# THE DEVELOPMENT AND APPLICATION OF THE ZAKAT COLLECTION BLOCKCHAIN SYSTEM

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## Abstract

Zakat in Islam has historically been a vital institution in fulfilling religious needs and social welfare. Its effectiveness in medieval and modern Islam is evident. However, this institution is seemingly not without inefficiencies. Ineffectiveness distribution process and lack of transparency in the zakat management are commonly cited as key impediments (bin Khatiman et al., 2021). Blockchain is expected to solve these issues due to its ability to record and trace every transaction, allowing administrators to discharge their accountability to zakat stakeholders. Thus, this study intended to develop a zakat collection blockchain system with the aim to provide economical and integrated continuous real-time zakat transactions, transparency and traceability by developing smart contracts in zakat management. The study employed four stages of process based on waterfall model starting from the interview session and analyse of the standard operating procedure (SOP) on zakat collection in the Zakat Collection Centre or *Pusat Pungutan Zakat-Majlis Agama Islam Wilayah Persekutuan* (PPZ-MAIWP). Then, design requirement specification (DRS) is employed after being reviewed and approved by PPZ-MAIWP. The results show that the development of blockchain in the zakat collection system could be eradicating extreme poverty and boost shared prosperity among the community in the country. The study contributes through a transparent and reliable environment for exchanging data and carrying out transactions through a decentralized digital ledger technology to record anything of value and as a result able to ensure transparency, reliability, trust ability and traceability of the zakat transactions.

**Keywords:** Blockchain, Fintech, Smart Contract, Islamic Finance, Zakat, Malaysia

**Authors' individual contribution:** Conceptualization — K.F.K.; Methodology — N.H.L.; Validation — H.S. and A.A.; Writing — Review & Editing — K.F.K. and M.D.T.; Visualization — V.H.P.; Supervision — N.H.L., H.S., and A.A.

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## 1. INTRODUCTION

Blockchains captured the world's attention in 2015, and is often recognized as a disruptive technology that has and will affect industries and bureaucracy, with use cases ranging from healthcare to supply chain management and from identity management to financial services (Mohanta et al., 2018; Morabito, 2017; Nofer et al., 2017). Researchers have given much attention to the technology, especially

following the rise in cryptocurrency prices and offerings in recent years. The use for blockchain is limitless; giving access to cryptocurrencies, tracking and settling digital and mainstream assets in an environment that is cryptographically secure, reducing the complexity and number of intermediaries participating in existing transaction processes, and better managing digital risks, such as settlement and counterparty risks (Piazza, 2017).

Blockchain record digital transactions based on its structure in which the database of an individual called blocks are linked together under a chain (Gohil & Thakker, 2021). The usage of blockchain is not only restricted to financial technology but expands to a technology that requires security in a transaction in which this technology offers high security in data collection called Smart contract (Sinha & Chowdhury, 2021). The blockchain contains a certain record for every transaction performed (Chong, 2021). Through the blockchain system, the participant would not need to know or trust each other when interacting due to the electronic business is approved automatically and recorded by a network through encryption algorithms without human interruption, centralized authority, or a third party, e.g., government, bank, financial institution, etc. (Gohil & Thakker, 2021).

The State Islamic Religious Council (SIRC) is a corporation (body) responsible to manage and administer matters relating to zakat in Malaysia and this is clearly stated in the Federal Constitution (Kamarubahrin et al., 2019). The Zakat Collection Centre (PPZ-MAIWP) was set up and started operating by serving the community of zakat payers on December 27, 1990 and from that the zakat management recorded an increase in the collection from year to year. The zakat collection and distribution involves millions of records and the absence of efficiency in zakat collection and zakat distribution due to low transparency has led to ineffective zakat administration (Rahman et al., 2012; bin Khatiman et al., 2021). These issues may reduce public confidence in the administrators of zakat.

A study by Elsayed et al. (2020) reveals that zakat institutions in Malaysia need to improve their Zakat Information System Technology (ZIST), which will consequently increase the zakat performance. The study also suggests that the adoption of technology and innovation is necessary for the zakat institutions in Malaysia to be effective in distributing zakat to as *naf* (eligible recipients of zakat), managing the funds, and increasing public confidence. Thus, with the technological developments, PPZ-MAIWP will benefit from blockchain technology because it provides a peer-to-peer system transaction based on a system that is fully distributed by an autonomous process mainly through the application of the smart contract. The basis of blockchain is a record of the database for all business and digital history which are performed among the participants (Gohil & Thakker, 2021). Every transaction carried out will be approved by the majority agreement of the participants in that system. Once the data information is keyed in, it cannot be adjusted or deleted from the system.

The blockchain is characteristic of end-to-end transactions where it has data distribution and it functions as automatic gatekeeper access to data, especially when using the smart contract method (Sheth & Subramanian, 2020). The smart contract that is attached to the zakat transaction will be able to guarantee effectiveness, transparency and trust in zakat transactions and as a result, will lead to an increase in the total zakat collection at the state and country level.

Consequently, the use of a blockchain platform in zakat revenue is capable of enhancing the transparency in the collection process in which every transaction of zakat collection will be able to be monitored and investigated. Zakat institution is able to fulfil the need of stakeholders by providing the element of trust, and honest and trustworthy methods. Therefore, the main objective of this study is to develop a zakat collection blockchain system which leads to increasing the competency of zakat management in the aspect of transparency, efficiency and real-time transaction report.

Furthermore, this study provides new insights into the body of knowledge, especially in the zakat management system and fintech. Past literature suggests that the level of efficiency and transparency in zakat institutions is determined by various factors including adapting technology-based management in their operation. However, there is limited study on blockchain technology on zakat management. Besides, from the managerial aspect, this study contributes to the new practices that could be implemented in zakat institutions. Consequently, this study will develop a zakat collection blockchain system due to the significant impact on zakat institutions' efficiency and transparency, especially in zakat collection. This is important to encourage Islamic social finance institutions to embrace blockchain technology in providing an efficient service to the development of social and economic.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature related to fintech, blockchain technology, zakat management and the role of blockchain in the management of zakat. Section 3 analyses the methodology that has been used to conduct the research which goes through four main stages based on waterfall model. Thereafter, Section 4 explains the development of the zakat collection blockchain system. Section 5 offers the conclusion and suggestions for future studies related to blockchain technology and zakat management.

## 2. LITERATURE REVIEW

### 2.1. Financial technology (fintech)

Fintech is a term used to refer to the use of technology in the finance system. Its existence attracts world attention after the global financial crisis in 2008 when the financial market and credit institutions in a growing economy collapsed and were unable to operate. The failure of a few big financial institutions in the United States of America and the capacity to solve the financial problem due to the housing credit crisis in 2008 caused a loss of trust widely in the global finance market (Esrati et al., 2018, Abaidoo & Agyapong, 2022). Fintech provides products and services in finance that are more flexible and easier with lower costs and

effective services. According to the data from Accenture in Esrati et al. (2018), a total of $5.3 billion has been invested in a fintech project in the first half of 2016 with an increase of 67% than the similar half of 2015. This investment increase mostly comes from financial institutions in which they collaborated with the Fintech Corporation to remain competitive in the finance market.

Fintech is viewed to be very advanced in the current technology and is considered to be the critical success factor for the Industrial Revolution 4.0. Some of the services that are included in the financial institution have been through a digital system such as payments, e-wallets, cryptocurrency, crowdfunding, blockchain, KYC/Regtech, AI, etc. Referring to the report produced by Fintech News in 2019, there are 198 fintech firms that are operating in Malaysia. This data shows a significant increase on yearly basis and it indicated that the digitalized financial system is to be accepted in the Malaysian setting. This scenario is consistent with the advancement in the computerized system that exists everywhere with a wider network, a bigger data collection, and the development of analytical tools which is easy and efficient to be used in a financial service system and this contributes to the rapid growth.

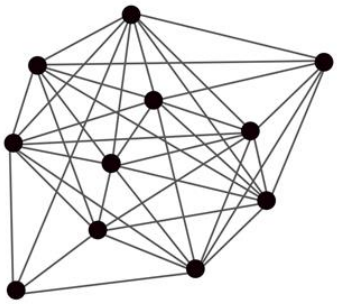
In Malaysia, the development of fintech is recognized when the Central Bank of Malaysia has provided a sandbox to administer the rules and regulations in order to monitor the activities of fintech firms. Moreover, they have also created a specialist team (Financial Technology Enabler Group) who will make policy formation regarding fintech. Based on this development, Islamic social financial institutions such as zakat institution is expected to benefit from this initiative where they can utilize this technology in current zakat management. Some technology specialists give the view that a transaction does not need a third party and can be performed quicker. Research by PwC (2019) shows that 84% of 600 executives agreed that blockchain technology is more trusted because it provides data security, trust and efficiency to their business process. Besides that, it is expected that more than a trillion business dollars in 2030 are business based on blockchain technology.

## 2.2. Blockchain mechanism and characteristics

The inflating price of bitcoin over the past decade and the subsequent mushrooming of alternative cryptocurrencies have sparked the rising popularity of blockchain. Evidently, research on the subject seems to take off since the mid-2010s (Fosso Wamba et al., 2019). Proposals for its use case cover diverse industries, such as logistics and supply chain (Abeyratne & Monfared, 2016; Tieman & Darun, 2017), construction (Li et al., 2019), healthcare (Mettler, 2016), automotive (Fraga-Lamas & Fernández-Caramés, 2019), and oil and gas (Lu et al., 2019). It is especially regarded as a disruptive financial technology (fintech) that can potentially transform the commercial and finance spheres (Fanning & Centers, 2016).

Blockchain is simply a decentralized network of nodes — servers, laptops, and computers connected to the blockchain — that verify, record, and store data blocks that are interlinked by chains (Figure 1). Each block contains multiple transaction records. Each record is identified with a hash, a fixed-length alphanumeric string generated from a string of characters using a mathematical function. This hash details the specific record for each transaction, including sender, recipient, other participants, date, time, and other such details as coded into the blockchain algorithm (Brito & Castillo, 2016; Salmon & Myers, 2019). After the block has been forged, it is also "stamped" with a hash, which connects it to the preceding block. This is the "chain". This hash also stores the transaction hashes recorded inside the block. Each block is added to the chain subsequent to the verification of the network participants of its authenticity, which is proven using a consensus mechanism[1] (Zīle & Strazdiņa, 2018). This entire process continues indefinitely, and theoretically, there is no limit to the number of blocks on the network.

**Figure 1.** Decentralized and distributed network of blockchain nodes



Transaction on the blockchain is carried out using public and private keys (asymmetric-key cryptography) that are owned by all participating nodes. The private key is used to encrypt information, effectively "signing" the transaction. The key is hashed to generate a public key, which the counterparty then uses to authenticate that a) this transaction request indeed comes from the original sender and b) the content has not been tampered with. Conversely, it is possible to encrypt information using one's public key; it can then only be decrypted using that person's private key. A public key may also be hashed to generate an address, which is not unlike a house address or bank account number. The private key must be kept confidential and safe; if misappropriated, it can be used to sign fraudulent transactions; if lost, the user will lose all digital assets associated with that key. Recovering the key is computationally infeasible (Yaga et al., 2019; Zheng et al., 2017).

The entire database is recorded on nodes and is regularly updated. Blockchain allows the nodes to transact with one another even with the absence of

[1] There are numerous mechanisms/algorithms, though the most prevalent are proof-of-work (PoW) and proof-of-stake (PoS). In PoW, the requesting node is required to solve a computational problem, which is then verified by the network; correct solutions will reward the node with a coin. This is known as mining. In PoS, instead of solving a puzzle, a node stakes its coins to ensure its chance of being selected as the one to forge the block, which rewards it with coin. This is a transaction fee, not mining. Coins are rewarded to disincentivize dishonest nodes. In a closed network, where nodes are known and authorized, they are unnecessary. Some blockchains use tokens to transact (see footnote 2). The transaction is then authenticated by validator nodes, and the tokens will exchange hands (Bach et al, 2018; Christidis & Devetsikiotis, 2016).

trust and an intermediary, hence its attribute as a trustless, low-cost peer-to-peer (P2P) network (Christidis & Devetsikiotis, 2016). Because the network essentially exists on several distributed nodes in various locations, there is no central authority or point of failure, so the risk of losing the entire database is minimized (Alam et al., 2019; Raval, 2016). But by the same token, transactions are irreversible, rendering payments made to the wrong address as vanished, and unable to be recovered. Frauds, equally, cannot be reversed, unlike in conventional bank transactions. The records stored in the network are open to the public and can be accessed in a matter of seconds. For this reason, it is most familiar with the description of a decentralized, distributed ledger.

Blockchain is considered immutable and secure because any alteration to a block would require the rebuilding and rehashing of the subsequent blocks (Hileman & Rauchs, 2017). For instance, slightly modifying the information, even a character, contained in the seventh block of a 10-block network would produce a new hash for the altered block. This will cause the block to disconnect from the original eighth block since the latter identifies the original seventh block by its hash. Effectively, modifying the seventh block transforms the network into a seven-block chain. To cover this clandestine deed, one must update the remaining three blocks so that they generate new hashes that can continue this new chain. If he fails to do so, or because the majority of the nodes in the network have verified the original chain to be the true chain that connects to the genesis block (the first block in a chain), this altered seventh block becomes an extinct or orphan block, and this new chain ends there (Decker & Wattenhofer, 2013).

There are now two forks in the blockchain network, one leading to the now abandoned seventh block, and the other is the consensually agreed correct path. Without collusion from the majority of the nodes — an expensive and resource-intensive undertaking — any attempt to alter information in a blockchain is effectively unfeasible (Bonneau, 2019). The advantages of using blockchains can be summarized in the following points:

- Traceability, audibility, and transparency of data and transactions, every one of which is "stamped" and verified.
- Public-private key enables participants to sign and authenticate transactions, preventing tampering or fraudulent requests.
- Transactions can be carried out without any intermediaries, and they will be automatically registered into the blockchain. Both cost and time can be minimized.
- It has no central point of failure because the database is constantly distributed to and verified with participating P2P nodes.
- No central authority also means that no one entity has the power to shut, erase, alter, or add any information to the network. But this also means that transactions are irreversible; lost or stolen private keys (and accordingly digital assets) cannot be recovered.
- Information stored in the network is secure and immutable from deliberate alterations.
- Any forks introduced into the chain are automatically corrected into a mutually accepted chain.

## 2.3. Blockchain models

The narrative thus far, however, pertains mostly to the public permission blockchain, implemented in the very familiar cases of bitcoin and ethereum. However, the scenarios discussed above may not necessarily be applicable to closed models. The differences between the models primarily lie with the authority to read, write, or commit information into the blockchain, but the general mechanism is more or less identical (Table 1).

**Table 1.** Blockchain models

| | | | *Read* | *Write* | *Commit* | *Immutability* | *Centralized* | *Efficiency* |
|---|---|---|---|---|---|---|---|---|
| *Blockchain types* | *Open* | Public permissionless | Anyone | Anyone | Anyone* | Virtually impossible to tamper | No | Low |
| | | Public permissioned | Anyone | Authorized participants | All or subset of authorized participants | Possible to tamper | Partial | Medium |
| | *Closed* | Consortium | Restricted to authorized participants | Authorized participants | All or subset of authorized participants | Possible to tamper | Partial | High |
| | | Private permission (enterprise) | Fully private or restricted to a set of limited authorized nodes | Network operator only | Network operator only | Possible to tamper | Yes | High |

*Note: * Requires significant investment in either mining hardware (PoW model) or cryptocurrency itself (PoS model). Read: right to access the network and see transactions; write: right to generate transactions and send them to the network; Commit: right to update or commit transactions to the network (by adding a block to the blockchain).*
*Sources: Hileman and Rauchs (2017), Zheng et al. (2017).*

The permissibility for anyone to read blockchain records is only in a public network, as in the case of bitcoin. One may also write into its blockchain, but this must be verified with a consensus algorithm. Malicious nodes may also force commit a record if it has sufficient resources, affording it higher chances to self-validate transactions, but this is an extremely costly endeavour (Bonneau, 2019). Honest behaviour in this chain is promoted with the reward of coins, more

specifically payment coins (or cryptocurrencies)[2]. On the ethereum blockchain, for instance, the rewards would be ether (ETH).

In lieu of coins, some models typically issue security or utility tokens[3]. The former represents the underlying external (off-chain) asset owned by the node, not unlike a share or a deed. For example, a company may crowdfund for a certain project, with the promise of sharing the profits with investors. They may issue security tokens to do so. These can be traded on the secondary market. Since there are no intermediaries, transactions can be completed quickly. Utility tokens, on the other hand, are akin to loyalty points or amusement park tickets: they are without any intrinsic value and cannot be used as currency outside of the store or theme park. Holders may use them to redeem a product or service offered by the issuer (Doe-Bruce, 2019; Liu & Wang, 2019; Oliveira et al., 2018). It bears mentioning that tokens are not a necessary feature of blockchains. Private network often operates without any tokens, verifying each transaction based on certain algorithms and protocols (Jeong et al., 2020). In this case, the blockchain merely acts as a distributed ledger database.

In the public permission model, writing is only for authorized nodes, while commitment can be carried out by either all or part of them. For closed systems, certain actions may only be carried out by a specific party. Transparency and audibility of a closed blockchain is an enduring issue, especially because the participants, especially organizations or corporations, are legally and morally required to uphold confidentiality. Even if sensitive information is withheld, it is still possible to reveal or reasonably estimate a participant's identity through his transaction patterns or other methods (Biryukov et al., 2014; Meiklejohn et al., 2013). To mitigate this issue, some academics (Kosba et al., 2016) suggest the use of public blockchains with zero-knowledge proof to enable the validator to verify a transaction without the requirement to disclose any sensitive information.

Security for closed models comes within and without the blockchain, such as legal contracts and threats, but immutability may not entirely apply. The risk of collusion is still possible, especially if the participating nodes are small and the validators cooperate in the scheme (Hileman & Rauchs, 2017; Schrepel, 2019).

## 2.4. Smart contracts

Smart contracts are lines of codes embedded into the blockchain algorithm that is "deployed using cryptographically signed transactions on the blockchain network" (Yaga et al., 2019, p. 32). It functions as an if-else statement, that is, the fulfilment of a condition will immediately trigger the resulting action. Theoretically, they may supplement or fully substitute traditional legal contracts (Alam et al., 2019; Raval, 2016). Smart contracts can also be used to create tokens (Oliveira et al., 2018).

To illustrate its execution: suppose the smart contract holds the condition that the release of a sum of payment to the seller is subject to the arrival of the item. Sequel to its confirmation by the buyer, the smart contract automatically executes the consequent action. In this instance, the services of a third party are rendered unnecessary, and the transaction can be executed quickly at a minimum cost. In actual practice, smart contracts would be even more complex, encompassing terms and conditions that involve multiple parties.

By their own nature, smart contracts are deterministic, that is, a similar output will always be produced for the same input. But it may also be non-deterministic if it requires off-chain information from external parties, a service termed oracle (or data feed). Because it is incorporated into the blockchain, it is possible for all authorized nodes (or anyone if it is a public blockchain) to inspect its code in detail. Similarly, it is possible to trace all operations of the contract because it is recorded on the blockchain (Christidis & Devetsikiotis, 2016).

## 2.5. Zakat administration in PPZ-MAIWP

Al Qaradawi (1999) defines zakat refers to the determined portion of wealth prescribed by Allah SWT taken from the more affluent person and allocated to its rightful beneficiaries. The property owner is obliged to pay the zakat when al-mal (wealth) reaches Nisab. Once the individuals reach the Nisab of zakat, a certain amount which is 2.5% of total money or assets must be paid by the individuals. Zakat collectors and the administrators assigned by the authority collect and manage the funds from the wealth of the rich and pass it to the zakat recipients. The payment of zakat in the exact amount with an efficient method will benefit more to recipients more and ultimately help in creating a balance socio-economy (Hoque et al., 2015).

In Malaysia, zakat institutions have been growing with their role expanding to be more holistic. In managing zakat, State Islamic Religious Councils (SIRCs) play the most important governance role relating to Islamic matters that fall under the states' responsibilities and this is clearly stated in the Federal Constitution. Nordin (2008) noted that the Constitution of Malaysia Article 3(1) pronounces Islam as the official religion of Malaysia with all Islamic matters to be placed under the control of the state government. In addition, according to Articles 3(2) and (3) of the Federal Constitutions, the religion of Islam is under the power of the Sultan (ruler), who is the head of the religion of Islam in each state. In other words, all Islamic matters including zakat must be referred to the respective SRIC, which acts on behalf of the Head of State.

There are 14 SIRCs in Malaysia, and each is aimed at making the administration of zakat systematic and effective for the Muslim *ummah*. Figure 2 shows how the zakat is managed and the relationship between the federal government, the state Sultans, and the state religious councils. It illustrates how the zakat is managed and shows

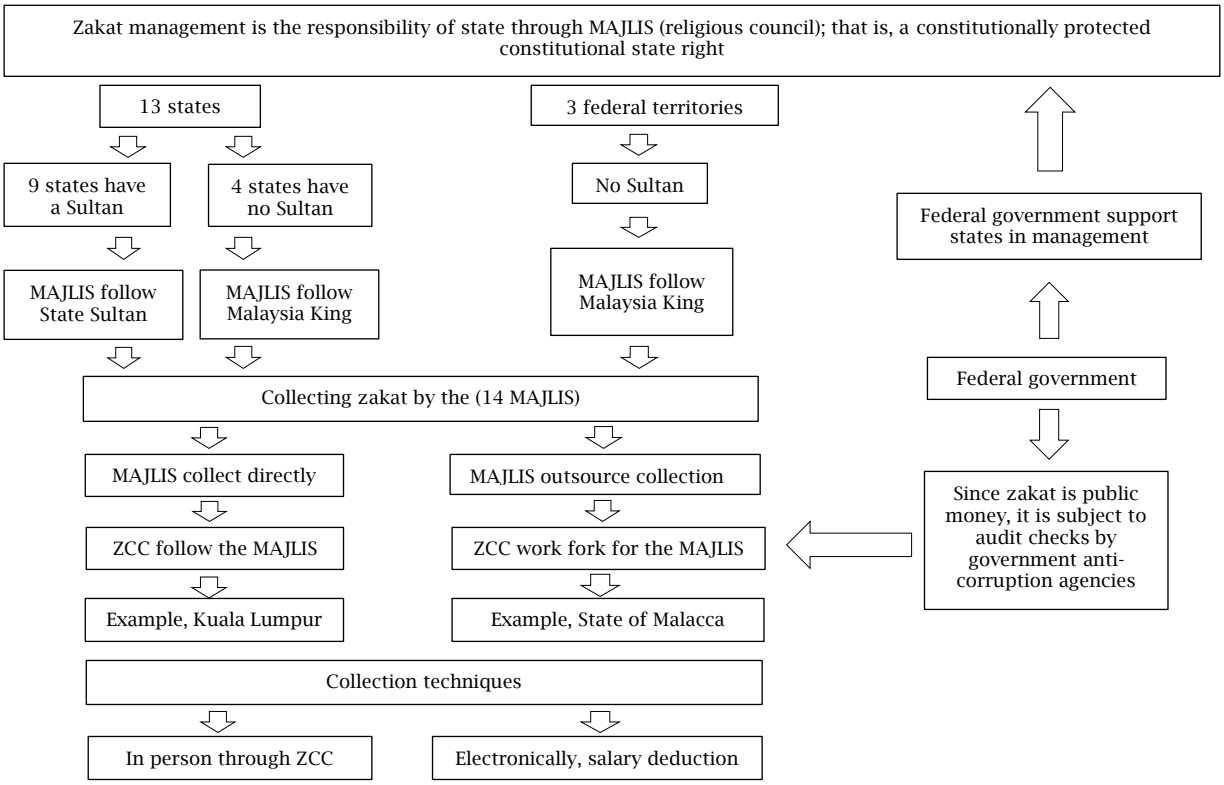
[2] Currency (coin) and token are dissimilar. Currency is a native feature of a blockchain that is used to incentivize the blockchain participants and used as a medium of exchange, much like conventional currency. Token, alternatively, is created on top of a blockchain; it is created and governed by a smart contract, to be used only within a blockchain network (Massey et al., 2017; Oliveira et al., 2018). On the ethereum blockchain, for instance, the currency is ether, while its token is that which is created, traded, or gifted only on the ethereum platform, e.g., Vechain.

[3] There are also other token archetypes: cryptocurrency, equity, funding, consensus, work, voting, asset, and payment (Oliveira et al., 2018).

the functions of the states' religious council. Excellent management and governance of zakat institutions is an indicator of economic achievement that would strengthen the evidence that zakat is a tool that can help boost the economy and the social development of Muslims. The Federal Territories Islamic Religious Council (MAIWP) in 1990 founded MAIWP Zakat Collection Centre (PPZ-MAIWP) which is an agency handling zakat corporately in Wilayah Persekutuan. PPZ-MAIWP (both collection and distribution operations) have been corporatized in 1991 due to the demand for more efficient and effective collection and distribution of zakat funds.

PPZ-MAIWP first introduced the concept of *amil* to collect zakat where they combined their specialities not only as *amil* but also in the fields of accountancy, computer, administration, marketing and secretarial. As the result, zakat collection in PPZ-MAIWP increases significantly every year due to the innovation and proactive regarding the zakat payments that have been made. Thus, this study believes that the application of blockchain technology in zakat management is needed since it offers various benefits such as improved capital optimization, enhanced transactional transparency and collaboration in socio-economic development that leads to promoting SDGs of the country.

**Figure 2.** Zakat management in Malaysia




*Source: Migdad (2019).*

## 2.6. The role of blockchain and smart contract in zakat management

Zakat institutions rely on zakat collection from the public and the trust placed in them by the wider community. The advantage of combining the technological concept of blockchain with the historical and traditional concept of zakat is that both of these innovations deal with maintaining a sense of public trust for the benefit of society as a whole. Zakat institutions are now turning to blockchain solutions as a way to improve social and economic outcomes. One of the many potential blockchain applications is in supporting transactions involving cryptocurrencies such as bitcoins. Bitcoin is a new form of currency and blockchain is the database that enables its secure transaction by providing transparency, enabling efficiency, and reducing costs (Tomasicchio, 2016).

Transparency is another benefit of using blockchain with zakat collection being recorded immutably and transparently. Givetrack is an organisation rooted in blockchain technology that allows donors to donate bitcoins to their favourite project and track its progress in real-time, such as Crowdfunding 2.0 (Lamb, 2018). The potential of blockchain for Islamic organisations is focused more on the financial industry. Blockchain's strength has attracted hundreds of financial institutions across the Organisation of Islamic Cooperation (OIC) countries to pursue solutions relating to the blockchain system. Dubai had unveiled its plan to become the leader of blockchain utilisation across its private and public sectors by 2020 (Zainuddin, 2017). The first movers in applying blockchain technology in Islamic finance include Blossom Finance, EthisCrowd, and OneCoin Ltd, a cryptocurrency company that is the first to launch a certified Shariah-compliant product. Other first movers include Finocracy, a Dubai-based fintech start-up (Sundararajan, 2017).

The application of blockchain technology offers numerous opportunities for zakat institutions by re-establishing trust in the sector, where every transaction must be verified through a process known as consensus that requires multiple system participants to independently verify authenticity (Piazza, 2017). It also reduces transaction costs, as participants can avoid using expensive third-party services to facilitate transactions. The blockchain technology implementation is to provide a solution for zakat institutions to enable them to offer transparency to their zakat payer and build trust with the expectation of gaining more support towards the zakat institutions' mission. There is a smart contract managing the transactions, the beneficiaries, the zakat payers, and the recorded amounts of materials in secure data that are private and confidential. Regarding the reporting function, blockchain technology would bring a major transformation by making information available in real-time. The information would post to the blockchain automatically if the organisation used digital currency or digital tokens (Byström, 2016). Real-time updating would also help the regulators. Since the transactions would be governed by smart contracts, functions could be built into the contracts to ensure an organisation was referred to a regulator if certain events occurred (Mark et al., 2016).

A smart contract is able to approve its permission, given order and predetermined conditions. The smart contracts can be performed by themselves, unable to be changed and can be distributed. The smart contract can be programmed with a language called solidity. According to Rane and Thakker (2020), a smart contract is a contract saver similar to saving transactions in the blockchain. The smart contract is a computer program without interruption stored in the blockchain system. It is perfect, rigid and also can be distributed. After a smart contract has been made and saved in the blockchain system, it is difficult to change the contract code. Everyone involved in the chain will approve the transaction outcome that has been made. The features of smart contract blockchain give the ability to program blockchain to manage the transaction among the participants involved in a decision or to generate and access data (Banerjee et al., 2018).

In addition, a smart contract can manage itself and perform payment by itself. They can build functions according to the types of transactions and will be able to approve within the chain. The trust of the process implementation can be achieved by coding the business operation to the smart contract that gives the right achievement between the untrusted party, and trust in the information obtained from the agreement of the business partner who chooses the service transaction for each work performance in a business process (Xu & Viriyasitavat, 2019). The smart contracts can determine business logic and comprehend to its core that is functioning in three functions storage regulations; approving rules; and rules that are carried out by itself.

Blockchain technology can be used by integrating a delivery platform and payment system in a smart contract that is conducted in the whole organization, in unity with the logistic provider and other chain crews. The main feature of blockchain in a smart contract is transactions "without trust". A smart contract can manage implementation, management, achievement and payment. A smart contract is an agreement between two people in a digital network. Smart contracts in blockchain can diminish time loss and cost when managing and handling contracts manually. The possibility of smart contract cases is probabilities and pre-contract to automatic access systems and involving from e-commerce to autonomous transaction machines (Sulkowski, 2019). Smart contracts and blockchain will revolutionise many industries and businesses to enable electronic transactions without human involvement (Stefansson, 2002).

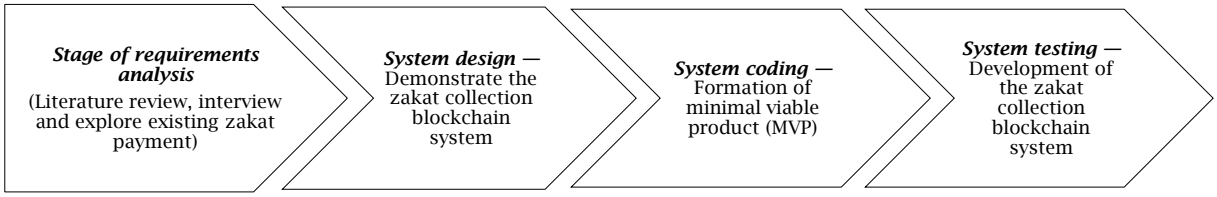
A smart contract is an agreement or contract operated electronically using an algorithm (Dutta, 2020). The smart contract is an agreement or regulation stored in the blockchain and will be implemented automatically in some of the transactions in the blockchain (Gupta, 2017). Some types of blockchain enable compute programs to implement a transaction when conditions in the smart contract are fulfilled. The main purpose of a smart contract is to increase trust and diminish the time to process a transaction (Gupta, 2017).

Zakat institutions manage to gain profit from blockchain technology because it provides a peer-to-peer transaction system by autonomous process mainly the implementation of the smart contract. Besides the features of end-to-end transaction that has data distribution and functions as gatekeeper access for data automatically, especially when using the smart contract method (Sheth & Subramanian, 2020). This can fulfil the need to provide trust in Islamic social finance by giving a more transparent, trustworthy and reliable method. The smart contract that is pinned with the zakat transaction can guarantee efficiency, traceability and trust in the zakat transaction and as a result, will increase the collection of zakat funds.

## 3. RESEARCH METHODOLOGY

This research aims to develop the zakat collection blockchain system based on waterfall model. This research employed a qualitative research approach, literature studies and interviews. The development of the zakat collection blockchain system used the waterfall model. According to Herawati et al. (2021), waterfall model is one of the Software Development Life Cycle (SDLC) models which consists of stages of requirements analysis, design implementation, testing and maintenance sequentially so that the development process will not proceed to the next stage if the previous phase has not been completed. It can be summarised in Figure 3 below.

**Figure 3.** The stage of the waterfall model in the development of the zakat collection blockchain system




The further explanation of the stages of the waterfall model in the zakat collection blockchain system are as follows:

*1. Interview the officer of Akademi Zakat (AZKA) of PPZ-MAIWP on zakat collection Standard Operating Procedure (SOP).*

The first stage employed a qualitative research approach to gain insights into the PPZ-MAIWP zakat collection centre on the SOP of zakat collection. In gathering the information, a semi-structured interview was conducted focusing on the detail of SOP on zakat collection in PPZ-MAIWP. The Manager, Assistant Manager of AZKA of PPZ-MAIWP and two IT personnel of PPZ-MAWIP were interviewed. The interview was guided by an interview protocol and probing questions were asked to pursue issues and to enhance the researchers' understanding of the responses, while at the same time improving the validity and reliability of the interview conducted (Yin, 2003).

The interviewee has extensive knowledge about the operation and collection of zakat due to the interviewee's experience in the development of SOP zakat collection which refers to Acceptance of Zakat Payment Over the Counter Service Flowchart. PPZ-MAIWP was chosen due to its policy focus on enhancing transparency in zakat management and its involvement with zakat payers. Insights gained from the zakat institution help to improve the researcher's understanding of the SOP of zakat collection. This is important to ensure that the zakat blockchain system will develop based on rules and processes that are used currently.

The first stage is a critical stage to give a deep understanding of the current zakat collection system through the Acceptance of the Zakat Payment Over the Counter Service Flowchart before it can transform into a digital reference to build the zakat collection blockchain system. Identifying the "closed loop process/open loop process" is crucial to digitize the Acceptance of Zakat Payment Over the Counter Service Flowchart to the blockchain backend system. It is important to identify the approval process in which the Flowchart will not be prioritized to ensure the zakat collection blockchain system can be formed. Therefore, the approval process from the system owner which is PPZ-MAIWP is important. Hence, after every Flowchart has been identified and all circle process has been closed, this will resolve the circle of digitalization of the Acceptance of Zakat Payment Over the Counter Service Flowchart.

*2. Demonstrate the zakat collection blockchain system and seek approval from PPZ-MAIWP.*

Before the zakat collection blockchain system is built, the digitalization of the Acceptance of Zakat Payment Over the Counter Service Flowchart needs approval from PPZ-MAIWP. The demonstration stage will give a real view of the digitalization of the operation of collection zakat in PPZ-MAIWP. The blockchain system is usually developed involving the Flowchart operation that is allowed to be changed and with the low stage of safety access. This is important to protect the private and confidential information of PPZ-MAIWP in particular, the zakat collection process. Once the demonstration is approved by PPZ-MAIWP, a design requirement specification (DRS) can be made. DRS must be researched and agreed upon by all parties involved in this project. This may only involve a few technical developments on the blockchain system that will be formed later. This DRS will be the referred design for the whole project. All changes requiring modification will be under the "Change Request" application after getting approval from all parties involved. This is to avoid delay in completing the development process.

*3. Formation of the minimal viable product (MVP).*

This process involves a very technical development team to ensure the zakat collection blockchain system can be formed. The objective of this stage is to create a minimum version of a system from DRS. The purpose of having MVP is to test the design hypothesis with a minimum source for the alpha test by decreasing the time for the development system and accelerating the studying process of the design system. The main features or elements in a development quality are Function, Design, Trustworthiness and Usability. MVP should have a group of features that must be delivered to the user with clear worth. The design must be similar to the Acceptance of Zakat Payment Over the Counter Service Flowchart. The outcome should be trusted through strict tests and its usability should ease zakat payer and PPZ-MAIWP.

*4. Development of the zakat collection blockchain system.*

There are two segments that will be made in the zakat collection blockchain system. Both segments have been successfully developed in this research and are stated below:

*Web Frontend Application:* An interface in which the user will interact or in other terms called Graphic User Interface (GUI). If agreed, for the purpose of blockchain backend system development in the future, it is suggested to use the current platform available in PPZ-MAIWP. For the purpose of this study, a dummy website is built.

*Web Backend Application:* This stores a system logic from one interface to another and also connects from one model to another model. The logic system is also covered in this segment. Web Backend Application will be the Middleware

between GUI and blockchain. The model that is planned and developed under Web Backend Application must follow the logic needed by MVP.

## 4. THE DEVELOPMENT OF THE ZAKAT COLLECTION BLOCKCHAIN SYSTEM

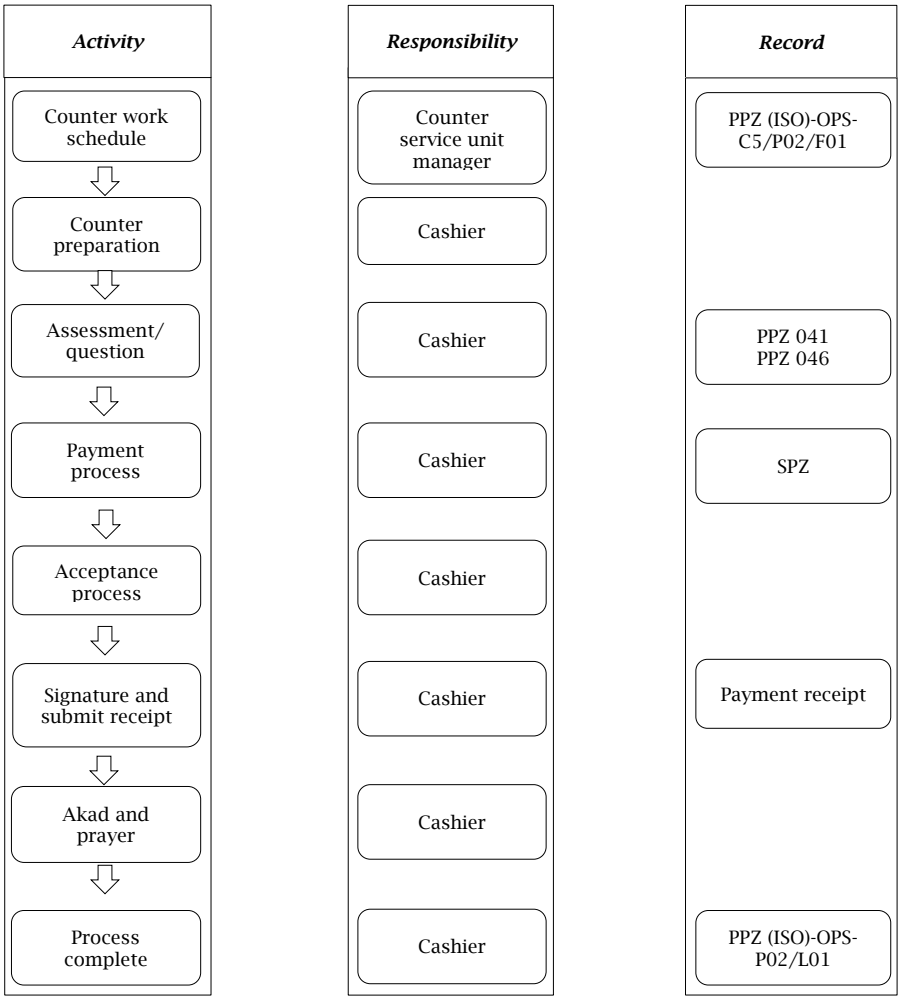
The development of the zakat collection blockchain system consists of three main outputs, as follows:

*1. The zakat collection system in PPZ-MAIWP.*

The interviewee was asked about the SOP of the zakat collection system in PPZ-MAIWP. This is an important approach and consistent with the study by Piazza (2017) where every transaction in developing a blockchain system must be verified through a process known as consensus which requires multiple system participants to independently verify the authenticity of the overall process. Below are some of the responses gathered from the interview.

There are many platforms currently used by PPZ-MAIWP in zakat payment, however, due to the reason related to the duration of this research an agreement has been reached to use one of the zakat payment platforms which is paid over the counter. A flowchart regarding this process is illustrated in Figure 4 below.

**Figure 4.** Acceptance of zakat payment over the counter service flowchart




For the purpose of the private data protection act, this research has developed a dummy-website for PPZ-MAIWP to ensure that current data will not be interrupted in the development of the blockchain system.

*2. Development of design requirement specification (DRS).*

To fulfil this purpose, this study will specifically develop an infrastructure for the zakat collection blockchain system that combines the front and back ends of the zakat collection blockchain system. This process is the critical success point for the development of the blockchain system to ensure it can be applied later.

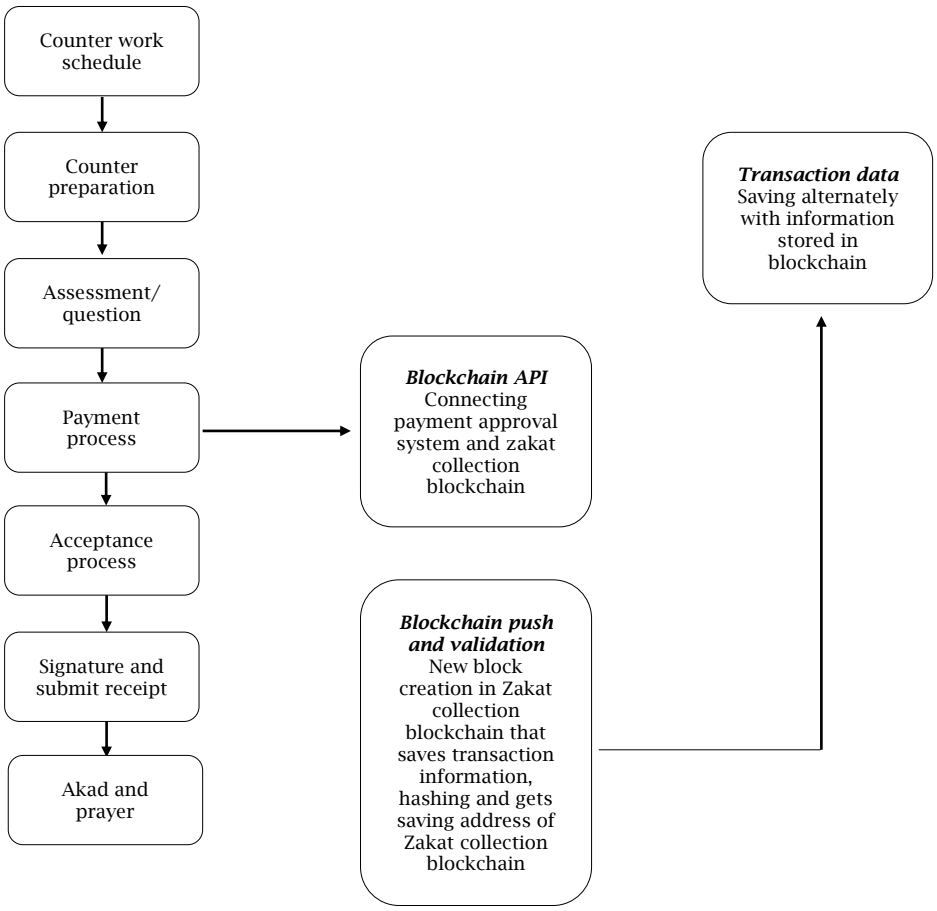
Before building the backend of the zakat collection blockchain system, the Digitalization of the SOP zakat collection that is conducted in the second stage present the real view of the zakat collection system in PPZ-MAIWP. The development of a blockchain system usually involves the flow of operation that is allowed to be changed by the involved institution and with the low stage of safety access. This is important to protect the private and confidential data of PPZ-MAIWP or particularly the zakat collection system.

Then, the design requirement specification (DRS) is successfully created and must be agreed upon by all parties involved in this project. This may

only involve a few technical developments on the blockchain system that will be formed later. The details of the technical need and timeline will be determined in the next step. This DRS will be the referred design for the whole project. All changes requiring modification will be under the "Change Request" application after getting approval from all parties involved.

Basically, the backend zakat collection blockchain system that is designed will commence after the zakat payment process is successfully made and recorded. To ensure any zakat payment transaction is recorded in the zakat collection blockchain system, "blockchain API" is used to connect between payment approval system with the formed zakat collection blockchain system. Next is a validation process that will be made with the creation of a new block in the zakat collection blockchain system, that saves hashing of transaction information and storage address in the zakat collection blockchain system. Next, to ensure saved data is secured, it will be saved alongside the information saved in the blockchain system through the formation of the zakat database. This is concluded in Figure 5 below.

**Figure 5.** Zakat database using blockchain tech flowchart




*Source: Khairi et al. (2022).*

*3. Development of zakat collection blockchain system through smart contract platform based on distributed technology.*

To fulfil this purpose, the study built the backend of the zakat collection blockchain system through a logic system. This process will save the logic system from one interface to another and also connect one module to another module. Web Backend Applications will become Middleware between GUI and blockchain. This module which is planned and developed under Web Backend Application will follow the logic that is needed by MVP. As the result, "blockchain hashing" can be provided for every transaction made for the purpose of traceability and monitoring. This is consistent with the previous studies by Tomasicchio (2016) and Lamb (2018) which stated that the blockchain is the database that enables its secure transaction by providing transparency, enabling efficiency, and reducing costs. Additionally, the features of end-to-end transactions through smart contract platforms based on distributed technology manage to ensure that the data related to zakat collection is distributed and functions as gatekeeper access for data automatically (Sheth & Subramanian, 2020). As a result, it is possible to trace all the zakat collection transactions as well as the zakat operations because it is recorded on the blockchain (Christidis & Devetsikiotis, 2016).

## 5. CONCLUSION

This study developed a zakat collection blockchain system for PPZ-MAIWP based on waterfall model aiming at strengthening the zakat institution alongside the development of current technology.

Persistent issues in the administration of zakat collection must be reduced to increase public confidence. One solution to this problem is through the application of blockchain technology, enabling traceability, transparency, data security and real-time transaction of zakat collection. This study also believed that with the blockchain system, the quality, efficiency, responsibility and corporate governance level of PPZ-MAIWP will increase and strengthen the public trust in paying zakat. As the result, the zakat collection can increase significantly because of the trust among the zakat payers and then, it can be distributed to the mustahik especially during the unpredictable economic situation nowadays because every transaction can be detected by every individual involved in the chains that have been formed.

Future works can improve this blockchain system by collecting the inputs of zakat institutions and blockchain experts. The blockchain system should also be evaluated by blockchain experts. By involving IT managers or experts affiliated with zakat institutions, it is possible to come up with a more robust blockchain system. Additionally, it allows the design of a feasible blockchain system that can be easily implemented by zakat institutions, which typically have little expertise and experience in IT solutions. Researchers can perhaps work closely with zakat administrators and IT experts to build a blockchain infrastructure from the ground up. This endeavour allows the development of a zakat collection blockchain system that satisfies the laws, rules, and standards related to zakat administration and financial technology in Malaysia.

The challenges on the adoption of new technology with unfamiliar with blockchain and its myriad concepts may be faced by the zakat administration, along with other stakeholders, lawyers, jurists, regulators, auditors, users, and the public — must be made aware and educated on the subject. Additionally, the system must be accessible. The convenience afforded by a user-friendly and useful platform is correlated to the inclination of the public to make zakat payments.

Regulators, much less Islamic scholars, are constantly playing catch-up to the rapidly advancing blockchain technology. Islamic scholars should therefore be more cognizant of the specificities of these activities. Additionally, practitioners must involve them in every step of the development to ensure their compliance with Shariah, perhaps via a Shariah committee not unlike that in Islamic financial institutions. Its function will be to ensure the compliance of the blockchain system as well as digital transactions. Despite these limitations, there is much to be hopeful for with regard to the zakat collection blockchain system. With proper execution, it may very well fulfil its promise of transforming the Islamic financial world. However, there is no comparison of the system of the zakat collection blockchain with other systems, and in different contexts of emerging countries. Therefore, further research on this issue is to be conducted and discussed.

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