The Legality of Smart Contract in the Perspectives of Indonesian Law and Islamic Law

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Abstract

This study aims to determine the legal status of smart contracts from the perspective of Indonesian law and Islamic law through a comprehensive literature review. The revolution of the internet and smartphones has changed human life, as happens in smart contracts. This difference in character between smart and conventional contracts has not been fully anticipated by applicable law. That is why the urgency of *fiqh* renewal or reform of the law in the cyberspace era. Although smart contracts are still in their infancy, and there are still many critical issues that need to be resolved, the results of the literature research show that the smart contract has fulfilled the principles in the agreement/contract in Islamic law**.** According to the ITE Law, a smart contract can be interpreted as an agreement referred to in Article 1313 of the Civil Code, "an act where one person binds himself to one or more other people". Although this study is not sufficient, this needs to be elaborated from the perspective of Indonesian law. The most important things in smart contracts to comply with the Islamic law are: the sequence of processes in the smart contract must comply with Islamic law, the object being transacted must be halal, the perpetrators have complied with the provisions of the Islamic law, fixed price during the contract period and the number of parties involved in the contract may increase over time.

Keywords: Smart contract; blockchain; Islamic law; Indonesian law

Introduction

The internet and smartphones have made Muslims live in the real world and the virtual world. Both will have legal implications because they are related to whether or not to do something. This is the urgency of reforming *fiqh* and law in the era of cyberspace.

Currently, the economic activities in the digital world are increasing with the adoption of smart contracts in the block chain and its derivative products, such as e-commerce, fintech (financial technology), and others. However, the discussion of smart contracts in terms of law (e.g., national law and Islamic law) is still relatively small. Although some studies have discussed it, the discussion is still not integrated and comprehensive to provide understanding to the public on technical, legal, and Islamic legal aspects related to the topic.

Smart contracts generally have different characteristics from conventional contracts. This difference in character has not been fully anticipated by existing law[1]. This is where the importance of legal reform[2], both Islamic law, and Indonesian law.

Smart contracts in relation to Islamic law have been studied by several previous researchers including Alisa Ahmad[3] who stated that smart contracts do not fully comply with the principles of the Islamic law that must exist in a contract. This is because the parties involved in the smart contract do not need to know each other it can lead to *gharar* (uncertainty) and allow things that are prohibited from being transacted. However, Alisa Ahmad did not discuss further what if the object/service transacted in a smart contract is permissible and what if even though the transacting parties do not know each other, no party is harmed in the smart contract[4]. Know Your Customer (KYC) is a customer identity management that can be used in smart contracts to prevent impersonation, fraud, money laundering, and terrorism[5].

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[1] Andi Muhammad Asrar Atjo, Hasbuddin Khalid, and Ahyuni Yunus, 'Pembuktian Kontrak Digital Pada Perdagangan Elektronik Menurut Undang-Undang Informasi & Transaksi Elektronik', *Journal of Lex Generalis (JLS)*, 2.19 (2021).

[2] Munawar, *Adab & Fiqih Bermedia Sosial Untuk Santri, Pelajar, Mahasiswa & Orang Tua* (Depok: YPI At Taqwa, 2020).

[3] Azlin; Alisa Ahmad, Mat; Noor Mat Zain, and Nur Diyana Amanina Zakaria, 'A Comparative Analysis of Smart Contracts and Islamic Contracts', *International Journal of Advanced Research*, 8.10 (2020), 316–25 <https://doi.org/10.21474/ijar01/11859>.

[4] Siti Rohaya and others, 'Artificial Intelligence, Smart Contract and Islamic Finance', *Asian Social Science*, 14.2 (2018), 145 <https://doi.org/10.5539/ass.v14n2p145>.

[5] Nikolaos Kapsoulis and others, 'Know Your Customer (KYC) Implementation with Smart Contracts on a Privacy-Oriented Decentralized Architecture', *Future Internet*, 12.2 (2020) <https://doi.org/10.3390/fi12020041>.

Regarding e-commerce transactions using bitcoin payments, the legal requirements of Article 1320 of the Civil Code are very difficult to fulfil[6], so smart contracts with such a model are invalid and can be cancelled through court decisions if the parties or one of the parties so wish. However, if the parties do not request cancellation, the contract remains valid and binding on the parties involved.

Another challenge that needs to be resolved to make smart contracts in line with Islamic law is the necessity of an agreement (*sighah*) (whether it can represent the interests of the parties involved in the smart contract) and how to prove it because the agreement is not written on paper[7]. With the specific requirements and standards that must be complied with by the transacting parties at the beginning, uncertainty can be minimized and parties who feel that their interests are not represented may not need to continue the smart contract[8]. The non-repudiation nature of digital signatures applied to smart contracts can be used to prove the authenticity of smart contracts[9] if unwanted things occur.

This study is designed to answer all the problems that still become challenges for previous researchers through literature review. The objective of this study is to determine the legal status of smart contracts from the perspective of Indonesian law and Islamic law. A literature review is very important to show the importance of a topic and identify gaps from previous researchers to avoid duplication of research and map research developments over time[10].

The sources used in this literature review are books, scientific articles (from journals and proceedings), and other sources relevant to smart contracts. In this study, the researchers collect, examine, and discuss scientific articles from reputable and indexed sources, such as Scopus, Web of Science, and others.

The employed literature review method was the technique put forward by Ramdhani[11], covering topic selection, search & selection of appropriate

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[6] Ridwan Romadhoni and Dona Budi Kharisma, 'Aspek Hukum Kontrak Elektronik (E-Contract) Dalam Transaksi E-Commerce Yang Menggunakan Bitcoin Sebagai Alat Pembayaran', *Jurnal Privat Law*, 7.1 (2019), 49 <https://doi.org/10.20961/privat.v7i1.30098>.

[7] Dhiaeddine Rejeb, 'Smart Contract ' s Contributions to Mudaraba', *Tazkia Islamic Finance and Business Review*, 15.1 (2021), 1–18.

[8] Melanie Swan, *Blockchain: Blueprint for a New Economy* (O'Reilly Media, 2015).

[9] Weidong Fang and others, 'Digital Signature Scheme for Information Non-Repudiation in Blockchain: A State of the Art Review', *Eurasip Journal on Wireless Communications and Networking*, 2020 <https://doi.org/10.1186/s13638-020-01665-w>.

[10] Hannah Snyder, 'Literature Review as a Research Methodology : An Overview and Guidelines', *Journal of Business Research*, 104.July (2019), 333–39 <https://doi.org/10.1016/j.jbusres.2019.07.039>.

[11] Abdullah Ramdhani, Muhammad Ramdhani, and Abdusy Amin, 'Writing a Literature Review Research Paper: A Step-by-Step Approach', *International Journal of Basic and Applied Science*, 3.1 (2014), 47–56.

articles, analysis & synthesis of selected articles, and organizing review results. In analyzing and synthesizing the selected articles, the researchers applied the method put forward by Lai[12], consisting of looking for similarities (comparing), looking for dissimilarities (contrasting), making a judgment (criticizing), and comparing strengths and weaknesses (synthesizing).

The final result of this research was a critical study of smart contracts in relation to Indonesian law and Islamic law. In addition, this study also provided what needs to be done so that smart contracts can be implemented and may go hand in hand with Islamic law.

Discussion

The Definition of Smart Contracts

A smart contract is defined as a set of promises stipulated in digital form (including its protocol) in which the transacting parties must carry out the promise[13]. The rules in smart contracts are determined by the users (the transacting parties) and enforced in the same network[14].

Smart contract programming requires an 'economic thinking' perspective that traditional programmers may not do in which fairness should be emphasized even though one of the transacting parties may try to cheat to maximize their economic benefits. Several bugs and loopholes have been reported in this smart contract program, in which these shortcomings can be exploited for theft or possible loss of money[15].

The purpose of smart contracts is to meet the requirements of joint contracts, minimize the need for intermediaries, reduce losses due to fraud, and reduce arbitration and transaction costs[16]. Smart contracts are needed to speed up the transaction process and maximize transparency because specific requirements and standards that must be complied with by the transacting parties are predetermined.

Referring to Law Number 11 of 2008 concerning Information and Electronic Transactions as amended by Law Number 19 of 2016 concerning

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[12] Emily R Lai, 'Critical Thinking: A Literature Review', *Transfusion*, 2011 <https://doi.org/10.1046/j.1537-2995.1995.35395184278.x>.

[13] Kristian Lauslahti, Juri Mattila, and Timo Seppala, 'Smart Contracts How Will Blockchain Technology Affect Contractual Practices?', *SSRN Electronic Journal*, 68, 2018 <https://doi.org/10.2139/ssrn.3154043>.

[14] Kevin Delmolino and others, 'Step by Step towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab', *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9604 LNCS (2016), 79–94 <https://doi.org/10.1007/978-3-662-53357-4_6>.

[15] Delmolino and others.

[16] Rohaya and others.

Amendments to Law Number 11 of 2008 concerning Information and Electronic Transactions, Article 5 to Article 12 explains that Information Electronic and/or Electronic Documents and/or Electronic Documents and/or Electronic Documents. or the printout is valid evidence, which is an extension of legal evidence according to the procedural law in force in Indonesia. Therefore, smart contracts can be legally used in Indonesia as an agreement made electronically in the form of an embodiment of the principle of freedom of contract.

How Smart Contracts Work

Briefly, a smart contract is created between two users. Furthermore, the terms and conditions of the contract are written as programming code. The smart contract is then placed on the blockchain and will be executed automatically when a triggering event occurs. Because contracts can run automatically, the need for intermediaries can be eliminated[17].

How smart contracts work can be illustrated as follows[18]. The smart contract process starts after there is an agreement between the transacting parties. The data are stored on every computer and then are sent to the network which is written in program code into the blockchain. Smart contracts will trigger key events, such as expiration dates and agreed prices. This information will be recorded and the smart contract will automatically be executed according to the requirements in the program code. If the parties agree to the terms and conditions of the contract embodied in the form of a signature, smart contracts will be cryptographically distributed to the shared ledger. When a certain code is met, the program will automatically perform the appropriate action. The final stage is determined by the regulator. Thus, regulators can use blockchain in maintaining the privacy of each actor's position.

There are three elements of a smart contract that make it different from conventional contracts[19]: autonomous, independent, and decentralized. 'Autonomous' means that there is no need for further contact once the smart contract is launched and running. 'Independent' means being able to do everything independently, such as fundraising, service provision, and spending resources for processing and storage. 'Decentralized' means being not centralized on a single server but distributed in network nodes.

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[17] Delmolino and others.

[18] Maher Alharby and Aad van Morsel, 'Blockchain Based Smart Contracts : A Systematic Mapping Study', *Computer Science & Information Technology (CS & IT)*, October, 2017, 125–40 <https://doi.org/10.5121/csit.2017.71011>.

[19] Swan.

Advantages of Smart Contracts Compared to Traditional Contracts

Smart contracts are claimed to have advantages in terms of efficiency, security, and impartiality in the implementation of the agreement. Therefore, it may reduce transaction costs, increase trust, and improve confidentiality between the parties involved[20]. On the other hand, traditional contracts are drawn up by legal professionals, most of which contain legal language. Related to this fact, the public has difficulty interpreting the legal language, making it slow down the transaction process. Traditional contracts also require a lot of printed documents, causing the risk of loss to be high. This jeopardizes the security and confidentiality of transactions. Enforcement also relies heavily on third parties and if something goes wrong, the parties involved need to rely on the public justice system.

As mentioned previously, smart contracts can solve the problem found in traditional contracts because they are created by programmers written digitally using programming code. Smart contracts have predefined rules and consequences (in digital form) with stated obligations, benefits, and penalties. These rules and consequences will reduce the potential for litigation and have an auditable transaction history.

Table 1 below shows the features that differentiate traditional and smart contracts. From the table, it can be concluded that smart contracts are a better option than traditional contracts.

Table1. A comparison between smart contracts and traditional contracts (source: digitalis.id)

Smart Contracts	Traditional Contracts
Low cost	High cost
Real-time	Take a long time
Have no or minimal human intervention	Human intervention is very high
Trust in code/program	Trust in people
Automatic	Need a human role

If compared to traditional cryptocurrencies (e.g., bitcoin), smart contracts offer the following advantages[21].

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[20] Florian Idelberger and others, 'Evaluation of Logic-Based Smart Contracts for Blockchain Systems', *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9718 (2016), 167–83 <https://doi.org/10.1007/978-3-319-42019-6_11>.

[21] Ari Juels, Ahmed Kosba, and Elaine Shi, 'The Ring of Gyges: Investigating the Future of Criminal Smart Contracts', *Proceedings of the ACM Conference on Computer and Communications Security*, 24-28-Octo (2016), 283–95 <https://doi.org/10.1145/2976749.2978362>.

1. Smart contracts offer fair exchange between distrusting parties by presenting rules that can be expressed in programmable logic. This feature prevents the transacting parties from committing fraud by canceling the exchange protocol and eliminating the need to meet with a (potentially deceptive) third party.
2. Smart contracts can minimalize interactions between parties and reduce opportunities for unwanted monitoring and tracking.
3. Transactions in a smart contract can also be enriched with other relevant external information, such as weather reports, stock information, and others.

In addition to having many benefits as mentioned above, smart contracts also have a dark side due to potential crimes, such as the following.
1. The fair exchange between the transacting parties allows transactions with criminals to take place.
2. With minimal interaction, it will be difficult for law enforcement to monitor illegal activities, such as theft of access keys. Likewise, criminals can be free to make criminal contracts and then leave. Even though they have left, the contract is still automatically executed without further interaction.
3. Enrichment of transactions with other information from outside will automatically expand the possibility of crimes, such as terrorism and others.
4. Decentralized smart contract systems usually allow anonymity (use of pseudonyms) which may provide a space of secrecy for criminal activities.

Smart Contract Blockchain

Smart contracts are the fundamental building blocks of blockchain applications. They are computer programs stored on the blockchain that allow turning traditional contracts into digital parallels. The validity of an electronic contract cannot be determined from the form of the contract but is determined from the fulfillment of the specified conditions.

The conditions for a valid agreement are regulated in Article 1320 of the Civil Code, where an electronic agreement or electronic contract is considered valid if it meets the following requirements, including Article 46 paragraph 2 of Government Regulation Number 71 of 2019 concerning the Implementation of Electronic Systems and Transactions (PP PSTE) which states that there is an agreement between the parties, which is carried out by a legal subject who is authorized or authorized to represent by the provisions of the legislation, the object of the transaction must not conflict with the laws and regulations, morality and public order.

Most studies state that current smart contracts utilize blockchain technology[22]. Blockchain is an ideal platform for smart contracts due to the security of the technology and immutability[23]. However, studies on smart contracts and blockchains are still very limited because the industry employing smart contracts and blockchains is relatively new.

Blockchain is a distributed database[24] that is identically stored in many places (called nodes), is immutable (cannot be changed and deleted)[25], and appends only (can only be added), in which each block contains a record of times and links to the previous block[26].

Blockchain smart contracts are defined as digital programs[27] based on blockchain architecture[28] that accommodate certain prerequisites in their internal logic to prevent unauthorized changes as a result of their decentralized nature[29]. The evolution of smart contracts to become part of the blockchain can be seen in Figure 1. Meanwhile, the life cycle of the smart contract blockchain has four phases as shown in Figure 2, namely as follows.

1. Recording of terms and conditions: smart contracts record the terms and conditions between the parties involved in a ledger that is shared between them and validated by the validator.
2. Dealing with internal and external systems: smart contracts can contact internal and external systems (e.g., banks) regarding account balances, prices, and other contract-relevant information.
3. Evaluation: the smart contract waits for an external trigger to check the conditions in the terms and conditions. Smart contracts usually have prepared data for reporting and compliance purposes.
4. Self-execution: the contract will be automatically executed if a condition is met through a certain trigger factor.

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[22] Consulting Capgemini, 'Smart Contracts in Financial Services : Getting from Hype to Reality', *Capgemini Consulting*, 2016, 1–24.

[23] Alharby and Morsel.
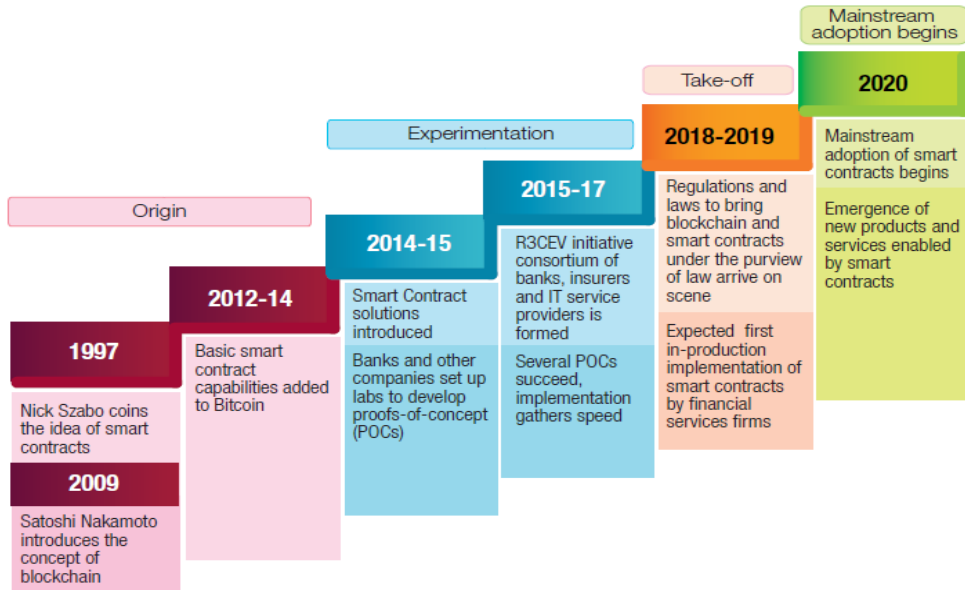
[24] Alharby and Morsel.

[25] Capgemini.

[26] Lauslahti, Mattila, and Seppala.

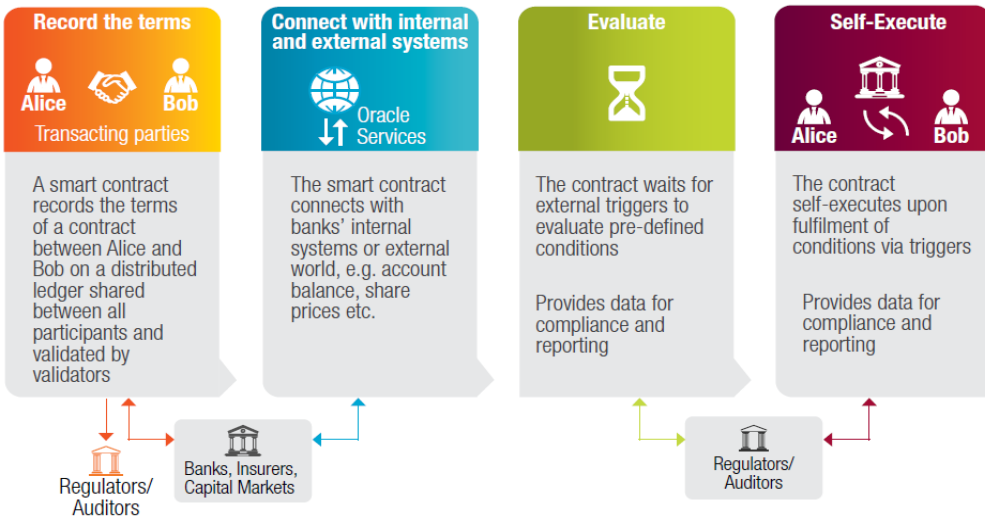[27] Lauslahti, Mattila, and Seppala.

[28] Rohaya and others.

[29] Capgemini.

Figure 1. The evolution of smart contracts into the blockchain

Source: Capgemini Consulting Analysis

Figure 2. The life cycle of smart contracts[30]

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[30] Capgemini.

Issues around Smart Contracts

To date, smart contracts are still relatively young. Therefore, there are still many critical issues that need to be considered, which can be divided into 4 categories, namely codification/coding, security, privacy, and performance issues[31].

1. Issues regarding program codification/coding

After reviewing the works of literature, the researchers found four problems that developers may face when writing smart contracts, namely difficulty writing the correct contract, the inability to change or terminate the contract, lack of support for identifying sub-optimal contracts, and complexity of the programming language[32].

The first is the difficulty of writing the correct smart contract[33], especially when it is linked to currencies[34]. If the smart contract cannot be executed as intended, there will be a loss of many currency units as happened in the case of the attack on the DAO (Distributed Autonomous Organization)[35]. The second is the inability to modify or terminate smart contracts[36] due to the immutability feature of the blockchain. The third is the sub-optimal support for smart contract identification[37]. The last is the complexity of the smart contract programming language. Programming in smart contracts usually uses a procedural language (e.g., solidity) utilizing complex state machines[38]. The state machine is used to help identify the required operations and allocate these operations to the appropriate objects[39][40]. The problem is that program code in a procedural language is executed sequentially. This makes the task of writing smart contracts in the programming language complicated and error-prone.

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[31] Alharby and Morsel.

[32] Alharby and Morsel.

[33] Delmolino and others.

[34] Karthikeyan Bhargavan and others, 'Formal Verification of Smart Contracts: Short Paper', *PLAS 2016 - Proceedings of the 2016 ACM Workshop on Programming Languages and Analysis for Security, Co-Located with CCS 2016*, 2016, 91–96 <https://doi.org/10.1145/2993600.2993611>.

[35] Loi Luu and others, 'Making Smart Contracts Smarter', *Proceedings of the ACM Conference on Computer and Communications Security*, 24-28-Octo (2016), 254–69 <https://doi.org/10.1145/2976749.2978309>.

[36] Bill Marino and Ari Juels, 'Setting Standards for Altering and Undoing Smart Contracts', in *International Symposium on Rules and Rule Markup Languages for the Semantic Web* (Springer, 2016), pp. 151–66.

[37] Ting Chen and others, 'Under-Optimized Smart Contracts Devour Your Money', in *IEEE 24th International Conference on Software Analysis, Evolution and Reengineering (SANER)*, 2017, pp. 442–46.

[38] Delmolino and others.

[39] Munawar, *Pemodelan Visual Dengan UML* (Jogjakarta: Graha Ilmu, 2005).

[40] Munawar, *Analisis Perancangan Sistem Berorientasi Obyek Dengan UML* (Bandung: Informatika, 2018).

Logic-based languages can solve this problem because there is no need to specify the sequence of steps in smart contract programming[41]. The problem is that the algorithms for logic-based languages are not efficient.

2. Security issues

There are several issues related to smart contracts that need to be anticipated, which include: (a) interdependent transactions[42][43] that occur when two transactions that have dependencies request the same contract to be included in a block. If the transaction is not carried out in the correct order, it results in a loss for one of the parties (b) the dependence on the timestamp[44] that occurs when smart contracts use time as a condition to trigger and execute transactions (e.g., sending money) (c) the vulnerability of mishandled exceptions[45] that occurs when a contract (caller) calls another contract (callee) without checking the value returned by the callee (d) re-entrancy vulnerability[46] that occurs when an attacker uses a recursive function call to make multiple withdrawals but their balance is deducted only once (e) criminal activity. Jules *et al.*[47] highlighted the following 3 things about smart contracts: leakage/sale of confidential documents, theft of private keys, and calling-card crimes. Leaking confidential documents can be done with the support of Serpent (Ethereum scripting language). The theft of private keys can be carried out using primitive cryptography, namely Succinct Non-interactive Argument of Knowledge (SNARKs). Meanwhile, data from outside, even though it has been authenticated, can still be used for calling-card crimes. (f) the lack of trust in data from outside or so-called oracles. There is no guarantee that data taken from outside can be trusted[48].

3. Issues regarding privacy

There are two issues surrounding privacy obtained from the results of this literature study: the lack of transactional privacy and the lack of privacy when requiring external data[49][50]. Lack of transactional privacy can limit the

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[41] Idelberger and others.

[42] Christopher Natoli and Vincent Gramoli, 'The Blockchain Anomaly', *Proceedings - 2016 IEEE 15th International Symposium on Network Computing and Applications, NCA 2016*, 2016, 310–17 <https://doi.org/10.1109/NCA.2016.7778635>.

[43] Luu and others.

[44] Luu and others.

[45] Luu and others.

[46] Luu and others.

[47] Juels, Kosba, and Shi.

[48] Fan Zhang, Ethan Cecchetti, and Kyle Croman, 'Town Crier: An Authenticated Data Feed for Smart Contracts', in *The 2016 ACM SIGSAC Conference on Computer and Communications Security, CCS '16*, 2016, pp. 70–282 <https://doi.org/10.1093/nq/146.29.48-a>.

[49] Ahmed Kosba and others, 'Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts', in *IEEE Symposium on Security and Privacy (SP)*, 2016, pp. 839–58.

implementation of smart contracts because many people perceive financial transactions (e.g., stock trading) as confidential information[51]. Whereas the lack of privacy in terms of external data will be a problem as all requests will be published so that they can be seen by anyone on the blockchain[52]..

4. Issues regarding performance

There is only one issue related to the performance of smart contracts, namely that execution must be sequential[53]. In a blockchain system, smart contracts are executed sequentially (e.g., one contract at a time). This will negatively affect the performance of the blockchain system because the number of smart contracts that can be executed per second will be limited. With the increasing smart contracts in the future, blockchain systems will not be able to do so. Therefore, smart contracts should be executed in parallel so that the performance of the blockchain system can be improved because more contracts can be executed per second.

Several researchers have tried to find solutions to all the aforementioned problems. Some problems are still in the form of a concept and some are already technical solutions to the problems that occur. Table 2 presents some solutions that have been attempted by several researchers.

Table 2. Issues around smart contracts and their solutions

Smart Contract Issues		Proposed Solution
Issues regarding coding	Difficulty in writing correct smart contracts [54]	1. Make smart contracts semi-automatically [55] 2. Use formal verification methods [56] 3. Provide education (e.g., through online tutorials) [57]

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[50] Hiroki Watanabe and others, 'Blockchain Contract: A Complete Consensus Using Blockchain', *2015 IEEE 4th Global Conference on Consumer Electronics, GCCE 2015*, 2016, 577–78 <https://doi.org/10.1109/GCCE.2015.7398721>.

[51] Kosba and others.

[52] Fan Zhang, Cecchetti, and Croman.

[53] Marko Vukolić, 'Rethinking Permissioned Blockchains', *BCC 2017 - Proceedings of the ACM Workshop on Blockchain, Cryptocurrencies and Contracts, Co-Located with ASIA CCS 2017*, 2017, 3–7 <https://doi.org/10.1145/3055518.3055526>.

[54] Delmolino and others.

[55] Christopher K. Frantz and Mariusz Nowostawski, 'From Institutions to Code: Towards Automated Generation of Smart Contracts', *Proceedings - IEEE 1st International Workshops on Foundations and Applications of Self-Systems, FAS-W 2016*, 2016, 210–15 <https://doi.org/10.1109/FAS-W.2016.53>.

[56] Bhargavan and others.

[57] Delmolino and others.

	Inability to modify or terminate a smart contract [58]	Make standards for modifying or discontinuing smart contracts [59]
	Support for sub-optimal smart contract identification [60]	Use 'GASPER' as a helping device [61]
	The complexity of smart contract programming languages [62]	Use logic-based language [6364]
Issues regarding security	Interdependent transactions [6566]	1. Use the 'SendIfReceived' function[67] 2. Use the condition/ guard[68] 3. Use OYENTE [69]
	Dependence on time/timestamp [70]	1. Use random number blocks instead of timestamps [71] 2. Use OYENTE [72]
	The vulnerability of mishandled exceptions [73]	1. Check return value [74] 2. Use OYENTE [75]
	The vulnerability of reentrancy [76]	Use OYENTE [77]
	Criminal activity [78]	No solution yet
	The lack of trust in data	Use Town Crier [80]

[58] Marino and Juels.

[59] Marino and Juels.

[60] Chen and others.

[61] Chen and others.

[62] Idelberger and others.

[63] Luu and others.

[64] Idelberger and others.

[65] Natoli and Gramoli.

[66] Luu and others.

[67] Natoli and Gramoli.

[68] Luu and others.

[69] Luu and others.

[70] Luu and others.

[71] Luu and others.

[72] Luu and others.

[73] Luu and others.

[74] Luu and others.

[75] Luu and others.

[76] Luu and others.

[77] Luu and others.

[78] Juels, Kosba, and Shi.

	from outside [79]	
Issues regarding privacy	Lack of transactional privacy [81]	1. Use Hawk [82] 2. Use encryption [83]
	Lack of privacy when requiring data from outside [84]	1. Use Hawk [85] 2. Use encryption [86]
Issues regarding performance	Executions that must be sequential [87]	Parallel execution of smart contracts [88]

Smart Contracts in Indonesian Legal Perspective

In Indonesia, there is still no specific regulation regarding smart contracts[89]. However, the rules regarding blockchain in financial technology or fintech can be found in several laws and regulations, such as Article 23 of the Financial Services Authority Regulation No. 77/POJK.01/2016 which elaborates on fintech-based lending and borrowing services. In Article 1313 of Indonesia's Civil Code, the explanation section explores the engagement due to a contract or agreement. Further explanation regarding the validity of a contract can be seen in Article 1320 BW which states that the validity of a contract must meet the following condition: it is made by a competent party, there is an agreement between the parties, there is an object that is agreed upon, and based on a lawful cause.

Thus, in terms of positive law in Indonesia, it can be concluded that smart contracts are very likely to be implemented as long as they do not conflict with Article 1337 BW of Indonesia's Civil Code and Article 18 of Indonesia's Law on Electronic Information and Transaction that bind the involved parties.

Contracts in Islamic View

Akad or *al-'aqdu* in Arabic means bond or agreement. The term *agreement* in the Qur'an is called *al-'aqdu* (contract) and *al-'ahdu* (promise)[90]. *Akad* or contract is an offer and acceptance agreement between the parties who make a

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[80] Fan Zhang, Cecchetti, and Croman.

[79] Fan Zhang, Cecchetti, and Croman.

[81] Kosba and others.

[82] Kosba and others.

[83] Watanabe and others.

[84] Watanabe and others.

[85] Kosba and others.

[86] Watanabe and others.

[87] Vukolić.

[88] Vukolić.

[89] Dzulfikar Muhammad, 'Karakteristik Perjanjian Jual Beli Dengan Smart Contract Dalam E-Commerce', *Jurist-Diction*, 2.5 (2019), 1655–74.

[90] Gemala Dewi, Wirdyaningsih, and Yeni Salma Barlinti, *Hukum Perikatan Islam Di Indonesia* (Jakarta: Fakultas Hukum Universitas Indonesia, 2007).

contract with terms and conditions following sharia law[91]. In this context, there must be objects or subjects that can be exchanged between the parties[92]. The term *akad* is usually used specifically for a contract that states an offer and acceptance[93]. Therefore, before a Muslim takes part in the offer and acceptance, it is necessary to first determine whether it is following the sharia law. The agreement of the transacting parties will be the basis of the contract[94]. Therefore, every element of a contract is an agreement from a legal perspective[95]. Thus, the contract must refer to the obligations, rights, and responsibilities of the involved parties.

The Pillars of the Contract in Islamic View

In Hanafi's view, the contract is a statement of offer (*ijab*) and acceptance (*qabul*). The pillars of the contract according to Maliki, Hanbali, and Syafi'i include 3 things[96]: (1) the statement of the contract (*sighah*) that must be fully disclosed and understood by all involved parties in the contract (2) the parties involved in the contract need to understand the principles of a contract that meets sharia law, as follows[97] : (a) not change/ constant (b) *Ash-syafafiah*/ transparent (c) *Ikhtiyari*/ voluntary (d) *amanah*/ keeping promises (e) *ihtiyati*/ caution (f) *luzumi*/ not to be changed (g) provide mutual benefits (h) *taswiyah*/ equality (i) *al-istitha'ah*/ ability (j) *at-taisir*/ convenience (k) *husnun-nawaya*/ good intention (l) lawful reasons (3) the subject of the contract must have value or benefit for the parties. For this reason, the parties need to know explicitly the specifications of the subject of the contract and agree on it based on their desire without coercion from any party. Other things that need to be considered related to the subject of the contract are as follows[98]: (a) is not an unclean thing (b) must have a return for the parties following Sharia principles (c) must be the property of the seller (d) must be physical or a service whose benefits are interchangeable.

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[91] Rahmani Rimonita Yulianti, 'Asas-Asas Perjanjian (Akad) Dalam Hukum Kontrak Syariah', *JurnalEkonomi Islam Universitas Islam Indonesia*, 2.1 (2008), 91–107 <http://www.pta-jambi.go.id/attachments/article/1449/AsasAsas Perjanjian.pdf>.

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[95] Siti Salwani Razali, *Islamic Law of Contract* (SIngapore: Cengage Learning Asia Pte Ltd, 2010).

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[97] Irma Devita, *Kiat-Kiat Cerdas, Mudah, Dan Bijak Memahami Masalah Akad Syariah* (Bandung: Pustaka Mizan, 2011).

[98] Hidayat Enang, *Fiqih Jual Beli* (Bandung: PT. Remaja Rosdakarya, 2015).

Smart Contracts in Islamic Law Perspective

The application of smart contracts in fintech (financial technology) and Islamic law is still under debate[99]. This is because blockchain is a new and not yet established technology. Smart contracts are also exposed to fraud risk, decentralization problems, market risk, elements of human nature outside the contract, systemic risks, jurisdictional issues, programmatic risks, and many more[100].

Through almost the same treatment as other technologies, smart contracts also need to accommodate sharia principles so that they may not cause doubt, especially among Muslims. For this reason, smart contracts need to be based on the Qur'an, Sunnah, *al-Ijma'*, and *al-Qiyas*. In general, smart contracts must be free from elements of *maysir* (gambling), *gharar* (uncertainty), and *riba* (interest).

The prohibition of *maysir* means that the contract must be free from bets, speculations, and derivatives thereof. Smart contracts must also be free from *gharar* (uncertainty) which means dubious contracts, unclear contracts, and dubious buying and selling. *Riba* (interest) is an important element that distinguishes between conventional contracts and Islamic contracts. *Riba* is strictly prohibited in the Qur'an as Allah says in the Qur'an: "*Allah has permitted trading and forbidden interest.*" (Al-Baqarah: 275).

In contemporary problems, smart contracts can be addressed to the *ilhaq* method, namely equating a problem that occurs with its equivalent case in *al-kutub al-mu'tabarah* or the *istinbathi* method if there is no equivalent opinion (*mulhaq bih*) in *al-kutub al-mu'tabarah*[101]. The *istinbathi* method is carried out by applying the *qiyasi*, *istishlahi*, *istihsani*, and *sadd al-dzari'ah* methods.

In general, Islam requires contracts to be detailed and transparent to maintain their validity. However, the factual conditions in smart contracts cannot be detailed, such as the purchase of solar energy in which the transaction volume and price are always dynamic so that it cannot be known in the future. This contradicts the idea of smart contracts should be self-executed. Therefore, this has sparked further debate about how 'smart' a contract is in sharia law.

According to sharia law, a contract is an *ijab* (statement) from one party and a *qabul* (acceptance) from another party, which causes legal consequences

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[99] Fares Djafri, 'Summary Report of the "LSE-HBKU Workshop on Fintech and Islamic Finances" Hosted by the Center for Islamic Economics and Finance (CIEF)', *Islamic Infrastructure Finance and the Sustainable Development Goals*, Feb 23, 2017, 2017, 1–9.

[100] Delmolino and others.

[101] Ahmad Mukhlishin, Aan Suhendri, and Muhammad Dimyati, 'Metode Penetapan Hukum Dalam Berfatwa', *Al-Istinbath : Jurnal Hukum Islam*, 3.2 (2018), 167 <https://doi.org/10.29240/jhi.v3i2.444>.

for the object of the contract by imposing responsibility on each party[102]. In other words, a contract in Islamic law is an agreement between two or more parties as outlined in an agreement to do and/or not to do something those results in a legal act (Article 20 of Indonesia's Sharia Economic Law Compilation). From the definition of this contract, it can be concluded that a smart contract is a contract that binds the parties involved.

After understanding the contracts in smart contracts and contracts in Islam, Table 3 outlines the differences and similarities between the two to better understand the actual reality.

Table 3. Similarities and differences between smart contracts and contracts in Islam

Pillars	Smart Contracts	Contracts in Islam	Analysis
Shighah	The system confirms the transaction after one of the parties accepts the offer from the other party.	Must express offer and acceptance.	*Sighah* on smart contracts is the same as *sighah* on contracts in Islam.
Parties involved in the contract	• The parties involved in the contract can be anonymous. • There are no special conditions for the parties involved in the contract.	• Need to know the customer (Know Your Customer-KYC). • Need special requirements for the parties involved in the contract.	In conventional smart contracts, there is an element of *gharar* (uncertainty) related to unknown parties.
The subject of the contract	Anything can be the object of a contract including Ponzi schemes, gambling, and others.	The subject must be according to Islamic law.	Conventional smart contracts involving subjects that are not following sharia are unlawful.

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[102] Muhammad Taufiq Romadlan Al-Bauti, *Al-Buyu' Ash-Syai'a Wa Asar Dawabit Al-Mabi' 'Ala Syar'Iyyatiha* (Beirut: Dar al-Fikr, 1998).

By considering the various explanations aforementioned, it can be concluded that the smart contract has fulfilled the principles of the agreement based on Islamic law as long as it prioritizes efficiency, security, and convenience and the objects transacted in smart contracts are halal objects. However, it must be ensured that the legal terms and conditions in the smart contract are executed in the right order to guarantee compliance with Islamic law.

Regarding the number of parties involved in smart contracts, which can continue to grow, it is not a problem as long as the period of time is fixed and does not change. Likewise, the price may not change during the contract period. However, the end of the contract period may be readjusted with the approval of community members in the smart contract because this is considered a new contract.

Conclusion

Smart contracts effectively replace traditional paper contracts. In addition, smart contracts help promote more credible transactions without compromising their authenticity and credibility. Without a doubt, smart contracts have the potential to revolutionize the industry in the digital world. Smart contracts in Islam are very important because they not only provide information but also act as a legal contract between the parties involved. The existence of smart contracts will accelerate the digital economy in a country.

The results of the literature study conducted by the researchers indicate that although the smart contract is still in its early stages and not yet established, it can be accepted with optimism. Most researchers have found that smart contracts will soon replace traditional contracts due to their practicality and lower transaction costs. In the context of Islam, smart contracts have fulfilled the principles of agreements following Islamic law as long as they prioritize efficiency, security, and convenience, the objects transacted in smart contracts are halal, and the perpetrators comply with the provisions of sharia law. However, it still needs re-justification along with technological developments related to smart contracts and blockchain. In the context of Indonesian law, although research on smart contracts is not sufficient, it still needs to be elaborated to anticipate future developments where smart contracts begin to replace traditional contracts.

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