

AUTOMATIZATION OF INTERNATIONAL LAW IN THE FOURTH INDUSTRIAL REVOLUTION THROUGH SMART LEGAL CONTRACTS

Muhammad Imran

Assistant Professor, College of Law, Government College University, Faisalabad
adv.drmmimran@gcuf.edu.pk

Muhammad Arif Saeed

Lecturer, Department of Law, The Islamia University of Bahawalpur
arif.saeed@iub.edu.pk

Aas Muhammad

Lecturer, Department of Law, The Islamia University of Bahawalpur
aas.muhammad@iub.edu.pk

ABSTRACT

Purpose – Smart contracts minimise transaction costs and boost efficiency. Smart contracts are costly, single-use, and inefficient. This study proposes a smart contract mechanism to address these issues. Design/methodology/approach – This study examines smart contract research history, models, and platforms to highlight their flaws. Based on typical contract content, a smart contracts model is built. Findings – This paper describes smart contract operation using several models. Decomposing smart contracts into sub-contracts facilitates global implementation. Then, smart contract benefits and deployment strategies are examined. Here's an illustration of how smart contracts will affect our lives. Originality/value – Smart contract is expanding. This article describes smart contract structure and functioning.

Keywords: AI, 4th IR, Applicability, international law, Smart contracts.

INTRODUCTION

Emerging innovations and their growth can change the exterior and internal workings of enterprises and commerce. There has been a "Fourth Industrial Revolution" since those technical advancements came to fruition (4IR). In the view of many leading thinkers in this field, the goals of 4IR include influencing future government and industry policies and practices. With the 4th Industrial Revolution, there are new prospects for bridging the gap between innovators and markets, providing a more active role for AI, and integrating multiple technological disciplines and technologies. Contracts that have been "translated" into computer code may be utilised efficiently to monitor the fulfilment of contractual commitments. There will be less money spent on fulfilling contractual commitments if smart contracts are used. When paired with blockchain technology, it eliminates manipulation by taking control of the contract and automatically executing its performance (Feng et al., 2019a).

Again, the fulfilment of an obligation is more guaranteed with smart contracts. As a result, it is more accurate and verifiable than a traditional method of writing and reading. Smart contracts are "self-enforcing" in that they guarantee that the contractual commitments of parties are carried out without variations when they are utilised in conjunction with the blockchain. Its functioning cannot be influenced or interfered with by any side. In other words, it removes the element of desire to execute contract responsibilities represented by code (Xu et al., 2016).

Additionally, using smart contracts and private blockchain in contractual agreements provides an additional benefit: autonomy. Contractual duties are carried out quickly because of the use of computer protocols to automate them, which saves a great deal of time in many corporate operations. It is the goal of smart contracts to remove human judgment, minimize the dependence on financial intermediaries, and to some part, be presumptively separate from the legal system.

Though conventional contracts have been the most popular form of interaction between parties worldwide, literature on payment systems has shown both the benefits and limits of traditional contracts. There has always been a direct link between parties' availability and capability to fulfill their

contractual commitments, regardless of how many conventional contracts seem. Despite these issues, the aim to promote international trade in the 4th Industrial Revolution has indeed been cited as a significant stimulus for developing smart contracts. The 4th Industrial Revolution and its accompanying technologies have become a major phenomenon. As a result, it is reasonable to assume that these technologies will be used in international trade and diplomacy. The transnational character of legal interactions where smart contracts might be used is predicated on the reality that participants to such a contract are statistically unlikely to be situated in a single country. Although this might lower regional barriers to trade, there seems to be little scholarly attention paid to the legal concerns involved in the execution and implementation of such smart contracts, hence the necessity to carry out this research. An apparent disagreement between the laws of various nations or states may also indicate this problem's existence.

In light of the preceding research hole, this study aims to provide a solution to the situation of what exactly constitutes a smart contract. These questions will be addressed and used as the basis for a private international law assessment detailed in the next section. Finally, the topic of whether smart contracts have a place in private international law of contracts will be addressed in this study.

History of research

Self-help and automation are not new ideas. Technologists and programmers have started developing computer software and technology that provide self-help in contractual agreements. However, Smart contracts are the name given to these innovative contracts. Invented or established with the express purpose of making contract arrangements between parties more easily enforced and automatically carried out, they serve this function well. Smart contracts have yet to be defined in a way everyone agrees on. There are many different theories about what they are and how they work. Smart contracts are the subject of this study, which seeks to elucidate their nature and workings. As a first step, it examines the history of smart contracts.

Furthermore, it clarifies how smart contracts work and their primary purposes. Blockchain technology, including its characteristics and advantages, will also be examined as some writers describe smart contracts in connection to it. This study will also examine the differences between private and public blockchains and permissioned and permissionless blockchains.

Key Features and Benefits of Blockchain Technology

Blockchain technology uses cryptographic algorithms and distributed consensus procedures to ensure data security, traceability, and transparency. Aside from security and public services, blockchain technology may also be used in other domains, including smart contracts, public services, and the execution of computer programmes. Persistence, auditability, decentralization, and, in certain situations, anonymity are some of the most important characteristics of the blockchain. These features allow it to save money while also increasing effectiveness. It is possible to conduct financial transactions without a neutral third party, such as a bank or an intermediary, thanks to the efficiency of the block chain (Feng et al., 2019a). The success of Bitcoin, for example, may be traced back to blockchain. The Bitcoin network may run without a third-party middleman as blockchain is the essential technology to perform Bitcoin. It is possible to build a smart contract in a dynamic approach such that the fulfilment of obligations may be triggered by using a reliable third-party source, which computer programmers often refer to as a 'oracle'. An oracle is a software platform created purposefully to communicate data from the actual world hence establishing mechanisms whereby a blockchain based approaches may connect with humans in the real world. In other words, oracles can help smart contracts adapt to changing situations. Because oracles may capture real-world events and transfer information to the blockchain to activate a smart contract, contracting parties can use them as a reference (Feng et al., 2019b).

Interim Conclusion

So it seems that a smart contract is a written instrument that both records and embodies contracting parties' agreement or mutual commitments and computer code that fulfils such guarantees on a digital machine. To put it another way, smart contracts are computer programmes based on if-then logic that are often used in conjunction with block chain technology to maximize its benefits (Zakery et al., 2021).

Demand analysis of smart contract

Every digital item has a code that governs it. The code that generates and saves digital assets determines most digital assets' usefulness, security, availability, general malleability, and transferability. As a result, some academics have claimed that 'code is law' and that the law regulates digital resources.

Critical analysis of the idea that code is law in smart contracts will focus on this study. After that, it will be debated whether or not smart contracts are contracts in the legal sense, or if they are just a vehicle for carrying out a transaction (Khan et al., 2021).

The Concept of “Code is Law”

Lawrence Lessig is often cited as the father of the 'code is law' concept. It's not just a contract; it's the law. According to this school of thought, programming code and the principles that govern it are crucial decisions for software developers and architects. As a result, conventional lawmakers would be replaced by system architects or programmers. Using a code would let the contracting parties manage and structure their relationship independently of any third party. In addition, programmers make decisions that restrict online capacity, and these choices have regulatory repercussions. Code is law, and the legal system governs the assets (Denis et al., 2006). If the weight and scale of office buildings may be seen as a deterrent to theft, Lessig could have a point. Regulation may also take the form of copyright protection code created for programmes that make software theft harder. The use of Digital Rights Management (DRM) software to prohibit the illicit use or copying of 'PDF' documents is an example. It is further claimed that using code to impose agreements is better than the established justice systems that have been around since the Roman Empire.

Smart Contract and the Concept of Code is Law

These software-based contracts are implemented on a distributed ledger called the blockchain, as we've already seen in our previous discussion on smart contracts. When it comes to smart contracts, many ideas combine to describe and reflect a common distrust of people, particularly judges and bankers, as being flawed and untrustworthy, in contrast to computers' objective objectivity, reliability, and predictability. It is difficult to assess assertions about the genuine capabilities and true capacity to transform the legal and economic environment because of the complexity of the technology underpinning smart contracts. This assumption is prevalent in some of the assertions made in technical papers or code and should be avoided at all costs (Feng et al., 2019b; Morena et al., 2020). A smart contract's computer code does not have any bearing on whether the material or activities it triggers are legally permissible in light of state mandates.

Criticism

In the legal agreements framework, using smart contracts is unquestionably advantageous. 89 The usage of code need not function in a legal vacuum, but smart contracts shouldn't work that way. 90 Smart contracts do not need human interaction or change, therefore ensuring that their digital information is error-free is critical to their success. Because most computer programmes have faults in their code, it is almost impossible to guarantee the absence of all coding defects (or "bugs"). To put it another way, the DAO had a flaw that enabled a hacker or group of hackers to infiltrate the system and steal close to \$50 million worth of cryptocurrencies. This suggests that the notion of self-enforcing smart contracts, which assumes a faultless performance, may not always be viable because of code mistakes (Walker et al., 2005).

Smart Contracts versus Traditional (Legal) Contracts

It can be concluded that payment systems' main distinction from ordinary contracts is the ability to fulfil contractual obligations. Traditionally, parties to contracts are held individually liable for the implementation and fulfilment of their contractual responsibilities and may choose to suspend or violate the commercial agreement at any moment. On the other hand, a smart contract automates the execution of a lawful contract, making compliance with the obligation a lot more difficult, the Szabo-envisioned vending machine, for example. Customers may enter money into the digital ATM, and the system will immediately deliver anything they have ordered (Carrington et al., 2011). Automated code may be used to carry out contractual obligations in smart contracts. As a result, no third party is required to carry out the code. Amending or terminating contractual obligations is very complex as part of the digital contract. Since there is no mechanism to alter or cancel the smart contract after it has been activated, there is no method for a party to prevent the contract's execution once the parties have activated it. Because no human intervention or intermediaries are required, smart contracts can be said to offer a wide range of advantages, including speed, real-time updates, low risk in execution, accuracy, and lower costs (Chang et al., 2019).

Smart contracts as contracts in the legal sense? Or a mere instrument for automated performance of contracts?

Smart contracts are questionable as legal contracts. Some writers challenge the relationship between

smart contract code and legal contracts, while others consider them legal contracts. Below, we'll analyse whether smart contracts are legal contracts.

The Association of Digital Commerce claimed in one of its publications that smart contracts are neither exceptionally clever nor automatically meant to be utilised as legal contracts. The debate over computer code as a binding document is not new. It may be traced to 'Ricardian contracts,' for which a text file compact is accessible by both parties and convertible into computer code. Some experts claim that smart contracts are only a legal contract if they satisfy all the requirements. Both law and legal principles regard a written agreement to be an agreed between client and contractor that creates a legally enforceable effect or connection (Huang et al., 2017). Thus, a contract's legitimacy depends on mutual agreement or a meeting of the minds,' meaning both parties must openly agree to it. According to the writers that say smart contracts are legal contracts, smart contracts are legal contracts if there is a mutual understanding on specified conditions.

Interim Conclusion

Smart contracts as code or technology do not constitute legal contracts. Smart contracts are computer software programs that allow contract execution, facilitation, and enforcement. Smart contracts are an execution mechanism for legal contract terms. It's naive to think that since smart contracts contain the word "contract," they are legally binding and reflect a contract inside the legal sense. Smart contracts' legal weight depends on their target jurisdiction and contractual provisions. Smart contracts are not contracts in the legal sense, but an instrument for automating contract execution. This provides the foundation for the following analysis.

Application

When parties in the contract come from different jurisdictions, private and domestic law or contention of laws rules determine which state's law is relevant to the legal connection. Private international law or conflict of laws rules only apply where no substantive uniform law is in place. Both substantive uniform law rules, such as those found in the 1980 United Nations Norms on Contracts for the Sale of Goods (CISG), and internal legal rules apply to international contracts whose execution is handled through the use of smart contracts will be the focus of this investigation (Dal Mas et al., 2020). As a model to define relevant law for courts inside the European Union and various local courts' private international law, the Regulation should also be studied in the light of treaties whose execution is carried out via smart contracts. It will be examined in the last section of this study if there are concerns of unjustified enrichment associated with smart contracts being used as an execution mechanism under the application of the provisions to non-contractual obligations.

Smart Contracts in the Scope of Private International law

As noted in the previous study, smart contracts do not constitute a formal contract, but rather an execution mechanism selected by parties to automate its contractual agreements and self-execute the conditions of the contract. Smart contracts are not legally disconnected from the paper-based agreement they attempt to implement. To claim that all smart contracts have legal ramifications is likewise absurd (Yue et al., 2016). How does jurisdiction handle smart contracts?

Private international law connects international contracts to a state's legal system to reduce legal ambiguity. These guidelines let smart contract parties decide which state's law regulates their rights and duties. Private international law principles determine the geographical position of legal connections between parties or allocate legal problems involving many nations to a certain legal system. In most circumstances, international contracts are related to a foreign country that needs a decision of an applicable law. When parties opt to execute their agreement using smart contracts, the appropriate law should be chosen purely private international legal standards. However, private international law principles are extra if a unified substantive law applies to the situation (Yue et al., 2016).

Smart Contracts and the 1980 United Nations Conventions on Contracts for the Sale of Goods (CISG)

The legal position of smart contracts was examined in the previous study. It is not a contract in the legal sense, but rather an execution mechanism selected by parties to automate their contractual terms and soul the terms and conditions. It's overly simple to say smart contracts have a formal split from the paper-based agreement they execute (Huang et al., 2017). All smart contracts having legal repercussions is likewise unfeasible. The issue is how arbitral awards deals with smart contracts.

Private international law remedies the legal ambiguity of foreign contracts by linking them to a state's legal system. These principles let smart contract participants agree on which state's law

determines their rights and duties. The rules in private law determine the geographic region of legal connections between parties or allocate legal problems involving several nations to a specific legal system using choice of law rules. Most international contracts are related to a second country that needs a decision of an applicable law. Therefore, when parties opt to execute their contract using smart contracts, the relevant law should be chosen based on private global law principles (Huang et al., 2017). When there is a unified substantive law, private international law standards are unnecessary to identify relevant law.

The applicable law in the absence of a choice of law

Suppose a contract using smart contracts comes under Rome I Regulation. In that case, member state courts will apply Rome I Regulation's requirements, even if that means applying non-EU law, such as Indian law, to any contractual obligations. Even if some of the parties to a contract are not European, member country courts will apply the Rome I Regulation to the agreement.

In cases where a commercial or civil agreement is at issue, Article 1(1) of the Roman I Regulation specifies the appropriate law. To what extent are "smart contracts" a "contractual responsibility" in light of this requirement? Rühl feels no case law settles this problem, because 'contractual responsibility' encompasses all freely performed private responsibilities, mutual or unilateral. States may employ choice-of-law clauses in their treaties since smart contracts are software and don't generally impose duties.

Parties' autonomy governs the applicable law under a Rome I Regulation agreement, a notion of private international law. It is permitted under Article 3 of the Rome I Regulation for parties to choose the federal statute of our choice without any connection to that legislation. Choice of law, according to some, is difficult to express in code and hence cannot be directly incorporated into a smart contract. However, a decision must be made and the best way to accomplish it is by announcing the legislation explicitly. A smart contract may include a choice of legislation or a distinct declaration or document. When you use smart contracts, one may choose the proper law. It is difficult to codify the choice of law rules since it is not enforceable contractually.

Applicable Law to Claims based on Unjustified Enrichment

Suppose a contract using smart contracts comes under Rome I Regulation. In that case, member state courts will apply Rome I Regulation's requirements, even if that means applying non-EU law, such as Indian law, to any contractual obligations. Even though some of the parties to a contract are not European, member country courts will apply the Rome I Regulations to the agreement (Shen et al., 2020).

In cases where a commercial or civil agreement is at issue, Article 1(1) of the Roman I Regulation specifies the appropriate law. To what extent are "smart contracts" a "contractual responsibility" in light of this requirement? States may employ choice-of-law clauses in their treaties since smart contracts are software and don't generally impose duties.

Parties' autonomy governs the applicable law under a Rome I Regulation agreement, a notion of private international law. It is permitted under Article 3 of the Rome I Regulation for parties to choose the federal statute of our choice without any connection to that legislation. Choice of law, according to some, is difficult to express in code and hence cannot be directly incorporated into a smart contract. However, a decision must be made and the best way to accomplish it is by announcing the legislation explicitly. A smart contract may include a choice of legislation or a distinct declaration or document. When you use smart contracts, one may choose the proper law. It is difficult to codify the choice of law rules since it is not enforceable contractually (Xu et al., 2016).

Interim Conclusion

This research examined the private international law component of smart contracts. It concluded that smart contracts may be used to execute either part or the whole of an international legal contract since they are an execution mechanism (Chang et al., 2020). The use of code, however, does not apply to all contractual terms. A good illustration of this is the transfer / delivery of the goods as part of an international commercial deal. The present arbitral principles may be used to determine the acceptable laws for transactions done via consensus mechanism under international law. These standards of private international law cover neither the legal contract nor smart contracts or computer code.

CONCLUSION

In suppositions, code is not law, smart contracts do not operate in a legal vacuum. There is nothing

more to it than computer code that serves as a tool or method for fulfilling a legal contract, which is what smart contracts are. Automated contract execution may be achieved by interpreting Contracts as executable computer code that reflects the legal aspects of a contract as executable computer code. Some parties may use the blockchain network to replicate existing paper-based contracts, while others may go even farther and use smart contracts to formalise their contractual arrangement. The internet is a crucial factor in translating Smart contracts, indicating the extent to which geographical barriers have no influence. However, there are no standard core rules that apply to smart contracts, private international law rules may be applied to define the appropriate law in transactions using smart contracts (Mettler, 2016). When the Rome I Regulation is applied to the underpinning legal contract and the parties freely submit their agreed relationship to the national law of their choice, the relevant contract law is formed under the idea of party autonomy. As the usage of blockchain and smart contracts spreads throughout the country, several states have responded by enacting their regulations. These rules, created to offer a viable framework that gives regulatory relief and protects their property rights, will benefit blockchain and smart contract users and producers.

The study emphasized smart contracts' legal features and how they relate to global commerce. For all the talk about "Fourth Industrial Revolution" technology that claims to replace or transcend human decision-making, smart contracts are only a small part of that trend. Aside from contract execution, smart contracts may also be used for other purposes under the 4th Industrial Revolution (IoR). Using these modules, a component of the Fourth Industrial Revolution, business activities may be automated and made more efficient across borders.

Only contractual responsibilities in commercial and civil circumstances may be determined by Rome I Regulation, which is often utilised in the EU. However, there are exceptions when a contract is completed or performed using a piece of software or computer code. A presumption exists, but no one-size-fits-all legal framework governs the use of a smart contract to carry out contractual agreement, as there is in traditional international agreements. Parties may pick the law that applies to their agreement, but if they don't, the law of the area where they plan to carry out their contractual responsibilities may apply instead. Party autonomy leads to this.

Articles 1 to 4 of Rome II's rule indicate identifying the right legislation when one party enriches another. Non-contractual responsibilities are the most typical foundation for these claims. In these cases, applicability applies to the legal contract that the smart contract intends to execute. If private international law is ready for smart contracts, the smart contract component of the trade may be governed by private international law despite how bad current internet and computer code contract rules may be, they have a place in international law. Smart contracts might revolutionize future corporate collaborations if widely implemented.

REFERENCES

- Carrington, K., Hogg, R., & McIntosh, A. (2011). The resource boom's underbelly: Criminological impacts of mining development. *Australian and New Zealand Journal of Criminology*, 44(3), 335–354. <https://doi.org/10.1177/0004865811419068>
- Chang, S. E., Chen, Y. C., Lu, M. F., & Luo, H. L. (2020). Development and Evaluation of a Smart Contract-Enabled Blockchain System for Home Care Service Innovation: Mixed Methods Study. *JMIR Med Inform 2020;8(7):E15472* <https://Medinform.Jmir.Org/2020/7/E15472>, 8(7), e15472. <https://doi.org/10.2196/15472>
- Chang, S. E., Chen, Y. C., & Wu, T. C. (2019). Exploring blockchain technology in international trade: Business process re-engineering for letter of credit. *Industrial Management and Data Systems*, 119(8), 1712–1733. <https://doi.org/10.1108/IMDS-12-2018-0568>
- Dal Mas, F., Dicuonzo, G., Massaro, M., & Dell'Atti, V. (2020). Smart contracts to enable sustainable business models. A case study. *Management Decision*, 58(8), 1601–1619. <https://doi.org/10.1108/MD-09-2019-1266/FULL/HTML>
- Denis, D. J., Hanouna, P., & Sarin, A. (2006). Is there a dark side to incentive compensation? *Journal of Corporate Finance*, 12(3), 467–488. <https://doi.org/10.1016/J.JCORPFIN.2005.08.006>
- Feng, T., Yu, X., Chai, Y., & Liu, Y. (2019a). Smart contract model for complex reality transaction. *International Journal of Crowd Science*, 3(2), 184–197. <https://doi.org/10.1108/IJCS-03-2019-0010/FULL/HTML>

- Feng, T., Yu, X., Chai, Y., & Liu, Y. (2019b). Smart contract model for complex reality transaction. *International Journal of Crowd Science*, 3(2), 184–197. <https://doi.org/10.1108/IJCS-03-2019-0010/FULL/PDF>
- Huang, B. T., Liu, Q., He, Q. M., Liu, Z. G., & Chen, J. H. (2017). Towards Automatic Smart-contract Codes Classification by Means of Word Embedding Model and Transaction Information. *Zidonghua Xuebao/Acta Automatica Sinica*, 43(9), 1532–1543. <https://doi.org/10.16383/J.AAS.2017.C160655>
- Khan, S. A. R., Razzaq, A., Yu, Z., & Miller, S. (2021). Industry 4.0 and circular economy practices: A new era business strategies for environmental sustainability. *Business Strategy and the Environment*, 30(8), 4001–4014. <https://doi.org/10.1002/BSE.2853>
- Mettler, M. (2016). Blockchain technology in healthcare: The revolution starts here. *2016 IEEE 18th International Conference on E-Health Networking, Applications and Services, Healthcom 2016*. <https://doi.org/10.1109/HEALTHCOM.2016.7749510>
- Morena, M., Truppi, T., Pavesi, A. S., Cia, G., Giannelli, J., & Tavoni, M. (2020). Blockchain and real estate: Dopo di Noi project. *Property Management*, 38(2), 273–295. <https://doi.org/10.1108/PM-01-2019-0005/FULL/HTML>
- Shen, B., Cao, Y., & Xu, X. (2020). Product line design and quality differentiation for green and non-green products in a supply chain. *International Journal of Production Research*, 58(1), 148–164. <https://doi.org/10.1080/00207543.2019.1656843>
- Walker, J., Pan, E., Johnston, D., Adler-Milstein, J., Bates, D. W., & Middleton, B. (2005). The value of health care information exchange and interoperability. *Health Affairs (Project Hope), Suppl Web Exclusives*. <https://doi.org/10.1377/HLTHAFF.W5.10>
- Xu, X., Pautasso, C., Zhu, L., Gramoli, V., Ponomarev, A., Tran, A. B., & Chen, S. (2016). The blockchain as a software connector. *Proceedings - 2016 13th Working IEEE/IFIP Conference on Software Architecture, WICSA 2016*, 182–191. <https://doi.org/10.1109/WICSA.2016.21>
- Yue, X., Wang, H., Jin, D., Li, M., & Jiang, W. (2016). Healthcare Data Gateways: Found Healthcare Intelligence on Blockchain with Novel Privacy Risk Control. *Journal of Medical Systems*, 40(10). <https://doi.org/10.1007/S10916-016-0574-6>
- Zakery, A., Capital, M. S.-J. of I., & 2020, U. (2021). Knowledge and intellectual capital in internationalizing SMEs, case study in technology-based health companies. *Emerald.Com*, 7(5). <https://www.emerald.com/insight/content/doi/10.1108/JIC-02-2020-0048/full/html>