

# Research on The Reform of Tax Collection and Management for The Innovative Development of The Block Chain in Guangdong-Hong Kong-Macao Greater Bay Area

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**Abstract:** In recent years, blockchain technology has been highly concerned by countries all over the world and has caused major changes in many industries. Starting with digital currency, blockchain technology has deeply penetrated into the financial field, affected many tax related fields, and promoted the reform of tax collection and management means. Starting from the application of blockchain theory and blockchain technology, this paper analyzes the application of blockchain in financial and non-financial fields through cases, and puts forward the feasibility of applying blockchain technology to the reform of tax collection and management in Guangdong-Hong Kong-Macao Greater Bay Area under the background of the innovative development of blockchain in the Greater Bay Area, combined with the current situation and existing problems of tax collection and management in Guangdong, Hong Kong and Macao, Put forward the specific system design scheme.

**Keywords:** Guangdong-Hong Kong-Macao Greater Bay Area, Block Chain Technology, Tax Collection and Management

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On January 1st, 2006, Wang Zhenyao, the Director of Relief Agency at the Ministry for Civil Affairs (MCA), has launched an ‘experiment’ of donating 5 hundred yuan, aiming to target the reform of charities in China. When asked by reporters in disaster mitigation center during an exclusive interview, Wang said, “Who would have thought that it has taken two months, with ten bureaucratic procedures just to cut a fifty-yuan tax?” In 2012, when Zhang Wangchen, a researcher in Research Center of Social Work and Volunteer Service at the Beijing Normal University, has done a survey on permanent residents aged over 18 in Mainland China by means of multistage sampling, it has found that when asked about whether they had ever gotten a tax discount certificate, over half of the respondents who had donated to charity in 2010 said that they haven’t requested for it. Along with respondents who have not known about this policy, 91% of all individuals have never received a certificate.<sup>1</sup> From May to July in 2013, when the People’s Daily Online launched a survey on the public perceptions and attitudes towards charities in China, the results have also demonstrated that 70% of the interviewees have thought that the level of development of China’s charity is inferior to that of developed countries. with more than 90% of interviewees also knowing little about the tax deduction policies for donations in China.

In recent years, charities in China have developed rapidly. The Wenchuan Earthquake in 2008 has greatly aroused the charitable consciousness of society, with 70 billion yuan raised in assistance of the disaster-affected regions, and with many enterprises also making large donations.<sup>2</sup> However, this also raises several questions; what is the status quo of personal charitable donations in China? Which income tax discounts are available for personal charitable donations? What are the incentive effects of the discounts for personal charitable donations? Does the bureaucratic procedures for the individual income tax management affect personal charitable donations? These questions will all be discussed in this paper.

## I. Preface

### *1.1 Background and significance of the topic*

In 2009, Nakamoto published the white paper on bitcoin. Bitcoin is gradually understood and accepted by the society. Blockchain technology, the underlying technology of bitcoin, has gradually attracted the attention of the whole world. Internet, banking, logistics and other industries have begun to study and use blockchain technology. It is innovative to introduce this new technology into the field of taxation.

At present, many domestic industries have a lot of research literature on blockchain technology, but there are few relevant literatures in the field of taxation. Therefore, there is a large exploration space to bring tax management into the research scope of blockchain.

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<sup>1</sup> Zhang Wangcheng, “An Empirical Study on Contemporary Donation Management and its Problem in China”, *China Soft Science*, VIII (2013), 163-169.

<sup>2</sup><http://www.charity.gov.cn/fsm/sites/newmain/preview1.jsp?ColumnID=286&TID=20101223162824828646847>.

The Chinese government attaches certain importance to blockchain. In 2016, the State Council of China issued the 13th five year plan for national informatization. The plan reveals the prediction of global informatization development: IOT, cloud computing, big data, artificial intelligence, machine deep learning, blockchain, biological genetic engineering and other new technologies drive the evolution of cyberspace from the interconnection of everyone to the interconnection of everything. Digital, networked and intelligent services will be everywhere. The real world and the digital world are increasingly converging, and the global governance system is facing profound changes."<sup>3</sup>

Recently, China's State Administration of Taxation has also expressed its attention to blockchain technology. Director Wang Jun mentioned at the national tax work conference held in January 2018 that blockchain technology has been studied. In fact, as early as 2017, the Department of collection, management and science and technology development of the State Administration of Taxation has established a blockchain research team.

In Guangdong-Hong Kong-Macao greater bay area, blockchain technology has been attached great importance. On November 9, 2018, Guangzhou Huangpu District and Guangzhou Development Zone established Guangdong-Hong Kong-Macao greater bay area blockchain alliance. Guangzhou Nansha District government also tried out blockchain government affairs to promote multi sectoral resource sharing of government services. In 2019, The opinions of the CPC Central Committee and the State Council on supporting Shenzhen to build a leading demonstration area of socialism with Chinese characteristics proposes to support innovative applications such as digital currency research and mobile payment in Shenzhen. Among them, the underlying technology of digital currency is highly related to blockchain technology.

Therefore, it is of great practical significance to study the combination of blockchain technology and tax collection and management, comply with the trend of the times and the development needs of the country, and comply with the attention paid by Guangdong-Hong Kong-Macao greater bay area to the development of blockchain technology.

## **1.2 Literature Review**

### **1.2.1 Domestic research**

Domestic research on blockchain technology appears relatively late and there are few literatures. The existing research literature mainly includes two types: one is from the perspective of economics or finance to explore how to combine blockchain technology with a certain financial and economic field; the other is from the perspective of computer technology to explore blockchain technology itself or around the development of blockchain technology application.

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<sup>3</sup> “十三五”国家信息化规划, The Thirteenth Five-year Plan on National Informatisation, <[http://www.gov.cn/zhengce/content/2016-12/27/content\\_5153411.htm](http://www.gov.cn/zhengce/content/2016-12/27/content_5153411.htm)>.

## **Literature related to blockchain Technology**

Tang Wenjian and LV Wen (2016) published how blockchain will redefine the world. The book introduces the origin and development of blockchain, the economic thought behind blockchain, the technical principles and characteristics of blockchain, the application prospect of blockchain, etc. at the same time, the author lists a number of research and application cases of blockchain in various fields.

Zhang Rui (2016) Based on the discussion in the banking industry, he believes that blockchain technology will have a subversive impact on traditional finance, reduce the operating costs of banking financial institutions and make banking institutions more compliant. In addition, blockchain may have a revolutionary impact in many aspects, such as cost control and transaction Anti-violation. He also predicts that digital currency will replace paper money in the future. Both system and macro-control will have a potential impact.

Liu Yuheng, Zhou Shiqi (2017) analyzed the securities field. They believe that as an emerging technology, the characteristics of blockchain are consistent with the development needs of the securities market. Blockchain technology has application space in securities issuance, registration and custody, clearing and settlement, but in practical application, supervision must be strengthened to prevent risks. In addition, we should pay attention to handling the relationship between traditional securities institutions and blockchain securities. To ensure the healthy and sound development of blockchain technology in the securities field.

The Ministry of industry and information technology, together with China blockchain technology and Industry Development Forum (2016), released the white paper on China's blockchain technology and application development, analyzed the current situation and trend of blockchain development, sorted out and summarized its core technologies and typical application scenarios, and provided suggestions on China's blockchain Technology development route, blockchain technology standardization and other issues.

The Key Laboratory of big data strategy (2017) conducted a detailed analysis on the concept of sovereign blockchain and believed that sovereign blockchain can ensure that data and behavior are subject to national supervision on the basis of retaining the existing advantages of blockchain technology, and has broad development space in the future.

In addition, in the scheme design of blockchain system, Dong Youkang and other scholars (2017) proposed the electronic voting system of the board of directors based on blockchain technology; Wang Litong (2017) proposed the scheme of rural financial information sharing platform based on blockchain technology; Yang Huiqin and other scholars (2018) proposed the scheme of applying blockchain to the construction of supply chain information platform; Xue Tengfei and other scholars (2017) proposed a medical data sharing model based on blockchain technology; Xu Yue and other scholars (2016) designed a comprehensive evaluation system of student behavior based on blockchain.

### **Relevant literature in the field of Taxation**

The State Council (2015) published the action platform for promoting the development of big data, which puts forward the development situation and significance, guiding ideology, overall objectives, main tasks and policy mechanisms of big data. In the platform, it clearly requires all social parties to cooperate to promote the development of big data in taxation.

Ou Ge and Jin Xiaoxi (2017) analyzed the advantages and disadvantages of the Golden Tax phase III project in data utilization, discussed and provided suggestions on the application of big data in the Golden Tax phase III Management.

Jia Yizheng (2017) put forward some problems and reasons in tax management under the background of big data, and gave some policy suggestions.

Ma Lie (2017) analyzed the problems of big data in the field of tax risk management and put forward suggestions to improve the problems from four aspects: building the foundation of the rule of law, management platform, institutional mechanism and talent security system.

Long Zhaohui and others (2017) put forward the concrete suggestions for the construction of the Internet plus Electronic Taxation Bureau by analyzing the situation and problems of the tax authorities at various levels in the current stage.

#### **1.2.2 Foreign research and application development of blockchain Technology**

In 2008, Satoshi Nakamoto published a groundbreaking paper, "bitcoin: a point-to-point electronic information system", which first proposed the concept of blockchain and proposed a digital money system based on blockchain technology - bitcoin.

Melanie Swan (2015) published blockchain: Blueprint for a new economy, which analyzes the main application fields of blockchain and its three stages of application, namely blockchain 1.0: digital currency stage, blockchain 2.0: smart contract stage and blockchain 3.0: expanding application in various fields.

By building a payment platform based on blockchain technology, ripple labs, a San Francisco start-up, obtained a financing of US \$30 million in 2015. Ripple platform can realize rapid exchange and remittance between different accounts and currencies, successfully saving users high handling fees and a lot of time costs.

In 2015, ascribe, Germany, designed a copyright trading system using blockchain technology, so that a large number of intellectual property transactions involving low value can be carried out safely, efficiently and at low cost.

In 2015, wave, an Israeli enterprise, said that it would take advantage of the openness, transparency and distrust of blockchain technology to optimize the current supply chain management mode and set off a digital revolution in the transportation industry.

In 2017, the Australian Stock Exchange announced that the blockchain system will replace the original traditional securities trading system. The new system will use smart contract technology to automatically manage the clearing and settlement procedures of securities trading.

In 2018, Softbank group of Japan developed a credit system based on blockchain technology to manage personal financial information. The system can obtain the borrower's rental payment history information and property information, and provide the information to the lender to assess the borrower's payment ability. This system simplifies a time-consuming risk assessment process and can help the lender quickly assess a large number of risks of Low credit

### ***1.3 Research ideas and methods***

Starting from the basic concept of blockchain, this paper first analyzes its core technology and characteristics, and then analyzes the application cases of blockchain technology in various fields. On this basis, combined with the current problems faced by China in tax management, based on the existing application cases, this paper analyzes the application mode of blockchain in the tax collection and management of Guangdong-Hong Kong-Macao greater bay area, and provides specific schemes.

1. Comparative analysis method. This paper will compare the research and application status of blockchain at home and abroad, and then clarify the role of blockchain technology in various fields through the comparison before and after blockchain application.
2. Interdisciplinary analysis method. This paper uses the interdisciplinary research methods of finance, economics and public finance to analyze the application of blockchain in the field of tax collection and management in Guangdong-Hong Kong-Macao greater bay area.
3. Case analysis method. This paper will integrate the application cases of blockchain in reality, and explore the possibility and specific application direction of blockchain in the tax collection and management of Guangdong-Hong Kong-Macao greater bay area.

## **II. Theory and application of blockchain technology**

### ***2.1 Blockchain technology theory***

Blockchain is a technical solution to collectively maintain a reliable database by means of decentralization and trust. One of the common forms is taken as an example below:

In a blockchain system, the central server for keeping data does not exist. The blockchain system is composed of multiple nodes (can be understood as participants), and each node has the same status in the system. Whenever the data changes, each node can participate in the process of recording data, i.e. bookkeeping, which is determined by the system and select the best one. The system will enter the content generated by the best, and submit the results to everyone for backup.

### 2.1.1 The core technology of blockchain

#### Asymmetric encryption algorithm

In the blockchain system, asymmetric encryption algorithms are widely used, such as elliptic curve algorithm, Merkel tree algorithm, etc.

The basic process of asymmetric encryption algorithm to realize confidential information exchange is that party a first generates a pair of keys (public key and private key). After receiving the public key, Party B can use the public key to encrypt the information to be transmitted. After the encrypted information reaches Party A, Party A will decrypt the received encrypted information with the previously generated private key.

In the traditional symmetric encryption algorithm, both sides of the information transmission need to transmit the key used for decryption while transmitting the information. In the asymmetric encryption algorithm, both sides do not need to transmit all the keys, and the private key is only in the hands of one party, which greatly reduces the risk of cracking after the information is intercepted. Even if the public key is intercepted on the Internet, the interceptor cannot control the public key. Decrypt the key.

Using asymmetric encryption algorithm can ensure that the blockchain system has high security and non-cracking.

Figure 1 briefly describes the asymmetric encryption model in a graphical manner:

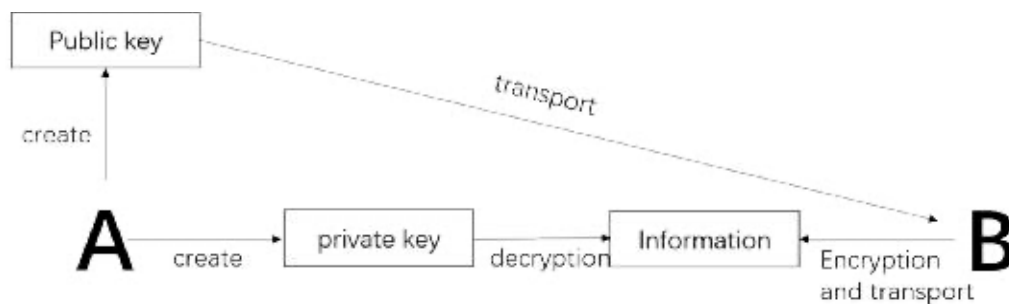


Figure 1 asymmetric encryption model

#### Distributed block chain structure

In the blockchain system, data is divided into different blocks. Blocks are generated one by one in chronological order, recording all value activities during the creation period. Each block is stamped with a time stamp and connected with the previous block. Through this sequential structure, a complete database structure is finally generated. This structure enables all data to be stored on the blockchain. At the same time, it can trace the source of each data in the system to verify its accuracy.

Through the distributed block chain structure, the decentralization and traceability of the blockchain system are realized, which is a means to ensure that the information in the blockchain cannot be easily modified.

### **Consensus mechanism**

The consensus mechanism solves the problem of how the blockchain achieves consistency in the distributed scenario (i.e. the scenario where there are countless nodes in the decentralized system). It is one of the keys of the blockchain system. The consensus mechanism solves the possible "inconsistency" among groups: the system selects the best "ledger" through the strength of the group and solidify it to ensure the organic unity of the overall "ledger" content through distributed maintenance.

### **2.1.2 Feature analysis of blockchain Technology**

#### **Decentralization.**

The traditional database is centralized. There is a central organization (server) to manage the data, uploading and modification can be interfered by the central organization.

Based on blockchain technology, distributed storage after data encryption can be realized without centralized management on the system and hardware facilities. Due to the distributed structure, in a blockchain system, the status of any node is completely the same, and there is no centralized organization with core power and core obligations in the whole system but depends on joint maintenance to maintain the operation of the system. Figure 2 compares the centralized structure with the decentralized structure.

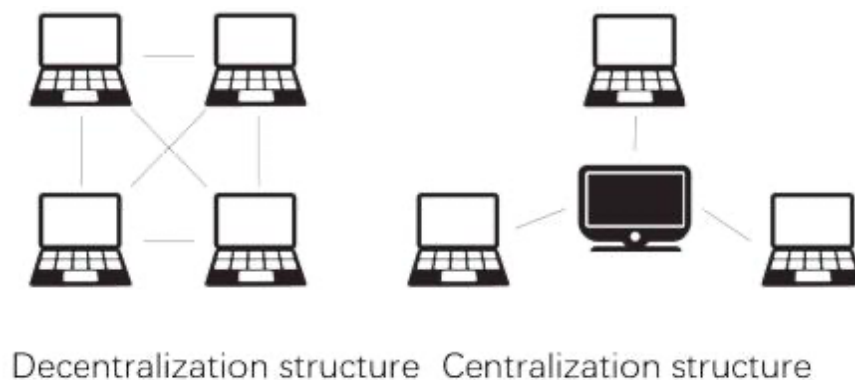


Figure 2 structure diagram of centralization and decentralization

#### **Non-tamperable (Security)**

Due to the existence of the blockchain consensus mechanism, each participant will get a copy of the complete database. If a single node modifies the data, it will have no impact on the whole database because it cannot affect the contents saved by other nodes. Therefore, the more nodes participating in the system, the higher the system's ability to prevent malicious tampering and the higher the data security.



## Traceability

Due to the existence of distributed block chain structure, the blockchain can record every modification in history, so it can trace the origin of every data in the system. In a blockchain system, every behavior is recorded and traceable.

## To trust

Due to the transparent operation of the whole system in the blockchain system, the data cannot be tampered with and traced, and nodes cannot deceive other nodes. Therefore, data exchange between nodes does not require mutual trust or the participation of trusted third-party intermediaries. This feature makes blockchain technology often used in anonymous and untrusted environments such as black-market transactions.

### 2.1.3 Classification of blockchains

#### Public chain

Most of the well-known blockchain products (such as bitcoin) are public chains. Public chains are blockchain systems that anyone can join. Public chains have obvious decentralized characteristics. All nodes enjoy the same power and jointly manage the same "public account", and their trust mechanism is "workload proof".

#### Private chain

Unlike the public chain, the write permission of the private chain is only controlled internally, while the read permission of the data can be selectively opened to the outside world. Although the decentralization of the private chain is weak, it still has the structure of multi-node operation of the blockchain.

#### Alliance chain

Alliance chain system is a network that can only be joined and exited after authorization. In real alliance chain applications, there are usually entity organizations corresponding to each node one by one, and each organization forms an interest related alliance to jointly maintain the healthy operation of the blockchain system.

The overview of the three types of blockchains is shown in the table below:

Name	Decentralization	Participant	Trust Mechanism	Excitation Mechanism	Data Writing
Public chain	strong	anybody	Proof of workload	need	3-20Times / S
Private chain	weak	Within the organization	Self-endorsement	No need	> 1000 times / S
Alliance chain	Optional	Agreement crowd	Collective endorsement	Optional	> 1000 times / S

## ***2.2 Application of blockchain technology***

As mentioned above, because the blockchain has the characteristics of decentralization, non-tampering, traceability, and trust, it can construct a good environment for economic activities to develop smoothly under the asymmetric and uncertain environment. Therefore, in theory, blockchain technology can be applied to all areas that need intermediary, such as payment, securities, logistics, audit work, taxation, etc.

In his book *Blockchain-Blueprint for a New Economy*, Melanie Swan describes the main application areas of the blockchain and the three phases of its application.

### **2.2.1 Currency (digital currency stage)**

This stage can also be called "programmable currency".

The blockchain digital currency represented by bitcoin is by far the most well-known application of blockchain technology and the most perfect technical system. The decentralized feature ensures that the blockchain currency does not need any endorsement from the central bank and other institutions, which also makes the "currency de nationalization". This assumption is possible. In addition, the characteristics of non-tamperable and traceability make the blockchain currency extremely safe, and the de trust makes it available in a large number of non-trust environments. Therefore, the blockchain currency may have a subversive impact on the existing monetary system.

### **2.2.2 Contracts (smart contract phase)**

This stage can also be called "programmable finance."

*Blockchain Revolution: How the technology behind Bitcoin is changing money, business, and the world* The book gives the basic theory of smart contracts: smart contracts are computer-processed trading protocols that automate contract terms. Its purpose is to automate the processing of a large number of special-purpose general contract conditions, reduce reliance on third-party intermediaries, and reduce contract disputes. Its economic goal is to reduce various potential costs in the transaction process, including losses caused by malicious behavior such as fraud, arbitration costs and execution costs.

This concept was proposed in 1994, but the lack of a technical means to protect the contract existing in the computer cannot be modified, it is difficult to protect the legal effect of the contract. The birth of the blockchain made smart contracts possible. Blockchain technology is the most effective way to implement smart contract assumptions, because blockchains are traceable and irreversible, and with certain code, contract conditions, contract signers and other important information can be permanently "engraved" It cannot be tampered with in the database so that its effectiveness can be determined. As a result, smart contracts can effectively automate various types of agreements in the case of non-trust, while eliminating third-party intermediaries, reducing the large cost of contract signing and execution.

Through intelligent contract technology, in theory, financial markets can establish a distributed credit system, and all financial activities with contract functions are included in this system. At present, typical applications of smart contracts include: Wall Street Bank is planning to build industry standards for blockchain, improving the efficiency of bank settlement payments, and reducing the cost of cross-border payments; some stock exchanges apply blockchain technology to securities clearing and settlement, etc.

### **2.2.3 Justice applications beyond currency, economics, and markets**

The author mentioned that blockchain technology is a new and efficient organizational activity model. Based on the characteristics of trust, information transparency, blockchain has potential applications in social governance, industry, culture and art. In this part, the author conceived the application direction of many blockchain technologies and constructed a society connected by blockchain technology, but the assumptions are all floating in the “imagination” stage, without giving specific theoretical guidance.

The following case discussion focuses on two phases of digital currency and smart contracts, and less on the third phase.

## **III. Application of blockchain Technology case study**

### ***3.1 Financial field***

#### **3.1.1 Optimize clearing and settlement: payment platform Ripple**

Ripple is a successful case of blockchain technology in the payment field. This platform is mainly used for different types of currency exchange and remittance, users connect and use the entire Ripple network through the gateway. Each gateway modifies the "General Ledger" through a consensus mechanism to securely process each transaction.

The main way to cross-border remittances in the traditional way is through international settlement centers. In the case of SWIFT, in the process of cross-border remittances, the SWIFT organization charges for each fund settlement, and it takes a long time (usually more than 24 hours) for the funds to arrive.

The advantages of the Ripple platform over traditional means are:

#### **Fast processing speed**

The nodes reach a consensus with each other, and the essence is peer-to-peer communication (P2P technology) in Internet communication. This process is extremely efficient. The traditional clearing process takes 3-5 days, and with the blockchain system, the entire process takes only 4 seconds.

## High security

The Ripple Gateway Protocol is not subject to personal control. The protocol runs on all relevant devices, and all devices maintain a complete "shared ledger". Every few seconds, the equipment running the agreement will reach a consensus on the "book", which confirms the four states of payment processing, balance correction, transaction execution, and transaction completion. Through common maintenance, the "book" is extremely secure, and it is impossible to invade and modify the "book" unless it controls most of the devices in the entire system at the same time (in fact, this situation is almost impossible in a large Ripple system).

Ripple's innovations in the field of payment can be summarized as follows: under the premise of ensuring transaction security, automatic settlement of deductions, saving manpower and material costs and time costs.

### 3.1.2. Smart contracts in the securities industry: Australian Stock Exchange

The "Application of the Securities Blockchain Exploration, Problem Challenges and Supervision Countermeasures" mentioned that the traditional securities settlement method and the development of the handling procedures have the following defects: the securities clearing and settlement cycle is long and complicated, and the clearing and settlement links need to be in error. Manual intervention; cost is huge (including securities clearing and payment, collateral management, custody business, etc.); the uniformity of clearing and collecting is not high, and it is scattered among various institutions.<sup>4</sup>

Based on the blockchain technology, the use of smart contracts to automatically execute securities settlements can help save manpower, save intermediate costs, and simplify procedures.

The Australian Stock Exchange (ASX) announced in December 2017 that it would replace the original CHES system with a blockchain system (distributed ledger, DLT). As Australia's leading exchange, this move has made ASX stand on the front line of securities industry innovation.

According to a report from coindesk.com, ASX CEO, Dominic Stevens said:

"We believe that using DLT instead of CHES will enable our customers to develop new services and reduce their costs, and it will put Australia at the forefront of innovation in financial markets. While we have a lot more work still to do, today's announcement is a major milestone on that journey."<sup>5</sup>

To put it simply, ASX replaces the old system with DLT technology for securities data records, and uses smart contracts to automatically manage the clearing and

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<sup>4</sup>刘瑜恒, 周沙骑《证券区块链的应用探索、问题挑战与监管对策》, Liu Y & Zhou S, 'The Application of Blockchain to Security Markets: Exploration, Challenges and Regulatory Responses' (2017) 4 *Financial Regulation Research* 89-109.

<sup>5</sup> coindesk.com, ASX Says Yes: Stock Market to Settle Trades with DLT

settlement of securities transactions. Blockchain securities systems can handle large volumes of data transmission and transaction processes at lower cost and with greater efficiency than traditional securities trading methods.

### **3.1.3 Low-cost credit data management: Japan Softbank Group**

In the contemporary financial system, banks are a typical “centralized” institution. In the process of managing customer property, banks need to spend a lot of manpower and resources to build a database for customers, maintain, update and protect the data system, and evaluate the customer's information. With the increasing amount of data in the centralized database, the investment of the bank has gradually increased, and the operating costs have increased.

In addition, with the development of society, economic and ideological changes, people's demand for small loans and credit card consumption is gradually increasing, which is also a challenge to the labor cost of banks.

With the help of blockchain technology, the cost of information management and information evaluation can be greatly reduced. In the following, credit management is taken as an example to analyze the typical example of putting blockchain technology into data management.

Japan Softbank Group has developed a blockchain system for managing personal financial information. The system is able to retrieve borrower information from Insite in Tokyo. Lenders can use this information to help determine the borrower's ability to pay, simplifying a time-consuming process of data management and user evaluation.

According to [cryptovest.com](https://cryptovest.com), the Softbank Group's blockchain-based system provides lenders with access to the borrower's credit history and real estate ownership. Its database will add approximately 170,000 records per month.

"Softbank Technology's blockchain-based system will offer financial institutions the access to customer's credit history and real-estate ownership. Its database is adding about 170,000 records each month."<sup>6</sup>

The advantages of this system are:

1. Reduce the manpower and material resources for manual data collection and manual credit evaluation. For large-scale microfinance needs, such credit systems have significant cost and efficiency advantages.
2. Access to third-party organizations and credit evaluation through indirect data can solve the problem that the credit information of general lending platforms is difficult to collect.

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<sup>6</sup> [cryptovest.com](https://cryptovest.com), Japan's SoftBank Developed a Blockchain-Based Consumer Data Management System

## **3.2 Non-financial field**

### **3.2.1 Copyright transaction: ascribe**

In the field of copyright transactions, Ascribe Germany opened its doors in 2015. The core design of Ascribe's copyright trading system is the use of blockchain technology to time mark intellectual property and create sustainable ownership for art and other digital media. This system enables a large number of intellectual property transactions involving lower value to be carried out safely, efficiently and at low cost. In essence, the automatic copyright trading system still belongs to the category of smart contracts.

It should be noted that a smart contract is essentially a type of program text, not a legal contract or agreement. However, a smart contract can be used as evidence for a contract or agreement, or a way to automate the contract. It should be noted that smart contract is essentially a kind of program text, not a legal contract or agreement. However, smart contracts can be used as evidence of contract or agreement signing, or as a way to automatically execute contracts.

### **3.2.2 Supply chain management: wave**

Israeli company Wave CEO Gardy Ruschin said in 2015 that the financial industry has undergone major changes, but the supply chain management model is still more traditional, because of the apparent lack of trust between international document systems. Wave attempts to take advantage of the open, transparent, de-trusted nature of blockchains to create a digital revolution in the transportation industry.

Wave drives the digitization of its supply chain business through blockchain technology. An article entitled "Israel Enterprise Wave uses blockchain technology to transform international shipping" provides an analysis: "All payments or documents must be agreed by the parties, and any changes made during the period can be measured immediately. Like electronic documents such as PDF can Copying countless times, the document agreed by the blockchain is unique because it requires electronic "signatures" from all parties involved. By sending the bill of lading in this way, all security and data concerns can be eliminated, eliminating the lengthy bill of lading."<sup>7</sup>

## **IV. Application of block chain technology and tax collection and management in Guangdong-Hong Kong-Macao greater bay area**

As has been analyzed above, on the premise of high security, blockchain technology shows strong advantages in automatic settlement, information collection, information management, automatic contract, etc. based on the previous research and combined with the characteristics of blockchain, this chapter will explore the

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<sup>7</sup> 《以色列企业 Wave 利用区块链技术改造国际海运》 ‘Israeli Company Wave Uses Blockchain Technology to Transform International Shipping’ (2016) 6 *Financial Computerising* 10.

necessity and feasibility of applying blockchain technology to the tax collection and management reform of Guangdong-Hong Kong-Macao greater bay area.

#### ***4.1 Application of block chain technology in Guangdong-Hong Kong-Macao greater bay area***

As one of the fourth largest Bay Area in the world, Guangdong-Hong Kong-Macao greater bay area has obvious advantages in comprehensive strength, openness and regional vitality, as well as in the application of blockchain technology.

In terms of policy, local governments strongly support the development of blockchain technology related industries. On November 3, 2016, the Financial Development Service Office of Shenzhen government issued the 13th five year plan for the development of Shenzhen's financial industry, support financial institutions to strengthen the research and exploration of blockchain, digital currency and other emerging technologies. On November 9, 2018, Guangzhou Huangpu District and Guangzhou Development Zone established the Guangdong-Hong Kong-Macao greater bay area blockchain alliance. Chancheng District of Foshan also created a blockchain government application innovation platform.

In terms of economic and industrial conditions, Guangdong-Hong Kong-Macao greater bay area has the highest GDP in the country, developed information technology industry, rich reserves of relevant talents, and has high-quality soil and leading conditions to take the lead in developing blockchain industry. At present, many enterprises in Guangdong-Hong Kong-Macao greater bay area have made full exploration and breakthroughs in blockchain technology. For example, the development of Tencent headquartered in Shenzhen "Zhixin chain" has been recognized by the highest court. The underlying technology of blockchain electronic invoice is also provided by Tencent and has been widely used. Huawei released Huawei cloud blockchain service (baas) platform in early 2018.

#### ***4.2 Tax system and collection and management in Guangdong-Hong Kong-Macao greater bay area***

At the beginning of the year 2019, China issued the outline of the development plan of Guangdong-Hong Kong-Macao greater bay area. So far, the construction of Guangdong-Hong Kong-Macao greater bay area has risen to a national strategy. Due to the differences in economic model, tax system and cultural environment, Guangdong-Hong Kong-Macao greater bay area have the characteristics of "one country, two systems and three tax areas", which hinders the flow of production factors among regions and affects the development of economic integration.

At present, due to the conflict between tax system and tax collection and management, there are the following problems in Guangdong-Hong Kong-Macao greater bay area:

① The difference of tax burden leads to capital flow. Due to the low tax burden in the design of tax system in Hong Kong and Macao, it leads to the problem of cross-

border transfer among Guangdong, Hong Kong and Macao, and a large number of funds flow to Hong Kong and Macao.

② The conflict of tax jurisdiction leads to double taxation. The conflict between regional tax jurisdiction and resident tax jurisdiction in Guangdong, Hong Kong and Macao leads to double taxation in Guangdong-Hong Kong-Macao greater bay area.

③ The conflict of tax collection and management leads to tax disputes. There are great differences in tax collection and management among Guangdong-Hong Kong-Macao greater bay area. The conflict and contradiction of tax collection and management system lead to a large number of tax disputes in Guangdong-Hong Kong-Macao greater bay area.

Therefore, regional tax coordination is the inevitable requirement of the economic integration of Guangdong, Hong Kong and Macao. It is very necessary to drive the integrated development of Guangdong, Hong Kong and Macao through the innovation in the field of tax collection and management

### ***4.3 Feasibility of applying blockchain technology in tax collection and management in Guangdong-Hong Kong-Macao greater bay area***

#### **4.3.1. Apply blockchain technology to improve the data management level of tax departments**

Although the existing Golden Tax phase III project has improved the management and application of tax data to a certain extent, it is still difficult to control the quality of data. Ou Ge and others pointed out that in the application of big data, tax managers need to process a large amount of information. At present, the Golden Tax phase III system still has problems such as insufficient data collection, low degree of data information collection and data analysis problems affecting data quality and data application, such as imperfect standards and poor data application level.<sup>8</sup>

These problems make it difficult for the tax authorities to grasp the accurate financial status and income of taxpayers, resulting in incomplete and asymmetric information, which leads to moral hazard and adverse selection. Taxpayers have a greater tendency to arrange accounting matters, avoid tax obligations, and cause tax loss.

With the wide application of big data and information technology in tax work, tax management has higher and higher requirements for tax related information data support, which also tests the data management ability of tax departments, and the application of blockchain technology can improve the data management level of tax departments.

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<sup>8</sup>欧舸, 金晓茜, 《浅谈税收大数据时代的金税三期工程》, Ou Ge, Jin Xiaoqian, 'Discussion on the Third Phase of Golden Tax project in the era of tax big data,' *China management informatization* 2017 (01):136-137.



#### **4.3.2 Apply blockchain technology to solve the problem of information asymmetry in tax work**

At present, the problem of tax information asymmetry is mainly manifested in two aspects:

First, the information asymmetry between tax authorities. At present, although the tax data provided by the Golden Tax phase III project is helpful for data communication and data retrieval between different authorities, in essence, the data still exist in the form of departmental possession. The barrier free sharing of tax information data has not been achieved. The traditional thinking of "each doing his own thing" and the imperfect information sharing mechanism will lead to duplication, contradiction and confusion in tax work.

The second is the asymmetry of information between tax collectors and payers. At present, when tax authorities use the information management system, there are three sources of data collection and call: information stored in the tax collection and management system, information from external tax departments and the Internet, and information provided by taxpayers. Except that the information in the system is reliable, the information from the other two sources is difficult to obtain and guarantee its reliability.

The problem of asymmetric information between tax collectors and payers mainly leads to two problems: ① non-compliance of tax payment. When the transparency of tax related data of taxpayers is insufficient, taxpayers may tend to evade tax obligations for their own interests. ② low efficiency of tax collection and management. Some enterprises have imperfect internal management and nonstandard tax processes, which makes tax collection and management more difficult and difficult. The application of blockchain technology can solve the problem of information asymmetry in tax work.

In addition to the above two functions, through the consensus mechanism of blockchain technology, we can also build an integrated tax collection and management and tax service platform for Guangdong, Hong Kong and Macao, improve the sharing ability of tax related data, help reduce various tax collection and management problems caused by tax system conflicts, and promote the integrated development process of Guangdong, Hong Kong and Macao.

### **V. Application of blockchain technology in tax collection and management scheme of Guangdong-Hong Kong-Macao greater bay area**

#### ***5.1 Taxation Agency Business Information Sharing System Based on Alliance Chain***

##### **5.1.1 Overview**

Referring to the design case of the alliance chain system mentioned above, combined with the needs of business information sharing between tax departments, this paper

designs a tax collection and management scheme for the application of blockchain technology in Guangdong-Hong Kong-Macao greater bay area, which mainly meets the following three requirements:

### **High quality and standardization of data.**

If the system is established and improved, the tax authorities in Guangdong-Hong Kong-Macao greater bay area need to use the system to retrieve massive data. Due to certain differences in business execution and reports between departments in different regions and at different levels, it is necessary to standardize the information uploaded to the system to make the understanding of information highly consistent among departments.

### **Exclusivity of internal systems**

Since the system is only used in relevant tax departments and has certain exclusivity, there must be restrictions on the access qualification of the system. In fact, there has long been a consensus that "public chain is used for public platforms, alliance chain is used for cross departmental platforms, and private chain is used for internal confidential information".

In order to ensure the exclusivity of the system, the inter department business information sharing system is designed in the form of alliance chain.

### **Convenience of operation**

At the application level, strong operability should be ensured to ensure that any staff can carry out basic operation in line with work needs after simple training, so as to ensure that this system can be popularized in daily tax work.

#### **5.1.2 System mode**

Establish quality standards for uploaded information (including content accuracy, content format, classification standards, etc.) To ensure high quality and high availability of information in the system. If each business information is uploaded in real time by the staff in charge of the business, the information quality may be uneven due to everyone's different understanding of the standard of information and different summary of work information. Therefore, in the implementation, each node should arrange special personnel to review and collect the information to ensure the integrity and authenticity of the information conform to the format and upload regularly.

The blockchain system adopts the form of alliance chain. Each qualified Department of the tax authorities in Guangdong-Hong Kong-Macao greater bay area has an alliance node. Each alliance node realizes direct docking, shares data and updates the same "general ledger" in real time.

During the establishment of the system, a professional blockchain system architecture team is responsible for the design to ensure strong operability of the system application layer, meet the operational needs of daily work and reduce the use threshold of the blockchain system.

The following figure shows the information sharing system:

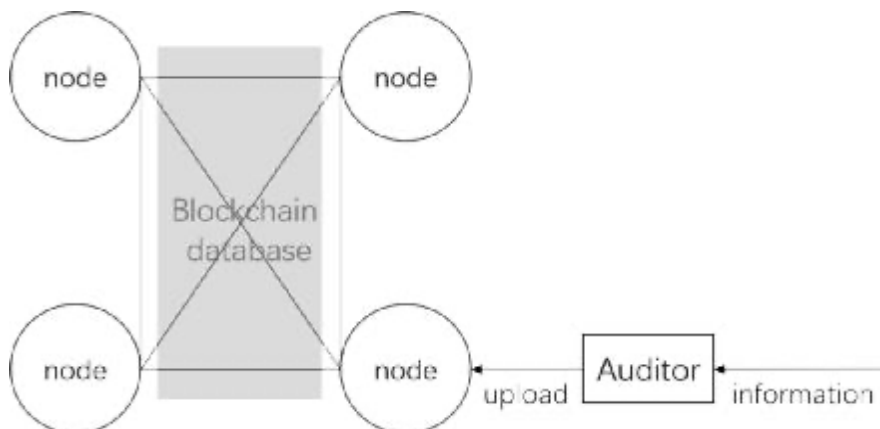


Figure 3: interdepartmental information sharing system

### 5.1.3 Operation process

First of all, the staff responsible for each business will upload the work information to the Department intranet and provide it to a specially assigned person for review. After confirming that a group of business information is true and standardized, the information will be classified and uploaded on the system node dedicated to the Department, and all other nodes will update the uploaded information in real time. When other institutions have the ability to query the business plan, business standard and implementation status. In case of requirements such as situation, you only need to enter keywords in the intranet to extract information from the alliance chain node of the received department in real time. The system operation flow is as follows:

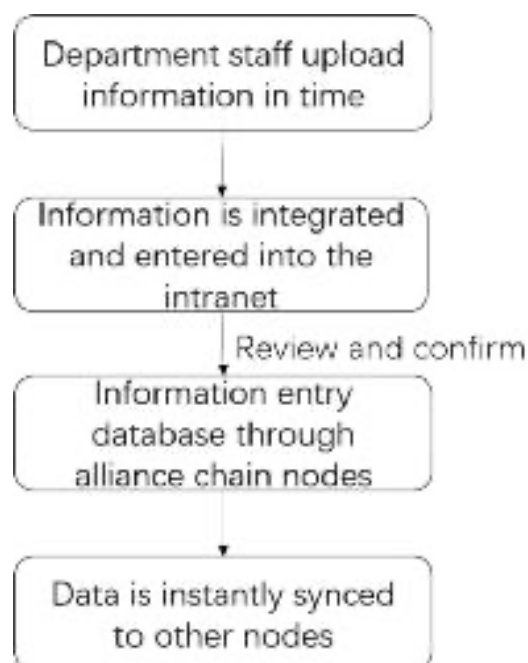


Figure 4: operation flow of inter department information sharing system

#### **5.1.4 Evaluation**

Since the rights of each node in the blockchain system are equal, the information between departments is symmetrical. At the same time, each node updates data in real time, so there is no "information barrier" between departments. The cooperation among tax authorities in Guangdong-Hong Kong-Macao greater bay area is more efficient, and effectively reduces duplication, contradiction, confusion and other problems in tax work.

This system can first be established within the tax authorities of the Pearl River Delta, and then be expanded to the tax cooperation between Guangdong, Hong Kong and Macao when it is mature, so as to improve the level of cooperation among the three places. Through the sharing of tax related information among Guangdong, Hong Kong and Macao, it can ensure the consistency of data and avoid being "loopholes" by taxpayers; it can also jointly carry out risk control and avoid the waste of resources caused by separate assessment.

### ***5.2 Design of tax related information collection system based on sovereign chain***

#### **5.2.1 Overview**

As mentioned earlier, there are three main sources of tax related information for the tax department: information stored in the tax collection and management system, information from third-party institutions and information provided by taxpayers. In addition to the information stored in the tax collection and management system, the other two information are inefficient and low data quality.

If the tax department can apply blockchain technology in the field of tax related information management, it can connect with third-party institutions (such as banks, housing and Urban Rural Development Bureau and other institutions with certain financial information), obtain a large amount of transaction information, income status and other relevant information and classify them into data sets, so as to carry out information management efficiently and reduce the cost of a large number of collection and sorting work and tax compliance cost.

Therefore, referring to the attempt of Softbank group of Japan to combine blockchain with credit management and other application schemes of blockchain technology in the field of information management, the following aspects should be considered in the design of information management system:

#### **The system is regulated and controlled by the government**

The standard blockchain system is decentralized. Although the decentralized mechanism has many advantages, this characteristic makes it difficult to supervise

and control at the governance level. Therefore, in order to ensure that tax information is under control, this paper introduces the concept of "sovereign blockchain".<sup>9</sup>

There are many technical similarities between the sovereign blockchain and the conventional blockchain system. For example, they all belong to a distributed structure and have the characteristics of de trust, non-tampering, openness and transparency, collective maintenance, etc. However, there are also essential differences between the two: the sovereign blockchain is not decentralized, but decentralized and polycentric; the sovereign blockchain technically provides the integration of regulatory nodes. Therefore, the sovereign blockchain is more suitable for areas that need to be strictly controlled by the state.

Therefore, in order to ensure that the tax related information management system can give full play to the advantages of blockchain technology under controlled and regulated conditions, it should be constructed based on the sovereign blockchain model.

### **Efficient automatic collection of tax related information**

Due to the complex sources and huge magnitude of tax related information, we should pay attention to the comprehensiveness and accuracy of information in the collection of information, and ensure the low cost and high efficiency of the collection process.

In the case of Softbank group in Japan, one advantage of Softbank group's credit system is that it directly collects financial related information by accessing third-party institutions, so as to reduce the complex information collection links.

Referring to this principle, if each taxpayer is filed separately in the system and a large number of third-party institutions involving financial information are connected to the system as nodes, the third-party tax related information can be collected as completely as possible.

### **Automatic evaluation of tax related information**

On the premise of complete collection of tax related information, the functions of automatic analysis of common indicators and automatic generation of evaluation reports can be realized by using the intelligent contract mechanism and preset code logic, so as to form a dynamic and visual tax related data analysis and display system.

### **Focus on information protection**

In the system design, we should make full use of asymmetric encryption mechanism to ensure the security of information transmission and storage, so as to ensure that important tax related information will not be disclosed and utilized.

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<sup>9</sup>大数据战略重点实验室,《重新定义大数据》,Key Strategic Laboratory of Big Data, Redefining Big Data, (Beijing: China Machine Press, 2017).

### 5.2.2 System mode

Based on the above key issues, the tax information management platform adopts the form of connection between public chain and private chain based on sovereign chain, as shown in the figure below:

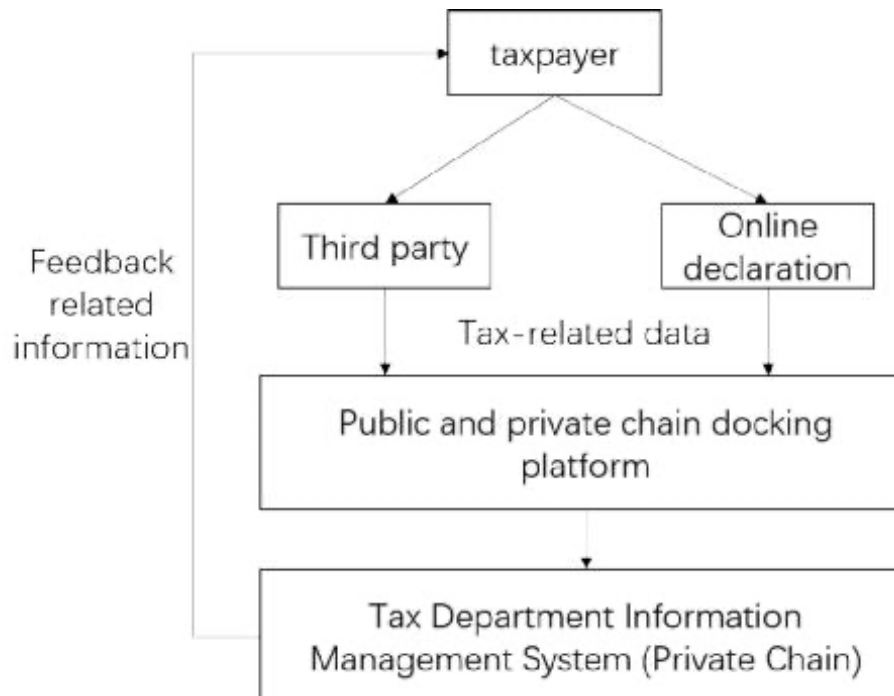


Figure 5: construction scheme of tax information management platform

The financial related behaviors of taxpayers are recorded in various third-party institutions and tax related functional platforms. These institutions report the data to the corresponding nodes according to the specific data reporting format, which together constitute a public chain system.

At the same time, taxpayers themselves can also conduct online tax declaration and online audit in this system, and the audited tax related data will also be entered into the tax information system.

The above behaviors occur in the public chain outside the tax information system. The information in the public chain is entered into the private chain part through the public-private chain docking platform, that is, in the tax related information system within the tax authorities, to file and save data for taxpayers and conduct automatic evaluation.

In the process of tax related information collection, the system has the following ideas on how to improve information transparency and collection efficiency:

① Apply blockchain technology to the whole business process of the enterprise to improve the transparency of tax related data. For example, when each transaction between enterprises is generated, both serve as nodes to upload the contract, execution order and other information of the transaction to form a smart contract.

After payment, the payment platform will automatically synchronize the transaction completion information, automatically generate blockchain electronic invoices and record them into the tax information system. This process greatly improves the efficiency and accuracy of enterprise financial work, and also greatly improves the efficiency of tax related information collection. By combining the invoice information with the actual transaction records, it can better improve the efficiency of tax supervision and eliminate the illegal act of falsely issuing and falsely offsetting VAT invoices.

② With the Chinese central bank's digital RMB, we can more accurately grasp the economic activities of taxpayers and improve tax compliance.

The Chinese central bank's digital RMB, as a digital currency whose issuance and circulation are under the supervision of the state, in its circulation, each transaction can trace the identity and transaction amount of both sides. At present, the central bank has completed the development of digital RMB and gradually started the pilot promotion. On March 3, 2021, the Ministry of Commerce issued the overall plan for comprehensively deepening the innovation and development of service trade, which mentioned that the digital RMB pilot should be carried out in Beijing, Tianjin and Hebei, the Yangtze River Delta, Guangdong-Hong Kong-Macao greater bay area and qualified pilot areas in the central and western regions. As of July 2021, the digital RMB pilot has been orderly expanded to "10 + 1", that is, "10 cities + 1 Winter Olympic scene". This means that in the near future, Chinese residents are expected to fully use digital RMB for payment.

The promotion of digital RMB will have a very significant impact on China's tax work. Due to the strong traceability of digital RMB in circulation, with the cooperation of digital RMB payment tools, the flow and stock tax related information such as taxpayer income, expenditure, property, behavior and monetary funds can be fully and accurately mastered by the tax authorities.

③ Based on the taxpayer's business behavior data, a taxpayer compliance evaluation model is established to automatically identify and warn the risk.

Tax non-compliance behavior is mainly reflected in the taxpayer's default, false declaration and other behaviors in the reporting and payment links. Although these behaviors are complex and diverse, their essence is that the capital flow and business behavior cannot correspond. In order to effectively identify risks, on the premise of collecting sufficient tax related data, with the help of machine in-depth learning, continuously learn the behavior characteristics of taxpayers'; malicious behavior, and form a tax compliance evaluation model. Focus on the taxpayers with low tax compliance estimated by the model, and feedback the results to the model, so as to continuously adjust the accuracy of the model. On this basis, tax compliance is expected to be greatly improved and tax management costs will be significantly reduced.

### 5.2.3 Evaluation

This system can improve the efficiency of tax related information collection and reduce a lot of human and material resources consumption. At the same time, it fully

exerts the superiority of Internet technology and accords with the development requirement of "Internet plus tax bureau". This system can serve as the foundation of the Internet plus tax bureau, and provide a basic support for a series of electronic tax functions for taxpayers and tax cadres. This system can also be established within the tax authorities in the Pearl River Delta first, and then expanded to the tax cooperation between Guangdong, Hong Kong and Macao when it is mature, so as to further improve the level of cooperation among the three places.

In operation, the system will have the following advantages:

1. Based on the principle of "sovereign chain", the whole tax information system is under the supervision of the government, which can ensure that the system is controlled by the state and avoid the "anarchism" tendency of conventional blockchain technology.
2. Under the extensive collaboration of a large number of third-party institutions, the role of smart contract technology and the supervision of digital RMB on funds, each financial data of taxpayers is highly transparent and the data in the tax information system is highly complete, which is of great help to the government's collection, management and audit work and can significantly improve tax compliance.
3. It can realize the automatic evaluation of tax related information and greatly improve the efficiency of tax data management.
4. Based on the principle of public chain, each taxpayer node forms a distributed account book. IN case of attack, the control of the whole system can be realized only by controlling more than 50% of the nodes. The number of taxpayer nodes is extremely large, and it is impossible to control more than half of the nodes, which effectively protects the authenticity and transparency of tax related data and cannot be destroyed and tampered with.
5. Based on the principle of alliance chain, the pilot of digital RMB is carried out in combination with the Guangdong-Hong Kong-Macao greater bay area, which improves the efficiency of tax related data and information exchange among Guangdong, Hong Kong and Macao. Combined with big data analysis, we can have a clearer understanding and judgment on the tax system and tax policies of the Guangdong-Hong Kong-Macao greater bay area, so as to promote the tax coordination of the Guangdong-Hong Kong-Macao greater bay area and promote the integrated development of the Guangdong-Hong Kong-Macao greater bay area.



## VI. Reference List

Coindesk: *Bitcoin, Ethereum, Crypto News and Price Data*, Online, <  
<https://www.coindesk.com>>

Cryptovest: *Cryptocurrency News, Reviews & Education*, Online,  
<[www.cryptovest.com](http://www.cryptovest.com)>

Nakamoto S, 'Bitcoin: A Peer-to-Peer Electronic Cash System', *Bitcoin*, Online,  
<<https://bitcoin.org/bitcoin.pdf>>

Swan M, *Blockchain: Blueprint for a New Economy* (United States: O'Reilly  
Media, 2015)

Tapscott D, *Blockchain Revolution: How the Technology Behind Bitcoin and Other  
Cryptocurrencies is Changing the World* (United Kingdom: Penguin, 1st ed, 2018)

巴比特 | 服务于区块链创新者, *8BTC | Servicing the Innovators of Blockchain*,  
<[www.8btc.com](http://www.8btc.com)>

大数据战略重点实验室, 《重新定义大数据》, Key Strategic Laboratory of Big  
Data, *Redefining Big Data*, (Beijing: China Machine Press, 2017)

董友康, 张大伟, 韩臻, 常亮, 《基于联盟区块链的董事会电子投票系统》, Dong  
Y, Zhang D, Han Z, Chang L, 'Board Voting System Based on the Consortium  
Blockchains' (2017) 12 *Chinese Journal of Network and Information Security* 17-  
23.

张锐, 《基于区块链的传统金融变革与创新》, Zhang R, 'Blockchain-Based  
Reform and Innovation of Traditional Financial Operation' (2016) 9 *International  
Finance* 24-31.

刘瑜恒, 周沙骑 《证券区块链的应用探索、问题挑战与监管对策》, Liu Y &  
Zhou S, 'The Application of Blockchain to Security Markets: Exploration,  
Challenges and Regulatory Responses' (2017) 4 *Financial Regulation Research*  
89-109.

马列, 《税收风险管理中的数据治理问题初探》, Ma L, 'Summary Analysis into  
the Data Governance Issue of Tax Risk Management' (2017) 8 *Taxation Research*  
119-121.

广州市税务学会课题组, 《我国“互联网+电子税务局”的设计与规划研究》,  
Guangzhou taxation society research group, 'China's Internet plus electronic tax  
bureau" design and planning research' (2017).

国务院,《促进大数据发展行动纲要》, State Council, ‘Action Plan Fundamentals for Promoting Development of Big Data’ (Beijing: People’s Publishing House, 2015)

贾宜正, 刘建, 谷文辉, 高瑞,《大数据背景下的税收治理问题研究》, Jia Y, Liu J, Gu W, Gao R, ‘Analysis of Taxation Governance Issues under the Context of Big Data’ (2017) 22 *Tax and Economic Research* (5) 17-23.

欧舸, 金晓茜,《浅谈税收大数据时代的金税三期工程》, Ou G & Jin X, ‘Overview of the Third Golden Tax Project in the Era of Big Data’ (2017) 20 *China Management Informationalisation* (1) 136-137.

唐文建, 吕文,《区块链将如果重新定义世界》, Tang W & Lü W, *How Blockchain Will Redefine the World* (Beijing: China Machine Press, 2016)

汪俐彤,《利用区块链技术构建农村金融信息共享平台研究》, Wang L, ‘Construction of Rural Financial Information Sharing Platform by Using Block Chain Technology’ (2017) 9 *Management & Technology of SME* 80-83.

胥月, 马小峰,《基于区块链的学生行为综合评价体系的研究与实现》, Xu Y, Ma X, ‘Research into the Blockchain Implementation of a System for the Comprehensive Evaluation of Student Behaviour’ (2016) 12 *Information Technology and Infomatisation* 131-133.

薛腾飞, 傅群超, 王枫, 王新宴,《基于区块链的医疗数据共享模型研究》, Xue T, Fu Q, Wang C, Wang X ‘A Medical Data Sharing Model via Blockchain’ (2017) 9 *Acta Automatica Sinica* 1555-1562.

杨慧琴, 孙磊, 赵西超,《基于区块链技术的互信共赢型供应链信息平台构建》, Zhang H, Sun L, Zhao X ‘Build Mutual Trust Supply Chain Information System Based on Blockchain’ (2018) 35 *Science & Technology Progress and Policy* (5) 21-31.

《以色列企业 Wave 利用区块链技术改造国际海运》 ‘Israeli Company Wave Uses Blockchain Technology to Transform Interantional Shipping’ (2016) 6 *Financial Computerising* 10.

中华人民共和国中央人民政府官方网站, *China Central Government website*, Online, <<http://www.gov.cn>>

中国区块链技术和产业发展论坛,《中国区块链技术和应用发展白皮书 (2016)》, China Blockchain Technology and Industrial Development Forum ‘White Paper for China’s Blockchain Technology and Development for its Use (2016)’, <<http://www.cbdforum.cn/bcweb/index/dd/7.do>>