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The Impact of Smart Contracts and Decentralized Finance Platforms on Transaction Costs in Indonesia's Traditional Economy

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ABSTRACT

This study examines the impact of smart contracts and decentralized finance (DeFi) platforms on transaction costs within Indonesia's traditional economy. Using a quantitative approach, the research involved 60 respondents engaged in traditional economic sectors, utilizing a Likert scale (1-5) to gather perceptions on the efficiency, transparency, and cost-reduction potential of these technologies. Data were analyzed using SPSS version 25, with results indicating that both smart contracts and DeFi platforms significantly reduce transaction costs. Smart contracts were found to automate agreements and enhance trust, while DeFi platforms increased accessibility and reduced financial barriers. Regression analysis revealed that these technologies collectively explain 62% of the variance in transaction costs. The findings underscore the transformative potential of blockchain technologies in Indonesia's traditional economy, offering practical implications for stakeholders and policymakers to address technological and regulatory challenges. This research provides valuable insights for the integration of blockchain solutions in fostering economic efficiency and sustainability.

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1. INTRODUCTION

In recent years, the evolution of blockchain technology has brought about transformative changes in various sectors of the economy globally. Among the most impactful innovations in this domain are smart contracts and decentralized finance (DeFi) platforms. The implementation of smart contracts and decentralized finance (DeFi) platforms in developing countries like Indonesia offers both opportunities and challenges. These technologies have the potential to simplify transactions, increase transparency, and reduce reliance on traditional intermediaries, which is particularly relevant in regions with underdeveloped financial infrastructure. In terms of opportunities, DeFi platforms can democratize access to financial services, allowing individuals to participate in global financial markets without the need for traditional banking infrastructure [1], [2]. By eliminating intermediaries, DeFi can also significantly reduce transaction costs, making

financial services more affordable for users in developing countries [3]. In addition, smart contracts are capable of increasing the speed and efficiency of transactions in the e-commerce sector, driving the growth of a more secure and reliable digital economy in Indonesia [4]. Challenges remain, such as regulatory uncertainty due to the lack of a clear legal framework, which may hinder the adoption of DeFi, especially regarding compliance with international standards such as AML and KYC [5]. Technological risks, such as smart contract vulnerabilities and market volatility, are also major concerns in ensuring the security and stability of DeFi platforms [6]. In addition, the transition from the traditional financial system to DeFi requires collaboration and innovation to develop hybrid models that can adapt to existing infrastructure [7].

Indonesia's traditional economy, which relies heavily on small-scale markets and informal trade networks, faces major challenges of high transaction costs and limited access to efficient financial infrastructure. These challenges are exacerbated by bureaucratic inefficiencies, the presence of multiple intermediaries, and low technology integration, impacting particularly on small and medium-sized enterprises (SMEs). SMEs, which contribute significantly to job creation and economic growth, are often hampered by these systemics. Traditional markets, such as in Asahan Regency, face high transaction costs due to competition with more technologically integrated modern markets and e-commerce [8]. In addition, limited access to capital due to collateral requirements worsens the ability of SMEs to grow and innovate [9], while bureaucratic inefficiencies increase operational costs ([10], [11]. To overcome these challenges, digitalization and technology integration are potential solutions, as implemented in Mijen, where SMEs' digital literacy was improved through community outreach [12]. In addition, effective marketing and product diversification, including utilizing social media and participating in local events, can improve SME competitiveness [13]. Support from educational institutions, such as the University of Indonesia, also plays an important role through education, training, and mentoring programs to help SMEs overcome their operational challenges [14].

Smart contracts and decentralized finance (DeFi) platforms, powered by blockchain technology, offer innovative solutions to traditional challenges in various sectors by automating agreements and ensuring secure and tamper-proof transaction execution. The technology eliminates the need for intermediaries, thereby reducing costs while increasing transparency and efficiency. Smart contracts have great potential in supply chain management, Industry 4.0, and health insurance, while DeFi platforms are fundamentally reshaping the financial landscape by providing decentralized financial services. In supply chain management, smart contracts increase transparency and efficiency through immutable records, such as in Walmart's blockchain project for food safety and De Beers' diamond tracking [4]. In Industry 4.0, these technologies facilitate automation and transparency, although challenges such as scalability and data privacy remain to be overcome [4]. Meanwhile, DeFi platforms eliminate intermediaries, reduce transaction costs, and promote inclusive financial services, enabling peer-to-peer transactions and the use of smart contracts to increase transparency and security [15]. DeFi also democratizes access to financial services by providing opportunities for lending and trading without the need for traditional banking systems [2]. In health insurance, blockchain and smart contracts help mitigate fraud by ensuring transparency and accountability through multi-signature claims processing, involving all entities in the claims process and recording every action on the blockchain [16].

This study aims to evaluate the impact of smart contracts and DeFi platforms on transaction costs within Indonesia's traditional economy. By employing a quantitative research approach, this paper seeks to address the following research questions: (1) To what extent do smart

contracts reduce transaction costs in Indonesia's traditional economy? (2) How do DeFi platforms influence the efficiency and accessibility of financial transactions for traditional economic actors?

2. LITERATURE REVIEW

2.1 Blockchain Technology and Smart Contracts

Blockchain technology, a decentralized ledger system, ensures secure, transparent, and immutable transactions by eliminating the need for intermediaries and enabling direct, trustless exchanges between participants. One of its key innovations is the smart contract, introduced by Nick Szabo in the 1990s, which functions as a self-executing agreement with encoded terms and conditions that automatically execute when predefined conditions are met, ensuring transparency and efficiency [17], [18]. In traditional economies, smart contracts have the potential to reduce transaction costs by automating processes such as payments, document verification, and compliance checks, thereby enhancing efficiency in areas like supply chain management, cross-border trade, and microfinance [19], [20].

2.2 Decentralized Finance (DeFi) Platforms

Decentralized Finance (DeFi) is a blockchain-based financial system that operates without central authorities such as banks, relying on smart contracts to deliver services like lending, borrowing, trading, and saving. Unlike traditional financial systems, DeFi platforms are highly inclusive, offering accessibility to anyone with an internet connection and a digital wallet [21], [22]. By removing intermediaries and reducing administrative overheads, DeFi platforms have achieved significant cost reductions, with examples like Uniswap and Compound revolutionizing financial transactions through direct peer-to-peer services. In emerging economies, DeFi provides a viable alternative for underserved populations to access financial services, fostering greater financial inclusion and efficiency [23], [24].

2.3 Transaction Costs in Traditional Economies

Transaction costs, as defined by [3], [25], encompass the expenses associated with economic exchanges, including search and information costs, bargaining and decision-making costs, and enforcement costs. In traditional economies such as Indonesia, these costs are often elevated due to inefficiencies, corruption, and reliance on intermediaries. Small and medium enterprises (SMEs), which dominate Indonesia's economic landscape, are particularly burdened by high transaction costs, exacerbated by limited access to financial services, bureaucratic hurdles, and inefficient payment systems. Previous research, including [11], [13], [26], highlights the critical need for technological interventions to reduce transaction costs and foster economic growth in traditional sectors.

2.4 The Role of Blockchain in Reducing Transaction Costs

Blockchain technology, particularly smart contracts and DeFi platforms, is recognized as a transformative tool for reducing transaction costs by automating processes and enhancing transparency, thereby addressing inefficiencies in traditional transaction methods. Empirical studies, such as those by [24], [27], highlight blockchain's potential to lower costs in sectors like logistics, finance, and trade. For instance, [24], [28] demonstrated that blockchain streamlines data flows and fosters trust among participants, significantly reducing transaction costs in supply chain systems. Similarly, DeFi platforms further reduce costs by offering direct access to financial services, eliminating the need for intermediary fees [1].

2.5 Challenges of Blockchain Adoption in Indonesia

Despite its transformative potential, the adoption of blockchain

technology in Indonesia encounters significant challenges, including limited digital literacy, inadequate infrastructure, and regulatory uncertainty [29]. Trust in decentralized systems and the absence of clear legal frameworks for smart contracts and DeFi platforms further hinder widespread implementation. Additionally, cultural and institutional barriers in Indonesia's traditional economy, where conventional practices are deeply entrenched, pose additional obstacles [20], [24], [30]. Overcoming these challenges necessitates a multifaceted approach that combines technological innovation, policy reform, and active collaboration among stakeholders to foster acceptance and integration of blockchain solutions.

2.6 Theoretical Framework

This study is grounded in Transaction Cost Economics (TCE), which examines how organizational structures and technologies can minimize transaction costs [31]. Blockchain technology aligns with TCE principles by providing a decentralized and transparent system that reduces inefficiencies in economic exchanges. Additionally, the Diffusion of Innovation (DOI) theory by [32] is relevant in understanding the adoption of smart contracts and DeFi platforms. DOI highlights factors such as relative advantage, compatibility, and complexity as critical determinants of technological adoption.

Although there is extensive literature on blockchain technology and its applications in developed economies, research on its impact in traditional economies, particularly in Indonesia, remains limited. Additionally, empirical studies exploring the combined effects of smart contracts and DeFi platforms on transaction costs in these contexts are scarce. This study addresses this gap by providing quantitative insights into the role of these technologies in Indonesia's traditional economy. By building on existing knowledge and addressing this research void, the study contributes to the broader discourse on blockchain technology's potential to transform traditional economic systems, offering findings that can guide policymakers, practitioners, and stakeholders in leveraging these innovations for sustainable economic development.

3. RESEARCH METHODS

3.1 Research Design

This study employs a quantitative research design to examine the impact of smart contracts and decentralized finance (DeFi) platforms on transaction costs in Indonesia's traditional economy. The research adopts a descriptive and causal approach to explore the relationship between the independent variables (smart contracts and DeFi platforms) and the dependent variable (transaction costs). A survey method was used to collect data from individuals and businesses operating in traditional economic sectors.

3.2 Population and Sample

The population for this study includes individuals and businesses engaged in Indonesia's traditional economy, such as small-scale traders, informal market participants, and SMEs. The sample size consists of 60 respondents, selected through purposive sampling, a non-probability technique ensuring the inclusion of participants who meet the following criteria: (1) active participation in Indonesia's traditional economy, (2) familiarity with blockchain-based technologies or related financial platforms, and (3) willingness to provide accurate responses based on their experiences.

3.3 Data Collection

Primary data were collected using a structured questionnaire designed to measure respondents' perceptions of smart contracts, DeFi platforms, and their impact on transaction costs. Respondents rated their responses on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4 Data Analysis

The collected data were analyzed using SPSS version 25, employing several statistical techniques: (1) descriptive analysis to summarize the demographic profile of respondents and overall trends in the dataset, (2) reliability tests using Cronbach's alpha to assess the consistency and reliability of the questionnaire, (3) correlation analysis to examine the relationships between smart contracts, DeFi platforms, and transaction costs, and (4) regression analysis to determine the strength and significance of the impact of smart contracts and DeFi platforms on transaction costs.

4. RESULTS AND DISCUSSION

4.1 Results

a. Demographic Profile of Respondents

The survey involved 60 respondents from Indonesia's traditional economic sectors, with a demographic profile showing 65% male and 35% female participants. The majority (70%) were aged between 25-45 years, while 60% had a high school diploma, and 30% held a bachelor's degree or higher. In terms of economic activity, respondents were predominantly engaged in small-scale trading (40%), followed by farming (30%) and informal services (30%).

b. Descriptive Statistics

Descriptive statistics were calculated to summarize respondents' perceptions of smart contracts, DeFi platforms, and their impact on transaction costs. The results revealed positive perceptions, with smart contracts having a mean score of 4.23 (SD = 0.82), indicating their automation and transparency, and DeFi platforms scoring a mean of 4.17 (SD = 0.71), reflecting high perceived accessibility and cost-efficiency. Transaction costs received a mean score of 4.32 (SD = 0.63), showing strong agreement among respondents that these technologies effectively reduced transaction costs.

c. Reliability Analysis

The Cronbach's alpha values for the variables were 0.875 for smart contracts, 0.856 for DeFi platforms, and 0.894 for transaction costs, indicating high internal consistency and confirming the reliability of the survey instrument.

d. Correlation Analysis

The correlation analysis revealed strong positive relationships between the variables, with smart contracts and transaction costs showing a correlation coefficient of $r=0.783$, $p=0.000$, and DeFi platforms and transaction costs having $r=0.745$, $p=0.000$. These results indicate that higher adoption of smart contracts and DeFi platforms is significantly associated with reduced transaction costs.

e. Regression Analysis

A multiple regression analysis was conducted to assess the impact of smart contracts and DeFi platforms on transaction costs. The regression model was statistically significant ($F(2,574)=25.63$, $p=0.000$) and accounted for 62.3% of the variance in transaction costs ($R2=0.623$). The standardized beta coefficients indicated that smart contracts ($\beta=0.543$, $p=0.000$) and DeFi platforms ($\beta=0.465$, $p=0.000$) both significantly reduce transaction costs, with smart contracts showing a slightly stronger effect.

4.2 Discussion

a. The Role of Smart Contracts in Reducing Transaction Costs

The results highlight that smart contract play a critical role in reducing transaction costs in Indonesia's traditional economy. By automating agreements and ensuring tamper-proof execution, smart contracts eliminate the need for intermediaries and reduce enforcement costs. These findings

align with prior studies by [31], [33]–[36], which emphasized the efficiency and transparency of smart contracts in various sectors.

In Indonesia's traditional economy, where inefficiencies and bureaucratic red tape are prevalent, the adoption of smart contracts offers a practical solution. Respondents noted improvements in time efficiency, reduced disputes, and enhanced trust among transaction parties, which collectively contribute to lower transaction costs.

b. The Impact of DeFi Platforms on Financial Accessibility

DeFi platforms significantly influence the accessibility and efficiency of financial transactions, as reflected in the regression analysis. These platforms provide direct peer-to-peer services, reducing the reliance on traditional banking systems. Respondents particularly appreciated the lower fees and faster transaction processing times, which are critical for small-scale traders and SMEs.

The findings align with [1], [23], [24], who highlighted the inclusivity and cost-efficiency of DeFi platforms. However, the study also identifies challenges such as digital literacy and technological barriers, which must be addressed to maximize the benefits of DeFi in traditional economies.

c. Combined Effect on Transaction Costs

The combined implementation of smart contracts and DeFi platforms results in a synergistic reduction in transaction costs. This dual approach addresses multiple cost dimensions, including search, bargaining, and enforcement costs. For Indonesia's traditional economy, this offers a pathway to greater efficiency, competitiveness, and inclusion in the digital economy.

d. Barriers and Challenges

Despite the positive findings, the study identifies several challenges to adopting blockchain technologies in Indonesia, including limited technological literacy, with traditional economic actors lacking awareness and understanding of blockchain; infrastructure limitations, such as inadequate access to digital tools and reliable internet in rural areas; and an unclear regulatory framework, creating uncertainty regarding the legal status of smart contracts and DeFi platforms. These challenges underscore the need for targeted interventions, including education programs to enhance awareness, infrastructure development to improve digital access, and supportive regulations to provide legal clarity and foster adoption.

4.3 Implications for Policy and Practice

The findings have important implications for policymakers and practitioners. Policymakers should focus on developing clear regulations to ensure the legal recognition of smart contracts and DeFi platforms, creating a secure and trustworthy environment for users. Practitioners, on the other hand, should prioritize promoting awareness and implementing training programs to improve technological literacy, thereby encouraging the adoption of blockchain solutions across traditional economic sectors.

5. CONCLUSION

This study underscores the significant impact of smart contracts and DeFi platforms in reducing transaction costs within Indonesia's traditional economy. By automating processes and enhancing transparency, smart contracts mitigate inefficiencies related to intermediaries and enforcement costs, while DeFi platforms offer accessible and cost-effective financial services, reducing fees and improving transaction efficiency. The findings reveal a synergistic

effect of these technologies, collectively contributing to a substantial reduction in transaction costs. However, barriers such as limited digital literacy, inadequate infrastructure, and regulatory uncertainty must be addressed to fully realize their benefits. Policymakers are urged to establish clear legal frameworks and supportive regulations to foster trust and adoption, while practitioners should focus on educational initiatives and targeted outreach to enhance technological literacy and usability. These efforts are vital for effectively integrating blockchain technologies into Indonesia's traditional economy, paving the way for sustainable growth and development. This research contributes to the expanding discourse on blockchain applications in emerging economies, offering a foundation for future studies to explore broader implications and strategies for adoption.

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