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A FRAMEWORK FOR BLOCKCHAIN BASED EFFICIENT SUBSIDY DISTRIBUTION IN INDONESIA'S ELECTRIC VEHICLE SECTOR

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Abstract. *In order to reduce the country's carbon emissions, Indonesia has massively begun to switch to electric vehicles in recent years. One of the steps is to supply endowments for the buy and transformation of electric vehicles to decrease fuel utilization for motorized vehicles. A few spectators addressed and questioned this arrangement since it was regarded uncertain and inclined to extortion. In this article, the creators survey the challenges and shortcomings of the method of disseminating electric vehicle appropriations and look for to supply elective arrangements to cases inclined to extortion by making a secure system that can be guaranteed to reach the parties agreeing to the prerequisites. The creator analyzes a few strategies of conveying household and remote government endowments with qualified innovation concurring to their designation. The creator tries to do a few robotization of a few steps within the plan. The examination carried out utilizing blockchain innovation makes utilize of the most highlights of the blockchain and savvy contracts for its improvement. The creator depicts our proposed system and compares execution with existing advanced frameworks some time recently concluding with our future work.*

Keywords: *Blockchain; Subsidy: Electric vehicle; Policy;*

1. INTRODUCTION

The ever-increasing utilization of fossil power in Indonesia, the biggest economy in Southeast Asia, is one of the most contributing components to the issue of destitute quality that numerous cities confront (Amilia et al., 2022). Consumption of fossil fuels within the transportation segment is the main cause of the discharge of carbon dioxide (CO2) into the climate. This has an effect on worldwide and neighborhood climate changes that have never happened before (Sutopo et al., 2018). The vitality utilization for the transportation segment is anticipated to twofold within the coming years, which is exceptionally high in spite of the government's endeavors in advancing green energy and vitality preservation. The later increment in gasoline costs globally exacerbated the issue, requiring governments to supply more than IDR 110 trillion in vitality endowments within the coming years, imposing financial and natural challenges for both government and society. The fast progress of electric vehicles (EV) and their preferences over fossil fuel vehicles guarantee a potential arrangement to lighten the challenges postured by fossil fuels and accomplish a more vital, effective, and naturally neighborly transportation framework (Amilia et al., 2022). In expansion, a few thoughts have appeared about other benefits of electric vehicles, to be specific, that they can be utilized as vitality capacity in control frameworks. They can discharge vitality into the organization when required to adjust requests (Huda et al., 2019). With its slant of fast development all-inclusive, expanding ten times from less than half a million units in 2014 to around 4.79 million units in 2019, EV has gotten to be an alluring innovation to embrace on an expansive scale (Amilia et al., 2022). To fathom this issue, Indonesia is serious about switching from inner combustion motors to more naturally inviting electric

vehicles, a long-term objective bolstered by measures such as the issuance of Presidential Direction No. 55 of 2019, which incorporates motivating forces to empower the move (Candra, 2022).

And finally, in 2023, Indonesia officially implements subsidies for the purchase of electric vehicles for certain groups of people according to the conditions specified in the Regulation of the Minister of Energy and Mineral Resources of Indonesia Number 3 of 2023 and the Regulation of the Minister of Industry of Indonesia Number 6 of 2023 concerning Guidelines for Providing Government Assistance for the Purchase of Two-Wheel Battery-Based Electric Motorized Vehicles (Regulation, 2023). The policy of providing incentives for electric vehicles raises pros and cons that will have an impact on the economy. This policy has drawn controversy from the public, so much so that many oppose it in the midst of a developing country's economy after the COVID-19 pandemic because it is felt to be inappropriate and is in a hurry to pass vital policies whose socialization is unclear in 2023. Government subsidy policies will always have opportunities for abuse. To ensure that it is properly enforced, it is essential to put in place a rapid verification system and track their records at every step of the process, from meeting the requirements for obtaining subsidies to activities after obtaining permits.In this article, we propose a framework for distributing electric vehicle subsidies with a blockchain system. We are trying to understand the mechanisms contained in government regulations and integrate the framework design with blockchain technology and smart contracts for automatic verification. This framework will help reduce the time-consuming verification process, minimize the possibility of mistargeting, reduce subsidy misappropriation, and can have an impact on increasing the enthusiasm of people who meet the requirements to take part in the program. The article is organized as follows: Section 2 describes the literature review, Section 3 describes the research methodologyand Section 4 describes the proposed framework in result and discussion.

2. LITERATURE REVIEW

Nations around the world are considering approaches with respect to the development of electric vehicles and have begun to respond to climate change. Since Indonesia is the 102nd biggest CO2 emitter globally, it is exceptionally imperative for the nation to reduce CO2 outflows within the transportation segment, which accounts for around 28.4% of total outflows (Choi et al., 2022). The advancement and selection of electric vehicles is considered a successful way to address vitality and natural issues (Lonan and Ardi, 2020). Seeing the condition and booming of the electric vehicle industry around the world, the government of Indonesia and car companies have started an introductory thrust so that electric vehicles can be utilized on a huge scale (Lonan and Ardi, 2020). A few thoughts about government arrangements around the world to advance EV appropriation, particularly pointed at buyers, In this case, an arrangement investigation of EV appropriation was conducted in driving EV markets, counting Norway, the Netherlands, and Sweden (Setiawan et al., 2022).

2.1 Blockchain

Blockchain innovation may be a conveyed database of shared public or private records or records of all computerized occasions that have been executed and shared among operators taking an interest in the blockchain. Its history can be followed to convey its record of innovation. Blockchain innovation differs from most existing data framework plans by joining four fundamental characteristics: decentralization, security, auditability, and brilliant execution (Saberi et al., 2019).On the blockchain, specialists make unused exchanges to include on the blockchain. These unused exchanges are broadcast to the network for confirmation and review. After the lion's share of hubs within the chain endorse this exchange, agreeing to pre-approved rules, this modern exchange is added to the chain as an unused piece. Records of those exchanges are kept at different disseminated hubs for security. In the interim, shrewd contracts, as a

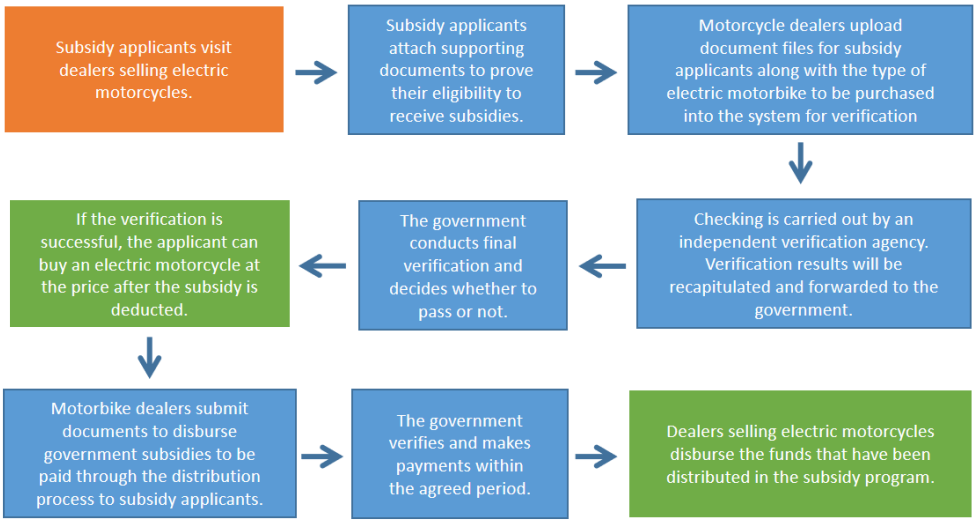
critical highlight of blockchain innovation, empower valid exchange execution without the inclusion of third parties (Saberi et al., 2019). Blockchain is essentially about actualizing security. Blockchain can be coordinated with different more secure framework generation strategies in terms of information capacity, and the combined utilization of blockchain innovation with IoT and AI can increment the security of information exchange forms within the framework (Khunaifi et al., 2023).

Over the years, several methods of verifying identity documents have been proposed. Methods such as signature verification and the utilization of biometrics such as fingerprints have been talked about in depth (Pawar et al., 2021). The literature review shows that applying blockchain technology to supply chains can have a few preferences. For illustration, decentralized long-distance conveyance administrations through progressed advances such as blockchain increment straightforwardness, benefit quality, and believe within the coordinations industry (Mazumder et al., 2021). Blockchain technology encourages supply chain following and contributes to supportability, which can be an imperative advantage for today's supply chains (Saberi et al., 2019). In expansion, this innovation makes a difference in moderate dangers, particularly those related to middle-person mediations such as hacking, compromised protection, political arrangement chaos, expensive compliance with government rules and controls, money-related institution insecurity, and contract debate. Other focal points of blockchain are diminished exchange costs, open straightforwardness, resource keenness, extortion location and avoidance, peer-to-peer networks, and superior arrangement fulfillment (Saberi et al., 2019). By applying the exchange-fetched hypothesis, Schmidt and Wagner investigate how blockchain can impact supply chain connections, especially in terms of exchange costs and forms of administration. They contend that blockchain can diminish administration costs by decreasing a few measurements of exchange costs, such as look and data costs, (re-)negotiation and bargain costs, and post-contract control costs. The application of blockchain can control artful behavior and diminish natural and behavioral vulnerability. And shapes of administration may focus on more market-oriented modes of administration (Schmidt and Wagner, 2019).

2.2 System Design Already Exists

The gasoline subsidy policy has become one of the hot topics in the DPR-RI. There have been efforts to reform energy subsidies since the 1980s (Akimaya and Dahl, 2022). This may clarify the government's cautious demeanor towards endowment arrangement changes. Time and time again, the Indonesian government attempted to pull back endowments as it were to face public clamor and, after that, have them repudiated (Akimaya and Dahl, 2022). In any case, the challenge of high electric vehicle prices will not be a huge issue in Indonesia within the future because Indonesia has copious crude materials such as nickel and cobalt, which are the most common components of electric vehicle batteries (Candra, 2022).In its plans for electric motors, the government divides several schemes, namely a subsidy scheme for the purchase of new electric motors and subsidies for the conversion of fuel-powered motors to electric battery-based motors (Regulation, 2023). There are four entities for the subsidy for purchasing new electric motorbikes: the recipient of the subsidy, the government, an independent verifier, and a conversion repair shop or motor dealer. The mechanism is for subsidy recipients, conversion workshops, and motorcycle sales dealers to apply for layered verification from several independent verifiers to be able to participate in the subsidy program with several conditions contained in the regulations. After a purchase is made, the motorcycle sales dealer can make a claim for reimbursement for a discount from the government. Files from the seller will be verified and recapitulated by an independent verifier. Recap results that pass verification will be validated by the government in order to issue a payment decision letter based on a predetermined period (Regulation, 2023).

Initial Draft Based on Government Regulations



Source: (Regulation, 2023)

Fig.1 Draft Based on Government Regulations
(Green = the subsidy has reached the entity)

2.3 Problems

Based on the explanation of the scheme plan above, it certainly requires a fairly lengthy process so that the community as subsidy recipients and conversion sales/workshop dealers can benefit from the subsidy and allows data manipulation in a centralized information system, which makes the verification process difficult and increases price markups from dealers and repair shops to electric motor components.

Various data security issues such as confidentiality, integrity, availability, and implementation solutions are possible using private blockchain smart contracts in several fields (Bakare et al., 2021). For privacy, the solution is a private blockchain network; for integrity, the solution uses a hash-chain structure for verification over the blockchain network; and for availability, the solution is to store transaction data (hashes) in tamper-resistant smart contracts (Bakare et al., 2021). For the benefit of the technology, blockchain barriers and challenges can be overcome by efforts by government research funds to encourage digitization (Bakare et al., 2021). In particular, blockchain has been identified as a promising solution for various operational challenges, including counterfeit control and supply chain transparency (Zhong et al., 2023). Evidently, the provision of subsidies is an important method adopted by the government to support the development of new technologies and industries. For companies or consumers, quantity subsidies are a type of compensation for making or buying a product per unit that adopts a new technology (Zhong et al., 2023).

3. RESEARCH METHODS

To create a design framework, this study used a qualitative multi-methods methodology that combines case studies with in-depth reading (Baharmand et al., 2021). Qualitative approaches were selected because they are appropriate for comprehending complex systems and formulating hypotheses and links since this research wants to explore in depth the difficulties of creating the process of providing subsidies to communities.

We analyze system designs that have been made in government regulations, focusing on the stages that take a long time. Group these parts and start planning to verify them with smart contracts so that all data changes can be traced. Trying to

analyze the stages that allow fraud and corruption to occur during the distribution process with blockchain technology We design so that the government can monitor the progress of the distribution of electric vehicles so that it doesn't take too long by trying to design several case studies in the field of supply chain.

4. RESULTS AND DISCUSSION

The essence of our proposed system is implementing transparency, traceability, and placing smart contracts on a distributed platform that supports blockchain for the storage of results.

4.1 Entities on the system

There are four main entities in this system: subsidy recipients (according to conditions), motorcycle sales dealers as executors, an independent verification team appointed by the government, and several government officials to oversee this process. Blockchain technology tries to shorten processing times and prevent illegal data manipulation with traceability.

4.2 The proposed framework

The proposed system with blockchain aims to facilitate traceability, data security, and transparency in subsidy program audits, as can be seen in the image below. This scheme makes it possible to minimize price manipulation by individual motorbike dealers and target recipients of subsidies that are right on target by managing it in a system, almost like a market place, so that subsidy applicants and motorbike dealers do not meet face-to-face and the list of electric motorbikes registered by dealers remains under government supervision so that they can monitor prices. The list of subsidy recipients is provided by the government with the latest data that meets the requirements. Smart contracts will help speed up verification, thereby avoiding repeated processes at one stage. If the new applicant's submission data meets the requirements but the data in the system is different, an additional verification will be carried out. In addition, the blockchain was chosen because of the robustness of the data; illegal persons cannot easily change the data managed by the blockchain system because every change will be recorded so that if there is fraud, it can be easily tracked.

A Framework Design is Proposed to Subsidize Electric Vehicles with Blockchain Technology

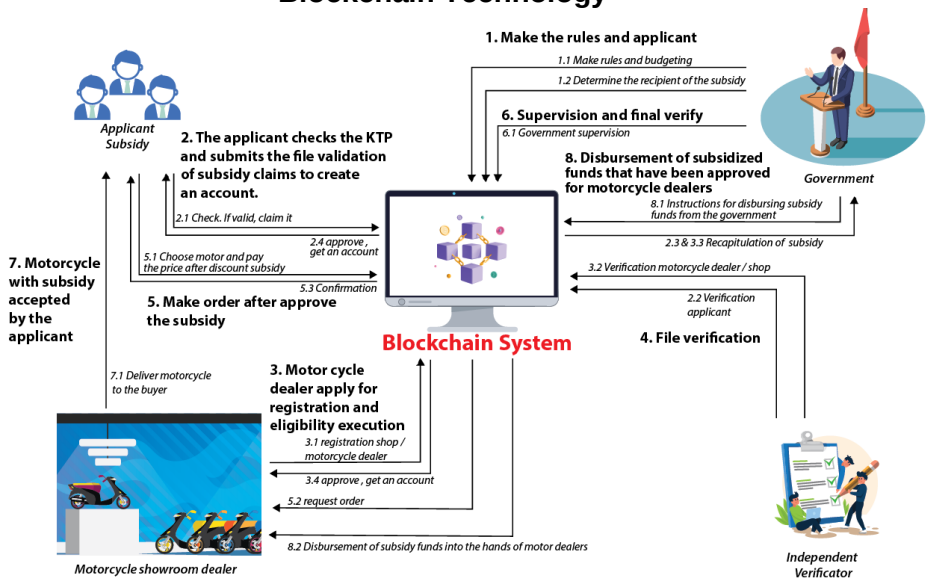


Figure.2 Overview of the Blockchain-based electric vehicle subsidy distribution system

This verification system contains the applicant's privacy data, so a system is needed that can guarantee confidentiality and avoid hacking with a blockchain solution with the on-chain method of several nodes. With a decentralized system with multiple nodes, hacking can be minimized because the blockchain has the resilience to only be hacked by hackers on multiple nodes simultaneously.

The following is an explanation of the framework design in Fig. 2. First, two entities that act as executors, namely the subsidy applicant and the motorcycle dealer, will register (the applicant must check the validation of the ID listed on the subsidy recipient) and verify their respective documents to be involved in this scheme. This scheme is different from the initial design in order to avoid price manipulation and other things in the transaction process. This process already holds individual privacy data; blockchain can guarantee data hacking processes against privacy data. Second, the files uploaded by them will be verified by an independent verifier, and the smart contract will avoid repeated verification processes. Verification will be integrated with population data included in subsidy recipients. Blockchain will play a role here as a traceability mechanism for data manipulation by unscrupulous individuals. Traceability data cannot be deleted; it can only be added so that track records can be traced. Third, the results of this verification will be forwarded to the government as the recipient of the data recapitulation. The government will later be designed to be able to monitor the progress of subsidies because they will be implemented like a market.

Fourth, successful subsidy applicants can choose to make payments at the price after the subsidy is deducted. Like a marketplace, all types of electric motorcycle purchases can be tracked. Fifth, the seller of the electric motorcycle will accept the order after being selected by the applicant. Electric motorcycles will be sent to applicants. Sixth, once the applicant process is complete, sales data is recorded in the system in real time. Then, at a certain time, the government will instruct them to disburse subsidized funds to sellers within the timeframe stated in the regulations.

Blockchain-based electric vehicle fund distribution system architecture

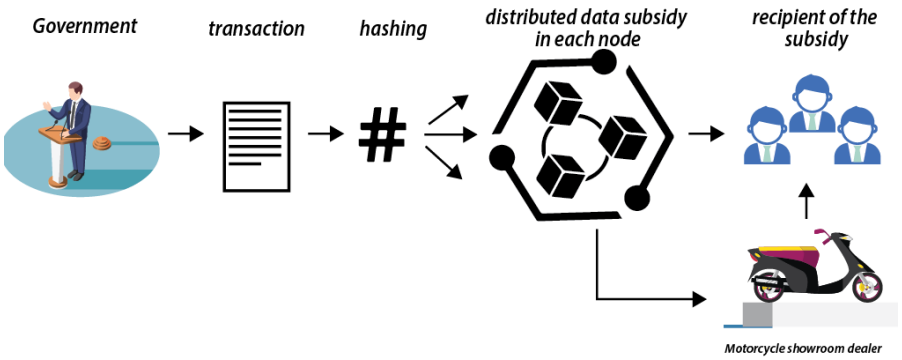


Figure.3 Blockchain-based electric vehicle fund distribution system architecture

The framework will create some blocks on the blockchain for transactions. One block hashes the previous block's hash data for cryptography. Then, the hashing utilizes some algorithms, such as SHA-1. Cryptographic hash functions are a kind of mark for text or data files with certain labels. These characteristics make cryptography and hashing stronger in terms of security. Then, the system stores hashing data on distributed nodes. Blockchain is an immutable and cryptographically secure digital distributed ledger.In peering, trust is the logical name for verifying nodes in a peer-to-peer network. Nodes that carry out transactions on a peer-to-peer blockchain network do not need to know the true identities of other nodes. These are referred to as blockchain trustless properties.

4.3 Benefit Analysis

In the plan, we propose blockchain as the main technology. Based on our analysis, there are benefits to this design. Here are some benefits, namely minimizing the occurrence of data hacking. Considering that this system handles a lot of public data, technology is needed that can guarantee that it can anticipate cyberattacks. Because the incoming data will be hashed and distributed to several nodes to validate the context, Second, prevent data settlements against data subsidies. Traceability is the advantage of blockchain, where data changes can be tracked by the system. Data stored on the blockchain cannot be deleted or changed; it can only be added so that any changes to the data will be tracked until it can be used. Third, the distribution process can be controlled in real time. With the marketplace concept, where the government's blockchain system is in control of transactions between dealers selling electric motorbikes and subsidy applicants. The availability of subsidized motorcycle quotas is limited because only a few types of motorcycles are eligible for the subsidy. Furthermore, increasing public confidence in the subsidy process Subsidies will always be a challenge for the government in this process. Corruption, cutting the value of subsidies, and other fraud affect the public's perception of subsidies from the government. With some of the benefits above, it can increase confidence in the government's performance in handling subsidies so that they are right on target..

CONCLUSION

This article discusses how Indonesia is preparing to enter a new era of massive transportation, namely by subsidizing electric vehicles for certain people who meet the requirements. Seeing that the subsidy process so far in Indonesia has not been optimal in the distribution process, we designed a vehicle subsidy distribution framework using blockchain technology with several main characteristics. The framework we propose provides great benefits such as transparency, traceability, cutting long distribution flows, and verification with smart contracts. The plan for the future is to increase the acceleration of file verification with smart contracts by integrating files with digital identity, not by manual file verification.

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