TRANSFORMATIONATION OF TRUSTED INTERMEDIARIES IN THE AGE OF BLOCKCHAIN

Cheng-Te Tseng, Department of Management Information Systems, National Chengchi University, No.64, Sec.2, ZhiNan Rd., Taipei 11605, Taiwan, +886-2-2939-3091, tsenga168@gmail.com
Shari S. C. Shang, Department of Management Information Systems, National Chengchi University, No.64, Sec.2, ZhiNan Rd., Taipei 11605, Taiwan, +886-2-2939-3091, sshang@nccu.edu.tw

ABSTRACT

Intermediaries have long played a crucial role in economic activities; they bridge asymmetry in information, enable parties to collaborate and overcome obstacles to transactions. Because of the recent development of the digital economy, the Internet has become an increasingly crucial platform for transactions, and the role of intermediaries must adjust within it. Through interviews of four cases, this study analyzes the effects of transaction cost theory on recent changes in the role of intermediaries. We conclude that in digital transactions, the transformation of the role of intermediaries is facilitated by blockchain technology, which enables intermediaries to achieve cross-industry collaboration and value cocreation.

Keywords: intermediaries, Blockchain, case study.

INTRODUCTION

In market operations, transaction functions such as matching, transaction settlement, and dispute resolution are generally performed by intermediaries. These intermediaries provide strategic opportunities to add value to economic activities.

With the discovery of blockchain technology, the functions of intermediaries must be reviewed. Information security and trust mechanisms have been reshaped. In a 2018 survey conducted by PricewaterhouseCoopers (PwC), approximately 84% of 600 executives from 15 regions reported their organizations to be involved with blockchain technology [1]. Gartner predicts that by 2030, the annual business value of the blockchain will exceed $3 trillion [2]. By the same year, 10% to 20% of the global economic infrastructure will likely run on blockchain-based systems. In the past 2 years, more than 500,000 new publications on blockchain technology and 3.7 million related news articles have been produced [3].

Transaction cost theory (TCT) proposed by Williamson in 1979 emphasizes that the optimal organizational structure is one that achieves economic efficiency through minimizing exchange costs [4].

This paper presents a review of the current state of intermediary theory and an elucidation of the behaviors in transactions observable in modern society. The purpose of the study is to explore how the transformation of intermediary roles can support value cocreation in the blockchain ecosystem.

LITERATURE REVIEW

Trust

Trust is a form of social capital; the ability to trust others is essential to the risk-taking associated with productive social exchanges. Trust promotes the relationship between people and groups. If people trust an authority, group operations can advance because the people within the organization are more willing to act in a manner that aids the organization; they may, for example, be more willing to accept the rules and decisions made by the authority [5]. Groups, therefore, function most effectively when their members collectively trust an authority. The following figure presents structures embodying different forms of trust [6].

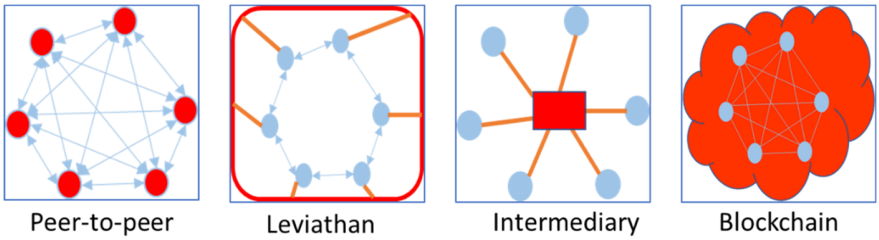

Figure 1. Trust Structure

- Peer-to-peer (P2P) trust: P2P trust is generally strong because it relies on mutual commitment between individuals. The individuals agree to do business without an intermediary because they have developed a relationship.
- Leviathan: The main elements of the Leviathan trust structure are the bureaucratic rules for participation and dispute resolution. The Leviathan structure serves as the basis for the legitimacy of the legal system and for social harmony.
- Intermediary: The reputation of the intermediary replaces social convention and government law in the establishment of trading activities. Intermediaries provide services that allow individuals to relinquish power or control.
- Blockchain: A blockchain is formed through a new type of "trustless" trust network in which trust is not placed in any individual actor.

Blockchain

Blockchain technology constitutes the basis of Bitcoin, which was developed and published by a person or people under the pseudonym "Nakamoto" in 2008. A blockchain is a distributed ledger and involves the combination of P2P networking with an encryption mechanism to create an immutable timestamp ledger. The World Economic Forum identifies blockchain technology as one of six major economic trends and as a leading feature of the evolution toward a digitalized and connected world [7].

Blockchain technology is developed with a focus on decentralization, information sharing, and tamper protection. Under the decentralized consensus mechanism that does not require third-party intermediaries, all P2P transactions within the network are faithfully recorded. A blockchain has the following key features [8]:

- Security and Immutability

  Each new block of a blockchain is encrypted and protected through a hash function. When a new blockchain is being mined, the blockchain is immediately synchronized with the other nodes in the network. Because of its decentralization, cracking or tampering with the blockchain requires a

consensus among participants. Thus, the likelihood of fraudulent transactions in the blockchain is negligible.

- Resiliency
  A blockchain is a decentralized network; the computers for each mutually authenticated node may be located all over the world. If a node decides to withdraw from the blockchain ecosystem, the other nodes continue to perform all transactional functions and maintain the normal operation of the network. Thus, the elasticity of the blockchain prevents the system from being dismantled.
- Transparency
  Transactions in a blockchain involve a transfer of value through trust confirmation using a public key infrastructure. The decentralized technology establishes a distinct profile (a public key identity) for each participant. Each change on the blockchain is observable and, therefore, more conceptually concrete, thereby creating a visual manifestation of value transfers between public keys and ensuring that users retain their trust in the transactions recorded within the blockchain ecosystem.
- Auditability
  Records of transactions are verified through an evaluation of relevancy, reliability, objectivity, accuracy, and verifiability. The verification of transactions through timestamps serves as the basis for inspection data reports.
- Permissibility
  Permissibility is a protection mechanism to regulate the access rights to the shared ledger, and different blockchains are characterized by different degrees of permissibility. Permissionless blockchains, such as Bitcoin, allow anyone to participate. By comparison, permissioned blockchains are limited to trusted participants. Enterprise blockchains are "private" because the scope of their nodes is limited to a set of approved participants, thereby rendering them "permitted" blockchains.

Intermediaries

The Cambridge dictionary [9] defines "intermediary" as "a person or an organization that makes business or financial arrangements between companies or organizations that do not deal with each other directly," meaning that an intermediary is positioned between two or more parties and facilitates a transfer of tangible objects or intangible services. Although intermediaries facilitate the communication process, they do not initiate the decision to deliver content, products, or services.

An intermediary organization acts as an agency for an individual or another company. The intermediary uses its position in the market to facilitate communication between the two parties and to generate transactions that create economic and social value.

Intermediaries can contribute to value creation in several capacities, including summarizing information about buyers, suppliers, and products; facilitating searches for suitable products; reducing information asymmetry through their product and transaction expertise; matching buyers and sellers; and improving confidence in the market and, consequently, enhancing trading capacity.

According to Bakos [10], the market has three primary functions and eight subfunctions (Table 1). In modern economic and commercial activities, intermediaries provide the first two primary functions, and the government generally assumes responsibility for the third.

Table 1. Bakos' functions of the market

Primary Market Function	Sub-Functions
Matching Buyers and Sellers	➢ Determination of Product Offerings ➢ Searching ➢ Price Discovery
Facilitation of Transactions	➢ Logistics ➢ Settlement ➢ Trust
Institutional Infrastructure	➢ Legal ➢ Regulatory

According to Giaglis [11], new intermediation methods, including reintermediation and cybermediation, will soon emerge to support transactions. Previously, traditional market activities necessitated completion through traditional intermediation methods due to the asymmetry and opaqueness of the transactional information. However, the existence of reintermediation demonstrates an evolution in the role of intermediary organizations; they can recreate missions and responsibilities according to their professional knowledge, background, and market positions, which ensures survival. The most modern iteration, the cybermediary, focuses on the operation of applications and automatically provides new services to mediate communication between data providers and end users, thereby maintaining information symmetry and providing a timely messaging experience.

Transaction cost

TCT asserts that an optimal organizational structure is one that achieves economic efficiency through minimizing the costs of exchange [12]. This theory maintains that each transaction has a coordination cost for monitoring, control, and management.

Benjamin and Wigand discuss how Information and Communications Technology (ICT) can reduce transaction costs, which generally result from an asymmetrical and incomplete distribution of information among economic agents, by reducing coordination costs in the value chain, which then benefits consumers by lowering prices. In addition, producers and retailers can reduce intermediation and coordination costs [13]. Bakos [10] particularly describes the ability of ICT to reduce transaction costs within the electronic market through its ability to substantially increase the amount and availability of information.

RESEARCH METHOD

A case study is an empirical investigation of contemporary phenomena, particularly in contexts where the line between phenomenon and context is unclear [14]. The purpose of a case study is to clarify the process of a decision: why the decision was made, how to implement the decision, and what the result was [15].

In this study, economic transactions are considered the basic unit of analysis. The core aspects of a transaction can be executed at a relatively low cost at the market or company level. However, in addition to direct transaction, external indirect transactions must be executed through communication and through the coordination of market mechanisms. Therefore, to effectively evaluate the economic transactions discussed in this study, we must consider a combination of peripheral conditions such as accurate delivery of information and trust in intermediaries [16]. Within the transaction process, several dimensions, including trust, settlement, logistics and products, and the intermediary involved must be evaluated [16, 17]. The presented cases herein are reviewed with consideration of these dimensions.

This is an exploratory study using interviews to investigate the professional understanding of and concerns about blockchains. Questionnaires are chosen for this study because they enable the identification of the factors that influence event occurrence. The main method for data collection involves a series of structured qualitative interviews, which enable us to gain an in-depth understanding of the participants' ideas, experiences, and concerns. Fig. 2 presents the research process of this study.

Figure 2. Research process

The interviews and questions are structured as follows.

Open Question: Prerequirements

- Knowledge of the concept of blockchain technology
- Provision of a description and examples of an intermediary

Intentions for Deploying Blockchain Technology

- Reasons to deploy blockchain technology
- Benefits engendered by blockchains
- Applications chosen to implement blockchains

Before Deploying Blockchain Technology

- Function of an intermediary in the original process
- Mission or responsibilities of these key intermediaries in processes
- Elimination or transformation of the function of intermediaries based on the value proposition

After Deploying Blockchain Technology

- Application schemes after implementation of blockchain technology
- New roles of intermediaries
- Need to revisit the current process given the definitions of cybermediation process, reintermediation process, and disintermediation process
- Continuation and expansion of other applications or processes

Data were collected through interviews with participants who use blockchain to solve problems. We interviewed each participant regarding the impact of blockchain construction. Table 2 summarizes the characteristics of the four participants.

Table 2. Description of selected cases

	Case 1	**Case 2**	**Case 3**	**Case 4**
Business Sector	Insurance	Health Care	Accounting	Supply Chain
Application	Information confirmation	Data management	Information confirmation	Information traceability
Interviewee	Manager	Manager	Manager	CEO
Interview Date	2021/2	2019/1	2020/3	2020/9
Location	Non-life insurance association (NLIA)/	National Health Insurance Agency (NHIA)	Financial Information Service Company (FISC)	Formosa Technologies Corporation (FTC)

	The life insurance association (TLIA)			
Interview Time	180 min	150 min	120 min	120 min

Following the interviews, a cross analysis was conducted to analyze the results (Table 3).

RESULT

Case Description

Case 1: Insurance

Many insurance companies rely on manual data entry, which does not protect against error or fraud. Furthermore, the same data must be entered into different registration systems, leading to additional costs and time spent on verification.

In July 2020, Taiwan's insurance industry opened the opportunity for data sharing between insurance companies through the implementation of blockchain technology. Data sharing currently holds the possibility of being expanded to enable claims services involving medical institutions and insurance companies to be completed in a single step.

The newly implemented blockchain insurance service is linked directly to hospital data. On April 23, 2021, the Life Insurance Association, the Taipei City Government, 4 medical institutions, and 14 property and life insurance companies jointly announced the launch of the "Insurance Claims Link" service. The Insurance Claims Link enables people to directly authorize hospitals to pass diagnosis certificates and expense receipts to their insurance company when they make an insurance claim.

Case 2: Health Care

The Taiwan National Health Insurance system allows patients to choose the hospital at which they receive treatment, meaning the same disease may be treated in different hospitals. Each time, clinicians must apply to receive medical records from a patient’s previous hospital, resulting in a time-consuming process that potentially leads to medical duplication and a waste of resources. To avoid this, the National Health Insurance Agency (NHIA) established the National Medical Referral (NMR) system, the design of which is based on blockchain technology. Through the blockchain mechanism, medical information becomes transparent, nontamperable, and traceable, and medical activities are more individualized in that they are implemented on the basis of complete and accurate data. Physicians can make decisions more efficiently and improve the quality of care. This framework combines patient recommendation data from the NMR system with electronic medical records (EMR) and electronic health records (EHR) from hospitals and clinics. The goal is to establish patients’ trust in the security of transactions, strengthen the relationship between clinics and hospitals, and complete the alliance's medical referral services. Within the framework of the blockchain, a blockchain-based decentralized application (DApp) was developed for personal health records to enable patients to access their EMR and EHR data.

Case 3: Accounting industry

Accountants are regularly required to perform different types of audits for businesses. Manual delivery processes for these audits, such as mailing, risk being intercepted. Moreover, banks typically rely on traditional mailing processes, such as when issuing letters regarding credit information. According to statistics published by the Accountants Association of Taiwan, the total number of bank-related letters in

Taiwan each year is estimated at 1.5 million. The amount of time spent on correspondence between accountants, banks, and companies is extensive and thus inefficient.

The Financial Information Service Company led 20 banks in establishing a "letter of proof blockchain" for financial statements and signed contracts. Four major accounting firms participated in this process: Ernst & Young, Deloitte Taiwan, PwC Taiwan, and KPMG Taiwan.

Case 4: Supply chain management

Formosa Technologies Corporation (FTC) was established in April 2000 as a professional information services company. FTC is owned by Formosa Plastics Group (FPG), a company operating in petrochemicals, textiles, plastic processing, electronics, biotechnology, medical supplies, educational supplies, and information industries. FPG has more than 100 subsidiaries worldwide. When a bank approves corporate financing credits, the bank must conduct an internal audit, a process that requires corporate customers to provide a fax or an authenticated copy of the paper order to the bank.

DBS Bank (Taiwan) announced its cooperation with FTC to launch a supply chain financing service platform using blockchain technology, thus playing a leading role in the improvement of the efficiency of financing downstream suppliers of FPG. This cooperation can further ensure the authenticity of transaction information on supplier financing received by banks.

CONCLUSIONS

Early research on market transactions has focused on reducing transaction costs, which would eliminate the need for traditional intermediaries in the value chain. However, the trust mechanism of blockchain technology does not obviate the need for intermediaries and may even create new opportunities for them. Therefore, the role of an intermediary must be based on its value contribution.

Modern forms of intermediation functionality are outlined as follows.

a) Disintermediation: If traditional intermediaries are unable to add value to transactions, the market will seek automatic matching, which does not require assistance from an intermediary.
b) Reintermediation: Traditional intermediaries can use their expertise to uncover new opportunities to facilitate business transactions and focus on niche markets.
c) Cybermediation: Intermediaries operate within a new infrastructure created through network technology coupled with blockchain trust mechanisms.
d) Cross-sector intermediation: Through cross-domain integration, participants can directly access data and efficiently focus on the business's value. All participants can gain new business benefits from the data ledger of the business executed in their industry. Science and technology applications are thoroughly integrated to drive industrial transformation and service innovation.

After cross-analysis of the aforementioned cases, we identified the influence of intermediaries in different sectors.

Table 3. Summary of the influences of intermediaries

Function	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Sector	**Insurance**	**Health care**	**Accounting**	**Supply chain**
Trust				
➢ Security	➢ CB/ RE/ CS	➢ CB/CS	➢ CB	➢ CB/ RE

➢ Verification	➢ CB	➢ CB	➢ CB	➢ CB
Settlement				
➢ Cost Structures	➢ CB/ RE	➢ CB/ RE	➢ CB/ RE	➢ CB/ RE
➢ Payment Mechanisms	➢ CB/ RE	➢ CB/ RE	➢ None	➢ CB/ RE
Logistics				
➢ Logistical Costs	➢ CB/ RE/ CS	➢ CB/ RE	➢ CB/ RE	➢ CB/ RE/ CS
➢ Information Consistency	➢ CB/ CS	➢ CB/ RE/ CS	➢ CB	➢ CB/ RE/ CS
➢ Economic Scale	➢ CB/ CS	➢ CB	➢ None	➢ CB/ RE/ CS
➢ facilitate process	➢ CB/ RE/ CS	➢ CB	➢ CB	➢ CB/ RE/ CS
Product /Service				
➢ Personalization	➢ RE	➢ CB/ RE	➢ CB/ RE	➢ DIS
➢ facilitate information exchange	➢ CB/ CS	➢ CB	➢ CB	➢ CB

NOTE:
1. DIS: Dis-intermediary
2. RE: Re-intermediary
3. CB: Cyber-intermediary
4. CS: Cross-sector intermediary

Our analysis revealed that actual market transactions in the e-Business community are likely provided through cybermediation. Production or services related to personal preference and consulting are unlikely to omit intermediaries because they require tailored services. In these cases, a reintermediary would support the value chain.

Blockchain technology provides incentives for transforming current models based on its mode of implementation. These incentives include reduced costs, faster transaction processing, reduced record retention of distributed ledger technologies, and enhanced data traceability and validation. The trust mechanism of blockchains is the most nonsubstitutable aspect of the economic activities of blockchain networks. Similarly, intermediaries can assert their professional value through the assistance of blockchains. Figure 3 illustrates how, with the advancement of network technology and blockchain engagement, intermediaries who adapt to the changing market can gradually replace intermediaries in traditional roles. Through intermediary cooperation between different industries, the synergy of value cocreation can lead to social and economic efficiency.

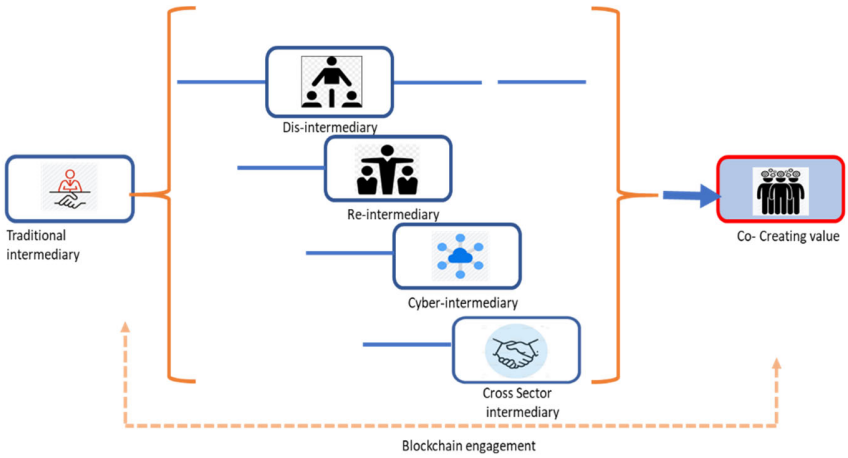

Figure 3. Transformational process of the role of the intermediary

Further empirical research is required to clearly understand how blockchain technology affects operational models. Through the combination of blockchain theory and applications, relevant stakeholders can focus on the professional development of intermediaries and maximization of benefits.

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