

# Analysis of Research Hot Topics on Blockchain Applications in the Engineering Field Based on Text Mining

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## ABSTRACT

*Blockchain technology is widely used in the field of engineering. To explore the research hot topics of blockchain technology applied in the engineering field, based on the relevant literature on the application of blockchain technology in the engineering field in the China National Knowledge Infrastructure (CNKI) database, the literature keywords were collected as analysis data sources. Python software was used to draw keyword frequency and word cloud maps, and the research topics and hot topics of blockchain technology applied in the engineering field were analyzed. Research has found that the smart contract function in blockchain technology is most widely used in the engineering field, mainly in scenarios such as energy, building information modeling (BIM), transactions, and auditing. In addition, the combination of blockchain technology with technologies such as the Internet and artificial intelligence is also a research hot topic in the field of engineering. To better apply blockchain technology to the engineering field, this article also proposes some implementation strategies.*

**Keywords:** Blockchain; Text mining; Engineering field; Research hot topics

## 1. INTRODUCTION

As an emerging technology in the 21st century, blockchain technology has the characteristics of decentralization, tamper-proof, openness and transparency, smart contract, etc. It can solve the problems of trust and consensus, and has gradually

become a key technology for decentralized transactions and automated execution in finance [1], medical care [2], sports [3], agriculture [4], law [5] and other fields. Based on the successful application of blockchain technology in the above fields, its application in the engineering field will also bring new development and opportunities. At present, researchers introduce blockchain technology to solve existing problems in the engineering field. Meisong et al. [6] believe that the use of blockchain technology to store a large number of data generated during the implementation of engineering construction projects can solve the problem of malicious tampering in the project implementation process with the time stamp of the data. Yuan Yuchao [7] uses the smart contract function of blockchain technology to audit the identity of suppliers to solve problems such as suppliers' non-compliance with requirements and bidding corruption.

However, researchers only use blockchain technology to solve problems in the engineering field, and there are no researchers to summarize and analyze these problems. Although it can help solve some problems in the engineering field, only proposing solutions to the problems is too scattered, and it is impossible to understand the classification of research topics applied to the engineering field of blockchain technology. It is not conducive to the subsequent development of blockchain technology in the field of engineering. Therefore, this paper takes CNKI as the literature collection database, uses the collected literature related to the application

of blockchain technology in the field of engineering as the data source, uses Python software to conduct text mining on the keyword data of the literature collection, obtains the keyword word frequency and word cloud map, and analyzes the research hot topics or research topics of blockchain technology in the field of engineering. The research conclusion has certain guiding significance for future researchers to better understand the research trends of blockchain technology applied in the engineering field.

## 2. Overview of Blockchain Technology

### 2.1 Blockchain Definition

In 2008, the digital currency known as "Bitcoin" was proposed in the founding paper "Bitcoin: A peer-to-peer electronic cash System" published by a research scholar named "Satoshi Nakamoto". The release of the Bitcoin white paper marks the emergence of its underlying core technology--the blockchain technology [8]. Blockchain is divided into narrow blockchain and generalized blockchain. The former refers to the chain data structure formed by a certain combination of data blocks according to the sequence of time, and uses cryptography and other related technologies to ensure data security; The latter refers to a new distributed infrastructure and computing paradigm that uses block chain data structure to verify and store data, uses consensus algorithm to generate and update data, uses cryptography technology to ensure data transmission and sharing security, and uses smart contract technology to program and process data [9-10]. From the perspective of the advantages of blockchain technology, Xiao Ting et al. [11] explained that smart contract is a new "digital contract" that is different from traditional contracts. In the smart contracts, if both parties to the transaction meet the other party's digital code requirements, the contract is automatically fulfilled and until the performance is completed; Guo Yuan et al. [12] discussed that smart contracts are an important part of blockchain. It is a computer protocol and mainly used for the dissemination, verification, or execution of contracts; Zhang Xiaosong et al. [13] concluded that smart contracts allow distrust users to complete data exchange or transactions without requiring any third-party trusted institutions. It is the most valuable application field of blockchain technology. From the perspective of blockchain-solving problems, Yang Yinghao et al. [14] analyzed the reasons for the slow

development of informatization in the engineering and construction industry and the application model and the overall architecture of the construction industry information system combined with the blockchain technology are proposed. It is concluded that blockchain technology has profound significance for improving the pain points of the construction industry and promoting the digital transformation of the industry; Liu Jiaju et al. [15] analyzed the current situation and disadvantages of construction project bidding and explore the application scheme of the blockchain electronic bidding platform. They put forward a new type of "blockchain + electronic bidding" scheme idea; Wang Zhenjiang [16] elaborated the technical advantages of blockchain technology in the field of bidding, then we constructed the bidding system architecture diagram based on blockchain technology and the practical analysis of the application of blockchain technology in the field of bidding.

### 2.2 The Importance of Blockchain

Blockchain technology has the characteristics of decentralization, smart contract, tamper-proof, encryption timestamp and so on. These characteristics applied in the engineering field will be able to solve many problems, and can use these characteristics to subvert the completion methods and patterns of certain tasks or processes in the field. In the field of engineering, the completion of an engineering project includes many stages or links, and involves many participants. Through the encryption timestamp feature of blockchain, the data generated by tasks or processes in each stage or link will not be tampered with, so as to solve the problem of trust and consensus among participants. At the same time, the feature of blockchain smart contract can also automate the completion of contract transactions and reduce the corresponding costs.

## 3. Research Design

### 3.1 Research Methods

Text mining is a hot word on the Internet recently. Text mining is the process of extracting potential and important patterns or knowledge that users are interested in from unstructured text information. It can be regarded as an extension of data mining or knowledge discovery in databases [17]. The mining of text information is mainly based on mathematical statistics and computational linguistics, which enables the computer to discover the laws of the

appearance of certain words and the relations between words and semantics and grammar. Text mining involves many disciplines, such as information retrieval, text analysis, information extraction, etc., and has been widely used by researchers at home and abroad. Based on a quantitative analysis framework, Li Munan et al. [18] collected patents related to smart cities around the world, and used topic modeling and text mining methods to identify and discuss potential hot topics. Compared with market research, questionnaire survey, expert interview and other methods, text mining can find the keywords with the highest word frequency more conveniently and quickly, and obtain the corresponding research hot topics or research topics, saving time, manpower, material resources, financial costs and other costs.

### 3.2 Data Collection

CNKI, as the world's largest continuously updated full-text database of Chinese academic journals, has a large number of literatures in the fields of natural science, engineering technology, agriculture, philosophy, medicine, humanities and social sciences, etc. Its literature types are relatively comprehensive, literature quality is relatively good, and data collection is also relatively convenient, with strong representativeness and authority. In this paper, CNKI is used as the literature collection database, and Octopus software is used to collect the relevant literature on the application of blockchain technology in the field of engineering. First of all, the search field selected "topic" search, "blockchain" AND "engineering" as the key topic search terms, to obtain 752 relevant literatures.

### 3.3 Data Processing

All relevant literature collected includes academic journal papers, dissertations, conferences, newspapers, books, achievements, featured journals, etc. Direct data analysis will lead to poor text mining effect. Therefore, it is necessary to eliminate the categories of literature data collected to ensure the best text mining effect. After preprocessing, 308 academic dissertations, 9 conferences, 46 newspapers, 2 books, 3 achievements, 11 featured journals and other categories were eliminated, and 373 academic journal papers were finally obtained.

Octopus software is used to collect the literature keyword content of the collected literature data, part of the original data is shown in Table 1. The collected table data is converted into text data. The

JieBa library and Python software are used to draw the keyword word frequency of the literature. Due to the large data, the first 24 partial data are selected and converted into a table form, as shown in Table 2. Then, according to the obtained keyword word frequency data, Word Cloud in Python is used to visualize the keyword data and draw the star-shaped word cloud map. As shown in Fig. 1, the word cloud map can visually display the feature words with high frequency in the keyword data text of the literature in the engineering field applied by blockchain technology. And it can more intuitively and clearly highlight the research topic or hot topics of the application of blockchain technology to the engineering field, in which the keyword with higher word frequency has a larger font size. The above results are analyzed and summarized, and the classification of research topics applied to the engineering field of blockchain technology is mined.

**Table 1. Part of the original keyword data**

Title	Keywords
Construction and application of supply chain	Supply chain finance; construction
finance platform -- taking CITIC Digital	Enterprises; blockchain; financing
Intelligence as an example	constraints
Research on evolutionary game of engineering	Blockchain; dynamic and static reward and
information sharing strategy based on blockchain	punishment mechanism; information sharing;
under dynamic and static government reward and	evolutionary game
punishment mechanism	
Blockchain privacy traceable storage scheme for	Privacy protection; blockchain;
power dispatch instructions	Traceability; group signature; power dispatch
Research on the application of new technology in	Project engineering; cost control; new
project cost control	Technology; BIM technology; blockchain technology
The application of supply chain finance in enterprises	Supply chain finance; enterprise; application practice; application strategy



also produce other problems accordingly. Combining it with other technologies and applying it to the engineering field is also a major research hot topics.

## **5. The Implementation Measures of the Application of Blockchain Technology in the Engineering Field**

According to the above result analysis, the application of blockchain technology in the engineering field has been widely concerned by researchers, and the blockchain technology is widely applied in BIM, audit and other scenarios, which promotes the automation of bidding contract management in the engineering field. Thus, it will reduce the cost generation. However, due to the development of blockchain technology is not mature, only the single use of this technology cannot completely solve the problems in the engineering field, and it can be combined with new technologies such as artificial intelligence to give full play to the cross-integration advantages of many new technologies. At the same time, due to the late emergence of blockchain technology, some people do not have a very detailed understanding of its specific content, and their willingness to apply blockchain technology is not active. At present, there is no relatively perfect application policy which reduces the willingness of some people. Therefore, the measures, such as in-depth researching on the application of the integration of blockchain technology and advanced technology, improving the enthusiasm of personnel to use blockchain technology, formulating the application policy of blockchain technology, should be taken to promote the application of blockchain technology in the engineering field.

### **5.1 Study Deeply the Application of the Integration of Blockchain Technology and Advanced Technology**

Blockchain technology has many technical advantages, such as decentralization, smart contract, timestamp, etc., which can help the engineering field to automate contract management and trace the information generated at different stages. Although blockchain technology can record all the information generated during the process, it cannot organize and use the information and maximize the value of the information. Therefore, strengthening in-depth research on blockchain technology itself

and integrating the blockchain technology with other advanced technologies will maximize the advantages of technology utilization. Combining blockchain technology with advanced technologies such as AI [19], big data [20] and cloud computing [21] to build a more stable blockchain system platform may promote the more comprehensive and fair realization of projects, tasks and activities in the engineering field. For example, the combination of blockchain technology and AI can help the smart contract to check errors or bugs in editing programs, which is conducive to the more accurate realization of smart contract, and the combination of blockchain technology, big data and cloud computing can sort out the information on the chain, which can help to extract useful information to complete projects, tasks and activities, and realize the maximum utilization of information value.

### **5.2 Improve the Enthusiasm of People to Use Blockchain Technology**

Blockchain technology has only developed for 16 years since its concept was proposed firstly in 2008. It is still in the development stage and far from perfect. On the other hand, practitioners in various industries do not have a deep understanding of blockchain technology. So, some personnel do not have a strong willingness to use this technology, for they believe that using a technology without sufficient understanding it may lead to worse results.

To improve the enthusiasm of employees to use blockchain technology, under the guidance of the Unified Theory of Acceptance and Use of Technology (UTAUT), the following specific measures can be taken. Firstly, governments can guide researchers and practitioners to pay attention to blockchain technology, deepen their understanding of the technology, and enhance their enthusiasm for using it by issuing relevant policy documents. Secondly, enterprises and institutions can issue relevant regulations, requiring internal technical personnel to conduct in-depth learning on emerging technologies and understand the current use of advanced technologies in the field. Finally, enterprises and institutions can also promote internal personnel's learning of new technologies by establishing reward mechanisms, such as providing certain material and economic rewards to personnel who have mastered new technologies.

### 5.3 Formulate Policies for the Application of Blockchain Technology

At present, there is no clear and targeted national and government policy guidance and support for the application of blockchain technology in China. The support policies for blockchain technology are only included in some policy documents that encourage the use of advanced technologies. In response to the lack of policies for the application of blockchain technology, we can consider from the perspective of the country and government how to guide and support the application of blockchain technology in the engineering field by issuing relevant policies.

With the release and implementation of policies, it will inevitably stimulate the enthusiasm of researchers, technicians, and enterprises, and promote the widespread application of blockchain technology in the field of engineering.

### 6. Conclusion and Prospect

Exploring the research topics of applying blockchain technology to the engineering field has great practical significance for the widespread application of blockchain technology in the engineering and other fields in the future. In this article, based on the relevant literature on the application of blockchain technology in the engineering field in the China National Knowledge Infrastructure database, the literature keywords were collected as analysis data sources. By using the Python software, the keywords frequency was calculated, and the word cloud maps was drawn. Then the research topics and hot topics of blockchain technology applied in the engineering field were analyzed. Research has found that the smart contract function in blockchain technology is most widely used in the engineering field, mainly in scenarios such as energy, building information modeling, transactions, and auditing. In addition, the combination of blockchain technology with technologies such as the Internet and artificial intelligence is also a research hot topic in the field of engineering. These research conclusions have certain reference value for studying how to apply blockchain technology to the engineering field. And the proposed implementation strategies can promote the application of blockchain technology in the engineering field to some extent.

Due to the fact that the relevant literature data collected in this article only comes from the China

National Knowledge Infrastructure database and is all Chinese literature, the analysis of the research topics and hotspots of blockchain technology applied in the engineering field is not comprehensive enough. In future research, we will combine data from Chinese and English literature to expand data coverage and more accurately explore the research topics and hotspots of blockchain technology applied in the engineering field.

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