

# Implementation of blockchain technology in digital financial management systems

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## ABSTRACT

This research aims to develop and test a digital financial management system model that is integrated with blockchain technology to address security, transparency, and efficiency issues in the traditional digital financial system. Blockchain technology is used to ensure the integrity and security of data by recording each transaction in the form of interlinked and immutable blocks. The methods used include experimental approaches, quantitative analysis, and model validation. The results of the study show that blockchain integration improves the transparency, security, and operational efficiency of digital financial management systems. Although the designed asset recording application still has weaknesses in UX and UI, such as the lack of drop-down features and manual data entry, blockchain technology has successfully strengthened data security with the use of unique record IDs (hashes) that cannot be changed and public transparency through Etherscan. This research makes a practical contribution to the application of blockchain technology in the financial industry and suggests further development to improve the user experience and add features that improve the efficiency and flexibility of the asset recording system. These findings support the potential of blockchain in advancing the integrity and performance of the digital financial system.

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## 1. INTRODUCTION

Data security is a major challenge in digital financial management systems. Blockchain technology is emerging as an innovative solution that offers better security and transparency compared to traditional systems. Blockchain is a decentralized database technology that allows every transaction to be recorded in the form of interlinked and immutable blocks. This ensures high data integrity and security. Traditional digital financial management systems often face challenges related to data security, transparency, and operational efficiency. The threat of unauthorized access, fraudulent activity, and high transaction fees are the main issues that need to be addressed. These issues have a direct impact on user trust and the operational efficiency of the financial system. Unauthorized access and fraudulent activity can result in significant financial losses, while high transaction costs and slow transaction processing can hinder operational growth and efficiency.

This research was conducted to develop and test a digital financial system model that is integrated with blockchain technology. The goal is to address the security, transparency, and efficiency issues that exist in the traditional digital financial system. This research focuses on

solving the problem of unauthorized access, fraudulent activities, and improving transaction efficiency in digital financial management systems. It is important to discuss the application of blockchain technology in the digital financial system because of its potential to strengthen security, increase transparency, and reduce operational costs. Thus, blockchain can improve user trust and operational efficiency. This problem is overcome by developing a digital financial system model that is integrated with blockchain technology. The model is tested through a combination of experimental methods, quantitative analysis, and model validation to measure the impact of this technology empirically. This research was conducted to fill a gap in the literature regarding the application of blockchain in digital financial management systems. This research also aims to provide practical solutions that can be implemented in the financial industry.

Previous research developed a blockchain-based financial management platform that is integrated with the supply chain to improve financing efficiency and capital flow for small and medium-sized companies. The methods include system requirements analysis, MVC architecture design, functional module implementation, and system testing. The results show that the platform improves the automation of fund flows, process monitoring, and automated settlement, is capable of handling up to 300 users simultaneously, and provides fast and efficient financing services (Liu et al., 2023; Zhang, 2023).

Further research aims to design and develop a blockchain-based financial management platform to improve the efficiency and security of financial transactions in supply chain financing. The methods used include system needs analysis, multi-user platform design, and implementation of key modules such as registration, account opening, voucher management, online financing, and fund management. The results show that this platform improves financing efficiency, capital flow, and transaction security, as well as supports the daily financial management of enterprises, improving their competitiveness and economic benefits (Cheng & Olechowski, 2024; Yang et al., 2023).

The next research aims to design and develop a blockchain-based financial management platform that integrates with supply chain financing to improve transaction efficiency and security. The methods used include system requirements analysis, MVC architecture design, implementation of key modules, and system testing. The results of the study show that this platform improves financing efficiency, capital flow, and transaction security, thereby supporting the daily financial management of companies and improving their competitiveness and economic benefits (Said, 2023; Singh et al., 2023).

The next research aims to design and develop a blockchain-based financial management platform that is integrated with the supply chain to improve the efficiency and security of financial transactions. The object is a platform that supports a company's financial operations in the supply chain. The methods include system requirements analysis, architectural design, implementation of functional modules, and system testing. The results show that the platform improves financing efficiency, capital flow, and transaction security, provides significant support for companies' daily financial management, and improves their competitiveness and economic benefits (Pargaonkar, 2023; Safiullin et al., 2023).

The latest research explores the relationship between Sustainability Management Control System (SMCS), green innovation, Supply Chain Management (SCM), and digital adaptability to sustainable financial performance in organizations in Indonesia. The quantitative method was used by collecting data through questionnaires from participants in Banten Province. Data analysis uses statistical techniques such as regression and structural equation models (SEM). The results show that the integration of SMCS, green innovation, SCM, and digital adaptability significantly affect sustainable financial performance, providing important insights for the development of sustainability strategies in Indonesia (Dharmayanti et al., 2023; Yuan & Fang, 2023).

Traditional digital financial management systems face a variety of challenges in security, transparency, and operational efficiency. Unauthorized access, fraudulent activity, and high transaction fees hinder growth and operational efficiency, as well as lower user trust. Blockchain technology offers innovative solutions with advantages in terms of security and transparency. Although several studies have developed blockchain-based financial management platforms, few researchers have focused on the application of this technology in addressing the challenges of unauthorized access, fraudulent activity, and transaction efficiency empirically. Research related to

the integration of blockchain in digital financial management systems to improve security, transparency, and efficiency is still limited. Therefore, this study intends to develop and test a digital financial system model integrated with blockchain technology to address the security, transparency, and efficiency issues that exist in traditional digital financial systems. The purpose of this research is to design and implement a digital financial management system that utilizes blockchain technology to ensure the security, transparency, and integrity of financial data.

This research differs from previous studies by developing a model of a digital financial management system that integrates blockchain technology to improve security, transparency, and operational efficiency. This research method involves experimental testing and quantitative analysis to assess the impact of blockchain on data security, transaction transparency, and operational efficiency compared to traditional technologies such as centralized systems and standard encryption. The main challenges of traditional digital financial management systems are data security that is vulnerable to cyber attacks, a lack of transparency that hinders audits, and low operational efficiency due to complicated manual processes and bureaucracy. Blockchain addresses this challenge with a decentralized structure that enhances security, records transactions that are transparent and immutable, as well as process automation that reduces transaction costs and time. This research shows that blockchain offers an effective and superior solution to traditional methods in digital financial management.

## 2. RESEARCH METHOD

The quantitative approach used in this study combines experimental methods, quantitative analysis, and model validation. First, an experimental approach will be used to observe the effects of blockchain applications in a controlled environment. Furthermore, quantity analysis will be applied to the data collected to assess the impact of the technology. Finally, model validation will be carried out to ensure that the research findings can be generalized into a broader context.

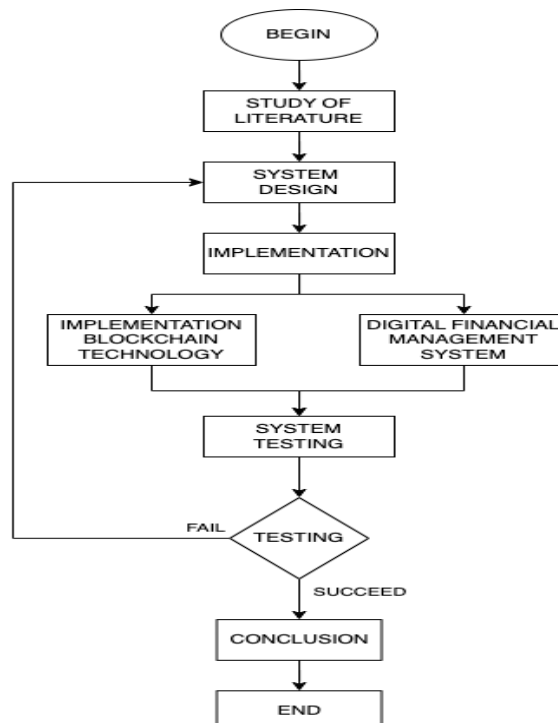


Figure 1. Research methodology

Based on Figure 1, it is shown that the research begins with the search and analysis of relevant literary studies to build a strong knowledge base. After that, a system design concept was developed to determine each element that will be used in the application of blockchain technology to a digital financial management system, followed by the creation of visual images depicting the

structure and workflow of the system to be developed. The next stage involves the preparation of all the necessary tools, materials, and information before entering into two main processes: the implementation of blockchain technology and the development of a digital financial management system as planned. After implementation, a trial of the system is carried out followed by a decision-making stage; If the trial fails, the process returns to the design conceptualization stage, while if successful, the conclusion is drawn as the final stage before completing the research.

### Research Design

This study uses a quantitative approach that combines experimental methods, quantitative analysis, and model validation. The design of this study is designed to provide a comprehensive and empirical analysis of the impact of the application of blockchain technology in digital financial management systems. An experimental approach was used to observe the effects of blockchain applications in a controlled environment, quantitative analysis was applied to assess the impact of the technology, and model validation was carried out to ensure that the research findings could be generalized (Arunmozhi et al., 2022; Jamil et al., 2022).

### Algorithm Configuration

Algorithm configuration involves setting the technical parameters of the blockchain to maximize the performance of the system. The algorithms used in this study are Cipher and Proof of Work (PoW) (Lasla et al., 2022; Malakhov et al., 2021). Ciphers are used to ensure data integrity by generating a unique hash for each transaction, while PoW is used as a consensus mechanism to validate transactions and add new blocks to the blockchain (Ge et al., 2021; Kaur et al., 2021). The algorithm configuration includes the block size which determines the amount of data that can be accommodated in a single block, the block creation interval that sets the time it takes to generate a new block, and the Proof of Work (PoW) consensus algorithm used to ensure that the addition of new blocks requires significant computational effort (Bamakan et al., 2020; Ferdous et al., 2021).

### Algorithm Implementation

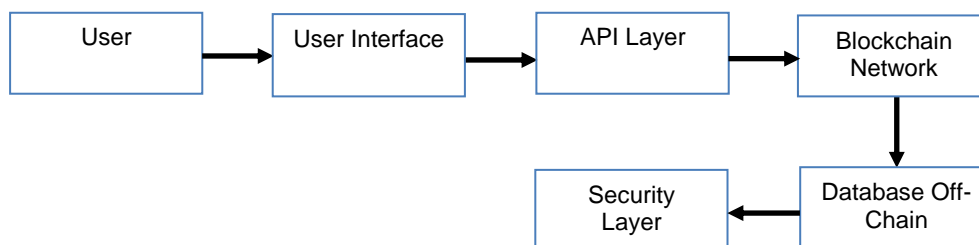


Figure 2. Algorithm implementation

Figure 2. The diagram illustrates the architecture of a blockchain-based digital financial management system. The User accesses the system through a user interface which can be a browser or a mobile application. This user interface includes a dashboard and transaction features. Next, the user interface interacts with the API layer, which is responsible for connecting the user interface with the blockchain network. Blockchain networks manage and verify transactions stored on the blockchain. In addition, there is an Off-Chain Database that is used to store transaction data and blocks that do not need to be stored directly on the blockchain, thereby increasing the efficiency of data access and query. All communications and data exchanged through this API layer are encrypted and secured by a security layer, which ensures user authentication and data integrity.

### Model Evaluation

Algorithm configuration involves setting the technical parameters of the blockchain to maximize the performance of the system. The evaluation of the model was conducted through a series of tests that measured the effectiveness of the system in terms of transaction speed, security, and transparency (Feng et al., 2022; Garg et al., 2021). Evaluation metrics include system response time, transaction success rate, and fraud detection capabilities (Baesens et al., 2021;

Seera et al., 2024; Van Belle et al., 2023a). The proposed research methodology is designed to provide a comprehensive framework for developing, testing, and evaluating blockchain-based digital financial management systems (Balasubramanian et al., 2021; Büyüközkan et al., 2021; Van Belle et al., 2023b). Through this quantitative approach, this research aims to provide empirical evidence on the effectiveness of blockchain in improving the security and efficiency of digital financial transactions, as well as practical contributions to the application of this technology in the financial industry.

### 3. RESULTS AND DISCUSSIONS

The implementation of blockchain technology in digital financial management systems (DFMS) shows significant improvements in several key aspects, including transparency, security, and efficiency.

#### System Design

The first system design has a user or admin display which is shown in figure 3.



Figure 3. Admin login view

In figure 3. The page displayed is the login interface for the Django administration system, which serves as an authentication gateway for administrators of Django-based applications. This interface consists of a few main elements. First, there is a heading "Django administration" which indicates that this page is specifically for Django application management. Second, there are two input fields labeled "Username" and "Password," respectively, that must be filled in with the correct authentication credentials. The "Username" field is used to enter the username, while the "Password" field is used to enter the password. Once the credentials are entered, the user can click on the "Log in" button to send the data to the server. If the credentials are valid, users will gain access to the administration dashboard, which allows them to manage the content and configuration of the app. The design of this page aims to ensure that only authorized users can access the administration features, thus maintaining the security and integrity of the system.

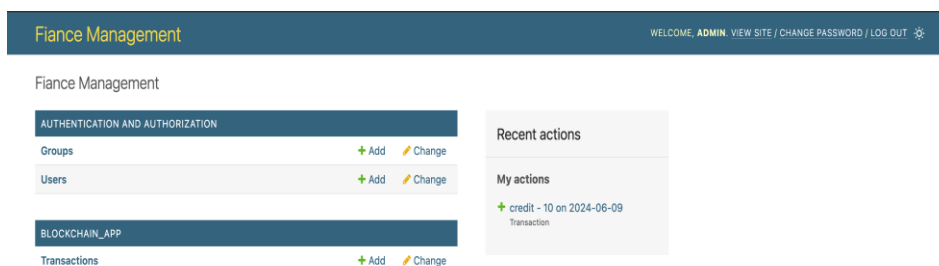


Figure 4. Dashboard view

In figure 4. Describe what the admin dashboard looks like after logging in.

#### Algorithm Implementation

The user page is shown in figure 5.

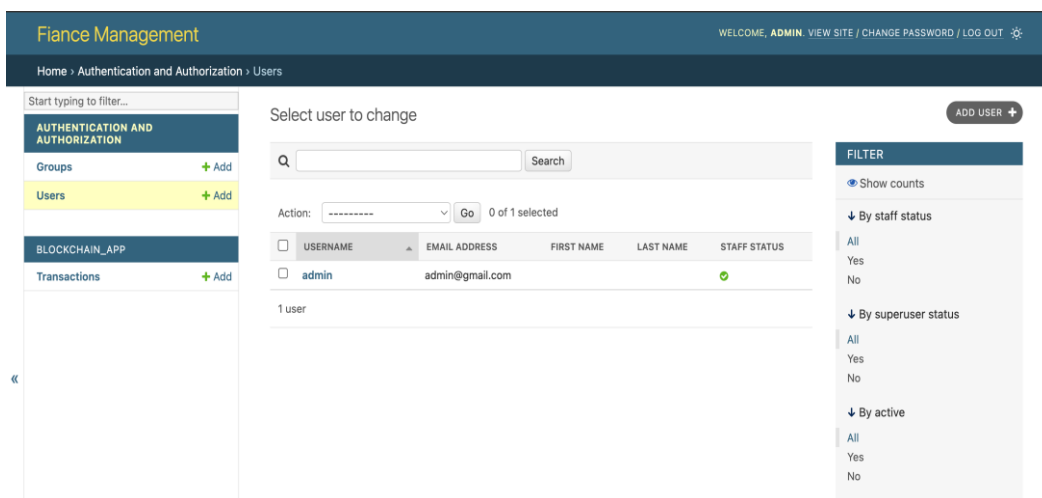


Figure 5. User view

In Figure 5. Display the user view where the display is to make every user who can only see the purchase transaction display.

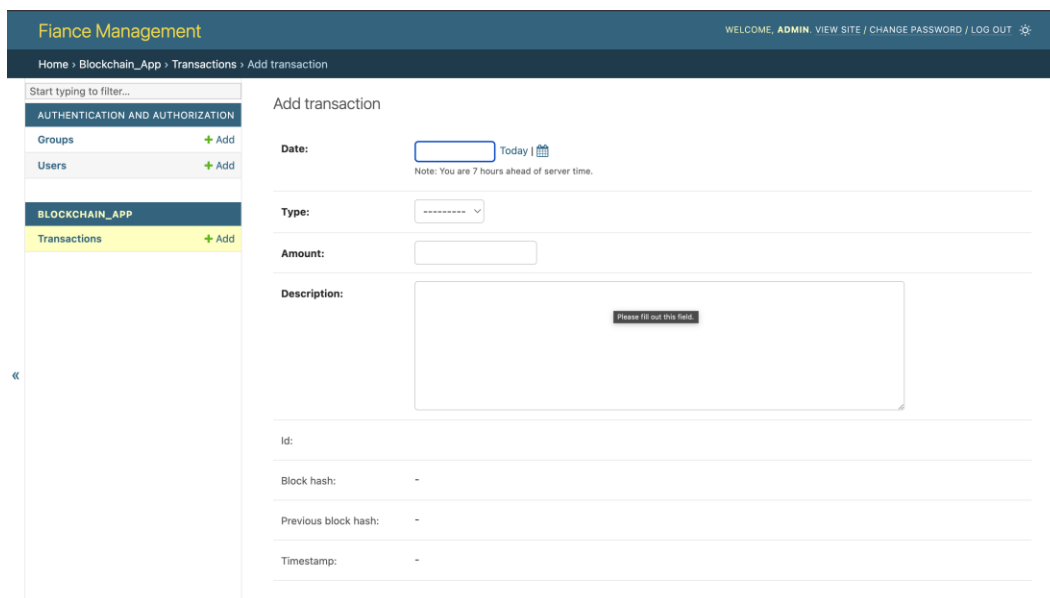


Figure 6. Transaction user interface

In Figure 6. Displaying User Interface When entering the latest transaction, this page can only be accessed by admins. The display of the Layer Fire after the transaction is shown in figure 7.

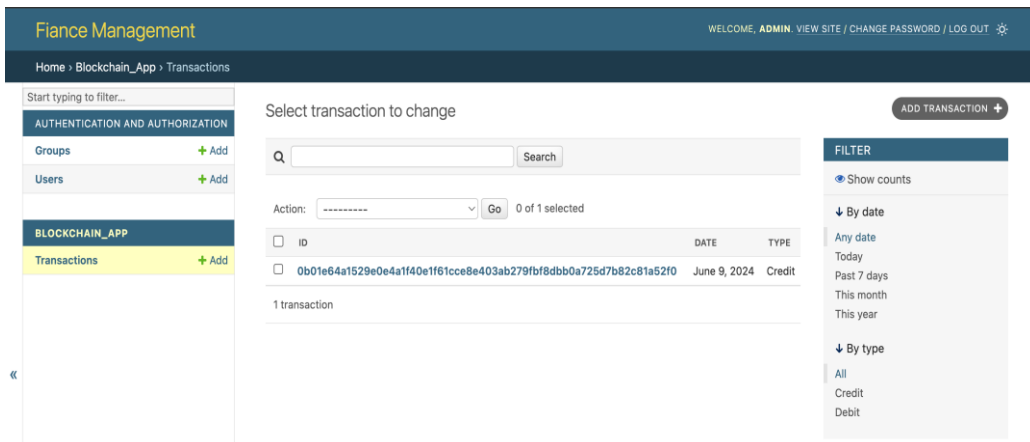


Figure 7. Blockchain results view

In Figure 7. Displaying User Interface When entering the latest transaction, this page can only be accessed by admins. Off-Chain Database display in figure 8.

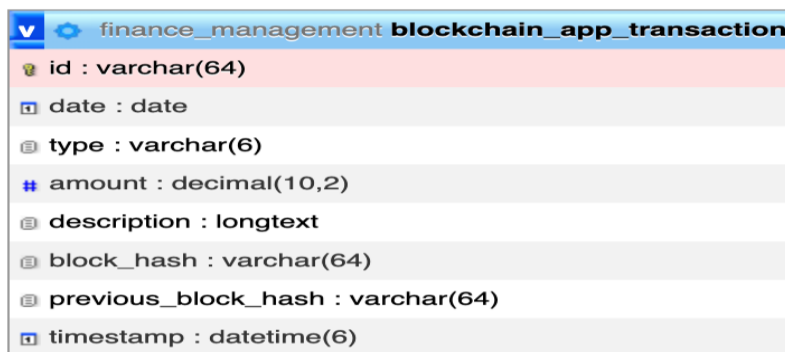


Figure 8. Database off-chain

In Figure 8. Displaying the Off-Chain Database, this page can only be accessed by admins. The post-transaction API layer view is shown in figure 9.

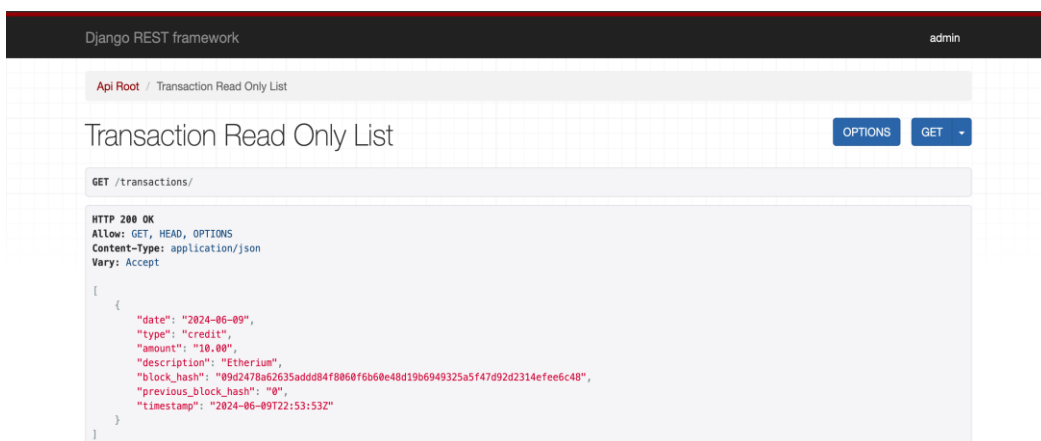


Figure 9. Transaction list

In Figure 9. API Layer that can be accessed by the public with transparency and security so that data cannot be changed or deleted.

**Testing**

Digital Financial Management Systems with blockchain technology provide a better level of data security compared to centralized data recording technology. Asset listing with blockchain technology strengthens data security because data on the blockchain is not easily manipulated. Each data contained in the system is protected by a unique Record ID (hash), which is traceable on Etherscan and cannot be changed. The application developed on this public blockchain network provides the advantage of data transparency of every element in the system, although under certain conditions it is not possible to share access control. However, the designed asset recording application is still not perfect, especially in terms of UX and UI. For example, the app does not yet have a drop-down feature, making it difficult for users to group data according to existing code categories, which causes data categories (code numbers) to have to be entered manually. In addition, the data types are limited and there is no correlation of data from column to column in a single table, so the calculation of values and depreciation rates is still done manually. On the other hand, if there is an error in creating the database tables and Triggers, they cannot be edited after they are created, so in the event of an inconsistency, both the database tables and their triggers will have to be redesigned.

### Discussion

The results are in line with the current literature, which emphasizes the role of blockchain in improving the security and efficiency of the digital financial system through inherent features such as immortality and decentralized verification. The observed increase is significant amid rising cybersecurity threats in the financial sector and confirms the potential of this technology in streamlining the transaction process.

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## 4. CONCLUSION

This research has made a significant contribution to the field of digital financial management by integrating blockchain technology. Research results show that blockchain improves security, transparency, and operational efficiency compared to traditional systems. Although there are challenges in the design and implementation of applications, this technology offers innovative solutions to problems of unauthorized access, fraudulent activity, and high transaction costs. In addition, the research identifies areas for further development, including optimization of application features and implementation strategies specific to diverse contexts.

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