Blockchain Governance: A Dynamic View

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Abstract. The governance of blockchain systems is unique due to its decentralized nature and automatically enforced rules and mechanisms. Moreover, blockchain governance is crucial in achieving success and sustainability. With this study, we aim to advance the theory of blockchain governance and support practitioners by defining blockchain governance from a holistic viewpoint and identifying its building blocks. As a result of a systematic literature review of 75 recent articles focusing on blockchain governance, we propose a dynamic model that deepens the researchers' and practitioners' understanding of blockchain governance. The conceptual model can serve as a reference framework and structured foundation for analyzing, discussing, and developing the governance of blockchain systems.

Keywords: blockchain governance, dynamic view, systematic literature review.

1 Introduction

Blockchain and distributed ledger technologies may disrupt industries by providing means for decentralization, enabling automation, reengineering business processes, and improving the management of information systems [1, 2, 3]. Blockchain relies on cryptography consisting of an interconnected and unmodifiable list of digital records shared within a peer-to-peer network [4]. One of its advantages is its ability to enforce automatic rules without intermediaries [5]. Smart contracts (i.e., code representing a self-executing digital contract) and consensus mechanisms (i.e., fault-tolerant methods of authenticating and validating a value or transaction on a distributed ledger) enable agreement assurance within the nodes of a network. These technological advances infer a deeper investigation of blockchain governance [1].

Indeed, a key factor in developing sustainable blockchain systems is related to their governance. Governance refers to the regulation of decision-making processes among actors towards shared objectives that lead to the development, reinforcement, or reproduction of social norms and institutions [6, 7]. The governance of blockchain systems differs from existing governance structures, such as markets, hierarchies, platforms, or organizations [8, 9]. First, due to its decentralized nature, blockchain governance needs to balance integrity and autonomy without a central authority [1]. Second, blockchain enables embedding governance mechanisms into blockchain transactions, and this automating self-governing characteristic of the technology opens new opportunities and challenges that need further investigation [10]. Thus, while effective governance is crucial in developing and operating blockchain systems, its differences to already investigated governance structures claim further research [11].

Blockchain governance has been studied through the lens of several theories including IT governance theory (e.g., [1, 9, 11]), platform governance (e.g., [12], [13], [14]), the organizational and corporate governance literature (e.g., [15], [16], [17]), agency theory (e.g., [9]), internet governance (e.g., [17]), and open-source software governance (e.g., [11]). While there is no consensus on one specific definition of blockchain governance, several terms share a common understanding among researchers. First, blockchain governance can be understood as both governance of the infrastructure (i.e., means and processes of directing, controlling, and coordinating actors within a blockchain system) and governance by the infrastructure (i.e., using blockchain to govern actions and behavior) [18]. Second, there is a distinction between on-chain governance (i.e., direct encoding of rules and decision-making processes into the blockchain infrastructure) and off-chain governance (i.e., non-technical rules and decision-making processes affecting the development and operation of blockchain systems) [19]. Third, technology governance refers to governing the technical development of the blockchain system, while network governance implies governance of the associated blockchain networks [20]. Fourth, studies drawing on organizational and corporate governance literature distinguish between external and internal governance [15, 16]. External governance refers to decisions made outside the blockchain system (e.g., the media, general public) but impacting managerial decision-making within the system [15]. Internal governance, in contrast, describes governance practices inside the system [15]. While distinguishing between these aspects is necessary and useful, there is also a need for a general definition that provides a shared common language for researchers and practitioners to understand and communicate this concept similarly and avoid confusion.

Current literature has identified different components of blockchain governance. For example, studies building on IT governance theory identify the dimensions of decision rights, accountability, and incentives [9]. Researchers inspired by organizational and corporate governance literature describe decision-making related to (i) owner control on the blockchain level, (ii) formal voting on the protocol level, and (iii) centralized funding at the organizational level [16]. Further, governance has been found to be concerned with decisions related to (i) demand management, (ii) data authenticity, (iii) system architecture development, (iv) membership, (v) ownership disputes, and (vi) transaction reversal [8]. Moreover, studies based on the theory of platform governance identify the following three key components of blockchain governance: (i) access, (ii) control, and (iii) incentives (e.g., [12]).

Besides these essential works that focus on some aspects of blockchain governance, there is a need to define blockchain governance from a holistic viewpoint and identify its key components. There are several reasons for this. First, blockchain governance models based on a single theory focus on particular aspects while neglecting many others. For instance, on-chain governance rules are more efficient and predictable than the off-chain counterpart. At the same time, on-chain governance is less adjustable to the unknown or changing environment [44]. On the contrary, off-chain governance is ambiguous, but it can respond to unusual cases more humanly and flexibly to the changing circumstances [44]. Therefore, it is crucial to have an integrative view of blockchain governance to balance the pros and cons of a single model. Second, analyzing blockchain systems from a holistic viewpoint and identifying the decision-making needs is essential, especially in distributed settings. In these decentralized systems, there are contradictory forces of autonomous actors with different incentives and goals, while there is a need for collaboration to achieve the shared objectives. Thus, governance decisions cannot be made to one aspect of the system without considering its possible consequences to other parts. Third, in some of the distributed systems (e.g., self-sovereign identity ecosystems), the governance framework (i.e., consisting of business, legal, and technical rules and policies of a system) is an essential building block beside the technological architecture [21, 22]. The development and management of a governance framework require similar development work as building the technical architecture. Thus, it requires a holistic understanding of different, interrelated parts of blockchain governance [21, 22]. Therefore, it is essential to identify the building blocks of blockchain governance and their interrelations, and propose a systematic way to determine the decision needs and understand, analyze, and communicate blockchain governance decisions throughout the whole lifecycle of a blockchain system.

Despite the growing body of literature, existing research falls short in providing a holistic understanding of the components of blockchain governance and their possible interrelations. The only work providing an integrative blockchain governance framework has been developed and proposed by van Pelt et al. [11]. The authors build on the definition of open-source software (OSS) governance and define blockchain governance as “The means of achieving the direction, control and coordination of stakeholders within the context of a given blockchain project to which they jointly contribute” [11, p. 7]. In this work, blockchain governance is a combination of six dimensions (formation and context, roles, incentives, membership, communication, and decision making) and three layers (off-chain community, off-chain development, and off-chain protocol). While this work provides an excellent framework for studying blockchain governance, it does not emphasize the dynamic, evolving nature of blockchain systems, it does not incorporate the legal and regulatory aspects, and also, the business aspects get less attention. However, governance decisions cannot ignore the legal and business context that both sets the constraints and provides opportunities for alternative governance structures. Furthermore, governance decisions need to consider the lifecycle stage of the blockchain system. For example, governance is typically more centralized in the formation phase, with more ad-hoc decisions made via traditional, social decision-making means. Still, it is continuously evolving towards decentralized governance structures and more routinized and automatized decisions in the operating phase.

Thus, while understanding blockchain governance from a holistic viewpoint is essential, there is a clear research gap in the literature in providing an integrative framework and a definition of blockchain governance that integrates insights from various theories. In our study, we aim to answer the research question “what is blockchain governance, and what are its building blocks?" by carrying out a systematic literature review and integrating the existing viewpoints to define blockchain governance holistically and identify its components.

The paper has several contributions to both theory and practice by proposing a dynamic model of blockchain governance that offers a holistic viewpoint and a more comprehensive understanding of blockchain systems and their governance. Researchers and practitioners (e.g., users, organizations, regulators) can use the proposed model as a reference framework in further studies and as a tool to systematically design, analyze and communicate the different aspects of the governance of blockchain systems throughout the various lifecycle stages.

2 Research methodology

A systematic literature review is an appropriate approach to synthesizing the existing studies to facilitate theory development and support policymakers and entrepreneurs for better decisions [23]. This methodology has high reproducibility and objectivity due to its transparency in data collection and synthesis [23]. Following the five-stage grounded theory method of Wolfswinkel et al. [24] for conducting a systematic literature review, we applied a review by defining, searching, selecting, analyzing, and presenting, which we will describe in the following subsections.

2.1 Defining

A well-written and detailed protocol document is essential for ensuring consistency throughout the whole review process by defining the criteria for inclusion, the fields of research, the appropriate sources, and specific search terms. For our study, all articles focusing on or partially mentioning blockchain governance can provide valuable insights into blockchain governance's definition and components. Therefore, we defined the inclusion criteria as follows: articles focused on studying blockchain governance or presenting the occurrences of blockchain governance. Since research on blockchain governance has just emerged in recent years, any relevant article might provide interesting views for our research in different fields. Therefore, we did not limit the fields of research, which may result in a multidisciplinary or holistic perspective for the studies on blockchain governance.

In this study, we used three multidisciplinary, electronic databases for keyword searching: the Web of Science, Proquest, and ScienceDirect. Those databases were considered appropriate sources since they cover a wide range of literature and are frequently used by previous scholars (e.g., [25], [26]).

Blockchain governance can be mentioned and discussed using different terms. Thus, we decided on the following string for searching in the three databases:

(blockchain OR ((distributed OR decentralized)
AND (ledger OR platform OR "autonomous organization")))
AND (governance OR management OR ecosystem)

2.2. Searching and selecting

In Figure 1, the searching and selecting stages are presented. In the Searching phase, we applied the defined search terms on the three online databases. We got the following results: 142 articles from the Web of Science, 323 articles from Proquest, and 473 articles from ScienceDirect.

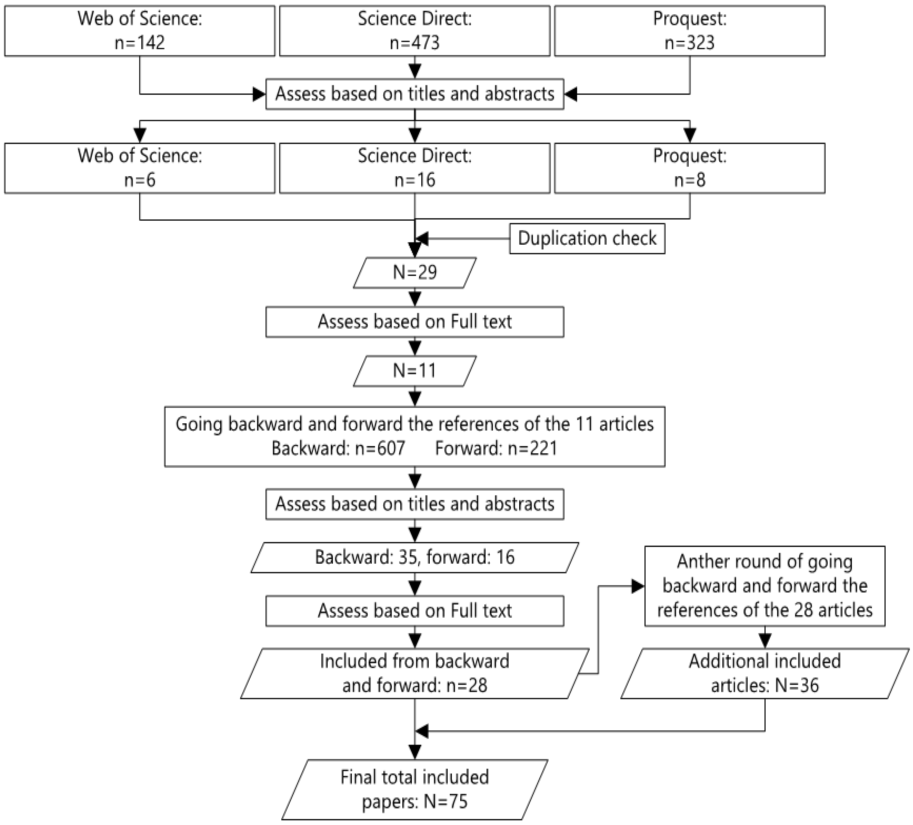

Fig. 1. Searching and selecting stages of the systematic literature review process

In the selecting phase, we filtered the articles based on their titles and abstracts using the defined inclusion criteria. This phase resulted in six relevant articles from the Web of Science, eight relevant articles from Proquest, and 16 relevant articles from ScienceDirect. In this step, we eliminated duplicates and identified 29 primary articles based on title and abstract. Next, we filtered the articles based on their content against the same inclusion criteria and received 11 articles. Later, we went backward and forward in the references of the 11 articles to find additional relevant articles with the same inclusion criteria. We found 607 articles by going backward through the references, and 35 articles were relevant based on the titles and abstracts. Within forward references (i.e., from the papers citing the referred articles), 16 out of 221 articles were found relevant based on the titles and abstracts. Then, we went through the 51 articles and filtered them based on their content against the same inclusion criteria and got 26 articles. Next, we did another round of backward and forward reference searches at the 26 included articles and found an additional 36 relevant articles. Therefore, the total number of final included articles was 75. During this stage, we made descriptive notes about each included article to offer a general overview.

2.3. Analyzing

We performed the data analysis of the final articles in three phases, each phase in an iterative manner. We used ATLAS.ti qualitative data analysis software [27] for open coding and axial coding. First, we did open coding using the constant comparative method [28] to identify the main characteristics of blockchain governance and gather descriptive statistics of the articles (e.g., objective, theories, and the research method). In this phase, we also used the code in vivo and automatic coding functionality of the software. As a result, the coding was detailed, and in many cases, followed the wording of the original articles [29, 30]. Example codes of this phase include “exit strategy”, “benevolent dictator”, “platform developers”, and “economic rewards”.

In the axial coding phase, we reorganized these codes into larger, overlapping categories using the code group functionality of the Atlas.ti software. These categories represented the different aspects of blockchain governance, such as “business aspects” and “actors and roles”. Then, we reduced the number of codes by renaming and merging the codes that referred to similar issues. This task resulted in a hierarchical code structure with a maximum of three levels (for example, “actor: developer”, “incentive: nonpecuniary: networking” and “descriptive: method: design science”). This code structure represented the building blocks of blockchain governance and provided the base for our conceptual framework.

In the theoretical coding phase, our objective was to formulate a definition and a dynamic model of blockchain governance from a holistic perspective. To achieve this, we integrated the theoretical insights from the articles and the building blocks of blockchain governance resulting from the axial coding phase. Both the definition and the model have been informed by the various definitions and components of blockchain governance and related concepts, such as, for example, governance, open-source software governance, platform governance, corporate governance, internal governance, endogenous governance, collaborative governance, distributed governance, and IT governance.

All phases of the data analysis have been carried out as an ongoing, iterative, co-creative process. First, the authors discussed the code structure several times and modified it according to the agreements. The code structure was considered final when all the codes belonged to a category, and there were no more questions from any of the authors. Second, several blockchain practitioners discussed the conceptual model during several meetings. After the first meeting, the model was refined based on the feedback. Later on, the attendees found the model easy to understand, and they used it as a tool to discuss issues related to the governance of their blockchain system.

As a final step, we reviewed the quotations behind the codes and summarized the findings in this article.

3 Findings

3.1. Descriptive statistics

In Figure 2, the number of different article types are presented each year. As visible from the figure, blockchain governance has gained increasing attention since 2018. More than half of the total included articles were published between 2018-2020. The included articles are journal articles (36%), conference articles (23%), and others (such as book chapters, theses, and university publications; 41%).

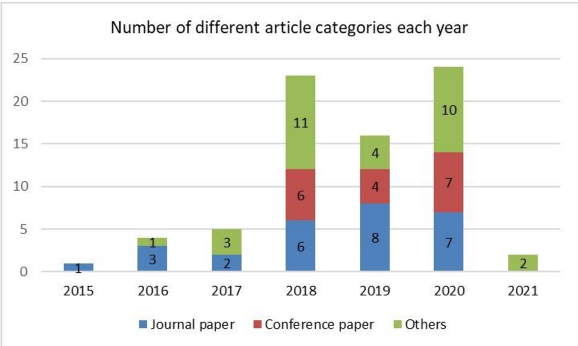

Fig.2. Number of different article categories each year

Various research methods have been applied in the included papers. Case study was the most frequently used approach, accounting for more than 50% of the included papers. Most of these case studies offered discussions related to Bitcoin and/or Ethereum, while some other studies analyzed EOS.IO [11], the Swarm City [9], Cardossier [8, 43], and Tezos [17]. In addition to case studies, other research methods included design science research approach [11, 31] and action research [20].

3.2. A dynamic model of blockchain governance

The diversity of theoretical lenses and viewpoints and the various dimensions of blockchain governance mentioned in the included articles lead us to investigate blockchain governance from a holistic perspective. Thus, as a result of our systematic literature review, we define blockchain governance as follows:

Blockchain governance encompasses technical and social means to make decisions on the different levels (e.g., individual, community, organizational, national, international) related to actors, roles, rights, incentives, responsibilities, rules, and the business, technological, legal, and regulatory aspects of a blockchain system during its whole lifecycle.

Furthermore, we propose a dynamic model of blockchain governance that can be seen in Figure 3. In line with the definition, the model captures the dynamic nature of blockchain governance where technology-based and social means impact the various facets of blockchain governance. In the following subsections, we describe the different aspects of the model of blockchain governance.

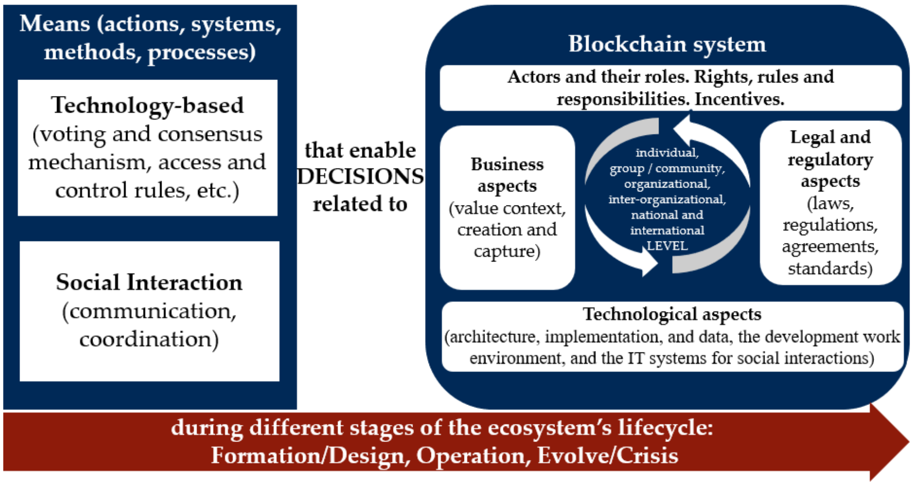

Fig. 3. A dynamic model of blockchain governance

Technical and social means for governance

This building block of our model encompasses both governance *of* and governance *by* the infrastructure. Governance means refer to actions, systems, methods, and processes designed for decision making. Blockchain technology allows *on-chain governance* (referred to also as automated self-governance); that is, automatizing governance decisions by technical means, in the form of voting mechanisms, smart contracts, DApp frameworks, and blockchain network protocols (e.g., [10], [44]). Embedding governance into technology refers to managing and maintaining systems of legal agreements, voting and property rights, and validating, maintaining, and enforcing social and functional properties or contracts in the system [32]. Technical means enable the standardization of interactions, embedding quality standards into the technical architecture, and providing incentives [12]. Automatizing governance decisions entails embedding social trust and determining the bargaining power of the actors [17, 18].

However, the technology cannot solely be held accountable for governance decisions. Besides these technical means, there is a need for *off-chain governance* enabled by traditional, social means for governance, such as communication, collaboration, and coordination among actors [11]. Social interactions among the actors are needed in different forms and channels [9, 11, 12, 18, 45]. Social governance means refers to formal and informal communication and collaboration among the actors, such as discussions via coordination systems, tracking systems, meetings, and working groups [11].

A key challenge in blockchain governance is to find the right balance between the technical and social means of governance (i.e., what, how, and when to automatize). A decision on embedding governance into technology should also be made based on other aspects of the system (for example, the lifecycle stage [8]). In blockchain systems, on-chain technical governance interacts with traditional governance mechanisms in both substitutionary and complementary ways [33].

Blockchain system

Actors and their roles

Governing a system requires identifying the actors (i.e., stakeholders, agents) that are influenced by, or can affect the system [17]. Blockchain systems have a boundary problem: defining the actors of the system is challenging [17]. Some actors are not even aware that they contribute to governance decisions [11]. Furthermore, some actors are affected by the decisions, but they do not interact [17]. Moreover, a group of actors with the same role may not be homogenous in their incentives and actions (e.g., token holders [17]). Another problem comes from the different preferences of different actors towards the chosen governance models [34].

Actors can be individually governed as a community or according to other affiliations (cf. the subsection Governance levels). Actors can be categorized into *passive* (i.e., users of blockchain, for example, to transfer money) or *active* users (i.e., users who contribute and support the operations of the network) [18]. Actors might be *public* or *private* [43]. Finally, they can be considered *internal* (i.e., users) or *external* (i.e., regulators or standard-setting bodies) [8].

Based on our review, actors can be grouped based on their roles in the infrastructure development processes or their roles in the ecosystem. Roles can be defined as a characteristic set of behaviors or activities undertaken by the actors [11]. Roles related to *infrastructure development* are nodes, miners or validators, users, developers, architects, and so forth (e.g., [11], [18], [42]). Roles related to a *system* can be owners, founders, leaders, providers, investors, contractors, complementors, standard-setting bodies, regulators, observers, operators, suppliers, and so on (e.g., [1], [12], [46], [34]). In some cases, there is a hierarchy between the roles, and specifying this hierarchy plays an important role in governance decisions [11].

Rights, rules, and responsibilities

One of the key factors for successful governance is the rights and responsibilities of the roles /actors and the rules in the system [10]. Rights and rules have been mentioned in various forms in the literature. First, access rights and rules have been referred to as rights/rules for entry, membership, input control, and participation (e.g., [8], [11], [15]). Second, decision rights and rules "concern the rights governing control over certain assets" [9] (p. 1022). Third, rights and rules should be developed related to development, software updates, data policies, and hard forks [15, 34, 35]. Fourth, rules and rights are needed for voting, validation/verification, overrides, and ownership (intellectual property) [8, 16, 17, 32, 34]. Rights and rules could be endogenous (i.e., developed by the community for the community, as a form of self-governance) or exogenous (i.e., rules established by external actors that have the power of influence) [44].

Governing a blockchain system implies designing the responsibilities and the accountabilities assigned to the roles [9, 11, 34, 45]. The importance of responsibility management has been emphasized in both the open-source software governance and the corporate governance literature [16, 36]. Accountability captures the level on which actors are and can be held accountable for their actions and behavior [11]. Accountability represents one of the key concepts in the theory of IT governance, platform governance, digital infrastructure governance, corporate and organizational governance [1, 7, 9, 10, 37].

Incentives

Incentives refer to actors’ motivations for participation and actions [11]. Incentives play a key role in governance decisions because they encourage desirable behavior in the system [9]. Aligned incentives allow actors to choose their own behavior and actions that coincide with the shared objectives of the system [9]. Incentives can be pecuniary (monetary) or nonpecuniary (non-monetary) (e.g., [11]). Besides financial benefits, blockchain systems offer a wide range of value, such as privileges, reputation, and visibility [9, 42]. Some actors contribute to the system to gain experience, do research, carry out technical and market testing, simulate business processes, collaborate or build new strategic alliances [20].

Technological aspects

Blockchain systems cannot be governed without decisions related to technology. In particular, these decisions are related to (i) the architecture, implementation, and data, (ii) the development work environment, and (iii) the IT systems for social interactions, knowledge, and memory management (e.g., [8], [9], [11], [34]). First, related to the architecture, implementation, and data, decisions are to be made related to the technical details of consensus mechanisms and voting mechanism, technical choices for the software stack, third-party software, technical requirements on connectivity and firewalls, the monitoring and maintenance of key performance parameters, the sharing of node-IPs, online or offline funding storage, transaction enforcement, validation and conflict resolution mechanisms, data authenticity, activity tracking, identity management and interoperability (e.g., [18], [20]). Second, decisions are needed related to software repository management, versioning, testing, and monitoring. Third, decisions related to coordination systems are important for enabling traditional governance using social interactions.

Business aspects

In blockchain systems, the actors co-create value together, and a key question is how to ensure a fair share of value among them. A successful business model is beneficial for all actors [38], and it is essential for a sustainable blockchain system. In this view, a fit between value capture, value creation, and value context is key to achieve dynamic stability [39]. According to this view, we grouped the governance decisions related to the business aspects into three groups: decisions related to value context, value creation, and value capture.

The decisions related to *value context* encompass identifying the purpose and context, the business requirements, and the strategies and mission of the system (e.g., [8], [11], [45]). For this task, there is a need to understand where the value resides in the system, considering all other aspects, such as the actors, their roles, their (possible) incentives, the opportunities enabled by the technology and its limitations, and the legal and regulatory context.

The decisions related to *value creation* are primarily related to cost factors and funding sources (e.g., [12], [20], [42]). Furthermore, decisions are needed related to core activities and how to split the funding fairly among the actors to establish incentives and facilitate innovative outputs.

Value capture entails not only the provision and negotiation but also the realization of value [12]. The decisions related to *value capture* typically deal with revenue streams and pricing models (e.g., [11], [12]). In blockchain systems, different actors might have different revenue models that need to be considered in decision-making processes.

Legal and regulatory aspects

While there are considerable advances related to the legal and regulatory environment of blockchain systems in different countries, uncertainty still exists related to the legal and regulatory aspects of the technology and the ecosystems built around it [40]. Blockchain governance encompasses decisions related to laws, regulations and industry policies, standards, and agreements (e.g., [10], [35], [40]).

In an uncertain *legal and regulatory* environment, decisions are needed on the specific regulations to comply with or in regard to lobbying for changes in the existing regulations [40]. In particular industries (e.g., financial or data services), the choice of jurisdiction or accountability over multiple jurisdictions is crucial [10].

Viable blockchain solutions need to have a *standard* industry policy strategy or an alternative strategy when standards are not yet fully established. Choices could be, for example, (i) creating a proprietary blockchain protocol, (ii) working with existing standards groups to adopt standards for blockchains, or (iii) joining an industry blockchain consortium [40].

Besides the decisions related to laws, regulations, and standards, one of the key tasks in developing blockchain systems is to create *agreements* among the actors that set out the rules and policies of the system. Agreements can exist in different forms, such as legal documents, shared understanding, or code (e.g., [8], [32], [45]).

Lifecycle stages

Blockchain governance evolves over time [8, 10, 34]. Blockchain systems are orchestrated in the formation/design phase (also called exploration/ bootstrapping), where the key question is “How should the system work?” In the operation phase, the key governance decisions have been made already, and the main question is “How should the system operate?” In some cases, the system can enter into the crisis phase, when the key question is "How should the system handle the conflicts?" Crisis situations can lead systems to death or to forming a new blockchain system via hard forks, or the system can go back to the operation phase via the self-renewal/soft fork.

While blockchain governance is typically considered decentralized, an evolution pattern can be observed that a central authority makes the first design decisions, and the system becomes more decentralized when maturing [34]. Furthermore, the level of automatizing governance also evolves over time: while ad-hoc decisions cannot be automatized, the planned decisions can be implemented later using technical means [8]. Thus, blockchain governance needs a dynamic, evolutionary viewpoint.

Governance levels
Understanding the scope of the decisions (i.e., the targets that the decisions have an impact on) is crucial in governance because it helps to understand the possible consequences of the decisions. We argue that decisions can be related to individuals or a group/ community [11]. Furthermore, some decisions (such as business, legal or regulatory ones) are made at the organizational, inter-organizational, national, or international levels [40].

4 Conclusions

Governance decisions in decentralized systems cannot be made solely by focusing on the key components from one specific theory (e.g., decision rights, accountability, and incentives from IT governance theory). Instead, making governance decisions needs a comprehensive analysis of the system. In this work, we synthesize findings from a systematic literature review of 75 articles related to blockchain governance. By integrating insights from recent work, we define blockchain governance from a holistic perspective. That is, blockchain governance encompasses technical and social means to make decisions on the individual, community, organizational, inter-organizational, national, international levels related to actors, roles, rights, incentives, responsibilities, rules, and the business, technological, legal, and regulatory aspects of a blockchain system during its whole lifecycle. This definition is novel due to its comprehensive characteristic. It provides a systematic viewpoint on the governance decisions that need to be made during designing, operating, and managing blockchain systems during crises.

Blockchain governance is multifaceted and complex [34], and decisions related to one aspect of the system affect other parts. In our model, we incorporated on-chain and off-chain governance, governance *of* the infrastructure, and governance *by* the infrastructure in one model, facilitating the investigation of how the technical and social governance means substitute for and complement each other [33]. This model emphasizes the dynamic, evolving nature of blockchain governance [34]: decisions should consider the lifecycle stage of the system. For example, governance might be more centralized in the formation phase but evolving towards decentralized governance structures. Furthermore, the complexity and ad-hoc nature of governance decisions also differ in different lifecycle stages. Our model also emphasizes the contextdependent nature of blockchain governance: for example, decisions should consider the legal and regulatory context and the value context of the system. While all components of blockchain governance have been mentioned in recent literature, our model is the first one that incorporates all.

This research has several theoretical and empirical contributions. First, the work contributes to IS research by providing a unique, holistic view of blockchain governance and its multifaceted, complex, and dynamic nature. In particular, the holistic definition of blockchain governance advances theory by integrating the different theoretical viewpoints and can serve as a reference definition for further studies. Furthermore, researchers can use the model as a reference framework in future work, such as empirical, comparative case studies. This integrative framework is significant since it balances the benefits and drawbacks of a single blockchain governance model and intends to cover all relevant components. Second, for practitioners, such as the actors of blockchain systems, the definition, and the model provide a structured foundation and a shared language to understand, analyze and communicate blockchain governance decisions. In particular, similarly to Business Model Canvas [41] that has been commonly used in business model development, this model can serve as a tool for identifying the gaps and questions, and provides a systematic way of documenting governance decisions throughout the whole lifecycle of the system, such as formation/design, operations, and crisis.

The study has limitations that we aim to address in our future work. First, we will describe our conceptual model more extensively and include some more insights from the articles on which our conceptual model is based. Second, we will describe future research avenues that we identified using our conceptual model. However, we believe that the comprehensiveness of our proposed model advances theory and practice also in this short form.

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