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Rethinking Governance with Blockchain: An Actor-Network Theoretical Approach

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Abstract:

The continuous advancement of digital technologies and innovations is progressively reshaping the dynamics of governments, societies, and organizations. Governance approaches must evolve in parallel with emerging technologies. Among the emerging innovations in technology: The Blockchain technology (BCT). BCT offers a wide range of solutions to many problems and its adoption has been successful in many fields. We would argue that traditional governance modes challenge understanding governance in digital innovations such as Blockchain. Therefore, suitable new governance frameworks are required. To this end, this article explores the limitations of existing modes of governance. This article aims to conceptualize a new mode of governance adapted to the technical features of the Blockchain based on the Actor-Network Theory (ANT). Through a review of conceptual literature, we relied on four key elements of the actor-network theory -actors, actor network, power and translation- to propose a new governance mode based on the new power relationships within the blockchain network. A flexible, dynamic mode of governance is proposed shaping the relationships between actors in the blockchain context.

Keywords: Blockchain, governance, actor-network theory, decentralized autonomous organizations.
JEL Classification: O33
Paper type: Theoretical Research

Résumé :

L'essor continu des technologies et des innovations numériques remodèlent progressivement la dynamique des gouvernements, des sociétés et des organisations. Les approches de la gouvernance doivent évoluer parallèlement aux technologies émergentes. Parmi les innovations technologiques émergentes : La technologie Blockchain. La technologie Blockchain offre un large éventail de solutions à de nombreux problèmes et son adoption a été couronnée de succès dans de nombreux domaines. Nous pensons que les modes de gouvernance traditionnels ne permettent pas de comprendre la gouvernance dans les innovations numériques telles que la blockchain. Par conséquent, de nouveaux cadres de gouvernance adaptés sont nécessaires. À cette fin, cet article explore les limites des modes de gouvernance existants. Cet article vise à conceptualiser un nouveau mode de gouvernance adapté aux caractéristiques techniques de la Blockchain sur la base de la théorie de l'acteur-réseau (ANT). À travers une revue de la littérature conceptuelle, nous nous appuyons sur quatre éléments clés de la théorie de l'acteur-réseau - acteurs, acteur-réseau, pouvoir et traduction- pour proposer un nouveau mode de gouvernance basé sur les nouvelles relations de pouvoir au sein du réseau blockchain. Un mode de gouvernance flexible et dynamique est proposé pour façonner les relations entre les acteurs dans le contexte de la blockchain.

Mots clés : Technologie blockchain, gouvernance, théorie de l'acteur réseau, organisation autonome décentralisé.
JEL Classification : O 33
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1. Introduction

Recently, Digital technologies have been developing and are gaining an increasingly leading role in organizations. These technologies offer new forms of organizing due to their potential benefits, such as facilitating tasks, managing data, and promoting transparency.

However, this advancement in the digital domain poses significant challenges concerning the existing and used theoretical frameworks of governance. As new technologies continue to emerge and evolve, governance approaches should advance at the same pace. The speed of adoption of these emerging technologies threatens to outpace the existing governance modes. Among the emerging innovations in technology, known by its particular technical features that challenge its regulation by traditional means is: The Blockchain technology (BCT).

Blockchain is gaining the attention of academics and practitioners. This technology has recently found effective use in many domains. Although blockchain technology offers numerous benefits for organizations, it also introduces novel risks and challenges that necessitate innovative governance models.

Blockchain technology extends beyond its role in supporting cryptocurrencies and decentralized applications, forming complex systems that enable the decentralized creation and exchange of digital values. The governance of these systems is crucial, as it involves decision-making processes that must consider the interests of diverse stakeholders, including token holders, network validators, developers, and founders, while maintaining decentralization. This governance is essential for the adaptability and long-term success of blockchain systems. Beyond its technological aspects, blockchain influences economic and social structures by offering new ways to organize and manage resources, data, and interactions, highlighting its transformative potential across various sectors (Schädler et al., 2023).

Therefore, there is a need to reassess the efficacy of traditional governance modes for Blockchain's successful development and deployment. The technology challenges the existing governance approaches for its "decentralized" nature. The decentralized nature of blockchain systems presents issues around the loss of single-actor autonomy over decisions and policy-making. Instead, networks that comprise public and private actors govern the interactions (Zwitter and Boisse-Despiaux, 2018). It also complicates the governance structure, as decision-making power is distributed among various actors, each with potentially differing interests and perspectives (Schädler et al., 2023). In other words, effective blockchain governance modes are necessary to ensure that a decentralized blockchain system may be governed in a way that guarantees its ability to adjust to future change and assure its survival.

Thus, blockchain governance systems lead academic inquiry into a previously underexplored domain: towards a decentralized governance. Despite the increasing managerial interest in the potential applications of the Blockchain technology, there is nascent research on blockchain governance. The existing literature lacks theoretical and conceptual tools with which to understand and describe the key elements involved in blockchain governance.

In short, if we look at the current gap in blockchain governance modes it seems that the question that keeps rising is how power is distributed in a particular decentralized system as blockchain.

This article aims to conceptualize a new mode of governance adapted to the technical features of the BCT. To this end, we employ the actor-network theory (ANT) (Callon, 1986a, 1986b; Callon & Latour, 1981; Latour, 1995, 2005) as our theoretical and conceptual foundation. We identify the key actors involved in blockchain governance and the changes in their roles and positions within the network. Our goal is to recognize the changes in power relationships that result from the introduction of new actors and relationships

This paper consists of five sections: First, we will introduce blockchain technology. Then, we will explain blockchain governance using current literature. Next, we will outline our study's

methods and discuss how we can use the Actor-Network Theory (ANT) to examine blockchain governance. Finally, we will present the new proposed decentralized governance mode.

2. Literature review

2.1 Blockchain technology

Essentially, the conception of blockchain dates back to the work of the pseudonnymos Satoshi Nakamoto (2008) who published the Bitcoin white paper that synthesizes concepts from cryptography, digital cash, and peer-to-peer computing. Blockchain technology holds significant potential to transform digital currency, improve logistics and facilitate the management of digital identity in a decentralized and trustless manner (Zwitter & Boisse-Despiaux, 2018). Originally designed as a distributed ledger for Bitcoin. Blockchain technology rely on a consensus mechanism: transactions are submitted and validated by nodes across a decentralized network forming a new block.. Each block contains information about a transaction, a reference to the previous block appended to the previous data. Actions performed within the blockchain platform are executed on-chain whereas the others are considered off-chain. In order to achieve trust, all actors need to agree with the on-chain data states (Liu et al., 2023). Distributed ledger technology eliminates the need of central authority by storing data in locked blocks that are replicated across every node in the blockchain network. As a result, it creates a transparent and immutable record of all transactions (Zwitter & Hazenberg, 2020).

The nodes' control mechanisms differentiate public permissionless, public permissioned, and private permissioned systems. In the first one, any user can join the network and participate in the validation process. In the second one, public permissioned blockchains, the validation process is restricted to authorized nodes. Conversely, only authorized nodes are allowed to validate and read transactions in private permissioned blockchains, which is the third type of blockchain.

The most exciting wave of Blockchain developments is the emergence of the concept of DAOs (decentralized autonomous organisations). DAO is an organization encoded as computer programs referred to as « smart contracts ». It is an implemented governance by systems that uses pre-programmed algorithms executed by computer systems based on code (Chohan, 2017). DAOs are defined by Hsieh et al. (2018) as « non-hierarchical organizations that perform and record routine tasks on a peer-to-peer, cryptographically secure, public network, and rely on the voluntary contributions of their internal stakeholders to operate, manage, and evolve the organization through a democratic consultation process ». As these organizations adapt their decision-making from pre-programmed rules that suppose the intervention of internal and external actors. Internal governance depends on the voting weight that relies on the ownership of tokens (Zwitter & Hazenberg, 2020). The external governance component depends on node operators; they can influence decision-making if they control more nodes (Zwitter & Hazenberg, 2020).

DAOs illustrate the most significant shift in power relationships, as a result of the transformation of BCT. At a basic level, this power can be subdivided into two parts. Endogenous power: This concerns the consensus algorithm used with the ability for some users to add transactions, upgrade nodes or collect fees (Florez, 2022).

Exogenous power: a mechanism other than consensus algorithms, includes forum discussions, voting and change proposals (Florez, 2022). In general, new technologies and Blockchain technology in particular, represent a significant new antecedent determining the extent of the need for new governance approaches that rely on new power distributions.

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2.2 Blockchain governance

The concept of governance is often portrayed by making a distinction between "old" and "new" governance (Zwitter & Hazenberg, 2020). According to Zwitter and Hazenberg (2020), the two modes (old and new) co-exist in practice. While old governance refers mainly to institutions and state structures, new governance refers to horizontal modes of decision-making. The identity and role played by actors are crucial to both traditional and new modes of governance. These modes are centralized and static. They do not consider the changes in power relationships related to the emergence of new relationships and actors within a specific context (Zwitter & Hazenberg, 2020). Therefore, there is a need to revisit the traditional governance modes and theories to adapt these modes to the new challenges arising in the digital domain.

Unlike many other technologies, the governance of a blockchain is a complicated task. It needs new distributed governance modes to achieve the whole system's long-term sustainability (Dursun & Üstündağ, 2021). Furthermore, the governance of blockchain systems presents many obstacles : First, it involves many actors due to the decentralization of power that enables several parties to govern collectively. Second, there is a vast difference between the existing governance modes of hierarchies, markets, organizations, etc…and the mode that should be adopted in a decentralized technology enabling the automatization of governance decisions (Laatikainen et al., 2023). As a technology, Blockchain remains hard to govern as the code is stand-alone and challenging to update (Liu et al. , 2022). On-chain and Off-chain governance are categorized in the literature as proposed governance models.

Off-chain governance relies on human interactions in decision-making and change proposals, followed by an update in the blockchain software. It involves core developers, miners, users, and business entities (Dursun & Üstündağ, 2021). Off-chain models remain relatively centralized, and power decisions are conducted outside the blockchain, taking a long time and excluding many actors involved in the system itself.

On-Chain governance models, however, are more recent and rely on voting through the protocol. The algorithms manage the voting results and their automatic execution (Dursun & Üstündağ, 2021). On-chain governance includes decisions on blockchain infrastructures and the design of consensus mechanisms that influence the behaviors of blockchain actors (Liu et al., 2022). While this governance is renowned for its quick decision-making, it is also risky and difficult to modify once it is implemented (Dursun & Üstünda, 2021).

The presented Blockchain governance models are focused on certain aspects while overlooking others. While on-chain governance modes are more efficient and formal compared to off-chain modes, they are less adjustable to an evolving and changing environment because the code is difficult to update (De Filippi & Memullen, 2019). On the other side, off-chain governance is ambiguous but can respond more humanly to edge cases to the changing circumstances (De Filippi and Memullen, 2019). The two mechanisms cannot be chosen; each mode is suited for a specific context. Ultimately, considering both modes advantages and drawbacks, their combination dictates how these blockchain systems will be governed.

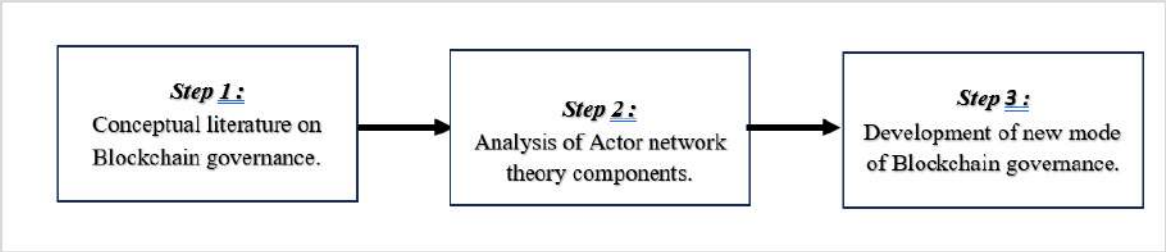
Actors—both human and non-human, within and outside the network—are pivotal to the success and sustainability of blockchain ecosystems.Thus, we try to apply a solid theoretical foundation based on the Actor-Network Theory (ANT) to identify the actors in addition to examining the power relationships between them within the blockchain network.

3. Research methodology

In the following, we outline the research methodology and we show how the proposed mode of Blockchain governance has been built. After a conceptual literature review, we tend to study blockchain governance through the lens of Actor Network Theory. The ANT provides a robust and detailed framework for examining the complexity of interactions and relationships between

humans and non-humans. Each component of the ANT will be analyzed in depth to understand the theory' applicability and relevance to the unique context of blockchain governance. This comprehensive analysis aims to develop and propose a governance model tailored to the specific features of blockchain technology.

Figure 1: Research design



Source : authors

4. Actor Network Theory: Components and analysis

Bruno Latour, John Law and Michel Callon are the ones who developed ANT, the theory is mainly known as a framework used to explore the role played by technology (non-human actor) in shaping relationships with humans (Latour, 1988, 2005). It aims to understand how networks are built and analyze the complex interactions between human processes and technology. The theory finds extensive utility within information systems as it aids in comprehending the influence of innovations such as Blockchain technology in organizations. Islam et al., (2019) state that the ANT has been applied across various domains : 1) To understand sociotechnical processes linked with technology development, 2) Argumenting these processes with empirical data, 3) to describe the causal trajectory that occurred by importing new elements and forming new connections within an entity.

ANT aims to provide a comprehensive understanding of how actors form alliances and enroll others, leading to networks of aligned interests that comprise both humans as well as artefacts (Mähring et al., 2004). Focusing on human, non-human, social and technical factors to understand complex situations is one of the main reasons ANT is commonly employed in academic settings (Mclean & Hassard, 2004). This theory helps comprehend the changes in the Blockchain's governance concept. We chose to study blockchain governance by focusing on four of the most essential components of the ANT : Power, Actors, Actor-network and translation.

4.1 Power

In Actor-Network Theory (ANT), power is an important idea. Latour (1984) states that power can be owned, but it comes from the work of many people together. Therefore, power does not cause actions; it is the result of collective actions. Moreover, Latour (1984) explains two kinds of power: "in potentia" and "in actu." "In potentia" means having power but not using it, which results in feeling powerless. In contrast, "in actu" means using that power to make others do things for you. The author believes that how much power someone shows depends on how many people join in and help (Latour,1984).

Hence, the essence of power resides in the actors' actions and not in possessing it and not executing it. Law (1986b) proposed an example illustrating that power is a consequence of the creation of a network:

"A text by itself will be ignored. A person will be snubbed. A device will rust. But if the three are put together it may become more difficult to ignore them. Under the right circumstances the effect is that of power"

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The concept of power is relative to the actor's actions and interactions within a network. Furthermore, to comprehend the concept of power relationships we need to understand how actors (human and non-humans) interact with each other and shape the network. Thus, translation is a way for the social and natural worlds to shape each other (Callon, 1986b).

4.2 Actor-Network

In ANT, an actor is « any element which bends space around itself, makes other elements dependent upon itself and translates their will into the language of its own" (Callon & Latour, 1981). Actors are considered to be both human and non-human entities that influence within a network with no distinction by ANT. They can be organizations, individuals, technologies or even abstract concepts. According to (Latour, 2005) each actor, whether human or non-human, individual or a group is essential in creating and influencing a network.
Networks are always changing as new actors join. An actor's identity is shaped by how they interact with others (Cressman, 2009). According to Latour (2005), ANT studies the associations between heterogeneous actors. According to Law (1992), heterogeneous networks are the product of everything (human/non-human), including people, social institutions, machines, organizations, and politics.
This view of the ANT, is suitable when studying the governance of blockchain. Our task is to understand and explore how these actors interact and how their relationships shape the network. A blockchain is simply a network of heterogeneous materials.

4.3 Actor-Network

According to Law (1992), actor network is a heterogeneous set of actors who are linked together by different relationships and who share aligned interests. The distinction between a simple network and an actor network lies in the heterogeneity between the actors in a network.
Actors gain power by enrolling others in actor-worlds as they wish them defined. This (heterogeneity) occurs through translation: defining roles, delineating scenarios, and creating obligatory passage points by a focal actor. One of the key elements of the ANT is Punctualization. ANT assumes nothing lies outside the network (Islam et al. , 2019). Therefore, actors are defined only through their relations with other actors within the network. Punctualization was first conceived to simplify the actor network considering it to be a simple actor (Vitale, 2023). In other words, the process of punctualization consists on converting an entire network into a single node in another network. (Callon, 1991).
According to Cressman (2009), this conceptualization yields two key points : First, depending on the perspective, everything can be both an actor and a network (a computer can be a complex network or a single node, punctuated, with a file-sharing network). Second, technical objects are processes not things. The relationships between the heterogeneous actors within a network are never static. They are constantly being performed (Cressman, 2009).

4.4 Translation

One of the critical elements of the ANT is Translation. Translation is an analytical framework that examines the role of technology and science in structuring power relationships (Callon,1986). Translating is the process where a network takes shape and undergoes transformation in ANT context (González & Cox, 2016). Translation can be defined as the process of making connections, passages, and communication between domains (Brown, 2002). According to Callon (1981), translation consists of relating things that were different, which leads to the creation of convergences and homologies. Translation can be considered the process by which the elements constituting a technology are related in a network.
According to Callon (1986), translation process involves four phases: problematization, interessement, enrolment and mobilization.

In problematization, the main actor sees itself as "indispensable". This actor creates a key point that others must pass through in their relationships (Callon, 1986). The main actor guides the development of the network. The actor determines other actors, their identities, and their interests to shape a network in alignment with his own interests.
Interessement involves convincing other actors to reconcile their interests with those of the focal actor. Enrolment follows a successful interessment, which involves accepting each actor's defined roles in the modified or newly created actor network. When the actors are adequately displaced across the network to meet the roles and needs of the focal actor, the mobilization of allies occurs. At the end of these phases, a network of relationships is formed.

5. Results and discussion: A decentralized governance mode:

In the previous section, we tried to study blockchain governance through the lenses of ANT in the aim to develop a governance approach that will be more suited to the blockchain structure. Our new approach is based on the fact that governance is decentralised, and governing tasks depend on the shifting roles of actors within the network. This means that the roles played by the actors cannot be static or centralized in one role; actors perform different roles. Given that, the relationships built in the blockchain systems vary in the light of many conditions and depending on different contexts (time, emergence of new actors, changes in regulation etc..). Furthermore, the change in relationships within blockchain structures generates a change in power connections. Contrary to traditional governance modes, the influence on decisions is variable and depends on the relationship between the actors. No single actor dominates the decision-making process, and every actor can influence the network, whether through: Voting, validating, participating in code elaboration, proposing protocols etc.
Through the lens of ANT, the identity of actors isn't enough to determine their influence on the blockchain network; an actor's power depends on their relationship with other actors within the network.
ANT helped us identify humans: miners, developers, investors and token holders and non-human actors: algorithms, smart contracts, the blockchain itself and codes in a blockchain network. The type of actors in the Blockchain network depends on the role they play within the network. According to Latour (1987), the role of an actor and its position within a network is relative to other actors using power. We can talk about micro and macro actors, and how these actors fluidly move from one position to another depending on the community agreement. Modes of governance, in general, rely on conceptions of power and control. In the context of blockchain, power results from different interactions between the network actors in specific contexts.
Therefore, in the decentralized mode of governance that we propose in the context of blockchain, the concept of power is flexible and related to the actor in the network. Power is shaped depending on interactions between the actors within the network. The roles are never defined in advance; they are attributed depending on the situation of the network.
The notion of power in the blockchain context is dynamic, distributed and not centralized between the hands of a single actor. The notion of "context" is fundamental to the roles played by each actor and, therefore, their influence on the whole network. In this case, the governance within a blockchain context depends not on actors but on the interactions between them in the network.
For example, the miners' role is to verify new blocks and add them to the blockchain through the power of computation, while developers' role is to make sure that the protocol is efficient and functional. In a more specific context, at the beginning of Bitcoin only two main actors were involved: developers and miners. As bitcoin gained value, new set of actors emerged, altering the power distribution within the blockchain network.

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A decentralized governance mode is also characterized by being dynamic. Constant change emerges from varying interactions between human and non-human actors. Thus, networks are dynamic and evolve through relationships between the actors.

While the traditional modes of governance present a static centralized type of power, the employment of the modes in a blockchain context is inadequate and threatens to undermine the potential benefits of a blockchain (decentralization is one of them). In addition to that, and as seen before, it is essential to highlight the role of non-state actors in developing governance mechanisms in the blockchain context. Consequently, overregulation can reduce the potential of the technology and the need for a hybrid mode of governance. In translation, one of the key elements of ANT, problematization occurs when focal actors choose others with similar interests to establish a passage point. In the context of decentralized blockchain governance, single-actor power should be rejected. The power could be maintained by any actor in the network at some point. In traditional governance modes, on a problematization level we can talk about how these modes fail to acknowledge the key roles of non-human actors and the dynamicity of power, focusing on a central authority maintaining a static power. The translation process is essential in conceiving an adapted decentralized governance mode for blockchain platforms. Within the decentralized mode of governance, actor's roles within the network vary according to its nature. The norms and rules can be translated into smart contracts and consensus mechanisms after the alignment of different actors with the focal actor.

The decentralized governance mode combines governance of and by the infrastructure. The incident of DAO's hack in 2016, forced everyone to rethink what constitutes solid blockchain governance. It showed that on-chain governance does not guarantee that the rules considered in the codes will be executed in the desired way. Therefore, fluidity within the decentralized mode is necessary: A mechanism that allows the network to update its protocols simply.

Table 1: Summary of the characteristics of a decentralized governance mode

Decentralized Governance Mode: Flexible
Actors: No central authority: No single actor dominates the decision-making process
Symmetry: All actors, whether human or non-human, are considered equal participants in the network, with no entity having priority or existing outside the network.
Agency: Every actor has the capacity to influence the network (proposing protocols, validating, participating in consensus, voting etc.)
Power relationships: The power emerges through interactions between actors. It considers the active role played by these actors in shaping power relationships and decision-making processes. The distribution of power is dependent on the specific relationships between actors within the network.
Translation: The norms, rules and objectives are translated in smart contracts and consensus mechanisms (with actors alignments in mind)
Off-chain + On-chain governance: A mechanism that allows the network protocols to be updated.

Source: Authors

6. Conclusion

Governance is a crucial element for the success and development of new technologies. However, effective governance should adapt to the technical innovations of the digital world. The use of blockchain is increasing in several domains and the governance of this emerging technology is complex. In the present paper, we tried to understand the blockchain governance through the lens of ANT. The purpose of our study was to show the need to reconceptualize the traditional governance in the realm of the Blockchain technology. We have proposed a decentralized governance mode considering the transformative nature of the network. Our work adds to the conversation about the roles of people and things system (human and non-humans) in a blockchain system.

It also looks at the power dynamics between the different participants in the blockchain network. The new governance mode is characterized by constant changes within the network: changes in power, changes in actor's roles, changes in focal actors, etc. The new mode combines on-chain governance and off-chain governance. In terms of the managerial dimension, our study can contribute to how practitioners design and implement their blockchain structures. Our paper can be considered as a starting point for further empirical research. While this study provides a theoretical foundation for decentralized governance models, future empirical research is necessary to validate and refine the proposed framework.

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