Blockchains for Islamic finance: Obstacles Challenges

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Abstract

This paper focuses on analyzing the innovative technology "Blockchain" and the potential of blockchain-based applications for Islamic finance. The main objectives were to define how blockchain can change the Islamic finance industry. The paper discussed the various interesting applications of blockchain in Islamic finance that can bring different benefits. The paper also shed light on the challenges facing Applying Blockchains for Islamic finance .

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Introduction

Islamic finance and its digital economy offer opportunities for Muslims and non-Muslims as both populations now seek a convergent solution to their pressing issues—rebuilding trust and confidence in a financial system that had lost them. Some technologists imagine this world without intermediaries, while others just want a faster and more efficient way of transacting. Either way, the challenge comes from accountability, and embedding that sense of accountability within the new systems that are being built, based on the sharing of risks and profits that anchor the nature of our economies, including the sharing economy of underutilized assets.(Mohamed & Ali, 2018)

The blockchain technology is rapidly gaining the attention of Organizations of Islamic Cooperation. There are various Islamic financial institutes which are planning to use the blockchain system to bring the benefits that come with it. The authorities in Dubai have revealed their plan that in 2020 they will be using blockchain in public and private sectors. It is no surprise that even government is showing interesting in the digital currency. Here we have the information related to the relationship of blockchain in Islamic finance and banking system.

What is the state of blockchain today? In PwC's 2018 survey of 600 executives from 15 territories, 84% say their organizations have at least some involvement with blockchain technology. Companies have dabbled in the lab; perhaps they've built proofs of concept. Everyone is talking about blockchain, and no one wants to be left behind. It's easy to see why. As a distributed, tamperproof ledger, a well-designed blockchain doesn't just cut out intermediaries, reduce costs, and increase speed and reach. It also offers greater transparency and traceability for many business processes. Gartner forecasts that blockchain will generate an annual business value of more than US $3 trillion by 2030. It's possible to imagine that 10% to 20% of global economic infrastructure will be running on blockchain-based systems by that same year.[1]

For the Islamic economy, blockchain technology has the potential to make a significant impact. The blockchain in Islamic finance and banking will surely help the Islamic banks, and financial institutes to succeed. Without worry about the interest and other such issues Islamic banking system will be able to work more productively.

Islamic financial institutions are increasingly using blockchain technology for complex financing terms, Shariah-compliant transactions and Islamic and sharia-compliant alternatives to conventional insurance. back-office

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[1] https://www.pwc.com/blockchainsurvey

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automation, and underwriting of micro-insurance. Islamic finance can use cryptocurrencies for SMEs finance, underpinned by blockchain technology, to structure payments in an efficient and cost-effective manner.

Blockchain's core attributes mean that it has significant potential for use in Islamic finance due to its:

- Transparency: blockchain provides provenance, traceability and transparency of transactions
- Control: access to permissioned networks is restricted to identified users
- Security: the digital ledger cannot be altered or tampered with once the data is entered. Fraud is less likely and easier to spot
- Real-time information: when information is updated, it's updated for everyone in the network at the same time

The blockchain in Islamic finance and banking will surely help the Islamic banks, and financial institutes to succeed. Without worry about the interest and other such issues Islamic banking system will be able to work more productively. Management of loans and other relatable services will become easy. in addition to reducing fraud and risk, it can bring down the high costs associated with Islamic finance. The cost of processing Islamic financial products is higher than regular financial services products, so blockchain is a very effective tool to bring down the cost in the back-end processing systems of Islamic finance companies The real challenge, going forward, will be the legality of smart contracts, and the global regulatory framework needed to establish true peer-to-peer lending across borders; just because it is legal in one country, does not make it so in the next.

Given this state, this paper aims to provide an introduction to applying Blockchain for Islamic finance and outline some potential areas for consideration for the all sectors of the Islamic finance. The book:

• Explains what Blockchain technology is and is not;

• Makes the case for Islamic finance to build knowledge of, and capability in, relation to Blockchain technology;

• Make sense of its impacts on Islamic finance, and anticipate future

developments; and

• Explore and discuss existing Islamic finance usage of Blockchains.

The blockchain basis

The term blockchain refers to the combination of a number of technologies, including the following: The blockchain data structure; Public key cryptography; Distributed ledgers; Consensus mechanisms. (Castiglione Maldonado, 2018)

In the simplest terms, a blockchain consists of a linked chain that stores auditable data in units called blocks. Many commentaries online start by explaining that a blockchain is similar to a Google document spreadsheet where multiple authors can contribute because of the mechanism of locking. Blockchain is a bit more complex than that example and has unique characteristics that make it an attractive technology for tagging, storing and tracking anything of value. Bitcoin was one of the first and most popular implementations of blockchain technology.

Although bitcoin has become a major buzzword in technology over the past few years, blockchain technology is more than just investment opportunities. Blockchains are peer-to-peer networks that use cryptology and distributed computers systems, and which can be used to share data and build applications. Blockchain has the potential to impact many data-focused aspects of everyday life, from banking and payments, to big data and smart contracts. Blockchain and bitcoin are not the same thing; bitcoin is implemented using blockchain technology, but blockchain technology can be used in contexts much wider than bitcoin or cryptocurrencies. (Castiglione Maldonado, 2018)

A blockchain consists of blocks, each block containing the data (anything of value), its own hash value (a unique cryptographic value containing characters and numbers generated through a complex computational algorithm) and a pointer to the hash of the previous block.(Sylvester, 2019)

Types of Blockchain

Since the Internet is comprised of a public version and several private variations, blockchains will also follow that path. Therefore, we will have public and private blockchains. Some will be natively bolted to a blockchain, whereas others might be a hybrid implementation that is part of an existing Web or private application.(Mougayar, 2016)

Blockchains can be classified as public, private or hybrid variants, depending on their application:(Sultan, Ruhi, & Lakhani, 2018)

Public – Public blockchains have no single owner; are visible by anyone; their consensus process is open to all to participate in; and they are full decentralized. Bitcoin is an example of a public blockchain.

Public blockchain is open source in which anyone can participate, without the need of permission. On such platform, anyone can download the code or software, and start running a full node on the local device, validating transactions in the network, thus participating in the consensus process. Due to the public nature, anyone can see or audit transaction on the public block explorer; however, the parties of a transaction remain anonymous. There are few advantages of using public blockchain. It has a potential to disrupt current business models through disintermediation. Moreover, there is no need to maintain servers or system admins by the central authority, this radically reduces the cost of creating and running decentralized applications (DApps). Some examples of public blockchain are Bitcoin, Ethereum, and Litecoin.(Abojeib & Habib, 2019)

Private – (also called permissioned) Private blockchains use privileges to control who can read from and write to the blockchain. Consensus algorithms and mining usually aren't required as a single entity has ownership and controls block creation.

Private blockchain can be defined as a platform controlled by a single or centralized organization with restricted number of nodes within that organization. It is valuable for solving efficiency, security and fraud problems within traditional institutions, but the most important feature of decentralization is not available for private blockchain. It has same advantages as of the consortium blockchain, but it is different from it in the sense that it has more restriction and is not distributed.(Abojeib & Habib, 2019)

Hybrid – Also known as consortium, these blockchains are public only to a privileged group. The consensus process is controlled by known, privileged servers using a set of rules agreed to by all parties. Copies of the blockchain are only distributed among entitled participants; the network is therefore only partly decentralized.

It is also called federated blockchain. It operates under the control of a specific group of organizations which are allowed to perform the role of full nodes. As opposed to public blockchain, the structure does not give access to all persons to participate in the process of verifying transactions. The consensus process is controlled by a preselected set of nodes in which the protocol defines the minimum number required to sign every block in order for the block to be valid. The right to read the blockchain can either be public or restricted to the participants only. This type of blockchain has some specific advantages. For example, it reduces transaction costs; avoids data redundancies; and replaces legacy systems. It is also helpful for simplifying document handling and getting rid of semi manual compliance mechanisms. The transaction processing in such blockchain is faster than a public blockchain, which means there is a potential for higher scalability. It also provides more privacy, but at the cost of lesser

transparency. Consortium blockchain can be suitable for the traditional banking sector.(Abojeib & Habib, 2019)

Investments in Blockchain

Major firms across the financial services landscape have made investments in blockchain-based start-ups, continuing into 2018. The herd of new strategic investors is playing an increasingly important role in the health of the financing market for these start-ups. As of the first half of 2018, the total investments in blockchain-related companies have exceeded US$1.3 billion across all investment rounds worldwide. Reported dollar volume invested in VC rounds raised by blockchain companies surpassed totals in 2017.(Mohamed & Ali, 2018)

Why it's hard to trust a blockchain

Blockchain, by its very definition, should engender trust. But in reality, companies confront trust issues at nearly every turn. For one, users must build confidence in the technology itself. As with any emerging technology, challenges and doubts exist around blockchain's reliability, speed, security and scalability. And there are concerns regarding a lack of standardization and the potential lack of interoperability with other blockchains.

Also contributing to the blockchain trust gap is a lack of understanding. Even now, many executives are unclear on what blockchain really is and how it is changing all facets of business. Although the public narrative has moved beyond bitcoin, even the more recent focus and hype around ICOs only hint at the potential impact. Blockchain's role as a dual-pronged change agent — as a new form of infrastructure and as a new way to digitize assets through tokens, including cryptocurrency — is not easy to explain. Think about other new technologies: users can try on virtual reality goggles or watch a drone take flight. But blockchain is abstract, technical and happening behind the scenes.

Another challenge for blockchain is building trust in the network. It is perhaps ironic that a technology meant to bring consensus hits a stumbling block on the early need to design rules and standards. Take payment systems and mechanisms in banking. Though everyone plays by the rules of existing systems today, they don't necessarily agree on how an alternative blockchain-based model should be designed and operated.

Likewise, there's a lack of comfort regarding regulation. The majority of regulators are still coming to terms with blockchain and cryptocurrency. Many territories have begun studying and discussing the issues, particularly as they relate to financial services, but the overall regulatory environment remains unsettled. It is perhaps ironic that a technology meant to bring consensus hits a stumbling block on the early need to design rules and standards.

The blockchain is agnostic with respect to the data it stores. Hence, the range of data being stored in the blockchain and the range of its application areas are as wide and as diverse as human activities themselves. As a result, it is impossible to provide a complete overview of all blockchain applications. For that reason, this section presents a small selection of concrete blockchain application areas in which the blockchain is already used or may be used soon:(Drescher, 2017)

• *Payments*: Managing ownership and transfer of digital fiat currencies.

• *Cryptocurrencies*: Managing ownership and creation of digital instruments of payment that exist independently from any government, central bank, or other central institution.

• *Micropayments*: Transfer of small amounts of money that would be too costly by using traditional means of transfer.

• *Digital assets*: Managing creation, ownership, and transfer of digital items that have value in their own right or represent valuable goods in the real world.

• *Digital identity*: Proving identity and authentication based on unique digital items.

• *Notary services*: Digitizing, storing, and verifying documents or contracts and proof of ownership or transfer.

• *Compliance and audit*: Auditing business activities of people or organizations in regulated industries in an audit track.

• *Tax*: Calculating and collecting taxes based on transactions or on sole ownership, reducing tax avoidance, or double taxation.

• *Voting*: Creating, distributing, and counting digital ballot papers.

• *Record management*: Creation and storing of medical records.

Applications of Blockchain in Islamic Finance

Islamic finance, as an alternative and ethical financing method, directs funding to impact-oriented real economic activities; it thus utilizes economic and financial resources to satisfy the material and social needs of all members of the community. The main foundations of Islamic financial products are its asset-based transaction nature, together with its equity-based nature of sharing risk and profits. Each of these financing categories has a fundamental role to play in increasing the financial inclusion and innovative start-ups, as well attracting potential capital from Islamic capital providers and sources.

Islamic finance is the only example of a financial system directly based on the ethical precepts of a major religion, providing not only investment guidelines but also a set of unique investment and financing products." Islamic finance is based on *Shari'ah*, the Islamic law that provides guidelines for multiple aspects of Muslim life, including religion, politics, economics, banking, business and aspects of the legal system What *Shari'ah* compliant financing seeks to do is to shape financial practices and accompanying legal instruments that conform to Islamic law. Major financial principles of Shari'ah include a ban on interest, a ban on uncertainty, adherence to risk-sharing and profit-sharing, promotion of ethical investments that enhance society and do not violate practices banned in the *Qur'an* and tangible asset-backing.(Elasrag, 9. April 2011)

Islamic finance is based on Shari'ah, an Arabic term that is often translated into "Islamic law". Shari'ah provides guidelines for aspects of Muslim life, including religion, politics, economics, banking, business, and law. Shari'ah-compliant financing constitutes financial practices that conform to Islamic law.(Ilias, 2010)

Shari'ah compliant finance has become an accepted and vibrant element in international financial transactions. It offers a fresh opportunity to emphasize the moral and ethical aspects of business and finance that reaches beyond the Arab and Islamic worlds to prompt a reexamination of the core values underlying all global financial transactions – making available the financial resources needed to develop the human capital that will sustain economic and social progress. The main principles of Islamic finance include:

The prohibition of taking or receiving interest;

Capital must have a social and ethical purpose beyond pure, unfettered return;

Investments in businesses dealing with alcohol, gambling, drugs or anything else that the Shari'ah considers unlawful are deemed undesirable and prohibited;

A prohibition on transactions involving maysir (speculation or gambling); and A prohibition on gharar, or uncertainty about the subject- matter and terms of contracts – this includes a prohibition on selling something that one does not own.

According to Thomson Reuters' projections, Islamic finance assets are projected to grow to $3.2 trillion by 2020. It depicts Islamic finance potentials to support the SDGs by providing innovative financing solutions. Compared to individual contribution, giving zakat or sadaqah through formal institutions, investing in Islamic bonds, can increase outreach, targeting the people in need, and providing a more strategic and sustainable solution. However, there are several challenges, inefficiency, a lack of transparency in terms of how the funds are collected, managed, distributed, and the differing views of Islamic scholars on how these should be dealt with the rulings or fatwa.[2]

However, the power and potential of blockchain and smart contracts is being recognized across the business and political spectrum. While it may take regulators some time to catch up, broader adoption will lead to sensible regulation.

Is Islamic finance and Blockchain are fully compatible with each other?. The answer is: a definite possibility with a caveat - by defining the appropriate behavior. Off course, the question is NOT about whether the existing bitcoins and cryptocurrencies are permissible under the Islamic Shari'a. This issue is left for the Islamic scholars to come with the appropriate answer (and for that matter, is NOT the paramount issue that we should be focused on). The most important features of Blockchain is about: a) It is a PEER-TO-PEER system of transactions; b) It is based on fully DISTRIBUTED system; and c) It is an AUTONOMOUS process (AI). Islamic finance is about enforcing righteous behavior, and blockchain is about "coding" those behaviors onto a full system of AI, which would then ensure that those behaviors are adhered to autonomously, without further interference of another party. It then becomes "self-enforcing", "self-regulating", "self-correcting", and "self-performing" platform. If all the statement above are true, then the answer of "a definite possibility" would be true. (Hasni bin Wan Sulaiman, 2017)

There are various interesting applications of blockchain in Islamic finance that can bring different benefits:[3]

1. Smart Contracts

smart or automated contracts in blockchain are a good way to ensure that any product or service is Shariah-compliant, and it allows the integration of any

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[2]Gratiyana Ningrat ,Islamic finance and blockchain: Can it bring greater impact?   In: https://www.thejakartapost.com/academia/2018/11/24/islamic-finance-and-blockchain-can-it-bring-greater-impact.html

[3] Zakiya Abdul Samad ,Understanding Blockchain in Islamic Finance & Banking,in: http://www.aims.education/islamic-finance-blog/blockchain-in-islamic-finance-and-banking/

contract terms and conditions, either with the customer or the third party, into the blockchain.

To avoid the rapidly increasing interest rates, Islamic banks can take help from smart contracts. It will help to reduce uncertainty and speculations. There are different types of contracts available in Islamic financing that will help in the management of profit-sharing agreements, agency arrangements and partnerships.

Contractual agreements are key enablers for trade and commerce which record mutually agreed upon terms for execution or dispute resolution. The Quranic verses (Surah Al-Baqarah: 282–283) enjoin Muslims to put contracts in writing for fairness and accountability. As such, Muslim traders rely upon an Islamic legal and institutional framework for the purposes of accounting and accountability, while Muslim scholars define legal norms and act as mediators in commercial disputes. Possessing written records is vital to the efficiency and transparency of commerce and for monitoring trade and agreements. Islamic law is the central institutional framework of being Muslim, and its inherent legal framework dictates, among other things, the ethical norms of business behavior, to form the foundation for trust, equality, and fairness. As the world evolves, we use technology to operationalize the specific intents of the Shariah so that Islamic economic actors can be adept at more efficient (and less risky) ways of doing business. Reliance on physical documents leads to delays, inefficiencies, and increases exposure to errors and fraud. Financial intermediaries, while providing interoperability for the finance system and reducing risk, create unnecessary overhead costs and increase compliance requirements.

Smart contracts, on distributed ledger technologies (blockchain) that have the capacity to inject greater efficiency and productivity while saving costs associated with traditional contracts. Many financial enterprises are exploring the use of smart contract technology for various applications across the banking, financial services, and insurance (including takaful) sectors (EY, 2017). As of now, prototypes developed have been simplified versions of a smart contract, but more work needs to be done in key areas, which will tackle legal and regulatory compliance, scalability and security, and the ability to code complex contracts which currently dominate the financial services landscape.(Mohamed & Ali, 2018)

Smart contracts are a complex set of software codes with components designed to automate execution and settlement of contractual agreements. In other words, they are programmable contracts which self-execute the stipulations of an agreement when predetermined conditions are triggered. Once two or more parties consent to all of the terms within the contract, they cryptographically sign the smart contract and deploy it to a distributed ledger. When a condition specified in the code is met, the program automatically triggers a corresponding action. By removing the need for direct human involvement, a deployed smart

contract on a distributed ledger could make contractual relationships more efficient and economical with potentially fewer opportunities for error, misunderstanding, delay or dispute.

How smart contracts work

It's worth noting that bitcoin was the first to support basic smart contracts in the sense that the network can transfer value from one person to another. The network of nodes will only validate transactions if certain conditions are met. But, bitcoin is limited to the currency use case. By contrast, ethereum replaces bitcoin's more restrictive language (a scripting language of a hundred or so scripts) and replaces it with a language that allows developers to write their own programs. Ethereum allows developers to program their own smart contracts, or 'autonomous agents', as the ethereum white paper calls them. The language is 'Turing-complete', meaning it supports a broader set of computational instructions. The idea is that one entity will no longer have control over your notes and that no one could suddenly ban the app itself, temporarily taking all of your notebooks offline. Only the user can make changes, not any other entity.

In theory, it combines the control that people had over their information in the past with the easy-to-access information that we're used to in the digital age. Each time you save edits, or add or delete notes, every node on the network makes the change.

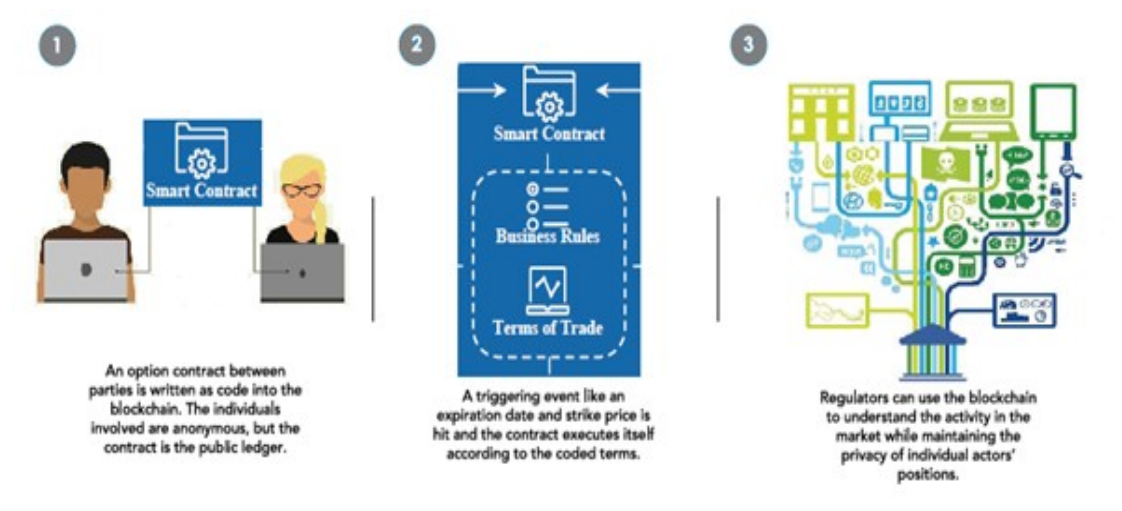Smart contracts can:

   Function as 'multi-signature' accounts, so that funds are spent only when a required percentage of people agree

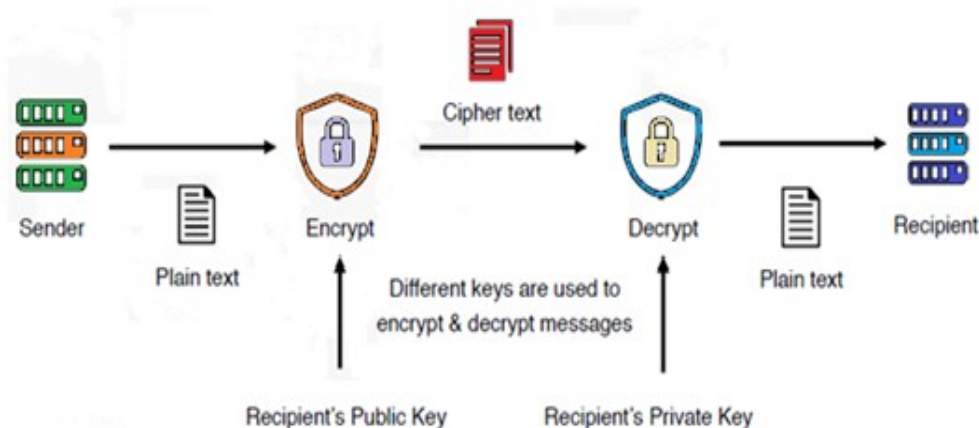   Manage agreements between users, say, if one buys insurance from the other

   Provide utility to other contracts (similar to how a software library works)

   Store information about an application, such as domain registration information or membership records.

An option contract between parties is written as code into the blockchain. The individuals involved are anonymous, but the contract is the public ledger.

A triggering event like an expiration date and strike price is hit and the contract executes itself according to the coded terms.

Regulators can use the blockchain to understand the activity in the market while maintaining the privacy of individual actors' positions.

There are several models of smart contracts being prototyped today but the basic blockchain-based technology uses public key encryption infrastructure (PKI) to encode the terms and conditions of a contract. PKI is a method of cryptography that uses of two types of keys. The first is a public key that all parties are aware of, and the second is a private key known only to its recipient. In a smart contract transaction initiated on a blockchain, the sending recipient encrypts their message into an unreadable 'cipher text' using algorithms or mathematical formulas, to protect and secure the data. Only the use of a private key can decrypt the 'cipher text' back into a readable 'plain text'. The key benefit PKI brings to smart contract transactions revolves around security, as it is extremely difficult, if not impossible, to reverse engineer a public key to a private one, making it very resilient to failures or hacks.[4]

How the Blockchain Cryptography works for Smart Contracts

Sender — Plain text — Encrypt — Cipher text — Decrypt — Plain text — Recipient

Different keys are used to encrypt & decrypt messages

Recipient's Public Key   Recipient's Private Key

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[4]Hazik Mohamed, Smart Contracts in Islamic Economic Transactions, March 16, 2017|Wahed Editors, https://journal.wahedinvest.com/smart-contracts-in-islamic-economic-transactions/

It is vital that the Islamic financial institutions move beyond challenges related to talent and smart contract innovation by forging strategic partnerships with experts in the space. In order to effectively partner with the smart contract startup ecosystem, it is crucial that Islamic banks, financial service providers and insurers develop an understanding of the smart contract landscape. They can also focus on conceptualizing entirely new products and services that are underpinned by smart contracts. The best results are likely to ensue from collaborative initiatives between accelerators, innovation labs, incubators, or direct with blockchain-based smart contract startups themselves in such innovation efforts.[5]

2. Cloud Storage

The biggest attraction of blockchain in Islamic banking is that banks will get access to cloud storage[6]. It will reduce all types of conflicts and help customers maintain their partnerships. The cryptographic mathematic algorithms will provide access to all the information. It will store all important data that can be accessed by banks and customers to avoid any issues.

The cloud storage data model specifies how digital data gets stored and retrieved across multiple servers in possibly geographically different locations and managed by a hosting provider. Cloud storage uses a logical memory model that allows providers to store your data on multiple servers in different locations in a way transparent to you.[7]

At a minimum, cloud storage includes space for some amount of data and a simple interface to manage files in the storage. Often this involves creating a special folder on your computer and monitoring file activity in it. Dropbox belongs to this category of cloud storage. More elaborate cloud storage includes sophisticated SaaS that seamlessly integrates with backend cloud storage. Google Docs offers this kind of service for Google Drive.

As ideal as cloud storage may sound initially, there are some serious issues that a company must consider[8]:

■ Because the database is not located on company premises, security becomes an enormous challenge. The company that owns the data no longer

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[5] Ibid

[6] Cloud storage refers to network storage devices where large amounts of data can be stored for future use. Often clouds are used to back up a computer's hard drive or store heavy data usage files, such as pictures and graphics, thus saving space on the computer's hard drive(s). As an example, as this book is being written the entire contents are being uploaded and stored on a cloud. When the text and graphics are finalized for each individual chapter the contents are moved to a Network Attached Storage (NAS) device. Besides being a space saving device the cloud has other advantages. If your PC hard drive crashes your data is safely stored in a cloud, which can be retrieved from another computer anywhere in the world. Charles A. Sennewald, Curtis Baillie, Computers and Effective Security Management, in Effective Security Management (Sixth Edition), 2016

[7] Aaron Wheeler, Michael Winburn, in Cloud Storage Security, 2015

[8] Jan L. Harrington, in Relational Database Design and Implementation (Fourth Edition), 2016

has complete control over security measures. It must rely on the cloud service provider to secure the database from unauthorized access; it must also implicitly trust the service provider's employees.

■ Access to the database requires a live Internet connection. Unlike architectures where the database is located on the company's internal network, no processing can continue when the Internet is unavailable.

■ The company that owns the data must rely on the cloud storage provider for consistent up-time. The responsibility for ensuring that the database is accessible is no longer with the company; it lies with a third party.

Overall, the owner of the data loses a great deal of control over the data when the data are stored in the cloud. The more important the security of the data, the riskier cloud storage becomes.

3. Digital Currencies

There are different types of digital currencies available, but the development of digital currency is not as simple as it seems like. It requires a complete process to manage the services. That is why such currencies come with benefits like improved security and different rewards to miners.

4. The collection of zakat

Another Islamic financial product ripe for blockchain disruption is the charitable zakat. Blockchain helps people know where there money is going, and to what purpose. The collection of zakat has been institutionalized in many Muslim countries. The promotion, collection and distribution of zakat are undertaken by the respective religious authorities according to shariah requirements. However, there are several challenges, according to research papers. They include inefficiency, a lack of transparency in terms of how the funds are collected, managed and distributed, the differing views of Islamic scholars on how these should be dealt with and extensive bureaucracy.[9]

Zakat is the transfer of ownership of a specific amount of money (or property) from someone who meets the certain criteria for the zakat to be obligated up on him/her to someone who deserves it by fulfilling certain criteria . It is a form of obligatory charity; and one of the five pillars of Islam. Due to its importance, it is mentioned thirty-two times in the Quran. The beneficiaries of zakat consist of eight categories including poor and needy. The criteria for individuals to be beneficiaries of zakat is well-identified in Shariah.(Abojeib & Habib, 2019)

Zakat is an annual charity obligation for Muslims; this obligation is calculated based on a basic living index cutoff amount called nisab which represents a basic standard of living index. Those whose net wealth falls below this limit are exempt from paying zakat. Typically, the nisab equivalent to three ounces of

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[9]Khairani Afifi Noordin,Islamic Finance: Using blockchain to improve transparency of zakat process, The Edge Malaysia Weekly, on August 27, 2018 - September 02, 2018. See : https://www.theedgemarkets.com/article/islamic-finance-using-blockchain-improve-transparency-zakat-process

gold. People having assets net greater than nisab for a full year qualify as having an obligation to pay zakat.

The amount of Zakat is calculated at 2.5% of liquid assets held for at least a full year: gold, silver, cash, savings, investments, rent income, business merchandise or profits, shares, securities, and bonds all qualify as part of the calculation. Since cryptocurrency like Bitcoin qualifies as a liquid asset, Muslims must take care to include their cryptocurrency assets in the calculation for their zakat obligation, as well as to keep track of how much cryptocurrency they've held for a full year, since assets held for less than one year need not be included in this calculation.

Blockchain made the process trackable, auditable, and immutable, all of which are essential qualities of any successful charitable raise. The service was inspired by pious Muslims who wished to use their cryptocurrency for religious payments, but had no outlets that appealed to them.

5. Improving the utility of waqf

Using blockchain to improve on the utility of waqf, which is Arabic for giving an endowment to a charity. In curious ways the concept of waqf parallels that of blockchain, in that the gifts are immutable and aren't owned by any particular entity. In fact, they are meant to be similar to the western concept of a "trust," but in God's name.

Waqf is a form of charity that is voluntary, permanent and irrevocably dedicated to Allah (SWT). Waqf can be either in kind, fixed assets, or cash. The donor of waqf (waqif) can specify the purpose of waqf which may vary from a general one such as helping poor and needy to a very specific one such as to help orphans with cancer. The waqif has also the right to specify the conditions for waqf. Is also worth to mention that the asset or property of waqf shall not be sold or distributed to charities, rather the benefits or revenue generated from investing waqf property. Waqf property is considered to be in the direct ownership of Allah, it can neither be gifted, traded, nor inherited.(Abojeib & Habib, 2019)

In the distant past, this Sharia precept was used throughout the Muslim world to improve societies and reduce poverty. Yet, many contemporary Awqaf are poorly managed, and thus have little impact on poverty. The key to improving trust in Awqaf is good governance, and transparency with stakeholders.

Finterra is a new company which announced developing a crowdfunding platform that uses blockchain to create smart contracts tied to specific waqf projects. It is hoped that this can provide a more efficient way to raise money, manage and transfer ownership of waqf.

The Waqf Chain allows participants to create project proposals to develop and invigorate endowment properties. Others can be involved in these project proposals by contributing funds. If the project goals are met, the project proposal will be accepted, and a certain number of endowment tokens are created and distributed to the participating funders. The tokens can be held to

gain stakeholder rights and revenue sharing or transferred and exchanged in the wider Finterra ecosystem (and on other networks) through the Finterra Inter-Chain Protocol.(Abojeib & Habib, 2019)

6- Effective, and efficient halal supply chains

Globally, there are almost 2 billion of Muslims from the 7.6 billion people in the world. Due to religious reasons, this enormous market of Muslims consciously seeks trusted, halal certified sources for their food, cosmetics, home care, pharmaceuticals, daily products and Shariah complied products to invest in. According to statistics, the global Halal market value that is recorded at approximately 1.4 trillion USD in 2017 is expected to reach 2.6 trillion USD in 2023.

Blockchain – with its characteristic that is high in transparency and traceability will be a good solution in providing reliable data and increase trust in the halal supply chains; increase seamless and efficient halal process from source to point of consumer purchase; improve sustainability of halal supply chains; and increase consumer's confidence in halal brands; and global recognition of halal products. Halal blockchains provide clear advantages for manufacturers, brand owners, retailers, logistics service providers, distributors, and halal certification bodies for better trust and authenticity.

The food industry is where trust is key to its operations. From farmers and producers to kitchens and end consumers, every step in the food industry can be improved by blockchain technology. A distributed ledger enables users to keep track of food origins, traceability, and quality control of food along the entire supply chain. As a system that can integrate data from all stakeholders into the ledger, blockchain technology can greatly benefit the food industry. However, some supply chains require even more transparency and traceability, and one of the areas that can make use of blockchain technology is the global halal market. Halal — which refers to the way that food should be produced and prepared according to Islamic law — is the food standard to which Muslims worldwide adhere. Moreover, halal food is considered to be healthier and more sustainable for the food industry. In recent years, with the rise in popularity of halal food, many producers that do not meet halal standards and requirements have been attempting to pass their food products as halal.[10]

A technology that can step in to alleviate this issue is blockchain, which can offer a transparent way to keep track of where food comes from, its producers, and relevant data which can vouch for the authenticity of halal food in the supply chain. Using this technology to guarantee halal standards, blockchain will open opportunities for new players in the market to offer their halal products to consumers all over the world. The food industry is set to undergo huge changes

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[10] Global Halal Market Turns to Blockchain for Supply Chain Integrity, https://www.asiablockchainreview.com/global-halal-market-turns-to-blockchain-for-supply-chain-integrity/

once the digital transformation to blockchain is implemented. This new technology will change the halal food market in numerous ways, from ensuring that all information about halal food, from its origin, quality assurances, to supply chain journey may be gathered into a distributed ledger that is transparent to all stakeholders. Whether it is the name of the butcher, the logistics company, the supermarket or the restaurant, all data about halal food can be gathered in the blockchain, enabling a flow of communication and overall greater trust in the quality of halal food that reaches consumers. For end consumers, blockchain technology will allow them to check the information of halal food using an application or website that may be accessed from anyone's smartphone.

Blockchain-based technologies, once implemented, are expected to be able to generate many more solutions for the $1.4 trillion global halal food industry. Halal food is unique compared to other types of food, as its religious laws state that halal food must be prepared and processed in certain ways, and must not ever contain any pork. Though globally-recognized labels such as HACCP (Hazard Analysis and Critical Control Points), GMP (Good Manufacturing Practice), and GHP (Good Hygiene Practice) have all been used in the halal food system to ensure that food is appropriately handled, blockchain technology can integrate all relevant information and gather them in a distributed ledger that may be made available to all stakeholders. There are numerous requirements for halal food that blockchain technology can be used to address. At the farm, the animal will receive an identification number, which can be stored in the ledger to monitor its food intake and living conditions. Then at the butcher, all documents relating to the animal's health and various timestamps can be added to the blockchain, in order to determine the cut of meat from the animal, the manner in which the meat was processed, and to verify that the meat is halal, according to religious laws. In the system, to ensure that halal meat is up to standards, the meat can also be tested with a DNA sensor after it is processed, then monitored with smart packaging that can track the logistics of the product from factory to supermarket or restaurant.

The sensors, as well as smart packaging in the supply chain, can also be developed to immediately send information to the blockchain to keep track of the halal product. Moreover, environmental data from locations to custom controls can also be stored in the blockchain system.

A large discussion group on halal blockchains was held with the captains of industry on 15 May 2017 at Universiti Malaysia Pahang in Kuantan (Malaysia) organized by the Faculty of Industrial Management. This large discussion group showed that halal supply chains have inherent problems or flaws, namely in (1) traceability (ability to verify the location of a product) and organizing product recalls; (2) transportation and warehousing (storage) compliance downstream the supply chain in accordance to halal requirements; (3) end-to-end chain integrity (unbroken chain): from source to point of consumer purchase; (4)

different halal systems and interpretations of different markets; and (5) lack of integration of information technology systems. These problems require a radically different approach to how halal supply chains are orchestrated. Halal blockchains have the potential to solve all of the above halal industry problems! (Tieman & Darun, 2017)

Blockchain is already called the fourth industrial revolution. It is a digital public ledger containing stringed data blocks with information, similar to our DNA.[11] It is not stored somewhere centrally, but distributed on many servers throughout the world. Blockchains are encrypted and automatically synchronized in the distributed blockchains and makes them a trusted public ledger that everyone can inspect, but no single user controls. A halal blockchain is a digital ledger of all halal supply chain transactions that have ever been executed. It is constantly growing as 'completed' blocks are added to it with a new set of recordings. The blocks are added to the blockchain in a linear, chronological order. Each node in the halal supply chain network gets a copy of the blockchain, which gets downloaded automatically upon joining the halal supply chain network. The halal blockchain has complete information about the addresses and their supply chain path right from source to the point of consumer purchase. As the halal blockchain database is shared by all nodes participating in a halal supply chain network, information is easily verified by just scanning the QR-code (a two-dimensional barcode) on a product. Blockchains pre-program the halal requirement for the destination market, halal storage-transportation-terminal handling terms, coding of halal on freight documents, and many more. In a blockchain you can easily identify the parties that committed fraud, as this remains visible. This discourages the industry to commit fraud in halal supply chains. Halal blockchains provide clear advantages for manufacturers, brand owners, retailers, logistics service providers, distributors, and halal certification bodies. For a better trust and authenticity of country's halal brands, halal certification bodies should embrace this new technology to support the halal industry in case of a halal issue, or worse, a halal crisis. They should support the halal certification of logistics service providers, distributors and retailers in order to facilitate a higher compliance in transportation and warehousing downstream the supply chain. Harmonization and standardization of halal supply chain standards in different jurisdictions are essential in the coming years to better support halal industries and their global supply chains.(Sadouskaya, 2017; Tieman & Darun, 2017)

At the same time it allows rating of halal logistics service providers based on the performance of their services. Robust, effective, and efficient halal supply chains are only possible with more intensive collaboration between companies in the supply chain. Blockchain technology allows halal networks to better use

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[11] Halal blockchain to boost supply chain transparency, May 29, 2017 . at :
http://halalsupplychainmanagement.blogspot.com/2017/05/halal-blockchain-to-boost-supply-chain.html

available halal assets, like halal warehouses & distribution centers, halal transport & containers, and halal compliant sea & air terminals. At this moment we see that brand owners have difficulty in dealing with halal issues and a halal crisis, as they are highly dependent on the speed of the halal certification body to verify possible claims of a halal integrity breach. As this verification might take a week, the damage is already done. Blockchains allow for instant verification in a transparent way and effective isolation of the issue. Blockchain technology enhances information sharing in the secured situation through the entire supply chain. The data stored on the public blockchain is accessible to everyone and cannot be tampered with. Therefore, it increases the trust, security and transparency in halal supply chain (Tan, Yan, Chen, & Liu, 2018)

With all data stored in the distributed ledger, it is available to all stakeholders, including the consumer who can access the information through a website or mobile application. For governments, blockchain can offer solutions regarding import controls of halal products, which will raise the standards of regulatory compliance.

Once information is sent to the blockchain from the different suppliers along the supply chain, it may be monitored for other purposes, such as legal and tax purposes. Businesses can also benefit from blockchain technology, as both B2B (Business to Business) and B2C (Business to Consumer) relations will be enhanced with greater transparency and assurance of authenticity. Consumers of halal food will be more confident that with just a QR code that can be scanned using mobile applications, they will be able to trace the origins and manner of production of the food product. Ultimately, blockchain technology can offer a platform for all players in the halal food supply chain to demonstrate their transparency and responsibility for their products. With the halal market's continuous growth, blockchain can offer a better solution that will ensure more high-quality halal products for all consumers.[12]

what about its application in the Muslim world or more directly in the Halal economy? Figure below, adapting the principal agent framework in for the interaction between a Halal food manufacturer who needs to establish trust in its product by securing a Halal logo (from the Halal ministry/government body). We are depicting the various parties involved before the Halal retail buyer (HRB) who ultimately purchases a food product. Across the chain of interactions there are various contractual obligations before the HRB makes a purchase which is driven by only one factor: the Halal logo, the trusted logo. The HRB is making an inherent assumption that all the contractual fulfillment has happened. (Rana & Akinlaso, Q3 2018)

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[12] Halal blockchain to boost supply chain transparency, May 29, 2017 . at :
http://halalsupplychainmanagement.blogspot.com/2017/05/halal-blockchain-to-boost-supply-chain.html
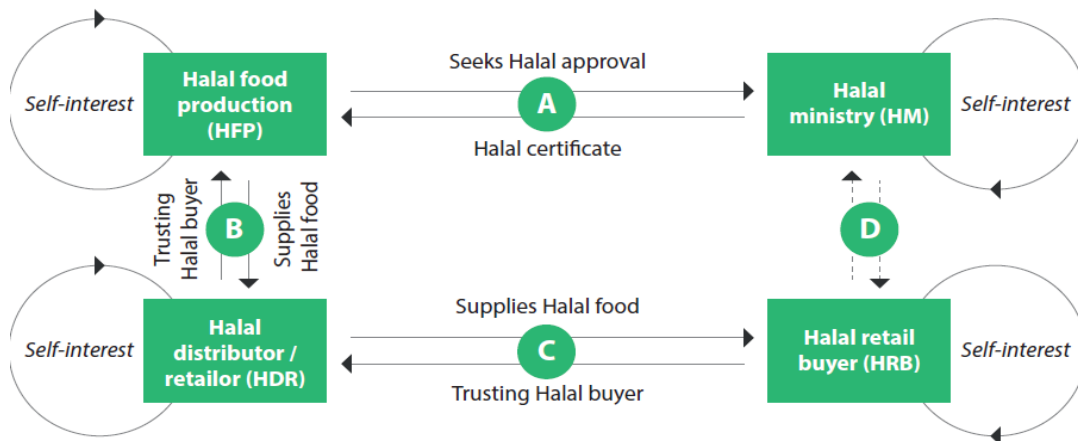
Principal-agent interactions for Halal food

*A. HFP needs a bona fi de unadulterated approval from HM; HM
need to deliver an authentication stamp saying Halal to HP.
B. HFP distributes Halal products to HDR; HDR pays HP
C. HDR provides Halal Products to HRBs
D. HRBs have bona fi de feelings that Halal stamp is authentic
Moral hazard: The entire value chain reeks of moral hazard problems due to
self-interest. Perhaps the only entity relying on a bona fide response is the end
buyer who is likely making a purely unadulterated decision purely based on trust
via the actual Halal logo.*

Use case: Blockchain in Halal food sector

Is blockchain the silver bullet to all problems that might exist in the sector? How does blockchain solve this problem? Consider Figure below where a potential blockchain solution is depicted to address the problem of information asymmetry. It does so by allowing the end buyer to verify that the entire value chain is compliant with Islamic requirements and limits the amount of potential fraud. Let's say a producer has completed the manufacturing process for the Halal food, say beef, and is now ready to deliver to the market. Before the physical transaction or shipping of the product, the manufacturer will perform certain Halal compliance and authentication measures (ie Halalticate) as part of the due diligence.(Rana & Akinlaso, Q3 2018)
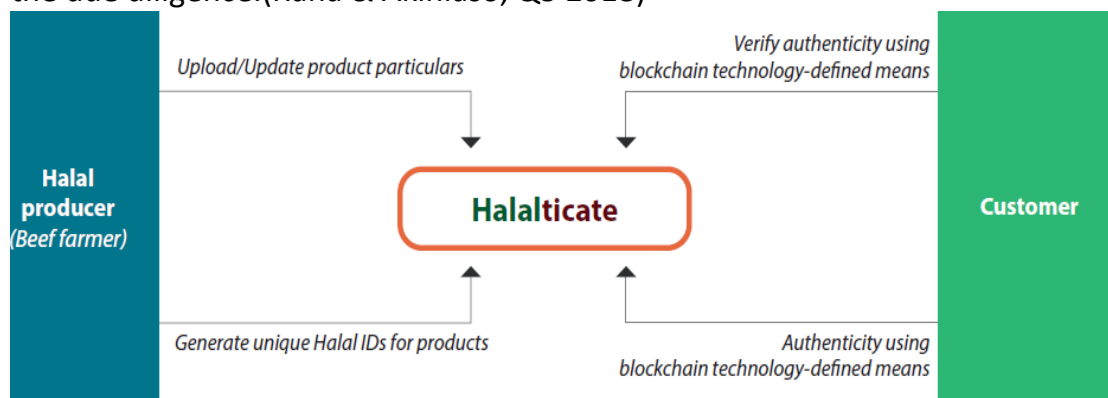
Blockchain model

Only after such due diligence will the product be eligible for the Halal logo, which is a mark of trust signaling to the retail consumer that the product is good and ready for consumption.

However, the process is still tainted with smidges of information asymmetry and risks, which leaves the consumer in doubts if not dismayed. Such risks can be managed by adopting either of the two methods presented in the principal-agent framework: screening and signaling.

Applying the screening method allows the consumer to verify the products authenticity in such a way that guarantee Genuity and satisfaction. This is where the blockchain technology comes in handy as it presents the possibility of a detailed trail of the beef and enables anyone to trace the

movement of the beef, right from its grazing ranch to the abattoir and down to the retail seller.

Signaling comes from the producer – the critical signal being that they have the food certify ed via the appropriate HM. Again, blockchain technology comes very suitable in securing and preserving such signals, making them tamperproof for the general public. Combining both method in a single platform and powering its application using blockchain technology will provide the trust needed in the transaction and eliminate the information asymmetry problem and its associated risk.

Consider a simple illustration below:(Rana & Akinlaso, Q3 2018)

1. The Halal food manufacturer uploads product particulars alongside certify cation from respective issuing authority to a blockchain platform, Halalticate;

2. The platform registers the product, and generates an immutable digital footprint using the product's description and Halal particulars in its blockchain database. The digital footprints will be in form of Unique IDs in various forms (Alphanumeric code, along with secure pattern, QR code, bar code or short links) for an individual product, batch or category;

3. Manufacturer attaches the Unique IDs to the product label and starts shipment.

On the other hand, the Halal customer who is about to purchase the product would verify the authenticity of the product in the following steps:(Rana & Akinlaso, Q3 2018)

1. The customer looks up the product's unique (Halal) IDs;

2. Customer sends at least one of the unique IDs to the Halalticate platform for verify cation using a mobile device via SMS, QR scan or NFC facility;

3. The customer receives an instant report and audit trail on the product (with detailed product description and Halal particulars).

7- Remittance Transaction Flow using Cryptocurrency and Blockchain

The need of the day is to leverage on the open nature of blockchain technology to innovate the remittance models and provide better user experience. There is no doubt that blockchain is a disruptive technology that will fundamentally

change remittances and payments as well as many other industries including banking. The first movers to use blockchain for remittance and payments have so far been limited to a few, especially in Islamic finance. Hence it provides limitless opportunities for Islamic banks to embrace it.

Islamic banks globally are embracing the digitization of banking services to achieve accuracy, security, speed in process and cheaper processing fees for remittance, i.e. peer-to-peer (P2P), business-to-business(B2B), business-to-individual (B2I) and e-commerce transactions. The objective is to achieve low-cost remittance and payment intermediary ecosystem using open and transparent blockchain technology.

Remittance as a peer-to-peer transfer of funds across borders are economically significant for many of the countries that receive them. Global remittances grew 7 percent to $613 billion in 2017, from $573 billion in 2016 and is expected to grow by 4.6 percent to $642 billion in 2018. It plays an important role in the growth and livelihood of immigrant families and is also a major contributor towards GDP, especially for the development of underdeveloped countries. The major driver behind the growth of cross-border global remittance is the increase in immigrant populations globally in search for better employment and higher earnings, which may not be possible in their native place. The most popular remittance is the peer-to-peer (P2P) or also known as "person-to-person" payments which enable the transfer of money to friends or family members, domestic or cross-border, which is relatively of low value and are recurring in nature.(Gupta & Alam, 2019)

The traditional remittance model is evolving with the advancement in technology based on blockchain. Blockchain technology facilitates the use of digital assets such as cryptocurrency to process payments using a unique secured shared electronic ledger.

Blockchain enables digitization of information stored in transparent, decentralized databases with peer-to peer network, which is fully secured and protected from deletion, tampering, and modification. Blockchain is a form of ledger of records or transactions arranged in sequence which is referred as blocks and are linked using cryptographic validation. Each block is referenced and identified using the previous block by a hashing function, which forms an unbroken chain and a blockchain is formed.

This unique feature of blockchain technology eliminates gharar (uncertainty) and makes transaction processing cost effective (low fees–ujr) and facilitates financial inclusion for unbanked migrant workers who need to remit money to their family in their home country. Another advantage is impenetrability, making it difficult to compromise as everything is tracked on a ledger which stops people from spoofing it or creating fake data. Blockchain strengthens the payment ecosystem by providing limitless opportunities in the usage of digital assets, payments, remittances, and implementation of smart contracts.

Another advantage is impenetrability, making it difficult to compromise as everything is tracked on a ledger which stops people from spoofing it or creating fake data. Blockchain strengthens the payment ecosystem by providing limitless opportunities in the usage of digital assets, payments, remittances, and implementation of smart contracts.(Gupta & Alam, 2019)

Blockchain-driven remittance will process remittance more efficiently and accurately while reducing the costs of processing transactions. Blockchain-driven remittance ensures transactions are transparent and agreeable between the parties and promotes trust with its secured method of processing, which also complies with the Shariah principles and fulfil the objectives of Islamic finance. There are ongoing debates on acceptance of cryptocurrency under the Shariah (Islamic law) as a medium of exchange. However, Islamic banks are embracing blockchain technology to enhance financial services. There have been initiatives by Al Rajhi bank to adopt Ripple's ecosystem for remittance and payments. This shows that the acceptance level is increasing amongst Islamic banks. Blockchain technology is reverberating across the entire global financial ecosystem and early adopters will have the better advantage. Islamic banks have to be prepared as fintech companies have already started the disruption and the acceptance at consumer level is increasing.(Gupta & Alam, 2019)

8- Takaful (Islamic Insurance)

By moving insurance claims onto an immutable ledger, blockchain can help eliminate common sources of fraud in the insurance industry. A shared ledger and insurance policies executed through smart contracts can bring an order of magnitude improvement in efficiency to property and casualty insurance. Through the blockchain, medical records can be cryptographically secured and shared between health providers, increasing interoperability in the health insurance ecosystem. By securing reinsurance contracts on the blockchain through smart contracts, the blockchain can simplify the flow of information and payments between insurers and reinsurers.

– Automated claims processing in commercial insurance, motor insurance, etc. Smart contracts that bring insurers, customers, and third parties to a single platform will lead to process efficiencies, and reduced claim processing time and costs.

– New products like peer-to-peer insurance/takaful.

The migration of traditional contracts to smart contracts can be estimated to save billions of dollars in the global Islamic finance markets. They are indeed significant, but do not come without challenges to be overcome, but it will be possible with the determination and resources to do so.(Mohamed & Ali, 2018)

As a niche section of the insurance sector, the takaful segment is significantly impacted by the disruptions occurring within the insurance sector. The global insurance market had a reasonable growth rate, with global real premium growth rates of 2.9% in the advanced economies and 7.4% in the emerging and developing countries in 2014, an improvement over the 2012 and 2013 rates.

Likewise, the growth rate of gross contributions in the takaful sector demonstrated

a recovery in 2014 from 2013, when the growth rate of premiums was by far the lowest historically. The reinvigorated gross contributions of the takaful sector reached US$22.1 billion in 2014, up from only around US$5 billion in 2006. In 2016 the global insurance market reported steady growth rates, supported mainly by emerging markets. Nonlife premiums in emerging Asia expanded at a rate of 7.3% in 2016, after a strong 9% growth in 2015.(Mohamed & Ali, 2018)

Smart contracts deployed through the blockchain will provide customers and takaful (insurance) companies a system to manage claims in a transparent, quick, and indisputable manner. Takaful policies, along with its terms and conditions, and potential claims can be recorded onto the blockchain and validated by the network, ensuring valid claims are dispensed and false claims are rejected. For example, the blockchain will reject multiple claims for one accident because the network would know that a claim has already been made. Smart contracts would also process claims efficiently by triggering payments automatically when certain conditions are met and validated. To more effectively detect identity fraud, falsified injury or damage reports, etc., blockchain can be used as a cross-industry, distributed registry with external data and customer data to:

– Confirm authenticity, ownership, and origin of goods as well as the legitimacy of documents (e.g., medical reports)

– Check for police reports indicating theft, claims history as well as a person's verified identity and expose patterns of deception related to a person or identity

– Proof of date and time stamps of policy issuance or purchase of a product/ asset

– Validate ownership and site changes

Still, to attain full blockchain-specific benefits from these applications above what is achievable with traditional solutions and other current types of cooperation, for example, via industry associations, broad cooperation between insurers, customers, manufacturers, and other stakeholders is needed. This is an example of an ecosystem growing beyond the traditional industry practice in the sharing economy of the digital era.(Mohamed & Ali, 2018)

9- Smart Sukuk

Smart Sukuk structure is one of the most recent and significant structures for future sukuk issuances. In the era of crowed funding and Financial Technology Enhancement, the Smart

Sukuk seems to be the future of Islamic fundraising for infrastructure and Business developments.

Smart Sukuk has different features from the conventional sukuk; it is obvious that sukuk markets are the most favorable in Islamic Finance. However, it is also clear that it is customarily issued by powerful institutions and government agencies, therefore sukuk become very costly in terms of issuances. The smart sukuk structure has endeavored to use the blockchain technology and boost efficiency, transparency, reduce the cost and make it possible for small and medium enterprises SMEs, social impact projects, groups and associations to issue their own sukuk using the new technology. The world first innovation in smart sukuk introduced by blossom finance, the facility endeavored to change the conventional ways of sukuk issuances using the blockchain. The blossom's[13] smart sukuk uses Ethereum blockchain smart contracts in other to strengthen the efficiency and make it a globally acceptable sukuk. The main significance of Smart Sukuk is standardizing and automating the accounting, legal and overhead payments of conventional sukuk offerings all these will be fully backed by a licensed legal entity in the issuing country.[14]

In terms of fees, the Blossom's Smart Sukuk product will not charge any up-front fees or costs to the institutions or investors as it is normally practiced in the conventional sukuk. Rather, the issuer or Blossom will take a 20% share of the investor's profits called a carried capital interest. This means that Blossom makes money only if investors made money, and Blossom may lose if the investors failed to make any profit in the deal, and this is exactly the Islamic system of sharing profit and loses collectively.

Unlike conventional bonds - which are based debt with an interest payment - a sukuk is a shariah compliant financing structure typically based on a profit sharing payment or ownership of an asset. Sukuk is securitized, meaning it is tradable on secondary markets much like a stock can be traded on a stock exchange. Islamic finance prohibits interest payments on loans and the sale of debt; sukuk markets evolved as a way to securitize Islamic modes of financing such as profit sharing. Sukuk has been a popular approach for governments seeking to finance infrastructure projects, but the legal complexity and overall cost to issue sukuk has kept it out of reach for the bulk of institutional clients. Depending on the particular needs of an institution, there are a variety of sukuk structures based on various Shariah-compliant contracts: profit sharing (sukuk

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[13] Blossom Finance was founded in 2014 to increase the availability of halal financial products using technology. Since 2015, Blossom has been helping microfinance institutions in Indonesia raise funds from international investors to fund micro-businesses aimed at reducing regional poverty. Blossom's Smart Sukuk helps institutions to raise cost-effective, Shariah-compliant financing from global investors using blockchain technology. Blossom Labs, Inc. is a US Delaware corporation. See: https://blossomfinance.com/press/islamic-finance-upgraded-smarter-sukuk-using-blockchain

[14] DR AUWAL ADAM SA'AD. "Smart Sukuk Structure From Shari'ah Perspective: The Application Of Mudarabah Smart Contract." e-Proceedings of the Global Conference on Islamic Economics and Finance 2018

24th & 25th October 2018 / Sasana Kijang, Bank Negara Malaysia, Kuala Lumpur

al-mudaraba), deferred-delivery purchase (sukuk al-salam), lease of an asset (sukuk al-ijara), joint venture (sukuk al-musharaka), sukuk al-istisnah (project based), and cost-plus asset purchase (sukuk al-murabaha). A notable difference between bonds and sukuk can be seen in the case of default: bond holders are left with a bad debt, but sukuk holders are left with a valuable asset.[15]

Currently, many institutions seeking to raise funds in a Shariah-compliant manner find a lack of options and these institutions find the only financing available is a conventional loan from a commercial bank. Loans with interest are prohibited in Shariah and therefore prohibited in Islamic finance. Sukuk emerged as a Shariah-compliant method for institutions to raise funds, but often has much greater legal and operational complexity than a conventional loan.

Investors in a sukuk are issued a share of ownership, which represents their fractional ownership in the underlying asset or structure with the terms of the sukuk ownership. Holders of sukuk receive periodic payments from the fund-raising institution. Investors can hold a sukuk until maturity, or they can sell their ownership in the sukuk to a third party. This subsequent sale to a third party is known as "secondary trading" and is what distinguishes a sukuk as a "securitized" asset.

Blossom's Smart Sukuk runs on the Ethereum blockchain, which supports "smart contracts". A smart contract encodes business rules directly into the underlying payment currency itself – the blockchain itself enforces the contract rules regarding payments and transfer of ownership.

Smart Sukuk Tokens support an industry standard protocol, called ERC20. The standard allows tokens to be traded globally on a variety of public cryptocurrency exchanges. An institution looking to raise funds can issue Blossom's Smart Sukuk, which collects funds from investors in exchange for Smart Sukuk Tokens representing an ownership portion of the sukuk. When the institution makes payments, the funds are automatically distributed back to the Smart Sukuk Token holders via the blockchain according to the rules of the smart contract - without the need of conventional banks or intermediaries.[16]

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[15] https://blossomfinance.com/press/islamic-finance-upgraded-smarter-sukuk-using-blockchain
[16] https://blossomfinance.com/press/islamic-finance-upgraded-smarter-sukuk-using-blockchain

Sukuk Al-Istisna Al-Ijara: After Construction

1 — Client makes lease payments & purchase payments on new hospital

Investors

2 — Once purchase amount is reached, ETH released to investors to buy their Smart Sukuk Tokens

Smart Sukuk

3 — Muhammadiya receives Smart Sukuk Tokens

Client (Hospital Operator)

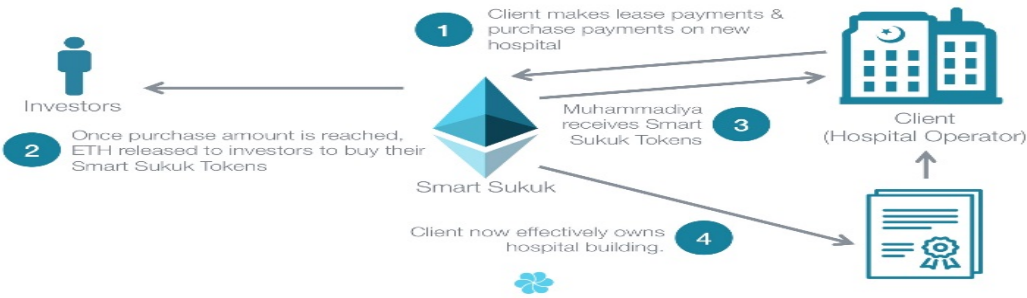4 — Client now effectively owns hospital building.

Diagram illustrating the maturity phase of Blossom's Smart Sukuk for construction projects.

Blockchains for Islamic finance: Obstacles & Challenges

The list of challenges facing Applying Blockchains for Islamic finance is long. There are technical, business/market, legal/regulatory, and behavioral/educational challenges to the blockchain's evolution. Some of the most important challenges include scalability (technical), innovation (business), trusting a network (behavioral), and modern regulation (legal). Understanding the tradeoffs and wise choices involving databases and blockchains is a key competency that needs to be perfected. It starts with a clear understanding of the strengths and weaknesses of each approach . Finding the right balance between what a blockchain is particularly good at, and marrying the derived benefits with back-end databases or existing applications is part of the magic that you need to continuously seek out. We are still learning what these boundaries are, and like the pendulum, we might swing excessively toward one side, then to another before finding a middle ground. Along with that topic is the issue of storing blockchain data for transactional, historical, analytical, and compliance reporting requirements. Here's some of major challenges facing applying Blockchains for Islamic finance:

Government Interferences

 Targeting Bitcoin primarily, several governments did not feel comfortable with a currency that was not backed by a sovereign country's institutions. Some countries and central banks issued official warnings against Bitcoin usage during its early years, including Russia, China, and the European Union. Blockchains are not Bitcoin, yet they allow the creation and distribution of cryptocurrency, as well as assets with real value. The operations of blockchains will continue to be the subject of government scrutiny until politicians and policy makers feel more comfortable with their usage.

Governments can send the wrong signals to the market, to policy makers, and to law enforcement agencies, who are typically proxies to them. In addition, heavy-handed government actions risk short-circuiting the private sector leadership in blockchain technology, which is known to bear the fruit of innovation. Of course, government regulation may be applicable for consumer protection and certain other level of standards, but early interference will generally not be helpful. Compliance is an important activity, especially for financial services providers who spend billions of dollars annually, in order to stay up to the date on the latest laws and regulations. Early blockchain platforms were focused on transactions, and not reporting. However, these platforms will need better taxation and reporting capabilities so that their output can be fed into traditional accounting systems. There will be solutions that address this sector.

Compliance and non-compliance are both costly, amounting to overhead that eats into profit margins. Some areas where compliance could offer breakthroughs might include:
•   Accepting cryptocurrency-backed tokens as real value.
•   Recognizing the finality of transactions that have passed through a blockchain.
•   Allowing the necessary legal linkages to smart contracts.
•   Permitting peer-to-peer counterparty validations via the blockchain.

Underdeveloped Ecosystem Infrastructure

As a starting point, each blockchain needs its own technology infrastructure, as well as a vibrant ecosystem around it, with a number of participants to support it. On the technology side, the protocol itself is a minimum requirement, and while it needs to be augmented by software tools and services to make it useful, it is the ecosystem of players around the technology that directly influences a blockchain's market progression. Without adoption, there is little impact. A vibrant ecosystem includes a variety of players in each one of the following segments:(Mougayar, 2016)
•   Complete technology stack, including infrastructure, middleware, and software applications.
•   Startups that innovate by creating new products and forging new markets.
•   Solutions and services providers that deliver end-to-end implementation for enterprises.
•   Funders and venture capital that take risks alongside the entrepreneurs and scientists
•   Advocates, influencers, analysts, volunteers, supporters, local communities.
•   Developers and technologists who work on core, and extended technology pieces
•   Users who are conditioned to try products, both as consumers and enterprise customers.
 It takes time for new applications to emerge when new foundational technology enters the scene. Nonetheless, replication is a good first step, because it allows one to gain experience when expectations are lower. Taken as an extreme case, just about any software application could be rewritten with some blockchain and decentralization flavor into it, but that does not mean it's a good idea to do so. Some blockchains such as Ethereum have a similar "virtual machine" capability, which allows programs to execute on the blockchain without requiring developers to be aware of the inherent computer architecture. Another blockchain criticism is the lack of so-called "killer apps" that are supposed to light-up exponential usage among consumers. We will certainly expect visible applications as beacons to others, but there is another

point of view supporting the case for several killer apps, not just one. Moreover, A lack of a comprehensive understanding of the basic capabilities surrounding the blockchain will deter any smart executive from seeing the fullness of its potential value. This challenge will be only solved via a concerted effort to get educated about the blockchain and its potential.

Unclear Regulations

 As long as the position of regulators is not clarified, confusion and uncertainty will continue to exist for everyone involved in the blockchain space. The blockchain is a blockbuster technology that affects so many areas, and it is likely that different flavors of regulation will come at it from a variety of directions. A fundamental paradigm shift that regulators will need to come to grips with is that trust is now more open, and "free from central controls" who they typically regulated. The nature of trust is changing, but regulators are used to regulating the "trust providers." Will they learn to adjust when the trust provider is a blockchain, or a new type of intermediary that didn't fit the previous model of central choke point regulation? Specifically, the blockchain is decentralized by default, so it's more difficult to regulate decentralized entities than central ones. Therefore, we will need to see innovation in regulations. Maybe blockchains can get certified for example.

Generally speaking, regulators and policy makers react in three different ways when faced with new technology:(Mougayar, 2016)

1.   Do nothing, and let the market mature and evolve on its own.

2.   Control the choke points. For example, these choke points might be the cryptocurrency exchanges or software providers who will be required to get licensed.

3.   Insert automatic regulation at the point of transaction, or somewhere during its journey. This might involve making room for the availability of direct data reporting via a backdoor, an information exhaust pipe, or a direct deduction on a transaction.

Security , Privacy and Lack of Standards

The issue of blockchain security will be an everlasting one. We are still getting used to transaction finality by consensus (no matter what the form of consensus is), instead of a "database commit" which is a more deterministic method. Large organizations, especially banks, have not been particularly interested in adopting public blockchains for their internal needs, citing potential security issues. The technical argument against the full security of public blockchains can easily be made the minute you introduce a shadow of a doubt on a potential scenario that might wreak havoc with the finality of a transaction. That alone is enough fear to form a deterring factor for staying away from public blockchain, although the argument could be made in favor of their security. In a public blockchain, the default mode for any transaction's visibility is openness and transparency. This means that anyone can trace the path of a transaction

including the value it holds, and its originating and destination address. That level of transparency was a non-starter in private blockchain implementations. However, it is now possible to achieve confidentiality in transactions by encrypting the values, and it is also possible to hide the identities via zero-knowledge proof schemes. Blockchain skeptics might think: we already trust one another, and we have century old institutions that perform that kind of trust, so why do we need to put trust inside a network?

Trusting a network of computers that perform mathematical computations instead of a "known, trusted" party that you can see requires a new mental paradigm that we are not used to. Eventually, we will come to grips with the fact that the trust is in the network—and it is a new form of trust. Let us remember that Internet payments were not completely trusted during the early Web years (1994–1998), at least not by the banks. We had to go through special "payment gateways" that were set-up specifically to perform that trust function while dissociating them from the banking systems who didn't want to touch untrusted technology. Soon enough, paying on the Web with a credit card became wildly accepted, and most current Web users will probably not remember these early days of trepidation and fear, although the similarity with trusting blockchains is strikingly familiar. (Mougayar, 2016)

As much as we will initially fret over the availability of blockchains as trust services delivery networks, they will be eventually be taken for granted, just as Internet access is taken for granted today in most parts of the world.

Standards arrive in two ways, typically. They either become de facto standards by virtue of market adoption, or they are developed and agreed upon a priori, by a standards committee, or a consortium group. Standards bring with them a number of benefits, including some network effects, easier interoperability, shared implementation knowledge, potential lower costs, and less overall risk. Standards can tackle different layers, targeting technical, platform or process-related areas. But here is a warning on standards. You do not generally compete on standards. They tend to level the playing field, and allow companies to compete on their own terms through the way in which they implement these standards. Your competitive edge might come from the speed of your implementation, or your ability to innovate beyond these standards. The blockchain will present the same opportunities and caveats for standards use. Standards will be necessary, but not sufficient. Several thousands of software developers will be needed to lift all the boats. What will help improve the number of developers?

• More general market awareness about the blockchain to drive higher levels of interests.

• Popularity of certification programs.

• Availability of formal academic degrees that specialize in this field.

• Training programs by the blockchain providers.

Human resources and Costs Issues

Most users cannot handle increased usage complexity, especially when the underlying technology is complex (the blockchain). Early blockchain applications may not have the best user experiences, but eventually, a user may not even know there is a blockchain behind their usage. Where are the Amazons and eBays of the blockchain? Those kinds of companies become reference points and archetype models because they are the first proof points that you can build a viable business on the blockchain. We will need to witness the emergence of such companies, and see their success materialize through market adoption. Not Enough Qualified Individuals Within Companies, It takes a while to convert thousands of employees to become experienced blockchain advocates. A critical mass of internal supporters and experts is also required inside organizations, so they can fuel a variety of blockchain experiments and create solutions themselves, without permission, just as Web applications and ideas have finally become second nature to most enterprises. On the other hand, Costs Issues is very critical ,It is not expensive to start dabbling with blockchain technology because much of it is free via open source licensing. However, full implementation will bear additional costs, not unlike the costs of typical information technology-related projects and deployments. Some Chief Information Officers (CIOs) may be reluctant to add to their tight budgets, until early returns on investment have been demonstrated.

Immature Middleware and Tools

Blockchain middleware and software tools are really important. The middleware is like the glue between blockchain infrastructure and the building of applications. Software development tools facilitate the overall software development projects. As soon we start to see complete, out-of-the-box products that promise to simplify how to start, develop, and deploy blockchain applications, we will know that a new phase has started.

Scalability

Scalability of blockchains is an issue that will continue to be debated. Scaling technical systems is a never-ending challenge. It is a moving target, because the needs for scale evolve as you grow; therefore you do not need to solve a problem you do not have yet. Scaling blockchains will not be different than the way we have continued to scale the Internet, conceptually speaking. There are plenty of smart engineers, scientists, researchers, and designers who are up to the challenge and will tackle it. What complicates the scalability of blockchains even further is the required balance that needs to be preserved between decentralization and security. Scaling a decentralized network with an economic model that is tied to its security is a new frontier that has not been attempted before.

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