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Blockchain Tech System: Optimization of the Use and Audit of Village Funds

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ABSTRACT

The central government has moved to provide capital support in the form of village funds to every administrative area in Indonesia. According to ICW (2022), the entire budget allotted for village funding in 2022 will be IDR 68 trillion. According to Indonesia Corruption Watch (ICW) monitoring data from 2015 to 2022, there were 155 instances of village fund corruption, which caused state losses totaling IDR 381,947,508,605 (ICW, 2022). Village monies were deposited in regional accounts as a result of issues with village fund realization reports. By ensuring that village funds have a reporting system that adheres to the value for money standards, village funds will be spent as efficiently as possible. Qualitative descriptive writing is the style used. The blockchain that is being used has a transaction database as well as superior features like smart contracts and full information sharing between peers and outside, which can make it simpler for auditors to examine village money. In addition, this technology provides superior data distribution and security capabilities. Budget realization reports are made immediately by an accounting information system using data from a transaction database. The ideal usage and management of local funds are encouraged by this technology, it is hoped.

Keywords: Blockchain, Capital Support, Central Government, ICW, Village Funds

INTRODUCTION

In accordance with UU No. 6 of 2014 regarding villages, the government started allocating funds from the national budget for villages. As part of its mission to raise the standard of living for the village's residents, the village fund program promotes equality. The administration of village government, implementation of village development, development of village communities, and empowerment of village communities are all areas in which the village government has authority, as stated in Article 18 of the Village Law.

Thus, enhancing public services in villages, empowering village communities, and most significantly, enabling villages to be the focus of development are the metrics that should be attained. 10 To guarantee that individuals have access to top-notch public services, village communities are being developed and empowered. to raise people's quality of life. The great village budget allocation is believed to be able to enhance people's lives. According to current information, 74,961 villages scattered throughout 434 districts and cities will receive IDR 68 trillion in village grants in 2022. 11 Despite a 4 trillion IDR decline from the previous year, this notional amount is still more than adequate. due to the fact that each village typically receives a budget of about IDR 900 million.

The substantial village budget distribution undoubtedly presents a significant challenge for combating corruption, particularly in the areas of accountability and transparency. The budget money in each village will be susceptible to corruption if the village head and local officials do not understand effective budget management (Purba et al., 2022). The central government requires a suitable method for distributing Village Funds, using an information technology system as a strategic means to make it easier to record or calculate Village Fund distribution(Arham & Hatu, 2020). This is because achieving the government's goals contained in Nawacita by carrying out development in village areas is important. This information system is anticipated to be able to address the issue of late Village Fund reporting, enabling timely payout (Jayathilake & Seneviratne, 2022). In addition, there is a system for accounting information that will be used to disperse village funds, increasing public openness over the use of village funds.

LITERATURE REVIEW

A Decentralized System of Consensus

There is general agreement regarding the significance of system decentralization, and specifically the decentralization and distribution of the underlying database (Glaser and Bezzenberger, 2015; Voshmgir, 2020; Beck et al., 2018). The blockchain-based cryptocurrency Bitcoin is a payment network that enables online payments to be made from one party to another without the need for middlemen, ensuring system resilience through network decentralization (Nakamoto, 2019). Bitcoin was the first application of blockchain technology. The taxonomy of decentralized consensus systems was developed by Glaser and Bezzenberger (2015), who stressed that it can be used to “any conceptual level objects of the domain and is relying on the infrastructure of a decentralized consensus system” (Glaser and Bezzenberger, 2015, p.12).

Village Funds in Indonesia

Since 2015, the Indonesian government has been distributing Dana Desa, or village grants, to village all around the country in an effort to increase community engagement in accordance with Act Number 6 of 2014 on Desa. The development of village funds serves the goals of enhancing the village's economy and public services, managing village potential, creating markets and jobs, and boosting local commerce and income. Based on our survey data, village finances several company categories (Afifah, Kartini,

& Yuningsih, 2017; Arifin et al., 2020). Village funds may operate a variety of businesses; for instance, BUM Desa may provide trading and finance services. Four major business types are financing, trade, renting out space, and providing essential services. Nearly one-fourth of village finances go toward financial services that provide locals loans (Djuwityastuti & Astuti, 2018). About one-fifth of the population trades and distributes rural crops to assist villages market their products.

The term “village funds” refers to the State Budget's (APBN) distribution of money for local community empowerment and development. These subsidies are distributed through the Budget of Income and Expenditure (APBD) district/city and are intended to reinforce suburban communities as development subjects while also enhancing public services in villages, reducing poverty, advancing the village economy, and closing development gaps between villages (Prasetio & Sabihaini, 2023).

The village government is in charge of managing the funds for the community, and as part of this planning process, there are meetings for the subvillage (Musyawarah Dusun), the village (Musyawarah Desa), and the village development planning meeting (Musyawarah Rencana Pengembangan Desa). The community's feedback is used to analyze and choose the suggested programs and priorities, which serve as the foundation for the village development work plan (RKP).

The distribution of village funding takes place in stages, with the Activity Implementation Team (TPK), established by the village government, carrying out the execution of activities. To ensure that the development activities outlined in the village budget are carried out properly, the head of the village government oversees the TPK. In general, the idea of village funds seeks to strengthen and develop rural communities by providing funding for a range of development projects and activities that cater to the particular needs and priorities of the village community.

The management and transparent use of the money allotted for the growth and welfare of the village community are referred to as the accountability of village funds. It involves many different things, such as accounting, decision-making, and reporting procedures. Vertical accountability, which involves the village government being accountable to higher levels of government, such as the district or city administration, is a crucial component of village financial accountability. This accountability makes sure that the monies allocated to the village are used in compliance with the rules and regulations established by the superior authority. Another essential component is horizontal accountability, which refers to the village government's need to answer to the local populace and stakeholders. This entails involving the neighborhood in decision-making, getting its opinions, and making sure that money is used transparently. The village fund accountability concept, which emphasizes the involvement and participation of the community in monitoring and evaluating the use of money, also includes social accountability. This can be accomplished through techniques like social audits, open forums, and neighborhood monitoring committees.

To achieve effective governance at the central and local levels, the Indonesian government is working to change its digital infrastructure. Implementing a village information system (VIS), a management-controlled information system, is one method for achieving digital government transformation at the micro level. Unfortunately, not all Indonesian villages have been able to implement VIS(Sihotang et al., 2023).

SDLC Construction

SDLC (Software Development Life Cycle) is a systematic process used in software development to plan, design, develop, test, deploy, and maintain software systems. It provides a structured approach to software development, ensuring that the software meets the requirements of stakeholders and is delivered on time and within budget. SDLC typically consists of several stages, including requirement gathering, system design, coding, testing, deployment, and maintenance (Subha & Zhang, 2022). Each stage has specific activities and deliverables that contribute to the overall development process.

The development and management of a healthcare or medical system typically follow a structured framework consisting of several key phases. It all begins with Requirement Elicitation/Gathering, where stakeholders' needs and expectations are carefully identified and collected. These requirements are then meticulously documented and specified in the next phase to provide a clear foundation for the project. Verification and Validation come into play to ensure that these requirements are precise and comprehensive, reducing the risk of misunderstandings and errors. Requirement Management is essential to track and adapt to any changes in requirements as the project progresses. System Engineering takes an interdisciplinary approach to define the system's scope, complexity, and interfaces. In the Design phase, detailed plans and blueprints are created, covering software, hardware, and architecture. Integration, Verification, and Validation ensure that system components work together seamlessly, meet requirements, and function as intended. Iterative Development allows for flexibility and refinement throughout the project. Monitoring and Maintenance ensure that the system remains in optimal condition post-deployment, with training and support for users. Finally, proper Disposal procedures are crucial, especially concerning sensitive medical data, and the responsible disposal of hardware components. This comprehensive framework ensures the successful development, deployment, and lifecycle management of healthcare systems. These stages are typically followed in the SDLC process, and they may vary depending on the specific methodology or model used.

RESEARCH METHOD

A methodological approach used to comprehend, explain, and analyze different aspects and phases in the software system development process is qualitative research using the SDLC (System Development Life Cycle) system development approach(Putra, 2022). This method enables researchers to investigate several aspects of system development involving people, processes, technology, and organizational context. To acquire a thorough understanding of user wants, technological difficulties, team dynamics, and other factors that affect the system development process, this research technique entails stages like collecting qualitative data through interviews, observation, and document analysis (Bulman, 2017; Ragunath, Velmourougan, Davachelvan, Kayalvizhi, & Ravimohan, 2010). Following that, this data was examined utilizing an inductive methodology, whereby qualitative discoveries were noted, examined, and incorporated into the SDLC stages of planning, analysis, design, implementation, testing, and maintenance (Kang & Kim, 2022). This strategy aids in comprehending the larger context.

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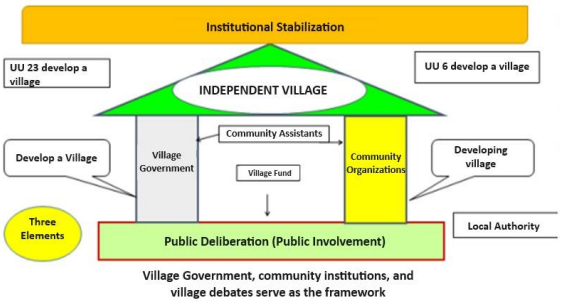
RESULTS

Village Fund Distribution Accounting Information System Using Blockchain Technology

The blockchain-based village fund distribution accounting information system is a closed system, meaning external factors cannot affect it (Fullana & Ruiz, 2021; Hartoyo, Sukoharsono, & Prihatiningtias, 2021; Sarwar et al., 2021). The system's output or results, however, can be viewed by the general public and other parties via a database. Blockchain technology enables peer-to-peer transactions. Therefore, information (which may take the shape of messages or crucial information or documents) can be sent from one user to another without the assistance of a third party to handle it. Due to the fact that all transactions on the blockchain are mirrored across the network, there is no need for reliance on a single server. This eliminates the possibility of fraud arising from altered data, server outages, or unauthorized account access. Characteristics of blockchain systems are identified in the following way:

The components of this system revolve around a network of stakeholders, primarily consisting of the national government, district/city government, village government, and third-party entities responsible for project implementation. Notably, the third party plays a pivotal role in driving the project forward. The system's scope is characterized by a focus on cost-effective initiatives tailored to benefit the village communities. These initiatives encompass a wide spectrum, ranging from infrastructural development to educational programs and community empowerment efforts. In terms of its relational structure, the system relies on internet-based connectivity to establish seamless communication and data exchange between its various components. Within the system, the input system involves the allocation and utilization of funds, starting from the central government to regional entities and subsequently to the villages. Transaction data pertaining to these financial flows is a key element. The output system is centered around a ledger, thoughtfully segmented into account blocks. This ledger serves as a repository of vital information concerning the distribution of village funds, offering transparency and accountability. System operation is characterized by a peer-to-peer networking approach, a method that streamlines data processing without the need for intermediaries. This approach promotes efficiency and reduces delays in the distribution process. Ultimately, the primary objective of this system is to expedite the often-protracted distribution process by enabling real-time reporting through the relevant ledgers. Additionally, it seeks to optimize the utilization of village funds, ensuring that resources are effectively channeled to benefit the communities they serve.

Figure 1. Village Fund Distribution Accounting Information System



By employing peer-to-peer models and smart contracts, blockchain technology also simplifies the auditing process. With the use of this technology, complete information is available from both internal and external sources. Additionally, because current data can no longer be altered or manipulated by responsible parties, information collected through

blockchain is also more secure. As a result, the data obtained is more trustworthy and can be utilized as audit proof by auditors in the future. The technical audit procedure differs from traditional methods and blockchain-based systems in other ways as well.

Tabel 1. There are Differences in the Technical Audit Process

Procedure	Conventional Audit	Blockchain Audit
Document Inspection	Using samples and verification	Dataset evaluation in ERP using Blockchain
Asset Inspection	Perform a physical examination	Perform RFID tagging
Observation	Observe the work process directly	Use of blockchain to verify workflows without having to observe directly
Investigation	Interview	Monitor work processes with blockchain and directly analyze possible violations for immediate inspection
Confirmation	Check account balance	Linking account data of related accounts in blockchain

Continue with Table 1. There are Differences in the Technical Audit Process

Re-Calculation	Recalculate account to verify	Monitors all accounts and automatically counts the accounts you want to check
Verification	Re-carry out the procedure for verification	Replicate all data and immediately identify errors/anomalies
Analytical Procedures	Using statistics	Filter data in real time with continuity equations and statistics.

Blockchain Method the system will process input transactions, record them in the ledger historically, and group them. Blockchain technology enables a peer-to-peer network architecture that enables all transactions to be tracked and confirmed on the network. as succinctly described in the graphic below:

Figure 2. The Ledger's Transactions are Processed using Blockchain

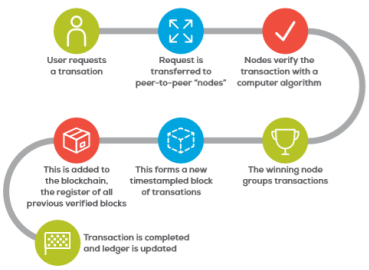


Figure 2 demonstrates how the blockchain system aids in the implementation of a control system for the management of village money by the government and community. Data cannot be changed or erased (Hartoyo, Sukoharsono, & Prihatiningtias, 2021), thus the village administration must carefully analyze its expenditure before making any expenditures. The only activity that takes place is the entering of transactions. In the meantime, agreements or contracts take place using current smart contracts to reduce abuse of power when dispersing community cash. The public's expectation of transparency can thus be satisfied. The public can keep an eye on activities that are cost-effective, particularly the execution of initiatives that get Village Fund funding. As a result of the village government's need to utilize funds honestly to advance village welfare, this technology also directly contributes to the fulfillment of the principle of accountability (Regueiro, Seco, Gutiérrez-Agüero, Urquizu, & Mansell, 2021). Transaction parties must register with the Village Fund distribution accounting information system using an address in order to use it. The address will only be effective for the execution of one project for third parties, however. By establishing an internet connection to one accounting information system application, the distribution of funds is carried out. The transfer of village funds from the center to the villages is the first step. From this procedure, it can be inferred that the system operates online and generates a database budget-style document (Lee & Park, 2021). According to the ceiling size established by additionally assessing the effectiveness of Village Funds in the region using regional cash account ledger data, funds are sent from the central government. According to the block and previous transactions, every delivery transaction is logged in the database. The village administration announces the project's execution following the receipt of the funds by the local government. Through the creation of banners, advertisements, and publications in compliance with the agreement with the National Police, which compels them to provide information on every activity related to the use of village funds.

A third party, a contractor, proposes a project via blockchain, a decentralized system. The government accepts the proposal, evaluates the contract, and moves forward with a smart contract. This automation boosts productivity and reduces turnaround times. The proposal is encrypted on a shared ledger, and the village government transfers funds according to the contract. Blockchain evaluates projects, and the third party prepares a Project Implementation Report, which is then sent to the village government.

Designs System Method

The system comprises four key entities, each with distinct roles and capabilities. First, there's the Data Owner (DO), who possesses a substantial volume of data requiring outsourcing due to limited computational and storage capacities. Secondly, the Cloud Storage Server (CSS) steps in with its robust computational and storage capabilities, offering essential storage services. The third component is the Blockchain with Smart Contract (SC), a decentralized, immutable, and transparent distributed ledger. The Smart Contract (SC) acts as an automated auditor, capable of executing predefined tasks within the blockchain network. Finally, the System Manager (SM) takes charge of deploying the blockchain containing the smart contract and formulating the system's public specifications. It's important to note that once the system is launched, the System Manager's access to it is restricted, ensuring the security and integrity of the system's operations.

In the setup step, as depicted in Fig. 3, SM builds system public parameters and deploys the blockchain. The encrypted data file is processed and outsourced by DO during the storage phase. For the outsourced file, DO specifically creates an appropriate authenticator. The outsourced file is then uploaded to CSS (1.2) after the authenticator has been published on the blockchain (1.1). When CSS receives a file from DO, it checks

its accuracy using an authenticator that has been made public on the blockchain (1.3). If the verification is successful, the file for DO is correctly placed in CSS. A smart contract SC on the blockchain is activated periodically to carry out the auditing procedure in order to confirm the accuracy of the outsourced file in CSS. CSS downloads the auditing challenge from the blockchain during the auditing phase (2.1). CSS creates the relevant integrity proofs using the data that has been stored and then uploads them to the blockchain (2.2). Based on the integrity proofs from CSS, SC performs data integrity verification and produces the auditing result (2.3).

Figure 3. Design of the Blockchain Audit Process

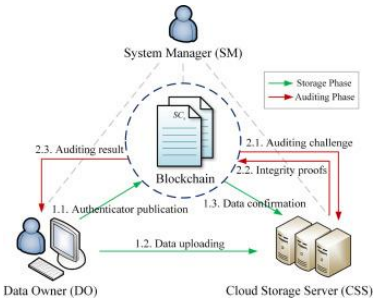
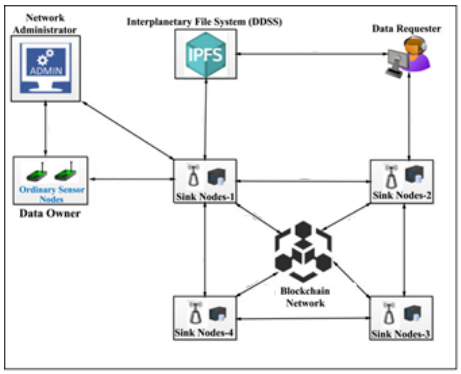


Figure 4. Design of the Blockchain Network



SM, DO, and CSS are only a few of the distributed nodes that make up the blockchain. These nodes are spread, equal, and independent. And any node on the blockchain can view the data that has been published there. According to the consensus process, the majority of remote nodes honestly carry out the pre-defined protocol. With a trusted executable environment, the smart contract (i.e., the executable software) put on the blockchain is operational. When certain criteria are satisfied, the smart contract automatically executes and outputs the auditing result without requiring human input.

Model for Design-Security

Assume DO may purposefully outsource an inaccurate file (i.e., the outsourced file does not match its corresponding authenticator) to frame CSS in exchange for payment. An untrusted CSS may conduct the following attacks to hide the fact that a file stored in the cloud has been corrupted since various accidents or malicious acts may result in the corruption of an outsourced file.

The system faces three significant security challenges in maintaining data integrity: Forge attacks, Replace attacks, and Replay attacks. In Forge attacks, the Cloud Storage Server (CSS) attempts to deceive the system by fabricating integrity proofs even when it does not possess the complete outsourced file. The aim is to circumvent data integrity

audits dishonestly. In Replace attacks, CSS generates integrity proofs by substituting a data block that has been challenged with an unchallenged one, seeking to manipulate the audit process and pass it without detection. Meanwhile, in Replay attacks, CSS reuses previously validated integrity proofs from prior audits during subsequent audits, deceiving the system into accepting them as legitimate. These security vulnerabilities underscore the critical need for robust safeguards and measures to ensure the trustworthiness and integrity of the outsourced data, making it imperative to devise and implement effective countermeasures against these potential threats.

Assume that all entities have trust in SM. Following system setup, SM will be inactive and unable to take part in the auditing process. SC is a pre-set software that SM has deployed, and it is transparent and unchangeable. SC can operate automatically and produce a trustworthy outcome. Additionally, during the auditing process, a third-party adversary might eavesdrop on communications sent across the blockchain in order to determine the contents of the outsourced file.

The Objectives of the Design

Three fundamental principles guide the design and operation of our system: Correctness, Protection, and Efficiency. First and foremost, correctness ensures that when the Cloud Storage Server (CSS) stores complete data, the integrity proofs generated by CSS adhere to the highest standards of accuracy, enabling them to successfully pass integrity audits.

Next, protection is a paramount concern. Our proposed strategies prioritize safeguarding data privacy against external threats and, notably, defending against CSS's attempts to undermine data integrity through forge, replace, and replay attacks. This commitment to protection underscores our dedication to maintaining the confidentiality and trustworthiness of the outsourced data.

Lastly, efficiency is a key consideration. We strive for data auditing tasks to be executed seamlessly, with minimal overhead in terms of both processing power and communication resources. This ensures that the system's performance remains optimized, allowing for the swift and effective verification of data integrity while minimizing resource utilization. These three guiding principles collectively form the foundation of our system's design and operation, enabling it to meet the highest standards of data security, privacy, and operational efficiency. Village fund distribution procedures can be seen in Appendix 1. Procedures for using village funds can be seen in Appendix 2.

DISCUSSION

A structured procedure is used to distribute village finances, providing accountability and openness. In order to start this process, historical data on the use of village money is examined, giving details on previous expenses and project outcomes. Funds are moved from the Regional Village Fund Management Unit (RKUN) to the Regional Village Fund Management Agency (RKUD) for each individual region, assisted by a virtual computer, after the general ledger data is painstakingly reviewed to ensure the accuracy of financial records. As a result, notifications are sent to the recipient's address verifying the successful transfer, and the RKUN ledger balance is reduced. The ledger balance then rises as a result of the Regional Government acknowledging receipt of the Village Fund delivery. The village government first submits a budget proposal for review, which includes a detailed analysis of expenditures from the previous year. The budget must subsequently receive approval from the regional government; if approved, the village monies are transferred, resulting in a reduction in the RKD ledger. Additionally,

the blockchain system's ledger is updated to provide transparency and immutability. If the regional government rejects the budget, they work with the village administration to rewrite it within a given time frame. The fact that all village fund documentation is duly presented to the regional administration for thorough scrutiny highlights the significance of fiscal accountability and cooperation between regional and village authorities.

There is a clear and accountable method for using village funds. The blockchain technology first runs an auction program where third parties can electronically submit contract bids. The Village Government reviews program contract proposals after receiving them and, if satisfied, gives its permission for the project to move forward in accordance with the agreement. The Village Government makes the decision about the distribution of the required cash after the project has begun. The third party then receives the allotted amount after the money are transferred in accordance with the agreement. Notably, the blockchain system precisely preserves every financial transaction and usage data, guaranteeing its durability and transparency. This approach not only makes effective fund distribution possible, but also ensures that consumption records are always available and unchanged for future reference and auditing needs.

CONCLUSION

The blockchain system is a control system for managing village money by the government and community. It allows for transparent transactions, agreements, and contracts using smart contracts to reduce abuse of power and ensure accountability. Transaction parties must register with the Village Fund distribution accounting information system using an address, which only applies to one project for third parties. The system operates online, generates a database budget-style document, and transfers funds according to the ceiling size established by assessing the effectiveness of Village Funds in the region.

A third party, a contractor, proposes a project via blockchain, which is then evaluated by the government. The proposal is encrypted on a shared ledger, and the village government transfers funds according to the contract. Blockchain evaluates projects, and the third party prepares a Project Implementation Report. The system model consists of four entities: Data Owner (DO), Cloud Storage Server (CSS), Blockchain with Smart Contract (SC), and System Manager (SM). The outsourced data file is processed and outsourced by DO during the storage phase, and a smart contract SC on the blockchain is activated periodically to carry out the auditing procedure. The design objectives for the proposed schemes include correctness, protection, and efficiency. CSS stores complete data, and integrity proofs generated by CSS can pass integrity audits. Protection measures should defend data privacy from external threats and fend off CSS's forge, replace, and replay attacks. Efficiency should be achieved with minimal overhead in terms of processing and communication.

LIMITATION

Indonesia's blockchain-based audit designs have the potential to enhance accountability and transparency in various industries. However, the country's human resources are not fully prepared for this technology. A professional workforce in blockchain matters is needed for usage and audit procedures. A joint effort between government, educational institutions, and corporate sector is needed.

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DECLARATION OF CONFLICTING INTERESTS
The authors wish to unequivocally state that, to the best of their knowledge and belief, there are no existing financial or interpersonal conflicts of interest that might have conceivably exerted any influence, whether direct or perceived, upon the conduct or findings of the research meticulously presented in this comprehensive study. This declaration underscores the commitment to upholding the highest standards of scientific integrity and transparency throughout the entire research process, ensuring the validity and credibility of the results and conclusions put forth herein.

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