

# Chapter 1

## Eliminating Trust Issues in Islamic Interbank Monetary System by Blockchain Technology

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### **ABSTRACT**

*In the literature, it is argued that there is an agency or incentive problem in the Mudarabah Interbank Instrument (MII), an instrument where the depositor is the rabbul-mal (capital provider or investor) while the counterparty is the mudarib or entrepreneur. It is to the receiving bank's advantage to 'declare' a lower profit rate. To solve this problem, the Malaysian Central Bank revised the rules by setting a minimum benchmark rate for the MII. This practice is quite similar to the fixed interest rate in conventional financial system which may trigger several Shariah issues. In this chapter, the authors argue that the blockchain technology is a better way to address the issue and propose and how it overcomes the issue in the Islamic interbank money market. As implication of the study, Islamic banks can start using it as a testing process for the future businesses, and in accordance with the analyzing test results, they can implement the system for every occasion.*

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### **INTRODUCTION**

Banks need to hold liquidity (cash) for a given period for liquidity management or managing the asset and liability mismatch. To achieve this, banks borrow money from other banks via money markets. This incurs interest whereby the banks agree on a rate of interest depending on the maturity. This practice is prohibited in Islam.

In the case of Islamic Financial Institutions (IFIs), they collect deposits and raise funds from individuals or companies, and government bodies or private sectors, to finance the deficit. The deposits or liabilities of the bank are normally held on a short-term basis (Saiti et al., 2016). Furthermore, the money deposited in normal savings and current accounts can be withdrawn upon the customers' demand. On the other hand, the financing or receivables which are recognised as assets will normally be for a longer term. The question that arises in this regard is how IFIs can manage the duration gap between its liabilities and assets?

In order to address this important issue, IFIs adopt several Islamic contracts such as partnership based (like *Mudarabah* and *Musharakah*), sale-based (*Murabahah* and *Tawarruq*) and service-based contracts (for example, *wakalah*). In the case of partnership contracts, Islamic banks agree on a predetermined profit-sharing ratio. The bank that accepts the funds agrees to pay some of its profit from its investments to the investee bank. For example, the *Mudarabah* Interbank Instrument (MII) is an instrument where the depositor is the *rabbul-mal* (capital provider or investor) while the counterparty is the *mudarib* or entrepreneur. The profit ratio will be predetermined by both parties, while the investor will bear losses. The tenure of MII ranges from as short as overnight up to a year. On maturity, the principal plus profit will be paid to the investor.

Bacha (2008) argues that there is an agency or incentive problem in this structure as it is to the receiving bank's advantage to 'declare' a lower profit rate. To solve this problem, the Malaysian Central Bank (BNM) revised the rules by setting a minimum benchmark rate for the MII. With this revision, the minimum rate of return for the MII was set to equal the prevailing rate of the Government Investment Certificate (GIC) plus a spread of 0.5% (Bacha, 2008). The benchmark rate serves to ensure that only banks with reasonable rates of return participate in the MII. This approach reduces the uncertainty in the profit rate as it is calculated as follows:

1. The prevailing rate on the Government Investment Certificate (GIC) of the same tenor + 0.5% (annualised), if the declared profit is lower; or
2. The declared profit adjusted for PSR; if it is higher than the GIC + 0.5% annualised;

This practice is similar to the fixed interest rate in the conventional financial system, which may trigger several *Shariah* issues. For example, waqf is facing challenges in enhancing its governance structure to ensure *Shariah* compliance as well as economic efficiency. A potential alternative approach to address the *Shariah* compliance issues that arise from lending and borrowing in the Islamic interbank money market is blockchain technology. Abojeib and Habib (2019) examined the importance of such innovation in Islamic finance, particularly Islamic social finance. They argue that Islamic social finance is facing several challenges that could be solved by such innovations. In this chapter, we argue that blockchain technology is better able to address the issue of understating the profit or advantage to one party and

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propose how it overcomes the issue in the Islamic interbank money market. The remaining sections are organised as follows. Section 2 will explain blockchain technology, section 3 proposes how the blockchain technology overcomes the trust issue in the Islamic Interbank System and section 4 concludes the chapter.

### **Blockchain Technology**

Crosby et al. (2016) explained that a blockchain is essentially a distributed database of records or public ledger of all transactions or digital events that have been implemented and shared among involved parties. Each transaction in the public ledger is verified by the consensus of a majority of the participants in the system. Once the information is entered, it can never be erased or destroyed. The blockchain contains a certain and verifiable record of every single transaction ever made. Bitcoin is a decentralised peer-to-peer digital currency and one of the more popular examples of blockchain technology. Zyskind and Nathan (2015) emphasised that third parties should not be trusted with personal and sensitive data as it could render a person or institution susceptible to attacks and misuse of data. Instead, users should own and control their data without compromising security or limiting the ability of companies and the authorities to provide personalised services.

Bitcoin is a system that could be highly useful in today's day and age (Bitcoin Wiki, 2018). As the name suggests, it is a chain of blocks that keep a record of the transactions of the system. It could also be termed ledgers. Every block contains the information of the preceding block and locks itself. After one block is closed, the upcoming block writes the preceding information. This process continues as new information is recorded and new blocks created, thereby constituting a chain.

One of the biggest concerns about this system is double-spending potential as the system is artificial. However, this clever system prevents this to happen. If someone has 1 million pieces of information on the system and wants to send it to another person on the system, he or she states a sending request which needs to be confirmed by the system's miners. When the transaction is complete, all the ledgers or blocks update themselves such that the sender has no information (blocks) and the receiver has 1 million pieces of information. In this system, the owner of the information is protected (Ray, 2018).

This explanation unveils the second unknown term, 'the miners'. In short, they are individuals who use their Central Processing Units (CPUs) to contribute to the system and accelerate the transaction time (Getting started with Bitcoin mining, 2018). They do this by connecting their hardware into the system. In a way, they constitute the physical element of the system without whom the system would not be able to operate on a global scale. When a send request is made, the transaction is encrypted and sent to the blockchain system. The miners' hardware is then used to solve the encrypted transaction's password using the power of the hash-rate. When the password is unlocked, the transaction happens. This is the confirmation phase of the transaction.

Miners are rewarded for their efforts by earning the blockchain's currency, which differs according to the blockchain system the miners are using. If it is Bitcoin's blockchain system, the reward is Bitcoin. If it is other crypto currency's blockchain, they are rewarded with the currency of the respective system. Miner's are rewarded based on the number of transactions they solve. The more encrypted transactions they solve, the more reward they earn. The rate of compensation changes, which means that profitability may also change (FAQ – Bitcoin, 2018).

This system is highly transparent. This is evidenced by the ability for everybody to see all transactions in the system; they are all public. Everyone has a unique code like IBAN but is more complex. Secondly, people need other people to be able to make a transaction. Lastly, everybody accepts the transaction so

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that double-spending or cheating can be prevented. In other words, the system is alive and evolves with its users. As such, the system is constantly updating itself with the transaction information of all the users, and everybody can see what is happening in the system.

As for the banks' transaction system, there is much ambiguity surrounding transactions. Recently, Iran declared that they left SWIFT as the US controls the entire system, and no other organisation is authorised to see the workings of the system. It is a system that lacks transparency. The US alone is in a position to allow or deny transactions. Given such limitations, we must question whether this system is suitable for a global money market.

### **Advantages and Disadvantages of Blockchain Technology**

Morabito (2017) explains that the blockchain system subsides in a mentality of distributing transactional data into several nodes that are represented by computers. These nodes merge and act as a single chain of information. Businesses can benefit from this system in several ways, such as empowering users. It means that users can manage their information as part of the transaction. It offers durability, sustainability and reliability because the blockchain system cannot fail with a single mistake and does not require someone to fix the problem because the information is stored in every block. Also, among the advantages of not having a centralised computing system is that trust is cultivated by allowing users to view every transaction. The transactions cannot be changed. Hence, the sustainability of transactions is guaranteed. As for the drawbacks, the three main disadvantages are redundancy, signature verification and consensus mechanism.

The conventional banking system has its mechanism of verifying transactions. It differs from bank to bank, but the main logic is similar. They are the third party in the money transaction process. Whenever someone wants to send money to another, they simply type the amount and send it to the receiver. The banks then approve the transaction and send it to the receiver account. The only validation mechanism is the bank. However, in blockchain, there are many validation mechanisms and all of them must approve the transaction. This situation comes up with a problem. It means that so much work has to be done. In addition to this, so much energy, electricity, consumption be needed. That means lots of work should be done for the same result. Also, it means that the whole system should update itself for only one transaction to be done. This infrastructure of blockchain deduces the redundancy of the system.

Secondly, every blockchain transaction must be digitally confirmed using a public-private cryptography scheme such as ECDSA (Elliptic Curve Digital Signature Algorithm). Confirming these transactions is complex, which results in bottlenecks in the system. In contrast, in centralised databases such as banks, once a connection has been established, there is no need to individually verify every request unless any alarms are triggered. The complexity of blockchain verification could be regarded as a disadvantage compared to the bank's signature system. In a distributed database or distributed ledger system like blockchain, effort must be expended in ensuring that nodes in the network reach consensus. Nevertheless, Iansiti and Lakhani (2017) argue that the blockchain technology can reduce the cost of transactions if it is adopted widely and reshape the economy.

To sum up, blockchain has advantages and disadvantages. Morabito (2017) explains that "blockchain governance has tremendous transformative potential for our societies". However, the risks and benefits associated with its practical applications, must be cautiously evaluated, avoiding unrealistic hopes, as well as the drawbacks of a technocratic way of thinking. If correctly managed, decentralised government services through blockchain are promising and desirable since it could support more transparent public

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administration. The decentralisation of governance through open, distributed blockchain like Bitcoin, nevertheless, presents severe risks and drawbacks, which offset the benefits. While initially designed as disintermediation tools, fully distributed blockchain is categorised by a huge amount of third parties and money-making businesses contributing intermediation services, with strong asymmetries of information and power between developers and users.

The free nature of existing distribution networks calls into question factors such as digital divide, unaccountable power of core developers, and lack of clearness in the decision-making process, thus making some blockchain advocates' expectations overestimated and unrealistic. Hence, there is cause to investigate the role of blockchain-based governance as a large catalyst of individual power in a complete sense. Furthermore, the promise of empowering individuals is likely to stay unfulfilled due to the prevailing role of markets and the tentative verification systems of fully distributed blockchain. On the other hand, the process of undermining public institutions, the superiority of economics over politics, and the change of citizens into customers with the promise of more autonomy, effectiveness, and fairness may conceal yet an additional dangerous process of the corporatisation of politics, which perpetually empowers markets to the disadvantage of citizens. Far from being innovative, such transfer of power from the public to the private sector has been ongoing in different forms for decades, with vast social and economic costs. For instance, the steps necessary to complete a securities trade are the same today as they were 50 years ago; computers only improved the trading speed. In contrast, blockchain primarily reorganises the operations of financial transactions in ways that were not envisioned just a few years ago.

It will take time for institutions to completely account for the profits and risks that blockchain-based governance offers. Some organisations cannot afford to wait for total clearness as the technology evolves and is deployed by their competitors. The swiftness of innovation will accelerate as technology, and financial services continue to come together, and success will repeatedly be determined by the ability to take sensible action founded on knowledgeable experience. Consequently, it is crucial for institutions to vigorously partake in this cycle of innovation and disruption to guarantee that they comprehend how technology is dynamically influencing the sector and that they are well-positioned to recognise and track opportunities as it evolves. Equally, it will be essential to realise that working to build up a perfect solution will be pointless if the challenge changes prior to the implementation of a suitable solution.

In the nearest future, we predict a reasonable multitude of changes and developments from Blockchain-based governance solutions. At the moment, the dawn of the blockchain revolution produces challenges that lie ahead for financial services that will require new and innovative thinking. Blockchain is a radical technological innovation that offers a great amount of potential and opportunities to organisations. Success will depend on the risks that firms are ready to take as well as on the speed of their actions and decisions. It becomes apparent that the most successful firms will be those that will be able to outperform and distinguish among competitors during this blockchain revolution.”

### **Working System of Blockchain Technology**

Blockchain offers numerous benefits such as transparency, efficiency, fast transactions, solid data storage and easy access to data. The infrastructure of blockchain technology allows all information to be kept by every member of the system and prevents anyone from changing the data. Ensuring the safety of data is the most advanced feature of blockchain. On the other hand, it is an open source technology, which means anyone can contribute to the system. Any person or corporation can develop a solution to

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make the blockchain system better. It may seem confusing that while everyone can enhance the system, they cannot ruin the information. This is an appealing feature. Blockchain lets everyone detect every transaction and at the same time, prevents them from fraud.

This being the case, blockchain is becoming more popular in every sector for different purposes. Recently, French President Emmanuel Macron proposed that the European Union use blockchain technology for agriculture so that we could track every step of the supply chain and keep up with bigger rivals (Paluch, 2018). This will allow them to track the transactions from raw materials to the end products. By giving codes to every starting block, it can be tracked similar to barcoding products. This offers the ability to analyse the productivity of raw materials. By tracking from the very beginning of the raw materials, they can compute their productivity and come up with solutions to make more efficient end products. It would allow tracking products to control the supply chain and produce more efficient products.

Blockchain leading area of application is finance. While it promises many opportunities, the main actors in finance (i.e. banks), should take advantage of blockchain. Islamic banks should invest more in this area. Without interest rate, they can reach the masses by using blockchain whole also using it as a platform to develop new products. Supporting such innovation would reflect positively in Islamic banks as being open-minded to new technologies.

Even though blockchain is readily associated with Bitcoin, its potential exceeds far beyond cryptocurrency. Blockchain promises secure transactions in a virtual world. Utilising this opportunity will attract the attention of individual customers and corporations. Using an uninterruptible system will provide continuous service for customers, unlike Visa and Mastercard, which suffered service interruption in 2018 (Paluch, 2018). Transactions controlled by a single authority may cause system failure for payments to their customers. With the advanced technology of blockchain, this type of outage cannot occur because of a distributed verification system. Each participant of the system can act as an authority to verify the transaction, and with the help of that system always keep functioning.

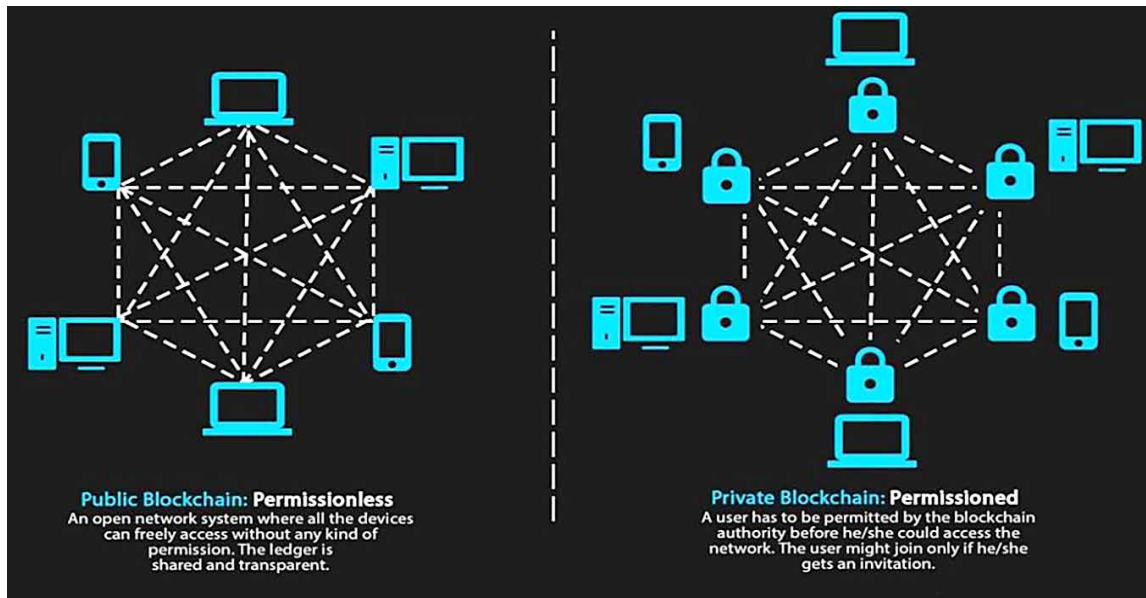
This chapter does not advocate that Islamic banks try to hide their real investment profit from their customers or lenders. Rather, it emphasises eliminating misleading investment information. Sharing every outcome of the investment will certainly increase the trust of customers. Shariah compliant banks should prioritise this delicate issue. As mentioned earlier, banks do not have to share their information with everyone. In dealing with sensitive business about money and money derivatives, they certainly want to keep secret information to themselves. Like any other business, banks also have confidential business information about how they make a profit.

A private blockchain system could be ideal for classified transactions. Only certain members can follow the processes during the investment. No one will be able to intervene in the process. Establishing a digital wallet for each party and naming each investment means the process is classified while also being able to be tracked. Some may argue that, if banks create this system, it would be anonymous and identifying which wallet belongs to whom is not possible. However, in a private blockchain system, banks can declare which wallet belongs to them and which wallet belongs to their investments. On the other hand, when they want to create a new wallet for themselves and their customers, they can inform the other parties, wait for the approval in order to prevent any misunderstanding, and then start the investment process. If anyone creates a new wallet, it can be detected because every member knows the number of wallets of the system. By doing so, every party would have knowledge of which wallet belongs to which bank and investment.

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Figure 1. Public and private blockchain network

Source: Mobiloitte Blog (2018)



There is no denying that the public blockchain system has some adverse characteristics. Dedicated software developers such as the Lightning Network team are trying their best to minimise these features. The focus should be on the capacity of eliminating trust issues that may occur in transactions like the Islamic interbank lending processes. By using private blockchain, Islamic banks can avoid the unfavourable elements of the blockchain system while retaining information specific to customers. As shown in Figure 1, only certain members can participate in the system and execute their job. It is a restricted area for any outsider. With a limited number of participants, the system will surely work more efficient compared to the public blockchain, and reduced likelihood of system failure would mean that the system functions more efficiently.

### Applying Blockchain Technology in the Islamic Interbank System

Swan (2015) emphasises that blockchain's main area of application is integrating cryptocurrencies to businesses due to its efficiency. According to Swan (2015), Ripple Lab is seizing the blockchain technology and reinventing the banking system by giving opportunities to conventional financial institutions to establish businesses more efficiently. Reinventing the banking system is a bold standpoint, but she supports her idea with the explanation that on the Ripple network, payments can be made through banks bilaterally without an intermediary. Also, Ripple is developing a smart contract system to be used on blockchain. It is safe to say that banks realised the benefits of the blockchain system and started to invest in this area. For example, in Turkey, Akbank started to use Ripple's network (Ripple, 2019). Similarly, JP Morgan has established its cryptocurrency to demonstrate its efficiency starting with selected industrial customers (Julia Horowitz, 2017). JP Morgan's cryptocurrency is planned to work as a stable currency. There will be no fluctuations in the price.

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Nakamoto (2008) also proposed a system for electronic transactions without relying on trust. He started with the usual framework of coins made from digital signatures, which provides strong control of ownership, but is incomplete without a way to prevent double-spending. To solve this, they suggested a peer-to-peer network using proof-of-work to record a public history of transactions that quickly becomes computationally impractical for an attacker to change if honest nodes control a majority of CPU power.

Similarly, Shariah compliant banks' income mentality is mostly based on profit sharing. This applies to borrowing and lending cash between banks. In the Islamic perspective, corporations, banks or individuals cannot charge the other parties a fixed income rate. The payback should at least be the same amount unless loss occurs. Nevertheless, this could be manipulated if Islamic banks become consumed by making a profit.

As mentioned earlier, banks borrow money from other banks to meet their cash needs. Islamic banks have a system that differs from conventional banks. They agree on a profit-sharing rate from a certain investment. The profit sharing ratio may differ accordingly to investment type, investment risks and capital. This may seem a burden to the borrower bank, which can mislead the outcome of the investment and can pay less profit to the other bank by hiding the real return of the investment. It is easy to forge a document and hide the real results. Parties may also declare no-profit and pay only the capital. In order to prevent this situation, banks can use a shared, transparent system to remunerate each party. The blockchain system would suit this purpose, as all transactions are transparent.

To clarify how it could be done, in Figure 2, Bank A and Bank B make a deal on investment and investment's profit sharing. Lender Bank A will send the lending amount from its wallet to Borrower Bank B's wallet. The amount will be known. Then Borrower Bank B will make its investment and send it to the investment wallet. In that stage, a transaction number (TX number) will be created automatically. By giving the code to the Lender Bank A, they will be able to detect if the right amount of money was sent to the investment wallet. They also can see Borrower Bank B's wallet account before and after the investment. After the investment is completed, the sum will be resent to Borrower Bank B's wallet. Lender Bank A is still able to follow all these processes and will have information about how much profit was made as a result of the investment. When the amount is sent to Borrower Bank B's wallet, Lender Bank A can demand its capital and profit share. If Borrower Bank B sends less money to Lender Bank A, Lender Bank A can demand its real share based on the evidence gleaned from tracking every step of the investment and know how much profit resulted from the investment.

**Step 1:** Lender Bank A sends money to Borrower Bank B.

**Step 2:** Bank B invests the amount and Transaction number (Tx number) generated.

**Step 3:** Generated Tx number is shared with Bank A to watch the process.

**Step 4:** Investment's outcome collects and Bank A can detect how much profit was made by tracking the Tx number of the investment and demands their profit share.

**Step 5:** Main capital and profit share sent to Bank A.

With the use of blockchain, banks, especially Shariah compliant ones, have a transparent and trustworthy system. This would cultivate trust, which would attract more participation and generate more Islamic capital. Unless banks prove their trustworthiness, they will lose customers, especially given the recent global financial crises. This is particularly true for emerging markets which entail greater levels of risk. Transparency and trust are core characteristics of banks and the capital market. If capital is to growing, Islamic banks need to keep growing as well.



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