


Application of Data Sharing Model of Investment Facilitation based on Multi-level Blockchain

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Keywords: Multi-Level Blockchain, Data Sharing, Investment Facilitation, Distributed Storage, Federated Learning.


Abstract: Big data technology has been used in almost every aspect of traditional industries in recent years. Investment facilitation involves multinational corporations, host countries, investors' home countries, investment promotion agencies and other subjects, with their data information. How to improve the efficiency of data storage and ensure the privacy and security of data has become a key technical issue for the wide application of investment facilitation. The data sharing model of investment facilitation based on multi-level blockchain can meet the requirements of transparency, sustainable development and high efficiency of investment facilitation, and better help investment facilitation to realize data sharing characteristics. By encrypting investment facilitation data and its index information, and uploading the encrypted data to the distributed storage outside the chain and the storage on the chain respectively, and adopting multi-level blockchain technology, the data storage efficiency is significantly improved, the security of investment facilitation data is ensured, and the scalability of blockchain is improved. In addition, the model uses the differential privacy technology in the parameter transmission of the federal learning module, which enhances data privacy protection. The application of investment facilitation to scientific research, monitoring and evaluation systems, as well as the promulgation and enforcement of host country laws, can be effectively realized by this technical means.

1 INTRODUCTION

In recent years, with the rapid development of information technology and the wide application of cloud computing, new network technology and Internet of Things equipment, international investment is gradually transforming to digitalization and informatization. At the same time electronic investment data are experiencing explosive growth and diversified development of data types. Nowadays, data is no longer a simple data storage medium and computing protocol, but a factor of production, with the value of resources, and causing legal disputes. International investment is also in the digital revolution, rushing to embrace the blue ocean of the digital economy. However, international investment is a complicated issue involving many subjects including multinational corporations, host countries, investors' home countries, investment promotion agencies and so on. The biggest problem is that it is difficult to guarantee the consistency,

authenticity and integrity of data, and it is difficult to resist malicious attacks. In this respect, blockchain technology has solved the problems existing in traditional cloud servers.

Blockchain technology is characterized by decentralization, decent-trust and anonymity, which is more in line with the security and privacy protection requirements in the field of data sharing in international investment. The emergence of smart contracts has turned the blockchain into distributed account book with computing power, through which users can calculate according to a fixed computing mode. For federated learning, participants can write intelligent contracts to complete parameters aggregation, allocation and other operations, so as to avoid the single point of failure of the third-party server in the global modeling stage. The multi-level blockchain architecture consists of the public chain and the alliance chain. The public chain is maintained by the special departments of the host country, which is responsible for the interaction between the host

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country and the system. At the same time, these departments also form different alliance chains according to different data types, and combine with attribute database encryption to ensure data privacy. (Malamas, Kotzanikolaou, Dasaklis, 2020)

Investment facilitation is a new issue in international investment. It is to create a transparent and efficient investment policy environment for investors by improving policy transparency and predictability, simplifying investment rules and procedures. Investment facilitation is not the right to amend or enact the investment laws and it has nothing to do with investment protection, investment promotion and investment liberalization. (Hamdani 2018) The transparency mentioned in investment facilitation suggestions put forward by various countries mainly includes the following aspects. When formulating investment-related policies, the government should provide comprehensive, clear and timely notice. The government should ensure effective access to information, including providing "one-stop" consultation points or special consultation points, and appropriate online services. The government should also promote simplification of the language of laws and regulations and publish the results of periodic review of the investment mechanism in a timely manner. From the perspective of the host country, a core aspect of investment facilitation is to improve the openness and transparency of investment supervision and management of the host government. Digital application is the simplest and most direct way to achieve transparency.

Investment Promotion	Investment Facilitation
marketing a location	make it easier to invest & do business
<ul style="list-style-type: none"> • Predominant role for IPAs • Competitive(zero-sum hypothesis) • Focused on location-sensitive investment • Potentially costly incentives 	<ul style="list-style-type: none"> • Whole-of-government approach • Non-competitive (low risk of "beggar-thy-neighbour") • Important for all investment (including domestic investment) • Low-hanging fruit

Figure 1: Scope of Investment Promotion and Facilitation.

Therefore, the most important issue is how to implement investment facilitation under the existing mechanisms. The research goal of this paper is to use blockchain technology to realize the application of investment facilitation at a wide range of levels. Finally, it will solve the problem of mistrust among the subjects, increase the transparency and effectiveness of investment facilitation, and ensure that the privacy, openness and transparency of investment data do not conflict.

2 CHALLENGES OF ESTABLISHMENT DATA SHARING MODEL ON INVESTMENT FACILITATION

2.1 Challenges in Institution

The current level of investment facilitation is low and the depth of cooperation is shallow. Although there are several cooperative organizations at the regional level, the multilateral level still stays on the sidelines. Investment facilitation belongs to an emerging transnational legal system. Among it, global governance has a stronger color than traditional legal governance, but the fact is that "transnational legislation" and "international legislation" complement each other and move forward. The "international legislation" based on the express or implied mutual consent of various countries has formed international law in the traditional sense (international hard law), but the development of globalization has put forward incremental requirements for transnational legal norms, that is international soft law formulated by various non-state actors, which requires the introduction of the law-making mechanism of "transnational legislation".

Table 1: Concrete Measures of Investment Facilitation.

Concrete Measures of Investment Facilitation				
	UNCTRAD2017	G20	APEC2009	OECD2015
Accessibility and transparency	Line1		√	√
Stability, security and protection			√	√
Predictability and consistency	Line 3		√	√
Efficiency and effectiveness	Line 2		√	
Constructive stakeholder relationships	Line 4	√	√	
Use of new technology			√	
Monitoring and review	Line 6		√	√
Enhance international cooperation	Line 7 & Line 10	√	√	
Capacity-building	Line 9	√		
Designate a lead agency	Line 5	√		
Support and technical assistance	Line 8			

The issue of investment facilitation is at the initial stage of consultation and joint construction by various governance entities around the world. Among them, transnational legislation has initially developed a set of regional standardized rules that can be used as reference by various countries, while inter-state legislation is trapped by conflicts of interest distribution and differences in preferences. First, at the regional level, only a preliminary investment facilitation rule framework was reached in the G20 and BRICS summits. Second, at the multilateral level, the WTO investment facilitation proposals promoted by developing members have not been truly adopted. Finally, at the bilateral level, there is a lack of clauses containing specific commitments to investment facilitation. Among the existing more than 3,300 international investment agreements, only some clauses contain investment facilitation commitments, and most of them focus on the entry and residence of investors and the enhancement of transparency of laws and regulations. According to UNCTAD's statistics, only India, Indonesia, ASEAN, Japan, China, Australia, Malaysia and other countries have relevant clauses in investment agreements, and the relevant content is often too simple. However, in a state where inter-state legislation is stagnant, there are still many domestic measures that are gradually benchmarked against the international system. This abnormal development is enough to attract attention. In this situation, the data sharing platform can bring together different stakeholders such as data subjects, data controllers, and data users, and include different types of data, avoiding repeated collection of data and wasting resources. In addition, the data sharing can ensure the uniformity of the degree of investment facilitation and reduce the huge difference between developed and developing countries.

2.2 Challenges in Recognition Principles

2.2.1 Transparency Principle

The principle of transparency is the most important and targeted principle in investment facilitation. The APEC investment facilitation agenda requires that every APEC economy should ensure the transparency of relevant laws, regulations and administrative procedures affecting the flow of goods, services, and capital, so as to create and maintain an open and predictable trade and investment environment. The "G20 Global Investment Policy Guiding Principles" also regard transparency as a principle and goal. In the WTO legal system and the international

investment dispute settlement mechanism, the principle of transparency is an extremely important principle. It is applicable to almost all fields of international investment and overcomes the information failure in international investment.

The investment facilitation proposals put forward by various countries in recent years also mentioned transparency requirements, mainly including: (1) The government should provide comprehensive, clear and timely notifications when formulating investment-related policies, (2) Ensure effective access to information, Including the provision of "one-stop" consultation points or special consultation points and appropriate online services, (3) promoting the simplification of the language of laws and regulations, (4) promptly publishing the results of periodic review of the investment mechanism. From the perspective of the host country, a core aspect of investment facilitation is to improve the openness and transparency of investment supervision and management of the host government. The application of digitizing is the simplest and most direct way to achieve transparency.

2.2.2 Sustainable Development Principle

The investment facilitation plays a vital role in promoting sustainable development. According to UNCTAD's calculations, developing countries are facing an annual sustainable development goal-an investment gap of US\$2.5 trillion (Hamdani 2018). Investment facilitation will effectively reduce the investment gap and help developing countries achieve sustainable development goals. Data sharing can help developed countries and developing countries to share interests and risks, bind interests and risks together, rather than separate them, and achieve sustainable goals in the investment field.

2.2.3 Efficiency Principle

The principle of high efficiency is the ultimate goal pursued by investment facilitation, different from investment liberalization, investment promotion and investment protection. The ultimate goal of investment facilitation is to improve the efficiency of the investment process, thereby effectively reducing investors' time and costs. The supporting measures related to the principle of high efficiency in the international standards proposed by APEC and UNCTAD include: (1) reducing the time for registration, approval, registration, taxation and other procedures, (2) avoiding multiple discussions, (3) reducing foreign investment needs to fill in Forms, and encourage them to be electronic, (4) The central

and local levels perform their duties and coordinate. Application and realization of E-government, "one-stop" services and a single window match the demands of investment facilitation above, then smooth deployment of follow-up work and the improvement of safety factors.

3 TENTATIVE PLAN OF APPLICATION OF DATA SHARING MODEL OF INVESTMENT FACILITATION BASED ON MULTI-LEVEL BLOCKCHAIN

3.1 Application Data Sharing in the Monitoring and Evaluation System for Investment Facilitation

In terms of performance evaluation, the Doing Business of World Bank, the Investment Climate Statement of US State Department and the Global Enabling Trade Report of World Economic Forum are all important annual report for monitoring and evaluating the business environment and investment environment. Among them, the most influential one is the Doing Business, whose data has been cited by many institutions and multinational companies. Based on the above report, this paper designs the performance evaluation index system of investment facilitation based on the specific objectives and action plans put forward by UNCTAD's Global Action Manual on Investment Facilitation and APEC's Action Plan on Investment Facilitation (Text of Global Action Memu in 2001 and Text of IFAP in 2009). The ultimate goal of this performance evaluation indicator system is to further evolve the international standards proposed by UNCTAD and APEC into quantifiable data, and to formulate data that can not only reflect the performance of environmental investment facilitation, but also reflect the best practices of investment facilitation. Based on the secondary and tertiary indicators demonstrated to the world, the investment facilitation level of countries and regions participating in international cooperation on investment facilitation is finally calculated. Among them, through the data sharing platform, the evaluation reports of multiple organizations are integrated, and the big data software system is used to make a specific evaluation system that meets the needs of the country or industry according to the set standards, and the monitoring

evaluation system is implemented through big data to track dynamic information.

3.2 Application Data Sharing in Scientific Research for Investment Facilitation

The League of European Research Universities (LERU) released the Scientific Data Roadmap in 2013, which clarified the benefits and challenges of scientific data sharing and reuse, the cost of scientific data development, and the management of scientific data. Skills and knowledge, as well as corresponding training and development opportunities (LERU 2015), in order to guide LERU member universities in the form of guidelines to carry out scientific data management related practices. In January 2014, the Ministry of Education, Sports and Culture of the United Kingdom and the Ministry of Statistics reached a data sharing agreement to promote the use of departmental management data to conduct research on population size, structure and migration dynamics (POPULATION, MIGRATION, 2013). Research on investment facilitation is currently in its infancy so that the research level and focus of research institutions and researchers in various countries are different. The most representative one is the study of the Center for Sustainable Investment at Columbia University. The Perspective established by this institution is an excellent platform to achieve data sharing data on investment facilitation research. Experts in this field around the world publish their work report through this platform, not just mature academic papers. Therefore, the achievements of investment facilitation research cannot be separated from the sharing of scientific research data in such a short period of time. (Sauvant, 2008-2022)

3.3 Application Data Sharing in Host Country for Investment Facilitation

Data can flow between countries in accordance with clear, practical, and fair access and reuse rules in data space, and access to a wider range of international data sharing conditions while ensuring compliance with the public interest and the legitimate interests of data providers. These are conducive to promoting data sharing between enterprises and governments and promoting the structure normativeness of the laws in host country in turn.

India set up the country's core institution for investment promotion and facilitation at the federal level——Invest India. That's the one reason not to be

ignored to a historical high recorded for India FDI inflows after the ongoing pandemic. For a large and politically diverse state such as India, the potential incompatibility of investment facilitation measures (such as national focal points and single-window clearance mechanisms) with its federal state structure has been a legitimate concern, particularly given how FDI projects inevitably require clearances from multiple levels of subnational political entities. Yet, Invest India virtually coordinates between federal and provincial state agencies, both horizontally and vertically. It therefore helps to diminish procedural inefficiencies caused by the "center vs. state" demarcation. By doing so, it attempts to fast-track all types of licenses, approvals and clearances for investors, without encroaching upon the constitutionally guaranteed functional autonomy of regional and local authorities. This not only shows the effectiveness, but also shows that the federal state implements investment facilitation at the domestic law level, let alone a unified centralized state.

4 HOW TO APPLICATION OF DATA SHARING MODEL OF INVESTMENT FACILITATION BASED ON MULTI-LEVEL BLOCKCHAIN

4.1 Industrial Data Sharing Platform

The industry data sharing platform is to set up a data sharing intermediary platform in a specific industry or field. For example, China's unified environmental assessment declaration and approval system has achieved national data sharing for fixed asset investment in China. It is conducive to the implementation of interconnection and centralized exchange at the national level, sharing EIA approval data with relevant local departments through the investment platform as needed, relying on the investment platform to reduce the burden of project units, the integrated management department of the investment platform supports data sharing, coordination and cooperation between departments. With the help of the data sharing platform, the ability of the company is significantly improved. On this basis, cross-border cooperation for scientific data sharing is realized.

There are already many practices for co-construction and sharing of scientific data according to different industries. Such as the Center for

Scientific and Industrial Research (CSIR) of India and the sharing of medical information in Kenya. Kenya Medical Research Institute (KEMRI) connects with each other and shares resources by compiling data and catalogs for research and use by Kenyan medical institutions. The earth system science data sharing platform in China is undertaken by the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences, the Institute of Resources and Environment of the Chinese Academy of Sciences, more than 40 well-known universities in the field of domestic geosciences, the World Data Center, International Mountain Center, and the University of Maryland and other international organizations and institutions participate in the construction and operation of this platform. With reference to the operating mode of these existing industry data intermediary platforms, it is feasible to apply data sharing to investment facilitation to a large extent.

In the application of investment facilitation, investment can be regarded as a generalized area, which can be specifically divided into energy industry investment, technology investment, infrastructure construction investment, and tertiary industry investment. The characteristics of different industries should be highlighted in the application of investment facilitation. For instance, in the energy industry, the focus of investment facilitation should be on the transparency and process of obtaining licenses and the social obligations undertaken by enterprises. In technology investment, the focus of investment facilitation should be on the security of the technology protection platform and the transparency of the scope of technology application. In infrastructure construction investment, the focus of investment facilitation should be on the degree of openness of relevant information in the host country, reducing corruption and promoting good communication between the home country and the host country.

4.2 Distributed Storage of Data in Investment Facilitation

In addition to considering the types of investment in different industries and fields, it is also necessary to determine an appropriate way of organizing data, that is, to implement the subject of investment facilitation data sharing. One is the collaborative construction and sharing model of international organizations. As the name suggests, the cooperative joint construction and sharing mode of international organizations refers to a sharing mode in which international

organizations jointly formulate related sharing strategies on a certain research direction or research subject under a certain agreement or treaty. The sharing strategy which includes the scope, method and related policies of sharing can promote the exchange and share of data in the same field. The cooperation methods of international organizations include international intergovernmental cooperation and international non-governmental cooperation. Either way, they must follow the purpose of sharing and be bound by a common agreement to promote the global sharing of data and improve technology of member states. The Organization for Economic Cooperation and Development (OECD) is an intergovernmental international economic organization composed of 30 market-economy international. It aims to jointly respond to the economic, social and government governance challenges brought about by globalization and grasp the opportunities brought by globalization.

In addition, there is a policy-driven co-construction and sharing model. This model refers to the promotion of the co-construction and sharing of scientific data under the compulsory drive of national laws, regulations and policies. The United States is the earliest experimenter of this model. The US Freedom of Information Act and the Copyright Act are the legal foundations of this model. US issued the "Global Change Research Data Management Policy" centered on the "full and open" scientific data sharing policy in 1991. Through this policy, the sharing of scientific data was promoted, thereby providing strong guarantees for scientific research in the United States, which ensures the realization of its strategic goals of national development and scientific and technological development in the 21st century (Yang, Chen, 2014).

4.3 Refined Management by Federated Learning

The professional and refined information data management platform unifies the data caliber and penetrates the investment business process. So the basic data of investment projects get rid of the discrete, isolated, incomplete, and unrelated state. Based on this, the foundation of investment management is consolidated. And the free interaction and sharing of information and data can meet the different needs of investment management and decision makers for rich investment data expression, and provide convenient support for micro-level investment decision makers.

In addition, it is necessary to carry out targeted management of different regions. This model limits those participating in the joint construction and sharing of scientific data within a certain geographic scope, which is similar to the coordination and sharing mode of international organizations, and the former is relatively in scope. Smaller ones, generally limited to a certain region or a certain country, collectively store shared resources in a specific location, and operate and build jointly under the joint management and co-funding of related units.

5 CONCLUSIONS

Through the investment data sharing model based on multi-level chains, multi-level storage on the chain and mixed storage of IPFS under the chain are adopted, which ensures the security of investment facilitation data and improves the scalability of blockchain. In the data sharing based on multilevel blockchain, the data of the host country of investment convenience is encrypted to prevent malicious attackers from stealing data. For the problem of data sharing among institutions, institutions can freely choose whether to participate in federal learning or not, and use local differential privacy technology to perturb and add model parameters before sending them. Bringing together stakeholders at all stages of the data production and use chain can greatly overcome information asymmetry in investment facilitation, as well as coordination among host countries, investors and other stakeholders, and at the same time meet the requirements of transparency, sustainable development and high efficiency in investment facilitation. In the future, in terms of specific applications, besides scientific research, legislation of host country and monitoring and evaluation system of investment facilitation, more suitable fields need to be developed. In addition, according to the characteristics of data itself, we should attach great importance to data security, and research in this area needs further strengthening.

ACKNOWLEDGMENTS

The author is most grateful to the Law School and the Silk Road Institute for International and Comparative Law of Xi'an Jiaotong University for their generous assistance. The research was funded by the projects of National Social Science Foundation of China Youth Project: Multilateral Reform and Chinese

Countermeasures of International Investment Arbitration under the Background of "One Belt and One Road" (18CFX084)

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