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Blockchain Technology Utilization in Improving Transparency of Regional Revenue Budget Allocation

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Abstract

The use of blockchain technology to manage the allocation of Regional Revenue and Expenditure Budget (APBD) is a strategic step to increase transparency and accountability in the government sector. This technology offers a decentralized approach that allows permanent, transparent, and unchangeable transaction recording without consensus from all related parties. This study aimed to evaluate the impact of blockchain technology implementation on efficiency, accuracy, and public participation in regional financial supervision. The research methodology used in this study is a descriptive qualitative methodology with an approach based on case studies and literature reviews, to identify and analyze the use of blockchain technology in increasing transparency in regional revenue budget allocations. The results of this study show that blockchain can provide solutions to traditional problems in APBD management, such as data manipulation and budget misuse, by providing a digital recording system that can be audited in real time by the public. With the integration of smart contracts, budget allocation can be automated based on predetermined requirements, thereby increasing public trust in the financial management of regional governments.

Keywords: Blockchain; Transparency; Budget; Accountability; Governance; Smart Tontract; Decentralization; Technology.

Introduction

In the modern era, the world is increasingly dependent on digital technology in various sectors, which demonstrates the importance of technology in human life. The advancement of this technology has caused a huge change in the lives of mankind across all civilizations and cultures. This change has also had a significant impact on the transformation of values in society (Wahyudi, 2014). Technology has become an important pillar of human development, changing the way we interact, work, and live. Technological innovation has had a significant impact on life since the discovery of

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satellites and the Internet. The development of information and communication technology (ICT) dominates almost every aspect of life. The technological network in society marks the transition to a new model that changes the economy, culture, and social structure (Castells 2010). The rapid development of the Internet, computers, and mobile devices has created an interconnected ecosystem, enabling access to information in seconds and facilitating global interaction in real-time. Within this framework, blockchain technology has emerged as one of the most important innovations in the digital era. This technology was first introduced by Satoshi Nakamoto through Bitcoin white paper: A Peer-to-Peer Electronic Cash System as a solution to the problem of online transactions without intermediaries. Blockchain is a rule in computer science that aims to determine the structure and sharing of data, and can be interpreted as a data structure that allows us to create digital books from data and share data in a network (Winarno et al., 2019). Blockchain in terms of data transparency greatly guarantees data transparency and security through cryptography. According to Don Tapscott and Alex Tapscott in Blockchain Revolution, " blockchain enables the transfer of digital assets safely and directly between parties without the need for trust or intermediaries" (Tapscott et al., 2016). By enabling transaction recording in the form of interconnected and immutable blocks, blockchain has the potential to revolutionize the financial industry as well as other sectors, such as logistics, health, and government.

The use of blockchain technology to increase the transparency of regional budget allocation is an innovative solution. Because of the level of data security and transparency of blockchain, certain parties cannot misuse the budget. Blockchain has the potential to change the current (traditional) budget audit practices, producing a more precise and timely real-time automated assurance system (Argani & Taraka, 2020). The use of blockchain for regional budgets will certainly increase public trust in the government; budget publications can be monitored directly by the public through government websites, showing the flow of budget distribution and the portion of the budget used by the government in development. Blockchain has the potential to increase the efficiency of the budget-use process in digital financial recording and improve the effectiveness of budget allocation. Blockchain also helps minimize errors in the financial reporting process and reduces human error in budget recording. The implementation of information technology in regional financial management can increase the efficiency and accuracy of financial reports, showing that the use of a regional financial information system (SIKD) with a blockchain system can speed up the reporting process (Kristin Kamenong et al., 2024)

Regional budget management using blockchain technology is expected to improve the various weaknesses of traditional systems. Blockchain creates a transparent audit trail that allows all stakeholders to easily verify the data. Thus, the risks of manipulation and corruption are minimized. For example, when a transaction occurs in a blockchain system, the transaction is recorded in a block. This block must first be

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validated before it can be included in a blockchain. In this validation process, all parties involved in the system can monitor and perform it (Prasetyo Utomo, 2021). Blockchain also encourages openness of information, which is key to increasing public participation in decision-making related to public policy. Overall, transactions using blockchain use blocks that simultaneously ensure the privacy and security of the data from each user.

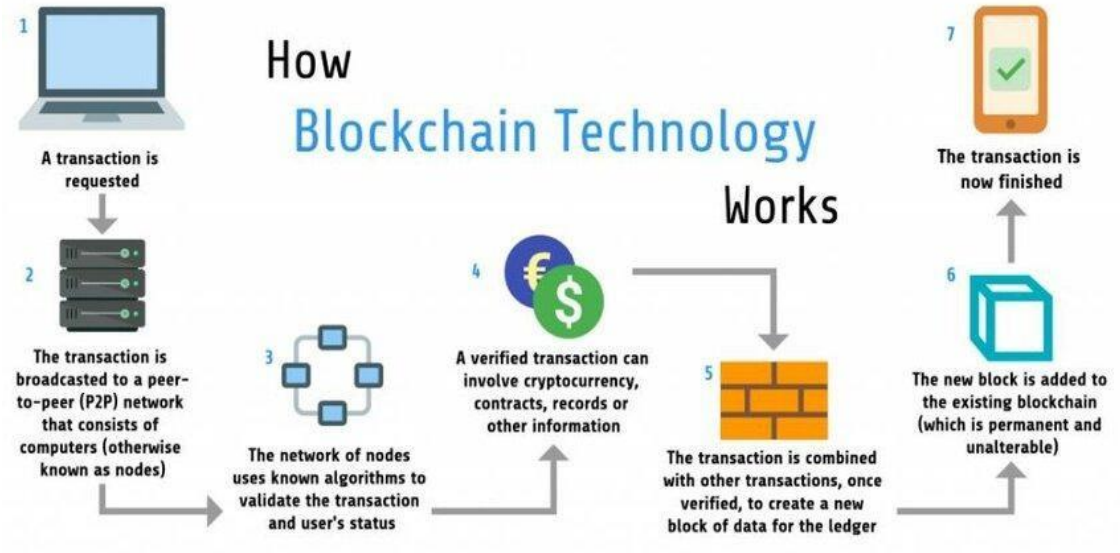

Figure 1.
How Blockchain Technology Works
Source: https://medium.com/@ipspecialist/how-blockchain-technolo-gyworks-e6109c033034

Previous studies have shown that the application of blockchain technology in government budget management can increase efficiency and reduce the risk of corruption. Zyskind argues that blockchain can provide a balance between data privacy and the accessibility of information for public audits. Additionally, the application of this technology can facilitate public participation in the process of public financial oversight (Zyskind et al., 2015). Several countries have implemented blockchain in their government systems. After achieving independence in 1992 from Russia, Estonia committed to reforming and improving its public service system digitally through the use of information technology. Blockchain was implemented in 2012 to support various e-government services. Estonia ranks first in the European Union in digital public services and continues to be a strong pioneer in this field. Including financial data management and public administration, which has been proven to increase public trust in the government, technology has become a major pillar in government life and a necessity that cannot be ignored. The Digital Economy and Society Index (DESI) 2021 report shows that Estonia is a leader in digital public services in Europe, ranking 1st and scoring 91.8, well above the European Union (EU) average of 68.1. Estonia's performance in digital

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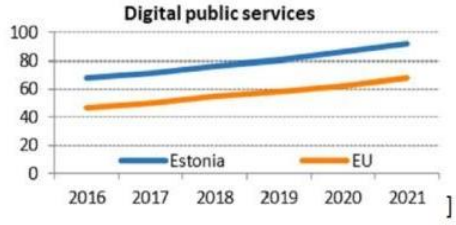
public services shows an increase in the percentage of e-government users compared with much lower EU countries. Digital public services for Estonian citizens are excellent and developing rapidly compared to those of the EU. Estonia managed to lead digital public services in Europe, scoring significantly better than the EU average in all categories measured. This reflects policies and innovations that support the digitalization of public services (e-Estonia Briefing Center, 2021).

4 Digital public services	Estonia		EU
	rank	score	score
DESI 2021	1	91.8	68.1



	Estonia			EU
	DESI 2019	DESI 2020	DESI 2021	DESI 2021
4a1 e-Government users % internet users	88% 2018	88% 2019	89% 2020	64% 2020
4a2 Pre-filled forms Score (0 to 100)	NA	NA	97 2020	63 2020
4a3 Digital public services for citizens Score (0 to 100)	NA	NA	91 2020	75 2020
4a4 Digital public services for businesses Score (0 to 100)	NA	NA	98 2020	84 2020
4a5 Open data % maximum score	NA	NA	91% 2020	78% 2020

Figure 2.
Digital Public Services in Estonia
Source: https://e-estonia.com/estonia-a-european-and-global-leader-in-thedigitalisation-of-public-services/

The use of blockchain for budget transparency is also supported by smart contracts, which are digital contracts that can automatically execute transactions based on predetermined terms and conditions. According to Tapscott and Tapscott (2016), smart contracts can ensure that fund allocations are made only if certain requirements are met, thereby reducing the possibility of budget misuse. This is relevant in the context of managing the Regional Revenue and Expenditure Budget (APBD), where blockchain can be used to monitor and control spending in real time (Tapscott et al., 2016).

This study tests the effect of blockchain technology on increasing transparency and accountability in regional revenue budget allocations. The main hypothesis proposed is that the implementation of blockchain technology in a regional revenue budget management system will increase transparency and accountability in budget allocation. Blockchain is a decentralized distributed ledger technology that offers solutions to various problems in regional budget management, including misappropriation and unclear allocation of funds by using this system. Every budget transaction is recorded

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permanently and openly, allowing the public and authorities to verify and monitor the allocation of funds in real-time.

The application of blockchain technology in public services in Indonesia marks a step forward towards digital transformation in the provision of public services. The application of blockchain technology in public services in Indonesia has significantly boosted various forms of implementation (Permatasari and Novelin, 2024). The practice of using blockchain by local governments in regional financial allocations in Indonesia remains minimal and limited. The Indonesian government through these regions in recent years is still in the early stages of implementing blockchain funds for public services and government, and in several regions, such as the special region of Jakarta, blockchain is used in the retail industry, transportation, financial services, and taxation systems, which shows the rapid use of blockchain in Jakarta. Under different conditions, such as in areas outside Java, the use of blockchain has not been optimally implemented for budget allocation. Several regions, namely Bali, Makassar, and Bangka Belitung Regency, have just entered the process of implementing and testing the use of blockchain in the process of public budget transparency. Bangka Belitung utilizes blockchain in the development of national strategy projects in its region, with the aim of implementing technology and following the development of information technology which is increasingly developing rapidly. This implementation also aims to increase regional transparency in the management and use of central and regional budget allocations to avoid corrupt practices and the misuse of existing budgets. Overall, this literature review confirms that blockchain technology has great potential for increasing transparency and accountability in the management of the Regional Revenue Budget (APBD). Effective implementation requires support from various parties, including the government, legislature, and civil society, as well as preparation of comprehensive regulations. Further research is needed to evaluate the long-term impact of blockchain implementation on regional financial governance and identify the best strategies that can be applied in the local context of Indonesia. Based on the background of the problem above, the problem can be formulated to cover the core of the problem: (1) How is blockchain technology utilized to increase the transparency of regional revenue budget allocation?

Method

The research methodology used in this study was a descriptive qualitative methodology with an approach based on case studies and literature reviews. It aims to identify and analyze the use of blockchain technology to increase transparency in regional revenue budget allocations, involving an in-depth analysis of the use of blockchain technology in certain regions that have implemented it. Data sources were obtained from secondary data, including scientific articles, national and international journals, mass media reports, previous studies, and policy products, especially the ITE Law No. 1 of

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2024, which regulates the challenges of utilizing information technology and electronic transactions to maintain a clean, healthy, ethical, productive, and equitable digital space in Indonesia. (Audit Agency, n.d.)

Results and Discussion

The use of blockchain technology in the management of Regional Revenue Budget Allocation (APBD) has a significant potential to increase transparency, accountability, and efficiency in local governments. Blockchain technology, which is based on a decentralized system, allows every transaction to be recorded in a digital ledger that cannot be modified without the consensus of all parties involved. This aims to reduce corruption and budget irregularities, which are common problems in APBD management. In a study conducted by Mouakil et al. (2020), it was found that the application of blockchain in e-budgeting systems in various countries showed a reduction in cases of abuse of authority as well as increased public trust in local governments. This system provides transparency that allows the public to directly monitor and supervise budget use. The previously complicated budgeting process can be simplified using smart contracts that can automatically execute fund allocations based on agreed provisions.

Based on this study, it is clear that blockchain technology has the potential to revolutionize APBD management by increasing transparency, accurate report generation, and public participation in monitoring budget allocation. By utilizing this technology, local governments can not only increase efficiency in budget spending, but also build public trust that has been eroded by various corrupt practices.

1. Blockchain Technology Implementation

The implementation of blockchain technology in the allocation of the Regional Revenue Budget (APBD) can be done through the integration of a transparent and trusted blockchain-based system for recording financial transactions. Utilizing this technology, every transaction made in budget management will be recorded permanently in an immutable block, thereby reducing the potential for fraud and data inaccuracy. Blockchain also allows real-time access to relevant parties, including the public, budget, and expenditure information, which increases accountability. Alhadid et al. (2020) stated that the adoption of blockchain in APBD management can increase public participation through a more efficient monitoring system.

Manjunath et al. (2022) show that blockchain technology can be used for smart contracts in spending projects, ensuring that funds are disbursed only after certain conditions are met, thereby strengthening project interest management and reducing the risk of corruption. In addition, blockchain helps in a faster and more accurate audit process, as stated by Zhao et al. (2019), because all transactions have a clear audit trail

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and cannot be manipulated. For example, in the implementation of e-budgeting in several countries, Mansour et al. (2021) show that the combination of big data and blockchain can improve data integrity in regional budget planning and implementation. Thus, public trust in regional financial management could be rebuilt.

Blockchain technology is applied in the context of regional budget allocation by creating a transparent and decentralized system to record all financial transactions related to budget expenditure and revenue. A real example of this application can be seen in e-budgeting projects that utilize blockchain, where all allocations and uses of funds are recorded in a digital ledger that can be audited publicly. One platform that has been developed is the Government Blockchain Association, which focuses on developing blockchain solutions to improve efficiency and transparency in government management, including in the regional financial sector.

This system uses smart contracts to automate and verify budget expenditure, allowing authorities and citizens to monitor budget use in real time. For example, in Estonia, the government uses a blockchain-based system for public transaction recording, which helps reduce budget misuse and increases accountability. Zhang et al. (2021) show that the implementation of blockchain has resulted in significant improvements in transparency and public trust in the use of local budgets in several regions that have implemented this technology. In addition, Banafa (2020) explains how a similar initiative in Dubai aims to unify all government transactions in a single blockchain ledger that is accessible to all stakeholders, thereby creating a more responsive and accountable system.

2. Transparency and Accountability

Blockchain technology fundamentally changes the approach toward transparency and accountability in local budget management. Blockchain, with its decentralized and immutable nature, allows every transaction to be permanently and openly recorded. These transactions can be audited by anyone with access to the blockchain network, thereby reducing the possibility of data manipulation and increasing public trust in government budget management. For example, the Chilean government implemented blockchain to publish public spending data directly, allowing the public to monitor the use of funds in real time. This shows how this technology provides a solution to overcome the weaknesses in traditional systems that are often opaque and prone to abuse.

The advantage of blockchain in transparency is also evident in its ability to provide a traceable digital audit trail. Unlike traditional systems, which often involve long bureaucracy and are prone to recording errors, blockchain allows for fast and efficient monitoring. Using this technology, auditors can easily trace the origin of transactions and ensure that funds are used according to their intended purpose. This advantage gives the public greater trust in the government, especially in the allocation of local budgets. In addition, in the context of institutional financial transactions, the significant impact of this increase in operational efficiency is clearly observed in the increased speed of service to

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customers. Customers no longer have to wait long for their financial transactions, such as fund transfers, payments, or asset purchases, to be processed. This not only increases customer satisfaction but also provides a competitive advantage for financial institutions that adopt this technology. (Chairunnas et al., n.d.)

3. Impact on Stakeholders

The application of blockchain in regional budget management has a significantly positive impact on various stakeholders, including the government, community, and supervisory institutions. For the government, blockchain increases accountability because every step in the budget management process is transparently recorded. Administrative efficiency also increases, because blockchain reduces the need for long and complex manual processes. By using smart contracts, funds will only be allocated if certain requirements are met, which helps avoid delays and misuse of funds by the community, providing wider access to government financial information. For example, in the context of zakat fund finance, the application of blockchain technology can increase public and stakeholder trust in channeling funds for zakat/charity. Research by Indranata (2024) shows that the total resources collected from the potential zakat collection of 17 member countries of the Organization of Islamic Cooperation (OIC) are sufficient to address the sources of poverty in the combined 17 OIC countries. (Indranata, 2024).

The resulting transparency allows the public to directly monitor budget allocations and expenditures, thereby increasing public involvement in budget oversight. Greater public participation strengthens social control over the government and increases trust in public policy. For example, in Estonia, blockchain has succeeded in increasing public trust in government services because financial data are more open and verifiable, which is beneficial because blockchain provides more structured and integrated data.

This simplifies the audit process, allows for more effective oversight of the public budget, and minimizes the potential for fraud. Blockchain also encourages collaboration between government agencies and independent auditors by providing access to the same data in real time, which accelerates the audit process. Overall, the implementation of blockchain creates a budget management ecosystem that is transparent, efficient, and trustworthy for all stakeholders. This transformation is an important step in creating better governance, particularly in terms of increasing transparency and accountability in regional budget management.

4. Social Challenges Blockchain Implementation

Blockchain has become a revolutionary technology in various fields from finance to health and supply chains. Despite its great potential for improving transparency, efficiency, and security, its implementation faces significant social barriers. One of the main barriers is the low level of digital literacy of the general public. Many individuals still do not understand the basic principles of blockchain technology, which is often

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considered complex and difficult to understand. This can lead to distrust of the blockchain technology and slow adoption. To overcome this problem, education and training programs are needed to help people understand how blockchain works and its benefits (Swan, 2015). Tiara Fazreen in Mutmainah (2018) that in Indonesia itself there are still many negative perspectives related to blockchain due to news of Bitcoin misuse for illegal transactions, furthermore, several challenges to the less than optimal implementation of blockchain technology in Indonesia concern several aspects such as human resources, technical, and governance. (Tiara Fazreen, n.d.) Resistance to changes in traditional organizations and institutions is a major challenge. Blockchain technology is changing the way many systems work, which have so far relied on third parties for verification and authentication. However, those who benefit from the old model often do not support the shift towards a more decentralized system (Tapscott & Tapscott, 2016). This barrier can be overcome through communication strategies that emphasize long-term benefits such as greater efficiency and reduced costs. Regulatory issues and the lack of a clear legal framework also contribute to social barriers that affect blockchain adoption. People often hesitate to use new technologies without adequate legal protection. In some countries, immature regulations or even bans on cryptocurrencies have slowed the overall development of blockchain. Therefore, collaboration between technology developers, regulators, and other stakeholders is essential for creating a legal framework that supports innovation (Narayanan et al., 2016).

Finally, trust between users in blockchain networks can be another social barrier. Although blockchain promises transparency, in practice, hacking incidents on several platforms have left people concerned about the security and reliability of the technology. Addressing this issue requires improving security standards and developing solutions to strengthen user trust in the blockchain ecosystem (Antonopoulos, 2017). By overcoming these social barriers, blockchain technology has the potential to be adopted more widely and provides significant benefits in various sectors.

Conclusion

The use of blockchain technology to manage the allocation of Regional Revenue and Expenditure Budget (APBD) has great potential to increase the transparency, accountability, and efficiency of regional governments. This technology allows for the permanent, unchangeable, and transparent recording of transactions, thereby reducing corruption, data manipulation, and budget misuse. The use of smart contracts automatically strengthens the management and supervision of funds and accelerates auditing and financial reporting. Countries, such as Estonia, have successfully implemented blockchain in their digital public services, becoming examples of the successful application of this technology. Although social challenges, such as low digital literacy and resistance to change, still exist, the long-term benefits of blockchain in increasing public trust and regional financial governance are significant. Clear regulatory

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support and collaboration between stakeholders are required to maximize and sustainably maximize blockchain implementation. Overall, blockchain adoption has the potential to be an innovative solution in regional financial governance, increasing public trust and reducing corruption and misuse of funds, as long as it is implemented with a mature strategy and adequate regulations.

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