INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 13, Issue 5, (2023) E-ISSN: 2222-6990

Malaysia Zakat Smart Contract Architectural Framework Design

Noor Lees Ismail, Zakaria Ismail, Omar Musa, Chong Kim Loy

School of Information Technology, UNITAR International University, Kelana Jaya, Selangor.

Faculty of Business and Technology, UNITAR International University, Kelana Jaya, Selangor.

Email: lees@unitar.my, mc210413437@student.unitar.my, omarm@unitar.my, chongkl@unitar.my

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v13-i5/16991 DOI:10.6007/IJARBSS/v13-i5/16991

Published Date: *21* May 2023

Abstract

Malaysia's zakat management system has greatly improved as a consequence of its integration with digital technologies. This technological approach is much more controllable than manual processes. Nonetheless, there still exists the possibility for human interference in the zakat management system to manipulate this technology intentionally for their own interest. To ensure transparency, these shortcomings in zakat management transactions must be corrected from the point of collection to the point of distribution of zakat to eligible asnaf individuals who are qualified to receive zakat under Shariah law, such as fakir, miskin, amil, and mualaf. This limitation may be addressed by employing smart contracts, which are digital ledgers based on blockchain technology. A digital ledger works like a manual ledger, but with a higher degree of security, making any manipulation of zakat management data impossible. This major concern spurred a thorough investigation into the aforementioned issues and public complaints about the present Zakat management system in general. However, the research is restricted to the issues of zakat management in Malaysia. To resolve this issue, an investigation into existing smart contracts proposals and applications used around the world is analyzed to adapt it to suit current and future demands for technology-enhanced zakat management. An architectural framework based on an upgraded smart contracts model is then proposed that may be used to improve Malaysian zakat management systems. This approach is confined to the construction of an architectural design framework, but it also seeks to plan and prepare for future development, which will involve the production of prototypes and proofs of concept for the previously constructed architectural design framework.

Keywords: Zakat, Blockchain Technology, Transparency, Smart Contract, Framework.

Introduction

Paying zakat, or almsgiving is one of the foundations of Islam's religion. Muslims who possess more than a particular amount of property in a calendar year must give zakat equal to 2.5 % of the value of their property. The minimal property ownership restriction is defined

based on the current price of pure gold weighing 85 grams as determined by the religious office or the Mufti's State Office (Zulkifli et al., 2021).

Zakat is an obligation imposed by Islam on any Muslim who possesses more than the permitted kifayah limit and satisfies the requirements that have been stipulated. Zakat is a sort of alms that differs from other types of charity. These mandatory alms must not only be contributed by a specific zakat giver who fits the qualifications but they must also be transferred to a specific zakat recipient known as 'Asnaf' as prescribed by Islamic law. Zakat is considered invalid if it is not paid to a qualified Zakat recipient. Unlike ordinary alms, where the giver and recipient are not bound by any restrictions. General alms givers may be among those who are obligated to pay zakats or non-obliged zakat givers, such as Asnaf or regular persons, including those who hold property of their own (Othman et al., 2020).

Zakat collected and paid to the zakat institutions is then distributed to eligible zakat receivers known as 'Asnaf' based on the conditions established by Islamic law. In this circumstance, an efficient and transparent zakat management system is required to ensure that the trust placed in it is correctly applied. Although zakat management has gone through several stages of improvement in terms of organizational structure, delivery system, and transparency of governance, there are still some limitations that need to be addressed in terms of zakat handling methods, particularly the accountability and trustworthiness of transactions in order to persuade zakat givers about its distribution. Because they have doubts about the authenticity of the zakat management, many zakat givers have chosen to provide zakat directly to the qualified Asnaf rather than via the zakat center (Mahmood et al., 2021).

According to this statement, it is critical that the zakat transaction be transparently documented so that the zakat issued legitimately reaches the qualified zakat recipient. Since zakat is managed by separate regulatory organizations in each state of Malaysia, the accuracy of transaction records is also necessary to avoid the repetition of zakat from the same persons. In other words, zakat recipients may petition for zakat from any state provided they match Asnaf's eligibility requirements (Obaidullah, 2016).

Systematic records tracks that are controlled and preserved centrally and shared among other zakat centers help counteract fraud received by zakat receivers due to flaws in the current legacy system. To solve and overcome this difficulty, the use of blockchain technology in the Zakat management system is advocated. Transparency in the management and distribution of zakat is important not only for giving zakat givers confidence to trust and make payments to zakat collecting centers but also for preventing public funds from being abused and participating in money laundering operations (Androulaki et al., 2018).

Hence, the purpose of this study is to investigate the inadequacies and deficiencies present in Malaysia's current zakat management system, which have resulted in a decline in the confidence of zakat contributors. Furthermore, the study proposes the development of a blockchain-based smart contract architecture framework specifically designed for the management of zakat in Malaysia.

Problem Background and Related Work

Despite the rising of zakat collections, accumulating funds are not being distributed properly and fairly. According to media articles, zakat fund exploitation is linked to zakat institution financial management, where the primary responsibility is to act as a conduit for zakat givers to collect and distribute funds to persons who are eligible to receive zakat. Such power abuse results in some people inside the organization embezzling funds for personal

benefit [6]. Evidence discovered diminishes zakat givers' confidence and trust in the credibility of the zakat institution's management efficiency, with an increasing number of zakat givers nowadays preferring to pay zakat directly to the asnaf and refusing the zakat institution's facilities due to the fund's mismanagement conflict (Abdul Ghani et al., 2021).

One previously undisclosed explanation has also been revealed: some people misinterpret the foundations of paying zakat and taxes, assuming that once taxes are paid, they are free from paying zakat completely. A conference was convened to clarify that zakat is required of Muslims in order to sustain the Asnaf, and that civil tax duties are waived and excluded for those who contributed to zakat institutions as a special dispensation from the Malaysian government (Johari et al., 2014).

In addition to the prior debate on the level of trust and confidence among zakat givers, this research emphasized the inefficiency of zakat distribution, where the disparity between zakat collecting and distribution indicates a flaw in the identification of qualified zakat recipients. These difficulties were discovered during the zakat aid application process, and the data recorded was discovered to have repeated entries in the system as a consequence of human errors, resulting in an uneven and unequal distribution of zakat aid money (Saad et al., 2016).

Many opinions on current research concentrate primarily on the long-term sustainability of funding allocations from various perspectives. Despite this, transparency is often recognized as a main cause of declining public trust and confidence, especially among non-profit organizations (Rangone & Busolli, 2021). Zakat institutions should participate in efficient and effective accounting methods to ensure smooth operations and improve the transparency and reliability of their zakat management system, restoring public trust and confidence in the zakat institution. As the world reaches the IR4.0 development phase, blockchain technology innovation may support the resolution of such conflicts, where the underlying issue impacting zakat organizations is the limited availability of a comprehensive ledger management system. Apart from integrating the system with smart contracts, a blockchain-based digital ledger applied helps to improve the existing zakat management system whilst also maintaining the traditional function of collecting and distributing zakat through the proper channel and avoiding human interference that can lead to corruption.

This research aims to design and recommend the most suitable and practical solutions to the issues and concerns raised by the public. The recommendations presented may be executed and implemented by the Zakat institution in order to restore public trust in the Zakat organization's management. Additionally, this suggestion may strengthen the governance of the Zakat management system in a more transparent and consistent manner.

Since many studies on zakat management in Malaysia have been conducted, there is still room for further exploration and in-depth research to improve Malaysia's zakat management system in accordance with the development of the fourth industrial revolution IR4.0 through implementing and adapting recent technology within the management sector as an addition to fulfilling the first and second sustainable development goals, particularly to address poverty in all aspects putting the focus on the poor.

Zakat is a financial aid initiative designed to help Asnaf improve their living circumstances, particularly in aspects like finance, health, housing, education, and so on. It is hoped that with such assistance, their living situations would improve, allowing them to move out of poverty and into a better life.

Blockchain Technology

A blockchain is a set of data stored in a ledger known as a block and each of these blocks is connected to each other in a network called a chain. Each of these consecutive blocks will contain a portion of stored encrypted information and a timestamp that acts as a serial key reference. Blockchain technology is a rapidly evolving technology and is implemented mostly in industries that involve valuable transactions. Blockchain technology is one of the fastest-growing technologies in recent years (Zainal et al., 2016). However, this technology is mistakenly known by the name of cryptocurrency and its original function is a medium exchange of digital assets such as bitcoin, Ethereum, and many more.

One of the earliest cryptocurrencies to use blockchain technology is Bitcoin, which has piqued the interest of various parties to learn more about the advantages of this distributed ledger system. This digital ledger has also been used in a variety of industries, including supply chain management, data management for electrical grids, real-time IoT operating systems, and suchlike (Nakamoto, 2008). Typically, the use of blockchain technology to record transactions is referred to as smart contracts. Cong and He (2019) noted that smart contracts are digital contracts that permit dependent conditions based on decentralized consensus and are often self-enforcing and tamper-proof. This smart contract records and preserve all transaction-related information using cryptographic security to avoid fraud. Protection of transaction data is crucial for audit or at least in the case of a transaction involving criminal activity.

The features of distribution and decentralization in smart contracts are an advantage that can ensure privacy-preserving on documents because they do not monopolize or owned by certain parties however can be accessed in a peer-to-peer blockchain network. This kind of freedom can guarantee the protection and preservation of the data contained in the smart contract. The transparency and authenticity of these stored transaction records not only aim to preserve their content but also to provide assurance to users of all records contained therein. Likewise, verifying from time to time by each block present in the network can prevent the data from being hacked or tampered by irresponsible parties (Kosba et al, 2016).

Key Concepts, Theories and Studies

A model for a zakat management solution using blockchain is presented in Figure 1 based on research by Hamdani (2020) where he recommended that the application of blockchain technology can be implemented in the recording of zakat transactions. The advantage of this technology he emphasizes is capable of recording transactions in a secured encrypted open decentralized ledger that can avoid the issue of errors and falsification of certain transactions. This transparency and openness will give the zakat givers a boost to trust the zakat management system because it is capable of avoiding mismanagement of funds handling.

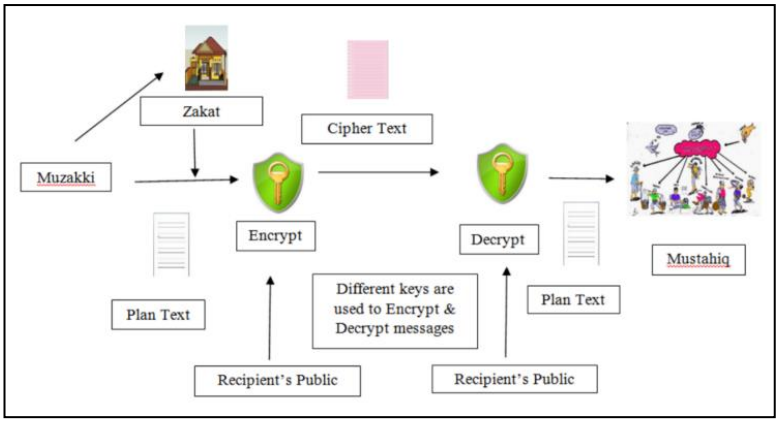


Figure 1. Blockchain zakat model.

The proposed structure illustrates the relationship between the zakat giver (muzakki) and the recipient (mustahiq also known as the asnaf). When a zakat giver deposits payment, their personal information, the total amount received, as well as nisab (limits) will be recorded in plain text in the current system. During the identification of the eligibility of zakat recipients, a similar process is also applied to the recipients' data. To maintain the security of this data, a blockchain-style ledger encrypted using ciphertext is implemented. In line with the fundamental concept of fostering transparency in zakat collection and distribution, the database is publicly available, ensuring that obtained amounts are distributed equitably.

Blockchain technology is one of the technologies that may be used to meet the requirements of this design framework since it offers the necessary encryption, transparency, public access, and decentralization. However, further research is needed to observe and uncover the use of blockchain technology that is suitable for adaption in this proposed design framework. The methodology disclosed by Hamdani is mainly focused on ensuring the security of data transmission by encoding and decoding exclusively on zakat transaction information using encryption technology based on two kinds of crypto keys. This information must be protected so that it cannot be modified by any unauthorized parties or activities such as data theft and espionage. In order to capture the information of zakat givers and recipients, a prototype based on smart contracts is constructed to show the process activities.

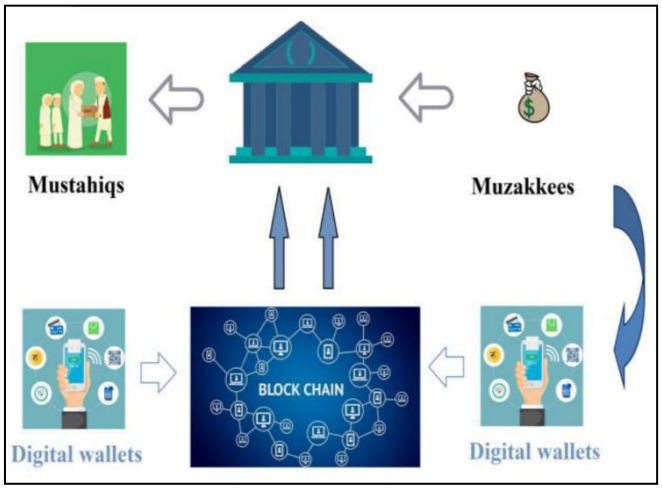


Figure 2. Zakat blockchain framework

According to Rejab (2020), a framework for zakat payment and distribution management that is incorporated into blockchain technology, as depicted in Figure 2 has been developed. Since most transactions today are digital, the usage of digital wallets is more easily accessible, and various digital wallet apps have been introduced and utilized in everyday transactions. This concept encourages zakat givers and recipients to use digital wallets at the same time it is easy to record all the personal data and financial transactions on the blockchain-based ledger. The only responsible left for the zakat institutions is to identify matches for eligible zakat recipients because zakat funds are completely controlled by a computerized system based on a digital wallet platform.

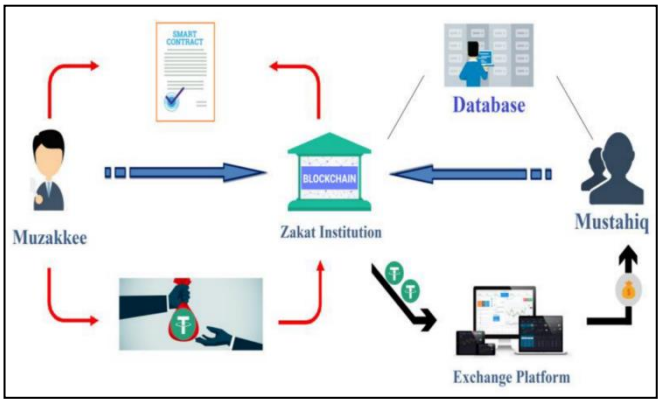


Figure 3. Zakat blockchain architecture.

His research further suggests that the architecture of the system as shown in Figure 3 can be implemented into a zakat management system whereby each zakat giver and receiver will have their own account created on the blockchain ledger. Transactions from zakat givers are stored through smart contracts and distributed to recipients accordingly. These transactions are recorded and logged within the Zakat institution database. The use of blockchain in these reception and distribution transactions will allow all transaction records to maintain its accuracy and transparency.

Rejab also emphasizes the use of tether as currency for zakat payment. This payment method requires the use of an exchange platform to convert fiat currency into tether cryptocurrency. Tether is a stablecoin that converts fiat currency into cryptocurrency with a value that maintained a fixed value that is equal to the value of the US dollar (1Tether/1USDT). It is encouraged as a cryptocurrency payment medium for zakat transactions since tether is one of the most traded currencies, making it one of the most suitable for the secure stablecoin (Eichengreen & Viswanath, 2022). In addition to documenting transactions, zakat institutions should have this cryptocurrency acceptance smart contract mechanism in place, to store zakat givers and recipients' data. The whole purpose of cryptocurrency is to prevent transaction duplication, particularly during the distribution phase.

Rejab's research is still in the conceptual phase and has not yet been realized, since it must be evaluated from an execution standpoint to establish whether it meets with the syariah compliance. No religious authority in Indonesia has yet to issue a statement recognizing cryptocurrencies as lawful and equivalent to fiat currency. This implementation must consider a number of factors, including a study of demand and the development of digital wallets that use cryptocurrency, smart contracts, and the practicality of leveraging tether as a currency in zakat-related affairs. In addition, users who are unfamiliar with the use of cryptocurrencies in their transactions are expected and required to do further investigation on cryptocurrency exchange standards. The application involving the integration of a digital

wallet and a cryptocurrency exchange should also be scrutinized since it does not specify whether the use of these two applications in the existing system or the overall development of these two applications in the proposed Zakat management system is presumed relevant.

This architectural framework design research is limited to the development of smart contracts in the existing Zakat management system. Integration of digital payment gateways and the exception of cryptocurrency wallets also has not yet been recognized as a legal currency in Malaysia (Statement on Bitcoin - Bank Negara Malaysia, 2014). However, as of today, Bank Negara Malaysia and the Security Commission Malaysia (SC) are currently reviewing cryptocurrency policies and procedures whereby they are permitting bitcoin storage as a digital asset (BNM and SC's Joint Response on "Policy Confusion over Cryptocurrencies" - Bank Negara Malaysia, 2020).

The adoption of cryptocurrencies as a digital asset is also thought to be gaining traction in Malaysia, with the establishment of four (4) Digital Asset Exchanges authorized by the SC, namely:

1. Luno Malaysia Sdn. Bhd.
2. MX Global Sdn. Bhd.
3. SINEGY Technologies (M) Sdn. Bhd.
4. Tokenize Technology (M) Sdn. Bhd.

This existence signifies the beginning of cryptocurrency storage's preparation and acceptability as a legal digital asset (List of Registered Digital Asset Exchanges - Recognized Markets (ECF, P2P, DAX, PCF and E-SERVICES), 2022). Therefore, the implementation of a cryptocurrency wallet is recommended as the next step of investigation.

A smart contract prototype integrated with the traditional Zakat administration system should is also suggested. Unlike the old central database, records of payments and disbursements are held in a smart contract and the present system's data will be fed into the proposed smart contract application. This solution is not intended to be a complete replacement for the current database, but rather to provide transparent transaction recording functionality with minimal modifications to the existing system. This prototype includes core features seen in most application systems that record financial transactions, such as creating a new record and editing and updating an existing record.

Comparison of Zakat Management in Other Countries

Table 1 shows the comparison of zakat institution that manages to collect and distribute in different countries namely Malaysia, Indonesia, and Egypt. The collecting and distribution of zakat varies between societies, particularly in Islamic countries. In Egypt, there are three offices that oversee zakat contributions. The donation office (maktab al-tabarru't) is responsible for collecting zakat funds from zakat givers and entering them into the central ledger system. Meantime, the intake office (abhth igtim'iyya) is responsible for registering and identifying the poor (fakir) and the needy (miskin). The distribution office (maktab al-sarf) will then distribute the zakat funds received by the donation office to qualified asnaf who have been recognized by the intake office. Based on how these three offices operate, the collecting and distribution of zakat seem to be more efficient and transparent since Egyptians emphasize that paying zakat is mandatory and brings blessings to their lives in addition to purifying their wealth. Their attempts to achieve sincerity and integrity in zakat distribution should serve as a model for any zakat institution's future direction since Egypt's zakat management system

acknowledges a framework of rights as understood by al-Ghazali and Sayyid Qutb, in which zakat distribution in the hierarchy between givers and recipients must be clear and not manipulated in order for individuals asnaf such as the poor (fakir) and the needy (miskin) to acquire their justified rights for charitable relief (Mittermaier, 2021).

Table 1
Comparison Zakat Management in Malaysia, Indonesia and Egypt

Country	Malaysia	Indonesia	Egypt
Zakat Office	Islamic State Council	Islamic Institution	Zakat Office
Management	Decentralized	Centralized	Centralized

While Indonesia, a sizable Islamic country with many prospects for zakat collection has laws and policies only address a fraction of the obligations of religious demands, such as hajj, halal and haram issues, Baitul Mal, as well as zakat management, where these necessities are assured by their government for the religious rights of its citizens. They emphasize that civil law should only enforce Islamic principles as much as they do not undermine one other.

Similar to the fundamental zakat management system in Egypt, the zakat management system in Indonesia relies on an Islamic institution to collect zakat money for eligible Asnaf through authorized zakat collectors (Amil). In recent years, however, there are being instances in which the Indonesian government has sought to include zakat funds into state income, provoking indignation from its citizens. In addition to paying regressive taxes, they must also make an annual zakat payment of 2.5% of their wealth. This violates their underlying principle, which holds that civil law has no jurisdiction to exploit Islamic practices for the goal of creating the nation's economy. In contrast to Malaysia, where zakat givers are exempted from taxes at the discretion of the Malaysian government's bequest.

As a result of this situation, many of its zakat givers prefer to pay zakat to traditional amils or distribute zakat themselves due to rising opinions against their government's manipulation of zakat funds and their concerns regarding transparency and accountability, where zakat distribution orientation is perceived to be counterproductive rather than efficient (Purbasari, 2018).

Problems in Zakat Management

When the globe was afflicted by a pandemic, the global economy started to suffer and shrink, and financial demands became a critical element for a few needy individuals throughout the world. Their government has provided different forms of financial relief, including zakat, to impacted Muslims. According to one study, Islamic countries, particularly the United Arab Emirates, Saudi Arabia, Qatar, and Iran, are the leading contributors to humanitarian emergency response programs in their respective countries to assist their populations survive the pandemic. However, it is reported that financial aid management lacks transparency and control over the compensation distribution, with some researchers believing that the initiative is only a cover for their governments to avoid the misuse of charitable donations to fund violent extremism. In these circumstances, untraceable and uncontrollable for these types of funds are more likely to attract criminal activity especially illicit transactions and money laundering (Akram et al., 2021).

Method of Determining the Recipient of Zakat

Computing the Basic Needs Deficiency Index (BNDI) based on the Poverty Headcount Rate (PHR) and the GINI coefficient (GC) assists in identifying the condition of poverty and determining eligibility for Asnaf. Aside from determining which areas have the highest concentrations of poverty, this accurate and valuable information is especially useful for channeling zakat funds to those Asnaf. This indexing method may also impose a budget on a certain Asnaf to pay the majority of their living expenses. This innovative approach supports in the measurement of poverty reduction by focusing on three major determinants: poor families' consumption of basic necessities, government control on zakat, and the number of zakat recipients. The proven effectiveness of the BNDI may be used to evaluate the performance of institutions whose zakat distribution is integral to the national goal of reducing poverty and inequality (Abdullah, 2015).

Key Debates and Controversies

Blockchain technology is a new comparative development and is often associated with cryptocurrency. This situation gives a skeptical view among religious people to adapt this technology to zakat management. This is because there are various scholarly views regarding cryptocurrency law that lead to the rejection of this technology. An understanding needs to be explained to the clerics about the similarities and differences between blockchain and cryptocurrency as well as why this blockchain technology is among the best options for the management of zakat institution transaction records with the explanation of the advantages and disadvantages of blockchain technology (Ibrahim et al., 2021).

Smart Contract Overview

A smart contract is a programmed transaction mechanism that executes agreements such as payment, settlement, and secured enforcement without a mediator. It reduces hostile and inadvertent anomalies as well as the necessity for authorized intermediaries, hence decreasing fraudulent loss, adjudication, and various policy-related expenses. Smart contracts eventually may replace conventional contracts because they eliminate legal hurdles, reduce expenses, expedite contract execution, and enable the creation of new business models. The relationship between "smart contract" and "blockchain" was highlighted by the development of a distributed digital ledger whose major aim is to secure and transparently store data, hence fostering trust among participants. A smart contract on the blockchain allows parties to audit the contract's code to verify if it follows the agreed-upon conditions. Once registered, the contract is tamper-proof. The contract is then carried out in the same manner for all parties (Vigliotti, 2021).

The Linux Foundation initiated the Hyperledger project in 2016 as a collaborative effort to develop open-source blockchain technology. The project was developed in order to offer solutions and applications for a wide variety of industrial use cases. It is a private and permissioned blockchain platform with a scalable and adaptable architecture geared for commercial adoption via a collaborative and open-source software development strategy. More than 400 models, testable theories, and practical distributed-ledger systems in various sectors and use cases have utilized Hyperledger Fabric (Alketbi et al., 2020).

Another open-source programmable blockchain application is used to create electronic money, payments, and applications. It creates a peer-to-peer network that uses smart contracts to securely execute and validate application code, enabling participants to trade without relying on a trusted centralized authority called Ethereum. Smart contracts on

Ethereum are written in high-level languages and translated into bytecode. Developers deploy an Ethereum smart contract by sending a transaction to the null address holding the bytecode rather than the source. After a successful deployment, the contract address is generated. By sending a transaction to the smart contract's address, any Ethereum user may activate it. The smart contract function and parameters are provided through the transaction's data field. Smart contracts are executed by Ethereum Virtual Machine (EVM), a stack-based virtual computer (Chen et al., 2020).

Based on the comparative analysis of these two blockchain applications' characteristics, Hyperledger-based applications appear to be more appropriate for use in this research because they employ internal validation and verification mechanisms such as Certificate Authority and Membership Service Provider, as opposed to Ethereum, which uses EVM for blockchain validation and verification.

Smart Contract Implementation

Since Bitcoin was created on the basis of blockchain technology, cryptocurrency has provided a platform for decentralized finance systems to augment existing financial management institutions in order to construct a more decentralized, open, permissionless, and borderless financial system. Libra, one of the systems raised in addition to Ethereum and FinTech, is likely to be successful in building an open platform for decentralized finance while employing a decentralized governance and development structure.

The majority of these decentralized financial products are built on smart contracts with open-source code, allowing them to be openly assessed and developed, hence minimizing data imbalances and fostering permissionless innovation. Over time, as more businesses and investors are engaging with the decentralized finance movement to leverage an open financial system using blockchain technology, more credible uses of applications will emerge extensively. With such a revolution, the decentralized banking system aims to encourage open access, lower transaction costs, extend financial inclusion, and stimulate permissionless development (Chen et al., 2020).

During the rapid transmission of the COVID-19 virus, a solution was proposed to solve the challenges endured by healthcare systems to effectively and transparently manage voluminous patient medical records and associated logs. Ethereum is regarded as the leading solution due to the fact that the platform is an open-source smart contract that allows transactions involving a huge number of codes to execute themselves. The proposed solutions are viewed as convenient and reliable, particularly for registering and retrieving recorded data, particularly confidential data pertaining to COVID-19 infection (Batchu et al., 2022).

DApps, for instance, allow interaction with Ethereum smart contracts to monitor the transmission of COVID-19 in real-time, since the platform is easily accessible and determined by the reliably collected data from multiple sources and alleviates the forwarding of fabricated or altered data. Ethereum smart contracts and other oracle systems demonstrated the crucial significance and benefits of adopting blockchain technology for COVID-19 owing to the integral data encryption security mechanisms of blockchain technology (Marbouh et al, 2020).

Hyperledger and Permissionless Blockchain

Blockchain technology was the foundation of Bitcoin's success, and it has since captured the attention of every industry sector, including academia. There is no argument that Blockchain technology is the basis of cryptocurrencies, since data storage, monitoring, and transactions are all convenient and reliable. This technology has already been used in a range

of fields, including smart cities, healthcare, Internet of Things, supply chains, and 5G networks, among several others (Shalaby et al., 2020).

The technology of a permissionless blockchain enables users to exit or enter the network at their discretion and execute transactions. Bitcoin and Ethereum are both examples of permissionless blockchains. A consensus mechanism, such as proof of work (POW), is used to organize transactions, which are then verified before being utilized to build blocks. Permissioned blockchains are distinguished by the fact that nodes are known, acknowledged, and cryptographically authorized (Thakkar et al., 2018). The number of selected nodes is allocated to decrease consensus processing time due to built-in access control to accurately determine who may read a block, add a block, conduct transactions, and oversee involvement in the blockchain network (Khan et al., 2020).

Enterprise applications that require essential access control, on the other hand, are better suited to permissioned blockchain platforms such as Hyperledger and Corda, which were designed to aid organizations in using blockchain technology in their particular applications [5]. Hyperledger exceeded Ethereum in terms of scalability, throughput, execution time, and latency, according to research where greater throughput was attained with various transaction amounts (Pongnumkul et al., 2017).

Gaps in Existing Knowledge

The International Shariah Research Academy for Islamic Finance (ISRA) has taken a step forward in collaborating with SysCode Sdn. Bhd. to develop the ISRA-SYSCODE blockchain platform known as ZakatTech. However, until now this development is still in the research phase based on Technical Note 0.1 issued on 8 August 2019.

To date, there are no official reports on the progress or development of the solution on the framework and architecture regarding this project to be implemented in the future. Thus, the purpose of this research is to propose the application of smart contracts to register assets, track and record transactions, and validate workflow.

One study also reveals the establishment of a system called Backend Demo Zakat Blockchain, which was developed by a team of researchers from the Faculty of Science and Technology, Faculty of Economics, and Muamalat from Universiti Sains Islam Malaysia. This system was subsequently tested at the Zakat Collection Center, Federal Territory Islamic Religious Council's Zakat management system. Due to the time constraints of the study's execution, the installation and demonstration of this system are confined to the processing of zakat payments via the zakat counter. The objective of this research is to justify the hypothesis that a blockchain-based system can be as well implemented in the current Zakat management system by examining the zakat collecting center's operational manual. In view of this author's observations, the system has been demonstrated to track the transaction of zakat funds in a transparent manner, as opposed to the traditional approach, which relied on physical documents and human intervention, exposing the system to the possibility of latency, inefficiency, and abuse. As the current technological landscape includes the Industrial Revolution 4.0 (IR4.0), which envisions a future without intermediaries, the application of smart contracts suggests that this is the healthiest mechanism for enhancing the zakat management system since transaction execution is performed faster and more reliable. The establishment of a peer-to-peer transaction system based on a fully distributed system, including smart contracts, is a journal for all digital transactions or events that have been completed and shared by participants. Without human interference, centralized authority, or

third parties, every transaction executed cannot be manipulated in order to ensure data security (Khairi, 2021).

A comprehensive design architecture framework will strive to enhance the above-mentioned demo, which now includes an end-to-end process involving zakat management based on blockchain technology, beginning with payment, distribution, receipt, and recording using smart contracts that aim to reduce human interference in the collection and distribution process in order to strengthen the integrity and transparency of zakat affairs. This will raise public confidence in the transparency and dependability of the zakat management system while greatly expediting the distribution of zakat since the full procedure could be completed digitally.

The Zakat Blockchain Demo Backend developed has a very limited scope since it was only tested at the Federal Territory Zakat Collection Center and was initially confined to recording Zakat payments at early stages. The proven Demo has more room for growth and may be used throughout the entire zakat activities and process, spanning from zakat collecting to its distribution. However, further study should be performed into the evaluation of every zakat management system in different states so that zakat-specific smart contract applications may be coordinated and used extensively in all states.

In contrast to this research, the suggested smart contract is intended to consolidate and enhance the existing zakat management system into a more transparent and reliable application that zakat givers and receivers would be able to use to keep informed about the collection and distribution of zakat funds.

The implementation appears to require integrating with existing systems without affecting or changing the structure and processes of the existing zakat management system, but instead embedding the recorded information into smart contracts in which the public has access to view using a unique general account permitted entry as opposed to granting direct access to the actual databases, resulting in private data exposure that can lead to potential threats, security protocol breaches, and information leakage.

System Design

The Zakat Collection Center is one of Malaysia's major financial organizations and is regarded as an appropriate case research for suggesting a solution to the apparent ambiguity of its fund management system, which has been noted in numerous media sources. It is critical to have a system in place that assures accountability and efficiency so that funds are allocated and distributed in an equitable and fair manner. Since there is currently no zakat collecting center that has formed an effort in this area, the research focused only on the construction of an architectural design framework as an initial preparation phase for the application of smart contracts for zakat management in Malaysia. The construction of this architectural framework is expected to serve as a catalyst for other possibilities until the application of smart contracts in zakat management systems achieves substantial success and becomes a model system to follow.

Basic Process Flow

Zakat management is generally comprised of three primary parties: the zakat givers, the zakat institutions, and the zakat recipients. Figure 4 shows that a zakat institution that acts as an amil, and is responsible as a mediator to collect zakat funds from zakat givers and distribute them accordingly to eligible zakat recipients. This is a one-way process, as it has traditionally been practiced, and is vulnerable to manipulation by certain parties which is unknown to the

public's awareness except for what the zakat institution discloses. To address this issue, a smart contract application should be incorporated to optimize this process flow so that every transaction is documented transparently.

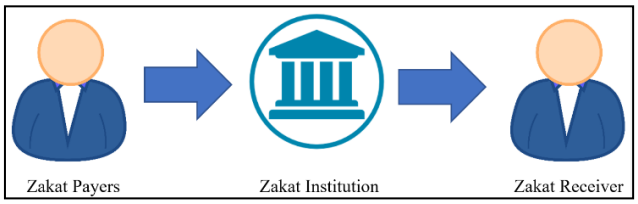


Figure 4. Basic process flow

Referring to Figure 5, smart contract features can be integrated into the existing management system to track all data involved in the institution's management of the zakat fund. All institution information, including revenues, withdrawals, updates, and so on, will be appropriately managed in the established system.

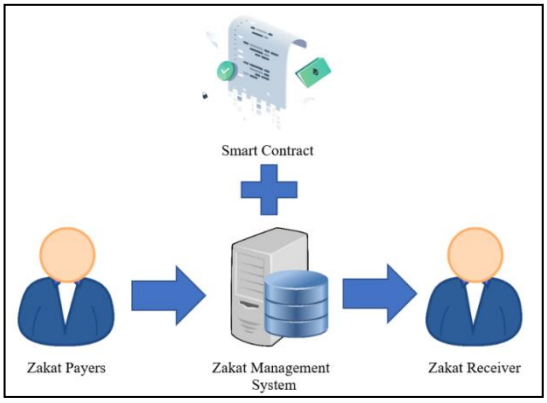


Figure 5. Process flow with smart contract

Architectural Framework Design

Figure 6 shows the purpose of developing a smart contract architectural framework. It is to address the issues that occur in the management of existing zakat systems wherein zakat funds can be deposited through a wide assortment of advanced payment gateways platforms such as bank transfer, credit card, direct debit, e-wallet, cryptocurrency, and other feasible mediums. When a transaction is completed, it is recorded in both the Zakat smart contract and the Zakat management system. With the potential advantages of a digitalized ledger, an unobstructed data stream from all payment gateways into the smart contract ensures the objective of preventing any manipulation and human intervention. Each transaction information transmitted to the Zakat management system is equitable to the records in the Zakat smart contract and serves as a hope of swerving away from any discrepancies. A matching process within the system is then carried out between the zakat givers and recipients in order to distribute the collected zakat funds appropriately, wherein the distribution data is transmitted via the chosen payment gateway to allocate funds to the qualified recipients' accounts. The system is maintained accountable and transparent by revising and auditing transactional information on a regular basis.

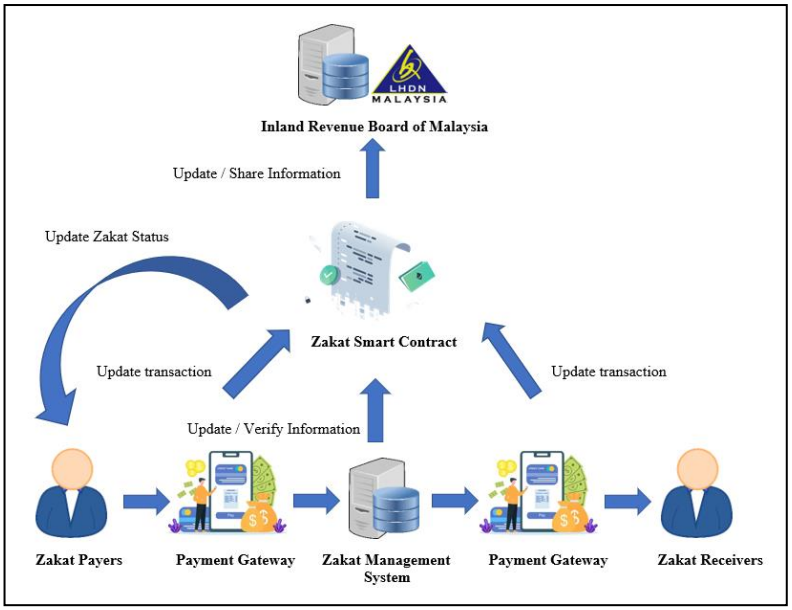


Figure 6. Smart contract architectural framework

Regular reports on documented transactions are made accessible to zakat givers in order to prevent any unfair practices while collecting and distributing zakat funds. All earnings and disbursements are recorded in the smart contract system, and the procedure in the system is validated to guarantee that the recipient is a qualified asnaf. This essential information is made public in order for zakat funds to be administered equitably and transparently, which helps to restore and enhance zakat givers' confidence in the zakat institution.

Zakat Smart Contract

In order to design and develop the smart contract, it is very important to identify the variables, attributes, and functions that will be used in the programming code. The variables are aimed to store the data that is used while running the programming code between functions, while attributes will store the permanent data into JSON data sets. The functions store programming code that will instruct specific tasks to smart contract applications that will manipulate the variables and attributes that feed to the application.

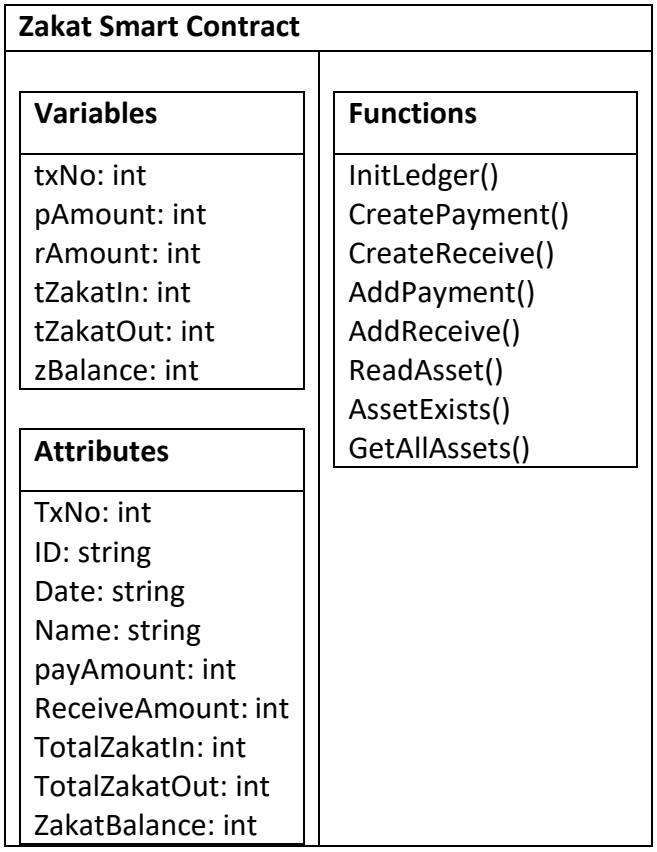


Figure 7. Zakat smart contract attributes and functions

The Zakat smart contract is intended to store important information for each Zakat giver's account. The smart contract system comprises multiple ledgers, as described in Figure 7, where all private and transactional data obtained is logged and stored on each of these blockchain networks. Every zakat giver will be issued their own account, enabling transaction records to be reviewed and managed in the same manner as a manual ledger would, with each transaction need to be validated and updated on its own account. Using blockchain technology keeps the digitalized account ledger secure and guarantees that the stored data cannot be tampered with to ensure data authenticity.

The proposed zakat smart contract system comprises nine (9) components for storing data that record matrices including Transaction No, IDs, Transaction Date, Name, Pay Amount, Receive Amount, Total Zakat received, Total Zakat Given, and Zakat Balance data. Beginning with the registration of the giver's and recipient's information, the zakat giver and zakat recipient data are recorded in separate accounts where the systems will capture their ID as a primary key. When the ID variable is successfully created, the ZakatGiver and ZakatRecipient transactions are recorded sequentially. This IDs enables the detection and prevention of duplicate transactions, implying that the identification key is the underlying cornerstone of this digital blockchain distributed ledgers technology.

To construct this smart contract, specialized functions like InitLedger(), CreatePayment(), CreateReceive(), AddPayment(), AddReceive(), ReadAsset(), AssetExists() and GetAllAssets() are employed. The primary function of InitLedger () is to initialize a new spread of ledger for a record on a single account. CreatePayment(), CreateReceive(), AddPayment() and AddReceive() are functions as manager transactions that contain variables to create the first ZakatGiver record, the first ZakatRecipient record apart from updating the zakat payment or acceptance by a particular person. The AssetExists() function is to check either the person has

been registered before. If the record exists, the system will add a transaction by referring to the previous ID recorded in the system in order to avoid duplication of IDs. The ReadAsset() function is responsible for displaying assets in a solitary transaction record, whereas the GetAllAsset () function displays the complete asset transaction contained in the smart contract ledger being used.

Implementation

Prior to the origin of blockchain technology, which has achieved widespread recognition in the technology industry, an architectural framework for revolutionary applications such as smart contracts is constructed and recommended for implementation in Malaysia in the near future. Many case studies suggested Malaysia would be ready to adopt, deploy, and adopt such blockchain technology by 2025 (Ismail & Haziq, 2021).

Since 2019, the Malaysian government has indeed initiated an effort to integrate blockchain and distributed ledger technology. Malaysian Industry-Government Group of High Technology is the agency that is entrusted to oversee its successful execution. This development is considered more favorable, with the Securities Commission Malaysia acknowledging the listing of Digital Asset Exchanges as an early milestone towards recognizing the application of digital currency based on blockchain technology (Securities Commission Malaysia, 2021).

Malaysia's official zakat institutions are one of the most renowned and active agencies in conducting and organizing regular seminars and conferences to raise the exposure of the importance and usefulness of this new technology. The seminars receive a large number of scholarly papers, critiques, and journal reviews on the application of this technology to integrate into the existing Zakat system in order to promote greater transparency, particularly in transaction activities. The Kedah International Zakat Conference (i-KEIZAC) (Lembaga Zakat Negeri Kedah Darul Aman, 2021) is one of those participating bodies that invite more than various speakers from across the world to propose ground-breaking ideas for zakat management in Malaysia.

As of 2020, the AZKA International Journal Of Zakat & Social Finance (AZJAF) published by the Federal Territory Islamic Religious Council in collaboration with the Zakat Collection Center (Pusat Pungutan Zakat, Majlis Agama Islam Wilayah Persekutuan, n.d.), likewise, has included several zakat-related journals, with several articles highlighting the role and advantages of employing digital money, cryptocurrency, blockchain, and smart contact within zakat management systems.

Based on these optimistic developments and advancements, the application of smart contracts for zakat management in Malaysia is feasible in the next coming years. Therefore, the construction of this architectural framework design is timely and essential as a first step toward its practical realization. In the next stage of research, this theoretical evidence is to be followed by pragmatic demonstration as a part of a proof of concept or prototyping processes. Integration and adaptation of this technology are necessary so that zakat management does not delay further behind comparable improvements in other industries.

Proposed Solution

Given that Hyperledger Fabric and Linux Distribution are both open-source and free software programs, they are employed to construct the smart contract for the usage of the Zakat fund management system. Since Hyperledger Fabric is one of the Hyperledger Project variants developed by The Linux Foundation, the software is an enterprise-grade blockchain software

project with the capabilities to fixate on conglomerate networks that connect a group of participants to expedite key proprietary business processes and transactions.

With this multilateral systems approach, supports are modular and adaptive across several industries and use cases. The Hyperledger ecosystem itself is diverse and evolving. Organizations can mix and match the technologies to strike a balance between security and efficiency, construct permissioned, permissionless, or hybrid networks, and interface with existing systems. Due to the fact that its technologies are open-source code bases as well as it is built with collaborative design and governance, organizations that adopt this have scalability in terms of size, complexity, effectiveness, and value. These deployments highlighted that blockchain, when properly built and deployed, provides exceptional improvements in speed, security, and transparency, assisting in fuelling confidence, boosting performance, and ensuring integrity, particularly in diverse multilateral systems.

In addition, Hyperledger Fabric technology offers cross-industry networks that eliminate dependency on centralized authority for transaction verification where it serves as a potent piece of software that ensures organizations, especially financial institutions, can collaborate on a safe and smooth network. Therefore, Hyperledger Fabric is considered a viable solution for building the smart contract application for the Zakat Institution in Malaysia since the application record transactions in a completely transparent which is accessible to all authorized network participants and allows to share of important documents through public or private channels.

Currently, Hyperledger Fabric support two (2) types of databases for storing the smart contract data named LevelDB and CouchDB. For these prototyping purposes, LevelDB has been chosen to store the JSON data.

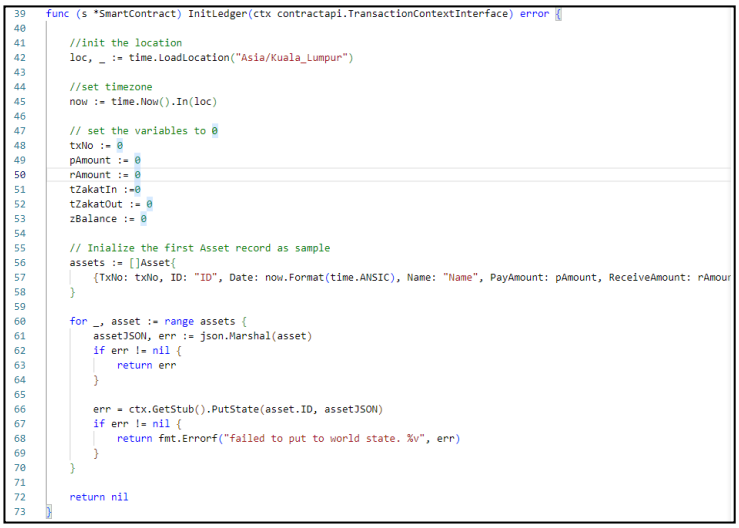
```
type Asset struct {
    TxNo              int     `json: TxNo`
    ID                string  `json:"ID"`
    Date              string  `json: Date`
    Name              string  `json:"Name`
    PayAmount         int     `json:"PayAmount"`
    ReceiveAmount     int     `json:"ReceiveAmount"`
    TotalZakatIn      int     `json:"TotalZakatIn`
    TotalZakatOut     int     `json:"TotalZakatOut`
    ZakatBalance      int     `json:"ZakatBalance"`
}
```

Figure 8. Smart contract structure

According to Figure 8, the smart contract construction starts with a framework of storing deciding attributes, such as the fields of TxNo, ID, Date, Name, PayAmount, ReceiveAmount, TotalZakatIn, TotalZakatOut and ZakatBalance. The explanations for each field are provided below

1. Field TxNo – to store the transaction number in ascending order.
2. Field ID – to store the zakat giver or zakat recipient's National ID for Malaysian or Passport Number for foreigners. This ID will be used as a primary key to avoid any duplication registration.
3. Field Date – to store transaction date and timestamp that capture from the system.
4. Field Name – to store the name for the respective ID that is registered in the smart contract.
5. Field PayAmount – to store the amount of zakat paid by the zakat giver.
6. Field ReceiveAmount - to store the amount of zakat received by zakat recipients.
7. Field TotalZakatIn – to store the total amount collected of zakat payment received by Zakat Institution from the zakat giver.

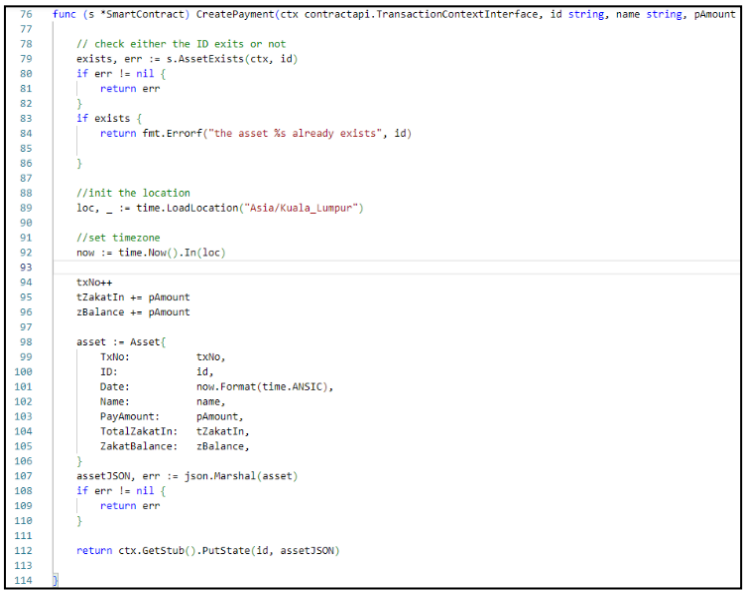
8. Field TotalZakatOut - to store the total amount disbursement of zakat given that received by the zakat recipient.
9. Field Zakat Balance – to store the current balance of zakat amount deduction of total amount collection from total amount disbursement.



```go
func (s *SmartContract) InitLedger(ctx contractapi.TransactionContextInterface) error {

    //init the location
    loc, _ := time.LoadLocation("Asia/Kuala_Lumpur")

    //set timezone
    now := time.Now().In(loc)

    // set the variables to 0
    txNo := 0
    pAmount := 0
    rAmount := 0
    tZakatIn :=0
    tZakatOut := 0
    zBalance := 0

    // Inialize the first Asset record as sample
    assets := []Asset{
        {TxNo: txNo, ID: "ID", Date: now.Format(time.ANSIC), Name: "Name", PayAmount: pAmount, ReceiveAmount: rAmour
    }

    for _, asset := range assets {
        assetJSON, err := json.Marshal(asset)
        if err != nil {
            return err
        }

        err = ctx.GetStub().PutState(asset.ID, assetJSON)
        if err != nil {
            return fmt.Errorf("failed to put to world state. %v", err)
        }
    }

    return nil
}
```

Figure 9. Initialize ledger

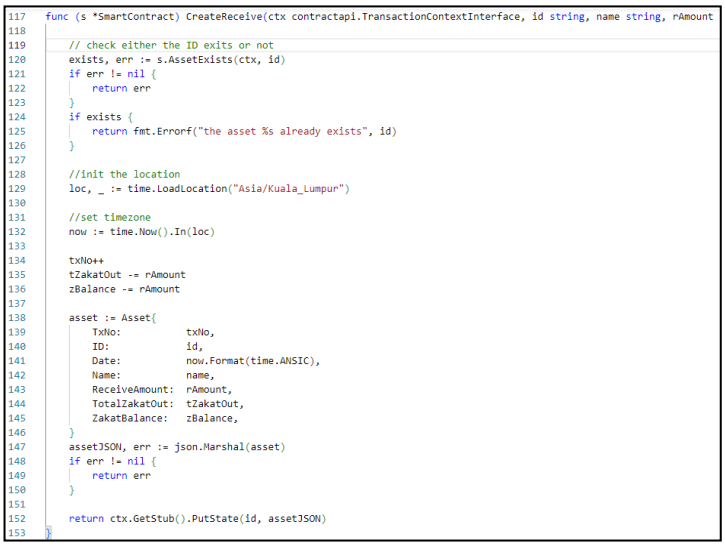
In this proof-of-concept prototype, transaction data is first entered to show the functionality of the ledger as shown in Figure 9. Based on the created fields, each ledger in this smart contract prototype then executes its corresponding functions. The initial ledger will consist of TxNo, PayAmount, ReceiveAmount, TotalZakatIn, TotalZakatOut and Zakat Balance that set with 0 value. Field ID and Name will set default as ID and Name. Field Date will capture the current machine date and time that is set as a reference to the timestamp of the record created. This transaction record, on the other hand, will clearly reveal the zakat management between the zakat giver and zakat recipient as well as the number of zakat funds involved.



```go
func (s *SmartContract) CreatePayment(ctx contractapi.TransactionContextInterface, id string, name string, pAmount

    // check either the ID exits or not
    exists, err := s.AssetExists(ctx, id)
    if err != nil {
        return err
    }
    if exists {
        return fmt.Errorf("the asset %s already exists", id)

    }

    //init the location
    loc, _ := time.LoadLocation("Asia/Kuala_Lumpur")

    //set timezone
    now := time.Now().In(loc)

    txNo++
    tZakatIn += pAmount
    zBalance += pAmount

    asset := Asset{
        TxNo:           txNo,
        ID:             id,
        Date:           now.Format(time.ANSIC),
        Name:           name,
        PayAmount:      pAmount,
        TotalZakatIn:   tZakatIn,
        ZakatBalance:   zBalance,
    }
    assetJSON, err := json.Marshal(asset)
    if err != nil {
        return err
    }

    return ctx.GetStub().PutState(id, assetJSON)

}
```

Figure 10. Create the first payment record

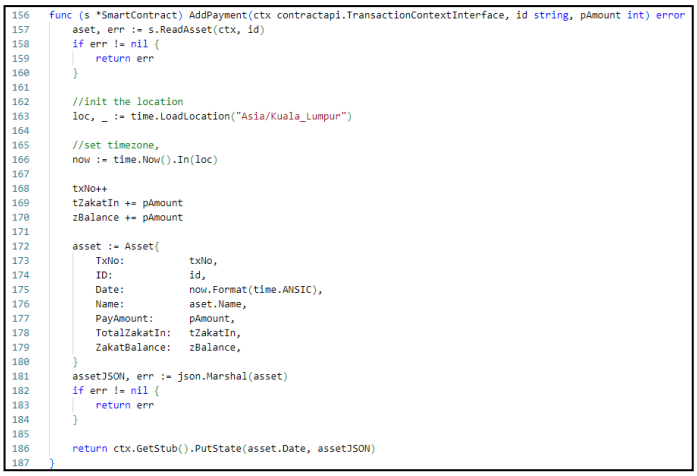
Figure 10 demonstrates how the CreatePayment() function registers new zakat payment transactions into the smart contract. Each newly recorded transaction will use an ID as the primary key. If the asset is duplicated while the transaction is being recorded, the system will send a notification to alert that the asset previously exists, based on the ID verification.



```
func (s *SmartContract) CreateReceive(ctx contractapi.TransactionContextInterface, id string, name string, rAmount

    // check either the ID exits or not
    exists, err := s.AssetExists(ctx, id)
    if err != nil {
        return err
    }
    if exists {
        return fmt.Errorf("the asset %s already exists", id)
    }

    //init the location
    loc, _ := time.LoadLocation("Asia/Kuala_Lumpur")

    //set timezone
    now := time.Now().In(loc)

    txNo++
    tZakatOut -= rAmount
    zBalance -= rAmount

    asset := Asset{
        TxNo:           txNo,
        ID:             id,
        Date:           now.Format(time.ANSIC),
        Name:           name,
        ReceiveAmount:  rAmount,
        TotalZakatOut:  tZakatOut,
        ZakatBalance:   zBalance,
    }
    assetJSON, err := json.Marshal(asset)
    if err != nil {
        return err
    }

    return ctx.GetStub().PutState(id, assetJSON)
}
```

Figure 11. Create the first disbursement record

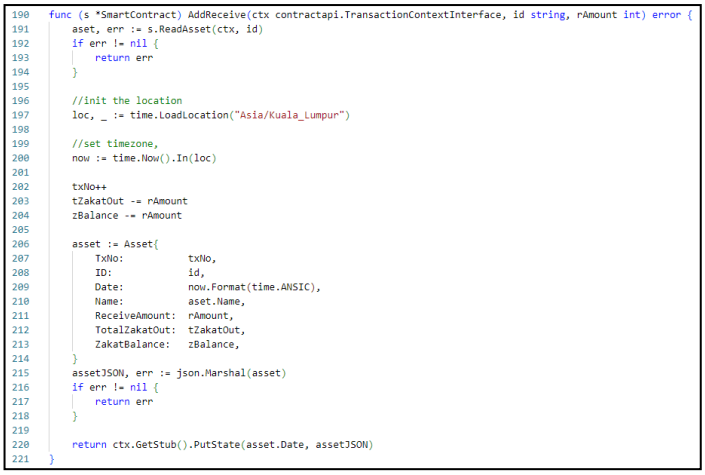
Figure 11 demonstrates how the CreateReceive() function registers new zakat disbursement transactions into the smart contract. Each newly recorded transaction will use an ID as the primary key. If the asset is duplicated while the transaction is being recorded, the system will send a notification to alert that the asset previously exists, based on the ID verification.



```
func (s *SmartContract) AddPayment(ctx contractapi.TransactionContextInterface, id string, pAmount int) error
    aset, err := s.ReadAsset(ctx, id)
    if err != nil {
        return err
    }

    //init the location
    loc, _ := time.LoadLocation("Asia/Kuala_Lumpur")

    //set timezone,
    now := time.Now().In(loc)

    txNo++
    tZakatIn += pAmount
    zBalance += pAmount

    asset := Asset{
        TxNo:           txNo,
        ID:             id,
        Date:           now.Format(time.ANSIC),
        Name:           aset.Name,
        PayAmount:      pAmount,
        TotalZakatIn:   tZakatIn,
        ZakatBalance:   zBalance,
    }
    assetJSON, err := json.Marshal(asset)
    if err != nil {
        return err
    }

    return ctx.GetStub().PutState(asset.Date, assetJSON)
}
```

Figure 12. Add payment record

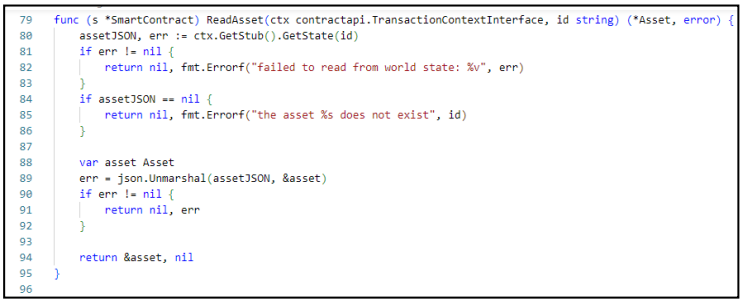
Figure 12 demonstrates how the AddPayment() function adds zakat payment transactions into the smart contract from the existing zakat giver.



```
func (s *SmartContract) AddReceive(ctx contractapi.TransactionContextInterface, id string, rAmount int) error {
    aset, err := s.ReadAsset(ctx, id)
    if err != nil {
        return err
    }

    //init the location
    loc, _ := time.LoadLocation("Asia/Kuala_Lumpur")

    //set timezone,
    now := time.Now().In(loc)

    txNo++
    tZakatOut -= rAmount
    zBalance -= rAmount

    asset := Asset{
        TxNo:           txNo,
        ID:             id,
        Date:           now.Format(time.ANSIC),
        Name:           aset.Name,
        ReceiveAmount:  rAmount,
        TotalZakatOut:  tZakatOut,
        ZakatBalance:   zBalance,
    }
    assetJSON, err := json.Marshal(asset)
    if err != nil {
        return err
    }

    return ctx.GetStub().PutState(asset.Date, assetJSON)
}
```

Figure 13. Add payment record

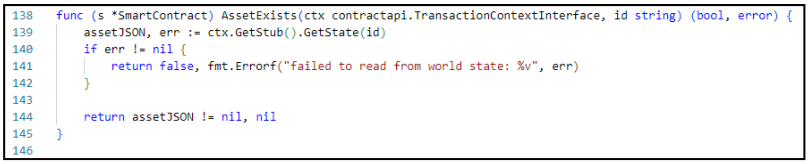
Figure 13 demonstrates how the AddReceive() function adds zakat disbursement payment transactions into the smart contract from the existing zakat recipient.



```
func (s *SmartContract) ReadAsset(ctx contractapi.TransactionContextInterface, id string) (*Asset, error) {
    assetJSON, err := ctx.GetStub().GetState(id)
    if err != nil {
        return nil, fmt.Errorf("failed to read from world state: %v", err)
    }
    if assetJSON == nil {
        return nil, fmt.Errorf("the asset %s does not exist", id)
    }

    var asset Asset
    err = json.Unmarshal(assetJSON, &asset)
    if err != nil {
        return nil, err
    }

    return &asset, nil
}
```

Figure 14. Read Asset

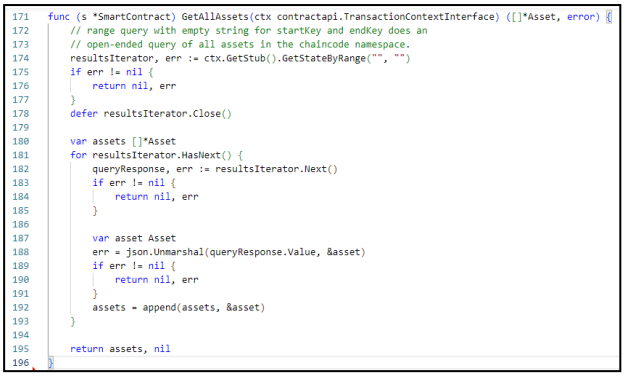
As much as it is comparable to the characteristic of registered ledger's transaction search tools, ReadAsset() features a function of displaying recorded transactions by entering the account's ID information as illustrated in Figure 14



```
func (s *SmartContract) AssetExists(ctx contractapi.TransactionContextInterface, id string) (bool, error) {
    assetJSON, err := ctx.GetStub().GetState(id)
    if err != nil {
        return false, fmt.Errorf("failed to read from world state: %v", err)
    }

    return assetJSON != nil, nil
}
```

Figure 15. Asset exists

Corresponding to Figure 15, the AssetExists() function notifies the system that the transaction input already exists in the system based on the previously created ID. This function is critical for preventing transaction ID duplication and serves as a protective mechanism in case of failure to generate similar ID.



```
func (s *SmartContract) GetAllAssets(ctx contractapi.TransactionContextInterface) ([]*Asset, error) {
    // range query with empty string for startKey and endKey does an
    // open-ended query of all assets in the chaincode namespace.
    resultsIterator, err := ctx.GetStub().GetStateByRange("", "")
    if err != nil {
        return nil, err
    }
    defer resultsIterator.Close()

    var assets []*Asset
    for resultsIterator.HasNext() {
        queryResponse, err := resultsIterator.Next()
        if err != nil {
            return nil, err
        }

        var asset Asset
        err = json.Unmarshal(queryResponse.Value, &asset)
        if err != nil {
            return nil, err
        }
        assets = append(assets, &asset)
    }

    return assets, nil
}
```

Figure 16. List all assets

As illustrated in Figure 16, the final function is GetAllAssets (), which aims to display all transaction records discovered in this smart contract ledger. This function may be used to provide a report detailing the whole transaction. With the creation of all of the described functionalities, zakat transactions utilizing smart contracts can be proven and demonstrated, establishing that the suggested architectural framework can be adopted and implemented. However, throughout the development of this prototype, only a small fraction of the whole development is built, and the following phase of exploration should require more details on this prototype to perform its best.

Prototype Smart Contract

In creating this prototype, the Go Programming Language is employed since it is one of the programming languages supported by the Hyperledger Fabric development environment due to its easy-to-learn syntax, which is almost identical to that of the C programming language. This may reduce the amount of time required to master this programming language for the development and demonstration of this prototype. In comparison to javascript and typescript, both demand more effort to comprehend and master the programming syntax and logic. This prototype is running on Virtual Machine on the Windows platform. Ubuntu is installed in the virtual machine to provide a development environment for Hyperledger Fabric installation.

Application Programming Interface (API)

To apply and effectively implement this smart contract, an API programme is required to interface the existing zakat management system with the developed smart contract. This is due to the fact that the purpose of this smart contract is not to replace the existing zakat management system, but rather to enhance the features of the existing system by allowing zakat management documentation to be recorded using smart contracts, thereby increasing the visibility of zakat management data. For all receiving, payment, distribution, and other procedures, the input is drawn from the system's existing database.

Conclusion and Recommendation

The result of this research is to contribute to strengthening the architectural framework to record transactions using blockchain technology in addition to solving existing issues. Furthermore, it is expected to help to improve the process of recording zakat transactions involving all parties as well as to improve the governance system of zakat institutions. This implementation can standardize the management of zakat institutions. With the

improvement of a managed transaction record system, this will restore public trust in zakat institutions.

Nevertheless, there are numerous restrictions, the most significant of which are time constraints. Owing to the relatively brief amount of time, the scope of the research had to be narrowed down so that it could be completed in the allocated time. In addition to the small sample size and restricted resources, the results of this research became rather concise and inadequate. As a result, the research is confined to only proposing a framework and proving the concept within a partial programming system since there is no complete prototype was developed as a testable demonstration system on the subject in this field. These several shortcomings and uncontrollable situations throughout the research have influenced the overall outcome of the research.

Among the recommended future work plans is to continue developing smart contract programming starting from the setup phase until the final completion in addition to integrating this system with other digital platforms such as electronic wallets and other digital banks. It is anticipated that follow-up research with relevant agencies should be undertaken in order to develop a full and complete prototype to assess the system's performance feasibility. With the advantages of machine learning technologies, incorporating artificial intelligence can help strengthen the existing blockchain system to perform automated matching processes where necessary information is mined or obtained through big data technology thereby helping the task of discovering and locating much more efficiently and conveniently.

References

Abdul Ghani, N. A., & Zakaria, A. (2021). Zakat and Islamic Banking Institution in Malaysia: A Review on Anti-Money Laundering Policy. International Journal of Zakat and Islamic Philanthropy, 3(1), 20–28. http://journal.zakatkedah.com.my/wp-content/uploads/2021/04/Vol.-3-Issue-1_20-28.pdf.

Abdullah, N., Mat Derus, A., & Al-Malkawi, H. A. N. (2015). The effectiveness of zakat in alleviating poverty and inequalities. *Humanomics*, *31*(3), 314–329. https://doi.org/10.1108/h-02-2014-0016.

Akram, M., Nasar, A., & Rehman, A. (2021). Misuse of charitable giving to finance violent extremism; A futuristic actions study amidst COVID-19 pandemic. Social Sciences & Humanities Open, 4(1), 100140. https://doi.org/10.1016/j.ssaho.2021.100140.

Alketbi, A., Nasir, Q., & Abu Talib, M. (2020). Novel blockchain reference model for government services: Dubai government case study. *International Journal of System Assurance Engineering and Management*, *11*(6), 1170–1191. https://doi.org/10.1007/s13198-020-00971-2.

Androulaki, E., Barger, A., Bortnikov, V., Cachin, C., Christidis, K., de Caro, A., Enyeart, D., Ferris, C., Laventman, G., Manevich, Y., Muralidharan, S., Murthy, C., Nguyen, B., Sethi, M., Singh, G., Smith, K., Sorniotti, A., Stathakopoulou, C., Vukolić, M., . . . Yellick, J. (2018). Hyperledger fabric: a distributed operating system for permissioned blockchains. Proceedings of the Thirteenth EuroSys Conference. https://doi.org/10.1145/3190508.3190538.

Baker, H. K., Nikbakht, E., and Smith, S. S. (2021), "Blockchain: An Overview", Baker, H.K., Nikbakht, E. and Smith, S.S. (Ed.) The Emerald Handbook of Blockchain for Business, Emerald Publishing Limited, Bingley, pp. 3-14. https://doi.org/10.1108/978-1-83982-198-120211003.

Batchu, S., Patel, K., Henry, O. S., Mohamed, A., Agarwal, A. A., Hundal, H., Joshi, A., Thoota, S., & Patel, U. K. (2022). Using Ethereum Smart Contracts to Store and Share COVID-19 Patient Data. Cureus. https://doi.org/10.7759/cureus.21378.

Chen, T., Li, Z., Zhu, Y., Chen, J., Luo, X., Lui, J. C. S., Lin, X., & Zhang, X. (2020). Understanding Ethereum via Graph Analysis. *ACM Transactions on Internet Technology*, *20*(2), 1–32. https://doi.org/10.1145/3381036.

Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, *13*, e00151. https://doi.org/10.1016/j.jbvi.2019.e00151.

Cong, L. W., & He, Z. (2019). Blockchain Disruption and Smart Contracts. The Review of Financial Studies, 32(5), 1754–1797. https://doi.org/10.1093/rfs/hhz007.

Eichengreen, B., & Viswanath-Natraj, G. (2022). Stablecoins and Central Bank Digital Currencies: Policy and Regulatory Challenges. Asian Economic Papers, 21(1), 29–46. https://doi.org/10.1162/asep_a_00843.

Ghazali, M. Z. (2016). Proposing Factors Influencing Trust towards Zakat Institutions amongst Moslem Business Owners. European Proceedings of Social & Behavioural Sciences. https://doi.org/10.15405/epsbs.2016.08.92.

Hamdani, L. (2020). Zakat Blockchain: A Descriptive Qualitative Approach. EkBis: Jurnal Ekonomi Dan Bisnis, 4(2), 492. https://doi.org/10.14421/ekbis.2020.4.2.1270.

Ahmed, I. T. A., & Zakaria, B. M. S. (2021). Using Blockchain for Managing Zakat Distribution: A Juristic Analytical Study. Al Hikmah International Journal of Islamic Studies and Human Sciences, 4(2), 1–25. https://doi.org/10.46722/hkmh.4.2.21b.

Johari, F., Ab. Aziz, M. R., & Ali, M. A. F. (2014). A Review on Literatures of Zakat Between 2003 - 2013. Library Philosophy and Practice. https://digitalcommons.unl.edu/libphilprac/1175.

Khairi. (2021). Teknologi Blockchain Berasaskan Kontrak Pintar dalam Memastikan Keberkesanan dan Ketelusan Pungutan Zakat. Siri Kajian Azka, 8(2021).

Khan, D., Jung, L. T., Hashmani, A. M., & Waqas, A. (2020). A Critical Review of Blockchain Consensus Model. 2020 3rd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET). https://doi.org/10.1109/icomet48670.2020.9074107.

Kosba, A., Miller, A., Shi, E., Wen, Z., & Papamanthou, C. (2016). Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts. 2016 IEEE Symposium on Security and Privacy (SP). Published. https://doi.org/10.1109/sp.2016.55

Marbouh, D., Abbasi, T., Maasmi, F., Omar, I. A., Debe, M. S., Salah, K., Jayaraman, R., & Ellahham, S. (2020). Blockchain for COVID-19: Review, Opportunities, and a Trusted Tracking System. Arabian Journal for Science and Engineering, 45(12), 9895–9911. https://doi.org/10.1007/s13369-020-04950-4.

Mittermaier, A. (2021). Non-compassionate care: a view from an Islamic charity organization. Contemporary Islam, 15(2), 139–152. https://doi.org/10.1007/s11562-020-00457-9.

Nakamoto, S. (2008). “Bitcoin: A Peer-to-Peer Electronic Cash System.” White Paper. Available at https://bitcoin.org/bitcoin.pdf.

Obaidullah, M. (2016). Revisiting estimation methods of business zakat and related tax incentives. Journal of Islamic Accounting and Business Research, 7(4), 349–364. https://doi.org/10.1108/jiabr-10-2014-0035.

Othman, S. H. B., Ismon, A. B. M., & Fahurruzi, M. F. (2020). The Study on The Development of Asnaf fisabilillah byThe Islamic Religious Council of Malacca. International Journal of

Academic Research in Business and Social Sciences, 10(2). https://doi.org/10.6007/ijarbss/v10-i2/6929.

Pongnumkul, S., Siripanpornchana, C., & Thajchayapong, S. (2017). Performance Analysis of Private Blockchain Platforms in Varying Workloads. 2017 26th International Conference on Computer Communication and Networks (ICCCN). https://doi.org/10.1109/icccn.2017.8038517.

Purbasari, I., Fauzan, E. M., & Azizah. (2018). Zakat in Indonesian State Treasury Funds: Its Potential Obstacle and Abuse. IOP Conference Series: Earth and Environmental Science, 175, 012200. https://doi.org/10.1088/1755-1315/175/1/012200.

Rangone, A., & Busolli, L. (2021). Managing charity 4.0 with Blockchain: a case study at the time of Covid-19. International Review on Public and Nonprofit Marketing, 18(4), 491–521. https://doi.org/10.1007/s12208-021-00281-8.

Rejab, D. (2020). Blockchain and Smart Contract Application for Zakat Institution. International Journal of Zakat, 5(3), 20–29. https://doi.org/10.37706/ijaz.v5i3.260.

Saad, R. A. J., & Sawandi, N. (2016). Factors Affecting and Means of Managing Zakat Surplus in Malaysia. International Information Institute, 16(8(A)), 3137–3142. https://www.researchgate.net/publication/310446201_Factors_affecting_and_means_of_managing_zakat_surplus_in_Malaysia.

Shalaby, S., Abdellatif, A. A., Al-Ali, A., Mohamed, A., Erbad, A., & Guizani, M. (2020). Performance Evaluation of Hyperledger Fabric. 2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT). https://doi.org/10.1109/iciot48696.2020.9089614.

Thakkar, P., Nathan, S., & Vishwanathan, B. (2018). Performance Benchmarking and Optimizing Hyperledger Fabric Blockchain Platform. Arxiv. https://doi.org/10.48550/arXiv.1805.11390.

Mahmood, T. M. A., Din, M. N., Al Mamun, A., & Ibrahim, M. D. (2021). Issues And Challenges Of Zakat Institutions Achieving Maqasid Syariah In Malaysia. AZKA International Journal of Zakat & Social Finance, 119–137. https://doi.org/10.51377/azjaf.vol2no1.46.

Vigliotti, M. G. (2021). What Do We Mean by Smart Contracts? Open Challenges in Smart Contracts. *Frontiers in Blockchain*, *3*. https://doi.org/10.3389/fbloc.2020.553671.

Zainal, H., Basarud-din, S. K., Yusuf, M. R., & Omar, S. N. Z. (2016). Managing Zakat Fund in Malaysia. Journal of Global Business and Social Entrepreneurship, 1(2), 46–53. https://www.researchgate.net/publication/312520688_MANAGING_ZAKAT_FUND_IN_MALAYSIA

Zulkifli, M. F., Taha, R., Awang, R. @ N., Nor, M. N., & Ali, A. (2021). Combating Poverty in Malaysia: The Role of Zakat. The Journal of Asian Finance, Economics and Business, 8(5), 505–513. https://doi.org/10.13106/JAFEB.2021.VOL8.NO5.0505.