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Abstract

Corruption is widely spread and not easy to avoid. Blockchain-based smart contract technology enables the opportunity to develop transactions in such a way that corruption should not be possible. In this paper, we develop and evaluate an arrangement based on blockchain-based smart contracts to avoid and reduce corruption. Smart contracts are used for buying and selling goods, in which the public must agree that the goods arrived and are used to contribute to the creation of societal value. Only then will the supplier be paid. Al transaction data is stored in a blockchain and opened to the public. In this way, the price of the good can be inspected to avoid unfair prices. The smart contract avoids the likelihood that corruption happen, and if it happens that it can be spotted.

Keywords: corruption, accountable, transparency, blockchain, smart contracts

I.   Introduction

Blockchain-based smart contracts can disrupt traditional governance structures by reducing bureaucracy through lower transaction costs and reducing moral hazard (Shermin, 2017). A smart contract is a programmed functionality that executes one or more parts of the legal contract (Kolvart, Poola, & Rull, 2016). Smart contracts can be applied in many different ways, with varying goals and circumstances (Lauslahti, Mattila, & Seppala, 2017). de Souza, Luciano, and Wiedenhöft (2018) propose that smart contracts can be used for all government payments as a way to increase transactions' transparency, as well as to avoid overbilling. Yet how smart contracts can be used in practice and its broader organizatonal implications are hardly explored.

A smart contract can be defined as "a mechanism involving digital assets and two or more parties, where some or all of the parties put assets in and assets are automatically redistributed among those parties according to a formula based on certain data that is not known at the time the contract is initiated" (Buterin, 2014, para. 2). A smart contract is a program that runs on the BC and has its correct execution enforced by the consensus protocol (Luu et al., 2016). A smart contract contains information about a deal and will only be executed if the conditions are validated by all nodes in the network (Luu et al., 2016).

The ledger itself is used by smart contracts that trigger transactions automatically when certain pre-defined conditions are met (Buterin, 2013). The rules in the smart contract define the conditions that need to be met before a contract is executed. The rules in the contract can be pre-defined, and agreement is reached by simply submitting if one agree. These contracts are formalized in machine-readable code and will be executed automatically when the conditions of the agreement are met (Glatz, 2014). Smart contracts can be used as a tool to avoid corruption by ensuring that contracts are only executed when all conditions are met. The blockchain features to ensure the transparency of the contract and the consent given. Furthermore, blockchains and smart contracts can reduce transaction costs by standardizing transaction rules and defining them in advance.

Blockchain-based smart contracts introduce new ways of aligning interests in a decentralized way (Tapscott & Tapscott, 2016). Suppliers will be incentivized to act according to the agreement because else no payment will occur. Due to the transparency, others can oversee what is happening. In such a situation, data, systems, people, and rules (Janssen & Kuk, 2016) make up the smart contract materiality. Smart contracts should be seen as complex assemblages of social and technical artifacts, human actors and sociomaterial routines enacted in the pursuit of reducing corruption.

Contracts are a very complex subject, provided they are the main way governments transfer money to other organizations, including private ones (de Souza et al., 2018). The goal of this policy-paper is to evaluate how smart contracts can be used to avoid and detect corruption

II. Literature Review

Several studies have examined the use of smart contract technology, notably blockchain and blockchain-based smart contracts, as a potential tool to combat fraud in public procurement (Weingartner, Batista, Kochli, & Voutat, 2021). Smart contract technology has a potential to support public government activities because of some benefits suchs as security, trust, stransprancy and collaboration (Pramod, Zachariah, & Salim, 2019). The literature review discusses the main advantages and challenges of using smart contract technology to tackle corruption, especially in the case of Indonesia. This section examines the literature related to these two factors: smart contract technology and control of corruption.

Krogsbøll, Borre, Slaats, and Debois (2020) study about the implemantiation of smart contract technology for a social benefit process from Syddjurs Municipality government in Denmark. The study developed a prototype implementation in the process of collaboration with a Danish Municipality. They found that the implementation of the collaboration provide some benefits such as integrity, direct collaboration and payments between the parties. Thus, the smart contract implementation in the public government need to be immutable and out of control from the government. On the other hand, the government have to change the laws, and provide a solution for the rare case when errors in the contract implementation result in unlawful behaviour.

In South Africa, provide an analysis of blockchain-based platform as feasible solutions to the problem of corruption in public procurement by providing a high-level review of the legal and practical issues that could prevent the use of such platforms (Williams-Elegbe, 2019). The paper give an illustration the decentralized nature of blockchain-based smart contracts as a possible feature to fighting fraud and corruption which is involving government party. The authors also talk about the legal problems with using a smart contract as a real contract, since there are no resources and there is no way to cancelling tender procedures or contracts.

Blockchain for public procuremet also introduced by government in Mexico. Public institutions, universities, and civil society organizations adopted a blockchain governance model as part of the Mexican solution. The Mexican Government created five smart contracts utilizing Ethereum to cover the following stages: government entities tendering registries, bidder's registration, bidder's prequalification process, the bidding process, and proposal assessment and selection. In the Seoul district of South Korea, the government devised a smart contract to increase the transparency and fairness of the review procedure.

III. Research approach

The study aims to evaluate how smart contracts can be used to avoid and detect corruption. This study uses a qualitative research approach to explore how smart contracts in Indonesia improve public service delivery and reduce corruption, especially for accountability transactions. The research method used in this study is a single case study via face-to-face interview and observation of the head of the village, society, and head of district at Tanjung Batu Village, south Sumatra-Indonesia. A case study allows for the investigation of a real issue within a defined context by utilizing a variety of data sources (Yin, 1994). A case study is "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident" (Yin (Yin, 2011), 1994 p.13).
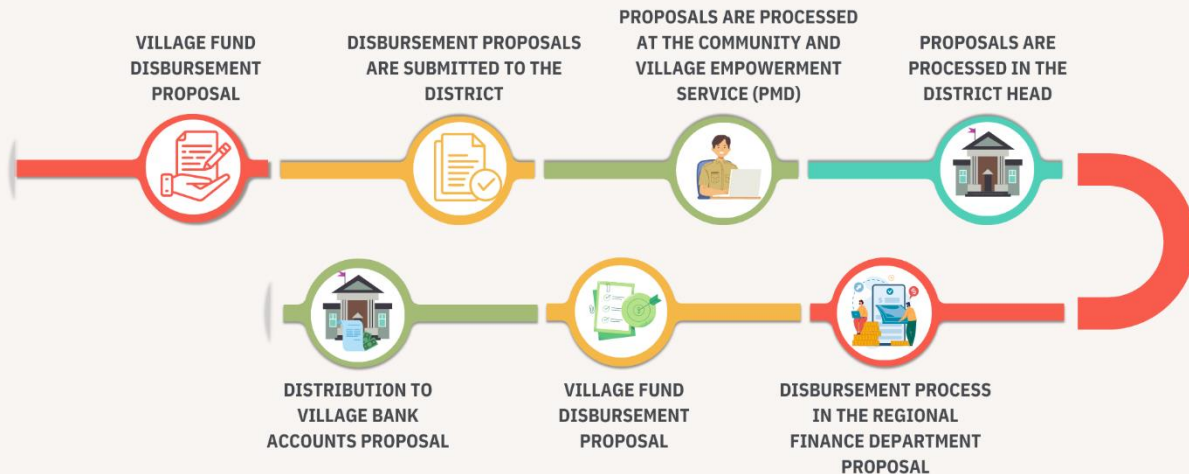
Additionally, Eisenhardt (Kathleen M Eisenhardt & Graebner, 2007)and Graebner (2007) stated that various data sources are used in a case study to examine an actual problem within a defined context (Yin (Yin, 2011), 1994). Using empirically supported case studies to generate theoretical constructs, propositions, or midrange theories is a common research method (Eisenhardt (K.M. Eisenhardt, 1989), 1989). A case study is an empirical description of a phenomenon based on various data sources (Yin, 1994). In addition, the case study is a comprehensive method that incorporates specific data collection and analysis approaches into the logic of the research strategy's design. In this study, the case study serves as a comprehensive research strategy to find the best answer to a specific research question, rather than just collecting data about the topic

Pilot case study: Village funds in Indonesia
Village funds are funds sourced from the state budget intended for villages transferred through district/city budgets and village funds are used to finance government administration, development implementation, community development, and community empowerment. Village funds are defined as funds originating from State Revenue and Expenditure Budget (APBN) which are intended for Villages which are transferred through the Regency/City APBD and are used to finance government administration, development implementation, community development, and community empowerment.

With the Village Fund, the source of income in each village will increase. Increased village income provided by the government to improve community service facilities in the form of fulfilling basic needs, strengthening village institutions and other activities needed by village communities which is decided through the Village Musrenbang (community forum in conveying aspirations, criticisms and suggestions from Government programs). However, the existence of the Village Fund also raises new problems, namely that not a few people are concerned about the management of the Village Fund. This is related to the condition of village officials who are considered to have low quality human resources, and the community is not yet critical of the management of the village revenue and expenditure budget (APBDesa) so that the form of supervision carried out by the community cannot be maximized.

Distribution of Village Funding in Indonesia

VILLAGE FUND DISBURSEMENT PROPOSAL

DISBURSEMENT PROPOSALS ARE SUBMITTED TO THE DISTRICT

PROPOSALS ARE PROCESSED AT THE COMMUNITY AND VILLAGE EMPOWERMENT SERVICE (PMD)

PROPOSALS ARE PROCESSED IN THE DISTRICT HEAD

DISTRIBUTION TO VILLAGE BANK ACCOUNTS PROPOSAL

VILLAGE FUND DISBURSEMENT PROPOSAL

DISBURSEMENT PROCESS IN THE REGIONAL FINANCE DEPARTMENT PROPOSAL

Distribution of Village Funds is carried out in stages, with the following conditions:

- The Village Head submits the Village Fund disbursement file to the sub-district head
- The sub-district head, as the head of the District Village Fund Facilitation Team, verifies the Village Fund disbursement documents, including the following matters
- After being declared eligible by the District Village Fund Facilitation Team, the Head of the District Village Fund Facilitation Team makes a Letter of Recommendation to the Regent
- The Head of the Community Empowerment and Village Administration Service as Chair of the District Village Fund Facilitation Team issues a letter of recommendation for disbursement of Village Funds to the District Head Cq Head of the Financial and Asset Management Agency
- The Head of the Regional Financial and Asset Management Agency, on behalf of the Regent, carries out the transfer from the Regional General Cash Account to the Village Treasury Account
- After receiving the Village Fund book transfer from the Regional General Cash Account, disburse it to the Village Cash Account.

While the objectives of Village Fund Allocation are:
- Overcome poverty and reduce inequality.
- Improving the quality of development planning and budgeting at the village level and empowering village communities.
- Encouraging the development of rural infrastructure based on justice and local wisdom.
- Improving the practice of religious, social, cultural values in order to realize an increase in social welfare.
- Improving services to rural communities
- Encouraging increased self-sufficiency and mutual cooperation of village communities.
- Increase the income of villages and village communities through Village Owned Enterprises (BUMDes).

Use of the Village Fund Allocation received by the village government 30% of the village fund allocation is used for village government operations in financing village operations, BPD operational costs, operational costs for the village fund allocation organizing team. Whereas 70% of village funds are used for community empowerment in the construction of village economic facilities and infrastructure, empowerment in the fields of education, health, community economic empowerment especially for alleviating poverty and financial assistance to heads of village community institutions, BUMDes, business groups according to the economic potential of village communities, as well as assistance finance to institutions in the village such as LPMD, RT, RW, PKK, Karang Taruna, Linmas.

Smart contracts Development and use

Smart contract requires first 1) the design of the smarte contract and thereafter 2) they can be impelemetned and 3) executed. IN the development of the smart contract, agreements that are acceptable need to be developed. The parties should agree on that the process will be like that and that they will do their part of the job and enter the data for the smart contract to be executed. In particular it was important that several people in the village would act as a kind of 'trusted party' for veryfying that the goods dould be deleiverd. This would require the following roles
1. Village financial officer: who provides the funds
2. Village procurement offier: who provides the name and description of the goods needed
3. Suppplier: who bid for and deliver the goods
4. Trusted party: who check if the goods are delivered and satisfay the quality critiera.

Secondly the contrac tneeds to be implementation and third excecuted.The working of a smart contract is prototype on the transfer of ownership of goods bought by the village. First the Villiage procurement officer provides the needed goods, includign the quality. Then suppliers can provide a quotation for the sellign and delivery of the goods. Then the supplier will be selected. This bidding process can also be automated in a smart contract in the future, but it is not.

The village house enters the sum of money that needs to be paid for the goods into a block. Only if the sellers confirm thta the goods are delivered, the village confirms that the goods are received, and one or more of the trusted and independent persons living in the village confirm that they have used the goods will the payment be processed and the transaction updated in the BC. Who those trusted and independent persons are should be defined in advance. Also it is possible to have a minimum number of people who agree on the receipt of the goods before the transaction is settled. This is the 'many eyes' that should ensure that the right product is actually delivered.

It the good is not transferred, then the money is given back to the village. The smart contract contains rules for the transaction that cannot be changed during the process nor interfered by one of the parties without the other one knowing. The smart contract might outline that others (trusted parties) have to confirm the transfer before the contract is executed to avoid dispute and ensure trust.

Smart Contract Benefits to Reduce the level of corruption

Utilizing technology to prevent or mitigate misbehavior is crucial when addressing corruption caused through frauds (Luciano, Magnagnagno, Souza, & Wiedenhoft, 2020). Smart Contracts are a difficult topic given that they are the primary means by which governments transfer funds to other organizations, including private ones. A contractual agreement creates an agency dilemma, which might have two outcomes, according to economics. The first is a moral risk resulting from asymmetric information, which is the principal's inability to see and confirm the agent's conduct. The agency issue arises when one individual or entity (the agent) may make decisions for another (the principal) (Garen, 1994; Guston, 1996). The second disadvantage is an inadequate contract, which is a result of the parties' inability to anticipate all possible events that may arise throughout the duration of the contract. It may also occur due to asymmetric information between the parties, as one of them may not have access to all contract-related information (Ortner & Chassang, 2018; Volejníková, 2007). Therefore, knowledge for all parties is

required to mitigate the risks connected with contracts, and its lack might limit the parties' ability to trust one another. Lack of information can also contribute to corruption's spread.

Smart contracts can minimize asymmetric information since they are more transparent and self-executed, which implies that once they are created and in existence, all parties have access to their information. If one of them is a government body, the contract information should be accessible to the entire population. In addition, contracts cannot be altered fraudulently, which helps to the contracts' guarantees and declarations and reduces asymmetric knowledge. Among the Blockchain applications in public organizations, the transfer of funds from one government level to another or from the government to private companies, the governance and storage of bid contracts via Smart Contracts can be mentioned. Smart Contracts can be applied to all government payments to increase the transparency of transactions and prevent overbilling, assuming that contracts and bids are common methods for perpetrating fraud and misappropriating funds. In addition to an increase in information access and transparency, the self-execution feature of contracts can lower the costs of manual payments, as well as errors, delays, and the risk of fraud and misbehavior.

Smart Contracts are independent and carry out all activities without any assistance or interference from a third party, demonstrating unprecedented transparency, enhancing efficiency, and lowering vulnerabilities. As part of future research, it will be necessary to determine the hurdles to Blockchain adoption and its primary weaknesses, such as risks, difficulties, and issues to monitor. One of these difficulties is Blockchain's decentralized governance, which is a significant variable when contracts involving government and public money. According to Atzori [1], traditional methods of State authority, citizenship, and democracy might present diverse obstacles. This research aims to assess how smart contracts may be utilized to prevent and detect corruption.

With village crowdfunding based on blockchain technology, this technology is able to increase transparency and also public trust in village fund corruption cases that often occur in Indonesia. If we review the discussion that the author has attached above, that blockchain which has a decentralized nature will add transparency and also the control of village heads to be more open in working to serve the community. It's not only the village head who feels the impact, but the regional head also no longer needs to check the contents of actual reports from the village head which can often be manipulated and prone to criminal cases. Regional and central heads can also open a history of realization that has been spent by village heads in the blockchain network. In view of the potential results from social and cultural aspects, this blockchain-based village crowdfunding can be an example of the birth of cultivating honesty and increasing social justice which has long been buried in the foundations of the Indonesian nation. This blockchain technology can be used for positive things and can be used for the progress of a nation in building transparency in a country.

Evaluating the smart contract application

Advantages	description
Trust	Others need to confirm the transaction. This can be multiple persons to avoid that one person can be bribed to ensure that the blockchain is executed.

Transparency of product and payment	The amount of the payment and the goods are stored. In this way it can be evaluated if a fair price is given.
Transparency of parties	The parties who sign on behalf of the village, the supplier and trusted persons can be stored. The storage of trusted persons is a trade-off between privacy and vulnerability and transparency. Trusted persons
Reliability	The money is already transferred in advance by the village. So the seller does not have to worry about the getting the money. The village will get the money back if the transaction is not conducted and no money has been lost.
Immutable	Smart contracts are immutable. Uploading bytecode, executing a constructor function, and storing the code on the blockchain prevents updates. Contract execution is flexible.
Accurancy	The accuracy of smart contracts is proportional to the precision of the code. Smart contracts, which are built on blockchain, provide data immutability, allowing parties to make contracts without knowing each other and eliminating contract breaches or management errors.
Security	Smart contract security refers to the security principles and procedures employed by developers, users, and exchanges while engaging with or implementing smart contracts.
Efficiency	Using smart contracts in financial transactions can make them faster, more efficient, and less reliant on third parties like government and head of village. This improves creditworthiness and the integrity of business dealings.

.In the context of decentralized governance, settlement of disputes through smart contract execution is difficult to implement (Beck et al., 2018), since consensus building depends heavily on the individual incentives and interests of the actors (Zachariadis et al., 2019). Therefore, to resolve disputes, decentralized BBPs may offer community-based resolutions such as escrow accounts (De Filippi, 2017; Glaser et al., 2019). Alongside community-based trust, the technology also plays a role, as users have to trust in the underlying features of blockchain technology (Lustig and Nardi, 2015; Glaser et al., 2019)

Essential conditions is to have having Authentication, Authorization and Accounting (AAA) capabilities in place in order to develop the smart contract on the BCT. In the case of transfer of ownership, the conditions can be stored in the smart contract and once fulfilled, the transaction can be executed resulting in the registration of the new owner in the record. In this way fraud and corruption about assets can be avoided. Using such mechanisms in a smart contract can automate some intermediary roles of a notary in the buying and selling of real-estate, although important notary roles like drafting a contract and compliance checking and enforcing a contract cannot be automated by BCT. Research needed is need to fully understand the potential of these smart contracts and to avoid mistakes.

Conclusions

The effects on corruption will be evaluated in practice in further research. Smart contracts make it possible to prevent fraud because of the blockchain technology that can decentralize smart Ethereum contracts so that agreements that have been made can be fair with a high level of trust. The study intends to assess how smart contracts can be utilized for accountability transactions to reduce potential corruption in village funds in Indonesia

References

Buterin, V. (2014). DAOs, DACs, DAs and More: An Incomplete Terminology Guide. Retrieved from https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/

de Souza, R. C., Luciano, E. M., & Wiedenhöft, G. C. (2018). *The uses of the Blockchain Smart Contracts to reduce the levels of corruption: Some preliminary thoughts.* Paper presented at the Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review, 14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of management journal, 50*(1), 25-32.

Garen, J. E. (1994). Executive compensation and principal-agent theory. *Journal of political Economy, 102*(6), 1175-1199.

Guston, D. H. (1996). Principal-agent theory and the structure of science policy. *Science and Public Policy, 23*(4), 229-240.

Kolvart, M., Poola, M., & Rull, A. (2016). Smart contracts. In *The Future of Law and etechnologies* (pp. 133-147): Springer.

Krogsbøll, M., Borre, L. H., Slaats, T., & Debois, S. (2020). *Smart contracts for government processes: case study and prototype implementation (short paper).* Paper presented at the International Conference on Financial Cryptography and Data Security.

Lauslahti, K., Mattila, J., & Seppala, T. J. E. R. (2017). Smart contracts–How will blockchain technology affect contractual practices? (68).

Luciano, E., Magnagnagno, O., Souza, R., & Wiedenhoft, G. (2020, Apr 22-24). *Blockchain Potential Contribution to Reducing Corruption Vulnerabilities in the Brazilian Context.* Paper presented at the 7th International Conference on eDemocracy and eGovernment (ICEDEG), Buenos Aires, ARGENTINA.

Ortner, J., & Chassang, S. (2018). Making Corruption Harder: Asymmetric Information, Collusion, and Crime. *Journal of political Economy, 126*(5), 2108-2133. doi:10.1086/699188

Pramod, D., Zachariah, B., & Salim, T. (2019). Moving Beyond Paperwork: Blockchain in Public Sector. *Telecom Business Review, 12*(1), 50-55.

Shermin, V. (2017). Disrupting governance with blockchains and smart contracts. *Journal of Strategic Change, 26*(5), 499-509.

Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: how the technology behind bitcoin is changing money, business, and the world*: Penguin.

Volejníková, J. (2007). Asymmetrical information and corruption. *Scientific papers of the University of Pardubice. Series D, Faculty of Economics and Administration. 11 (2007)*.

Weingartner, T., Batista, D., Kochli, S., & Voutat, G. (2021). Prototyping a Smart Contract Based Public Procurement to Fight Corruption. *Computers, 10*(7). doi:10.3390/computers10070085

Williams-Elegbe, S. (2019). Public procurement, corruption and blockchain technology in South Africa: a preliminary legal inquiry. *Regulating Public Procurement in Africa for Development in Uncertain Times (Lexis Nexis, 2020)*.

Yin, R. K. (2011). *Applications of case study research*: Sage.