STUDY OF THE GOVERNANCE OF BLOCKCHAIN TECHNOLOGY

Dr. Shimaa M. Ahmed
Doctor of Philosophy in Commercial Law
Faculty of Law - Cairo University

Abstract:

Blockchain is a shared decentralized database. Distributed among a network of nodes, the term distributed ledger technology (DLT) is also used to describe a system in which transactions are recorded from multiple places at the same time (on different nodes in the network) without a central data store. Blockchain is an advanced product that stores data securely and reliably on the network, and several researchers in the field of blockchain, have expanded the capabilities and capabilities of the Bitcoin blockchain technology with the spread of the Ethereum blockchain platform, which added the capabilities of smart contracts to Bitcoin, smart contracts are Self-executing agreements are tokenized within the blockchain in the same way that users exchange bitcoins. Contracts are "smart" because they can carry out obligations without the intervention of a third party. In this research, we address the governance of the blockchain by defining the term governance, its use and types.

Keywords:

Blockchain, Distributed Ledger Technology, Smart Contracts, Governance, Public Sector.

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دراسة حوكمة تكنولوجيا البلوك تشين

د. شيماء محمد أحمد
دكتوراة القانون التجاري - كلية الحقوق - جامعة القاهرة

الملخص:

البلوك تشين أو "سلسلة الكتل" هي قاعدة بيانات لا مركزية مشتركة. يتم توزيعها بين شبكة من العُقد، ويستخدم مصطلح دفتر الأستاذ الموزع distributed ledger technology (DLT) أيضاً لوصف هذا النظام الذي يتم فيه تسجيل المعاملات من أماكن متعددة في نفس الوقت (علي العقد المختلفة في الشبكة) بدون مخزن بيانات مركزي. ويعد البلوك تشين منتج متطور يقوم بتخزين البيانات بشكل آمن موثوق به علي الشبكة، وقام عدد من الباحثيين في مجال البلوك تشين، بتوسيع نطاق قدرات وامكانيات تقنية البلوك تشين الخاصة بالبتكوين مع انتشار منصة البلوك تشين Ethereum التي اضافت امكانيات العقود الذكية إلي البتكوين، فالعقود الذكية هي اتفاقيات ذاتية التنفيذ يتم ترميزها داخل البلوك تشين بنفس الطريقة التي يتبادل بها مستخدمون البتكوين. فالعقود تكون " ذكية " لأن لديها القدرة علي تنفيذ الالتزامات دون ثمة تدخل من طرف ثالث. ونتناول في هذا البحث حوكمة البلوك تشين من خلال تعريف مصطلح الحوكمة واستخدامتها وأنواعها.

الكلمات الدالة: البلوك تشين، دفتر الاستاذ الموزع، العقود الذكية، الحوكمه، القطاع العام

Introduction

Introduce the concept of the blockchain economy and talk about the governance problem. Computer programs, namely software created using blockchain, can be broadly referred to as smart contracts. As such, they often hold certified and unchangeable data. However, it is questionable whether relationships formed through intelligent (legal) contracts are legally valid and have any impact. Therefore, it is crucial to compare a smart contract to a conventional contract. Typically, blockchain is categorized as a distributed ledger technology (DLT). It is made up of several technologies and protocols that make use of an architecturally decentralized ledger that is shared, distributed, reproducible, concurrently accessible, and based on encryption. Both clear text and encrypted data can be recorded, verified, updated, and stored. We defined cyber-governance as a type of governance that would accommodate entities that reside in the digital domain in addition to traditional governance objects and methods. Therefore the aim of this paper is to present the essence of Blockchain from the governance perspective.

Blockchain Technology

Blockchain is a digital, decentralized public record that functions as a ledger(1) of steadily expanding transactions that are arranged chronologically and connected by cryptography. Although there is no agreement on a single definition of the term "blockchain," most of the writers of the sources studied offer a preliminary definition that includes a literal description of the features of blockchain using the same core language(2). According

(1) A ledger in accounting is a book that classifies financial information, including debit/credit transactions, and shows current balances. Available at: http://www.businessdictionary.com/definition/ledger.html

(2) Cryptography is the science of transforming information into a secure format via encryption. Available at: https://techterms.com/definition/cryptography

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to other scholars, the term is especially vague and can signify different things to different people depending on the situation.

The History of Blockchain

The history of Blockchain is quite recent, brief, and closely related to Bitcoin. As previously said, Satoshi Nakmoto, a mysterious inventor or entity, launched Bitcoin in 2009; it is unknown if this moniker can be ascribed to a single person or a group of inventors. Blockchain is the fundamental technology needed to run Bitcoin. However, according to the white paper that describes Bitcoin as a peer-to-peer electronic payment system7, the term originates from a Japanese American resident in Southern California who continues to vehemently deny that he is the one who came up with the idea for Bitcoin(3).

The cryptocurrency community and various media sites have made finding the identity of Bitcoin's creator a top priority. It was described as "one of the most intriguing stories in technology" by The New Yorker. Although everyone is interested in learning who created Bitcoin, it's possible that anonymity was chosen on purpose. It may well validate the idea of trust upon which blockchain technologies are based, guaranteeing that one need not physically confirm the identity of the party with whom one has entered a contract to transact. Since decentralisation is a popular idea, the growing use of Bitcoin in corporate operations is evidence that the technology underlying it is reliable. It is safe to infer that Bitcoin's popularity and worth were unaffected by the fact that its creator(s) remain a mystery. But it undoubtedly led to a flurry of speculations among the sceptics. For instance, unconfirmed reports assert that the National Security Agency of the United States (NSA) was able to locate Satoshi using stylometry8, which involved creating a writing style for Satoshi to identify him. This was done in response to suspicions that Satoshi was a Russian or

(3) Adrian Chen, we need to know who Satoshi Nakamoto is. The new yorker, May 09, 2016. Available at: https://www.newyorker.com/business/currency/we-need-to-know-who-satoshi-nakamoto-is

Chinese agent attempting to harm the American economy. The NSA has neither acknowledged nor denied these reports, therefore there is still some debate surrounding the subject(4).

To meet the "need to certify the date a document was generated or last amended," such as when an inventor puts a patented idea in writing, a couple of telecom researchers originally described the blockchain platform in 1991. 9 They used the example of dating daily notes in a lab notebook to compare their understanding of timestamping. If every page is stamped and notarized, it becomes much harder to change an entire, sequentially dated notebook without being seen. Any page that was changed or omitted would be clear. The objective was to extend this idea to digital papers, which may typically be changed covertly. To do this, they developed a computational technique (which will be discussed later) to guarantee that timestamps are 1) obvious and 2) unreliable. The foundation for the digital cash platform of Bitcoin was created by this time-stamping technique(5).

How Work the Blockchain?

Let me begin by providing a quick overview of the technological context. A blockchain is essentially a peer-to-peer networked computer system that houses a public, decentralized, digital registry that allows for the unchangeable concatenation of chains of transactions into blocks and the full transparency of the storage and ongoing updating of information(6).

(4) Hanane Boujemi, policy and regulatory challenges to deploying Blockchain technologies, dissertation submitted in partial fulfilment of the requirements for the degree of master of arts in contemporary diplomacy (internet governance), December 2017. Available at: https://www.diplomacy.edu/resource/policy-and-regulatory-challenges-to-deploying-blockchain-technologies/

(5) Nathan Fulmer, Exploring the legal issues of blockchain Applications, January 2019, Akron law review: vol. 52 : iss.1 , article 5.p.164. Available at: https://ideaexchange.uakron.edu/akronlawreview/vol52/iss1/5

(6) Katrin Becker, Blockchain Matters—Lex Cryptographia and the Displacement of Legal Symbolics and Imaginaries, law and critique (2022) 33:113–130,p.114. Available at:

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Users upload their transactions to the blockchain network, such as the transfer of Bitcoins or Ethers or the uploading of medical files. Since blockchain participants can remain anonymous and conduct business using aliases, the transactions are recorded in a pseudonymous manner. 38 Multiple encryption and cryptographic techniques, including hashing and key generators (or "key gens"), are used to ensure pseudo anonymity. The latter uses extremely complex mathematics involving prime numbers to produce cryptographic keys that are sequences of numbers and letters. Public and private keys are the two sets that are utilized in every transaction. Private keys must be kept secret because they are employed as digital signatures for the conduct of transactions and are "wallets" or addresses that are publicly available to all nodes.

The miners who put forward the new blocks also include the transactions to them. A block must first be created by solving a cryptographic puzzle before it can be added to the chain. Miners are unique nodes that add transactions to blocks by resolving Proof-of-Work (PoW) challenges or other issues. PoW is a system that forces the miner to put in some effort, typically using computer processing power. Since creating a PoW is a low-probability random operation, it typically takes a lot of trial and error to establish a reliable PoW. For Bitcoins, for instance, a hash is what acts as a PoW. Another string of numbers and letters is a hash.

A hash function is a mathematical operation used in cryptography that converts a string with a variable number of characters into one with a fixed number of characters. Even minor alterations to the original string result in an entirely different hash. A cryptographic technique called hashing enables the pseudonymization of the data contained in the relevant transaction. The node that completes the problem distributes the answer to every computer in the network. Each node in the network checks the PoW, and if it is accepted by an electronic consensus and proven to be true, a block is added to the chain. A miner is

https://doi.org/10.1007/s10978-021-09317-8

rewarded with coins or tokens if they create a block that is accepted by an electronic consensus.

There are other reasons for miners to keep running their equipment in addition to the block reward. Users' transaction fees are also received by miners. Even though most senders choose not to pay the fees, miners will always give priority to transfers with greater transaction costs. Because of this, the blockchain industry has been referred to as a "fee economy." A new block is added to the ledger following a successful transfer that has undergone successful mining(7), Mining can be defined as the use of the processing power in a computer to resolve very complex mathematical problems to keep the block chain public ledger and to find new Bitcoins. Decentralized and dispersed across a network of computers, the ledger. Blocks are connected to one another in a line that runs continuously, producing a chain of blocks, hence the name "blockchain."

A block includes a date, a hash of the previous block, the transactions, and the computational issue that had to be solved before the block was added to the chain. It also contains a reference to the preceding block(8).

There are a variety of additional uses for the blockchain, particularly for any good or service that could gain from the security and openness that this technology provides. For example, food products may be used to assure the traceability of a material or product across the chain of manufacturing and distribution(9).

(7). Rehana Parveen, Alanoud Alajmi, An Overview Of bitcoin's Legal and Technical Challenges, Journal of legal, Ethical and Regulatory Issues, Volume 22, Special Issue 1, 2019, p.3.

(8) Georgios Dimitropoulos, the law of blockchain, forthcoming in: Washington law review (2020), p.12-12.Available at: https://www.researchgate.net/publication/339998624

(9) For example, the supermarket chain walmart uses blockchain technology to improve food tracking and safety in China. See jorbes.com, IBM & Walmart Launching Blockchain Food Safety Alliance In China With Fortune 500's JD.com (December 14, 2017). Available at:

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The blockchain itself can serve as proof. It essentially provides evidence that a transaction took place. Because of this, it appeals to the raw materials business, which sees in it a straightforward and efficient solution to switch from the time-consuming approval of paper documents to the quick, safe, and affordable process of electronic validation. For instance, in the shipping industry, a smart contract can be used to execute the payment as soon as a shipment is delivered. The use of the blockchain allows payment to be initiated automatically as soon as receipt of the goods is verified; this confirmation can occur with or without human intervention, for instance when the goods are equipped with a GPS so that their location can be verified, and this information can be transmitted directly to the system(10).

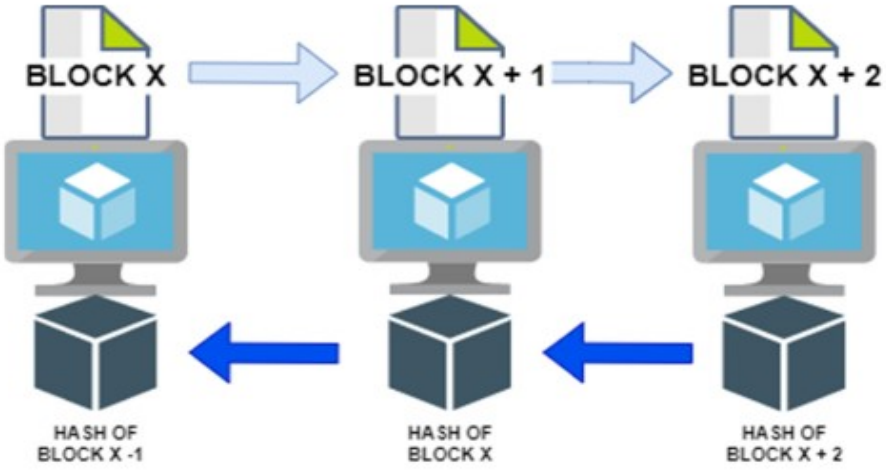

Figure 1. Example of Blockchain Architecture.

Source: Olanrewaju Sanda, Michalis Pavlidis and Nikolaos Polatidis, A Regulatory Readiness Assessment Framework for

https://www.forbes.com/sites/rogeraitken/2017/12/14/ibm-walmart-launching-blockchain-food-safety-alliance-in-china-with-fortune-500s-jd-com/

(10) Florence Guillaume, blockchains, smart contracts, decentralized autonomous organizations and the law, 2019, p.55. Available at: https://doi.org/10.4337/9781788115131

Blockchain Adoption in Healthcare, March 2022, p.68, Available at: https://doi.org/10.3390/digital2010005

Public or Permissioned Ledger

Depending on whether an open, public network is employed or a limited, permissioned network is picked, access controls can be used with or without distributed ledger technology. The most well-known example of an open, public network where anyone may see the ledger and publish transactions without any permission is probably the decentralized digital currency Bitcoin (assuming, of course, the individual has the proper computer equipment and software). Ledgers are duplicated on a public blockchain across numerous computers, or "nodes," that are linked to a shared network via the internet. "Miners" refers to the people running the nodes. A closed, permissioned network, in contrast, is only accessible to specific users who have been granted authorization and the required credentials to access the ledger by a trusted third party. The financial services sector's present preference for the use of permissioned networks is not surprising. Public networks are currently not truly practical in financial services due to anti-money laundering ("AML"), know-your-customer ("KYC")[11], and privacy reasons (covered in greater detail below). The Bank Secrecy Act's standards and a financial institution's own KYC procedure should apply to a Bitcoin miner that operates anonymously on a public network, just as they would if they were performing a similar task for a bank in the financial services sector. It makes sense that a bank's systems cannot be integrated with public networks given the current frameworks, but as technology advances, this too may change.

In a permissioned network, every participant is aware of who the counterparty is on the opposite side of a transaction. In a transaction, being able to identify a counterparty is crucial for a

(11) Eric Alston, Blockchain and the Law – Legality, Law-like Characteristics, and Legal Applications, July 2021. Available at: https://www.researchgate.net/publication/347582331

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variety of reasons, including KYC and AML. It gives parties a method to make legal demands against each other in the case of non-performance by one of them, which is especially useful for financial transactions. The opposite party may also bring legal action and exercise its rights and remedies under the transaction papers if the nonperforming party fails to remedy a default. On public networks, however, transactions are frequently made anonymously or with parties who have concealed their true identities(12).

Smart Contracts

concept of what needs to be demonstrated for there to be a legally binding agreement between parties. A contract must, at the at least, contain an offer by one party, an acceptance by another, and some sort of consideration. When software engineers use the phrase, they're referring to self-executing computer code (the type of code will depend on the protocol on which the code is implemented). I believe a hybrid legal contract with some elements written in code and some remaining in human prose would be a more beneficial structure for the loan market. This kind of hybrid legal contract, which combines a legal agreement and a smart contract, has been referred to as "smart legal agreements," and it would be most helpful for financial instruments.

A blockchain's integrated smart contracts are computer programs that have the ability to send and receive both assets and data(13). Smart contract distribution of data and resources is totally determined in code and is initiated by the satisfaction of specific requirements. Smart contracts are being introduced by businesses

(12) Bridget Marsh, Lsta Josias Dewey, Holland & Knight Llp, The Loan Market, Blockchain, And Smart Contracts: The Potential for Transformative Change, Global Legal Insights – Blockchain & Cryptocurrency Regulation, 2019, First Edition, P.7.

(13) Narayanan et al., 'A Simple Model for Smart Contracts' (n 8) Chapter 10.7; Brown (February 10, 2015), Available at: https://gendal.me/2015/02/10/a-simple-model-for-smart-contracts/

more frequently as prototypes[14]. However, it should be highlighted that because they frequently depend on off-chain information provided by specialized intermediaries, smart contracts do not always inherit the trust lessness and informational integrity of the blockchain[15]. Despite these issues, organizations based on blockchains can be built using smart contracts. The organization's funds are collected and distributed according to these smart contracts on a blockchain, generally on "Ethereum." These businesses carry out financial choices automatically, such as allocating profits and making payments to investment targets[16].

One can imagine how the LSTA Confirm might evolve into a smart contract with some clauses remaining in plain text. For instance, the clause referring to the LSTA Arbitration Rules might continue to be text, but clauses relating to the calculation of the loan purchase price might be coded and thus become self-executing. While traditional contracts can still be used to organize and carry out transactions, smart contracts can do so in a more secure and efficient way. However, before smart contracts are widely used, there are still several issues that need to be resolved. We are optimistic that smart contracts and blockchain technology will ultimately alter our business, even while we are aware that the

(14) For example, the insurance giant AXA has rolled out the Fizzy insurance contract that automatically compensates travelers for delayed flights; see AXA, 'AXA goes blockchain with fizzy' (13 September 2017). Available at: https://www.axa.com/en/newsroom/news/axa-goes-blockchain-with-fizzy

(15) Elisa Mik, 'Smart Contracts: Terminology, Technical Limitations and Real-World Complexity' (2017) 9 Law, Innovation and Technology 269, 278. Available at: https://www.tandfonline.com/doi/abs/10.1080/17579961.2017.1378468

(16) Philipp Hacker, Ioannis Lianos, Georgios Dimitropoulos & Stefan Eich, Regulating Blockchain: Techno-Social and Legal Challenges – An Introduction, Oxford University Press, 2019, 3-24. P.5-6. Available at: https://global.oup.com/academic/product/regulating-blockchain-9780198842187

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technology is still in its infancy and is not a cure-all for all the current problems our market is facing(17).

Since "code is not law," smart contracts. Only Nevada has passed legislation that takes these smart contracts into account and establishes a legal framework for judicial enforcement of agreements made and stored on the blockchain. A "contract kept as an electronic record pursuant to Chapter 719 of NRS and validated by use of a blockchain" is what the Nevada statute describes as a smart contract. This concept permits the use of contracts as evidence and even permits the use of an electronic record to satisfy the statute of frauds if a writing is necessary to enforce the contract. Enforceability may be compromised if the smart contract is not preserved and accurately duplicated for "later reference by all parties," though(18). However, enforceability may be refused if the smart contract is not in a format that can be saved and precisely replicated for "later reference by all parties"(19).

Blockchain Government

The "Blockchain Statute law" is the initial guiding concept. Blockchain technology ensures "total compulsion," making it possible to create unbreakable laws. This law can be placed on the blockchain and made to operate automatically via smart contracts. We've already talked about the code's legal status. As a result, we must treat the regulations listed on the software as if they were a form of law. Since blockchain permits "absolute law" that cannot be altered or violated, the idea of Blockchain Statute legislation should now be presented. Additionally, in the Fourth Industrial Revolution16 period, where we coexist with living creatures

(17) Bridget Marsh, Lsta Josias Dewey, Holland & Knight Llp, Obcit, p.8
(18) Nathan Fulmer, exploring the legal issues of blockchain applications, Akron law review: vol. 52 : iss. 1, article 5. (2019) ,p.184.
(19) John Mirkovic, blockchain pilot program final report, recorder of deeds (May 30, 2017). Available at:
https://www.documenters.org/documents/blockchain-pilot-program-final-report-4122/

everywhere, this is the only method to stop humanity from impending a disaster due to accidental errors or malicious intent

Transparent disclosure, sometimes known as the open-source strategy, is the second tenet. The blockchain software code, which makes up the public infrastructure, and the data it includes are all included in the scope of this disclosure. They must be made as transparent as possible. The Australian government's Government 2.0 guidance already asserts that all data, except for those with obvious justifications for non-disclosure, should be made public. Additionally, since blockchain technology is a distributed ledger, it is appropriate for information exchange and disclosure. There are two further justifications for the phrase "Transparent disclosure." The need for everyone to be able to verify the laws built into the code is one reason why blockchain software should be made public. The greatest way to increase software security and promote the growth of an ecosystem is using open-source strategy, which is another justification.

The third rule calls for the use of "An automated method." This would enable us to create a government structure that is both far quicker and more effective. Smart Contract automation of administrative systems in the government is already happening in several places. It is feasible to handle the laws incorporated in the blockchain with the approval of the entire community, so we need not be afraid of the automation of governmental administrative systems. This results in the fourth principle that follows.

Building "A direct democratic governance system" is the fourth principle. Blockchain technology has already been used in numerous projects around the world to repair outdated voting systems, but we can think beyond the current voting system. Through a consensus process including all community members, the laws that are embedded in the blockchain can be chosen and changed. In other words, we may create a system that enables the democratic voting and unanimous approval of all community members to automatically amend "the law" stored in the blockchain.

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With the support of the blockchain network's users, several blockchain initiatives that aim to fix the flaws in the Bitcoin or Ethereum blockchains are aiming to incorporate automated revision. 18 Although it is difficult to apply this function to the current administrative system, it is possible to do so soon with the Blockchain government.

Creating a Distributed Autonomous Government is the sixth principle (DAG). We can construct a government that is entirely distinct from current governments if everyone, the entire community, participates and gives consent for governmental legislation through a consensus process and makes it run on a blockchain automatically. It indicates that a government system can be built as a social operational infrastructure, a community's automatic information processing system whose rules are set with the permission of the entire community. DAG is the name for such a government(20).

Defining Blockchain Governance

Since the 1980s, the phrase "governance" has been used frequently. The variety of circumstances in which it is used has expanded quickly along with the term's usage. Every process of ruling, whether carried out by a government, market, or network, whether over a family, tribe, formal or informal organization, or territory, and whether through laws, norms, power, or language, is referred to as governance(21).

Two distinct functions that governance can play in the context of blockchain are emphasized before discussing blockchain

(20) MyungSan Jun, Blockchain government - a next form of infrastructure for the twenty-first century, Jun Journal of Open Innovation: Technology, Market, and Complexity (2018) 4:7, p.9-10. Available at: https://www.researchgate.net/publication/323157618_Blockchain_government_-_A_next_form_of_infrastructure_for_the_twenty-first_century

(21) Bevir, M. Governance: A very short introduction. Hampshire, UK: Oxford University Press. (2012)
Available at: https://global.oup.com/academic/product/governance-a-very-short-introduction-9780199606412

governance in more detail. The authors Ines, Ubacht, and Janssen draw a distinction between blockchain governance and blockchain governance itself. First, "government by the blockchain" describes the application of blockchain technology to better regulate and coordinate ongoing acts and behaviour. In this situation, technology plays a supportive role in enhancing current governance procedures. An illustration would be the usage of a blockchain to automate and apply current governmental procedures. The governance of the blockchain, on the other hand, refers to the creation, modification, and upkeep of the blockchain technology itself. The focus of this work is on the latter function of governance. Thus, the governance of the blockchain is referred to as blockchain governance throughout this essay(22).

in keeping with the concept's description, define blockchain governance as the placement and implementation of decision rights. claims that in a blockchain context, governance refers to the processes, rules, and procedures used to maintain the protocol. defines it as the way in which public blockchain communities and key stakeholders arrive at collective action, specifically with respect to protocol change.

propose an expanded IT governance structure for the "blockchain economy," as they put it. They draw three important aspects of governance from the literature on IT governance: Decision rights I accountability (ii), and incentives (iii) capture the extent to which actors are and can be held accountable for their conduct. Decision rights I is concerned with the rights that enable one to manage control. They define a blockchain's governance as a combination of the degree of incentive alignment, the level of decision-rights centralization, and the degree to which accountability is either technically or institutionally implemented.

(22) Ølnes, S., Ubacht, J., & Janssen, M. (2017). Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. Journal of Government Information Quarterly, 34(3), 355–364. Available at: https://doi.org/10.1016/j.giq.2017.09.007

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Examined the social and technological governance of Bitcoin using the block size controversy as a case study. The authors distinguish between two coordination mechanisms: I infrastructure governance (via the protocol) and (ii) infrastructure governance (by the community of developers and other stakeholders). The same authors specify the following three parameters to examine Bitcoin's governance in more detail: I the provision of incentives for involvement and recognition of the status of contributors; ii) the definition and maintenance of community borders; and iii) dispute resolution procedures They claim that there are two distinct communities that make up the Bitcoin project: I the community of network nodes, which is separated into passive users and active users (miners), and (ii) the community of developers(23).

The authors Hsieh et al. and Wang analyze the governance of public blockchains using organizational and corporate governance theory. Between internal and external governance, they draw a divide. External governance in this context refers to the effect of external stakeholders on the organization, in this case, a blockchain, such as the community, media, and public. Regarding internal governance, the authors distinguish three levels: I blockchain owner control; (ii) formal voting; and (iii) centralized funding at the organizational level. Also referencing corporate governance literature, it makes a distinction between internal governance and external governance (exit) (voice). Regarding external governance, the author notes that there is currently no official method for a takeover, or to put it another way, to depose the blockchain's core development team. Users selling their tokens simultaneously to put pressure on developers is one of the exit tactics that can be used. Another option is the flexibility to branch off a project whenever you want. In a twelve-part case study, writers Gasser, Budish, and West looked at the governance structures of multistakeholder governance bodies in real-world

(23) Beck, R., Müller-Bloch, C., & Leslie King, J. (2018). Governance in the blockchain economy: A framework and research agenda. Journal of the Association for Information Systems, 19(10), 1020–1034. Available at: https://aisel.aisnet.org/jais/vol19/iss10/1

settings using Bitcoin. They did this by utilizing a framework for analysis that differed between four dimensions: I the purpose and context, which considers the factors that led to the formation of the governance group; (ii) formation, which takes into account the multi-stakeholder group's architectural composition; and (iii) operation, which describes "the operational systems and tools that they use to reach the consensus necessary to create its outputs and address the issue at hand." Outcomes, which highlight the results of multistakeholder initiatives(24).

Usage of the Term 'Blockchain Governance'

As previously said, all governance is essentially a social construct made up of conventions, culture, institutions, and people in addition to laws (or bylaws). This is the same for blockchains despite passionate arguments to the contrary.

We must first explore what blockchains specifically offer to comprehend the (mis-)usage of the term "blockchain governance." They enable systems in which following protocol is automatically enforced, relying neither on norms nor a legal system and leaving no room for individual choice. Although this rigorous division between norms and discretion and enforceable procedure is innovative, its significance has been overstated. We find a propensity to wilfully overlook all concerns about norms and culture among the more ardent proponents of blockchain technology and to completely equate governance with coded procedures (code is law). It is difficult to reject the assertion that blockchains change everything if all governance is reduced to procedure.

The usage of blockchain governance in two similar but different contexts—governance of the chain itself vs. governance using the network—leads to further uncertainty. The highly divisive and

(24) Rowan van Pelt, Slinger Jansen, Djuri Baars & Sietse Overbeek, 2021, Defining Blockchain Governance: A Framework for Analysis and Comparison, Information Systems Management, p.27-28, 38:1, 21-41, Available at: https://doi.org/10.1080/10580530.2020.1720046

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politicized character of the blockchain realm, where we see several factions reinterpreting and reframing the phrase to match their outlook, further complicates usage in the first context.

Blockchain governance in this context refers to control over the blockchain (i.e. the specific question of making consensus-relevant changes to the software running a blockchain). Here, consensus relevance refers to a modification to the blockchain's internal rules that must be implemented (i.e., the software must be updated) by all pertinent users, miners, cryptocurrency exchanges, and wallet software providers. A hard fork occurs when the network breaks into two groups, one group adhering to the new rules and the other group adhering to the old rules, if a significant enough percentage of the network does not implement the changes.

Examples of this approach include where governance is conflated with voting procedures(25), hard forks are hailed as enabling "much more flexibility in operation than traditional structures" because "a user is free to choose which blockchain to follow," and where governance is loosely defined as "any process leading to consensus-relevant changes in the software"(26).

We frequently see the adoption of a rigid division of governance into off-chain governance and on-chain governance in this scenario.

On-chain governance's main concept is the use of blockchains' built-in coded voting mechanisms to allow choices about consensus-relevant software upgrades to be mediated by the consensus system itself. The term's industrial usage is succinctly summarized. "A method for controlling and making adjustments to cryptocurrency blockchains is known as on-chain governance. In this style of governance, the blockchain protocol contains the rules

(25) Curran, B. What is Blockchain Governance? Complete Beginner's Guide. (July 30, 2020), Available at: https://blockonomi.com/blockchain-governance/

(26) Rajarshi, M. (2020). What is Blockchain Governance: Ultimate Beginner's Guide. Blockgeeks Available at: https://blockonomi.com/blockchain-governance/

for implementing modifications. Through code updates, developers submit modifications, and each node votes on whether to accept or reject the change ".

They specifically claim that procedures may be vague or opaque: "off-chain collectives that organize over phone calls or at conferences, which either leads to shadow hierarchies where only a few, unwritten people make decisions." Proponents of this way of doing things disparage the off-chain (human) world as being outmoded in its reliance on people, norms, and culture to achieve governance. Everything off-chain is hidden and possibly evil, whereas everything on-chain is visible and fair. This is the central tenet of this school of thought. This contrasts with the Bitcoin tenet that all changes that affect the consensus are harmful because they entail human intervention and, since code is law, they violate the law. They contend that on-chain governance simply facilitates and encourages such criminal activity and that immutability, not coordinated network updates, is the desired outcome.

The other context for blockchain governance completely disregards the prior query and concentrates on how to achieve governance utilizing the blockchain. It assumes the existence of a working blockchain network, like Ethereum, which may be used to implement smart contracts that store the steps of a decision-making paradigm in their code. The purpose of this type of on-chain governance is to make it possible for the development and management of Diffuse Autonomous Organizations (DAOs). The blockchain is used to enforce or guarantee adherence to protocol[(27)], but the choices being taken have nothing to do with the blockchain itself (i.e., organisations whose bylaws are written in code and enforced by the blockchain).

Short of a hard fork of the underlying network, a DAO's rules cannot be modified once it has been deployed to a blockchain. DAO authors must include the rules-for-changing-the-rules in the

(27) Fischer, A. & Valiente, M.-C. Blockchain governance. Internet Policy Review, 10(2). (April 20, 2021). Available at: http://hdl.handle.net/10419/235958

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initial deployment while anticipating the need for updates. This may be compared to a regular legislative procedure along with a procedure for modifying the constitution upon which the law is based.

Cyber-Governance: How Technology Imposes Governance Principles

The article "Code is Law" brought home a very basic understanding of the relationship between law and cyberspace. It clarified how codes govern behaviour in cyberspace just like laws do in the physical world. However, over the past 20 years, there has been a significant change in the degree to which our world and cyberspace are interconnected. Our physical reality is largely determined by the realm of cyberspace, and interactions between the two are extremely fluid. The use of paper money is becoming less and less common as more and more of our payments are made online. Online purchasing is becoming more common than unusual, and digital goods are all around us.

The military has even acknowledged cyberspace as a distinct realm of battle alongside land, sea, air, and space because of this advancement. Cyberspace imposes radically different standards than we are accustomed to from the ideas that form the basis of our current legal system from a governance standpoint. From the standpoint of legal entities, resources, and regulations, we can examine traditional governance and cyber-governance, two different types of governance. States, corporations, international organizations, non-governmental organizations, civil society organizations, people, and other legal entities sui generis are all recognized as being part of traditional governance. Traditional government would take physical goods, to some extent digital goods, and intellectual property into consideration as resources. Raw supplies, money, and territory are also included. These resources operate under the basic presumption that value of any kind is derived through productivity. Traditional governance considers laws, rules, contracts, and conventional methods of legal enforcement, such as courts and the state's executive functions.

When all these factors are considered, traditional governance is based on the underlying presumptions that individual agency and legal standards are connected to the principle of territoriality and that this principle is enforced at the national and regional levels by the judiciary and executive branches(28).

The phrase "cyber-governance" refers to traditional governance that has been enhanced by the fact that physical reality, social and legal interactions, formats of potential legal and contractual contact, and the entities that can be dealt with are all increasingly influenced by cyberspace. It raises serious doubts about the underlying presumptions that the original territoriality concept and its application remain equally valid. The importance of new entities for governance is beginning to grow. Examples include technical corporations in particular, online advocacy groups, hackers and hacktivists, cybercriminals, and an entirely new category of entities that we'll call "digital entities." These digital creatures are made up of artificial intelligence, bots, botnets, viruses, worms, and other types of programming that can function somewhat independently of their authors. As evidenced in the European discussions on Robot-rights and the rights and duties of artificial intelligence, these digital entities are indeed becoming a legally enforceable phenomenon(29).

Data is the new oil in cyber-governance, and the area of human users' attention is the new frontier that is available for conquest. Machine learning and artificial intelligence are the latest techniques for extracting value from data and the attention space. The Cyber-domain creates new potential for commercial organizations to act as legislators and regulators in terms of

(28) Benedetta Cappiello & Gherardo Carullo, Blockchain, Law and Governance, Springer Nature Switzerland AG 2021, (eBook)p.91, Available at:
https://doi.org/10.1007/978-3-030-52722-8

(29) Zwitter A, Wer haftet für künstliche Intelligenz, wenn sie Mist baut? Süddeutsche Zeitung, (2016). Available at:
www.sueddeutsche.de/digital/serie-kuenstliche-intelligenz-wie-ein-hund-1.2854646

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regulation. Code as law has already been mentioned. Additionally, "terms of use" have emerged as a new tool for controlling any service's user base. Clients of social media platforms and other digital services have rights that are governed by the terms of service. These rights apply to the service as well as ways of social engagement (such as the permitted message types on Twitter) and its by-products, especially data. Contracts are the only means of enforcing data ownership because there are no laws governing it outside of those governing privacy and intellectual property rights. These agreements frequently take the form of terms of service. The disparity in power between users and service providers in the cyberspace (compare for example terms of use for services of Google, Facebook, Microsoft, Instagram, WhatsApp, etc.) Instead of being equal contract partners, new digital service providers operate as de facto regulators. In other words, if Facebook were a country, its 2.5 billion active users would be subject to its constitution, which is made up of its terms of use, restrictions imposed by the user interface, and other forms of codes. In this regard(30), blockchain can be viewed as a particular type of regulatory code that implies design standards and, as a result, normative norms of governance. We don't yet know what executive, regulatory, and law enforcement roles artificial identities like bots will be able to play in the future(31).

Situating Blockchain Governance in Existing Power Structures

Decentralization affects political structures by eliminating a central point of control. As Bitcoin develops and, if adopted widely, faces a range of social and political issues, the technology will continue to have an impact on current social and governmental

(30) Akinpelu O (2020) Facebook is Still King as the Social Media Giant Hits 2.5bn Monthly Active Users. Available at: https://technext.ng/2020/01/31/facebook-is-still-king-as-the-social-mediagiant-hits-2-5bn-monthly-active-users/

(31)Benedetta Cappiello. Gherardoet Carullo, Blockchain, Law and Governance 1st ed. 2021 Edition. opcit, p. 93. Available at: https://www.x-mol.com/paper/1415084111292469248

institutions, resulting in an increasingly diverse range of political viewpoints(32).

Blockchain protocols operate in a world that already has physical limitations, institutions, cultures, and conventions, but most importantly, sovereign governance systems. These current power structures will influence and be influenced by decisions made about the governance of any specific blockchain system. Participants in blockchain systems who break national state laws will face state-based penalties for their activities. However, participants in blockchain systems continue to use the services provided by state actors (e.g., bankruptcy, fraud claims).

Blockchain technology-related discourse frequently emphasizes "decentralization" and "trust lessness." Blockchains, so the idea goes, will change how people communicate, conduct business, and even govern themselves by enabling decentralized transactions and decision-making and decreasing or even eliminating the need to rely on individuals. The "hidden political ambition" of Bitcoin is, in fact, "getting rid of politics by depending on technology," according to De Filippi and Lovelock. However, blockchain technologies are sophisticated sociotechnical systems, or rather, social informational-technical systems, as we argue in this volume. Both "decentralization" and "trust lessness" are contentious concepts that describe technological and social discourses, as well as how they interact to both promote a certain form of reality and describe it. Decentralization is a term commonly used to describe how power is exercised in blockchain systems, implying that this power is diffuse rather than concentrated. This is vitally important because it will influence the conclusions we draw about how responsibility, accountability, and risk should operate within these systems(33).

(32) De Filippi, P., & Loveluck, B. The invisible politics of Bitcoin: Governance crisis of a decentralized infrastructure. Internet Policy Review, 5(3), p.15. (September 30, 2016). Available at: https://doi.org/10.14763/2016.3.427

(33) Victoria L. Lemieux and Chen Feng, Building Decentralized Trust Multidisciplinary Perspectives on the Design of Blockchains and Distributed

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Governance Decisions for Blockchain-Based Systems in The Public Sector

We examine the governance choices necessary for the application of blockchain technology in the public sector in this section. Our review of the literature on blockchain governance indicates that micro, meso, and macro analyses of blockchain governance decisions in the public sector are possible. According to our understanding, blockchain governance decisions are made at several levels and are not independent of one another(34).

highlights how closely connected the micro, meso, and macro governance techniques are in public administration, making it impossible to analyse one level of governance without being aware of the others. We outline the nine different sorts of governance decisions that must be made at nine different levels to implement blockchain-based technologies in the public sector.

In addition to these governance choices, some studies concentrate on the macro-level interactions among political, sociocultural, governmental, and market-based institutions in the governance of a blockchain-based system, as well as policy objectives in blockchain governance (such as the public interest, media coverage). These components are not listed as a discrete category in our framework, but rather, we assume that they have a general impact on all levels of governance as contextual variables. For instance, in the public sector, any choice on blockchain governance must be in line with the policy objectives, societal expectations, and public values. Given this general strategy, we will elaborate on the governance choices made at each level in the design of a blockchain-based system for the public sector in the following sections and consider how choices made at one level can influence those made at another level.

Ledgers, Springer Nature Switzerland AG, (eBook) p.24, 2021. Available at: https://doi.org/10.1007/978-3-030-54414-0

(34) Roberts, A. Bridging levels of public administration: How macro shapes Meso and Micro. Administration and Society, 52(4), 631–656. (2020). Available at: https://doi.org/10.1177/0095399719877160

Governance at Micro Level

Micro level governance issues with the infrastructure choices made by system designers for a blockchain-based system. This includes considerations relating to the blockchain's infrastructure design, the modularization of smart contracts and decentralized apps, and the compatibility of the blockchain-based system with the current IT infrastructure.

Governance at Meso Level

Meso level governance is concerned with how the network community that the blockchain-based system is built upon interacts with one another.

The interactions of many sorts of users, including miners, verifiers (or node operators), core developers, token holders, content creators, and network users, are essential to a blockchain-based system. The management of decision-making among these players, the kind of incentive mechanisms that enable system upkeep, and the impact of consensus methods on the roles of actors in blockchain governance are all governed by governance decisions made at the mes level.

Governance at Macro Level

Macro-level governance focuses on the organization, accountability, and control of the blockchain-based system in achieving policy goals and functions. These factors are influenced by laws and norms that are derived from the institution's legal, cultural, historical, and constitutional underpinnings. The "embedded qualities" that serve as guidelines for both individual and organizational decision-making are macrolevel governance decisions (Williamson, 1993). Macro-level governance decisions pertain more precisely to how decision-making authority is divided among network participants, the kind of accountability

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mechanisms in place, and who oversees and responsible for the implementation procedures(35).

Conclusion

In this article, we examine how blockchain can lead to the emergence of a brand-new economic system that we refer to as the blockchain economy. No matter how the blockchain economy evolves, the concepts it evokes provide significant research challenges. Autonomous transactions that adhere to smart contract rules and are enforced according to them appear very different from transactions in the digital economy. By looking at the IT governance literature that emphasizes decision rights, accountability, and incentives, we prepare the ground for investigating such problems. and how these dimensions' implications for governance.

Finally, we argue in a study that applying blockchain technology to the public sector will probably necessitate a certain amount of concession on the part of the government and public sector organizations.

ABBREVIATIONS

DAO	Decentralized Autonomous
NSA	Agency of the United State
PoW	Proof-of-Work
AML	Anti-money Laundering
KYC	Know Your Customer
DAG	Distributed Autonomous Government

(35) Evrim Tan, Stanislav Mahula, and Joep Crompvoets, Blockchain governance in the public sector: A conceptual framework for public management, p.4-5, 2022. Available at: https://doi.org/10.1016/j.giq.2021.101625

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