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Original Research Paper

Economics

COST-BENEFIT ANALYSIS OF USING BLOCKCHAIN TO REFINE THE PROCESS OF INTERNATIONAL TRADE

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ABSTRACT In September 2016, a new financial technology company under Barclays completed the world's first letter of credit trade financing transaction using blockchain technology. This new transaction method can shorten the trade process to as little as 4 hours from 7 to 10 days originally. This transaction is regarded as a simpler, safer, and faster way of future international trade transactions. This research conducted questionnaire interviews with professionals in charge of international trade business in domestic banks. The expected values provided by these respondents with professional knowledge and experience were used as samples. After the data were aggregated, t-value verification was performed and the cost was calculated. The benefits method analyzes the efficiency and benefits it can bring, and it is hoped that the empirical results of this research can provide useful references for banks or enterprises.

KEYWORDS : Blockchain; International trade; Cost-benefit analysis

INTRODUCTION

Since the 2008 financial tsunami, Satoshi Nakemoto published "Bitcoin: A Peer-to-Peer Electronic Cash System", released the first Bitcoin software in 2009, and also created the first Bitcoin software node. A technology called "blockchain" was born. In September 2016, the Wave, a startup financial technology company under the Bank Barclays, completed the world's first letter of credit trade financing transaction using blockchain technology. This new method shorten the trade process to as little as 4 hours from 7 to 10 days originally and regarded as a simpler, safer, and faster way of future international trade transactions.

In order to test how much the use of blockchain can increase the efficiency of international trade, how much revenue it can generate, and whether it is worthwhile for banks to make improvements in trade processes and operations, this research conducted on professionals in charge of international trade in domestic banks. After the questionnaire interview, using the expected values provided by these respondents with professional knowledge and experience as samples, the data is collected, the t-value test is performed, and the efficiency and benefits that it can bring are analyzed by the cost-benefit method. It is expected that the empirical results can provide a useful reference for banks or enterprises.

Literature Reviews

Overview Of The Development Status Of International Trade

The broad definition of international trade refers to all transactions involving the sale of goods or services across countries or regions. Since each country has its own natural resources, production habits, life culture, and consumption patterns, it is much more complicated than the commercial activities carried out within a country.

The industrial revolution in the 19th century was a catalyst for international trade activities. Due to mechanized mass production, commercial activities have undergone drastic changes, and people's wealth and living standards have risen sharply. Scholars have begun to invest heavily in research and advocate various economic and trade theories. It is an important milestone in the vigorous development of international trade today. Under the development trend of the "globalization" movement, the exchanges between countries are obviously more frequent, and countries are rushing to join the world organization, in order to promote international trade to increase national income. Meanwhile, for the people of importing countries, the utility and welfare can also be enhanced by diversified types of products produced in different countries and regions to choose from. The types of goods in international trade today are even different from the tangible goods of the past, and intangible goods have been developed, such as labor services, production technology, insurance, and financial products, and so on. International trade has not only changed the mode of production, but also changed the entire trading system. As a result, the financial businesses of various countries have been closely linked.

After 1980, the popularization of computers opened up the information age, and its rapid development time and time again opened up new ways of operating. The Internet was advancing at a rapid rate. In order to pursue this trend, various financial systems began to follow this trend. Crazy development of various platforms and methods for exchanging information, such as Electronic Data Interchange (EDI), Automatic Clearing House (Automatic Clearing House) payment system, telephone voice transfer and automatic teller machine (ATM) transfer, etc., are all the important products developed under the rapid technological development.

International Trade Payment Method

International trade refers to a business with a long history, and its payment terms and methods have increased over time. According to Zhang (2010), the payment methods of the buyer and the seller must be determined in accordance with the contractual conditions of the two parties. The following common payment methods are summarized.

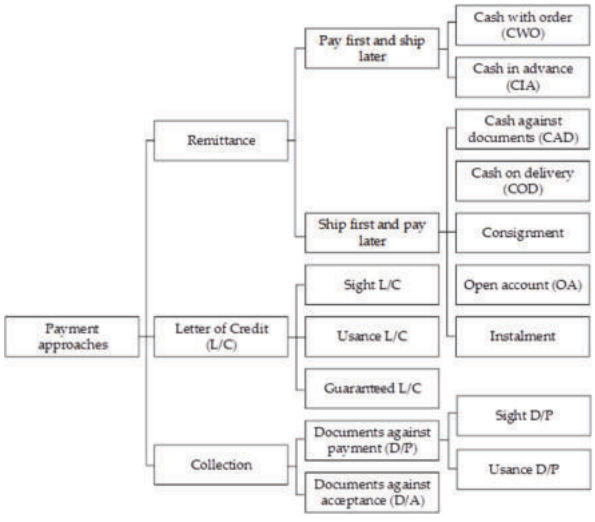


Figure 1. Schematic Diagram Of International Trade Payment

In most international trade, the settlement method is foreign exchange. Both buyers and sellers use banks or other financial institutions to move and transfer transaction funds. According to the different orders of payment and shipment,

this type of transaction is divided into pay before shipment and pay before shipment. For payment before shipment, since the exporter receives the payment first, there is no risk of not being able to collect the payment. Therefore, this type of trade is beneficial to the exporter, but the importer needs to bear large credit risk. If the counterparty fails to perform the contract, a loss then happens. For shipping before payment, the exporter has to first fulfill the transaction obligation of the shipment. The risk bearer and the beneficiary are completely opposite to the former. Among them, the open account (O/A) is one of the main payment approaches in practice.

A letter of credit is a document issued by a bank to a third person (usually an exporter) in accordance with the request and instructions of the customer (usually the importer). The basic process is that the importer shall, at the request of the exporter, submit a request to the correspondent bank in the place of import. File an application to ensure that if the exporter makes shipments in accordance with the contract in the future, the importer will unconditionally pay for the goods. With this transaction approach, as long as the exporter fulfills the delivery obligation within the specified time according to the conditions stated in the letter of credit, the exporter can prepare all relevant documents after shipment and apply for export bills to the financial institution. The payment can be recovered without waiting for the importer to pay (Qin and Li, 2010).

After exporting the goods, the exporter needs to prepare the bill of lading (B/L) representing the ownership of the goods and other related documents (for example commercial invoice, insurance policy, certificate of origin, etc.), and at the same time issue a bill of exchange with the importer as the payer (Bill of Exchange). It is a transaction approach in which it is handed over to the designated foreign exchange bank with the importer, and the bank acts as an agent for the exporter and collects the payment from the importer. According to the payment time of the importer, the collection is divided into documents against payment (D/P) and documents against acceptance (D/A).

Current Status Of International Trade

Since the beginning of the 21st century, global merchandise trade has been growing at a double-digit rate, surpassing the growth of nominal world GDP. The only time when the volume of trade fell was at the beginning of the 2008 financial crisis. Growth in emerging markets, especially in Asia, is even stronger. In 2013, emerging markets in Asia accounted for about a quarter of global exports (WTO, 2014). According to the Asian Development Bank, the role of this sector in global trade will continue to grow. It is estimated that 40% of total exports will be estimated by 2030 (ADB, 2011).

The world is changing rapidly. The technological innovation of transaction channels and product digitization, the transformation of corporate behavior and expectations, regulatory changes and increasingly fierce market competition have fundamentally changed the space of the trade finance market. As companies become more mature in cross-border trade and become more familiar with their trading partners and the countries in which they are located, the demand for risk hedging is declining. Because of the relatively high fees for trade finance instruments, as well as the complexity and time delays associated with relying on paper documents, companies have greater choice in using trade finance instruments.

The Development History Of The Blockchain.

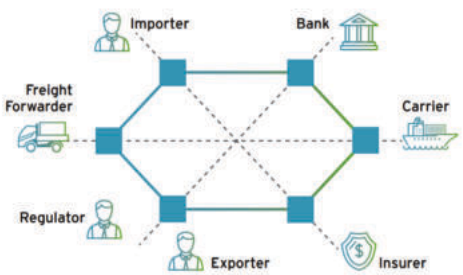
Blockchain originated from "Bitcoin: A Peer-to-Peer Electronic Cash System" published by Satoshi Nakemoto in 2008. It is the core mechanism of Bitcoin's operation. The first block was created in January of the following year. The coin blockchain began to officially operate.

However, blockchain is not a brand-new technology. Starting with the famous Byzanitine Generals Problem proposed by Leslie Lamport in 1982, technologies such as cryptography, time stamping, and algorithms have been slowly added, which will reduce the development of the past few decades. The combination of accumulated technologies is a decentralized database that does not rely on third-party verification and transmission (Zhang Ruichen, 2016). It uses its own distributed nodes to store, verify, and transmit network data. All participants here have the opportunity to keep accounts with qualifications and review transaction records.

A series of blocks created through PoW (Proof of work) is a blockchain. In a period of time (about 10 minutes for Bitcoin), the compiled transaction data blocks are linked to a chain. Each block contains a timestamp, the hash value of the previous block, random numbers, and information about the transaction records contained in the block (Nomura Research Institute, 2016). In the case where multiple nodes in the P2P network succeed with PoW almost at the same time, a branch may be temporarily generated in the Bitcoin blockchain. In this case, the chain that becomes longer later is judged to be a trusted chain. Therefore, in order to complete the transaction, it is necessary to confirm that the relevant blockchain will not fork after the transaction data is merged into the block and multiple blocks are created later. Generally speaking, when about six additional blocks are created, the relevant blockchain is considered to be a real block (Nomura Research Institute, 2016).

For international trade, the business structure of the letter of credit system created by blockchain technology can be centered on exporters and importers, and each relevant manufacturer and agency is connected to the blockchain trade service platform. The transaction contract is used as the blueprint is to establish smart contracts, verify by the platform, and finance remittances.

Figure 2 shows the blockchain trade platform architecture. Trade goods and trade documents (such as bills of lading) can be tokenized on the blockchain to provide buyers with delivery guarantees. Asset tagging on the blockchain can provide buyers with delivery guarantees and better risk management, provide actual shipment status tracking and visibility into transportation conditions. Manage the process and transfer of trade documents (such as bills of lading) such as blockchain, reduce the delay in receipt of trade documents and the buyer's detention of goods, and prevent losses caused by document manipulation and errors (Varghese and Goyal, 2017).



Source: Varghese and Goyal (2017).

Figure 2. The Blockchain Trade Platform Architecture

Trade receivables and other payment instruments, such as promissory notes, checks, money orders or money orders, act as negotiable bills that can be transferred to third parties such as banks and other financial institutions. This allows suppliers to obtain funds to meet working capital needs by selling or transferring these payment instruments through discounting, factoring, or confiscation. Since payment instruments are basically credit instruments created by

transactions, they can be published directly on the blockchain network as local assets. Payment instruments such as bills of exchange or promissory notes can be digitally created as financial contracts between the issuer and the redeemer. Direct issuance of payment instruments through the blockchain can prevent fraudulent invoices and increase accounts receivable. It also improves the efficiency of the process of managing accounts receivable, and improves financing options for SMEs.

As for the operation method and process of blockchain trade, trade receivables such as bills of exchange and approved invoices can be issued on the blockchain to reduce fraud and reduce bank risks through the digitalization of payment tools, so that banks Can provide more attractive financing (Varghese and Goyal, 2017). The system operation process of blockchain trade is to allow both parties to the transaction to register members on the service platform and open an e-wallet, and then the exporter logs in the shipping information for the importer to confirm. Depending on the content of the contract, the importer may be asked to charge first or directly out. As long as the importer confirms that the goods arrive smoothly, the system will directly transfer the payment to the exporter after the arrival time is registered, and the transaction ends. If there is a dispute in the transaction, the arbitration unit can be contacted via the platform for objections or litigation requirements.

Payment methods and underlying transaction contracts can be simulated as smart contracts on the blockchain to provide sellers with payment certainty. The process steps of the transaction are as follows. Firstly, the buyer and seller use the smart contract to confirm the sales contract and trade terms. Secondly, the importer requests the bank to issue a letter of credit (L/C). Thirdly, the bank issues and forwards the letter of credit (L/C). Fourthly, the bank informs the exporter of the letter of credit (L/C). Fifthly, the exporter confirms the letter of credit between the issuing banks (L/C). Sixthly, the bank issues a letter of credit after confirmation (L/C). The relevant documents are at the node of the blockchain. Seventhly, the bank pays the exporter after confirming the establishment of the transaction.

In order to reduce the risk of delayed payment or refusal of payment, the letter of credit (L/C) can be simulated as an automatically executed contract on the blockchain. This will automatically perform contract verification and contract terms and ensure faster payment to the seller by preventing disputes caused by ambiguities in the payment contract. Automated blockchain payment methods can also speed up payment by discovering differences as early as possible, correcting and improving the efficiency of the process (Varghese and Goyal, 2017).

The Relevant Past Studies

In the past, some relevant researches have been accumulated in the literature.

Chen (2006) used UML modeling tools to support his proposal on the rapid development of information technology and the emergence of the e-commerce transaction model, as well as the most important online payment security problem. The new electronic cash application model with the characteristics of security, originality, anonymity, and immutability is hoped to meet the needs of online payment, which was already B2C as the main transaction method at that time.

Chen (2013) takes the Bank Payment Commitment (BPO) as the mainline to study the awareness and willingness to use the domestic import and export manufacturers engaged in the international trade business. Based on the service functions provided by the BPO, the paper summarizes six Facing 29 questions, sending questionnaires to relevant companies across the country for sample collection. After collecting and analyzing, understand the relevance of the company's perception of BPO and the willingness to use it, and provide what managers in the financial industry and related industries need Reference information to provide a financing method to reduce trade risks. However, its research still has its research limitations such as its geographic area and research object. The operation time of the product is not long and its effectiveness still needs time to be verified. Therefore, the analysis results have doubts about the existence of bias.

Yi (2015) focuses on the e-commerce exchanges between Taiwan and China, discussing the cross-border electronic transaction mode between third-party payment providers, financial companies, platform operators, and logistics companies, using Q-trade to cross-border electronic transactions. The trading platform conducts research, discussion, and analysis with the case company, and compares the advantages and disadvantages, and problems of third-party payment compared to other traditional trading modes. Zhang (2016) uses blockchain technology as the technical basis of the platform, and uses the letter of credit in international trade as a system prototype, trying to create an international trade application platform to assist parties in the transaction to solve the problems and risks derived from the letter of credit in the past. And further speed up the trade processing process to reduce time consumption and reduce transaction costs.

Cognizant Technology Solutions Corp (2017) launched a series of white papers on investigation reports. Based on the shortcomings and pain points of traditional international trade processes, it proposed a model for applying blockchain smart contract technology to international trade letter of credit financing. Supported trade networks can reduce the problem of inefficiency in trade finance-related industries, thereby benefiting all stakeholders involved. In 2017 "How Blockchain Can Revitalize Trade Finance" published in August believes that for improving trade efficiency, the key role of blockchain technology lies in the financing field, promoting the flow of trade assets and making it more transparent. Reduce trade disputes and fraud, and thereby provide delivery channels and certainty, increase cross-professional cooperation, thereby reducing the difficulty of regulating transactions.

Zhang (2018) formed an analysis framework based on the strategy proposed by Lin and Pao (2004). Through the 7S model, the five forces model, and the PESTEL model, the bank reviewed the internal environment, industrial environment, and overall social environment of the bank, based on the mission statement. Analyzing the case C Bank's specific business strategy for the blockchain of finance technology proves that its research and development and use of emerging blockchain technology and applying it to the banking business will help improve financial services. Effectiveness.

METHODOLOGY

Expert Interview

This study intends to explore whether there will be a traditional trade model that is superior to the use of letters of credit and other tools after the blockchain technology is incorporated into the international trade process. This research adopts the method of interviews with experts to evaluate the cost and possible effects of applying the technology in international trade to professionals engaged in international trade-related affairs according to your experience and professional knowledge, so as to obtain data. Then use the cost-benefit analysis method to integrate and analyze the data obtained, and get the final research results.

An interview is defined as communication between two or more people. The interviewer obtains the required information

from the interviewee through verbal communication or questionnaire surveys. Based on literature review and expert consultation, the questionnaire design of this study subdivided the analysis aspects of the experiment's cost indicators into four items: system construction, technical training, information security risk and operation management; and the benefit indicators were classified into direct benefits , Indirect benefits and potential benefits.

Table 1. Questionnaire Indicators, Dimensions, Items And Inclusions

Indicators	Dimensions	Items	Inclusions
Cost	System construction	Hardware build	1. Data processor and other equipment 2. High-speed Internet line setup 3. Computer equipment
		Software build	1. Server 2. Operating System
		Organizational establishment	1. Professionals (engineers and business talents, etc.) 2. Construction of management and executive departments 3. Technology development and employee training
	Technical Training	Personnel costs	1. Recruit internal professionals 2. Recruiting new recruits 3. Legal staff
		Time and resources	1. Training time 2. Venue, accommodation and other expenses
	Operation Management	Daily operation	1. Operation and maintenance of machinery and equipment 2. Business operation expenses (paper or electronic) 3. Real estate rent, utilities and taxes 4. Advertising costs 5. Other Miscellaneous Branches
		Depreciation allowance	1. Depreciation of machinery and equipment 2. Software equipment update
		Damage repair	When an abnormality or error occurs in the system, the cost that may be required for maintenance
	Information Security Risk	Data leakage	1. Outflow of personal data or corporate data 2. Risk of asset misappropriation
		Unexpected information	1. Data error or alteration 2. System failure 3. Fraud
		Hacking	1. Account secrets are stolen 2. Cyber Attack 3. Interruption of communication services
Benefit	Direct benefit	Operating cost	1. Cost of paperwork 2. Credit investigation (KYC and AML) cost 3. Personnel costs
		Transaction efficiency	1. The time required for the overall transaction process 2. Transaction identification mechanism (error checking and correction) 3. Extraction of system data
		Transaction risk	1. Add tamper-proof hash format to the information system 2. Integrity of data storage 3. Transaction records 4. Information Security
	Indirect benefit	Overall credit level	1. Accumulation of credit history 2. The credibility of credit data
		Ease of supervision	1. Integrity of transaction records 2. The time it takes to obtain the application 3. The credibility of transaction records
	Potential benefit	Develop potential customers	1. Search for potential customers who may cooperate 2. Investigation of potential customers' transaction records

Through the design and distribution of questionnaires, this research entrusts professionals who are engaged in international trade letter of credit business in banks, based on their professional knowledge and years of experience, write out the part of the financial flow that they believe to introduce blockchain technology into international trade. How much efficiency and benefits may be generated, and how much cost and time may be required. It is expected that through this structured interview, we can obtain relevant data and calculate the international trade process developed by blockchain technology. Is its cost cheaper than traditional forms such as letters of credit? Can it be superior to the control group representing the traditional model in terms of effectiveness?

Cost-benefit Analysis

Cost-benefit analysis refers to an approach to search for a certain expenditure goal by proposes several plans to achieve the goal and uses certain technical methods to calculate the cost and benefit of each plan, selects the best decision through comparison methods, and based on certain principles. As an economic decision-making method, the cost-benefit analysis applies the cost-expense analysis method to the planning decisions of government departments in order to find out how to obtain the maximum benefits with the least cost in investment decisions. It is often used to evaluate the value of public utility projects that need to quantify social benefits.

This study uses a cost-benefit analysis method, with the

traditional international trade process as the control group, and the international trade process using the blockchain as the experimental group, with these two groups as the main body of the research. In addition, system construction, technical training, information security risk and operation management are considered as cost-oriented projects, while the benefit-oriented indicators are divided into three projects: direct benefit, indirect benefit and potential benefit. And the impact results are divided into direct utility and indirect utility, the direct utility score (minus 100 points to positive 100 points) is the scoring method, and the indirect utility score shows the result based on the actual amount. This verifies whether the blockchain trade process, as an emerging transaction method, has better efficiency and less risk.

In the empirical research, the control group and the realization group will be brought into the cost and benefits index for comparative analysis. If the benefit score of the experimental group is higher than the benefit score of the control group and the cost score of the experimental group is less than the benefit score; which means that the experimental group has the value of development and implementation. Conversely, if the benefit score of the experimental group is lower than the benefit score of the control group, or the cost score and amount of the experimental group are greater than the benefit score and amount, it indicates that the cost of the experimental group is too large or the benefit is too small, and it is recommended not to use the trading method of the experimental group.

Experimental Design

This study divides the result into direct utility and indirect utility. The direct utility is expressed in the range of negative 100 to positive 100 as a basis for qualitative analysis; the result of indirect utility is presented in NT dollars, and this result will be used for data analysis.

Table 2. The Meaning Of Direct Utility And Indirect Utility And How To Fill In

Descriptions	Utility	Meanings	Filling Suggestions
Direct utility		Take the positions of the experimental group and the control group as the starting point to evaluate their impact on the projects of each aspect, such as: operational efficiency, error rate or fraud probability.	Using 0 as the baseline, if the impact is considered positive, please fill in a value from 0 to positive 100; otherwise, fill in a value from negative 100 to 0.
Indirect utility		Evaluate the experimental group and the control group, the possible costs and the possible increase or decrease of benefits in each aspect of the project.	Take the New Taiwan dollar as a unit, quantify the possible cost and the possible increase or decrease of the benefits, and quantify the impact of the two groups on each project as money.

After digitizing these cost and benefit tables, the control group and the experimental group—that is, the traditional trade mode and the new trade mode with the blockchain—are cross-compared and analyzed for each item in the two groups. If the benefit score of the new model is higher than the benefit score of the traditional model, and the cost score of the new model is less than the benefit score, the inclusion of block training in the experimental group of international trade payment methods has its implementation and development value. The study then will suggest that banks and enterprises may consider updating and investing in this business. But if the results are contrary to the above situation, it is implied that the technology is not mature enough to be economically effective, and it is recommended to postpone the use of the blockchain-based payment method.

Empirical Analysis

Descriptive Statistics Of Cost Indicators

The main sample data of this research comes from 6 professionals in the full-time international trade business of Bank C in China. They are asked to provide the data predicted by professional knowledge and experience in the questionnaire form, and use this as the basis for the data analysis of this research.

It can be seen from Table 3 that there are 16 groups in which the experimental group has a larger value than the control group, one group has a larger value than the control group, and the other group has a value that is equal to the experimental group. The traditional payment method and the blockchain technology will increase the operating efficiency of hardware and software in the system, and bring easier, more convenient, or faster work for the team department specializing in trade affairs.

Table 3. Cost indicator-the direct utility of the system construction

Items	Hardware		Software		Organization	
Objects	Control	Experiments	Control	Experiments	Control	Experiments
A	85	95	80	80	90	30
B	10	40	-10	50	5	30
C	0	60	20	80	0	50
D	-20	30	-10	40	-10	40
E	20	70	10	80	0	40
F	-10	20	0	30	0	30
Mean	14.17	52.5	15	60	14.17	36.67
Maximum	85	95	80	80	90	50
Minimum	-20	20	-10	30	-10	30
Std. Dev.	37.47	27.88	33.91	22.80	37.47	8.16

Notes: The figures in the table are in 2 digit significance.

It can be seen from Table 4 that the experimental group has 13 groups with a larger value, and the control group has 5 groups. It represents the opinion of most professionals that the use of the experimental group's trade process based on blockchain technology will make the cost of trade affairs rise.

Table 4. Cost indicator-system construction indirect utility aggregation

Items	Hardware		Software		Organization	
Objects	Control	Experiments	Control	Experiments	Control	Experiments
A	100	150	200	100	150	100

B	200	180	300	200	150	100
C	100	400	100	300	300	500
D	180	200	100	300	50	200
E	1	2	5	10	1	2
F	100	180	80	200	40	60
Mean	113.5	185.33	130.83	185	115.17	160.33
Maximum	200	400	300	300	300	500
Minimum	1	2	5	10	1	2
Std. Dev.	70.86	127.45	103.65	113.80	109.11	178.53
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.						

It can be seen from Table 5 that the number of all experimental groups is directly greater than that of the control group, which means that the time, funds, and resources used by most people for this trade that incorporates blockchain technology are compared with the current international trade operations.

The affairs and the impact of the changes brought about are all positively evaluated.

Table 5. Cost indicators-the direct utility of technical training aggregation

Items Objects	Personnel costs		Time and resources	
	Control	Experiments	Control	Experiments
A	30	50	20	50
B	10	30	5	30
C	0	80	0	30
D	-30	30	-20	40
E	-10	30	-10	20
F	-20	20	-10	30
Mean	-3.33	40	-2.5	33.33
Maximum	30	80	20	50
Minimum	-30	20	-20	20
Std. Dev.	21.6	21.91	14.05	10.33
Notes: The figures in the table are in 2 digit significance.				

It can be seen from Table 6 that in the personnel cost items, there are only 2 groups in which the experimental group's value is greater than the control group. This means that more than half of the professionals believe that the new trade mode represented by the experimental group is compared to the use of letters of credit. The traditional mode of trading tools costs less for this project. In the project time and resources, there are 4 sets of data that are larger in the experimental group, which means that the international trade process needs to be increased after the blockchain technology is incorporated. The opinions on training time and other resource costs accounted for the majority.

Table 6. Cost indicator – the indirect utility of technical training

Items Objects	Personnel costs		Time and resources	
	Control	Experiments	Control	Experiments
A	50	30	20	20
B	250	180	100	750
C	150	500	50	100
D	30	400	200	300
E	5	2	2	4
F	300	250	200	150
Mean	130.83	227	95.33	220.67
Maximum	300	500	200	750
Minimum	5	2	2	4
Std. Dev.	123.06	198.31	87.61	280.45
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.				

It can be seen from Table 7 that there are 14 groups in the experimental group that are larger than the control group, and 4 groups in the control group.

Therefore, many interviewees of full-time trade affairs think that the new type of international trade using blockchain technology is important in operation and management.

Efficiency is higher than the traditional international trade process that is still used today.

Table 7. Cost indicators-aggregate results of the direct utility of operations management

Items Objects	Daily operation		Depreciation allowance		Damage repair	
	Control	Experiments	Control	Experiments	Control	Experiments
A	30	60	10	30	5	10
B	5	45	5	20	10	20
C	0	50	50	20	30	10
D	-10	40	-10	20	-20	50
E	10	40	-10	30	-20	40
F	-20	10	10	-10	20	-20
Mean	2.5	40.83	9.17	18.33	4.17	18.33
Maximum	30	60	50	30	30	50
Minimum	-20	10	-10	-10	-20	-20
Std. Dev.	17.25	16.86	22.00	14.72	20.60	24.83
Notes: The figures in the table are in 2 digit significance.						

It can be seen from Table 8 that the control group and the experimental group each have 9 sets of more expensive data on the three items of daily operation, depreciation allocation and damage maintenance.

This indicates that in the aspect of operation management, although operation management is efficient.

For the above, the new trade process may be higher than the traditional trade mode such as the letter of credit. But in terms of money expenditure, the six interviewees think that they are similar.

Table 8. Cost indicators-aggregate of the indirect utility of operations management

Items Objects	Daily operation		Depreciation allowance		Damage repair	
	Control	Experiments	Control	Experiments	Control	Experiments
A	300	150	50	20	100	60
B	300	210	100	75	150	120
C	200	400	50	100	50	200
D	200	300	100	200	200	300
E	1	2	1	2	2	4
F	200	150	100	50	200	100
Mean	200.17	202	66.83	74.5	117	130.67
Maximum	300	400	100	200	200	300
Minimum	1	2	1	2	2	4
Std. Dev.	109.18	137.32	40.5	71.03	81.08	105.43

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.

It can be seen from Table 9 that the variable MG, which is the import growth rate data of various countries, shows the rejection of single roots at a significant level of 1%. The experimental group-is a new trading method with blockchain technology as the core of the system. There are 10 groups larger than the control group. Among them, 8 groups of data are concentrated in unexpected information and hacker attacks. Blockchain technology can't be modified and the consensus verification mechanism feels trust; in addition, considering one of the characteristics of blockchain technology-high transaction transparency, 60% of professionals believe that the new type of international trade is effective in preventing data leakage, less than traditional trade that has been developed for a long time.

Table 9. Cost indicator-the direct utility of information security risk aggregated results

Items Objects	Data leakage		Unexpected information		Hacking	
	Control	Experiments	Control	Experiments	Control	Experiments
A	90	50	-10	40	10	-10
B	20	10	-5	15	5	10
C	40	10	50	50	60	60
D	-30	50	-40	10	-40	30
E	-40	40	-30	30	-20	40
F	90	80	-40	10	30	-30
Mean	28.33	40.00	-12.50	25.83	7.50	16.67
Maximum	90	80	50	50	60	60
Minimum	-40	10	-40	10	-40	-30
Std. Dev.	56.36	26.83	34.02	16.86	35.46	33.27

Notes: The figures in the table are in 2 digit significance.

As can be seen from Table 10, the experimental group that applies blockchain has 8 groups in the information security risk section that are larger than the control group representing the traditional trade model, of which 6 groups are in the two projects of data leakage and hacking. The result represents the data security of all the documents needed for transactions converted into data and placed on the semi-public platform. About half of the people hold a conservative attitude towards this, and in the items of unexpected information, only 30% think that new trading parties need to spend more money, indicating that most professionals are confident in the ability of blockchain technology to prevent misinformation.

Table 10. Cost indicator-the indirect utility of information security risk aggregated

Items Objects	Data leakage		Unexpected information		Hacking	
	Control	Experiments	Control	Experiments	Control	Experiments
A	50	50	45	30	50	40
B	150	160	250	200	180	210
C	300	300	200	100	100	100
D	100	300	50	100	200	300
E	1	3	1	4	2	3
F	200	100	100	50	40	20
Mean	133.5	152.17	107.67	80.67	95.33	112.17
Maximum	300	300	250	200	200	300
Minimum	1	3	1	4	2	3
Std. Dev.	107.77	125.84	97.44	69.82	79.97	118.85

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.

Descriptive Statistics Of Benefit Index

In Table 11, we observe that the experimental group has 16 groups with larger values in terms of direct benefits, showing that more than 80% of the respondents believe that the use of blockchain technology in the trade process have positive scores In terms of operating costs, transaction efficiency, and these items of transaction risk. While in the control group representing the traditional trade model, half of the values are negative.

Therefore, it can be interpreted as the professional's influence on the operational efficiency of the traditional trade process in this dimension. Each item is given more negative reviews.

Table 11. Benefits index-the aggregate result of the direct utility of the direct benefit						
Items Objects	Operating cost		Transaction efficiency		Transaction risk	
	Control	Experiments	Control	Experiments	Control	Experiments
A	10	30	-10	40	10	50
B	10	40	-5	50	10	30
C	60	0	50	60	0	30
D	-30	20	-10	50	-20	40
E	-10	30	10	30	-10	20
F	30	50	-20	50	-20	30
Mean	11.67	28.33	2.5	46.67	-5	33.33
Maximum	60	50	50	60	10	50
Minimum	-30	0	-20	30	-20	20
Std. Dev.	31.25	17.22	25.25	10.33	13.78	10.33
Notes: The figures in the table are in 2 digit significance.						

In the direct benefits shown in Table 12, there are a total of 10 groups in the experimental group with a larger amount than the control group, and 8 groups in the control group, indicating that the interviewees face the new technology-blockchain in this aspect. The amount of money created is about half the amount that is believed to increase and the amount that is considered to be reduced.

Table 12. Benefits index-the aggregate result of the indirect utility of the direct benefit						
Items Objects	Operating cost		Transaction efficiency		Transaction risk	
	Control	Experiments	Control	Experiments	Control	Experiments
A	10	20	30	10	25	30
B	200	160	130	70	200	160
C	50	200	300	100	300	100
D	200	300	200	300	100	300
E	1	3	1	3	1	4
F	50	10	100	400	10	100
Mean	85.17	115.5	126.83	147.17	106	115.67
Maximum	200	300	300	400	300	300
Minimum	1	3	1	3	1	4
Std. Dev.	91.19	123.34	110.71	164.35	121.09	106.06
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.						

Table 13 shows the indirect benefit impact value of the experimental group. There are 9 groups larger than the control group, which means that most professionals in trade business believe that blockchain technology will bring trustworthy and safer transactions. It is also easier to supervise due to the transparency and traceability of transactions. Compared with the new international trade, the traditional trade method that has been developed for a long time has a negative score in terms of credit and supervision difficulty.

Table 13. Benefits index-the direct utility of the indirect benefits are aggregated results				
Items Objects	Overall credit level		Ease of supervision	
	Control	Experiments	Control	Experiments
A	20	10	10	50
B	5	25	20	15
C	10	60	80	60
D	-10	30	-30	40
E	10	30	-10	20
F	-10	20	-10	40
Mean	4.17	29.17	10	37.5
Maximum	20	60	80	60
Minimum	-10	10	-30	15
Std. Dev.	12.01	16.86	38.47	17.25
Notes: The figures in the table are in 2 digit significance.				

Then look at Table 14, the experimental group has 7 groups with larger values, the control group has 3 groups, and the two groups have the same data. There are 2 groups; although in Table 14, most of the respondents give the experimental group a positive evaluation, some professionals think that the benefits are not as good as the international trade methods that are still used today, and some believe that the benefits of the two groups created in this dimension should be equal.

Table 14. Benefit indicators-indirect benefits indirect utility aggregation results				
Items Objects	Overall credit level		Ease of supervision	
	Control	Experiments	Control	Experiments
A	5	5	3	3
B	300	250	200	175
C	50	200	100	50
D	200	300	100	200
E	1	2	1	3
F	100	200	10	40
Mean	109.33	159.5	69	78.5
Maximum	300	300	200	200

Minimum	1	2	1	3
Std. Dev.	119	126.4	79.43	86.91
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.				

In terms of potential benefits, we can get it in Table 15. The experimental group has a score greater than that of the control group. There are 5 groups, that is, respondents with relevant professional knowledge and experience. They believe that blockchain technology will help develop potential customers.

Table 15. Benefit indicators-the results of the direct utility integration of potential benefits

Items Objects	Develop potential customers	
	Control	Experiments
A	10	10
B	5	30
C	10	50
D	-20	30
E	20	40
F	-10	30
Mean	2.5	31.67
Maximum	20	50
Minimum	-20	10
Std. Dev.	14.75	13.29
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.		

As shown in Table 16, the interviewees' forecasts for the number of revenues that the experimental group can create only 3 groups. while the other half believe that the experimental group invested in blockchain technology has less revenue than the control group of trade methods.

Table 16. Benefit indicators-the results of the indirect utility integration of potential benefits

Items Objects	Develop potential customers	
	Control	Experiments
A	2	3
B	100	70
C	100	50
D	100	200
E	1	5
F	100	50
Mean	67.17	63
Maximum	100	200
Minimum	1	3
Std. Dev.	50.87	72.28
Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.		

Combining all the above summary tables, we can get the result of the direct utility. There are 30 experimental groups larger than the control group, 5 groups smaller than the control group, and 1 group with the same result. It is indicated that the respondents think that the block the blockchain technology will bring higher efficiency and lower error rate to international trade, and can reduce the possibility of transaction fraud for 80% of the business. In addition, the comparison result of indirect utility is that the experimental group is larger than the control group. On the contrary, the 19 groups in the control group are smaller than the 15 groups in the control group, and the 2 groups with the same value.

It can be realized as the respondents believe that the new trade method can create higher returns in projects with more than half of the benefit indicators.

Cost-benefit Analysis

For all the values in the summary tables in the first two subsections, the sources are calculated based on the predicted numbers provided by six professional practitioners. Since these data are all based on personal predictions of future changes, they are inevitably mixed with the subjective consciousness of the interviewees, showing that the changes that blockchain technology will bring to international trade are different for everyone. Therefore, the maximum and minimum values in the first and second sections of the summary table are very different from each other. In order to make predictions, this study takes the average of all items of each respondent as the expected value, and adds up and compares all the expected values.

According to the final aggregate results in Table 17, in terms of cost, the experimental group joining the new international trade process of blockchain technology will bring better operational efficiency and better performance than traditional international trade methods. At the same time, we can also conclude from Table 18 that international trade using this new technology requires more costs, such as money, time, and resources than the current mature trade process.

Table 17. Cost indicator-the aggregate result of the direct utility average

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Hardware build	14.17(37.47)	52.50(27.88)	38.33*	0.075
Software build	15.00(33.91)	60.00(22.80)	45.00**	0.025
Organizational establishment	14.17(37.47)	36.67(8.16)	22.50	0.21
Personnel costs	-3.33(21.60)	40.00(21.91)	43.33***	0.0062
Time and resources	-2.50(14.05)	33.33(10.33)	35.83***	0.00071

Daily operation	2.50(17.25)	40.83(16.86)	38.33***	0.0029
Depreciation allowance	9.17(22.00)	18.33(14.72)	9.16	0.42
Damage repair	4.17(20.60)	18.33(24.83)	14.16	0.31
Data leakage	28.33(56.36)	40.00(26.83)	11.67	0.66
Unexpected information	-12.50(34.02)	25.83(34.02)	38.33**	0.042
Hacking	7.50(35.46)	16.67(33.27)	9.17	0.65
Total	76.68(11.10)	382.49(14.13)	305.81	5.928

Notes: The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

Table 18. Cost indicator-the aggregate result of the indirect utility average

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Hardware build	113.50(70.86)	185.33(127.45)	71.83	0.262
Software build	130.83(103.65)	185.00(113.80)	54.17	0.409
Organizational establishment	115.17(109.11)	160.33(178.53)	45.16	0.611
Personnel costs	130.83(123.06)	227.00(198.31)	96.17	0.342
Time and resources	95.33(87.61)	220.67(280.45)	125.34	0.336
Daily operation	200.17(109.18)	202.00(137.32)	1.83	0.98
Depreciation allowance	66.83(40.50)	74.50(71.03)	7.67	0.824
Damage repair	117.00(81.08)	130.67(105.42)	13.67	0.807
Data leakage	133.50(107.77)	152.17(125.84)	18.67	0.788
Unexpected information	107.67(97.44)	80.67(69.82)	- 27.00	0.595
Hacking	95.33(79.97)	112.17(118.85)	16.84	0.78
Total	1,306.16(33.31)	1,730.51(52.85)	424.35*	0.056

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

The results in Table 19 show that the experimental group has obtained a much higher evaluation value than the control group on the efficiency score of the benefit side, which means that the addition of blockchain technology will help in the implementation of international trade practices. Enhance the efficiency of trade, reduce its transaction risks and regulatory difficulties; and the actual income forecast, as shown in Table 20, is expected to generate income from the experimental group, which will be higher than the current international trade method. Compared with the traditional trade model, adding blockchain technology to the international trade process can bring more revenue to the company or bank.

Table 19. Benefit indicator-the aggregate result of the direct utility average

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Operating cost	11.67(31.25)	28.33(17.22)	16.66	0.286
Transaction efficiency	2.50(25.25)	46.67(10.33)	44.17***	0.0054
Transaction risk	-5.00(13.78)	33.33(10.33)	38.33***	0.0004
Overall credit level	4.17(12.01)	29.17(16.86)	25.00**	0.016
Ease of supervision	10.00(38.47)	37.50(17.25)	27.50	0.154
Develop potential customers	2.50(14.75)	31.67(13.29)	29.17***	0.0049
Total	25.84(5.997)	206.67(6.83)	180.83	1.0273

Notes: The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

Table 20. Benefit indicator-the aggregate result of the indirect utility average

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Operating cost	85.17(91.19)	115.50(123.34)	30.33	0.64
Transaction efficiency	126.83(110.71)	147.17(164.35)	20.34	0.807
Transaction risk	106.00(121.09)	115.67(106.06)	9.67	0.886
Overall credit level	109.33(118.99)	159.50(126.40)	50.17	0.495
Ease of supervision	69.00(79.43)	78.50(86.91)	9.50	0.847
Develop potential customers	67.17(50.87)	63.00(72.28)	- 4.17	0.9106
Total	563.50(23.998)	679.34(37.51)	115.84	0.3159

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

In order to judge whether the experimental group-the international trade process applying blockchain technology can be put into use, we made Table 21 and Table 22 to facilitate comparison after excluding one-time systems construction costs such as hardware, software, and organization from Table 20 and Table 21.

Table 21. Cost indicator (recurring cost)-the aggregate result of the direct utility average

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Personnel costs	-3.33(21.60)	40.00(21.91)	43.33***	0.0062
Time and resources	-2.50(14.05)	33.33(10.33)	35.83***	0.00071
Daily operation	2.50(17.25)	40.83(16.86)	38.33***	0.00299
Depreciation allowance	9.17(22.00)	18.33(14.72)	9.16	0.418
Damage repair	4.17(20.60)	18.33(24.83)	14.16	0.307
Data leakage	28.33(56.36)	40.00(26.83)	11.67	0.661
Unexpected information	-12.50(34.02)	25.83(34.02)	38.33**	0.0423
Hacking	7.50(35.46)	16.67(33.27)	9.17	0.654
Total	33.34(11.96)	233.32(10.63)	199.98***	0.00058

Notes: The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

Table 22. Cost indicator (recurring cost)-the aggregate result of the average of indirect utility

Items Objects	Controls	Experiments	Differences	t-statistics
	(A)	(B)	(B) – (A)	
Personnel costs	130.83(123.06)	227.00(198.31)	96.17	0.342
Time and resources	95.33(87.61)	220.67(280.45)	125.34	0.336
Daily operation	200.17(109.18)	202.00(137.32)	1.83	0.98
Depreciation allowance	66.83(40.50)	74.50(71.03)	7.67	0.824
Damage repair	117.00(81.08)	130.67(105.42)	13.67	0.807
Data leakage	133.50(107.77)	152.17(125.84)	18.67	0.788
Unexpected information	107.67(97.44)	80.67(69.82)	- 27.00	0.595
Hacking	95.33(79.97)	112.17(118.85)	16.84	0.78
Total	946.66(39.48)	1,199.85(60.88)	253.19	0.2409

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance. The "***", "**", and "*" denotes statistical significance at 1%, 5%, and 10% level, respectively.

Finally, in order to understand the direct and indirect effects of blockchain technology on the cost and benefit aspects, the direct and indirect effects of the experimental group and the control group are summed up. Show the total of the two utilities of the result, and compare the net benefit and the profit-to-cost ratio to complete the final result.

Table 23 is the final result of the cost index and benefit index expressed by the direct utility method. The net benefits of the control group and the experimental group are calculated to be -7.5 and -26.65, and the profit-to-cost ratio is 0.78 and 0.89, and the indirect utility is shown. In Table 24 of the final result, the net benefit amount of the control group is -3.8316 million, and the profit-to-cost ratio is 0.6, and the part of the experimental group is the net benefit -5.2051 million and the profit-to-cost ratio is 0.57.

Table 23. Consolidation of the final result of direct utility

Indicators Schemes	Cost	Benefit	Net benefit	Benefit-cost ratio
Controls	33.34	25.84	-7.50	0.78
Experiments	233.32	206.67	-26.65	0.89

Notes: The figures in the table are in 2 digit significance.

Table 24. Consolidation of the final result of indirect utility

Indicators Schemes	Cost	Benefit	Net benefit	Benefit-cost ratio
Controls	946.66	563.50	-383.16	0.60
Experiments	1,199.85	679.34	-520.51	0.57

Notes: Unit: 10,000 NTD. The figures in the table are in 2 digit significance.

Regarding the net benefit of the experimental group, whether it is the direct utility of operating efficiency or the indirect utility of representing the amount of revenue, not only are they less than the control group, the total benefit is also less than the total cost, which means that the new technology of blockchain is applied internationally. In terms of trade practice, it has not yet been able to make a profit.

Therefore, based on the above analysis results, the investment in the new trade process of blockchain technology is currently not cost-effective, and it is judged to be an unprofitable investment, and it is not recommended to use it at this stage.

CONCLUSION REMARKS

From the literature review of this article, we know that the application of blockchain technology to the bank's international trade letter of credit can improve the convenience and completion rate of transactions from the

technical level, and also speed up the administrative processing process to reduce time consumption. The implementation plan to solve the pain points of many problems of the bank letter of credit. This research is aimed at the bank's international trade business, comparing the cost-effective efficiency and cost of the new international trade process and the traditional international trade process, which is more suitable in the current environment. In order to obtain the research samples, we conducted interviews with professionals engaged in related businesses in Bank C, and recorded the amount of data provided by the interviewees in the form of questionnaires, which was used as the basis for cost-benefit analysis, and the results were calculated after aggregation.

According to the empirical results of this article, whether it is the control group or the experimental group, both of them as solutions do not have obvious benefits at this stage. The results of the control group show that, for banks, international trade business is not a highly efficient and surplus-generating department. Therefore, most banks have a negative attitude towards the development of the trade sector, so there is no incentive to introduce new technologies to change this business. In addition, the experimental group representing blockchain technology did not have obvious benefits for the operational efficiency of the international trade process and the amount of money. Moreover, it has been mentioned many times in the past research literature that one of the characteristics of blockchain technology —Decentralization will squeeze the interests of traditional centralized institutions and will face the obstruction of their vested interests. Therefore, as a basic business that is not particularly emphasized by the banking industry, international trade business has no incentive to actively improve its business processes.

Although the value of the profit-to-cost ratio of the experimental group is less than 1, and the result is not recommended, the blockchain, as a new technology that has appeared for no more than ten years, is still in the development stage for actual business applications. The conditions of the existing environment have not yet been adjusted in response to the blockchain technology, and many related supporting measures have not yet been formed or positioned. So that at this stage, a conclusion that is not applicable has been reached. If after some years, changes in the business environment have established the relevant supporting facilities and conditions, perhaps the cost or efficiency of the experimental group's implementation of the plan will reach the level that can be used.

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