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**Article**

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REVIEW Open Access

# Analysis and outlook of applications of blockchain technology to equity crowdfunding in China

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**Abstract**

Equity crowdfunding via the Internet is a new channel of raising money for startups. It features low barriers to entry, low cost, and high speed, and thus encourages innovation. In recent years, equity crowdfunding in China has experienced some developments. However, some problems remain unsolved in practice. Blockchain is a decentralized and distributed ledger technology to ensure data security, transparency, and integrity. Because it cannot be tampered with or forged, the technology is deemed to have great potential in the finance industry. This study examines current problems in the practice of equity crowdfunding in China. Based on the analysis of the characteristics of blockchain technology, this study further explores its practical applications in equity crowdfunding. 1) Blockchain technology may be a secure, efficient, low-cost solution for the registration of stocks and shares of a firm financed by crowdfunding; 2) Blockchain technology simplifies the transaction and transfer of crowdfunding equities, and thus facilitates their circulation; 3) Blockchain technology enables peer to peer transactions between investors and entrepreneurs, and solves the problems of regulatory compliance and security of fund management; Blockchain technology can be used to develop a voting system for crowdfunders, which enables them to be involved in corporate governance. This helps protect the rights and interests of small investors; 5) Blockchain technology helps regulators know about market conditions, and supports regulatory activities such as managing investors and fighting money laundering.

**Keywords:** Blockchain, Equity crowdfunding, Equity registration and transaction, Voting of Shareholders, Regulation of equity crowdfunding

## Background

### Blockchain

#### *Definition*

Blockchain technology is a distributed ledger recording technology (Walport 2016). It can record transactions in a secure, transparent, decentralized, efficient, and low-cost way (Schatsky and Muraskin 2015). Blockchain technology originated with Bitcoin as a bottom-level technology (Nakamoto 2008). It was originally used to record historical transactions of encrypted digital money such as Bitcoin. As the research on digital money went deeper, the underlying blockchain technology was separated from Bitcoin

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and further developed as a technology related to existing technologies such as cryptography, network topology, and consensus algorithms. (Zhang 2016).

There are several types of blockchains – public blockchain, private blockchain and hybrid blockchain. Each type has its advantages and disadvantages, allowing them to meet needs of various applications (He et al. 2016, Buterin 2015).

**Key advantages** Blockchain technology is a disruptive technology with many advantages. First, the decentralized structure, which lacks a centralized database, enables the blockchain to operate with high efficiency and low cost. It is also resistant to outages of a centralized database. Second, the technology solves the double-payment problem. The public ledger is shared by users on the Internet. It ensures the security, transparency, and integrity of data, which cannot be tampered with or forged. It helps to protect the security and privacy of user data (Zyskind et al. 2015). Third, because blockchain is programmable, it can increase flexibility and reliability in various applications (Pilkington 2016). Currently the main drawback of using block chain technology is the high usage of power and computing resources by the distributed system (Swan 2015).

**Potential applications** With these features, blockchain technology may be applied in many areas. Swan presents three categories of potential applications (Swan 2015). The first is currency, including currency transfer, remittance, and E-payment systems. The second is smart contracts in financial markets. The third is other social applications beyond currency and financial markets, such as notary, voting, and healthcare applications (Swan 2015). Pilkington also discusses the application of blockchain in digital identification, voting systems, and financial applications (Pilkington 2016). Huckle discusses potential applications of blockchain technology in the shared economy (Huckle et al. 2016).

The central banks of many countries, including Britain and China, have issued reports or statements to promote the research on blockchain and its applications in financial industry (Walport 2016, Bloomberg View 2016). Nasdaq launched Linq in 2015 (Nasdaq 2015). Deloitte are using blockchain technology to improve its auditing service (Deloitte 2016).

### Equity crowdfunding

**Crowdfunding** Crowdfunding originated from the concept of crowdsourcing, where a firm gets ideas, feedbacks, and solutions from Internet users to solve the firm's business problems (Belleflamme et al. 2014). Crowdfunding is the practice of raising fund from a large number of Internet users (Heminway and Hoffman 2010). Schwienbacher defines crowdfunding as "an open call, essentially through the Internet, for the provision of financial resources either in the form of donation or in exchange for some form of reward and/or voting rights to support initiatives for specific purposes" (Schwienbacher and Larralde 2010). Mollick gives a specific definition that refers to the efforts by entrepreneurial individuals and groups to fund their ventures by drawing on relatively small contributions from a large number of individuals using the internet without standard financial intermediaries (Mollick 2014).

The participants of crowdfunding include crowdfunding platforms, fundraisers, and investors. The crowdfunding platform is an intermediary for crowdfunding. Fundraisers launch a project on the platform and set a target amount. Funders and investors of crowdfunding projects receive rewards after funding the projects. Thus crowdfunding enables value discovery and matching (Fan 2013).

It is difficult for small business or startups to obtain loans from banks, or investments from venture capitals. Crowdfunding helps small firms to raise funds from the Internet. It provides a new channel of financing with low cost, fast speed, and low entry barrier to firms, especially start-ups (Bradford 2012).

**Equity crowdfunding** Equity crowdfunding is a specific type of crowdfunding in which a fundraiser (normally a startup) launches a crowdfunding project with shares of the business as rewards. Investors and project supporters invest in the project in exchange for equity (Cui 2014). According to Ahlers, "entrepreneurs make an open call to sell a specified amount of equity or bond-like shares in a company on the internet, hoping to attract a large group of investors" (Ahlers et al. 2015). Compared with traditional fundraising methods, equity crowdfunding is more efficient with lower costs and barriers to entry, which is useful to start-ups (Zhang 2016). In 2012, the Jumpstart Our Business Startups Act (U.S. Congress 2012) legalized equity crowdfunding. Equity crowdfunding platforms such as Wefunder and AngelList experienced steady development. They supported the fund raising of many start-ups—for instance, ZENEFITS. To date, 132 start-ups have received USD$25 million from 76,000 investors via Wefunder (Wefunder 2016).

**Practice and regulation of equity crowdfunding in China** Due to differences in regulatory laws, economic conditions, and cultural norms, different countries face different equity crowdfunding problems in practice. This study focuses on the relevant issues of equity crowdfunding in China. The Chinese government has proposed "encouraging people to do business creatively and drive innovation", offered supports to crowdfunding and crowdsourcing, guided and encouraged crowdfunding platforms to develop their business in compliance with regulations, take pilot experiments on public and small amount crowdfunding, and enhance their risk control and standardized management (The State Council 2015). In recent years, crowdfunding platforms have been active in China. Among them, there are several popular and influential platforms in the area of equity crowdfunding, such as Da Jia Tou (dajiatou.com) and Angel Crunch (angelcrunch.com). To date, more than 70 equity crowdfunding websites in China have been collected by the crowdfunding navigation website zczj.com.

China's existing laws only allow the public offering of shares by listed companies. Other forms of public offering of shares or fund-raising are considered illegal. Hence, current equity crowdfunding operations impose certain restrictions on the qualification of investors, number of investors, and amount of investments. Crowdfunding is essentially carried out in the form of private offerings or semi-public offerings (Yang 2014).

In terms of regulation, to curb illegal fund-raising, regulate the market, and protect the interests of investors, the Securities Association of China (SAC) issued the

"Measures for Private Equity Crowdfunding (tentative) (draft)" (Securities Association of China SAC 2014), to better manage the equity crowdfunding market.

In the practice, a lack of protection on the rights and interests of investors is a bottleneck of equity crowdfunding in China. The problems including a lack of legal and regulatory framework for crowdfunding process, unclear rights and obligations of crowdfunding websites, a lack of investor qualification management, information asymmetry and an undeveloped credit rating system for general public and so on (Wang 2016, Liu 2014). There were several cases where some companies illegally transferred equities to small investors through Taobao and Weibo. But it turned out that what they did damaged the interests of investors (Hu 2014).

Based on the observations on the equity crowdfunding practice, many Chinese researchers proposed that the Chinese government should strengthen the regulation on crowdfunding websites, introduce investor qualification management, enforce information disclosure, protect the interests of investors, and lift regulatory restrictions on crowdfunding. All these will facilitate the development of crowdfunding market (Lou 2015, Dong et al. 2014, Wang 2016). Certainly, regulatory and technical support are needed to solve the problems mentioned above. We will discuss these issues hereafter.

## Applications of blockchain technology to equity crowdfunding in China

### Problems faced by china's equity crowdfunding

Equity crowdfunding has positive impacts in financing and supporting start-ups and encouraging innovation. However, the legal and practical aspects of some issues still need to be resolved and improved. This article focuses on issues in China's equity crowdfunding practice that can be resolved by using the blockchain technology.

#### *Registration of shares*

Equity crowdfunding can help a company successfully raise funds on the Internet, where the shareholders' numbers can be large; their interconnections can be loose; and their locations can be geographically separated. The shareholder structure of a crowdfunded company is very different from a traditional private firm, which has a small number of founders.

Instead, it is more like the shareholder structure of a listed company. However, the shares of a crowdfunded company are not recorded by a credible centralized registration system such as the China Securities Depository and Clearing Corporation Limited (CSDC), or traded on a trustworthy and reliable settlement system such as a public stock exchange system. Hence, the equity registration and management of shares of crowdfunded companies poses a challenge.

**Shareholder registration and confirmation** According to the "Companies Act" and "Company Registration Regulations," to be recognized as a qualified shareholder of a limited liability company, a shareholder needs to invest in the company and be recorded on the company's shareholder list, which is approved by the company registration authority and filed with the company registration documents.

Currently, shareholder registration is mainly carried out internally by shareholder list and externally by business registration. However, such registration is not equivalent to confirmation of share rights. It is a declaratory procedure, mainly providing prima facie

evidence against a third party (Hu and Zhu 2013). In addition, in recent years, the State Administration for Industry and Commerce (SAIC) has gradually weakened the management of company establishment and equity registration (AntBlockchain 2016). Compared with traditional private enterprises, the relationship among investors and the relationship between investors and crowdfunded firms are looser. This creates strong demand for credible and effective shareholder rights registration and confirmation.

**Registration cost management** The current registration of shareholders and relevant procedures generally rely on paper documents. Although paper documents cannot be easily altered, they require high administrative costs. Because crowdfunding shareholders are distributed over different regions, traditional commercial registration involves the signing and postal delivery of important documents. This procedure is complicated, and creates new problems, such as security concerns and high costs.

#### *Issues in equity transaction and transfer*

The difficulty in shareholder registration creates difficulty for equity transaction and transfer. The existing registration procedure complicates equity transaction and transfer, making it inconvenient for investors to trade equities and liquidate their investments, thereby hindering equity circulation. The lack of liquidity of equity is associated with high risk, which discourages investors from investing, and is detrimental to crowd fundraisers who want to successfully raise funds and obtain high valuations of their businesses (Lee and Wu 2003). If equity transaction and transfer become efficient, then investors can more easily transfer equities and liquidate their investments, the liquidity of equity increases, and market transactions are activated. This will have positive impacts on both investors and crowdfunders.

In practice, crowdfunding platforms often provide registration and transaction services. However, considering the low capability, credibility, and information security of these platforms, such services are not appropriate. The “draft” by SAC also explicitly prohibits crowdfunding platforms from providing services such as holding equity on behalf of investors and equity transfer. Thus, to facilitate transfer, transaction, and circulation, we need to introduce a third-party registration, settlement, and trading system with high credibility and cost efficiency.

#### *Management of funds raised from crowdfunding*

The main challenges of fund management in China’s domestic equity crowdfunding are security of money and compliance with regulations. Unlike peer to peer lending, where money deposits do not form a capital pool, the procedure of crowdfunding involves many investors, fundraisers, and crowdfunding platforms, where it is easy to form a capital pool. Hence, there is a risk that the crowdfunding platform could improperly use the deposit capital. From a legal perspective, the existence of a capital pool may not comply with regulations.

At present, some crowdfunding platforms such as Da Jia Tou (dajiatou.com) have announced that the raised funds are held by a third party that offers an escrow service. With good crowdfunding platforms mixing with bad crowdfunding platforms, a public statement from a crowdfunding platform is not sufficient for investors to discern whether the platform really controls the capital pool. Currently, we do not have

effective mechanisms to regulate and overview mismanagement and misuse of funds by crowdfunding platforms (Yang and Lunga 2014).

#### *Issues in protecting crowdfunding shareholder rights and interests*

One of the problems currently faced by equity crowdfunding is the lack of an effective way for investors to participate in corporate governance. Hence, it is easy for insiders to control a company at the cost of the interests of investors.

The small investors of a crowdfunding company may be geographically distributed in a wide region. Thus, it is not easy for them to directly overview managers. It may not be cost efficient and practical to frequently hold general shareholder meetings, resulting in a lack of effective means for small investors to participate in corporate governance. This may lead to conflicts of interest caused by insider control, which hurt the interests of investors (Yuan 2014). Therefore, effective corporate governance, as well as protection of investor rights and interests, help protect the value of investment and thus encourage investment (Porta et al. 2002).

Current crowdfunding companies need to establish a cost-efficient and credible voting system for investors to vote on critical business decisions. Such a system will ensure that shareholders have a say in important decisions, small investors can participate in corporate governance, large shareholders do not infringe upon the interests of small investors, and the interests of all investors are protected.

#### *Regulation of equity crowdfunding*

Current regulation issues faced by equity crowdfunding include the standard of qualified investors, quota of investment, regulation of crowdfunding platforms, regulation of illegal fund-raising, detection of fraudulent fund raising, and opposition to money laundering ("Draft") (Securities Association of China SAC 2014). To resolve these regulatory issues, regulators should have comprehensive and detailed information about the equity crowdfunding market, as well as a good understanding of the overall crowdfunding market.

### Practical applications of blockchain technology

Based on the characteristics of blockchain technology, this section theoretically analyses and explores the practical value of the blockchain technology to issues faced by equity crowdfunding in China. Blockchain has the following characteristics: a distributed ledger, decentralized data management, data security, transparency and integrity, anti-tampering and anti-forgery, high efficiency, low cost, and no risk of a centralized database failure. In addition, blockchain's programmable features increase flexibility and reliability in different application scenarios.

With regard to the registration and confirmation of shareholders of a crowdfunded company, paper documents such as shareholder lists are a kind of centralized information storage media. However, centralized data management does not resolve the problem of data security because the risks of data loss and data tampering remain. Blockchain technology-based shareholder lists can be used as a better alternative to traditional paper documents. Blockchain's features of decentralized data management, distributed ledger storage, anti-tampering, and anti-forgery ensure that it is more secure than traditional paper documents.

Regarding the cost of registration management, blockchain offers a digitized solution, which can reduce administrative management and human cost and eliminate the process of signing paper documents, delivering documents by post, certification of documents, and notarization. This allows crowdfunding shareholders located in different regions to securely register their rights at low cost. As long as they invest money in the crowdfunding company, their rights as shareholders can be automatically recognized via a smart contract supported by the blockchain technology.

As for difficulties in equity transaction and transfer, we need to introduce a credible, affordable, and efficient third-party system for equity transactions and settlements of these transactions. Some scholars have proposed regional equity trading centers to offer services such as equity registration, custody, and transfer to crowdfunding company shareholders (Liu 2016). However, establishing a centralized regional registration and settlement system introduces operational and intermediary costs. A centralized system also poses the risk of system failure. In addition, regional equity trading centers may not be established on a unified platform. The decentralized management of many regional trading centers may reduce equity liquidity and hinder circulation of equity.

Therefore, establishing a unified blockchain-based equity crowdfunding platform could be a better solution than many regional trading centers. Blockchain enables a distributed ledger; provides data security, transparency, and integrity; and offers anti-tampering and anti-forgery features. It helps a platform earn public trust and become a credible third-party institution. Blockchain also resolves the double payment issue, ensuring the uniqueness of equity transaction and transfer. At the same time, the digitization of equity eliminates paper documents, reduces labor costs, and improves the efficiency of equity transaction and transfer. To resolve the security of fund management and compliance issues, we may use blockchain technology to achieve point-to-point, direct money transfer between users. In a P2P lending model, money from investors' accounts can be directly transferred to a fundraiser's account without going through the platform. During the fund-raising process, fund-raising documents can be stored in blockchain. After the fund raising, investors are automatically registered as shareholders by blockchain. Investors receive proofs to show that they own equity in the crowdfunding company. Because money does not go through the platform, a capital pool will not arise. This solves the problem of security of funds and compliance with regulations. (Zhang 2016).

Due to the complexity of corporate governance in practice, blockchain cannot completely resolve the issues of corporate governance and protecting shareholder interests. However, from a technical perspective, blockchain's high credibility, programmable nature, and tamper-proof features make it a feasible solution for e-voting (Pilkington 2016). A crowdfunding equity management platform may introduce a blockchain based voting system for shareholders located in different regions. This would allow shareholders to participate in corporate governance with high efficiency and low cost.

In addition, establishing a blockchain-based equity crowdfunding platform would help regulators obtain comprehensive information about the crowdfunding market, enact policies consistent with market needs, and regulate the qualification of investors and the quota of investment. It would help regulators to oversee the behaviors of equity crowdfunding platforms and detect illegal and fraudulent fund raising. Blockchain's tamper-proof and traceability features would enable regulators to effectively track

personal identities and funds, making it a tool for anti-money laundering. The Antshares technology's white paper explains how an anti-money laundering system is embedded in its systems (Zhang 2016).

Based on the above analysis, we believe that, with the maturity and wide use of blockchain technology, a unified crowdfunding equity registration, transaction, and transfer platform can be established based on the blockchain technology.

### Cases of blockchain in equity management

#### *NASDAQ Linq: private equity market based on blockchain*

Nasdaq launched its blockchain platform, Nasdaq Linq, in 2015, and conducted experiments using blockchain technology for transactions of securities. The purpose of the experiments was to demonstrate that equity transactions can be digitally managed on a blockchain platform (Rizzo 2015). Linq is a private corporate equity management tool. Its system supports digitized confirmation of equity rights, significantly saving time and paper. Some start-up companies have tried Linq, and completed share registration and transactions (Nasdaq 2015). NASDAQ Global Software Development Director Zinder said that the use of blockchain technology was of great significance in improving private corporate equity distribution (Nasdaq 2016).

#### *Antshares technology: digital asset management platform based on blockchain*

According to the Antshares whitepaper, Antshares is based on blockchain technology; it digitizes physical assets and property rights, and uses a peer-to-peer (P2P) network to realize decentralized network protocols for financial services such as shareholder registration, issuance of stocks, equity transfer and transactions, and clearing and settlement of equity transactions. The services can be used in equity crowdfunding, P2P lending, digital asset management, and smart contracts (Zhang 2016).

To explore the practical applications of blockchain, Antshares carried out trials on compliance with regulations. Antshares users can carry out real-name authentication via CA certified institutions authorized by the Chinese government. The blockchain-based equity registration can be digitally signed by companies certified by the Chinese government. It legitimizes the relevant activities. User authentication and anti-money laundering protocols are embedded in the Antshares APIs. Third-party payment, banking, and other financial institutions may use Antshares protocols to achieve compliance (Zhang 2016).

Of course, the current application of blockchain in digital asset management is still in the exploratory stage. There are still many legal and technical issues to be resolved.

## Results

Based on the literature review, analysis of features of blockchain and cases of blockchain applications, we believe that blockchain technology has high value and good prospects in resolving the problems of equity crowdfunding and optimizing its process.

First, crowdfunding shareholders are scattered over wide regions, making it more important to complete and verify shareholder registration. The traditional shareholder registration process is not effective. Blockchain technology offers a more secure, efficient, and low-cost solution to accomplish equity rights registration and simplify the complex registration process.

Second, transactions in crowdfunding equity and ownership transfer are complex at the operational level. An equity management platform based on blockchain technology, however, may provide secure electronic transactions, significantly simplifying the process of equity transaction and transfer. This will facilitate equity circulation and activate the crowdfunding market.

Third, there are security and compliance issues in crowdfunded money management. With blockchain, point-to-point transactions and direct transactions between users can be achieved; funds can be moved directly from investors' accounts to fund-raisers' accounts without going through crowdfunding platforms. This helps address financial security and compliance issues.

Fourth, crowdfunding shareholders face difficulties in voting and the protection of their rights and interests. Blockchain technology can help establish a highly credible online voting system, providing a channel for scattered shareholders to participate in corporate governance.

Fifth, regulator supervision of equity ownership can be enhanced by using a unified blockchain ownership management platform. Regulators can obtain comprehensive and specific market information, thereby improving the effectiveness of the regulation of investors, fund raisers, and crowdfunding platforms.

## Conclusion and discussion

From a theoretical perspective, blockchain technology is a solution that achieves efficient and low-cost equity registration, equity transaction and transfer, and shareholder voting in the crowdfunding industry, eliminating legal risks related to fund management. It can also help regulators supervise and understand the crowdfunding market. Thus, blockchain applications have good prospects in the field of equity crowdfunding.

At present, the blockchain application in equity management is still in the exploratory stage; there are many legal and technical issues to be resolved. There is still a need for blockchain enterprises and market managers to actively cooperate with each other, implement blockchain applications, and introduce innovative solutions. They need to deepen their understanding of blockchain technology, its value, its opportunities, and its risks. They should actively promote blockchain applications in the Chinese crowdfunding market and other digital asset management markets. Economic efficiency and social benefits can be achieved through technical innovation and applications.

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**Authors' contributions**

ZZZ provided the framework and ideas of this research to HZ. ZZZ also revised the draft provided by HZ and translated all texts from Chinese to English. HZ did literature review, wrote a draft of this paper. Both authors read and approved the final manuscript.

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**Competing interests**

The authors understand the Journal Policy of Financial Innovation on declaration of interests and declare that they have no competing interests.

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