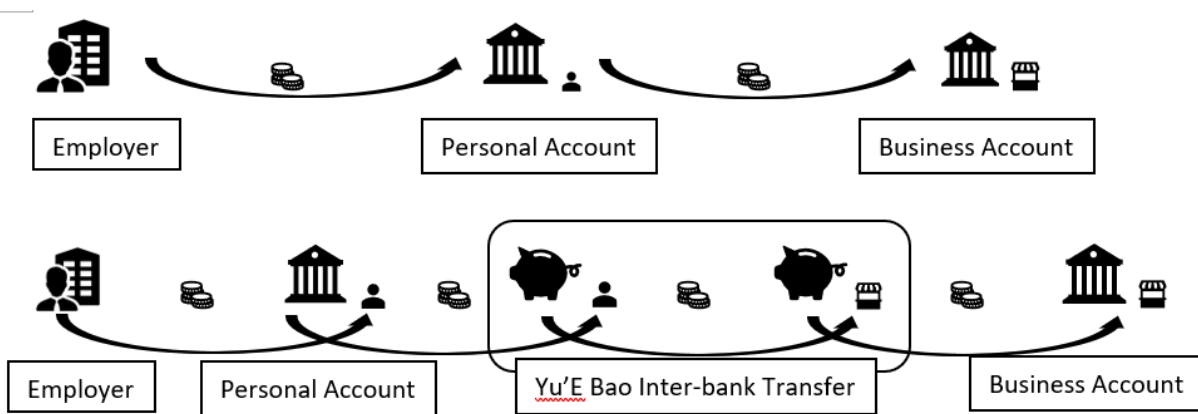
⏱ T+0 Transfer Timing

The real-time purchase and redemption on Yu'E Bao strengthen the liquidity of funds and enables funds to be transferred quickly from between each payment account. For lawbreakers who wish to deplete illicit funds abroad, the instant online transfer enables them to pass through crime

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[13] Li, H. (2018, October 11). *互联网金融反洗钱办法出台 银行如何加强反洗钱(Internet Finance Anti Money Laundry Regulation Launch, How Banks Enhance Anti Money Laundry Monitoring).* Retrieved June 10, 2020, from http://bank.jrj.com.cn/2018/10/11075425184506.shtml

money quickly, which significantly reduces the possibility of criminal asset being frozen and detained because by the time it is detected, the money has already travelled out of reach.

On January 01, 2019, the new provision[14] issued by the People's Bank of China orders Internet Finance Providers to establish internal control mechanisms for detecting and preventing money laundering and terrorist financing. All Internet Finance Providers in China must follow Know Your Client (KYC) rules and report large and suspicious transactions.

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[14] China, People's Bank of China. (2018). *互联网金融从业机构反洗钱和反恐怖融资管理办法（试行）(Internet Finance Entities AML/ATF Management Solution)* (p. 1). Beijing, Beijing: CacCyberspace Administration of China.

4.0   BLOCKCHAIN APPLICATIONS IN DIGITAL FINANCING

In the past 14 years, Alibaba has established an ecosystem of internet finance and has continuously improved in the fields of payment, microcredit, insurance, credit security, e-commerce, and so on. Its success primarily relied on its e-commerce and logistics system and has cultivated a perfect soil for Blockchain. Ant Financial has established the blockchain team as early as 2015. According to the 2019 Global Blockchain Invention Patent Ranking report from incoPat and IPRDaily[15], Alibaba Group dominates the list with 1505 Blockchain invention patents registered. With 724 patents applied, Tencent follows as in the second place.

source: https://www.statista.com/statistics/1119195/global-number-of-blockchain-patent-applications-publicly-filed-by-leading-company/
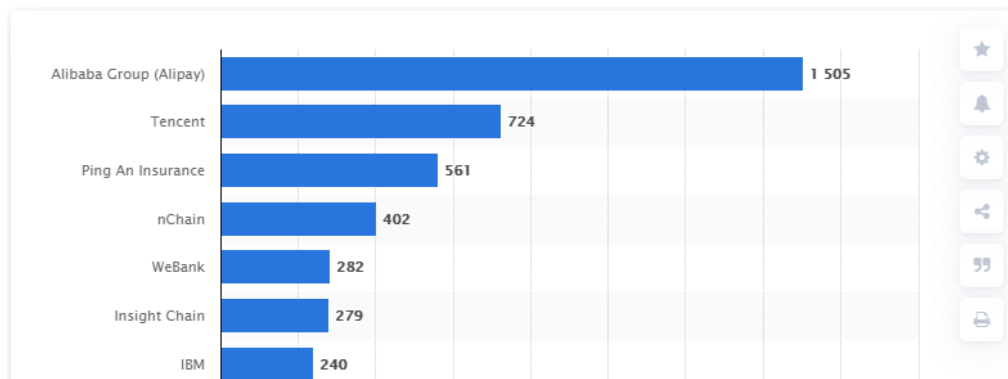
Why would Information Technology giants compete to explore Blockchain technology? According to Geoff (Guofei) Jiang, President of Advanced Technology Business Group, Head of Discovery, Adventure, Momentum and Outlook (DAMO) Academy's Fintech Labs, Ant Financial,

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[15] Textor, P.; 22, M. (2020, May 22). *Global blockchain patents publicly filed by major company 2019.* Retrieved June 15, 2020, from https://www.statista.com/statistics/1119195/global-number-of-blockchain-patent-applications-publicly-filed-by-leading-company/

Blockchain will become a technology with more influence than Artificial Intelligence (AI). "In the past, an important difference between the digital world and the physical world was that the physical world is real and could not be changed without any trace, but the data could be deleted, copied, or altered without any trace. Blockchain technology can make the digital world as authentic as the physical world. Data sharing and the smart contract will enhance the efficiency and consistency in decision-making unprecedentedly. In short, Blockchain Technology will become the cornerstone of trust in the future digital society.[16]", *蚂蚁金服蒋国飞：向全行业开放技术能力 蚂蚁区块链需要同路人(Ant Financial Guofei Jiang: Share Technology to all Industries, Ant Financial Blockchain need Accompany),* 2020, January 09.

In August 2016, Ant Financial launched its first Blockchain application – "Hearing Impaired Children Gain Voice" public welfare donation tracking project. In this project, Ant Financial was able to follow each donation trail from the beginning to the end. In March 2017, T-Mall, formerly Taobao operated by Alibaba Group, was looking for new technical solutions for anti-counterfeiting and traceability of imported food from abroad. Ant Financials' Blockchain exploration can solve such a problem. After a series of processes such as Research and Development (R&D), Concept Verification, Node Deployment, and Testing, the "Hearing Impaired Children Gain Voice" project finally launched in September 2017. Combined with physical anti-counterfeiting technology, consumers can quickly check all logistics information by scanning the QR code on the packaging of imported food. Credible source information, such as manufacturer background, quality inspection result, location of the oversea warehouse, and eventually the distributor information, will be shown on the smartphone. The secure and

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[16] Zhao, Q. (2020, January 09). *蚂蚁金服蒋国飞：向全行业开放技术能力 蚂蚁区块链需要同路人(Ant Financial Guofei Jiang: Share Technology to all Industries, Ant Financial Blockchain need Accompany)*, p. 1. Xinhua Net

unchangeable logistic information mainly builds confidence in e-commerce consumptions. The application of commodity traceability is based on the idea of "one thing, one code" that "in the future, all social commodities can be on Chain… Furthermore, all of us will develop a mind of tracing authentication of products."[17], *蚂蚁上链：蚂蚁金服和大公司区块链之路 (Ant Financial and the Road of Enterprise Blockchain),* 2018, March 02.

Ant Financials' Blockchain has not been involved in virtual digital assets, and they are keeping a safe distance from digital currency. At present, all applications of Ant Financial Blockchain are aimed at logistics and supply chains, because the technology is still in its early stages, and there are still many obstacles to overcome.

In the following section, we will discuss briefly what Blockchain is and how Blockchain can function as a distributed ledger technology that provides a trustworthy and secure information warehouse.

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[17] *蚂蚁上链：蚂蚁金服和大公司区块链之路 (Ant Financial and the Road of Enterprise Blockchain).* (2018, March 02). Retrieved June 15, 2020, from https://www.odaily.com/post/5121776; blog published on 星球日报 (ODaily)

4.1 What is Blockchain?

Quoted from the article *How Blockchain can Change Banking: Banking on a Public Platform*, published by Deloitte,

"Blockchain refers to a new type of digital database organization, allowing a wide group of participants to simultaneously access the public depository of information, which is chronologically updated, with unprecedented level of security and reliability. It can only be updated by consensus of majority of the participants in the network (e.g. by "proof of work" consensus). Moreover, once entered on blockchain, information can never be erased. Blockchain contains a secure and verifiable record of every single digital transaction ever made."[18] *Blockchain Applications in banking: Opportunities for Services and Compliance Activities,* 2019, May 31.

In short, Blockchain functions as a distributed ledger that is trustworthy, secure, and verifiable to every single digital transaction ever made. A distributed ledger is a type of database that is synchronized and shared among the participants of a decentralized network.[19] Deloitte report *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption* published on April 18, 2017, concluded and listed eight key features[20] of the Blockchain technology:

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[18] Information, F. (2019, May 31). *Blockchain Applications in banking: Opportunities for Services and Compliance Activities.* Retrieved June 19, 2020, from https://www2.deloitte.com/mt/en/pages/financial-services/articles/mt-blockchain-applications-in-banking.html; Deloitte Malta

[19] Brakeville, S.; Perepa, B. (2019, June 01). Blockchain Basics: Introduction to Distributed Ledgers. Retrieved June 30, 2020, from https://developer.ibm.com/technologies/blockchain/tutorials/cl-blockchain-basics-intro-bluemix-trs/

[20] Shah, M.; Chatterjee, S. (April 18, 2017). *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption.* Blockchain in Banking: While the Interest Is Huge, Challenges Remain for Large Scale Adoption, page 5. doi:https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf

Distributed Ledger

Identical copies of information are shared on the Blockchain near real-time. Network participants (nodes) independently validate information without a central governing authority. Even if a node tries to alter a block to the Chain, the remaining nodes would detect these changes and reject the block from the main Chain, prevent corruption and ensure no disruption.

Digital

Each node is defined by a hash, a 256-bit number, created by the network using an algorithm. A node includes a header, a reference to the previous block's hash, and a group of transactions.[21] The complex sequence of address hashes creates a unique, secure, and interdependent chain.

Updated Near Real Time

Depending on the network's rules, once a transaction occurs, the data will either be verified instantly or be logged into a secured code and transferred in a queue of pending transactions.

Chronological and Timestamped

Each node of the record is a repository that stores information pertaining to a series of transaction that links the current to the previous block in the same transaction. These connected blocks form a chronological chain showing a trail of the underlying transaction.

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[21] Deloitte Touche Tohmatsu LLP Malta. (2016). *How does a Blockchain Work?* [Brochure]. Author. Retrieved June 19, 2020, from https://www2.deloitte.com/content/dam/Deloitte/mt/Documents/financial-services/how-does-a-blockchain-work-infographic-2016.pdf

🔒 Cryptographically Sealed

Blocks created are cryptographically sealed in the Chain, which means that the blocks created and placed on the network become impossible to delete, edit, or copy, creating a high level of robust and trustworthy digital assets.

⚖ Irreversible and Auditable

When a block is distributed through the network, each node adds the block to the main Chain. The network becomes an immutable and auditable Blockchain.

⚖ Operate 'Trustless'

The decentralized storage in a Blockchain is failure-resistant. Even if, in the event of a large number of network participants – the computers or servers in the network failed, the Blockchain remains available. Data stored in a Blockchain is immune to hacks or data loss.

🏛 Fewer Third Parties

Determined based on a set of rules the network has agreed to, a transaction on Blockchain can be validated only if all the nodes on the network unanimously approve it. The rule is called consensus, which can be altered to suit different demands.

Blockchain technology, alternatively Distributed Ledger Technology (DLT), was initially developed from the idea of preventing fraud in digital currency exchanges. The encrypted, distributed, and tamper-proof nature of Blockchain makes it difficult for perpetrators to commit

fraud. In order to understand how Blockchain could fight Fraud and Money Laundering, a simplified process illustration was created to show how it was processed[22].
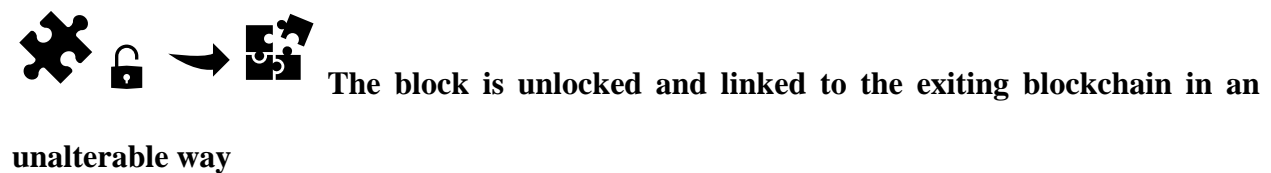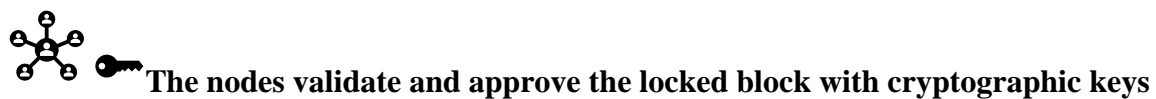
A send money to B

The transaction creates a locked block online

The locked block is distributed to every node in the network

The nodes validate and approve the locked block with cryptographic keys

The block is unlocked and linked to the exiting blockchain in an unalterable way

Transaction completed

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[22] Deloitte Touche Tohmatsu Malta. (2016). *How does a blockchain work?* [Brochure]. Author.
https://www2.deloitte.com/content/dam/Deloitte/mt/Documents/financial-services/how-does-a-blockchain-work-infographic-2016.pdf

4.2 Smart Contract

The introduction of smart contracts is a critical development in blockchain technology. The smart contract goes hand-in-hand with Blockchain. Smart contracts are coded on a blockchain that self-controls the execution of the terms under specified circumstances.[23] In other words, actions are executed automatically by a network of computers when predetermined conditions have been satisfied and verified. The application of a smart contract enables automated peer-to-peer transactions, which usually performed through a third-party trustee. For example, a smart contract can be exercised in a supply chain process. When Buyer A comes to a smart contract with Seller B, the contract will execute as the following steps:
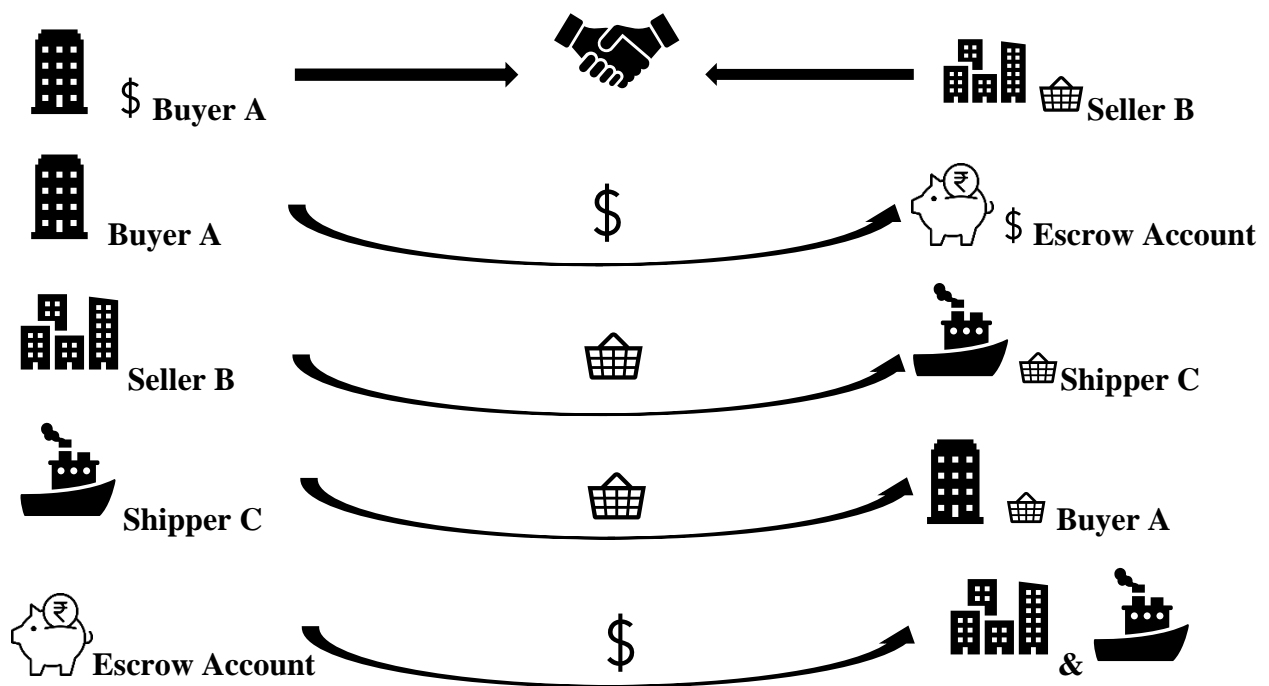
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[23] Lipton, A.; Levi, S. (2018, May 26). An Introduction to Smart Contracts and Their Potential and Inherent Limitations. Retrieved June 20, 2020, from https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/

Only if the previous step is completed and verified, the next action can be executed. If Buyer A failed to receive the shipment by a specific date, the money deposited in the escrow account would be returned.

Smart contract functions as a digital tool that carries out an automated and fast, secure, and trusted transaction executor; however, participants must agree on the rules and terms that determine those transactions[24]. Framework for resolving disputes and other exceptions still need to be done off the Chain, where fraud and corruption still exist like in the old days.

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[24] Lipton, A., & Levi, S. (2018, May 26). An Introduction to Smart Contracts and Their Potential and Inherent Limitations. Retrieved June 20, 2020, from https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/

4.3 Consensus Mechanism

Consensus Mechanism is a protocol placed in Blockchain to ensure that all the nodes participated in the network are complying with the agreed rules.[25] By having every participant consent to the distributed ledger, it ensures the transaction emerges from a legitimate source, making the Blockchain a secure and reliable technology for digital transactions. There are many consensus mechanisms in the market, and the following lists the three most popular ones.

Proof of Work (PoW) – a consensus mechanism that is based on solving a mathematical equation.[26] PoW consensus assumes that half of the network nodes are honest miners. Hence, obtaining more than half of the hashing power can attack the network.

Proof of Stake (PoS) – a centralized consensus mechanism. By taking a large portion of wealth, the miner/participant possesses more powerful than other participants and can influence the well-being of the network.

Delegated Proof of Stake (DPoS) – a consensus mechanism that comprises one vote per coin. Stakeholders with more coins possess more votes. The stakeholders' vote determines to reform and make changes in the network.

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[25] Sayeed, S.; Marco-Gisbert, H. (2019, April). (PDF) *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack*. Retrieved June 20, 2020, from https://www.researchgate.net/publication/332737156_Assessing_Blockchain_Consensus_and_Security_Mechanisms_against_the_51_Attack Page 2 Para 4

[26] Sayeed, S.; Marco-Gisbert, H. (2019, April). (PDF) *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack*. Retrieved June 20, 2020, from https://www.researchgate.net/publication/332737156_Assessing_Blockchain_Consensus_and_Security_Mechanisms_against_the_51_Attack Page 7-8

4.4 Public and Private Blockchain

In order to provide different solutions, public and private ledgers were implemented to solve different types of problems.

Public Blockchain Network is a permission-less network. Anyone can join the network, and all participants participate in all the transactions without preferential treatment. Private Blockchain Networks allows only selected participants to join the network, and data is shared with selected nodes based on the smart contract rules.[27] Considering the compliance requirement, Public Blockchains does not provide a secured network, given that it does not have identity management capability.[28] On the other hand, Private Blockchains have identity management applications that require users to input their identity solutions, such as using Google or LinkedIn. Also, with fewer participants and a closed network environment, Private Blockchain Networks perform better for enterprise applications. However, Private Blockchains are more vulnerable to hacks. Although private permissioned ledgers can use more efficient consensus algorithms, due to a relatively small group of participants, hackers may not need mining powers to breakdown the blockchain system. As compared to this, public blockchains are more secure due to its complex and massive data structure.

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[27] Jayachandran, P. (2020, February 12). *The difference between public and private blockchain*. Retrieved June 17, 2020, from https://www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/

[28] Sharma, R. (2019, June 11). *Council Post: Public Vs. Private Permissioned Ledgers And Blockchain Standards*. Retrieved June 17, 2020, from https://www.forbes.com/sites/forbestechcouncil/2019/06/11/public-vs-private-permissioned-ledgers-and-blockchain-standards/

5.0   BLOCKCHAIN AND INTEGRITY OF INTERNET FINANCE

5.1   Fighting Money Laundering and Fraud with Blockchain

Distributed Ledger Technology features to improve data quality and transparency that can benefit customer identity management, hence improves Know Your Client (KYC), Customer Due Diligence (CDD), and Anti-Money Laundering (AML) function. This section will discuss how blockchain systems advance and streamline an effective AML program.

It is principal that financial institutions know who their customers are, where the funds are coming from, and where the funds are expensed to. Without understanding the necessary client information, it is impossible to have proper compliance monitoring with AML/KYC regulations. The entire Anti-Money Laundering compliance program is built upon knowing whom you are dealing with. Without having accurate customer information, money laundering cannot be detected and prevented. A strong AML compliance program is based on risks presented and identified from a comprehensive CDD process. The objective of CDD should enable financial institutions to project a type of transaction in which a customer is expected to engage. These processes assist the bank in predicting potentially unusual or suspicious transactions.

According to the Financial Industry Regulatory Authority (FINRA) 2018 Regulatory and Examination Priorities Letter, AML program functions as a principal operational risk identification of the financial institutions and the regulators. In the banking system, central authorities can apply reporting tools such as the Suspicious Transaction Report to safeguard against Money Laundering and other financial crimes. Forensic Accountants rely on existing money tracking systems when fraud cases engaged. However, with Internet Finance and Blockchain, virtual currency is transferred from one digital wallet to another versus bank accounts controlled and monitored by

the banking system. On the international scale, Internet Finance may function as a tunnel that transmits funds across boarder without registering with a regulator. It challenges the regulator and maybe destabilize foreign exchange markets since virtual currencies can fall outside the standard regulatory framework.[29]

Even though Internet Finance may cause challenges to the regulators and compliance workers, there are several benefits Blockchain can bring to help eliminate some of the problems that cannot be solved under the current systems.

With the help of distributed ledger technology, KYC onboarding, and CDD program can be more consistent, transparent, and cost-efficient. DLT allows the market to set up a centralized identity management warehouse, such that once the identity of a customer is verified, the information will share with all parties on the entire network.[30] This will resolve each financial institution's duplicate efforts, independently conducting KYC review on each of the clients. Another benefit that DLT can provide is that it drastically reduces excessive manual processes from obtaining KYC information, which requires tremendous time consuming and labor intense. With customer KYC data ready to be integrated into the bank system, name screening for high-risk customers (Political Exposed Person, Sanction Client, Exposed to Negative News, etc.) can be immediately identified and flagged out accordingly, therefore reduced the high percentage of false positives.

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[29] Metallo, V. N. (2020). *The Impact of Artificial Intelligence on Forensic Accounting and Testimony—Congress Should Amend "The Daubert Rule" to Include a New Standard. The Impact of Artificial Intelligence on Forensic Accounting and Testimony—Congress Should Amend "The Daubert Rule" to Include a New Standard*, 69. doi:https://law.emory.edu/elj/elj-online/volume-69/essays/artificial-intelligence-amend-daubert-rule.html; page 2056 para 1

[30] *Distributed Ledger Technology: Implications of Blockchain for the Securities Industry (Tech.).* (2017). Washington, DC: The Financial Industry Regulatory Authority. doi:https://www.finra.org/sites/default/files/FINRA_Blockchain_Report.pdf

Refer to Association of Certified Anti-Money Laundering Specialists (ACAMS) report, *Distributed Ledger Technology*, the potential cost savings in annual AML by applying distributed ledger technology is almost one-third of the current spending.[31] The automated and integrated data system is crucial to fill in the data gaps and help compliance departments strengthen their AML and compliance functions. The ability to intake a large amount of data enables financial institutions to see an instantaneous holistic picture of the transaction grids and trace for the flow of illicit funds. The current transaction monitoring systems are designed and conducted independently by each financial institution. DLT allows effective communication between one and another, hence enables AML investigators to track the source of funds and the depletion of funds. It helps reduce the level of uncertainty when investigating a chip of suspicious transaction activity.

Identity theft continues posing challenges for all consumers worldwide. Identity theft is when a fraudster uses someone's personal information without consent for criminal activities. They may use the stolen information to gain access to financial accounts, defraud others, or hack into online accounts. Objective Blockchain ID (OBID) provides a highly reliable, accurate, and secure ID authentication. The entire OBID is designed to verify and create a person, and their validation is encrypted into the blockchain ID. Using a combined of various biometric cognitive techniques, OBID is immutable to replicate, and its authentication has a vast potential to prevent identity theft and cyber-attack.

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[31] Zelensky, N. (n.d.). *Distributed Ledger Technology: Streamlined CDD Examination Process through Blockchain Application (Rep.). Miami, Florida: Association of Certified Anti-Money Laundering Specialists.* doi:http://files.acams.org/pdfs/2018/Distributed_Ledger_Technology_N_Zelensky.pdf?_ga=2.251543878.1584323 006.1593397524-1098590259.1592330986; page 9 para 3

6.0   IMPACT ON THE INVESTIGATIVE FORENSIC ACCOUNTANT PRACTICES

The public looks up to Investigative Forensic Accountants (IFAs) to enhance trust in the investigated information of the companies they investigate and help the capital market and financial legal system function with greater confidence. Investigative forensic accountants practice under strict guidelines, professional codes of conduct and regulations, and are required independent of the entities they investigate.[32] Objectivity and professional skepticism is applied to ensure whether the subject is acting compliant with rules and regulations.

With Blockchain technology, payment systems can be decentralized, and governments are exposed to new challenges to track and regulate money transactions.[33]

An IFA is engaged in providing an assessment on recorded transactions supported by relevant, objective, accurate, and verifiable evidence[34], while the blockchain digital evidence constitutes sufficiently reliable and auditable information for forensic verification. However, the IFA may not be able to determine fraud by solely evaluating the information on the Blockchain. A transaction recorded in a blockchain might still be unauthorized, fraudulent, or illegal.[35] For example, transactions can still be executed between conspirators through a side agreement that is not recorded on the Blockchain. Another example is that a transaction could be manipulated and misrepresented in the financial statement.

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[32] *Standard Practices for Investigative and Forensic Accounting Engagements.* Page 5. Issued by Chartered Accountants of Canada and Investigative & Forensic Accounting
[33] Kai, J. (2018, March 27). *Blockchain: The regulation challenge - Paris Innovation Review.* Retrieved June 29, 2020, from http://parisinnovationreview.com/articles-en/blockchain-the-real-disruptions-and-challenges
[34] *Standard Practices for Investigative and Forensic Accounting Engagements.* Page 9. Issued by Chartered Accountants of Canada and Investigative & Forensic Accounting
[35] Alexander, A. (2019, December 03). *Blockchain: Unlocking new potential.* Retrieved June 30, 2020, from https://www.accountingtoday.com/news/blockchain-unlocking-new-potential

The key characteristics of blockchain technology offers a company a streamlined financial reporting and managing process. Previously, accounting data such as general ledger, journal entries, and trial balances are provided in various formats. Blockchain is featured to record the ledger in a specific format on a near real-time basis. The application of Blockchain could also reduce the complexity of a procurement and supply chain procedure, in which the multiple steps of procurement provides an opportunity for fraudulent activities. Supporting documents such as agreements, purchase orders, invoices, and contracts can be encrypted and stored to a blockchain.

For IFAs, as more and more companies started to use the blockchain system, accessing information from the Blockchain will likely be more efficient. By developing software to extract and preserve blockchain evidence, IFA could eliminate time and labor-consuming comparing to the manual data extraction and audit preparation activities. With more automation in the company's system, IFA can speed up in the preliminary preparation stage, which could reduce the lag time immediately after the fraud concern is raised. The near real-time ledger record on Blockchain allows IFA to preserve on-time evidence and leave fraudsters low chance to alter or destroy the evidence.

Blockchain adoption may enable IFA to obtain auditable data and develop a procedure to obtain digital evidence directly from blockchains. Like accessing the subject's bank account history, IFA would need to obtain blockchain data from the central blockchain platform but would be able to refrain from the lengthy process of external confirmation.

The procedure to obtain an external confirmation letter from banks using Blockchain Technology may have the following potential advantages:

Blockchain Feature	Breakthrough from traditional Bank Confirmation
De-centralization	Instead of relying on a central system like banks to confirm the information and store all correspondence information, communication and cooperation can be avoided by extracting timely data directly from Blockchain based on a consensus mechanism. Without lengthy back and forth communication and authorization between accounting firms and the bank, it dramatically improves the efficiency of the process.
Unchangeable Data	Blockchain's unchangeable feature diminishes the possibility of tampered confirmation letters during the circulation between banks and auditors. Risks such as a conspiracy between auditors and the bank or document forgery may be eliminated in the situation. Hence, it ensured the reliability of the external confirmation information.
Traceability	The traceability of the Blockchain makes the information stored on Chain with accurate time and result. With data integrated onto one network, evidence collection and document construction can be efficiently completed.
Privacy	Only parties who have the key can view the Blockchain's information, which ensures the security and privacy of the information.
Automation	By using Smart Contract, auditors can reduce the time of coordination, communication, and approvals between bank branches and back office, and hence improve the efficiency of the confirmation process. Currently, multiple control steps were in place to ensure that obtaining an external confirmation letter is secure, as well as the information obtained is

Blockchain Feature	Breakthrough from traditional Bank Confirmation
	admissible and auditable. Many factors may cause the external confirmation void, such as conflict of interest and outdated data. With the help of Blockchain, conflict of interest may no longer be a concern as data were drawn from a publicly distributed ledger. Real-time execution of transactions can be extracted as well.

However, extracting evidence from Blockchain will present a new challenge because the blockchain data center is likely not controlled by the subject client.[36] The IFA will need to consider and evaluate the legal accountabilities and liabilities of extracting Blockchain evidence. Besides, IFA needs to include consideration of the consensus protocol for the specific Blockchain, as to whether the protocol could be manipulated. Please see the following section for a detailed discussion.

[36] Bible, W., Raphael, J., Taylor, P.; Valiente, I. O. (2017). *Blockchain Technology and Its Potential Impact on the Audit and Assurance Profession* (pp. 10-11, Rep.). Deloitte Touche Tohmatsu Limited. doi:https://www2.deloitte.com/content/dam/Deloitte/us/Documents/audit/us-audit-blockchain-technology-and-its-potential-impact-on-the-audit-and-assurance-profession.pdf

6.1 Blockchain Based Digital Forensics

In June 2018, Hangzhou Internet Court heard a dispute over an internet communication copyright case. In order to prove that the defendant has published the works of the plaintiff's copyright, the plaintiff extracted the source code of the infringing webpage through a third-party platform and uploaded the compressed hash values to Factom (a software company that provides Blockchain Evidence Capture service) and uploaded them to the Blockchain. The trial's core issue is whether the evidence stored in the Blockchain is admissible for the court decision. In the Hangzhou Internet Court hearing, the defendant first analyzed and demonstrated the reliability of Blockchain technology. The court then determined that the electronic data stored by the certified Blockchain platform was metadata by contesting it through time stamp and hash calculations. While the Hangzhou Internet Court had already decided that blockchain evidence can be legally viable on a case-by-case basis, on September 07, 2018, as the world's first occurrence, China's Supreme People's Court formally ruled that Blockchain evidence would be recognized as one form of digital evidence admitted in Internet Courts.[37]

The Vulnerability of Blockchain Evidence

Before Blockchain was accepted within the judicial system, the acceptance rate of electronic data was relatively low.[38] The judges are often concerned about whether the relevant

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[37] Yang, Y. (2018, September 13). *Blockchain data accepted as evidence in law suit filed by short video app Douyin*. Retrieved June 20, 2020, from https://www.scmp.com/tech/policy/article/2163914/blockchain-data-accepted-evidence-legal-complaint-filed-short-video-app.

[38] Sylvia Polydor, A. (2020, January). *Blockchain Evidence in Court Proceedings in China – A Comparative Study of Admissible Evidence in the Digital Age* (as of June 4, 2019) · Stanford Journal of Blockchain Law & Policy. Retrieved June 26, 2020, from https://stanford-jblp.pubpub.org/pub/blockchain-evidence-courts-china/release/1.

evidence is metadata or secondary data, which the latter is not reliable or admissible. Since Blockchain uses distributed and decentralized accounting technology, the concern of metadata or derivative evidence is no longer an issue because all copies of the original data have the same credibility. However, it should also be noted that Blockchain technology is not flawless.

Indeed, on the technical level, Blockchain is highly reliable due to its distributed data technology, consensus mechanisms, and encryption algorithms, but there is still a gap between the reliability required by judicial evidence. On the one hand, unlike a centrally managed database, the public Blockchain is a decentralized technology. There is no centralized authority to regulate the compliance requirement, which increases the risk of the Blockchain being attacked. On the other hand, the consensus mechanism is not 100% immune to fraud. Consensus can be broken under certain conditions. For example, the Majority Hash Rate Attack (51% Attack) is an immediate threat to the consensus mechanisms. The 51% attack is a technique that occurs when attackers get the majority (over or equal 51%) of the hashing power, and then they can drive the decision by dominating the longest Chain.[39] As shown in the following graph, in the article *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack*, published on April 29, 2019, Sayeed and Marco-Gisbert has summarized three widely adopted consensus mechanisms and their vulnerability to different attacks[40]:

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[39] Sayeed, S.; Marco-Gisbert, H. (2019, April). (PDF) *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack.* Retrieved June 20, 2020, from https://www.researchgate.net/publication/332737156_Assessing_Blockchain_Consensus_and_Security_Mechanisms_against_the_51_Attack; page 5

[40] Sayeed, S.; Marco-Gisbert, H. (2019, April). (PDF) *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack.* Retrieved June 20, 2020, from https://www.researchgate.net/publication/332737156_Assessing_Blockchain_Consensus_and_Security_Mechanisms_against_the_51_Attack; page 6

Table 1. Main features of consensus mechanisms.

Consensus	Energy Cost	Decentralization	Processing Speed
PoW	High	High	Low
PoS	Low	High	High
DPoS	Low	Low	High

Table 2. Consensus mechanisms that are vulnerable to various attacks.

Consensus Mechanisms	51% Attack	Long Range Attack	DDoS Attack	P+Epsilon Attack	Sybil Attack	Balance Attack	BGP Hijacking
PoW	✓	✗	✓	✓	✓	✓	✓
PoS	✓	✓	✓	✗	✓	✗	✗
DPoS	✓	✓	✓	✓	✓	✓	✗

Long Range Attack[41] is an attack technique similar to the 51% Attack in that new branches were created on the Blockchain and overtook the main Chain. **Distributed Denial-of-Service (DDoS) attack** is a technique that overwhelms the target with a flood of Internet traffic. **P+Epsilon Attack** is a technique that attackers offer payouts to participants to succeed with the attacking goal. **Sybil Attack** aims to corrupt the network by creating nodes under fake identities, to validate unauthorized transactions or to alter valid transactions. **Balance Attack** is a technique that attackers can comprise target nodes using hashing power and separating the branch from the other nodes in the network. **Border Gateway Protocol Hijacking (BGP)** is a technique that "the internet service provider (ISP) makes false announcements over the routing system to divert traffic." *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack*, 2019, April.

In this sense, the Blockchain itself is not easily tampered with but can be jeopardized by attacking the consensus protocols. Reliability of evidence usually determines for admissibility of

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[41] Sayeed, S.; Marco-Gisbert, H. (2019, April). (PDF) *Assessing Blockchain Consensus and Security Mechanisms against the 51% Attack*. Retrieved June 20, 2020, from https://www.researchgate.net/publication/332737156_Assessing_Blockchain_Consensus_and_Security_Mechanisms_against_the_51_Attack; page 5-6

evidence in court. Thus, Blockchain evidence's admissibility is highly related to the acceptance of electronic signatures in a legal setting.[42]

6.2 Admissibility of Blockchain Evidence

Similar to any electronic evidence presented in court, there is no objection to use Blockchain evidence as supporting evidence as long as its reliability can be shown, for example, through an expert witness. However, going through an expert witness would cost time and money. By avoiding such loss, China's Supreme People's Court accepted the evidence in legislation.

Compiled by the China Academy of Information and Communications Technology and the Shanghai Higher People's Court and instructed by The Supreme People's Court of The People's Republic of China Information Communication Center, the *White Paper on Blockchain Technology Application in Judicial Evidence Storage[43]* was issued in June 2019. The White Paper discussed three critical criteria used to evaluate Blockchain evidence's admissibility: 1. Reliability of Electronic Data; 2. Relevancy, and 3. Legitimacy of Electronic Data.

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[42] Sylvia Polydor, A. (2020, January). *Blockchain Evidence in Court Proceedings in China – A Comparative Study of Admissible Evidence in the Digital Age* (as of June 4, 2019) · Stanford Journal of Blockchain Law & Policy. Retrieved June 26, 2020, from https://stanford-jblp.pubpub.org/pub/blockchain-evidence-courts-china/release/1; para 4

[43] He, B., Cao, H., Wei, K., Yang, B.; J. N. (2019*). 区块链司法存证应用白皮书(Application of blockchain judicial certificate White Paper)* (1.0st ed., pp. 17-36) (China, The Supreme People's Court of the People's Republic of China (中华人民共和国最高人民法院), Trusted Blockchain Initiatives (可信区块链推进计划)). Beijing, Beijing: Trusted Blockchain Initiatives. http://www.caict.ac.cn/kxyj/qwfb/bps/201906/P020190614499397999292.pdf

Reliability of Electronic Data

The reliability of electronic data depends on three levels: the reliability of electronic evidence carrier, the reliability of electronic data, and the reliability of electronic evidence content. The reliability of electronic evidence carriers means that the media and equipment used to store electronic data must be original, identity, and integrity during the process of litigation presentation. Forgery, alteration, replacement, and destruction will result in the evidence inadmissible. Blockchain technology has dramatically expanded the extension of electronic evidence carrier due to its distributed ledger technology and anti-tamper mechanism. The reliability of electronic data refers to whether the electronic data, as the technical form of electronic evidence content, is original or is exposed to issues such as modification or alteration. The reliability of the content of electronic evidence means that the information in the electronic evidence can be corroborated by the information in other evidence to prove the facts of the case accurately.

Relevancy and Legitimacy of Electronic Data

The relevance of evidence is that the evidence must have a certain level of connection with the case facts or other controversial facts to be proved. From the perspective of evidence law, the relevance standard requires that every specific evidence must have substantive significance to prove the facts of the case. Blockchain technology itself does not enhance the relevance of electronic evidence.

The confirmation of the legitimacy of evidence includes the legitimacy of evidence collection subject; the legitimacy of the form of evidence; legitimacy of the procedure of evidence collection; and the legitimacy of the way of evidence preservation.

6.3 Other Judicial Considerations

The White Paper also concluded key legal considerations in the process of Blockchain evidence extraction and preservation. Blockchain evidence collection and preservation must be legally compliant. Legal compliance is evaluated including but not limited to the following aspects: the legitimacy of the process of blockchain collection, the legitimacy of blockchain collection initiator (lawyer/IFA), the legitimacy of blockchain evidence extractor (Forensic IT/third-party blockchain platform), the legitimacy of the Blockchain platform operator. Considerations of whether the nodes are traceable, whether the information recorded on Blockchain is legally stored and if it can be verified through multiple methods are essential as to the judicial acceptance of the stored data on Blockchain.

The verification of information consistency on each node of the distributed ledger is another crucial point. Strong consistency of data refers to the consistency of the data stored in each node of the blockchain system to achieve the purpose of trusted data sharing. The system must be able to prove the data locked on the Blockchain is endorsed and approved by adequate node consensus. Each node participates in the Blockchain should ensure the information stored on Blockchain is up-to-date and identical to all other nodes.

Data security and system security of the data warehouse are crucial criteria for evaluating electronic judicial evidence. Data security is reflected in the way that confidential data should be encrypted and stored safely. The necessary logistic protection mechanism, such as password set-ups, should be adopted. Data privacy protection should be ensured that it only enables the authorized parties to access the data. An intelligent and comprehensive system monitoring function should be implemented to ensure that data is not easily tampered with, and the data accessing histories should be recorded in the trace for audit purposes. The monitoring system should have

robust security capabilities run stably for 7x24 hours. Blockchain networks must build an advanced security system that can discover security vulnerabilities and network security threats, and it can recover networks quickly when the network is damaged under a hacking attack. In the process of network transmission, the data should be encrypted in a commonly adopted way of the Blockchain industry.

7.0   IMPLEMENTATION OF BLOCKCHAIN

To better grasp the potential future of Blockchain's implementation, Deloitte's Center for the Long View has elaborated on four scenarios on how Blockchain could develop[44]:

There are no technical restrictions

Scenario 4: Blockcracy
Blockchain heralds a new age with banks losing the entire securities and transaction business to the public ledger.

Scenario 3: Survival of the largest
Blockchain is a complete success with big players and tech giants realizing the potential fully.

Institutions have lost people's trust ← Trust in the established system → **People trust the established system**

Scenario 1: One-eyed among the blind
Blockchain flops at tremendous cost. The wait for blockchain's great breakthrough continues.

Scenario 2: Blockchain in a niche
Blockchain becomes a weapon of trust for fighting concentrations of power and corruption in niches.
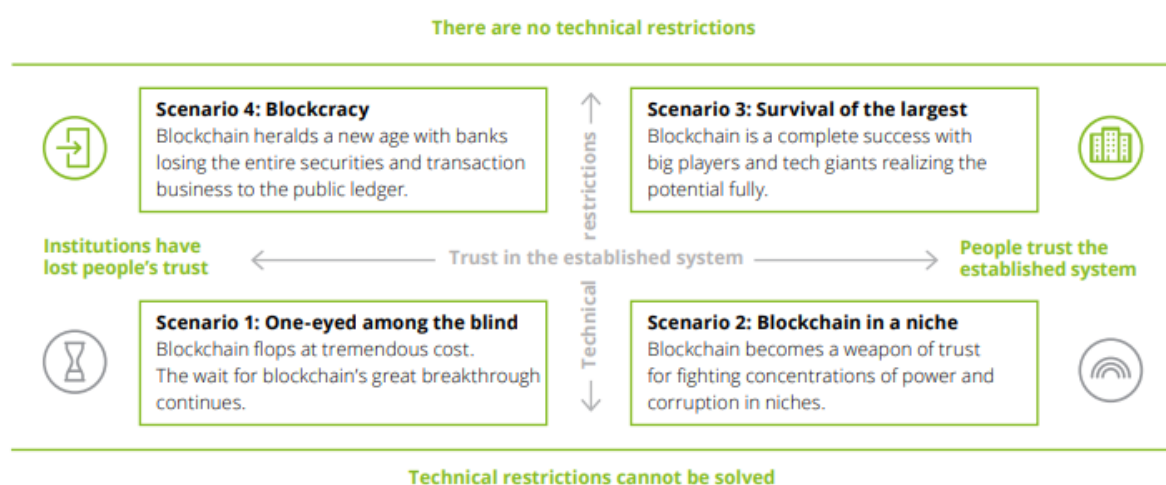
Technical restrictions cannot be solved

Figure 1: On scenarios

Leading financial institutions and regulatory authorities worldwide have started to engage in a multitude of Blockchain projects, and their fundamental goals are secure and cost-effective. Although Internet Finance providers like Yu'E Bao have not started to initiate Blockchain technology's implementation into their financial products at the current stage, banks are most definitely interested in Blockchain. During August and early September of 2016, Accenture interviewed 32 commercial banking professionals, and interviews were conducted at large or global banks in the United States, Canada, and Europe about the potential of Blockchain/Distributed Ledger Technology to transform the payments business.[45] "Considerable

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[44] Deloitte Blockchain Institute. (2017). *Blockchain @ Rethinking Banking: A view on how blockchain can change banking* [Brochure]. Berlin: Author.
https://www2.deloitte.com/content/dam/Deloitte/de/Documents/Innovation/Blockchain-Banking-Whitepaper-Deloitte-2017.pdf

[45] Accenture Mobility, Accenture Digital. (2016). *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network* [Brochure]. Author. Retrieved June 10, 2020, from

interest in blockchain is clearly brewing at participating banks." *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network,* 2016. The executives expect a wide range of benefits from adopting Blockchain technology, including fewer errors, quicker processing, lower costs, and new revenue opportunities.

The banking industry acts as an intermediary in the global economy through its internal accounting system management and coordinated financial system. Blockchain technology has the potential to reshape the entire banking industry in multiple ways. However, Blockchain integration and implementation is not a "plug and play" technology. Blockchain initiatives will require addressing critical regulatory and compliance issues.[46] The appropriate legal and regulatory framework must be developed to support the use of Blockchain.

https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50 page 6

[46] Accenture Mobility, Accenture Digital. (2016). *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network* [Brochure]. Author. Retrieved June 10, 2020, from https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50 page 8
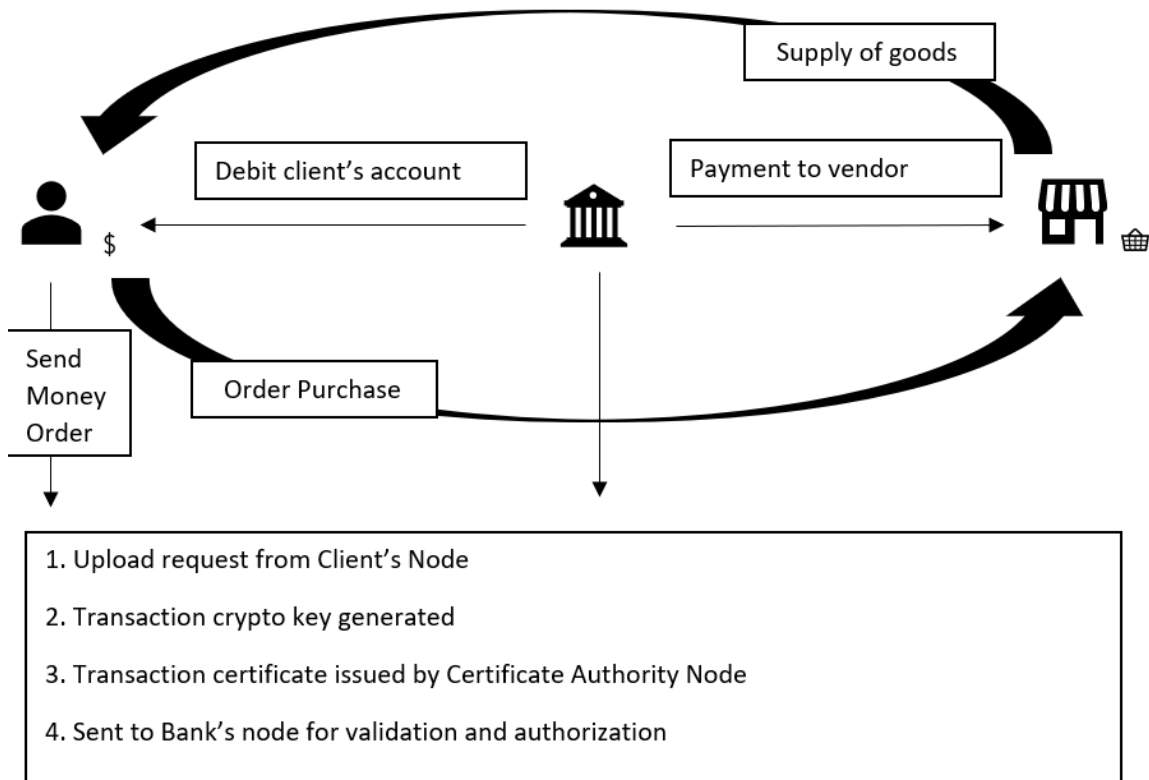
7.1   Examples of Blockchain in Banking

Remittance in the current banking system can be a timing process. Current bank processing system workflow can be summarized as the following graph:
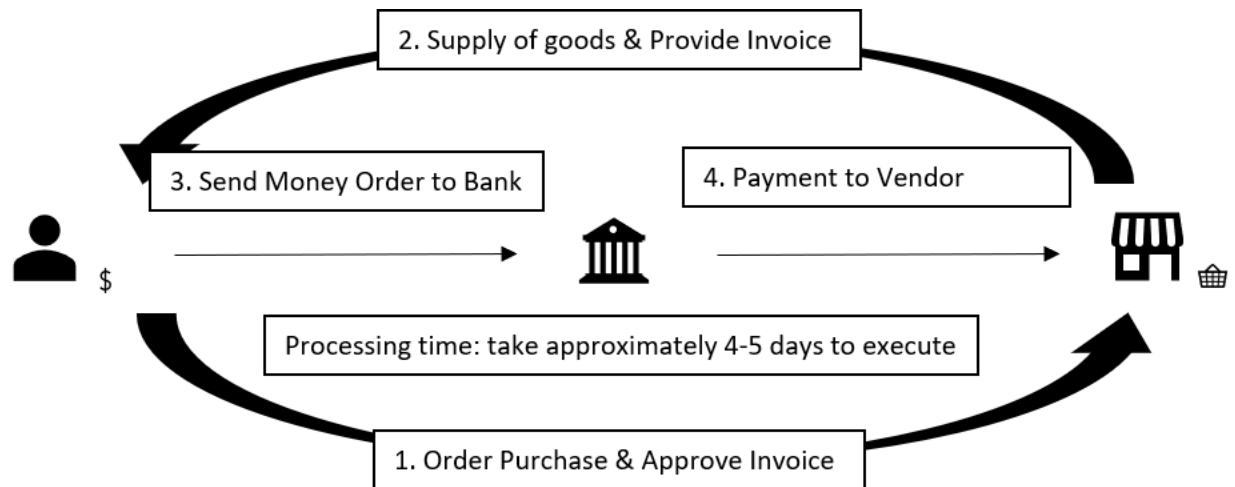
The process has multiple steps involved throughout the lifecycle of a remittance. From upon receiving money order to processing document submission and executing money transfer, the process is mainly manually conducted, which increases potential fraud risks and errors. The process requires cumbersome verification and communication, and it brings up fees for both the banks and customers. Blockchain technology provides a more convenient payment method in this scenario. Blockchain technology helps eliminate multiple manual steps involved in remittance processing. The entire transaction will become automatic and, more importantly, features for real-time tracking and real-time settlement of transaction[47].

Implementing Blockchain may enhance the process to be:

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[47] Shah, M.; Chatterjee, S. (April 18, 2017). *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption.* Blockchain in Banking: While the Interest Is Huge, Challenges Remain for Large Scale Adoption, 5. doi:https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf; page 15

1. Upload request from Client's Node

2. Transaction crypto key generated

3. Transaction certificate issued by Certificate Authority Node

4. Sent to Bank's node for validation and authorization

With the implementation of Blockchain technology, the whole process will take only a few hours to execute. All three parties - clients, vendors, and banks benefit from it.

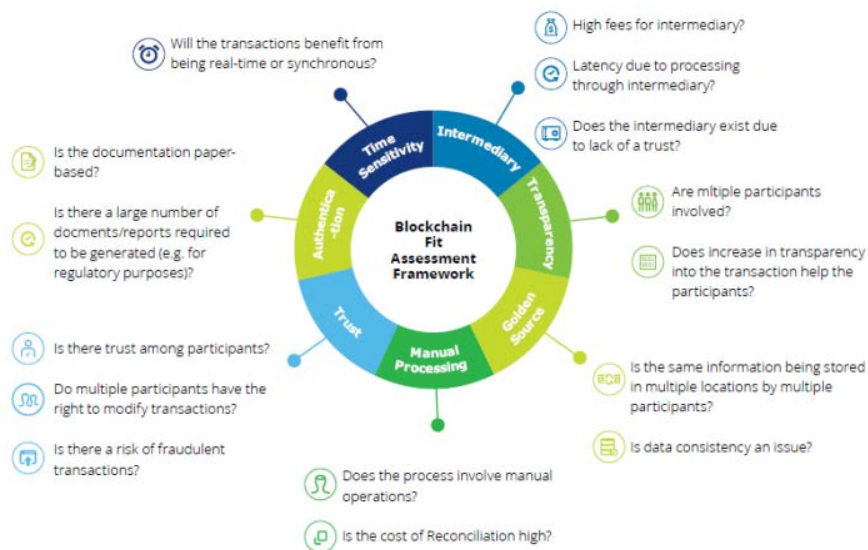| Clients:	Vendors:	Bank:
• Enhance relationship with vendors • Better relationship leads to a discounted price and cast savings	• Savings in time and cost • Instant working capital	• Increase revenue from new clients and high client retention[48] • Cost savings and labor savings

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[48] Shah, M.; Chatterjee, S. (April 18, 2017). *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption.* Blockchain in Banking: While the Interest Is Huge, Challenges Remain for Large Scale

Clients:	Vendors:	Bank:
		• Other services opportunities may be explored

Adoption, 5. doi:https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf page 17

7.2   Fitness Assessment

Deloitte Touche Tohmatsu India LLP has developed a Blockchain Fit Assessment Framework in 2017. The graph is used to "evaluate whether a particular process is the right fit for a Blockchain-based solution." *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption,* April 18, 2017. We will use the following chart to evaluate if Blockchain is suitable for a money market provider process.

Source: https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf

Factors	Assessment Framework	Money Market Provider Fit
Intermediary	• High fees for intermediary? • Latency due to processing through intermediary? • Does the intermediary exist due to lack of trust?	**No -** there is no intermediary required, transactions are generally conducted within the system.
Transparency	• Are multiple participants involved? • Does an increase in transparency into the transaction help the participants?	**Yes -** applicant, customer, merchants, vendors, bank, asset management institution are involved in the transaction. Higher transparency would increase trust in the system.
Golden Source	• Is the same information being stored in multiple locations? • Is data consistency an issue?	**Yes -** common customer, vendor and merchant's information is stored across multiple entities.
Manual Processing	• Does the process involve manual operations? • Is the cost of Reconciliation high?	**Yes -** cost of reconciliation is high and is manually conducted at the back office.

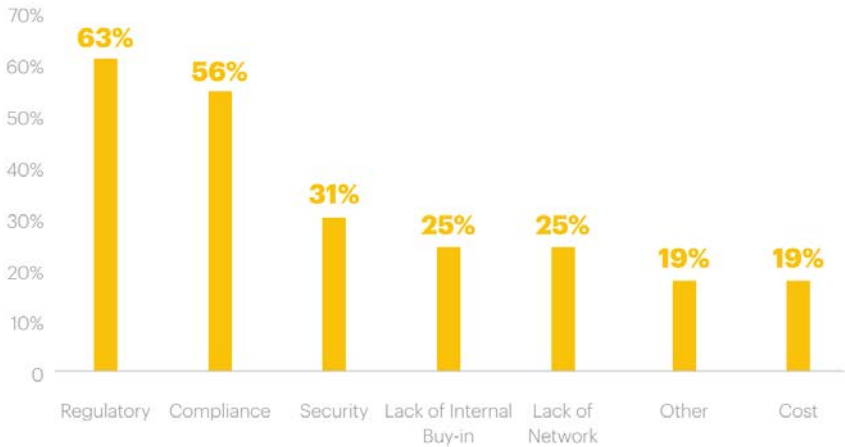| Factors	Assessment Framework	Money Market Provider Fit
Trust	• Is there lack of trust among participants? • Do multiple participants have the right to modify transactions? • Is there a risk of fraudulent transactions?	**Yes -** multiple participants are involved in the transactions including merchants, customers, vendors, etc. All parties meet online and are not acquainted to each other, causing a lack of trust.
Documentation	• Is the documentation paper-based? • Is there a large number of documents / reports required to be generated?	**Yes -** multiple documentation requires to be stored at each participant.
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	**Yes -** it will help improve customer experience and reduce discrepancy.

With the implementation of Blockchain in money market providers, all three parties will be benefit from it:

Clients:	Vendors:	Money Market Provider:
• Increase customer satisfaction	• Built better trust with customers	• Cost savings by reducing manual processes

• Increase trust and confidence	• Higher client retention	• Increase in revenue as more customers trust in the system

7.3 Current Challenges and Limitations

While Blockchain technology has the potential to revolutionize the financial system, there are a number of challenges and limitations in its way.[49] As stated in Accenture's survey report, the most significant resistance to implementing Blockchain is Regulatory and Compliance concerns. From the government and other regulatory agencies' perspective, the acceptance of Blockchain technology must proceed from the perspective of national security and stability.

Source: https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50

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[49] Vogels, M. (2018, September 27). *The Balance Between Regulations & Disruption*. Retrieved June 25, 2020, from https://medium.com/beyond-blocks/the-balance-between-regulations-and-disruption-eb367676c4ef

Sanction issues must be solved before open blockchains are successfully implemented. Economic sanctions laws and regulations are imposed by governments to restrict business with particular persons, entities, governments, countries, or territories. Risks related to the sanction issue is that information on the Blockchain is verified by multiple users agreeing that the content on the ledger is complete and accurate. [50] Failure to enter information related to sanctions, deliberately or not, may expose those involved in the Blockchain to sanctions risk. The information included in the ledger does not accurately reflect the underlying transaction details. For example, if the distributed ledger does not contain information such as the material of goods that were made initially from a sanctioned country, then participants in the network may receive exposure to the breach of sanction law.

Blockchain, Trade Finance and Sanctions Issues, published by financierworldwide.com in February 2018[51] has offered four sanctions-specific functionalities that developers should consider when creating and building Blockchain:

1. Blockchain technology should incorporate with sanctions screening technologies so that ledgers on Blockchain can be screened for sanction exposures, and the users in the network can be alerted if anything that is sanction related.

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[50] Landless, P., Burney, A., Lyons, M., Harley, B.; McDermott, A. (2017, November 22). *Clifford Chance Discusses Blockchain, Trade Finance, and Sanctions.* Retrieved June 25, 2020, from https://clsbluesky.law.columbia.edu/2017/11/22/clifford-chance-discusses-blockchain-trade-finance-and-sanctions/

[51] Landless, P., Burney, A.; Harley, B. (2018, February). *Blockchain, trade finance and sanctions issues.* Retrieved June 25, 2020, from https://www.financierworldwide.com/blockchain-trade-finance-and-sanctions-issues

2. Banks and other financial institutions should have the ability to block the transaction or the Blockchain as a whole if any sanction exposure was detected.

3. Sanctions provisions should be built into blockchains, and the Blockchain should be able to detect and alert sanction events as they occur and self-execute the sanction provisions.

4. Blockchain technology should enable the users to record data according to their regulatory requirements and should allow retrieving the ledgers to the relevant authorities in a manner consistent with data privacy and other restrictions that may apply.

Another issue with regulations and compliance issues is that Blockchain is the lack of a universal standard. Bilateral agreements and altered processes between banks may severely diminish the network effect. More importantly, Accenture has concluded that many executives noted that the Blockchain network should be open to banks and non-banks. "Potential non-bank network participants could include fintech companies and technology firms as well as other corporations across the supply chain,[52]" *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network,* 2016 is the solution offered from the report.

Although Blockchain technology was invented in 2008 by Satoshi Nakamoto and has been in use for over ten years, acceptance of new technology is another issue faced by many institutions. A new technology that wants to break the walls of the tradition may progress slowly. Beyond the above factors, something is more fundamental: banks may resist implementing decentralized

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[52] Accenture Mobility, Accenture Digital. (2016). *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network* [Brochure]. Author. Retrieved June 10, 2020, from https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50 page 6

technology because it has a potential threat for the banks, weakening their position and profits. Even though after a few generations of testing and adaption, the benefits from Blockchain application may be tremendous, the early-stage research and development cost is enormous. The initial cost and time of investment in the technology might be high, and the payback period might be extended. Hence, banks should consider it a long-term investment, and make sure that the investment aligns with their vision statement.[53]

Blockchain implementation requires a significant overhaul of the existing system. The banks need to make sure that all the relevant stakeholders agree to come together on the platform. Educate key stakeholders within the organization on Blockchain's enormous potential benefit is the crucial for an evolutional change in the industry.[54] Banking customers should also be educated to accept and trust the new technology. Users' unfamiliarity with the blockchain technology may prompt them not to trust the bank fully. The bank must strategize the transition to minimize losses.[55]

[53] Shah, M.; Chatterjee, S. (April 18, 2017). *Blockchain in Banking: While the Interest is Huge, Challenges Remain for Large Scale Adoption. Blockchain in Banking: While the Interest Is Huge, Challenges Remain for Large Scale Adoption*, 5. doi:https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf page 27

[54] Accenture Mobility, Accenture Digital. (2016). *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network* [Brochure]. Author. Retrieved June 10, 2020, from https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50

[55] Accenture Mobility, Accenture Digital. (2016). *Blockchain Technology: How Banks are Building a Real-Time Global Payment Network* [Brochure]. Author. Retrieved June 10, 2020, from https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50

8.0 OTHER EMERGING ISSUE WITH INTERNET FINANCE AND BLOCKCHAIN

8.1 Internet Court

In the morning of December 4, 2019, the Supreme People's Court of China held a press conference on the white paper *Chinese Courts and Internet Judiciary*[56] and released the white paper. This is the first white paper on Internet Justice issued by Chinese courts. The first white paper on judicial innovation and development in the Internet era.[57] According to the white paper, Hangzhou Internet Court was first established on August 18, 2017. The following year, on September 09 and September 28, 2018, Beijing Internet Court and Guangzhou Internet Court were established successfully. In September 2018, Hangzhou Internet Court adopted Blockchain to protect the copyright of online literature. It became the first court in the world to introduce Blockchain technology at court.[58] On October 24, 2019, Hangzhou Internet Court launched its blockchain-based smart contract judicial application. This judicial application aims to handle contract defaults and reduce human interruptions.[59] On September 09, 2018, Beijing Internet Court developed and launched the Tianping Blockchain Electronic Evidence Preservation Platform (Tianping Chain)[60]. The process of extracting and preserving electronic evidence in the system is secure and reliable. Tianping Chain has involved multiple organizations in the chain as nodes, such as judicial authentication center, notarial office, and government-owned entities, to

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[56] China, People's Court (人民法院), Supreme People's Court of the People's Republic of China (中华人民共和国最高人民法院). (2019). *Chinese Courts and Internet Judiciary (中国法院互联网司法)* (pp. 1-21). Beijing, Beijing: People's Court Press (人民法院出版社).

[57] Chinese Courts and Internet Judiciary (中国法院互联网司法). (2019, December 04). Retrieved June 28, 2020, from https://www.chinacourt.org/article/detail/2019/12/id/4704040.shtml

[58] Wang, W. (2020, March 21).*信息化让互联网法院领跑法制时代(Information Technology Makes Internet Court Lead in Law Era)*, p. 1.

[59] China, The Supreme People's Court, Supreme People's Court of the People's Republic of China (中华人民共和国最高人民法院). (2019). *Hangzhou Internet Court launches upgraded version of judicial blockchain* (p. 1). Beijing, Beijing: court.gov.cn. http://english.court.gov.cn/2019-10/25/content_37520625.htm

[60] B. (2018, September 9). 天平链介绍 *(Introduction of Tianping Chain)*. Retrieved June 28, 2020, from https://tpl.bjinternetcourt.gov.cn/tpl/

serve the joint governance concept and joint endorsement.[61] As of October 31, 2019, the three Internet courts have accepted 118,764 Internet cases and closed 88,401 cases.[62]

The Internet Courts primarily focus on solving jurisdictional Internet Disputes such as online infringement, online platform lawbreaker, information privacy breach, and cyberspace intellectual property rights. The trail teams of local courts have made a series of rules and principles to frame the procedure of online hearing, in case of cross-jurisdictional filing, online video hearing, electronic evidence transmission, blockchain evidence preservation, and intellectual historical case recommendation.[63]

Nowadays, courts in various regions have widely used cutting-edge technologies such as big data, cloud computing, artificial intelligence, and Blockchain to promote the comprehensive application of information technology in justice. In August 2019, the Supreme People's Court of China announced that the "unified judicial blockchain platform" is under construction. So far, it had included 21 courts from multiple provinces on-chain, as well as organizations such as dispute remediation platform, notary office, judicial appraisal center, and other nodes. More than 180 million pieces of data are on the chain to store certificates and support on-chain evidence collection and verification.[64] With Blockchain in the judicial service background, it is expected

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[61] Fu, W.; Huang, H. (2018, December 23). *电子证据平台天平链 三个月在线证据采集数据超百万条(Electronic evidence platform Tianping Chain has collected millions pieces of online evidences in three months)*. Retrieved June 28, 2020, from http://cn.chinadaily.com.cn/a/201812/23/WS5c1ef057a31097237248f483.html published by China Daily

[62] China, People's Court (人民法院), Supreme People's Court of the People's Republic of China (中华人民共和国最高人民法院). (2019). *Chinese Courts and Internet Judiciary (中国法院互联网司法)* (pp. 6). Beijing, Beijing: People's Court Press (人民法院出版社).

[63] China, Cyberspace Administration of China, Office of the Central Cyberspace Affairs Commission. (2019). *最高法发布《中国法院的互联网司法》白皮书 (Supreme People's Court issues Chinese Courts and Internet Judiciary White Paper)* (p. 1). Beijing, Beijing: Supreme People's Court of the People's Republic of China.

[64] X. (2019, December 09).*杭州互联网法院应用"区块链"提升审判效率(Hangzhou Internet Court Uses "blockchain" to Improve Trial Efficiency)*, p. 1. http://www.xinhuanet.com//mrdx/2019-12/09/c_138616841.htm

to be further enhanced to areas such as reducing internet financial crimes, improving social credibility, and resolving fraud risks.

8.2 Digital Currency

Digital Renminbi (RMB), or in terms of DC/EP (digital currency/electronic payment), developed by the People's Bank of China, is a virtual currency backed by China's central bank.[65] The new digital currency does not have an official name but is referred to as DC/EP. The digital currency will share some features with cryptocurrencies such as Bitcoin and Facebook Inc.'s Libra.[66] Internal tests of the new currency were announced on April 17, 2020. The test is conducted in four pilot cities, including Shenzhen, Suzhou, Chengdu, and Xiong'an (a satellite city of Beijing) and in areas that will host the 2022 Beijing Winter Olympics.[67] At present, the pilot testing functions in several industries include transportation, education, medical care, consumption, etc.[68]

So far, the central bank - People's Bank of China (PBOC) has not yet published a file to describe the definition of DC/EP. Dr. Chuanwei Zou collected information and summarized the following vital characters of DC/EP[69]:

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[65] Huang, R. (2020, May 25). *China Will Use Its Digital Currency To Compete With The USD*. Retrieved June 30, 2020, from https://www.forbes.com/sites/rogerhuang/2020/05/25/china-will-use-its-digital-currency-to-compete-with-the-usd/

[66] Cheng, J. (2020, April 20). *China Rolls Out Pilot Test of Digital Currency*. Retrieved June 30, 2020, from https://www.wsj.com/articles/china-rolls-out-pilot-test-of-digital-currency-11587385339

[67] Cheng, J. (2020, April 20). *China Rolls Out Pilot Test of Digital Currency*. Retrieved June 30, 2020, from https://www.wsj.com/articles/china-rolls-out-pilot-test-of-digital-currency-11587385339

[68] 能干掉美元吗？中国法定数字货币让人民币脱胎换骨(*Replace USD? PBOC issued Digital Currency redefine Renminbi*). (2020, April 22). Retrieved June 30, 2020, from https://finance.sina.com.cn/blockchain/roll/2020-04-22/doc-iirczymi7616171.shtml

[69] Zou, C. (2019). 对人民银行数字货币／电子支付的初步分析(*Initial Analysis on People's Bank of China DC/EP*), 12(371), 10. doi:https://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFDLAST2020&filename=XJR

1.   Digital currency does not undertake any other social functions except for the four primary functions of Money (value scale, circulation means, payment means, and value storage). To ensure the total amount of the existing currency in the market remains the same, commercial banks withdraw cash reserves and exchange for digital currency in an equal amount.

¥ = ₿

2.   The issuance of digital currency follows the traditional currency issuance method. The central bank issues digital currency to the business library of commercial banks. Commercial banks, entrusted by the central bank, provide financial services for digital currency to the public and cooperate with the central bank to maintain the operation of the digital currency circulation system.

3.   The digital currency is an encrypted digital string representing the specific value amount. It is guaranteed and signed by the central bank. Like paper money, the digital currency includes authenticity information such as basic number, amount, owner, and issuer signature. The number is a unique identification of digital currency and is used as the index of digital currency. However, unlike the paper currency, digital currency is programmable and can attach the user-defined executable script.

4.   The registration center and certification center of digital currency. The Registration Center functions as a ledger record that documents the life of a piece of digital currency, from the ownership registration to the complete flow, circulation, and extinction of the digital

O201912003&v=MjIyNjc0SDlqTnJZOUZaNFI4ZVgxTHV4WVM3RGgxVDNxVHJXTTFGckNVUjdxZlllVnZGQ25rVzc
vSVBTZlpZYkc=&UID=WEEvREcwSlJHSldTTEYzWEpEZktmNnhJZHMySWk1Rmk5VFA5N2JJVlNFZz0%3d%249A4h
F_YAuvQ5obgVAqNKPCYcEjKensW4lQMovwHtwkF4VYPoHbKxJw!!&autoLogin=0

currency. The certification center is a privacy and security control center that ensure the anonymous design of digital currency. Public Key Infrastructure (PKI) and Identity Based Cryptography (IBC) were offered to different users, financial institutions and individual owners correspondently. It allows them to access a certain level of confidential information.

5.   Money deposited in a bank account is connected to the client's identity, while the digital currency is controllable anonymity. The digital currency only discloses transaction data to the central bank. However, without the holder's authorization, even commercial banks cannot track the ownership or check the use of the money.

6.   In DC/EP, the Distributed Ledger Technology only applies to confirm and register digital currency and functions as a digital currency detector. The transaction of digital currency is still completed by a centralized ledger system that does not require a public consensus mechanism. Thus, avoiding some unsolved problems (i.e., 51% Attack) of the distributed ledger at the current stage.

A significant benefit of the digital currency backed by the central bank is that it mostly enhanced third-party payment platforms' regulation and supervision. As per Dr. Chuanwei Zou, the introduction of central bank controlled digital currency changed the Bank and Internet Finance institutions' pyramid structure to a more flattened structure:

Source: http://opinion.caixin.com/2019-11-01/101477903.html
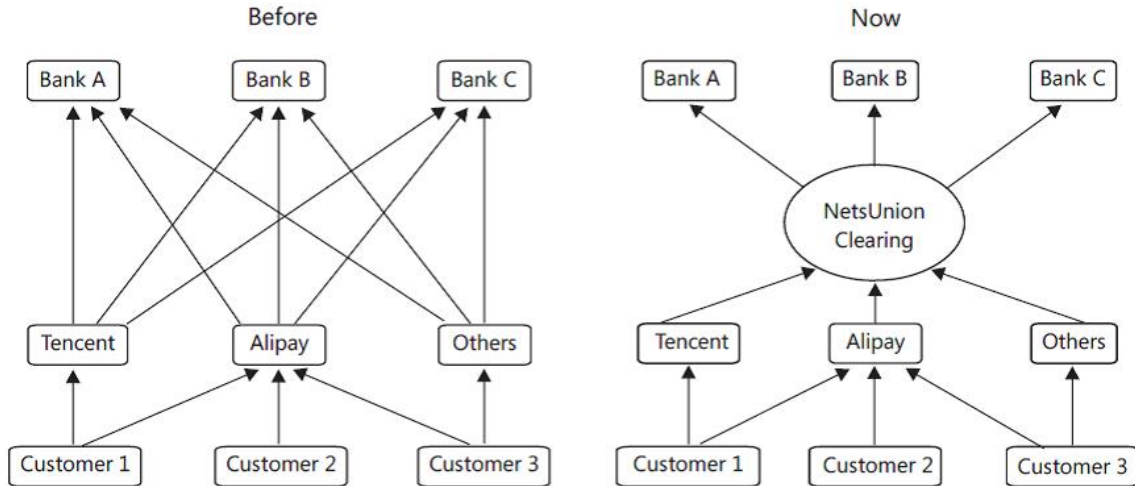
In this way, the third-party payment platforms must deposit 100% reserves to the Central Bank, instead of commercial banks. Hence, the platforms are directly supervised and monitored by the central bank. In addition, DC/EP's programmability brings tremendous potential for intelligent monitoring of anti-money laundering/anti-terrorist financing and anti-tax evasion. Overall, the digital currency may maintain the primary function of paper money while enhancing the financial industry's order and integrity through better supervision and regulation.

9.0 CONCLUSION

Compared with traditional finance, Internet Finance has its advantages in many ways. With its core characteristics of the information recording and information processing, which can significantly reduce costs and improve capital allocation efficiency.[70] Internet Finance Providers offer a more convenient and user-friendly mobile payment. With the continuous improvement of security measures, the scope of mobile payment has been expanded. It even tends to replace traditional settlement payment methods such as cash and credit card in China. With relatively low entry barriers, Internet Finance Providers open their services to small businesses and lower-income groups. Accumulate little into a lot. Internet Finance grew its scale into a competitive player in the market. While Internet Finance brings innovation and efficiency to the market, risks become more complicated due to the fuzzy business boundary and immature regulation and supervision system. Operational risks such as Ponzi Scheme in Peer-to-Peer platforms, money laundering in Third-Party Payment platforms, and privacy leaks due to low network security have substantially damaged investors' confidence in Internet Finance.

Could Blockchain technology save Internet Finance's reputation and help regain investors' confidence? Believing in that Blockchain can optimize or even change compliance procedures given information stored on-chain is considered shared and secure. After discussing Blockchain's application in fighting money-laundering and fraud, the implementation of Blockchain technology in a financial institution indeed helps detect and prevent Money Laundering and Fraud schemes. Even under the circumstance that crime has already occurred, Blockchain also plays a crucial role in evidence extraction and preservation.

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[70] Hu, Z. (2017, June 28). 我国互联网金融：模式、优势和风险 *(China Internet Finance: Model, Benefit and Risks).* Retrieved June 30, 2020, from http://www.sic.gov.cn/News/455/8174.htm

Banks and many other institutions showed great interest in implementing Blockchain technology. Fitness Assessment also shows that Internet Finance will be fertile soil for Blockchain technology. However, because the technology is still in its early stages, and there are still many obstacles to overcome, maybe it is too early to think about integrating Blockchain in Internet Finance. The Chinese government is encouraging more industries to adopt Blockchain technology strategically. Gradually, Blockchain may grow into a vast web that links everything in real life to the virtual world and parallelly functions as a regulator to ensure our daily lives' integrity.

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