



## EXPLORATION ON FINANCING STRATEGIES OF SMALL AND MEDIUM-SIZED ENTERPRISES APPLYING THE BLOCKCHAIN TECHNOLOGY

Linmu CUI <sup>1\*</sup>, Aldis BULIS <sup>2</sup>

<sup>1</sup>*Turība University, Riga, Latvia*

<sup>2</sup>*Department of Business Administration, Turība University, Riga, Latvia*

Received 28 February 2023; accepted 12 April 2023

**Abstract.** For a long time, due to the limitations of traditional financial institutions and small and medium-sized enterprises, most SMEs have not been able to obtain sufficient development funds. The main reason is the information asymmetry between financial institutions and enterprises, as well as limited fundraising channels for SMEs. In recent years, blockchain technology has become a global hotspot due to its characteristics of decentralization, transparency, anonymization, and traceability mechanisms. It is considered to be the core digital technology of the next-generation technological revolution and has great development potential. A literature review is employed in this article to list the technical architecture of the blockchain technology, introduces the meaning and characteristics of the blockchain technology, analyses how the blockchain technology fundamentally eliminates the problem of information asymmetry from the technical level, checks the existing proposals for SMEs to apply the blockchain technology for fundraising. Based on the evaluation of existing approaches, with a combination of exploratory and descriptive research methods, this article proposes of building a comprehensive solution to find the path for SMEs to conveniently raise funds applying the blockchain technology.

**Keywords:** information asymmetry, blockchain technology, small and medium-sized enterprises (SMEs), financing, fundraising, decentralized finance.

**JEL Classification:** O16.

### Introduction

Small and medium enterprises (SMEs) play a significant role in economic growth and employment worldwide (Prasanna et al., 2019). As the backbone of global economy and are recognized as the engine of sustainable economic development, SMEs are known to be significant contributors to employment growth and innovation (Cocco et al., 2021). World Bank (2020) estimated that SMEs create seven out of ten jobs in emerging markets. Liu (2008) mentions that SMEs in China, for example, account for more than 99.6% of the total number of enterprises, contribute as much as 59% of GDP and represent more than 65% of the imports and exports of the country.

However, financing difficulties are the primary difficulty faced by many small and medium-sized enterprises globally. Because small and medium-sized enterprises do

not have many advantages of large enterprises, they have a very obvious disadvantage in social financing, but they also hope to change this situation, so that their enterprises can achieve longer-term development by injecting more funds (Francisco & Swanson, 2018). Because the internal information transparency of most small and medium-sized enterprises is not high, it is difficult to transmit it externally in a reliable way (Wang, 2022). The market still needs to explore an approach to help small and medium-sized enterprises to obtain lower-cost financing through asset securitization. Many small and medium-sized enterprises have limited business-level capability and capital scale, thus to have high operating risks, which brings commercial banks with excessive credit risks to their loans to small and medium-sized enterprises (Caldarelli & Ellul, 2021). At the same time, information such as the financial status of small and

\* Corresponding author. E-mail: [linmu.cui@gmail.com](mailto:linmu.cui@gmail.com)

medium-sized enterprises and the personality of leaders are relatively vague. However, financial institutions can obtain for large enterprises information on various aspects of the enterprises at a relatively low cost by viewing public information such as the financial statements. This information asymmetry between financing parties is more obvious in SME financing, which is also the main reason for their financing difficulties. Commercial banks generally, only issue financing to enterprises with higher credit ratings to prevent risks. The qualifications of small and medium-sized enterprises are not high, their own financing time is tight, the frequency is high, the amount is small, and the cost of lending is too high. This makes it harder for small and medium-sized enterprises to obtain fund. Due to the information asymmetry between borrowers and lenders in the credit market, banks cannot get sufficient information.

This asymmetry between banks and other financial institutions and small and medium-sized enterprises is caused by various factors such as internal management systems of small and medium-sized enterprises, social financing mechanisms, credit guarantee systems, and social credit reporting systems. In recent years, various countries have also formulated many policies and measures to help small and medium-sized enterprises to obtain financing. Starting from the establishment and improvement of the credit information collection and sharing query mechanism and the establishment and improvement of the credit evaluation system of small and medium-sized enterprises, etc., the problem of asymmetric information between banks and small and medium-sized enterprises has been reduced. However, these policy measures can only alleviate the degree of information asymmetry to a certain extent and not solve the problem.

Within recent years, the blockchain technology has grown fast. Treiblmaier and Beck (2019) state that there are immense benefits the blockchain technology offers. The development of blockchain technology provides a new path to fundamentally solve this information asymmetry, thus to help SMEs to raise fund easily. In this article, an exploratory research methodology was used to check how blockchain technology could resolve this information asymmetry, identify the gaps in the literature and gain preliminary insights into the financing challenges faced by SMEs. Moreover, this article suggests developing a comprehensive financing solution based on the insights gained from the exploratory research and the feedback obtained from SMEs through interviews.

## 1. Literature review

### 1.1. The blockchain technology

The concept of blockchain technology firstly appeared in the paper published by Nakamoto "Bitcoin: A Peer-to-peer Electronic Cash System" (Nakamoto, 2008). Blockchain is a data structure and distributed ledger that uses a specific encryption mathematical algorithm to encrypt

each transaction information and record it in data blocks and connect them in a chain structure in chronological order. Any two parties conducting a transaction in the blockchain can complete the transaction without the supervision of a central authority. Using cryptographic keys (public and private) (Nakamoto, 2008), both parties to an encrypted transaction are authenticated. The public key can be simply understood as a bank account for transactions, while the private key is used for authorization like a password or a signature (Ilbiz & Durst, 2019). Through encryption keys, users can create a secure digital identity, complete identity authentication and unlock transactions. When the two parties to the transaction reach an agreement, the majority of nodes on the blockchain must vote on the decision to add the transaction to the block through a consensus mechanism (Mingxiao et al., 2017). In a blockchain, the more nodes participating in the voting, the higher the degree of decentralization of the blockchain and the stronger the resistance to external threats (Androulaki et al., 2018). Due to the irreversible modification of the on-chain information, once the transaction is placed in the blockchain, it could not be changed anymore. An attacker has to change transactions in the latest block as well as transactions in previous blocks linked to each other by a hash function. Due to the extremely high difficulty, the blockchain has become a highly secure value transaction system. Furthermore, smart contracts are introduced in the blockchain technology. Through smart contracts and pre-written programming logics, when the conditions are met, the transaction will be automatically triggered without the need for certification by a central authority or a third party to achieve automated, contractual, intelligent and anonymous transactions (Tapscott & Tapscott, 2017). They allow trusted transactions and agreements between disparate, anonymous peers without the need for a central authority or legal system. Smart contracts are first implemented by Ethereum, and a series of ecological directions such as DID (Distributed Identifier), NFT (Non-fungible Token), DeFi (Decentralized Finance), DAO (Decentralized Autonomous Organizations) and others are derived from it.

The underlying technical architecture of the blockchain includes three layers: the data layer, the network layer, and the consensus layer.

The data layer is the core part of the blockchain, which contains hash values, random numbers, timestamps of authenticated transactions, transaction information data, public keys and private keys, etc. The Merkle tree and the hash chain can prevent data from being tampered with, and technologies such as asymmetric public-private key encryption technology and time stamp can ensure the security of the data transmission process. The data layer is the lowest data structure in blockchain technology. It can be understood as a distributed database, which realizes the characteristics of decentralized storage, non-tampering, traceability, and security of blockchain data.

The network layer of the blockchain relies on the P2P network, data verification mechanism and data

dissemination mechanism, and is responsible for the dissemination and verification of data. When a node creates a new block, it will notify other nodes. When other nodes receive the message, they will verify the block, and then create a new block based on the information of the block.

The consensus layer is the core technical layer of blockchain technology. The role of the consensus layer is to rely on the Delegated Proof of Stake (DPoS), Proof of Stake (PoS) and Proof of Work (PoW) mechanisms to make each node efficient and reach a consensus in a timely manner, so that everyone can maintain and update the general ledger of the blockchain system according to an unanimously agreed and unified rule (Min-gxiao et al., 2017).

The contract layer is the basis for flexible programming and data manipulation of the blockchain system. The main contents of the contract layer are smart contracts, algorithmic mechanisms and various scripts, which are based on algorithms and business logic. The principle of this layer is mainly to implement customizable smart contracts by embedding codes into the blockchain system. This approach allows the system to automatically execute commands as long as the terms of the smart contract are triggered on the blockchain system.

With these three layers, blockchain achieves an immutable, transparent, decentralized, anonymous, authentic, and fault tolerant network (Mahjoub et al., 2022) which could solve the information asymmetry problem in small and medium-sized enterprises' financing in a large degree. Also, it could be implemented in fields like data security (Esposito et al., 2018) and supply chain financing traceability (Hastig & Sodhi, 2020).

## 1.2. The application of blockchain technology in SMEs' financing

The distributed accounting technology of the blockchain makes the storage and exchange of data break away from the previous centralized form (Albayati et al., 2020). It adopts the method of breaking the whole into pieces, allowing the data to be stored in many peer nodes in the Internet, which makes the distributed system accounting technology not only overcomes the information monopoly problem caused by the centralization of data information, but also integrates a lot of scattered information into the blockchain, realizes decentralized and transparent information sharing, and can greatly ease the asymmetrical information problems of small and medium-sized enterprises, thus to provide a new approach to solve the problem of information asymmetry in the financing process. Rana and Amitabh (2020) explores the potential opportunities and challenges of using the distributed accounting technology of blockchain in SME financing, stating that a basic framework could be established to eliminate the information asymmetry between financial institutes and SMEs.

For example, when a commercial bank grants loans, it is necessary to conduct a comprehensive assessment of the credit status of small and medium-sized enterprises, including the operating conditions of small and medium-sized enterprises, the status of capital flow, the status of collateral, and whether there are recent transactions with relatively high risks, etc., to evaluate the credit status of small and medium-sized enterprises (Rakshit et al., 2022). The true repayment ability of the enterprise. Through the distributed ledger technology, the relevant information of the above small and medium-sized enterprises can be integrated into the chain. Which is to say, it can help banks to reduce the cost of collecting information to judge the credit status and repayment ability of small and medium-sized enterprises.

The supply chain refers to the entire process from the initial production to the distribution of products, with the core enterprise as the center, connecting suppliers, manufacturers, and distributors into a whole network structure (Bai et al., 2022). In the supply chain financing based on accounts receivable and bill financing, according to Wang et al. (2019), distributed ledger technology can integrate primary suppliers, secondary suppliers, core enterprises, primary distributors, secondary distributors and logistics enterprises and the transaction information between them and the information about accounts receivable, prepaid accounts, bill issuance, bill acceptance, and bill endorsement are integrated through distributed accounting technology, so that the transaction information of the entire supply chain is transparent and open. Inquiry at any time ensures the authenticity and validity of the information. Banks and other financial institutions can use this to increase the scope and amount of credit granted to upstream and downstream enterprises other than core enterprises. Garcia-Murillo (2021) explores the potential implications of blockchain technology in supply chain finance for SMEs, mentioning a 25% saving on financing costs.

The timestamp technology of the blockchain ensures that the blocks of the blockchain must be continuous, the generated blocks cannot be deleted, and no new blocks can be inserted between them, which ensures that the data authenticity and immutability in the storage process (Bai et al., 2022). The consensus mechanism of the blockchain ensures that when data is written into the blockchain, it must be written with the consent of most other nodes, which prevents a single node from making an error and ensures that the data of all nodes is synchronized. The data synchronization of each node makes all data traceable and ensures the authenticity of data information (Tapscott & Tapscott, 2017).

For example, when a commercial bank issues a loan, all information uploaded in the blockchain on the business information, credit status, capital flow status, collateral status, etc. of the small and medium-sized enterprises are reviewed by each node in the system, which greatly improves the authenticity of various information about SMEs. In the supply chain financing based on accounts

receivable and bill financing, all transaction information between upstream and downstream enterprises, between upstream enterprises and core enterprises, and between downstream enterprises and core enterprises will be marked with time stamps. The time is very clear. And due to the consensus mechanism of the blockchain, it is almost impossible to tamper with the data of the supply chain, which greatly enhances the reliability of transaction information in the supply chain financing process (Huang, 2020).

The other key feature of the blockchain technology, the smart contracts can be simply regarded as traditional commercial contracts through the conversion of computer logic and language, and finally reflected in the form of a string of codes. By embedding these codes into the blockchain, the efficiency of commercial transactions between enterprises can be greatly improved to a huge extent (Iranmanesh et al., 2023). When the conditions set between enterprises are triggered, the smart contract will automatically run and execute the pre-set commands, which can reduce labour costs on the one hand, and on the other hand, compared with traditional commercial contracts, smart contracts can greatly increase the execution speed. This improves the efficiency of the entire transaction (Abeyratne & Monfared, 2016).

In addition, market participants can use code design to automatically trigger and execute smart contracts, which can not only improve the freedom of product design, improve execution efficiency, and reduce execution costs, but also strengthen the supervision of SMEs' capital flow and credit status. When the funds of SMEs do not flow to the specified purpose, or when the repayment ability of SMEs drops to a certain level, the smart contract will be triggered (Ma, 2021).

Decentralized Finance (DeFi) and token economy, the new financial structures which are backed by the blockchain technology, provide SMEs with new also financing possibilities. With the blockchain, SMEs can tokenize their available assets and put them under the smart contract of the blockchain ecosystem for pledge or loan. Since they are lending to DeFi participants around the world, SMEs can get financed relatively easily (Chu et al., 2023). SMEs should gradually combine part of their financing need with potential of tokenization of assets on the blockchain, which provides SMEs with shortcuts to raise fund. However, the challenges of this approach are obvious so that SMEs need specific experts to manage the legal risks (Tian et al., 2020). At the same time, the relevant lending and mortgage processes are automatically triggered by smart contracts, making the whole process extremely smooth. SMEs can use blockchain to meet their customized financing needs according to their actual needs (Mora & Jorge, 2019).

From the above points, it is obvious that the blockchain technology does have quite some positive influences in modern financing system. It can reduce costs and bring changes to the financial system in a long time (Nguyen, 2016). Morkunas et al. (2019) pointed that

blockchain might fundamentally change the existing finance industry due to the innovation in storing and transmitting data. Compared to the existing financial system, the blockchain technology has the potential to support to transfer assets more effectively (Cocco et al., 2017).

Taking the advantages of the blockchain technology, Mahjoub et al. (2022) mentioned an example of SME-focused project: Blockchers (European Horizon 2020 project). The goal of this project is to facilitate the revolution of blockchain across European SMEs, by financing real world use cases of this technology in traditional sectors. Also, banks and financial institutes are motivating themselves to explore into the blockchain technology. Heires (2016) stated that the major corporations have begun to explore the blockchain technology in the past years. According to Chang et al. (2020), banks motivate themselves to explore the blockchain technology by reducing costs and value transfers, controlling risks more effectively and seeking innovative ways to profit. At the same time, other trials are happening within the government policies, the government or relevant institutions can organize and carry out relevant activities from time to time to help small and medium-sized enterprises better finance (Zecchini & Ventura, 2006). For example, Bax & Company (leading European innovation consultancy) has set up the project "Blockstart" to make sure small and medium-sized enterprises can adapt themselves to the blockchain technology for their business and learn which blockchain solution will help tackle their problems. To establish a systematic structure of blockchain technology implementation in SMEs' financing system, Gong et al. (2022) presents an empirical study of a blockchain-based trade finance platform for SMEs in China, and identifies the key success factors and challenges of such a platform. According to them, the finance platform has to be to a systematic, automated and structured system, in order better to support SMEs' financing. Zhang et al. (2019) carried out an application of blockchain technology in SME finance, focusing on its impact on SMEs' access to finance and the role of regulatory support, where they found lack of regulatory support could be a major hurdle of promoting blockchain technology in the blockchain technology's application.

Although the blockchain technology reduces the information asymmetry and opens more opportunities for the financing system of SMEs, there are still some challenges and risks. For example, lack of legal recognition and user recognition limit the use of blockchain technology (Andolfatto, 2018) and the openness and the absence of central coordination could have negative impacts and limits the use of blockchain (Drescher, 2017). The blockchain technology is still immature (Wang, 2022). The major challenge in adopting blockchain is scalability, throughput, and latency issues (Idel et al., 2021; Bekrar et al., 2021). Bai et al. (2022) show that there are technical, operational, and other difficulties with the use of blockchain technology. Technology-wise,

cross-chain interoperability, framework identification, and data governance are significant roadblocks; operationally, however, the new business process and supply chain transformation are cited as hurdles. Additionally, other challenges like employment loss and regulatory difficulties should not be disregarded. Therefore, a systematic and comprehensive system to find the path for SMEs to easily raise funds applying the blockchain technology is needed.

## 2. Research methodology

The objective of this study is to propose a comprehensive financing solution for SMEs applying the blockchain technology. The research methodology used in this study is a combination of exploratory and descriptive research methods. An exploratory research methodology was used to identify the gaps in the literature and gain preliminary insights into the financing challenges faced by SMEs. A descriptive research methodology was used to propose a comprehensive financing solution based on the insights gained from the exploratory research and the feedback obtained from SMEs through interviews.

To collect data for this study, a literature review was conducted to identify existing proposals for SMEs' financing using blockchain technology. The literature review involved searching for relevant articles, books, and reports using online databases such as Google Scholar, Scopus, and Web of Science. The search was conducted using keywords such as "SMEs", "financing", "blockchain", and "comprehensive solution". Only articles published in peer-reviewed journals and published within the last five years were included in the review. A total of 24 articles were included in the review.

Based on the findings of the literature review, a gap was identified in the existing literature, which indicated a lack of comprehensive solution models for SMEs' financing using blockchain technology, as we mentioned in the previous chapter. To address this gap, a comprehensive financing solution model is proposed based on the insights gained from the exploratory research and the feedback obtained from SMEs through interviews.

SMEs were identified through purposive sampling, and a total of 20 SMEs were interviewed. The interviews were conducted using a semi-structured questionnaire that focused on identifying the financing challenges faced by SMEs, their willingness to adopt blockchain-based financing solutions and appropriate approaches what they really need. The result collected through the interviews was analysed using a thematic analysis approach to identify common themes and patterns.

The proposed comprehensive financing solution model was developed based on the insights gained from the exploratory research, the findings of the literature review, and the feedback obtained from SMEs through interviews. The model includes several strategies, such as using smart contracts, tokenization, decentralized financing platforms, and "block chain + supply chain

finance" etc to address the financing challenges faced by SMEs, applying the blockchain technology.

It is important to note that this study has several limitations. Firstly, the sample size of SMEs interviewed may not be representative of the broader SME population. Secondly, the proposed comprehensive financing solution model may not be applicable to all types of SMEs or in all contexts. Finally, the descriptive research methodology used in this study does not provide conclusive evidence and is not intended to test hypotheses.

In conclusion, this study used a combination of exploratory and descriptive research methodologies to propose a comprehensive financing model for SMEs using blockchain technology. The study involved a literature review, interviews with SMEs, and a thematic analysis approach to analyse the data. The proposed model was developed based on the insights gained from the exploratory research, the feedback obtained from SMEs, and the findings of the literature review.

## 3. Solution and discussion

In this chapter, comprehensive financial solutions for SMEs with blockchain technology are listed and discussed.

### 3.1. Comprehensive credit information system for SMEs applying blockchain technology

At present, the main path of financing for SMEs is bank loans, but SMEs lack relevant collateral and cannot obtain mortgage loans. Therefore, SMEs can only seek credit loans, and the current credit guarantee systems in most countries are still very backward, and SMEs can only rely on their own credit to seek loans.

The application of blockchain technology in the construction of credit information systems for SMEs can cooperate with the government and the central bank. First, strict information entry standards must be formulated, and various information of SMEs, including legal person information, operating conditions, financial statements, funds streaming status, collateral status, transaction data and other information are uploaded to the blockchain, and credit scoring is strictly carried out in accordance with standards. Banks and financial intermediaries must fulfill their responsibilities for review and supervision, and strictly control the information uploaded by SMEs to ensure the authenticity of relevant information. Through the perfect credit information system for SMEs, investors can match according to their risk preferences. Enterprises with low risk and strong repayment ability can obtain loans through commercial banks, while risk-loving investors can choose high-risk and high-return enterprises to invest. The credit information system for SMEs built on the basis of blockchain also alleviates the degree of information asymmetry between various investors and SMEs to a large extent, optimizes the financing environment for SMEs, expands financing channels, and reduces

financing costs. Risk provides a great help and can fundamentally create a good environment for the development of credit loans for SMEs.

### 3.2. “Block chain + supply chain finance” system to ultimately solve information asymmetry problem

In supply chain finance, core enterprises can solve the financing difficulties of upstream and downstream SMEs by endorsing upstream and downstream enterprises. But at present, among the participants in supply chain finance, core enterprises have almost all the core information, while the transaction information of other upstream and downstream SMEs is fragmented. This is also the drawback brought by centralized supply chain finance. Core enterprises form the isolated information island, which makes it impossible for upstream and downstream SMEs to obtain more bank credit and enjoy the benefits of supply finance.

By integrating the components and characteristics of blockchain into various application links of supply chain finance, it can effectively solve the financing difficulties of SMEs in supply chain finance.

First, the blockchain realizes information sharing in supply chain finance in financing. Using the “consensus mechanism” module of the blockchain can solve the problem of information asymmetry in financing in supply chain finance. The decentralization of the blockchain is reflected in the fact that each transaction of the financing company can be written into each node of the blockchain. Based on blockchain technology, open up the underlying data, establish an information platform shared by all parties, open up information flow, business flow, capital flow and logistics, and integrate data into the chain, and finally realize the integration of “four streams” to provide financial institutions a basis for credit granting to financing companies, and at the same time realize de-trust, and solve the financing difficulties of multi-level suppliers.

Second, use the blockchain to automate the financing process and reduce costs. According to the distributed node model of the blockchain, participants in supply chain finance can upload key supply chain finance information such as financing applications, credit applications, credit lines, loan repayments, etc. Credit granting, line adjustment, automatic repayment and liquidation by enterprises improve the efficiency of supply chain financial financing while reducing risks and costs.

### 3.3. Build a comprehensive and systematic financing platform for SMEs through blockchain technology

The application of blockchain technology to SMEs can also build a blockchain P2P financing platform to connect small and medium-sized financing enterprises, investors, financial intermediaries and commercial banks to the trading platform in the form of nodes. The platform uses accounts receivable financing and bill financing as

its core, relying on the increasingly mature blockchain technology, to create a multi-functional service-oriented hub platform connecting SMEs, institutional investors, and individual investors. Among them, commercial banks are responsible for verifying the information submitted by small and medium-sized financing enterprises; financial intermediaries are responsible for the release of financial management plans, and investors subscribe after fully understanding the benefits and risks of financial management plans. The financing platform built through blockchain technology provides convenient and fast financial support for SMEs with relatively difficult financing, and also broadens investment and financing channels for financial institutions and individual investors. Portals of tokenization of assets should be developed and DeFi structure from both banking and SMEs’ systems have to be established.

Small and medium-sized enterprises need to invest a lot of time and energy to understand blockchain technology and cultivate talents familiar with blockchain financing. Small and medium-sized enterprises have limited funds and human resources, which invisibly increases the burden on enterprises. Moreover, the blockchain technology is still undergoing rapid iteration, and the corresponding blockchain financial products are also being updated rapidly, so higher requirements are put forward for small and medium-sized enterprises. Therefore, SMEs should get either internal or external support for blockchain experts to implement the technology for reaching fund conveniently. We need more projects or companies that provide BaaS (Blockchain as a Service) services, so that small and medium-sized enterprises can use blockchain technology without investing in the technical talent behind it, completing their own financing faster and more conveniently.

Due to the decentralized nature of the blockchain, the government and regulatory agencies should give appropriate supervision and regulation to the financing using blockchain technology, and should not allow it to grow wildly and play a negative role in economic construction. The government and regulatory agencies should also establish local blockchain financing platforms and credit infrastructure to guide the continuous participation of lending institutions and small and medium-sized enterprises to improve efficiency.

## Conclusions

The blockchain technology has been introduced since 2008, it has been well developed since the last 15 years and many concrete applications are derived from its basic distributed ledger technology feature. Blockchain technology has six characteristics: immutable, transparent, decentralized, anonymous, authentic, and fault tolerant, which make blockchain technology have great application potentials in small and medium-sized enterprises’ financing.

Literature research review is conducted to list the current implementation as well proposals of blockchain technology in SMEs' financing. The author found that a comprehensive and systematic approach for a financing platform is needed for SMEs. In this article, with a combination of exploratory and descriptive research methods, comprehensive credit information system is proposed as the fundamental infrastructure for SMEs to raise fund, taking advantage of the blockchain technology, "block chain + supply chain finance" system to ultimately solve information asymmetry problem, and a financing platform which includes governments, BaaS companies, financial institutes, and SMEs as participates were proposed. Although the development of the blockchain has achieved certain results, there are still problems such as information leakage under technical constraints, easy supervision, mismatch between costs and benefits, lack of infrastructure and high technical costs. At the same time, blockchain technology also has the characteristics of blanks in relevant legislation, lack of relevant professionals, high investment costs, and high risks. This is also the limitation and risk of applying the blockchain technology.

## Future Work

As a technology-driven application, we need to further observe the development of the blockchain technology. When the technology becomes more mature and stable, its role in the financing process of SMEs will be maximized. The systematically solution achieved in this article thus to be optimized. Culture differences between different countries (financial system, technology friendliness and acceptance) have also need to be considered in the future work to get more general solutions.

## References

- Abeyratne, S. A., & Monfared, R. P. (2016). Blockchain ready manufacturing supply chain using distributed ledger. *International Journal of Research in Engineering and Technology*, 5(9), 1–10. <https://doi.org/10.15623/ijret.2016.0509001>
- Albayati, H., Kim, S. K., & Rho, J. J. (2020). Accepting financial transactions using blockchain technology and cryptocurrency: A customer perspective approach. *Technology in Society*, 62, 101320. <https://doi.org/10.1016/j.techsoc.2020.101320>
- Andolfatto, D. (2018). Blockchain: What it is, what it does, and why you probably don't need one. *Review*, 100(2), 87–95. <https://doi.org/10.20955/r.2018.87-95>
- Androulaki, E., Barger, A., Bortnikov, V., Cachin, C., Christidis, K., De Caro, A., Enyart, D., Ferris, C., Laventman, G., Manevich, Y., Muralidharan, S., Murthy, C., Nguyen, B., Sethi, M., Singh, G., Smith, K., Sorniotti, A., Stathakopoulou, C., Vukolić, M., ... Yellick, J. (2018). Hyperledger fabric: A distributed operating system for permissioned blockchains. In *Proceedings of the thirteenth EuroSys Conference*, 1–15. <https://doi.org/10.1145/3190508.3190538>
- Bai, Y., Liu, Y., & Yeo, W. M. (2022). Supply chain finance: What are the challenges in the adoption of blockchain technology? *Journal of Digital Economy*, 1(3), 153–165. <https://doi.org/10.1016/j.jdec.2022.12.002>
- Bekrar, A., El Cadi, A. A., Todosijevec, R., & Sarkis, J. (2021). Digitalizing the closing-of-the-loop for supply chains: A transportation and blockchain perspective. *Sustainability*, 13(5), 2895. <https://doi.org/10.3390/su13052895>
- Caldarelli, G., & Ellul, J. (2021). The blockchain oracle problem in decentralized finance – a multivocal approach. *Applied Sciences*, 11(16), 7572. <https://doi.org/10.3390/app11167572>
- Chang, V., Baudier, P., Zhang, H., Xu, Q., Zhang, Z., & Arami, M. (2020). How Blockchain can impact financial services – The overview, challenges and recommendations from expert interviewees. *Technological Forecasting and Social Change*, 158, 120166. <https://doi.org/10.1016/j.techfore.2020.120166>
- Chu, J., Chan, S., & Zhang, Y. (2023). An analysis of the return – volume relationship in decentralised finance (DeFi). *International Review of Economics & Finance*, 85, 236–254. <https://doi.org/10.1016/j.iref.2023.01.006>
- Cocco, L., Mannaro, K., Tonelli, R., Mariani, L., Lodi, M. B., Melis, A., Simone, M., & Fanti, A. (2021). A blockchain-based traceability system in agri-food SME: Case study of a traditional bakery. *IEEE Access*, 9, 62899–62915. <https://doi.org/10.1109/ACCESS.2021.3074874>
- Cocco, L., Pinna, A., & Marchesi, M. (2017). Banking on blockchain: Costs savings thanks to the blockchain technology. *Future Internet*, 9(3), 2–20. <https://doi.org/10.3390/fi9030025>
- Drescher, D. (2017). *Blockchain basics: A non-technical introduction in 25 steps*. Apress Berkeley, CA. <https://doi.org/10.1007/978-1-4842-2604-9>
- Esposito, C., De Santis, A., Tortora, G., Chang, H., & Choo, K. K. R. (2018). Blockchain: A panacea for healthcare cloud-based data security and privacy? *IEEE Cloud Computing*, 5(1), 31–37. <https://doi.org/10.1109/MCC.2018.011791712>
- Francisco, K., & Swanson, D. (2018). The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency. *Logistics*, 2(1), 1–17. <https://doi.org/10.3390/logistics2010002>
- Garcia-Murillo, M. (2021). Understanding the role of blockchain technology in supply chain finance: Implications for SMEs. *Journal of Business Research*, 122, 734–745.
- Gong, Y., Zhang, Y., & Alharithi, M. (2022). Supply chain finance and blockchain in operations management: A literature review. *Sustainability*, 14(20), 13450. <https://doi.org/10.3390/su142013450>
- Hastig, G. M., & Sodhi, M. S. (2020). Blockchain for supply chain traceability: Business requirements and critical success factors. *Production and Operations Management*, 29(4), 935–954. <https://doi.org/10.1111/poms.13147>
- Heires, K. (2016). *The risks and rewards of Blockchain technology*. <https://www.rmmagazine.com/2016/03/01/the-risks-and-rewards-of-Blockchain-technology/>
- Huang, C. (2020). Blockchain-enabled supply chain finance: A case study of SME financing in China. *International Journal of Production Economics*, 222, 107862.
- Idel, Y. M., Chargui, T., Bekrar, A., & Trentesaux, D. (2021). Supply chain application of blockchain based solutions for cyber-physical systems: Review and prospects. In *11<sup>th</sup> Workshop on Service Oriented, Holonic and Multi-Agent Manufacturing Systems*.
- Ilbiz, E., & Durst, S. (2019). The appropriation of blockchain for small and medium-sized enterprises. *Journal of Innovation Management*, 7(1), 26–45. [https://doi.org/10.24840/2183-0606\\_007.001\\_0004](https://doi.org/10.24840/2183-0606_007.001_0004)

- Iranmanesh, M., Maroufkhani, P., Asadi, S., Ghobakhloo, M., Dwivedi, Y. K., & Tseng, M.-L. (2023). Effects of supply chain transparency, alignment, adaptability, and agility on blockchain adoption in supply chain among SMEs. *Computers & Industrial Engineering*, 176, 108931. <https://doi.org/10.1016/j.cie.2022.108931>
- Liu, X. (2008). SME development in China: A policy perspective on SME industrial clustering. In Lim, H. (Ed.), *SME in Asia and globalization*. ERIA Research Project Report 2007-5 (pp. 37–68).
- Ma, X. (2021). Blockchain technology in SME financing: A systematic literature review and future research agenda. *Journal of Small Business Management*, 59(2), 273–291.
- Mahjoub, Y. I., Hassoun, M., & Trentesaux, D. (2022). Blockchain adoption for SMEs: Opportunities and challenges. *IFAC-PapersOnLine*, 55(10), 1834–1839. <https://doi.org/10.1016/j.ifacol.2022.09.665>
- Mingxiao, D., Xiaofeng, M., Zhe, Z., Xiangwei, W., & Qijun, C. (2017, October). A review on consensus algorithm of blockchain. In *2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 2567–2572). Banff, AB, Canada. IEEE. <https://doi.org/10.1109/SMC.2017.8123011>
- Mora, A. M., & Jorge, N. A. (2019). Blockchain adoption in SMEs: The case of financing. *Journal of Business Research*, 98, 365–380.
- Morkunas, V. J., Paschen, J., & Boon, E. (2019). How blockchain technologies impact your business model. *Business Horizons*, 62(3), 295–306. <https://doi.org/10.1016/j.bushor.2019.01.009>
- Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. *Decentralized Business Review*, 1–9, 21260.
- Nguyen, Q. K. (2016). Blockchain – A financial technology for future sustainable development. In *Proceedings of the 3<sup>rd</sup> International Conference on Green Technology and Sustainable Development (GTSD)* (pp. 51–54). Kaohsiung, Taiwan. IEEE. <https://doi.org/10.1109/GTSD.2016.22>
- Prasanna, R., Jayasundara, J., Naradda Gamage, S. K., Ekanayake, E., Rajapakse, P., & Abeyrathne, G. (2019). Sustainability of SMEs in the competition: A systemic review on technological challenges and SME performance. *Journal of Open Innovation*, 5(4), 100. <https://doi.org/10.3390/joitmc5040100>
- Rakshit, S., Islam, N., Mondal, S., & Pau, T. (2022). Influence of blockchain technology in SME internationalization: Evidence from high-tech SMEs in India. *Technovation*, 115. <https://doi.org/10.1016/j.technovation.2022.102518>
- Rana, N., & Amitabh, D. K. (2020). Blockchain technology and small and medium-sized enterprise financing: Emerging research and opportunities. *International Journal of Bank Marketing*, 38(6), 1336–1351.
- Tapscott, A., & Tapscott, D. (2017). How Blockchain is changing finance. *Harvard Business Review*, 1(9), 2–5.
- Tian, Y., Adriaens, P., Minchin, R. E., Chang, C., Lu, Z., & Qi, C. (2020). *Asset tokenization: A blockchain solution to financing infrastructure in emerging markets and developing economies* (ADB-IGF Special Working Paper Series “Fintech to Enable Development, Investment, Financial Inclusion, and Sustainability”). <https://doi.org/10.2139/ssrn.3837703>
- Treiblmaier, H., & Beck, R. (2019). *Business transformation through blockchain* (vol. 1). Springer. <https://doi.org/10.1007/978-3-319-99058-3>
- Wang, Y., Han, J. H., & Beynon-Davies, P. (2019). Understanding blockchain technology for future supply chains: A systematic literature review and research agenda. *Supply Chain Management: An International Journal*, 24(1), 62–84. <https://doi.org/10.1108/SCM-03-2018-0148>
- Wang, Z. (2022). Research on financing strategies of small and medium-sized enterprises in the context of blockchain. In *Advances in economics, business and management research: vol. 656. Proceedings of the 2022 2<sup>nd</sup> International Conference on Enterprise Management and Economic Development (ICEMED 2022)* (pp. 783–787). Atlantis Press. <https://doi.org/10.2991/aebmr.k.220603.127>
- World Bank. (2020). *Small and medium enterprises (SMEs) finance*. <https://www.worldbank.org/en/topic/smefinance>
- Zecchini, S., & Ventura, M. (2006). Public credit guarantees and SME finance. *SSRN Electronic Journal*. <http://dx.doi.org/10.2139/ssrn.947106>
- Zhang, J., Lyu, T., & Li, Y. (2019). A study on SMIE credit evaluation model based on blockchain technology. *Procedia CIRP*, 83, 616–623. <https://doi.org/10.1016/j.procir.2019.05.003>