

Blockchain and Cryptocurrency for Islamic Finance: A Perspective of Scholars

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Abstract

The creation of financial models using cutting-edge technology, such as Blockchain, is essential for success in the financial industry. Blockchain technology can be utilized to create secure apps of this nature. Every banking institution customer's top priority is security. Smart contracts are the code running on a Blockchain which carries the terms and conditions of the transaction. These secure contracts provides and cost-effective and easy solution to the financial institutions. With the use of technology Islamic banks can provide services to the people of far-off areas with a cheap cost. So, in this way financial inclusion will increase as unbanked people will also be able to avail financial services. This will have positive impact on the performance of Islamic financial institutions. Therefore, Government and regulatory authorities should make such policies which support adoption of Blockchain and related technologies like AI (Artificial Intelligence) in the financial sector. Cryptocurrency is another important element of new financial technology. A Cryptocurrency is built of Blockchain platform. There are different opinions of Shariah scholars about its validity. We need to do search in this field. If certain conditions are met, Cryptocurrency may be allowed, as per views of Shariah scholars. An important condition is that the currency should be backed by the Government and regulated by the central bank. If Cryptocurrency is adopted by the Islamic financial

sector with due considerations, it will make the transactions easier, transparent and cost-effective.

Keywords: Blockchain, Smart Contracts, Financial Technology, Artificial Intelligence, Financial Inclusion, Performance, Shariah, Cryptocurrency

Introduction

Development of financial models with the use of latest technology like Blockchain is a key for success in the financial sector. Blockchain can be used to make such applications which are secure. Security is the primary want of every customer of the financial institutions. Artificial Intelligence means making the machines think like human beings. AI is used in combination with other technologies like Blockchain to develop such apps and dapps that have changed the way and shape of financial products and services. These technologies are beneficial for the Islamic banks, Takaful operators and other financial institutions.

Blockchain is the prime element of Financial Technology commonly known as Fintech which is growing rapidly and it has changed the way the financial services are delivered, all over the world. This is beneficial for Islamic financial industry as well. We need to bring applications made on the platform of Blockchain augmented with AI for our Islamic financial sector, for the growth of Islamic finance. Cryptocurrency is an add-on to the latest financial technology. Cryptocurrencies may be adopted in a country for Islamic finance after certain modifications and subject to certain rules and regulations, which will be explored in this study. Adoption of these new technologies by the Islamic financial institutions is needed to compete the conventional finance industry, to grow and to reach the unbanked people in all areas of the country.

Shariah-compliant financial products with the application of new technologies like Blockchain and AI is the need of the day. With the use of new technology Islamic financial services may be provided to those people in far off areas which are still deprived of such services. Technology reduces the costs and increases the financial inclusion. By new mechanism, Islamic financial institutions may provide financial services to global customers as

well, provided that other terms and conditions are settled among the participating countries.

New generation loves new technology and prefer to use it to avail financial services as compared to the traditional way of getting financial services by visiting the banks' branches. Adoption of technology by the financial institutions has proved beneficial for both the institutions and the customers. Technology improves performance of the financial sector considerably. An important feature of Blockchain is a smart contract which is actually the code of a contract¹. Now a smart contract may support a legal contract or it may even replace it². Blockchain has extensive application in the financial sector like banks, insurance, Takaful and management of the financial institutions. It is applied in other sector like real estate, health and education as well. Similarly, AI is used in combination of Blockchain in different products and services of Islamic banks³.

Global Islamic Fintech Report 2021 shows that Islamic Fintech volume within OIC countries was 49 billion Dollar in 2020 which is 0.7% to total market share. Islamic Fintechs are expected to show a growth to 128 billion Dollar by 2025. Moreover, Islamic Fintech is expected to grow at 21% CAGR as compared to a growth rate of 15% projected for conventional Fintech. As per GIFT index Saudi Arabia, Malaysia, Indonesia, UAE and UK are the top five strong ecosystem for Islamic Fintech whereas Bahrain, Kuwait, Pakistan, Jordan and Qatar are fast maturing ecosystems in this regard.

Compared to conventional contracts, smart contracts are more practical and appropriate. These contracts employ user-friendly interfaces and procedures to provide safety and facilitation. The term "Smart contract" refers to "agreements existing in the form of software code deployed on the Blockchain platform," according to⁴. The applicability of smart contracts for banks and other service providers was discussed by Mik⁵. Credit card payments can be effectively tracked using smart contracts. Banks, e-governance, insurance, energy, the arts and cinema, education, and other industries can all benefit from smart contracts.

The foundation of an Islamic bank is the idea that there should be no interest (Riba) in any financial goods or services. This is because Allah and His

Messenger Hazrat Muhammad (PBUH) have categorically forbidden the interest. To give the world an interest-free financial system, Shariah scholars and financial specialists worldwide have been working hard. In this regard, Mufti Taqi Usmani from Pakistan has also made a significant contribution. Islamic banking began in the 1960s and now accounts for a sizable portion of the total financial market activity.

Both conventional finance and Islamic finance can make use of technology. However, Islamic finance differs from traditional finance in that it has a peculiar nature. Blockchain and AI are more advantageous for several Islamic financial institution products or services. For instance, a particular product is complicated and includes several contracts. Blockchain will manage all of these contracts and intricate processes, making this service more affordable.

The next sections of this report include the Literature Review, Objectives, Research Questions, and Methodology. This is mainly qualitative research based on the Constructive paradigm. The Grounded Theory approach is used for data collection and analysis.

Literature Review

Blockchain is the primary component of Fintech. Around the world, several types of stakeholders have expressed a strong interest in it. The newest innovation-bringing instrument is Blockchain combined with artificial intelligence. Artificial intelligence employs a variety of techniques, including neural networks, case-based reasoning, statistical reasoning, and rule-based reasoning ⁶.

These methodologies are being utilized to create a wide range of applications, including sentiment analysis, translation apps, image processing apps, chatbots, and driverless automobiles that are now in the testing phase⁷. Blockchain has demonstrated that it has several advantages because of its distinctive quality of being unchangeable. Because of its distinctive structure, Blockchain is more suited for the creation of financial applications. Blockchain's architecture consists of numerous blocks connected to one another via cryptographic hash codes in a peer-to-peer network, ensuring that not a single point experiences failure.

Blockchain technology is more dependable to use and maintain since numerous nodes can run for a single transaction. The second crucial characteristic of Blockchain is its adaptability to various application kinds. Another crucial aspect of Blockchain is transparency, which allows users to view the history of all transactions (nodes). Blockchain cannot be changed. Global researchers are highlighting how Blockchain will soon be widely used and beneficial for the banking sector. Blockchain is a massive database of blocks that each contain transaction data, a time stamp, and a cryptographic hash code that is saved to the following block⁸.

The main characteristic of Blockchain is that it resists attempts to modify it and allows for the tracking of transactions. Transparency and traceable transactions are the core principles of Islamic banking and finance. So, the greatest technology for Islamic money is Blockchain. People's confidence in financial deals, fund transfers, and other transactions will increase⁹.

Islamic finance academics have recognized how to investigate if an agent's work is in compliance with the rule of the best benefit for the stakeholders as a serious difficulty. The role of the bank is one of mediator in Islamic finance. The researchers advised transaction monitoring via Blockchain to attain the highest level of agent responsibility and openness. All parties involved, including the government, regulator, investors, and Shariah boards, will feel at ease overseeing the Islamic bank acting as an agent if smart contracts and Blockchain are employed for financial services. If we put the question of legality aside for the time being, blockchain-based monitoring will be a useful tool¹⁰.

Smart contracts enable the creation of traceable and unchangeable records of ownership. Smart contracts might have a revolutionary impact on how Islamic banks operate by cutting the cost of operations for Islamic financial products by up to 95%. One of the goals of Islamic financial institutions is to support social welfare initiatives. In order to allow the banks to distribute monies in accordance with Shariah norms for the welfare of all people, donors typically designate Islamic banks as their agents for this reason. It is considered that Islamic banks work to maximize both their own gain and societal wellbeing.

Once created, smart contracts will offer effective regulatory oversight and monitoring for the aforementioned operations¹¹.

According to Evans¹², a Blockchain management system is similar to an accounting setup. Bitcoin is an example of how Blockchain could be used to establish a new payment system. A peer-to-peer network's dispersed nodes authenticate Bitcoin transactions. The transactions are recorded on publicly accessible distributed ledgers that are connected to one another through encryption. Continuously, new and improved applications of Blockchain are being developed in various fields of financial services. Muneeza's¹³ study included a section on crowdfunding as one of the uses of Blockchain he had in mind. Six crowdfunding platforms make up her study sample, and she came to the conclusion that Blockchain can solve the problems those platforms confront.

The promoters can use smart contracts to raise money or they can issue their own shares by giving the investors a pay-back guarantee in the event that they are unable to secure the necessary funding. Promoters and crowdfunding contributors will benefit from this assurance as it will enable them defend their interests at the lowest feasible cost¹⁴. The current banking system has problems with several intermediaries, pricey transactions, centralized fund-and data-management, and double payments. The Blockchain-based crowdfunding method can solve these problems. Additionally, new features might be introduced, such a voting mechanism that would let the general public and shareholders engage in corporate governance. In a similar vein, smart contracts can be used to detect any fundraising scam¹⁵. Cryptocurrency can be used to make payments without an intermediary by using smart contracts for authenticity management¹⁶.

Huge cost savings are anticipated when financial transactions are automated using Blockchain technology. Fanning estimates that global payments, account settlements, and regulatory procedures saved 20 billion USD in costs in 2016. If the financial services are actually switched to a system built on Fintech, it is anticipated that business lost due to closure hours will fall by 50%, difficulties will decrease by 80%, and efficiency will improve by more than 90%¹⁷. Although switching the current financial system to Blockchain is a difficult endeavor, efforts are still being made to combine the current digital

solutions with Blockchain by working with outside software suppliers¹⁸. Shariah-compliant banking and other Islamic financial services may take new avenues as a result of this.

It is accurate to describe cryptocurrency as electronic cash that may be used to make payments in place of paper bills. It is constructed using Blockchain technology, which enables secure, unchangeable, and traceable financial transactions. With the use of Blockchain, restrictions on the manufacture of additional units may also be imposed.

The link between cryptocurrencies and bank deposits is inverse, thus as investments in cryptocurrencies rise, bank deposits will decline. Banks only have one choice to combat this threat: to allow investors to also participate in cryptocurrencies. The banks must incorporate bitcoin as an alternative into their portfolio as a component of diversification, or else they may decide to use the Blockchain to provide their clients with a less expensive, more practical, and extremely secure investment choice¹⁹. Since cryptocurrency lacks the physical existence of real money, it carries a certain amount of risk for consumers and could pose a threat to a nation's economy²⁰. Although Bitcoin has remained popular since its launch, academics and economists have not paid it any attention. Researchers have studied the technological features and regulatory requirements for cryptocurrencies, but they haven't looked into how Bitcoin is used as money. The first step might be to introduce Bitcoin as an additional form of money in a country before accepting it as a replacement for fiat money in the following stage²¹.

The legitimacy of cryptocurrencies in terms of Shariah is a subject of disagreement among academics of that religion. It was immediately rejected and deemed haram by renowned Egyptian scholar Shaikh Shaki Alam on the grounds that it violates fundamental Islamic laws about money. It could be regarded as halal if it satisfies the requirements of Maqasid e Shariah. It appears that Shariah academics don't fully comprehend how cryptocurrencies operate. All cryptocurrencies that have a market cap over 28,000 cannot be referred to as money. They are referred to as crypto assets. Along with coins, there are various kinds of crypto assets. The prerequisites for an item to be recognized as money are that it must function as a "store of value," "unit of account," and "medium of exchange"²². Bitcoin contains some components

that are against Shariah law. Since it is impossible to identify a coin's true value, Gharar is present in Bitcoin. Prices are determined based on presumptions, and the value store and value technique differ from one another. Gharar is prohibited under Shariah²³. Gharar is Arabic for doubt, deception, and speculative danger²⁴. Other academics contend that because Bitcoin lacks an inherent value and is not under the control of a central bank, fraudsters can simply abuse it. Additionally, it goes against social fairness, which is a fundamental tenant of Islamic beliefs. As a result, Bitcoin violates Shariah law and should be outlawed²⁵.

The future of Islamic banking and Islamic Financial technology is quite promising in the Muslim world. Muslim nations now have a big and growing population of smartphone users, which has facilitated the development of financial technology. There are obstacles to the development of Fintech in these nations, of course; in particular, the lack of adequate research and the absence of pertinent rules²⁶.

Research Objectives

1. To explore the role of new technology known as Blockchain for the Islamic Finance
2. To present views of Scholars about legitimacy of cryptocurrency as per Islamic principles and its possible advantages, if it is allowed.
3. To explore the advantages of adopting the Blockchain technology by the Islamic financial

Research Questions

1. What is Blockchain technology and how is it relevant for Islamic Finance?
2. Is cryptocurrency valid from Islamic point of view? What will be its benefits for financial sector if allowed?
3. What are the benefits of adopting Blockchain technology to the Financial Institutions?

Methodology

Type of Research: *Qualitative*

Research Paradigm: *Constructivism*

Research Method: *Grounded Theory*

Nature of Research Study: Exploratory

Data Collection Sources:

The primary data was gathered from professionals in the fields of information technology and financial technology, as well as from bankers, shariah scholars, and academicians, in addition to the information gathered through various papers that were made available online as a secondary source.

Data Collection Tools/Instruments:

Unstructured interviews have been used to gather primary data. The researcher adhered to the qualitative research idea that the "researcher themselves is the greatest instrument" when gathering data. While some of the questions were reliant on the interviewee's line of work and evolved during the discussion, others were dependent on the sort of interviewee.

- **Target population**

The target population was the Blockchain experts, professionals working in the financial sector, bankers and the Shariah Scholars.

- **Type of sampling technique**

Purposive sampling was used.

- **The sample size**

20 experts were interviewed. The experts include the CEO of Fintech Consultancy Firm, Bankers and the Shariah Scholars.

Ethical Considerations

Data was gathered with the experts' consent, in accordance with social and moral norms, and with the understanding that it would only be used anonymously for research.

Findings and Discussion

Blockchain

Blockchain is a digital ledger, meaning it has a register and a database. Blockchain, however, is distinct from conventional databases. It is decentralized and distributed. There were safeguards in place for the traditional database, which was located on the primary server. There were some centralized procedures for data input and retrieval. Blockchain can obtain three or more things at the same time. Because Blockchain is a distributed ledger, many parties may maintain that database with them. Due

to the distributed nature of its various protocols, they can also update it. Different nodes imply that it can be audited, modified, and approved by the in charge computers or servers (referred to as nodes). They act in this way because mining provides a reward, so they do it for that reason. Endorsing or validating transactions or data added to the Blockchain is known as mining. The security of data is now at hand. Data is scattered and decentralized, making it incredibly difficult to manipulate. Data is saved in one or a maximum of three to four locations in traditional databases, making it simple for someone to change, manipulate, or hack that data from those locations. However, because Blockchain data is saved in thousands of locations, it is very difficult for a hacker to manipulate it or cause a security breach because that data is immutable. The transparency of Blockchain's data base is another benefit, as it allows for the release of information without concern for third parties manipulating it.

Globally, numerous stakeholders have expressed a strong interest in Blockchain. Artificial intelligence and Blockchain can work together to create new goods and services for various industries, including banking and finance. A wide range of products are created in this approach, including chatbots for banks, analytical software, and translation software. Blockchain is incredibly helpful for creating creative and secure financial apps because of its immutability feature. Another aspect of Blockchain that the Islamic finance sector appreciates is transparency. Transparency in practices and offerings is encouraged in Islamic finance. Blockchain can also be utilised for crowdfunding, whether funds are being raised for commercial or charitable purposes.

Blockchain and smart contracts are related; a smart contract is a computer programme. Blockchain is a distributed, decentralized, extremely secure, and unchangeable digital ledger, but you can process that data, or, to put it another way, you may create protocols for the data that specify which data will be input in what way. How will that be handled? What results will that have, then? Smart contracts are such Blockchain-specific apps. Although smart contracts are broad programmes that may be used to any situation, the Blockchain is the sole technology that supports them. Because they are

typically used for transactions, these are known as contracts. These applications are made to conduct transactions after input of transactional data. Currently, this idea has been expanded with the intention of creating digital apps that make use of Blockchain's decentralized, distributed, and secure capabilities and can produce an outcome, a good or service. This is how smart contracts or decentralized programmes, sometimes known as dapps, work. Smart contracts were proposed prior to the invention of the Blockchain.

Good work on smart contracts was done in the 1990s, and scientist Nick Szabo proposed that we construct such contracts that run automatically and be performed through the Internet/e-commerce. In such contracts, we set forth a number of requirements, and when they are satisfied, the contracts should be automatically executed. Because the internet was not very secure at the time and it was highly challenging to create smart contracts for large transactions, this notion did not gain much traction at the time. Security was especially challenging because of the prevalence of hacking threats. Smart contracts can now be implemented on Blockchain because it is a very safe platform. Smart contracts were challenging to implement in the 1990s due to lax security and increased hacking risks, but now that a safe platform has emerged in the form of Blockchain, the idea of smart contracts has gained popularity.

Since cryptocurrencies are an application of Blockchain, which is also a platform, and since Bitcoin was the first digital currency to use it, it does not follow that the Blockchain platform cannot be used for other purposes. Any application can use Blockchain technology. Bitcoin is one of its applications. The financial industry is the first to embrace Blockchain since cryptocurrency is a P2P (peer to peer) payment system that is decentralized, distributed, and digitalized. We might therefore conclude that the most apparent application for Blockchain is a payment system. One further factor is that precise data from such transactions is available and current. The network will reject and not perform the transaction if the data is inaccurate. On the blockchain, auditing services are available. The field of accounting, auditing, and taxation will therefore become automatic for you. This is a crucial application of Blockchain technology in banking. In the world of business, invoices come

from several providers. Using IOT devices integrated with artificial intelligence, that data is recognized, processed, and converted into information.

Cryptocurrency

What is cryptocurrency, exactly? Its response consists of three points. The first is that there is no bank that issues cryptocurrency. The fact that this currency does not exist physically is the second point. Thirdly, it is virtual, just like online banking, where you enter a few digits to transfer money. What potential benefits could there be for crypto currency? Smuggling will be less common thanks to crypto currency, and the cost of the specific paper required for real cash will also go down. If you use cryptocurrency in a regulated setting, you can achieve a high level of transparency.

There are numerous Fatawa on it. The majority of them discuss ensuring. Physical money either has a value like gold or silver or is backed by a commitment from the government. Those Fatawa who have criticized it lack the necessary technical expertise or sufficient Shariah arguments. Such Fatawa are rarer when a strong Shariah analysis has been conducted based on technical knowledge and is supported by reliable Islamic teachings. This is the reason that nearly all of Pakistan's Dar-ul-Aftah have not made a final judgement about cryptocurrencies. There are various causes for it. The fact that cryptocurrency has no intrinsic value is a significant factor. Only if it is used as a means of exchange after being recognized as legal tender will it be beneficial.

Today's topic is cryptocurrency or digital currency. While some Shariah experts believe it to be permissible, others disagree. Another group contends that bitcoin is permissible in specific circumstances. We must first check what the Shariah says regarding money. A well-known hadith of Hazrat Muhammad (PBUH) on interest states that silver should be used against silver and gold should be used against gold. He stated clearly that these two items are what gold and silver refer to as currency. Therefore, it is prohibited to give or accept one hundred rupees in the form of cash or digital currency. When it comes to digital currency, Bitcoin, money is invested in it in a similar fashion to gambling, where you predict whether its price will increase or decrease. Consequently, it is likewise haram. Since it is not permitted by law,

digital currency is illegal in Pakistan. If we look at Islamic banks, the majority of Shariah scholars consider them to be unlawful, but as more people use them and learn more about how they work, opinions are changing over time, and eventually Shariah scholars may come to recognize them.

The use of cryptocurrency requires government approval. It is simple to proclaim something legal if the government recognizes it as a national currency and permits its use as a means of exchange. Its use is not halal at the moment because the Pakistani government has not proclaimed it to be legal tender.

There should be a centralized authority for cryptocurrencies. Pakistan has a relatively low propensity to accept cryptocurrencies; Shariah scholars have differing views on the matter; some consider it to be forbidden, while others impose restrictions on its legality.

Cryptocurrency will eventually become a CBDC, the digital currency of the central bank, rather than just another cryptocurrency. The central bank will have jurisdiction over it. Currently, central banks are not doing this, but they are considering replacing paper money with a cryptocurrency that will be properly regulated by a body. The future of cryptocurrencies is dependent on this event. As an alternative to local currency, people will use it. In a similar manner, banks will swap the CBDC of one nation for that of another nation when conducting international business. People and banks will use cryptocurrency if it is governed by the central bank.

Crypto is a revolution. Costs will be reduced. Furthermore, since you won't need to carry cash, it will give you security from theft and robbery. If cryptocurrencies are used, the risk associated with transporting cash will be eliminated.

The first step is that it needs to be backed by an asset in order to make it Shariah-compliant. The government's accreditation is the second factor. The third factor is that it is made known to people so they can start using it as money. Even the users do not consider it to be money. Economists are arguing over whether it is a currency or an asset. It is thought that legalising cryptocurrencies under the right circumstances will raise the caliber of financial services. It will, indeed. There is no need for cash then. Bitcoin's anonymity served as the foundation for its creation by Satoshi Nakamoto.

Nobody is aware of who has how much money. Instead than increasing transparency, this will only cause more issues. There is no problem if the government is aware of the cryptocurrency transfers.

Islamic finance has a highly promising future. The globe began to realize the applicability of Islamic banking and financial products after the 2008 financial crisis, and the Covid19 pandemic has now provided a signal for IT-assisted Islamic financial products for the general public. Blockchain is helping Islamic finance develop in a favorable way. Providing clients with trust is crucial. The primary benefit of Fintech-based products, such as those that employ Blockchain and AI, is increased system trust. Cryptocurrency is a byproduct of Blockchain and may be helpful if the relevant criteria and prerequisites for its validity are satisfied.

Conclusion

Blockchain is a new phenomenon. It is now accepted as a revolutionary technology for the financial sector all over the world. Applications made on it provides ease and security for the financial transactions. Its use by the Islamic financial sector will increase the financial inclusion as well as performance of the institutes. Its use will enable the Islamic financial institutions to provide cost effective and efficient products to their customers. Cryptocurrency is built on Blockchain. At present there are different views of Shariah scholar about its validity. Those who disallow it consider it on the point that it has no intrinsic value. Hacking and control of currency by an outside organization or country is fear in this regard. However, if it is controlled by the Government through central bank and other conditions for its validity are met, it will also prove a good thing for the Islamic financial sector.

Recommendations

- The governments need to act quickly to advance Blockchain technology and artificial intelligence in Pakistan. The founding of PIAIC is a critical step in this direction. Both long-term planning and policy creation as well as immediate action are required.
- Regulatory bodies must publish regulations that benefit both existing and future digital enterprises.

- Innovation and Blockchain are the future. The adoption of it by financial institutions must be eager. Increased financial inclusion will result from Blockchain adoption.
- Shariah scholars need to explore the reality of Cryptocurrencies more deeply and provide solid suggestions to make it Shariah-compliant.
- If cryptocurrency is issued under the control of the Government and its security is ensured, it will facilitate the Islamic financial sector a lot.

References

- ¹ Idelberger, Florian, Guido Governatori, Régis Riveret, and Giovanni Sartor. "Evaluation of logic-based smart contracts for blockchain systems." In *International symposium on rules and rule markup languages for the semantic web*, pp. 167-183. Springer, Cham, 2016.
- ² Rahim, S. M., Zam Zuriyati Mohamad, Juliana Abu Bakar, Farhana Hanim Mohsin, and Norhayati Md Isa. "Artificial intelligence, smart contract and islamic finance." *Asian Social Science* 14, no. 2 (2018): 145.
- ³ Kmeid, R. "Islamic Banker. Retrieved from Will Artificial Intelligence rejuvenate Islamic finance." (2017).
- ⁴ Kmeid, R. "Islamic Banker. Retrieved from Will Artificial Intelligence rejuvenate Islamic finance." (2017).
- ⁵ Mik, Eliza. "Smart contracts: terminology, technical limitations and real world complexity." *Law, Innovation and Technology* 9, no. 2 (2017): 269-300.
- ⁶ Shahnawaz, and Ravi Bhushan Mishra. "An English to Urdu translation model based on CBR, ANN and translation rules." *International Journal of Advanced Intelligence Paradigms* 7, no. 1 (2015): 1-23.
- ⁷ Khan, Shahnawaz, and Mustafa Raza Rabbani. "Artificial intelligence and NLP-based chatbot for islamic banking and finance." *International Journal of Information Retrieval Research (IJIRR)* 11, no. 3 (2021): 65-77.
- ⁸ Nakamoto, Satoshi. "Bitcoin: A peer-to-peer electronic cash system." *Decentralized Business Review* (2008): 21260.
- ⁹ Abu-Bakar, Mufti Muhammad. "Shariah analysis of bitcoin, cryptocurrency, and blockchain." *Shariah Analysis in Light of Fatwas and Scholars' Opinions* (2018).
- ¹⁰ Lacasse, Richard-Marc, Berthe Lambert, and K. H. A. N. Nida. "Islamic Banking- Towards a Blockchain Monitoring Process." *Revue de Gestion et d'Économie* 6, no. 1 & 2 (2018): 33-46.
- ¹¹ Lacasse, Richard-Marc, Berthe Lambert, and Nida Khan. "Blockchain technology-Arsenal for a Shariah-compliant financial ecosystem." *Journal of Business and Economics* (2017).
- ¹² Evans, Charles W. "Bitcoin in Islamic banking and finance." *Journal of Islamic Banking and Finance* 3, no. 1 (2015): 1-11.
- ¹³ Muneeza, Aishath, Nur Aishah Arshad, and Asma Tajul Arifin. "The application of blockchain technology in crowdfunding: towards financial inclusion via technology." *International journal of management and applied research* 5, no. 2 (2018): 82-98.

- ¹⁴ Zhu, Huasheng, and Zach Zhizhong Zhou. "Analysis and outlook of applications of blockchain technology to equity crowdfunding in China." *Financial innovation* 2, no. 1 (2016): 1-11.
- ¹⁵ Niforos, Marina, Vijaya Ramachandran, and Thomas Rehmann. "Block Chain." (2017).
- ¹⁶ Biancone, Paolo Pietro, Silvana Secinaro, and Mohamad Kamal. "Crowdfunding and Fintech: business model sharia compliant." *European Journal of Islamic Finance* 12 (2019).
- ¹⁷ Rabbani, Mustafa Raza, Shahnawaz Khan, and Eleftherios I. Thalassinou. "FinTech, blockchain and Islamic finance: An extensive literature review." (2020).
- ¹⁸ Alidin, Az Azrinudin, Abdo Ali Abdullah Ali-Wosabi, and Zamri Yusoff. "Overview of blockchain implementation on islamic finance: Saadiqin experience." In *2018 Cyber Resilience Conference (CRC)*, pp. 1-2. IEEE, 2018.
- ¹⁹ Othman, Anwar Hasan Abdullah, Syed Musa Alhabshi, and Razali Haron. "The effect of symmetric and asymmetric information on volatility structure of crypto-currency markets: A case study of bitcoin currency." *Journal of Financial Economic Policy* (2019).
- ²⁰ Zahudi, Zalina Muhamed, and R. A. T. R. Amir. "Regulation of virtual currencies: Mitigating the risks and challenges involved." *Journal of Islamic Finance* 5, no. 1 (2016): 63-73.
- ²¹ Carrick, Jon. "Bitcoin as a complement to emerging market currencies." *Emerging Markets Finance and Trade* 52, no. 10 (2016): 2321-2334.
- ²² Yakubowski, M. "Could Crypto be Compliant with Sharia Law." *Available at <https://cointelegraph.com/news/could-crypto-be-compliant-with-sharia-law-experts-answer>* (2019).
- ²³ Bakar, Nashirah Abu, Sofian Rosbi, and Kiyotaka Uzaki. "Cryptocurrency framework diagnostics from Islamic finance perspective: a new insight of Bitcoin system transaction." *International Journal of Management Science and Business Administration* 4, no. 1 (2017): 19-28.
- ²⁴ Ali, Engku Rabiah Adawiah Engku, and Mohd Daud Bakar, eds. *Essential readings in Islamic finance*. Cert Publications, 2008.
- ²⁵ Meera, Ahmad Kameel Mydin. "Cryptocurrencies from islamic perspectives: The case of bitcoin." *Bulletin of Monetary Economics and Banking* 20, no. 4 (2003): 475-492.
- ²⁶ Firmansyah, Egi Arvian, and Mokhammad Anwar. "Islamic financial technology (FINTECH): its challenges and prospect." In *Achieving and Sustaining SDGs 2018 Conference: Harnessing the Power of Frontier Technology to Achieve the Sustainable Development Goals (ASSDG 2018)*, pp. 52-58. Atlantis Press, 2019.