SMART CONTRACTS: A NEW FORM OF CONTRACT IN MODERN DAY

Grace Emmanuel Kaka[1,*], Muhammad Helmi Md Said[2], Tinuk Dwi Cahyani[3], Alaa Basil Baqer AlFadhel[4]

[1]Sa'adu Zungur University Gadau, Bauchi State, Nigeria

[2]Universiti Kebangsaan Malaysia

[3]Universitas Muhammadiyah Malang, Malang Indonesia

[4]Universiti Kebangsaan Malaysia

Corresponding author: graceemmanuelkaka@basug.edu.ng; gekaka2011@gmail.com

Abstract

Smart contract as a new form of contract is recognized to provide speedy and efficient transactions. Eliminating textual ambiguities, cumbersome contractual terms, enables negotiations, verify terms and automatically enforce tempered-free contractual terms without the need for intermediaries. In traditional contract, contractual terms are written in formal language which are quite cumbersome, the process of concluding transactions is slow and requires the intervention of lawyers, banks, registry departments and the courts. Many jurisdictions including Nigeria are still carrying out contractual transactions relying solely on traditional contract despite advancement in technologies including Blockchain technology, Ethereum and use of cryptocurrencies like Bitcoin and others as medium of exchange in online transactions. Using a qualitative doctrinal legal research method, this research gathered online sources and examined the legality of smart contract and Blockchain technology. While highlighting the importance of using smart contract in business transaction in Nigeria. The research adds to ongoing discuss on smart contracts and Blockchain technology. Suggesting the need for a shift from purely traditional contracts in Nigeria, to adoption of smart contracts to ease both domestic and trans-jurisdictional transactions mostly concluded online. However, there is a need for a robust framework for smart contract in Nigeria just like the E-SIGN Act and the UETA in the United States and other similar legislations that have been developed in other countries across the world.

Keywords: Smart Contract, Blockchain, Legality, Enforcement, Transactions

1.0 INTRODUCTION

Nick Szabo first coined the concept of Smart contract in late 1990s.[1] Besides being a speedy and efficient form of transaction, it eliminates the textual ambiguities associated with traditional contract.[2] Such as replacing cumbersome contractual terms with a formal language understood by machines using codes on blockchain. These types of contracts are programs on computers that enable parties to negotiate, verify and enforces terms of a contract in an automatic way without recourse to third parties or intermediaries. In smart contracts unlike traditional contracts, the trust in code are replaced with trust in people.[3] It can dispense with the need for contractual terms between the parties[4] so long as there is meeting of the mind. Smart contracts are mostly executed on the blockchain technology. Blockchain is a type of a distributed ledger technology where business transactions are arranged sequentially in blocks according to Alexandra Savellyev.[5] These blocks are linked to previous ones and immutably recorded across a peer-to-peer network with the use of cryptographic machine that is trusted. Maintaining coherence, based on the parties agreement and without the need for an intermediary or a middleman.

As such, data is securely stored based on the decentralization principle. Smart contracts are immutable (records stored on the blockchain cannot be changed); it is transparent (all data on the blockchain is made public, but cannot be indiscriminately changed or easily edited); redundant (each blockchain user retains a copy, this means that the transactions cannot be taken offline to warrant system failure or malicious acts by third parties); disintermediated (dispels the need for middle men such as lawyers, banks and courts). An example of a successful blockchain technology is the Bitcoin, while Ethereum is fast making waves as another distributed ledger technology that can self-execute smart contracts. Similarly, the credibility of

[1] N Szabo, 'Smart Contracts: Building Blocks for Digital Markets'. *EXTROPY: The Journal of Transhumanist Thought* [1996] (16) 18.
[2] L Efimova, O Sizemova and A Chirkov, 'Smart contracts: between freedom and strict legal regulation'. *Information & Communications Technology Law* [2021] (30) (3) 333 – 353. https://doi.org/10.1080/1360834.2021.1889759.
[3] T de Graaf, 'From Old to New: From Internet to Smart Contracts and From People to Smart Contracts'. *Computer Law & Security Review* [2019] (5) 1.
[4] T de Graaf.
[5] A Savelyev, 'Copyright in the Blockchain Era: Promises and Challenges'. *Computer Law & Security Review* [2018] (34) 551.

codes makes smart contracts durable and reliable because there is legal guarantee for contractual parties that their contractual terms will be satisfied.[1]

Nigeria like most countries in the world is yet to adopt smart contracts as an alternative contract in business transactions. This has continue to hamper the growth of business especially cross-border or trans-jurisdictional transactions. Even domestic transactions carried out intra-state still follow the traditional contract formation. Although, there are still some issues surrounding the legality and enforcement of smart contracts in trans-jurisdictional transactions. Yet, studies have shown that this new form of contract is viable, easy and effective in business transactions and widely utilized and recognized across the globe. This research is important because it does not only examine smart contract legality and enforceability alone, but highlights the importance of smart contracts as a new form of contract in modern day. Suggesting the need for its adoption in Nigeria to ease business transactions and to help lawyers have a less cumbersome contract terms that is trusted and tempered-free.

2.0 LITERATURE REVIEW

Nick Szabo says, smart contract constitute a set of digital shaped promises, where there terms are executed.[2] In contrast, Lawrence Lessig, sees it dumb contracts that rare weak and subject to human frailty.[3] Mayank Pratap argues that smart contracts are computer codes formed on the blockchain by two or more persons, containing terms agreed upon by the parties and once the terms are fulfilled, the smart contract automatically executes itself in the form of an out-put.[4] Max Raskin differentiates between weak and strong smart contract, whether court can change smart contract after its implementation or not.[5] Kevin Werbach said smart contracts can be regarded as the recent trend, an evolution of electronically generated agreements, or, a contract on a blockchain different from traditional contracts.[6] While Alexander Savelyeva is of the opinion that it is a contract that transcends national borders, performed regularly and is not

[1] L Efimova, O Sizemova and A Chirkov, note 2.
[2] N Szabo, note 1 p 18.
[3] L Lessig, Code is Law: On liberty in cyberspace. Harvard Magazine [2020] I January. <https://www.harvardmagazine.com/2000/01/code-is-law-html>accessed 7 April 2024.
[4] Mank Pratap, 'Everything You Need to Know About Smart Contracts: A Beginner's Guide' [2017] 27 August. <https://hackernoon.com/everything-you-need-to-know-about-smart-contracts-a-beginners-guide-c13cc138378a> accessed 29 March 2024.
[5] M Raskin, 'The Law and Legality of Smart Contracts'. *Georgetown Law Technology Review* [2017] (12) (1) 310-311.
[6] K Werbach and N Cornell, 'Contracts Ex Machina'. *DUKE Law Journal* [2017] (67) 371.

restricted to any national law rather it has global perspective. As such, smart contract can exist without a legal framework in place.[1]

In 1991, blockchain was established as the first concept of a digital document where documents or signatures cannot be changed.[2] Roman Beck, opined that blockchain has the ability to tract different types of assets including cross-border transfers and complex financial transactions.[3] Muniba Memon, views blockchain as a network of computers on the Internet where peer-to-peer (B2B) devices work. It is like a file a user stores on his computer based on the consent of parties to the transaction, and has the feature of safety and integrity to execute.[4] From Werbach and Cornell's perspective, smart contracts has the capacity to distort global commercial transaction but cannot replace traditional contracts, as such it calls for legal solution.[5] Fairfield said, the most beneficial standard-form clauses for the consumer and buyers is the ability to freely use cryptocurrency via a connected digital wallet.[6] Eliza Mik opined that for smart contract to gain the status of a commercial transaction, it must change from being technical to become legally enforceable. The contractual parties must rely on legal protections in traditional contracts to make their transactions legally binding and enforceable.[7] While Savelyev, thinks a legal system is immaterial in smart contract since it is a new form of cyberspace transaction that is an alternative to whole legal system.[8] In Nigeria, little is known about smart contracts and its adoption in contracts or business transactions. Even though they have gained wide recognition in other countries across the globe.

3.0 Research Methods

[1] JJ Szczerbowski, ' Transaction Costs of Blockchain Smart Contracts'. *Law and Forensic Science* [2018] (16) (2) 3.
[2] S Haber and W Stornetta, 'How to Time-Stamp a Digital Document, Crypto'90, Lncs 537'. *Springer Journal of Cryptology* [1991] (3) 10.
[3] R Beck, et al., 'Blockchain Technology in Business and Information Systems Research'. *Springer* [2017] 3.
[4] M Memon, et al., 'Blockchain Beyond Bitcoin: Blockchain Technology Challenges and Real-World Applications, 2018 International Conference on Computing, Electronics & Communications Engineering (iCCECE): 2018, 31.
[5] K Werbach and N Cornell, note 11 p 322.
[6] JA Fairfield, 'Smart Contracts, Bitcoin Bots, and Consumer Protection'. *Wash. & Lee L. Rev. Online* [2014] (71) 44-46.
[7] E Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity'. *Law, Innovation and Technology* [2017] (9) (2) p 5.
[8] A. Savelyev, 'Contract Law 2.0:'Smart'contracts as the Beginning of the End of Classic Contract Law'. *Civil aw Bulletin* [2016] (32) 3.

The research adopted the doctrinal legal research which is purely qualitative. Online-based resources were gathered and analyzed using the traditional method of research in law as against technological realities. Doctrinal research is generally library based, purely theoretical, black-letter law research, legal dogmatic, or arm-chair research.[1] In this research, the doctrinal legal research was utilized in examining the legality of blcokchain smart contracts as a modern form of contract.

4.0 Discussion

4.1 Concept of Smart contract

Smart contract according to Simon Geiregat, do not have a universally accepted definition.[2] Researchers are of the opinion that smart contract is not contract in legal sense of it.[3] Rather, it can best be described as software or hardware that can initiate, control or document relevant acts legally, based on prearranged or proven digital events through which parties can legally conclude binding contracts.[4] Savelyev declined equating smart contracts to any type of a legally binding transaction. Arguing that agreements on blockchain computer code automated operation, in the legal sense is not a contract, at best, it is a purely technical phenomenon which is not strange to law.[5] As a result, the ability to use legal rules to govern public relations through smart contracts is limited. British scientist Imran Bashir thinks that smart contracts do not require mediation.[6] Real smart contracts do not require third party interference, its legal foundation is the computer code that secures the contractual terms. It is enjoys cryptographic protection from being hacked or interfered with by outside sources. It is executed without recourse to the courts, notaries, registrars or others, distinguishing it from standard or traditional contracts.[7]

[1] NALT's Blue Book Basic Guide Series No. 2, 2021. <www.SabiLaw.org.> accessed 10 April 2024.
[2] S Geiregat, 'Cryptocurrencies Are (Smart) Contracts'. *Computer Law and Security Review* [2018] (34) (5) 1144.
[3] JK Martinez, 'Designing Online Dispute Resolution'. *Journal of Dispute Resolution* [2020] (1) (10) 135 – 150. https://scholarship.law.missouri.edu/jdr/vol2020/iss1/10.
[4] O Rabinovich–Einy and E Katsh, 'Blockchain and the Inevitability of Disputes: The Role for Online Dispute Resolution'. *Journal of Dispute Resolution* [2019] 47.
[5] A. Savelyev, note 19.
[6] H Eenmaa-Dimitrieva and MJ Schmidt-Kessen, 'Creating Markets in No-Trust Environments: The Law and Economics of Smart Contracts'. *Computer Law & Security Review* [2019] (35) 69.
[7] Imran Bashir, *Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained* (Packt Publishing Ltd., March 2017) 53.

Imran further argues that it is a secured and continuous software that maintains the status of an agreement.[1] However, Mark Giancaspro questions whether a Smart contract can be regarded as complete contract because, as a computer code, smart contract verify and execute terms when certain predetermined conditions are met and is deemed non-cancelable.[2] As a result, it becomes technically impossible to derogate from the contract. The code becomes legally binding because smart contracts are founded on the *pacta sunt servanda* concept that parties must honour their agreements.[3] While Vos and others contend that, despite the automatic and self-execute feature of smart contract, it may nevertheless result in problems that necessitate judicial involvement. The danger remains that performance is likely to be impacted by circumstances outside the code like system error or breakdown. Sometimes a cod will behave unexpectedly, leading to unavoidable disagreements that must be resolved.[4] In the absence of a specified regulation, the standard contract rue will apply under the circumstances, and contracting parties will find it safe to enter into a smart contract.

4.2 Key Elements of Smart Contracts

Smart contracts as highlighted above, self-execute contract terms directly encrypted into code and executed on a blockchain or distributed ledger technology. Understanding its main elements is essential for comprehending its unique characteristics and functionalities. These key elements include:

1. Digital Code

The primary element of a smart contract is the digital code that contains the contract's terms, conditions, and instructions. Unlike traditional contracts, which are expressed in natural language, smart contracts use programming languages to define the logic and operations that govern the contract's execution. This digital code are similar to the natural or formal language

[1] Bashir note 26
[2] M Giancaspro, 'Is a 'Smart Contract' Really a Smart Idea? Insights from a Legal Perspective'. *Computer Law & Security Review* [2017] (33) 825.
[3] A Ivanov, M Bashkatov and E Galkova, 'Peak of Blockchain Hype: Legal Risks and Opportunities' (2 edn HSE Publishing House, Skolkovo Institute for Law and Development, National Research University Higher School of Economics, Moscow, 2018) 34.
[4] G Vos, L Akka, N Green, R Hay, P Hunn, M Kyle, C Woolard and A Zacaroli, 'Legal Statement on Cryptoassets and Smart Contracts' [November 2019] 8. <https://35z8e83m1ih83drye280o9d1-wpengine.netdna-ssl.com/wp-content/uploads/2019/11/6.6056_JO_Cryptocurrencies_Statement_FINAL_WEB_111119-1.pdf> accessed 10 March 2024.

in traditional contracts. Hence Lessig,[1] argues that 'code' is law. This is because the code regulates, implements values, or not. It enables freedom, or disables them. Code protects or promotes privacy monitoring. Therefore, the terms of their contracts is imbedded in these codes hence, good faith and fair dealing principle of law should operate to hold accountable, those contracting parties who exploit the software bugs to undermine party's expectations.[2]

2. Self-execution

Smart contracts are designed to automatically and autonomously execute, once the predetermine conditions encoded within the contracts are met. Intermediaries are dispensed with and human error risk and manipulations are minimized.[3]

3. Blockchain or Distributed Ledger Technology

Smart contracts are typically implemented on a blockchain or distributed ledger technology. The blockchain serves as a decentralized and immutable ledger that records the transaction history and the execution of the smart contracts.[4] It is also considered the most disruptive technology innovation after the invention of the internet.[5] Participants can reach consensus, based on its clever mathematical cryptography and distributed algorithm. They can also reliably transmit trust and value without third party intervention at a meagre cost. This technology ensures transparency, security, and tamper-proof integrity.

4. Pre-defined Conditions

Smart contracts include pre-defined conditions that must be met for the contract to execute. These conditions are often expressed as "if-then" statements or other programming logic. Therefore, when specific circumstances are met, the terms and conditions included in smart contracts are automatically enforced. Smart contracts, as opposed to traditional contracts, can

[1] L Lessig, 'Code is Law: On liberty in cyberspace. Harvard Magazine [2020] I January. <https://www.harvardmagazine.com/2000/01/code-is-law-html>accessed 7 February 2024.
[2] J Fairfield and N Selvadurai, 'Governing the Interface between natural and formal language in smart contracts'. *UCLA Journal of Law & Technology* [2022] (27) (2) 79 – 118 at 114 – 115.
[3] LW Cong and Z He, 'Blockchain disruption and smart contracts'. *The Review of Financial Studies* [2019] (32) (5) 1754 – 1797.
[4] P Kumar, GA Dhanush, D Srivatsa, SN Aakash and S Sahisnu, 'An efficient and novel buyer and seller's distributed ledger based protocol using smart contracts' In the proceedings of the International Conference on Distributed Computing and Internet Technology, Bhubaneswar India, January (2020) 349 – 363.
[5] H Eenmaa-Dimitrieva and MJ Schmidt-Kessen, 'Creating markets in no-trust environments: The law and economics of smart contracts'. *Computer Law and Security Review* [2019] (35) (1) 69 – 88.

reduce transaction risk, reduce service and maintenance, and boost the efficiency of business process because once deployed, blockchain protects them.[1] Therefore, smart contracts are expected to provide a better solution to the current transaction mode in various industries.

5. Decentralized

Smart contracts operate in decentralized manner, meaning they are not controlled by a single central authority. Instead, they are executed on a network of computers (nodes) that collectively validate and enforce the contract's execution. This decentralization ensures transparency, security, and resilience. It has been argued that, blockchain smart contracts provide a secured, decentralized, extensible, low-cost, and efficient data sharing distributed framework in the Internet of Things (IoT). This can be helpful to the healthcare industry often faced with data sharing problems.[2] Therefore, when access rights are set through smart contracts, users can safely and efficiently share data without the fear of cyber-attacks because reliability of data is fully guaranteed.

6. Immutability

Once developed on a blockchain, smart contracts become tamper-free and immutable. This characteristics provides a high level of trust and security, as the terms of the contract cannot be modified after deployment without consensus from the network participants. This element is such that, issues such as conditions of shipment, automate payments, and refund in cases of violation of predefined terms are easily managed.[3] Similarly, immutability and non-repudiation, demand and supply management, real-time tracking of commodities, data protection and transparency are inevitable.[4]

7. Digital Signatures

Smart contracts often require digital signatures to verify the identity and consent of the contracting parties. Digital signatures provide cryptographic proof of authenticity and ensure

[1] Z Zheng, S Xie, H-N Dai et al., 'An overview on smart contracts: challenges, advances and platforms'. *Future Generation Computer Systems I[2020*] (105) 475 – 491.
[2] Y Xu, H Chong and M Chi, 'A review of smart contracts applications in various industries: A procurement perspective'. *Hindawi: Advances in Civil Engineering* [2021] 1 – 26. https://doi.org/10.1155/2021/5530755.
[3] H Hasan, E AlHadhrami, A AlDhaheri, K Salah and R Jayaraman, 'Smart contract-based approach for efficient shipment management'. *Computers and Industrial Engineering* [2019] (136) 149 – 159.
[4] Chong and Chi, note 37 at 3 & 16.

the smart contract integrity.[1] Once, the coded terms of the contract as written on blockchain is agreed upon by the parties, they thereafter place their cryptographic or digital signature on the smart contract. Then, blockchain automatically record the smart contract and at the conclusion of the transaction, the computer programme automatically updates the subsequent action.[2]

8. Interoperability

Smart contracts can interact and integrate with other smart contracts and systems. This enables the automation and coordination of complex business processes across different platforms and organizations. For instance, in procurement (acquiring goods or services from external sources), efficiency is hindered because, traditional procurement requires employees to coordinate vast amount of paper works besides other intermediaries, long preceding time, potential collusion, information delays, and trust issues.[3] However, with smart contracts, procurement is electronic and more comprehensive.[4] Hence, blockchain and smart contracts application can mitigate the complexity of procurement system, prevent corrupt and fraud in the procurement process.

9 Scalability and Efficiency

Smart contracts can handle a large volume of transactions simultaneously and execute them with minimal delays or friction. Once the contract is triggered, speed is ensured as the scripted contract will self-execute and proceed to the next transaction.[5] Hence, it solves delay payments in construction industry,[6] minimizes the time and costs involved in making insurance

[1] NRM Zain, Blockchain and smart contract: Importance of digital signatures. A paper presented at the Seminar on Contemporary Islamic Banking Practices, IIiBF, International Islamic University Malaysia, December 2017.
[2] NRBM Zain, ERAE Ali, A Abiden and HA Rahman, 'Smart contracts in blockchain: an exploration of legal framework in Malaysia'. *Intellectual Discourse*, *IIUM Press* [2019] (27) (2) 595 – 617.
[3] NA Bakar, K Peszynski, N Azizan, V Pandiyan and K Sundram, 'Abridgment of traditional procurement and e-procurement: Definitions, tools and benefits'. *Journal of Emerging Economies and Islamic Research* [2016] (4) (1) 1 – 18.
[4] Chong and Chi, note 37, 2 – 3.
[5] Chong and Chi, 15 - 20.
[6] H-Y Chong and A Diamantopoulos, 'Integrating advanced technologies to uphold security payments: data flow diagram'. *Automation in Construction* [2020] (114) 103158.

company claims,[1] and resolves excess time taken and low efficiency in handling official documents.[2]

10. Legal Compliance

Traditional legal principles such as contract formation, legality of purpose and consent still apply to smart contracts.[3] Researchers subjected smart contracts to contract theory provisions and argued that they constitute contracts in the legal sense.[4] Adding that all contractual requirements and conditions apply to them in prove and at various stages of the contract.[5] Smart contracts can therefore be called digital contracts because they can easily control a party's obligations in a contract through blockchain databases.[6]

4.3 Smart Contract Formation

Under contract law, a valid contract is formed when all the elements of a contract are present and co-exist. These elements include consent, offer and acceptance, subject matter or the object that is being contracted upon, capacity and cause or consideration. Smart contracts may be considered legal contracts if they meet all the requirements of a traditional contract. From both civil and common law perspectives, an agreement between contracting parties that results in a legally binding relationship is a legal contract,[7] as against other social or domestic arrangements.[8]

---

[1] V. Aleksieva, H. Valchanov and A Huliyan, Application of smart contracts based on ethereum blockchain for the purpose of insurance service, *In proceedings of the international conference on Biomedical Innovations and Applications (BAB),* Varna Bulgaria, November (2019) 1 – 4.

[2] IGBB Nugraha, Y Bandung and A Zaky, Official document management for government service Indonesia using smart contract, *In proceedings of the IEEE International smart cities conference (ISC2),* Casablanca Morocco, October (2019) 390 – 395.

[3] B Kaczorowska, 'Juridical status of so-called smart contracts against the background of the polish legal framework'. *Masaryk University Journal of Law and Technology* [2019] (13) (2) 189 – 217. Doi. 10.5817/MUJLT2019-2-3.

[4] A Shah and J Alsadiey, 'Legal adaptation of smart contracts (analytical study)' (2022) 14(3) *International Journal of Early Childhood Special Education (INT-JECS),* p 1802 - 1807. Doi: 10.9756/INT-JECSE/V1413.210.

[5] ARW Ahmed, 'The concept of intelligent contract from the perspective of civil law (comparative study)'. *Journal of Economic, Administrative and Legal Sciences* [2021] (5) (8) 88 – 89.

[6] A Shah and J Alsadiey, 'Legal adaptation of smart contracts (analytical study)'. *International Journal of Early Childhood Special Education (INT-JECS)* [2022] (14) (3) 1802 - 1807. Doi: 10.9756/INT-JECSE/V1413.210.

[7] H Beale, *Cases, materials and text on contract law.* [Hart, 2019 102 – 115].

[8] N Filatova, 'Smart contracts from the contract law perspective: Outlining new regulative strategies'. *International Journal of Law and Information Technology* [2020] (28) 217 – 242. Doi: 10.1093/ijlit/eaaa015.

One common application scenario for blockchain technology is a smart contract. Put another way, if a contracting party using the blockchain network writes the terms of the agreement on codes and post it on the blockchain technology, which automatically execute the contract when the terms are fulfilled by consulting the data that was recorded on the blockchain.[1] The smart contract, which is a decentralised application, is automatically recognised by blockchain technology, which also generates a contract address for it.[2] If the party wishing to transact sends the requisite conditions to the contract address for the purpose of executing the contract, the smart contract permits it to operate automatically.

First, once the parties comprehend the structure of their coded agreement, it may be possible to determine whether they are in agreement. This is why smart contracts may be considered legal contracts.[3] Second, executing a smart contract on a blockchain may be considered an offer, whereas completing the necessary fields, entering data, or transferring digital assets could be considered an acceptance.[4]

Conclusively, smart contracts often give rise to financial or material effects that qualify as legal effects.[5] Usually, there is something that is transferred for a consideration that has value. This research argues that analyzing the technical perspective of smart contract within legal construct reveals that, smart contracts like traditional contracts possess the legal elements of an enforceable contract. This is because a valid smart contract must contain the elements of consent, offer and acceptance, and legal obligation which is the transfer of the subject matter in return for a reciprocal consideration. More so that laws are being developed to cover aspects of smart contracts in other countries,[6] like the Uniform Electronic Transaction Act (UETA) of the United States that validates electronic signatures and electronic transactions or contracts formed by electronic means like smart contracts.[7] The UETA also applies to contracts that have been enacted in a digital format for which the contracting parties have agreed to transact

[1] K Chen, G Kou, J Shang and Y Chen, 'Visualizing market structure through online product reviews: integrate topic modelling'. *Electron Commer Res Appl* [2015] (4) (1) 58 – 74. https://doi.org/10.1016/j,elerap.2014.11.04.
[2] S-H Jeong and B Ahn, 'A study of application platform for smart contract visualization based blockchain'. *The Journal of Supercomputing* [2021] (78) 343 – 360. https://doi.org/10.1007/s11227-021-03879-1.
[3] GG Howells, B Marten and W Wyrmnest, *Language of Information, Contract, and Communication.* [The Common European sales law in Context: Oxford, 2013] 190.
[4] N Filatova, 'Smart contracts from the contract law perspective: Outlining new regulative strategies', p 224 – 225.
[5] N Filatova, 'Smart contracts from the contract law perspective: Outlining new regulative strategies', p 224 – 225.
[6] Fairfield and Selvadurai, note 32, 108 – 109.
[7] Zain, Ali, and Rahman, note 41, 609.

electronically.[1] As well as the Federal Electronic Signatures in Global and National Commerce Act (E-SIGN),[2] which contains provisions recognizing the authenticity of electronic signatures and electronic records. Others are, the Australian Federal Electronic Act 1999 (ETA)[3] which gives formal recognition to contracts made using electronic means.

4.4 Smart Contract and Traditional Contract

Smart contracts like traditional contracts implies an agreement that is intended to be legally binding, except where *abinitio*, it can be shown there was no such intention. The codes on the computer always execute what it has been programmed to do.[4] Their characteristics are visible in:

1. Form and Representation

Traditional contracts are typically written or oral agreements expressed in natural language. They are often documented on paper or in electronic formats, such as PDFs or Word processing files. The terms and condition are articulated in human-readable language and require interpretation by the parties involved. Smart contracts are digital agreements written in programing code. They are implemented on a blockchain and act as a decentralized platform that executes and records contract transactions.

2. Execution and Enforceability

Traditional contracts require manual execution and enforcement. Parties involved in traditional contracts rely on external mechanisms, such as courts or arbitration, to interpret and enforce the terms of the agreement. This process can be time-consuming, costly, and subject to potential disputes. While, smart contracts executes automatically and self-enforce based on predetermined conditions and code logic. The smart contract executes the agreed terms or actions of contracting parties automatically, on fulfilment of certain conditions like transfer of funds and delivery of goods. The self-execution and self-enforcement feature of smart contracts eliminates the need for intermediaries and enhances efficiency.

[1] Unif. Elec. Transactions Act Ss 5(b) (Unif. L. Comm'm 1999).
[2] 15 U.S.C. Ss 7001.
[3] Federal Electronic Transactions Act 1999 (ETA) (Cth) (Austl).
[4] Martinez note 22.

3. Intermediaries and Trust

In traditional contracts, intermediaries such as lawyers, notaries, or banks, are required to enable the contract formation, validation, and enforcement. These intermediaries, add complexity, time, and cost to the contract process. Trust in traditional contracts is largely based on the legal system and the reputation of the parties involved. Smart contracts operates on a decentralized blockchain, reducing the need for intermediaries. The trust in smart contracts is rooted in the transparency, security, and immutability of the blockchain technology. The decentralized nature of smart contracts guarantees that the executed contract is tamper-free and verifiable.

4. Flexibility and Programmability

Traditional contracts offer flexibility in terms of negotiability and adaptability. Parties can negotiate and modify the terms of the contract based on their specific requirements. However, the execution of the contractual obligations often relies on manual intervention and human oversight. Smart contract on the other hand, offers programmability, enabling the automation of contract execution. The agreed terms and conditions are coded into the contract, and actions are executed automatically when specified conditions are met. This automation reduces the potential for human error, provides real-time performance tracking, and enables complex self-executing actions.

5. Jurisdiction and Legal Compliance

Traditional contracts are subject to jurisdictional laws and regulations that forms and enforces the contract. The interpretation and enforcement of the traditional contracts can vary across different legal systems, which can lead to complications and disputes in cross-border transactions. On the other hand, smart contracts on the other hand, operate on a global scale, transcending national borders. They are not tied to a specific jurisdiction but are subject to the applicable laws governing the underlying blockchain technology and any relevant legal obligations. However, the unique challenges of jurisdictional enforcement and legal compliance for smart contracts are still being addressed in international legal frameworks.

4.5 Smart Contract and Blockchain Technology

Although only the Blockchain (decentralized system) can ensure immutability, smart contracts can also be conceived through centralized networks.[1] In clear terms, smart contracts are both technology and blockchain-based, and its system are currently able to provide smart contracts with the necessary security and reliability. Smart contracts as agreements are coded to operate within a decentralized or distributed blockchain network, and that can be automatically executed by that network when specific conditions are validated.[2]

Blockchain as a distributed ledger, provides verifiable evidence of a transaction between two parties.[3] There is no central warehouse. The blockchain is constantly updating and duplicating on many nodes assigned to the platform. It is considered as the infrastructure for bitcoin and other financial systems. Technically, blockchain is a public digital register that keeps records shared by participating parties on the distributed computer network.[4] Every transaction that occurs in the network is recorded, whether it is immutable, validated, transparent, secured, and pseudo-anonymous. The database exist because parties' identity in the transaction have appeared via an address through a particular key in the form of a random string. Each block created is linked to each other in a linear (like a chain), and chronological order hence updating and keeping these chains occurs every 10 minutes. Which is shared amongst all users.[5] These blockchain are categorized into public blockchain (it allows anyone who has the appropriate computing ability to send the messages for processing and being involved in the process of reaching consensus for users within the network);[6] private blockchain **(**has a limited participants that can write into the blockchain. Only invited persons or pre-selected persons are granted entry by the approval of an administrator upon the satisfaction of certain requirements);[7] and permissioned Blockchain (they are a mix of the

[1] E Mik, 'Smart Contracts: A Requiem' *Journal of Contract Law* [2019] 2.
[2] AU Janssen and TJ Vennmanns, 'Smart Dispute Resolution in the digital age: the potential of smart contracts and Online Dispute Resolution for dispute prevention and resolution in Consumer Law cases'. International Journal on Consumer Law and Practice [2021] (9) (7). https://repository.nls.ac.in/ijclp/vol9/iss1/7
[3] <https://dictionary.cambridge.org/dictionary/english/blockchain> ACCESSED 4 April 2024.
[4] M Geranio, 'Fintech in the Exchange Industry: Potential for Disruption'. *Masaryk UJL & Tech.* [2017] (11) 247.
[5] S Agnikhotram and A Kouroutakis, 'Doctrinal Challenges for the Legality of Smart Contracts: Lex Cryptographia or a New, Smart Way to Contract'. *Journal of High Technology Law* [2018] (19) 315.
[6] S. Seth, Public, private, permissioned blockchains compared. Investopedia [2022] 28 July. <https://www.investopedia.com/news/public-private-permissioned-blockchains-compared/>accessed (18 April 2023).
[7] J Earls, et al., 'Smart Contracts: Is the Law Ready?'. *Chamber of Digital Commerce* [2018]. *URL: https://digitalchamber. org/smart-contracts-whitepaper (дата обращения: 06.02. 2019)*, p 59.

public and private blockchain which supports customization options. It allows anyone to join the network after being verified.) The permissioned blockchain to businesses is Blockchain-as-a-Service (BaaS), designed to be scalable for company needs or task that the service provider rents out to other business organizations.[1] However, because it uses the internet, it is vulnerable to hacking.

Although a smart contract is not the same as a blockchain, it functions primarily through the blockchain's digital structure.[2] How thoroughly a contractual obligation can be expressed digitally and which contract terms are regulated or covered by the smart contract depends on the technical maturity and complexity of blockchain and contractware.[3] Blockchain serves as the backbone for smart contracts that are carried out and decided by decentralised organisations (like a court system) via a distributed network or nodes that validates and updates the distributed ledger.[4] By strengthening ex ante enforcement, smart contracts based on blockchain technology lessen opportunism. Because smart contracts' contractual obligations are encoded in code and are decentralised throughout a blockchain network, parties to the contract have more confidence. Therefore, even though smart contracts and blockchains conclude contracts or portions of them, the issue of unfinished contracts will still exist. There are difficulties in resolving disputes because of the codified nature of smart contracts, which does not square well with incomplete contracts.

4.6 Effect of a Smart Contract in transactions

The impacts of smart contracts are evident in their properties or qualities. These include security, trustless execution, cost-effectiveness, and autonomy, among other things. While its characteristics include an electronic format that makes it possible for functions to be activated digitally, a fundamental conditional framework between contracting parties, boolean logic that increases certainty due to the binary nature of contract outcomes, and an emphasis on performance that reduces the possibility of opportunistic breaches. Blockchain is the only platform used in the construction and automatic execution of these contracts.[5] Smart contracts

[1] Seth, note 69.
[2] Janssen and Vennmanns note 65.
[3] Z Beebeejaun and A Faccia, 'Electronic alternative dispute resolution, smart contracts and equity in the enrgy sector' *The Journal of World Energy Law and Business* [2022] (15) (2) 97-113. https://doi.org/10.1093/jwelb/jwac004.
[4] MN Temte, 'Blockchain challenges traditional contract law: Just how smart are smart contracts?' *Wyo Law Review* [2019] (19) 87 at 89-90.
[5] L Efimova, O Sizemova and A Chirkov, note 2.

have conditions that are met by blockchain technology and are expressed in one of the computer languages. It is a unique document that allows parties to any kind of contract to publicly express their intentions. The blockchain platform enables the commencement, automatic execution, and termination of civil responsibilities on the internet, with digital assets as its subject matter.[1] Thus, enforcing or protecting smart contract code from being hacked guarantees its legal validity.

4.7 Legal Issues in a Smart Contract

1. Legality of Smart Contract

In Smart contract, domestic law plays little or no role because of the absence of a central public blockcahin operator that could be subject to national authority and jurisdiction. As a result, de Graaf finds it justifiable to replace traditional contract with computer codes. Domestic law still has application, although its uses are less clear. Therefore, national or domestic contract law would only be applicable to issues pertaining to public blockchains that resulted from inter-jurisdictional private relationships between individuals alone and with legal entities. Transnational or cross-border transactions are subject only to international conventions.[2] A smart contract is an innovative method of enforcing obligations. This presumption is supported by a smart contract's technological and legal characteristics. More so, automatic contract execution cannot be revoked or changed; hence, this legal characteristic can be viewed as a novel approach to guaranteeing obligation fulfilment and fostering mutual confidence between the parties.

2. Legal enforceability

Researchers have argued that self-enforcement and exogenous enforcement can both facilitate smart contract execution.[3] It is also possible to enforce laws using conventional or unconventional techniques. While a range of conflict resolution techniques, such as arbitration that is binding or non-binding or going to court, are examples of traditional enforcement strategies. The applicable law is clear and the court determines the wrong or non-performance

[1] L Efimova, O Sizemova and A Chirkov.
[2] M Butchwald, 'Smart contract dispute resolution: The inescapable flaws of blockchain-based arbitration'. *University of Pennsylvania Law Review* [2020] (168) 1369 -1423.
[3] Butchwald.

of a contract, awards damages, specific performance and other reliefs as well as enforcements of the orders granted. On the other hand, non-traditional enforcement techniques might entail the network-level enforcement of a smart contract's code without the requirement for dispute resolution. Especially with the use of blockchain technology and other online dispute resolution mechanisms like eBay, Monetha, Enigma,[1] Jury.Online, Kleros, and Sagewise.[2]

3. Interpretation of Contract Terms

The parties contractual terms must be translated from legalese into computer language by a programmer, computer scientist, or other programming professional since smart contracts are written in codes that a machine performs automatically.[3] The language has drastically changed from being understandable by the general public to being computer produced, requiring expertise that most lawyers lack to code contractual agreements.[4] Furthermore, the inclusion of a programmer in the contractual connection raises the risk of "mistakes" or "misunderstandings" when the business relationship transitions to a programmed language for parties without legal representation.[5]

The significant abstraction gap between legal and programming languages could potentially lead to an issue with implementation and purpose.[6] Smart contracts are used differently in court than electronic agreements since the former are written in normal language while the latter are not.[7] Judges can easily read the words of a digital agreement, and the human brain interprets phrases using comparable reasoning and subjective standards. After that, they employ customary contract law. On the other hand, terms in a computer language can only be understood by the machine and do not allow for human discretion in interpretation.[8]

[1] DWE Allen, AM Lane and M Poblet, 'The governance of blockchain dispute resolution' *Harvard Negotiation Law Review* [2019] (25) (75) 76 – 100.
[2] TV Nam, NB Minh, TV Hai and TG Giglione, 'The Development of New Technology Intergration in E-commerce Dispute Resolution in Vietnam'. *Revista Brasileira de Alternative Dispute Resolution – RBADR, Belo Horizonte* [2022] (4) (7) 215-229. DOI: 10.52028/ rbadr.v4i7.13.
[3] H Eenmaa-Dimitrieva and MJ Schmidt-Kessen, 'Creating Markets in No-Trust Environments: The Law and Economics of Smart Contracts'. *Computer Law and Security Review* [2019] (35) (1) 75.
[4] P Cuccuru, 'Beyond Bitcoin: An Early Overview on Smart Contracts'. *International Journal of Law and Information Technology [2017*] (25) (3) 7.
[5] S Wheeler, 'Modelling the Contracts of the Future'. *Griffith Law Review* [2017] (26) (4) 15.
[6] A. Savelyev, 'Contract Law 2.0:'Smart'contracts as the Beginning of the End of Classic Contract Law', *Information & Communications Technology Law* [2017] (26) (4) 11.
[7] S Agnikhotram and A Kouroutakis, 'Doctrinal Challenges for the Legality of Smart Contracts: Lex Cryptographia or a New, Smart Way to Contract'. *Journal of High Technology Law* [2018] (19) 315.
[8] Savelyev, note 81, 10.

It should be noted that the parties' choice to represent certain terms of their relationship through computer codes is acceptable in any judicial or arbitral actions that may follow from that relationship. The legal efficacy of the parties' agreement would be dismissed if the courts did not recognise this type of contractual relationship.[1] Therefore, the codes must be generated in comprehensible language or communicated in a form that allows the court to review the terms of the smart contracts. It is improbable that the court would possess the requisite competence to review the coded language in smart contracts.[2] However, it is advisable to resort to a "hybrid agreement," which combines computer codes and legal language in the smart contract.

4. Digital Signatures and Identity of Contracting Parties

Smart contracts often require digital signatures to verify the identity and consent of the parties involved. Digital signatures provide cryptographic proof of authenticity and ensure the integrity of the smart contracts.[3] Once an agreement is concluded as contained in the blockchain or distributed ledger, the parties may place their cryptographical signature or digital signature on the smart contract which is automatically updated.[4]A "digital signature" is a type of electronic signature that arises when public key cryptography are applied to verify user authentication. Due to the dual authentication methods, a digital signature is regarded as an electronic signature that will not be forged easily.[5]

The digital signature used in smart contracts, is a mathematical number that represents one of the parties to the contract, and represent the private key (digital signature) for each contracting party which has the capacity to perform three tasks simultaneously. Firstly: the signer's endorsement and commitment to the terms and obligations stated in the smart contract; Secondly: giving the command to run the smart contract automatically once signed; and

[1] S Farrell et al., Lost and Found in Smart Contract Translation—Considerations in Transitioning to Automation in Legal Architecture, *UNCITRAL, Modernizing international trade law to support innovation and sustainable development. Proceedings of the congress of the United Nations commission on international trade law:* 2017, 4.
[2] O'shields, R., 'Smart Contracts: Legal Agreements for the Blockchain', (2017) 21 *NC Banking Inst.*, p 190.
[3] Zain, note 40.
[4] Zain, Ali, Abiden and Rahman, note 41.
[5] Wellnessliving. 11 JULY, 2019. Digital Signatures and the Ueta / Esign Act. <https://www.wellnessliving.com/knowledge-sharing/knowledge-base/ueta-esign-act-wellnessliving> accessed 10 January 2024.

Thirdly: the signature with the private key will be the same as the key that will allow the transfer of virtual currencies from the digital wallet of the purchaser or the buyer to that of the seller.[1]

In Smart contract, "private keys" are used to generate a valid signature.[2]The main purpose of a signature is to get authentication, integrity and non-repudiation of contracts. A signature enables parties to authenticate the signature provider's identity, which can be verified through physical contact, telephone conversation and visits to the offices of another party to exchange business cards. In traditional banking services, for instance, when any person wants to withdraw money from her or his account the bank will compare the signature on the withdrawal form with the signature on the bank's records. This is a simple way to explain how hand-written signatures are used in verifying ownership of a person to a bank account. The courts have others means of verifying the authenticity of documents with handwritten signatures. For example, during a court proceeding a witness or a person that has knowledge of a person's signature or handwriting expert, can be called to verify the signature. Therefore, when the handwritten signature is appended on a document, the signer could not renounce the signature. Based on this concept, electronic signatures are equivalent to handwritten signatures or at the very least perform the same task.[3] A digital signature used in smart contracts would not be valid if it does not refer to the signer's identity. Therefore**, s**mart contracts like other types of contracts, require the contracting parties to have full capacity and for the contracting parties to know the identity of the counter parties when transacting on the internet.

5. Jurisdiction and Applicable Law

The formation of the contract is the first most important element to grant jurisdiction to the court. The court must determine the validity of a contract for a suit to be properly instituted.[4] Such that even if the contract is electronic like smart contracts, the basic elements of a valid contract such as offer, acceptance, and consideration must be present in the contract formation to validate the transaction and grant jurisdiction to the court.

[1] Al Rwby, AR Ara, 'Procedural Problems for the Electronic Signature before the Civil Judiciary: A Comparative Study between the Egyptian, French, Omani and Emirati Laws'. *Security and Law Journal* [2015] 37-38.
[2] P Debono, 'Transforming Public Procurement Contracts into Smart Contracts'. *International Journal of Information Technology Project Management (IJITPM)* [2019] (10) (2) 18.
[3] Kisswani, N.M.&Al-Bakri, A.A., 'Regulating the Use of Electronic Signatures Given the Changing Face of Contracts', (2010) 7 *Macquarie J. Bus. L.*, p 56.
[4] BJ O'grady, Formation of a Contract - Understanding the Process [2020]. <https://www.brianogradylaw.com/Articles/Formation-of-a-Contract-Understanding-the-Process.shtml> accessed 19 March 2024.

The content of the smart contract is an encrypted program written in one of the programming languages documenting the will of the parties and the terms of the agreement signed or sealed with a digital signature. Due to decentralized nature of record-keeping or transactions relating to smart contracts stored or verified via blockchain technology, it is important for legislative bodies to recognize the legality of such transactions through legislations to make smart contract transactions enforceable. However, since laws of contract are domestic in nature, there remains a problem of determining the applicable law and the appropriate court with jurisdiction in cross-border or trans-national transactions using blockchain smart contracts.

4.8 Legal Framework for Smart Contracts in Nigeria

In Nigeria, little is known about smart contracts like most countries across the globe. As such, no specific legal framework has been developed to address smart contract issues or business transactions using the blockchain technology. Therefore, where smart contract issues arises, only the law of contract is applicable under common law becomes applicable. This means that contracting parties are not fully protected under the law and any risk arising from the smart contract would hardly be subject to judicial interpretation because such transactions are strange to the Nigerian legal system.

5.0 Conclusion

In conclusion, smart contract a new form of contract has become widespread. Its impact has been felt in different sectors of governments across the globe. Easing business transactions for contracting parties. Smart contract transactions using blockchain, have proven effective, trustworthy and tempered-free, the features of which gives contracting parties confidence. While they are computer codes, the legality of smart contract has remained an issue unresolved especially the issue of applicable law, jurisdiction and enforceability of smart contracts.

Recommendations

It is hereby recommended as follows:

That Nigeria should explore the benefits of smart contract in business transactions to enable it to enhance its business horizon and easy contract formation between parties.

More research should be conducted on the enforceability of smart contract including the applicable law and issues surrounding jurisdiction in smart contract transactions. This will enable Nigeria to develop a robust legal framework for smart contract legality and its adoption in the country.

المصادر

1- A Ivanov, M Bashkatov and E Galkova, 'Peak of Blockchain Hype: Legal Risks and Opportunities' (2 edn HSE Publishing House, Skolkovo Institute for Law and Development, National Research University Higher School of Economics, Moscow, 2018) 34.
2- l Rwby, AR Ara, 'Procedural Problems for the Electronic Signature before the Civil Judiciary: A Comparative Study between the Egyptian, French, Omani and Emirati Laws'. Security and Law Journal [2015] 37-38.
3- AU Janssen and TJ Vennmanns, 'Smart Dispute Resolution in the digital age: the potential of smart contracts and Online Dispute Resolution for dispute prevention and resolution in Consumer Law cases'. International Journal on Consumer Law and Practice [2021] (9) (7). https://repository.nls.ac.in/ijclp/vol9/iss1/7
4- A Shah and J Alsadiey, 'Legal adaptation of smart contracts (analytical study)' (2022) 14(3) International Journal of Early Childhood Special Education (INT-JECS), p 1802 - 1807. Doi: 10.9756/INT-JECSE/V1413.210
5- ARW Ahmed, 'The concept of intelligent contract from the perspective of civil law (comparative study)'. Journal of Economic, Administrative and Legal Sciences [2021] (5) (8) 88 – 89.
6- A Shah and J Alsadiey, 'Legal adaptation of smart contracts (analytical study)'. International Journal of Early Childhood Special Education (INT-JECS) [2022] (14) (3) 1802 - 1807. Doi: 10.9756/INT-JECSE/V1413.210.
7- A. Savelyev, 'Contract Law 2.0:'Smart'contracts as the Beginning of the End of Classic Contract Law', Information & Communications Technology Law [2017] (26) (4) 11.
8- A Savelyev, 'Copyright in the Blockchain Era: Promises and Challenges'. Computer Law & Security Review [2018] (34) 551.
9- A. Savelyev, 'Contract Law 2.0:'Smart'contracts as the Beginning of the End of Classic Contract Law'. Civil aw Bulletin [2016] (32) 3.
10- BJ O'grady, Formation of a Contract - Understanding the Process [2020]. <https://www.brianogradylaw.com/Articles/Formation-of-a-Contract-Understanding-the-Process.shtml> accessed 19 March 2024.
11- B Kaczorowska, 'Juridical status of so-called smart contracts against the background of the polish legal framework'. Masaryk University Journal of Law and Technology [2019] (13) (2) 189 – 217. Doi. 10.5817/MUJLT2019-2-3.
12- DWE Allen, AM Lane and M Poblet, 'The governance of blockchain dispute resolution' Harvard Negotiation Law Review [2019] (25) (75) 76 – 100.
13- E Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity'. Law, Innovation and Technology [2017] (9) (2) p 5.
14- NALT's Blue Book Basic Guide Series No. 2, 2021. <www.SabiLaw.org.> accessed 10 April 2024.
15- E Mik, 'Smart Contracts: A Requiem' Journal of Contract Law [2019] 2.
16- Fairfield, 'Smart Contracts, Bitcoin Bots, and Consumer Protection'. Wash. & Lee L. Rev. Online [2014] (71) 44-46.
17- GG Howells, B Marten and W Wyrmnest, Language of Information, Contract, and Communication. [The Common European sales law in Context: Oxford, 2013] 190.
18- G Vos, L Akka, N Green, R Hay, P Hunn, M Kyle, C Woolard and A Zacaroli, 'Legal Statement on Cryptoassets and Smart Contracts' [November 2019] 8. <https://35z8e83m1ih83drye280o9d1-wpengine.netdna-ssl.com/wp-

content/uploads/2019/11/6.6056_JO_Cryptocurrencies_Statement_FINAL_WEB_111119-1.pdf> accessed 10 March 2024.
19- H Beale, Cases, materials and text on contract law. [Hart, 2019 102 – 115].
20- H Eenmaa-Dimitrieva and MJ Schmidt-Kessen, 'Creating markets in no-trust environments: The law and economics of smart contracts'. Computer Law and Security Review [2019] (35) (1) 69 – 88.
21- H Eenmaa-Dimitrieva and MJ Schmidt-Kessen, 'Creating Markets in No-Trust Environments: The Law and Economics of Smart Contracts'. Computer Law and Security Review [2019] (35) (1) 75.
22- H Hasan, E AlHadhrami, A AlDhaheri, K Salah and R Jayaraman, 'Smart contract-based approach for efficient shipment management'. Computers and Industrial Engineering [2019] (136) 149 – 159.
23- H Hasan, E AlHadhrami, A AlDhaheri, K Salah and R Jayaraman, 'Smart contract-based approach for efficient shipment management'. Computers and Industrial Engineering [2019] (136) 149 – 159.
24- H-Y Chong and A Diamantopoulos, 'Integrating advanced technologies to uphold security payments: data flow diagram'. Automation in Construction [2020] (114) 103158.
25- IGBB Nugraha, Y Bandung and A Zaky, Official document management for government service Indonesia using smart contract, In proceedings of the IEEE International smart cities conference (ISC2), Casablanca Morocco, October (2019) 390 – 395.
26- Imran Bashir, Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained (Packt Publishing Ltd., March 2017) 53.
27- J Earls, et al., 'Smart Contracts: Is the Law Ready?'. Chamber of Digital Commerce [2018]. URL: https://digitalchamber. org/smart-contracts-whitepaper (дата обращения: 06.02. 2019), p 59.
28- J Fairfield and N Selvadurai, 'Governing the Interface between natural and formal language in smart contracts'. UCLA Journal of Law & Technology [2022] (27) (2) 79 – 118 at 114 – 115.
29- JK Martinez, 'Designing Online Dispute Resolution'. Journal of Dispute Resolution [2020] (1) (10) 135 – 150. https://scholarship.law.missouri.edu/jdr/vol2020/iss1/10.
30- K Chen, G Kou, J Shang and Y Chen, 'Visualizing market structure through online product reviews: integrate topic modelling'. Electron Commer Res Appl [2015] (4) (1) 58 – 74. https://doi.org/10.1016/j,elerap.2014.11.04.
31- Kisswani, N.M.&Al-Bakri, A.A., 'Regulating the Use of Electronic Signatures Given the Changing Face of Contracts', (2010) 7 Macquarie J. Bus. L., p 56.
32- K Werbach and N Cornell, 'Contracts Ex Machina'. DUKE Law Journal [2017] (67) 371.
33- JJ Szczerbowski, ' Transaction Costs of Blockchain Smart Contracts'. Law and Forensic Science [2018] (16) (2) 3.
34- L Efimova, O Sizemova and A Chirkov, 'Smart contracts: between freedom and strict legal regulation'. Information & Communications Technology Law [2021] (30) (3) 333 – 353. https://doi.org/10.1080/1360834.2021.1889759.
35- L Lessig, Code is Law: On liberty in cyberspace. Harvard Magazine [2020] I January. <https://www.harvardmagazine.com/2000/01/code-is-law-html>accessed 7 April 2024.
36- LW Cong and Z He, 'Blockchain disruption and smart contracts'. The Review of Financial Studies [2019] (32) (5) 1754 – 1797.
37- Mank Pratap, 'Everything You Need to Know About Smart Contracts: A Beginner's Guide' [2017] 27 August. <https://hackernoon.com/everything-you-need-to-know-about-smart-contracts-a-beginners-guide-c13cc138378a> accessed 29 March 2024.
38- M Butchwald, 'Smart contract dispute resolution: The inescapable flaws of blockchain-based arbitration'. University of Pennsylvania Law Review [2020] (168) 1369 -1423.
39- M Giancaspro, 'Is a 'Smart Contract' Really a Smart Idea? Insights from a Legal Perspective'. Computer Law & Security Review [2017] (33) 825.
40- M Geranio, 'Fintech in the Exchange Industry: Potential for Disruption'. Masaryk UJL & Tech. [2017] (11) 247.
41- M Memon, et al., 'Blockchain Beyond Bitcoin: Blockchain Technology Challenges and Real-World Applications, 2018 International Conference on Computing, Electronics & Communications Engineering (iCCECE): 2018, 31.
42- MN Temte, 'Blockchain challenges traditional contract law: Just how smart are smart contracts?' Wyo Law Review [2019] (19) 87 at 89-90.
43- M Raskin, 'The Law and Legality of Smart Contracts'. Georgetown Law Technology Review [2017] (12) (1) 310-311.
44- NA Bakar, K Peszynski, N Azizan, V Pandiyan and K Sundram, 'Abridgment of traditional procurement and e-procurement: Definitions, tools and benefits'. Journal of Emerging Economies and Islamic Research [2016] (4) (1) 1 – 18.

45- N Filatova, ‘Smart contracts from the contract law perspective: Outlining new regulative strategies’. International Journal of Law and Information Technology [2020] (28) 217 – 242. Doi: 10.1093/ijlit/eaaa015.
46- NRM Zain, Blockchain and smart contract: Importance of digital signatures. A paper presented at the Seminar on Contemporary Islamic Banking Practices, IIiBF, International Islamic University Malaysia, December 2017.
47- NRBM Zain, ERAE Ali, A Abiden and HA Rahman, ‘Smart contracts in blockchain: an exploration of legal framework in Malaysia’. Intellectual Discourse, IIUM Press [2019] (27) (2) 595 – 617.
48- N Szabo, 'Smart Contracts: Building Blocks for Digital Markets'. EXTROPY: The Journal of Transhumanist Thought [1996] (16) 18.
49- O Rabinovich–Einy and E Katsh, ‘Blockchain and the Inevitability of Disputes: The Role for Online Dispute Resolution’. Journal of Dispute Resolution [2019] 47.
50- O'shields, R., 'Smart Contracts: Legal Agreements for the Blockchain', (2017) 21 NC Banking Inst., p 190.
51- P Cuccuru, 'Beyond Bitcoin: An Early Overview on Smart Contracts'. International Journal of Law and Information Technology [2017] (25) (3) 7.
52- P Debono, 'Transforming Public Procurement Contracts into Smart Contracts'. International Journal of Information Technology Project Management (IJITPM) [2019] (10) (2) 18.
53- R Beck, et al., 'Blockchain Technology in Business and Information Systems Research'. Springer [2017] 3.
54- S Agnikhotram and A Kouroutakis, 'Doctrinal Challenges for the Legality of Smart Contracts: Lex Cryptographia or a New, Smart Way to Contract'. Journal of High Technology Law [2018] (19) 315.
55- S Farrell et al., Lost and Found in Smart Contract Translation—Considerations in Transitioning to Automation in Legal Architecture, UNCITRAL, Modernizing international trade law to support innovation and sustainable development. Proceedings of the congress of the United Nations commission on international trade law: 2017, 4.
56- S-H Jeong and B Ahn, ‘A study of application platform for smart contract visualization based blockchain’. The Journal of Supercomputing [2021] (78) 343 – 360. https://doi.org/10.1007/s11227-021-03879-1.
57- S Geiregat, ‘Cryptocurrencies Are (Smart) Contracts’. Computer Law and Security Review [2018] (34) (5) 1144.
58- S Haber and W Stornetta, 'How to Time-Stamp a Digital Document, Crypto’90, Lncs 537'. Springer Journal of Cryptology [1991] (3) 10.
59- S. Seth, Public, private, permissioned blockchains compared. Investopedia [2022] 28 July. <https://www.investopedia.com/news/public-private-permissioned-blockchains-compared/>accessed (18 April 2023).
60- S Wheeler, 'Modelling the Contracts of the Future'. Griffith Law Review [2017] (26) (4) 15.
61- T de Graaf, ‘From Old to New: From Internet to Smart Contracts and From People to Smart Contracts’. Computer Law & Security Review [2019] (5) 1.
62- TV Nam, NB Minh, TV Hai and TG Giglione, ‘The Development of New Technology Intergration in E-commerce Dispute Resolution in Vietnam’. Revista Brasileira de Alternative Dispute Resolution – RBADR, Belo Horizonte [2022] (4) (7) 215-229. DOI: 10.52028/ rbadr.v4i7.13.
63- P Kumar, GA Dhanush, D Srivatsa, SN Aakash and S Sahisnu, ‘An efficient and novel buyer and seller’s distributed ledger based protocol using smart contracts’ In the proceedings of the International Conference on Distributed Computing and Internet Technology, Bhubaneswar India, January (2020) 349 – 363.
64- V. Aleksieva, H. Valchanov and A Huliyan, Application of smart contracts based on ethereum blockchain for the purpose of insurance service, In proceedings of the international conference on Biomedical Innovations and Applications (BAB), Varna Bulgaria, November (2019) 1 – 4.
65- Wellnessliving. 11 JULY, 2019. Digital Signatures and the Ueta / Esign Act. <https://www.wellnessliving.com/knowledge-sharing/knowledge-base/ueta-esign-act-wellnessliving> accessed 10 January 2024.
66- Y Xu, H Chong and M Chi, ‘A review of smart contracts applications in various industries: A procurement perspective’. Hindawi: Advances in Civil Engineering [2021] 1 – 26. https://doi.org/10.1155/2021/5530755.
67- Z Beebeejaun and A Faccia, ‘Electronic alternative dispute resolution, smart contracts and equity in the enrgy sector’ The Journal of World Energy Law and Business [2022] (15) (2) 97-113. https://doi.org/10.1093/jwelb/jwac004.
68- Z Zheng, S Xie, H-N Dai et al., ‘An overview on smart contracts: challenges, advances and platforms’. Future Generation Computer Systems I[2020] (105) 475 –