



Application and Challenges of Blockchain Technology to Big Data-Based Credit Reference in China

Cheng-yong Liu^{1(✉)} and Cheng Chen^{2(✉)}

¹ Beijing Institute of Technology, Zhuhai 519088, Guangdong, People's Republic of China

liucy13@126.com

² Taiwan University, Taipei, Taiwan, China

legalcici@126.com

Abstract. Big data-based credit reference gradually attracts wide attention due to its ad-vantages in remedying the shortages of traditional credit reference and dealing with new challenges arising from financial credit management. Nevertheless, this new method is also adapted through different studies and experiments to be problematic with island of credit information and information security. Some researchers begin exploring the possibility of applying blockchain technology to the individual credit reference field. The business links in the individual credit reference can be innovated through the blockchain mechanism so that credit data from different industries get collected through peering points, secure communication and anonymous protection on the basis of such techniques as distributed storage, point-to-point transmission, consensus mechanism and encryption algorithm. In this way, it is feasible to solve island of information and enhance the protection of user information security. A promising future can be expected about the big data-based credit reference, but there are also many problems with blockchain-based credit reference in China.

Keywords: Big data · Blockchain · Credit reference · Islands of information

1 Foreword

The operation of modern financial system can never be separated from the credit support. Big data-based credit reference gradually attracts wide attention due to its advantages in remedying the shortages of traditional credit reference and dealing with new challenges arising from financial credit management. Nevertheless, this new method is also adapted through different studies and experiments to be problematic with island of credit information and information security. Some researchers begin exploring the possibility of applying blockchain technology to the individual credit reference field. In this way, it is feasible to solve island of information and enhance the protection of user information security. A promising future can be expected about the big data-based credit reference, but there are also many problems with blockchain-based credit reference in China. Future research is required to find corresponding solutions and verify their feasibility.

2 Problems Concerning Big Data-Based Credit Reference in China

Big data-based credit reference means the employment of such new technical means as big data, deep algorithms (incl. cloud computing), mobile terminal, and artificial intelligence to re-design a credit rating model, both structural and non-structural data to analyze the credit information of enterprises and individuals [1], portrait of credit subjects from different dimensions to present their default rate and credit conditions so as to form credit evaluation of higher reference value [2]. As the big data-based credit reference is to collect, arrange, save, process and release the information about credit subjects in essence, it is still within the credit reference business scope defined in Credit reference Management Regulations of China. The development of big data-based credit reference still faces following outstanding challenges.

2.1 Islands of Credit Information

There isn't any information sharing mechanism among big data-based credit service agencies. What's more, the credit information between financial industry and non-financial industries are scattered around different agencies [3] so that a number of problems arises, such as difficult data integration and islands of information [4]. The possible causes include: firstly, the ownership of data in our country is not defined yet, and all the agencies involved view such data as their own core assets and are unwilling to share the data or providing distorted data, which result in the islands of information; secondly, out of consideration about privacy protection, all the agencies prefer securing the information under control to sharing them with others; thirdly, besides the mechanical and institutional reasons, data can't be securely shared among different agencies and industries due to the technical architecture of traditional credit service industry so that the problem about islands of information is not solved in the traditional credit reference work.

2.2 Infringement of Privacy and Consent Rights

During the information collection process, big data-based credit service agencies frequently infringe the privacy right, consent right and other rights and interests of the information subjects because of the asymmetrical information. Hereby the phenomena are explained as follows: In the first place, information collection against the big data background features elusiveness and block box processing. The information subjects can never know whether the collected personal sensitive data contains any information forbidden to be collected by relevant laws and regulations¹ and whether the collected information is true and accurate [5–7]. Secondly, even if the users give consent, it is hardly to acknowledge the scope of collection, intended use, and the time and place of

¹ It is specified in Article 2 and 14 of Credit service industry Management Regulations, personal information acquisition is limited to credit-related information, and the scopes of personal information that can and can't be collected by the credit service agencies are defined.

copying and transmission under present “package authorization” mode [8], and the consent right can’t fulfill the designed purpose. Thirdly, the credit report resulting from analysis by big data-based credit service agencies is in nature a kind of personal information, and its output and use should be based on the consent from information subjects². In China, some big data-based credit service agencies extend the credit evaluation results to all sorts of social living scenes without gaining the prior consent of information subjects.

3 Application of Blockchain to Big Data-Based Credit Reference in China

Now there are mainly two modes through which the blockchain technology is applied to the big data-based credit service industry in China [9–14].

3.1 Scenes of Application

Data exchange platform mode

In the data exchange platform mode, all the participants independently maintain the original databases and submit only some limited abstract information to third party data exchange platform for safekeeping through the blockchain technology. The inquirer can send inquiry application to the original data supplier through the platform so that a sea of external data is available for inquiry and the core business data are protected from being disclosed. For instance, GXB data exchange is a decentralized data transaction platform based on blockchain technology [15, 16]. Its representative clients include a number of industrial enterprises that have data exchange demand in such industries as internet, finance, government agencies, banking, insurance and securities. On the other hand, it takes the financial performance data produced by such clients as the major assets in data transaction in order to solve the data sharing and exchange problem among different industries.

Common construction and sharing data platform mode

As for the common construction and sharing data platform mode, the generation, recording and inquiry of credit are completely dependent on blockchain technology [12]. It creates decentralized credit inquiry, credit performance, and default records, and offers such data for all the credit reference users and consumption financial partners that use client credit records. In this platform mode, once such data and information as personal credit performance and default records are generated and distributed to all the

² It is specified that “when credit service agency or information supplier or user obtain the permission from information subject through contractual terms and conditions, prompt that can attract the attention of information subject shall be offered in the contract in combination with explicit explanation” in Article 19 of Credit Service Industry Management Regulations, and “information user shall use the personal information for the proposes agreed with the information subject instead of using it for any other purpose, or provide the information for a third party without gaining the permission from the information subject” in Article 20.

nodes of network, every credit behavior will become personal assets with definite ownership. The members can use and share the open and transparent user credit data that are protected from being falsified or denied. This is a relatively radical mode in the application of blockchain technology to credit. Chinese Cloud Prism credit system has devoted itself to the blockchain-based credit reference business of this mode since 2014 [17].

Analysis of two modes in terms of advantages and disadvantages

Though having a low construction cost, the data exchange platform mode has many demerits. More specifically, this mode focuses more on the combination of existing technologies with data in credit service industry, so it is easier in operation, low in cost, and more possible in achieving a success. Nevertheless, it still fails to solve following problems perplexing the present credit service industry, though it does use the blockchain technology: 1. difficulty in data acquisition; 2. authenticity of data; and 3. data monopoly.

The common sharing and construction data platform mode is hard in construction but advantageous in many aspects. However, since blockchain technology gets radially applied to the generation, recording and inquiry of credit in this mode, following credit application problems can be solved: 1. Difficult data acquisition; 2. Information monopoly.

3.2 Application Strengths

The combination of big data-based credit reference system with “blockchain technology” is helpful in solving such issues as islands of information and credit security.

Solve islands of information

The distributed storage of blockchain offers a physical foundation of information sharing which is exactly an effective means for solving the islands of information. We analyze first the data exchange platform with “alliance chain”. Some academicians believe it is impossible to avoid data abuse in the completely decentralized information sharing system, thus only the credit reference and sharing mechanism built on the basis of the incompletely decentralized “alliance chain” technology can implement the information sharing functions of credit reference system within a more secure scope [5]. Then, it sets to analyze the common construction and sharing data platform of “public chain” mode. In this mode, the information ownership belongs to individuals [6] so that platform architecture can connect the enterprises with public sections so as to carry out user data authorization, solve the issue about islands of information, and achieve common sharing, communication, construction and use of information resources.

Maintain information safety

The combined use of “blockchain technology” with “encryption algorithm” in the big data-based credit reference system may be able to alleviate the conflict between information sharing and information protection.

- (1) The “asymmetrical encryption function” of the blockchain is helpful in protecting the confidentiality of information and data, whereas its “distributed function” can

assure their completeness. In the first place, after personal information is input into the blockchain-based credit reference system, personal information will be deeply encrypted and protected with the asymmetrical encryption algorithm [18–21]. Then, the blockchain information network can hardly be attacked. Moreover, the blockchain exists in the whole network in a distributed way, which means every complete node in the platform is involved in the system maintenance and the information completeness won't be affected by an attack of single node by computer virus or any artificial mis-operation.

- (2) In the alliance chain-based credit reference system, not all the data are broadcast to the whole network, and not all of them are open and transparent. Except for the parties involved in data sharing and transaction, no other third party can obtain the data.
- (3) The common construction and sharing data platform of public chain appears to be relatively weak in information security protection. The transaction data are made visible to the whole network and traceable by the general public, when such data are maliciously explored or utilized, the legal information rights and interests of individual or agencies will be harmed. It is, thus, proper to take following measures to avoid the possible risks [11].

4 Challenges for the Development of Blockchain-Based Credit Reference in China

4.1 Contradiction Between Blockchain Technology and User's Right to Be Forgotten

The blockchain technology has the feature of permanent recording, which contradicts with the “right to be forgotten” in information protection in existing Chinese legislation system. To put it more specifically, in accordance with Article 16 in Credit reference Management Regulations of China, the personal credit records saved in the blockchain should be kept for only 5 years, and the adverse credit information that has been kept for over 5 years should be deleted. However, the credit reference system constructed with blockchain as the core technology is a network of data that can permanently record all the input information. This poses a great challenge to the execution of users' “right to be forgotten”.

4.2 Unsuitability of Traditional Credit Reference Regulation to Blockchain-Based Credit Reference

The present credit reference regulation system in China is mainly arranged with traditional credit service industry, demanding further improvement in both legislation and means. First of all, the present credit reference regulatory system remains weak and ineffective in spite of the existing hierarchic institutional system.

Secondly, the anonymity and decentralization of blockchain form certain challenge to the traditional regulatory mode and makes the latter even more difficult to adapt to the regulation demand against the new situation [22].

4.3 Damage on Information Subjects' Rights and Interests Caused by Missing of Private Key

Once the private key of user to blockchain-based credit reference system is lost, forgotten or disclosed, the user won't be able to get an access to the information stored in the block and the information ownership will be thus affected [23]. Let's take the blockchain-based credit reference system as an example, once the user loses the private key, he/she will have no right to authorize the credit service agencies to use his/her information. Even if he/she re-joins the blockchain, the credit service agencies still can't trace his/her previous credit data. This does affect the credit assets of the user and cause some loss of interest.

4.4 Non-compliance of Public Chain Architecture with Safety Protection Criteria

The blockchain-based credit reference architecture of public chain can't meet the information safety protection evaluation criteria for domestic credit reference information system [24]. More specifically, in accordance with Article 21 and 31 in Network Security Law of the country^a and Article 30 of Credit service agencies Management Regulations³, the state enforces hierarchical network safety protection system [24]. As the public chain system allows several nodes to lose effect or retreat from it in essence, and even indulges the existence of malicious nodes. This is believed by some to be possible to cause severe consequence to the blockchain-based credit reference system. Therefore, it fails to comply with the national classified protection of information security in terms of physical access control, cyber security guarantee, service performance, and system operation reliability [5].

5 Conclusion

The traceability of blockchain enables all related steps from data collection to transaction, circulation, computation and analysis to be kept in the blockchain and the data quality to become unprecedentedly trustable. The correctness of data analysis outcome and data mining effect are also better guaranteed. Now the blockchain technology has been applied to the big data-based credit service industry of China, including the data exchange platform mode and common construction and sharing data platform mode, in order to achieve data sharing and conquer the problem about islands of information. But when it comes to the practical employment and development, there are still many challenges in front of blockchain-based credit service industry in China. Active endeavors are needed in terms of technology and legislation in order to meet the future market demand.

³ In accordance with Article 30 of Credit Service Agencies Management Methods, "the credit service agencies shall assess the safety of the credit information system according to national classified information security protection criteria. The information systems of level 2 security protection shall be assessed once every two years while those of level 3 or above shall be assessed every year".

Acknowledgement. The paper is a periodical achievement of the 2018 school-supported scientific research program A Study on Liability Theories about Insider Trading of Financial Derivatives of Beijing Institute of Technology, Zhuhai (XK-2018-19).

References

1. Xinhai, L.: Dingwei: application of big data-based credit reference and the revelation—with American internet financial company zestfinance as an example. *Tsinghua Financ. Rev.* **10**, 98 (2014)
2. Mingsheng, S.: A study of big data credit reporting and the protection of personal information subjects' rights and interests. *Credit Ref.* **5**(220), 38–39 (2017)
3. Yongqian, T.: Wang Xiaotian. Improvement of legislation about individual credit information against big data background, *China internet* **5**, 43 (2017)
4. Qiang, W., Sude, Q., Jieru, B.: Discussion about application of blockchain to credit service industry. *Telecommun. Netw. Technol.* **6**, 38 (2017)
5. Guomao, S., Meng, L.: A study on application of blockchain technology to individual credit field—based on digital inclusive finance perspective. *Stud. Corp. Financ.* **1**(15), 121 (2017)
6. Tong, L., et al.: Hadoop-based visual deep web acquisition platform design. *Comput. Eng. Sci.* **2**, 217–233 (2016)
7. Liu, Y., Chenghuan, Z.: Scrapy-based deep web crawler study. *Eng. Res. Appl.* **7**, 112 (2017)
8. Harper, J.: Reputation under regulation: the fair credit reporting act at 40 and lessons for the internet privacy debate, cato institute policy analysis, No. 690. <https://ssrn.com/abstract=2033360> (2011). Last accessed 8 May 2018
9. Jie, H.: Application of blockchain technology and smart contract in intellectual property determination and transaction and corresponding laws and regulations. *Intel. Prop.* **2**, 14–15 (2018)
10. Hailong, W., et al.: Rights ascertainment plan for big data in blockchain. *Comput. Sci.* **2**, 16–17 (2018)
11. China blockchain technology and industrial development forum: china blockchain technology and application progress whitepaper, released at the website of Informatization and Software Service Industry Office, Ministry of Industry and Informatization (in October of 2016) <http://www.gongxiangxueshe.com/forum.php?mod=attachment&aid=NzkwfGJI0GNiNjZifDE0Nzc0NjcxMzJ8Mjg5OXw2OTc3> (2016). Last accessed 8 May 2018
12. Zhongbin, Z., Yansong, L.: Application practice of blockchain technology to credit service industry and future prospect. *Credit Ref.* **7**(222), 47 (2017)
13. Chunming, T., Long, G.: Multi-parties key agreement protocol in block chain. *Netinfo Secur.* **12**, 19 (2017)
14. Desheng, L., Jianping, G., Yibin, D.: A tentative discussion about the application of blockchain technology to book copyright protection. *Science-Technology & Publication*, vol. 6, p. 77 (2017)
15. GXB data exchange: GXB Dapp whitepaper, released by GXB website. http://static.gxb.io/files/GXS_Dapp_Whitepaper_V1.0.pdf (2016). Last accessed 8 May 2018
16. Yong, Z., Xiaohui, L.: Study on and achievement of an improved blockchain consensus mechanism. *Electron. Des. Eng.* **1**, 38–39 (2018)
17. Cloud prism credit: blockchain credit service released at. <http://www.yintongzhengxin.com/blockchain/index.html?ver=17.5.107>. Last accessed 8 May 2018

18. Linming, G., Shundong, L., Jiawei, D., Yimin, G., Daoshun, W.: Homomorphic encryption scheme and a protocol on secure computing a line by two private points. *J. Softw.* **12**, 3275 (2017)
19. Xian, Z., Yuzhao, J., Ying, Y.: A glimpse at blockchain: from the perspective of privacy. *J. Inf. Secur. Res.* **11**, 985 (2017)
20. Kang, L., Yi, S., Jun, Z., Jun, L., Jihua, Z., Zhongcheng, L.: Technical challenges in applying zero-knowledge proof to blockchain. *Big Data* **1**, 59–60 (2018)
21. Huaqun, W., Tao, W.: Cryptography on blockchain. *J. Nanjing Univ. Posts Telecommun. (Nat. Sci.)* **6**, 64–65(2017)
22. Ruijue, Z.: Legal supervision of blockchain technology. *J. Beijing Univ. Posts Telecommun. (Soc. Sci.)* **3**, 39–43 (2017)
23. Si, Z.: *The Technology Principle, Application and Suggestion of Block Chain, Software*, vol. 11, p. 52 (2016)
24. China National Standardization Management Committee: Information Security Technology–Baseline for Classified Protection of Information System Security (GB/T 22239-2008) (released in June of 2008). <http://www.gb688.cn/bzgk/gb/newGbInfo?hcno=D13C8CD02AFC374BC31048590EB75445>. Last accessed 8 May 2018