Decentralization and governance in blockchain; mutually exclusive or coexistent?

1st Hans A. Koning
Vrije Universiteit (VU),
Department of Computer Science
Amsterdam, the Netherlands
h.a.koning@vu.nl - ORCID 0000-0002-6401-3850

2nd Tina van der Linden
Hogeschool Utrecht (HU)
Law Faculty
Utrecht, the Netherlands
ORCID 0000-0002-6972-1223

3rd Jaap Gordijn
Vrije Universiteit (VU),
Department of Computer Science
Amsterdam, the Netherlands
ORCID 0000-0002-6401-3850

***Abstract*—Decentralization and governance can be at odds. Werbach posits that a blockchain will fail if there is no governance, for instance, to resolve disputes, while, on the other hand, the existence of any (in)formal governance structure means there is no longer decentralization: a paradox [27]. This paper discusses that paradox by reviewing empirical input from blockchain experts who draw on their practical experience.**

This paper shows that there is no paradox between blockchain governance and decentralization. People in large groups, spread all over the world, can work together and have a functioning decentralized blockchain. Governance should not be equated with making decisions. Governance does not provide decisions; it provides boundaries and guidelines, and sets the procedure of how decisions are being made. The main objection to the paradox is that it is a generalization that omits the principle of compromise. A key principle of decentralization is that at no point in time anyone can take control over the system or reduce the voting power of any other stakeholders. If these principles are not compromised, the paradox simply cannot be true. In short, governance gives legitimacy, it does not give control. However, nuance is needed. Simply accepting the paradox would imply that there cannot be blockchain governance, while rejecting or ignoring the paradox can seriously jeopardize decentralization.

The panel of blockchain experts was asked about the need for governance and the relationship between technology and governance. This gave a more philosophical insight into blockchain governance and contributes to an even deeper understanding of governance and decentralization and how they interact.

***Index Terms*—Blockchain, Governance, Decentralization, Participatory Research.**

I. Introduction

This paper reports on the analysis of insight gained from a larger empirical study on decentralized blockchain governance through input from blockchain experts. We focus on one of the more intriguing but not so well-known challenges in blockchain governance, namely the paradox between governance and decentralization. This was first mentioned by Vili Lehdonvirta and coined by Werbach as the Vili paradox [13], [27], [17]. It challenges the simultaneous existence of governance and decentralization, and by that the very concept of decentralized blockchain governance.

Bevir describes governance as referring to "All processes of governing, whether undertaken 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" [1]. In this research, governance is seen as the ultimate voice of reason that provides a fallback that is rooted in our deepest sense of morality and provides direction to what is right and how choices can be made for and by the community. Decentralization describes how the ability to make decisions works within the permissionless blockchain. As there is no single party keeping the record, no single party is responsible for it, which means that no single party is accountable. Decentralization diffuses power, and that has become an anchor to the blockchain [25]. Another definition sees the blockchain as a distributed system with multiple authorities that control different components, but no single authority is fully trusted by all others [23]. Here the decentralized blockchain is looked at like one could look at democracy, be it that the blockchain is a technology: of the people, by the people, and for the people. Governance and decentralization overlap in the sense that both are social practices but are incongruous on (de)centralization. Governance does not rule out or object to centralization, whereas decentralization aims to avoid it at all costs. Furthermore, in very black-and-white terminology, (corporate) governance embraces trust towards its stakeholders, where the decentralized blockchain prefers to replace it with technology, the notion of a trustless trust notion [28]. And that opposing view on trust is where the possible conflict between governance and decentralization lies.

For this paper, instead of reviewing the literature or analyzing industry cases, renowned blockchain experts are interviewed. The purpose of the paper is to contribute to a deeper understanding of blockchain governance and the challenges facing it. The new insights may serve as input for consideration during the ideation, formation, and auditing of blockchain projects and could help build a more sustainable decentralized ecosystem. That would especially be helpful for the operation of a Decentralized Autonomous Organization (DAO), as seen by Hassan et al. ' as a blockchain-based system that allows people to coordinate and govern themselves [9]. That would make the DAO the ultimate showground where decentralization and governance can come together, and in doing so, make the paradox dissolve. .

The structure of this paper is as follows. We begin by explaining the paradox in sec. II, and review the related work. In sec. III-A we explain the research design for this study, and sec. III-B details which respondents participated in this study.

The main question which explores the relationship between governance and decentralization is explained in sec. III-C, while sec. IV lists the responses to the main question. A total of four follow-up questions were asked to the respondents, which sec. V lists. The responses to these questions are listed in sec. V-A through sec V-D. Sec.VI will detail the views of the author as triggered by the analysis of the responses of the respondents. Before drawing conclusions, the author critically reviews the methodology in sec. VII. Finally, sec.VIII, summarizes the conclusions.

II. Related work on the relation between decentralization and governance

The focus of this paper lies on the relationship between governance and decentralization. This was triggered by an analysis by Werbach, referring to a speech by Vili Lehdonvirta at the Alan Turing Institute in 2016, in which Lehdonvirta challenged the coexistence of governance and decentralization [27], [13], [17]. This was followed by an interview with the Financial Times in 2017 [11]. These are references from 2016, an era in which the term Distributed Ledger Technology (DLT) was quite popular and often used intercangeably with blockchain. Both Lehdonvirta and Werbach use the term DLT, but this paper uses the term blockchain. Lehdonvirta posits that once you address the problem of governance, you no longer need a decentralized blockchain. Instead, you can use technology based on a trusted third party, as you are already trusting someone to make the rules of that technology. He calls this the governance paradox.

If Ethereum needs to undergo a code change in order to remain successful and competitive, is that because the founder Vitalik Buterin and his core developers have the ability to force changes? If so, they are no different than any other project, say Microsoft or Google. It is precisely at that point, when the few can decide for the many, that the advantages of decentralization start to disappear. Therefore, with decentralization, there is no longer governance, thus Lehdonvirta argues.

Werbach interprets this in the following way: apart from voluntary agreements, if a blockchain fails to collectively resolve disputes, it will fail. The other side of the coin is that, when the blockchain has an (in)formal governance structure, it is no longer truly decentralized. This can be translated as if there is governance, there is no decentralization, and if there is decentralization, there is no governance. They cannot exist together. Werbach coined this as Vili's paradox. For Werbach, this is the beginning to think about the blockchain and its future as the new trust architecture [27]. Although there are many external forces on the decentralized blockchain's path, such as regulatory challenges and new applications, the real challenge will be the blockchain's ability to create a new form of governance, says Werbach.

An important factor is the distinction Lehdonvirta makes between applying the rules and making the rules. The first refers to the functioning of the blockchain. He states that by a blockchain's design, applying the rules is done in a decentralized manner. However, the same cannot be said for making the rules, as the blockchain itself is a product of rules. These man-made rules are probably not perfect and need to be adjusted or updated from time to time, an effort that will require a centralized third party. With that, Lehdonvirta demonstrates that in the foundation of the decentralized blockchain lies a governance problem. He continues by stating that once you address the governance problem, you might realize that you possibly no longer need a blockchain. However, you might still want it. That, according to Werbach, requires a governance structure that can apply to multiple blockchains, include multiple stakeholders, and use multiple tools to coordinate. One might see that as sheer impossible and, by that, as supporting the paradox. It does support the author's view, however, that blockchain governance is very much divers and situational, and far from a 'one size fits all' type construct.

Who:	**Running the code**	**Changing the code**
Filippi et al. (2016)	Governance by the infrastructure	Governance of the infrastructure
Lehdonvirta (2016)	Applying the rules	Make the rules (governance)
Ølnes et al. (2017)	Governance by the blockchain	Governance for the blockchain
Liu et al. (2022)	On-chain governance	Off-chain governance
Laatikainen et al. (2023)	Blockchain system aspects (business, legal, technology regulatory).	Roles, rights, incentives, and responsibilities of the actors in the blockchain.

Fig. 1. Chronologic overview

The distinction Lehdonvirta makes between applying the rules and making the rules has also been observed by others, most notably Filippi et al. in 2016 prior to Lehdonvirta's speech [2]. They noted a difference between governance **by** the infrastructure and governance **of** the infrastructure. This was followed by Ølnes et al. who identified governance **by** the blockchain and governance **for** the blockchain [18]. In more recent years, Liu et al. (2022) and Laatikainen et al. (2023) also recognized a difference. Lui et al. made a distinction between on-chain governance versus off-chain governance [14]. Laatikainen et al. took a different perspective and made a distinction between the aspects of the blockchain system versus the roles and rights of the actors in the blockchain [12]. All make a clear distinction that is summarized as running the code and making the code. A chronological overview is represented in figure number 1.

Looking at Bitcoin and Satoshi Nakamoto's assertion that he had created a system that operated without relying on trust [16]. Werbach argues that Nakamoto created a system that eliminated the need for a third party to validate transactions [27]. That is, however, only one aspect of trust, or better said, blockchain decentralizes the enforcement of the rules, not necessarily the making of the rules. Although Lehdonvirta feels that it is hard to separate the two, he defines governance as private rule making and qualifies public rule making as

regulation [26].

In her landmark work Governing the Commons, Ostrom notes that community-based management and user participation are suitable alternatives to state- or market-based solutions [19]. This insight is well reflected on the blockchain, where the participation of users and community-based management are key to success. However, that is not without challenges. In their paper Shackelford et al. point out that ever since the beginning of the Information Age, the struggle with addressing privacy, security and cryptography and the involvement of third parties insecurity persisted [22]. This led Szabo, perhaps driven by frustration, to theorize about what he called the God Protocol, a trusted third party that creates undisputed security [24]. However, Shackelford et al. and Szabo's assessment are a turning point for the way we think about third parties and trust. Satoshi Nakamoto put this issue at the center of the white paper [16]. They all point to the fact that close attention must be paid to the relation between how systems are developed and how they operate. Lehdonvirta calls this the distinction between the making and the enforcement of the rules.

Lehdonvirta and Werbach challenge the co-existence of governance and decentralization. There are two reasons why this is interesting to investigate. To begin with, governance is addressed by virtually all blockchains in some way or another, so at first glance it seems that for most blockchains there is in fact no paradox. Furthermore, the paradox is not a well-known phenomenon as there are not many references available to support the paradox. This makes it an interesting question to pose to the respondents in order to allow for further analysis and discussion.

III. The Delphi Method

A. The Research design

This paper is part of a larger empirical study focused on blockchain governance. The main purpose was to identify what defines blockchain governance and to look at factors that impact or contribute to it, like the human factor. The Delphi method was chosen as the research method, as this allowed for a deeper understanding of blockchain governance and its contributing factors. The opinions of well-known and internationally recognized blockchain experts were sought. This so-called nominal group technique aims to converge experts' opinions on a particular topic [3]. As a consensus methodology, it can produce very relevant results, for example, in determining the relevant factors at play [8]. For the question on the paradox, consensus on the existence of the paradox was not the aim. Rather, a wide inventory of opinions was done in order to get a better understanding. Although empirical research such as the Delphi method can be prone to bias, mitigation measures such as multiple people in the research team were taken to prevent this [6]. Once the respondents had answered the questions, the results were coded, so the relationships between the responses could be analyzed [4]. The approval for the empirical study was granted by the University Ethics Committee. Before approval, the questions and selection process were discussed and agreed on in the research team and supported by the Department's empirical and methodological unit. A total of five questions (one main question plus four follow-up questions) were sent to the nine respondents, potentially yielding 45 responses. A total of 39 responses were collected, which are given in sec IV for the main question, and in sec. V-A through sec V-D for the follow-up questions.

B. The respondents

Ten to twenty-five respondents are suggested for a Delphi group, although there is no empirical research to justify this [15]. The quality of the respondents is the most crucial component in Delphi; therefore, selecting or getting access to the right respondents is an essential step. For the selection of the respondents, the following criteria were applied. Respondents should (a) represent a decentralized blockchain, (b) have extensive practical, hands-on experience, and expertise in a decentralized blockchain project, and (c) have a good reputation in the ecosystem. Based on these three criteria, ten potential respondents were recruited from the author's own network, as he has been active in the blockchain community for more than ten years. Due to time constraints, one of the respondents opted out, resulting in nine respondents for the Delphi group. Each of the nine respondents represented a different project. The seven projects that can be named are: (1) Litecoin, (2) Algorand, (3) MakerDAO, (4) Digibyte, (5) MetaBrands, (6) PIVX, and (7) Syscoin. These projects and respondents represent a good cross section of the decentralized blockchain.

C. The main question: Relationship Governance and Decentralization

During the Delphi study, over a three-month period, a total of seven main questions were asked, some with subquestions. This resulted in sixteen questions presented to the respondents. This paper discussed the sixth main question of the study, and its focus was on the relationship between governance and decentralization (the paradox). The earlier questions asked were what attributes define blockchain governance and how these attributes should be seen. The paradox is explained in sec. II.

The main question was as follows: *Kevin Werbach (Wharton University) in his book "The Blockchain and the New Architecture of Trust" quotes Vili Lehdonvirta (Oxford Internet Institute) on page 133-135 who says: "With governance there is no longer decentralization. But with decentralization at any interesting scale, there must be governance [27]." This is what Werbach calls Vili's paradox. In the simplest terms this means that to Vili decentralization and governance are at odds. Do you (dis)agree with Vili's paradox, and why, or can there be a compromise?*

IV. Results

There was an overwhelming rejection of the existence of the Vili paradox; see figure number 2.

Do you (dis)agree with Vili's paradox?	
Agree	1
Disagree	8

Fig. 2. Responses to Vili's paradox

Only one respondent agreed with the paradox, be it that this came with a nuance. This respondent made a reference to Werbach's 'trust but verify' paradigm and stated that humans - in principle - simply cannot be trusted [28]. Any possibility of human involvement will ultimately result in the system being manipulated, and therefore the paradox needs to be accepted. This manipulation is why many blockchains try to mitigate, for instance, by open source transparent code and by decentralizing the governance over the nodes. Despite the fact that the other respondents rejected the paradox, many indicated a certain degree of sympathy with the notion of the paradox. This was often related to respondents knowing examples of where governance leads to a reduction in decentralization, the acknowledgment of a potential conflict of interest, or understanding that there are governance challenges related to scaling the blockchain. In their motivation, the respondents who reject the paradox noticed a division into three categories, namely Lehdonvirta's definition of governance, a reality that is different and the paradox lacking nuance.

The first group of respondents rejects the paradox based on Lehdonvirta's assumed definition on governance. In these comments, it was felt that Lehdonvirta's interpretation or definition of governance on the blockchain was inaccurate or in more neutral terms different from theirs. One respondent asks, "Is the paradox wrong, yes. Is Lehdonvirta correct, often. But a conflict of interest does not mean that there is a paradox." Furthermore, one respondent felt that Lehdonvirta wrongly conflates governance with authority, for instance, in decision making. Governance is often seen in a centralized context. Governance and centralization are, however, two quite different things. Centralization is the process where authority is moved to one central place, while governance provides the structure that is used to make decisions. Governance can be centralized or decentralized. In that sense, it is not uncommon that there is confusion between the ideology of governance and centralization. Governance can be very decentralized, allowing people to come and leave as they please and also to apply their influence as they please. Even decentralized systems were built by humans, which is still a human element. Another respondent felt that saying governance removes decentralization is disproven by reality, as a project like Bitcoin shows. A tool for execution can be as open or decentralized as it is designed to be. The contradiction Lehdonvirta is trying to pull out is that governance has control over something, and control is a centralizing force. That perspective is perceived by respondents as flawed. Lastly, it was seen that the premise of Lehdonvirta that humans need to be governed is questionable. Governance is perhaps seen by Lehdonvirta in a state perspective, where substantial centralized control is necessary, for instance, in managing the economy or financial sector. From that perspective, it follows that humans and their activities must be governed. That is a very arbitrary point of view according to one respondent. Most people are not unhinged and, therefore, do not need to be controlled in every aspect of their lives. This was something already noticed by Plato when he stated that good people do not need laws to tell them to act responsibly, whereas bad people will find a way around the laws [20]. What we do need is a method to arbitrate disputes in a non-violent manner.

The second gfroup of respondents rejects the paradox based on their own observations. Especially the fact that a large group of people, not being physically present, not knowing each other, can arrive at key decisions, would simply prove Lehdonvirta wrong. This is illustrated by the fact that the current Bitcoin protocol is not the same as when it was launched. Changes have been successfully implemented, debates have been held, and consensus has been reached. Over the years several upgrades and forks happened, proving that governance is a living thing and a much needed tool to govern the evolutionary process with known rules that can be modified under exceptional conditions. Another respondent states that there are numerous instances in which decisions are made in a decentralized manner through soft forks and similar mechanisms. These decisions and processes are far from centralized in their development, activation, or deployment. This was most notably seen in the Bitcoin blockchain, which has deployed several features and fixes, despite not having anything remotely close to a centralized governance structure. Another observation was that if a system that is originally designed for a specific function and becomes obsolete or vulnerable to exploits, one does not simply let it perish because of a fear that adding a governance model humanizes it and by that makes it more centralized. Intervention would be the logical course of action. Furthermore, the implementation and reliance on open source code, the 'trust but verify principle', decentralizes the governance and disproves the paradox. In fact, the introduction of governance has led to a significant reduction in the centralization of decision making, for instance, eliminating single points of failure according to one respondent. Additionally, it was felt that Lehdonvirta sees governance and centralization as part of each other. But just because a large group of people can arrive at a decision, it does not mean that it is centralized. Additionally, it seems according to this respondent that Lehdonvirta sees blockchain governance as something that can be controlled. It cannot and control is a very centralized notion. Several respondents felt that it is a mistake to assume that governance is "centralized". The same principle applies to a blockchain entity, say a DAO [9]. As a DAO eventually 'acts as one', that fact in itself does not make it centralized. Unified or having reached consensus can be seen as unified, not as centralized.

The third of respondents rejects the paradox because it lacks nuance. That lack of nuance can be applied to the paradox itself as well as to the rejection of the paradox. We begin by adding nuance to the acceptance of the paradox. Completely ignoring the paradox is most likely naive. It is

therefore argued here that it is better to see the paradox as a cautionary tale. It is important to realize that the blockchain is still in its early days and mistakes will inevitably occur. As one respondent said, “We are learning and will figure out to further avoid the paradox.” Although most respondents are sympathetic to the paradox and can see why Lehdonvirta has formulated it, they do reject the paradox. The simple reason to accept the paradox is to see that there are many examples of failed projects, which could be proof that the paradox is true. In that case, it needs to be ruled as a project that is no longer decentralized. That might be seen as splitting hairs, but it is nevertheless an important distinction. However, this reasoning can also be an oversimplification. The general sentiment was that decentralization and governance are not at odds; they are simply two moving parts in an ecosystem, a living system, that are directly related to each other. This is especially seen in the fact that the blockchain space has a high degree of experimentation. Thousands of blockchains have been created that address complex technical, social, and financial challenges. They do this each as a new chain, and each new blockchain will ultimately face new disputes. That is an opportunity to learn from successes and failures, which, eventually, will identify the right compromises to avoid the fate Lehdonvirta predicts. Simply because a large group coming together to make decisions is not centralization by definition, as was also pointed out in the previous section.

V. The follow-up questions: Where does Decentralized Governance stand

When the Delphi study was designed, it was not expected that a single open question would exhaustively address the relevant aspects of governance and its relationship to decentralization. In that light, four follow-up questions were asked. These questions are a little more curious in the sense that they look at philosophical aspects of governance. For instance, does blockchain make governance obsolete, what role does the notion of being immutable play, and if something needs updating, should it be the technology or the governance?

The following introduction to the four follow-up questions was given to the respondents. ”An interpretation of Lehdonvirta’s paradox could be that there is a need for new governance and to abolish all old, and perhaps even challenge the need for governance altogether. Blockchain by its design is deterministic and immutable. The ecosystem in which the blockchain operates is subject to change, making it far from deterministic and immutable. In that light a fork can be seen as where change and immutability come together. That raises interesting questions, which you are invited to comment on.

1) *Does blockchain with its deterministic nature make current/old governance models obsolete, or even bolder stated: Does blockchain need governance?*
2) *What aspects/features of technology can governance be used for?*
3) *Should we strive for situational (replaceable, updated from time to time) governance or situational technology?*

Does blockchain make governance models obsolete? (Does blockchain need governance)	
Blockchain needs governance	4
Depends on the blockchain	2
Blockchain does not need governance	2
No response	1

Fig. 3. Responses to seeing governance as obsolete.

4) *Does ephemerality (something not being permanent but transitory), as seen in forking and migration, solve the immutability constraints of a broad governance solution?*

The respondents were asked to pick one question, but were left free to answer all four. Most of the respondents answered all four additional questions.

A. Follow-up question 1: Is governance obsolete in blockchain?

The responses to the question ”Does blockchain with its deterministic nature make current/old governance models obsolete, or even bolder stated: Does blockchain need governance?” are presented in figure number 3. Respondents who felt that blockchain does not need governance saw governance in a way as overkill and argued that blockchain does not need formal governance. If a need for governance does materialize, it is expected that a natural, informal, social system will emerge that is based on the exact needs and requirements of that blockchain and its community. Such an informal system will still leave room for a fork option if people do not agree with any given consensus-based decision. The absence of governance from inception should be seen in this light. Another respondent argued that provable computation obviates the need for most dispute resolution: there is the reliance on computation, generating a deterministic outcome. Rarely is there a need for governance.

The respondents who did feel there is a need for governance could rubric their responses into three categories, namely blockchain is deterministic, governance as a concept, and the need for governance. When seeing the blockchain as deterministic, it was felt that only something that does not change will not require governance. If there is a need for change or the ability to meet new challenges, there is a need for governance. A blockchain as deterministic limits the ability to learn. According to two respondents, the blockchain is not fully deterministic, as there is still a lot of randomness in the blockchain, for instance in the ordering of transactions within a block. That makes looking at blockchain as purely deterministic also a little naive, as blockchains have shown to evolve over time, for instance in protocol upgrades. As for the need for governance, each blockchain is deployed for a specific function and will therefore have different goals and needs. Therefore, there is simply no standard blockchain model, which underscores the need for blockchain governance. One respondent summarized his response by stating that governance is not being made obsolete by blockchain, but on the contrary, governance can complement it.

Two respondents argued that they could not make a clear choice, as in their view it depends on the blockchain itself, its goals, its community, and its place and role in the ecosystem. That was predominantly related to the need for change in that blockchain. If there is no need for a lot of change, then governance becomes obsolete. If a blockchain is faced with challenges, there is a need for governance.

The general sentiment of the respondents was that a system that can adapt in the right circumstances is still better than a system that is rigid and untrained.

B. Follow-up question 2: What can governance be used for?

The answers given by seven respondents centered on the aspects or characteristics of governance that, in their view, could be used. In their responses, two separate categories emerged, namely use cases and decision making. In the first category, use cases, respondents listed four specific tasks or features for governance, namely guide protocol configuration, manage smart contracts, facilitate code changes, and manage token issuance. The second category centered on aspects of decision making that in their view would benefit from governance, for instance, how to form a consensus, how to support collaboration, and where the top or priority decisions are made. This was also reflected by a respondent who sees governance as a provider of legitimacy in decision-making. This can be seen as a procedural justification: if the process is fair, the final decision becomes acceptable even if it is not the desired outcome for a particular blockchain participant.

In addition to those two categories, the respondents made additional comments that can be best described as technological constraints of governance. To begin with, technology is a tool, and users decide how to use it. This implies that, simply said, governance has its limitations. The second comment said that technology can be used for governance, but not vice versa. This can be interpreted as meaning that technology cannot be governed, according to this respondent.

The remaining responses were more contemplative about governance, like describing the higher purpose of governance. One respondent felt that governance offers guidance as to how to respond in different situations, and aptly surmising that governance allows us to respond to the unknown unknowns. Another respondent felt that governance offers legitimacy. It could be argued that this is comparable to accountability as often seen in corporate governance. That same respondent added that governance is necessary when collaborating with other stakeholders, for instance, if multiple points of input are needed.

The two comments that stood out the most and were seen by the researcher as the most valuable were as follows. The first observation is complex and part of a long response and might not be easily understood outside the lengthy and frequent dialogues between the researcher and the respondent. First, he makes a distinction between governance as a standard operating procedure (SOP) and as preemptive dispute arbitration (PDA). The respondent specifically rules out post hoc governance, as that is the realm of the judicial processes. The first, the SOP, has severe limitations as the scope and context easily become too broad. PDA is not much needed in a blockchain as most issues are eliminated by provable computation. This aligns with the blockchain having pretransactional compliance. But the respondent still sees a use for PDA, namely if it is contextualized as an SOP to initiate actions. This is driven by the notion that not everything is deterministic, and nondeterministic systems are prone to failure.

Should we strive for situational governance or situational technology?	
Technology is situational	2
Governance is situational	2
Both are situational	3

Fig. 4. Responses to seeing technology or governance as situational.

The second observation summarized what governance is ultimately, namely a tool that helps navigate through the unknown unknowns. That is, according to this respondent, the ultimate use case for governance. This summation, navigating the unknown unknowns, is embraced here as the perfect description of what (blockchain) governance ultimately is and should be.

C. Follow-up question 3: Should technology or governance be situational?

In the previous responses, the respondents indicated that they see an interdependence between technology and governance. It is therefore worth exploring how they see that interdependence, and if one of them needs to change, should it be the technology or the governance? In other words, is technology leading and governance needs to be adapted to it or is it the other way around, and technology should be adapted to governance? It is often not as black and white as stated above, so the question might be rephrased as: should we strive for situational (replaceable, updated from time to time) governance or situational technology?

The responses did not show a strong preference for any specific category, but were more evenly distributed, see figure number 4.

The two respondents who see technology as situational see governance more as an independent variable. They indicated that the governance model at its core, namely the principles and values of governance, should not be adjusted. One respondent listed open source code as an example, a core principle that should never change. In addition, it was felt that it was better to adjust technology and not to alter the principles or values of governance. Additionally, it was mentioned that blockchain, as an immutable system, should be treated as ephemeral. That short-lived perspective makes it logical not to alter the governance but the technology instead. Technology may fade or be replaced, but the governance model is always the same. Both respondents nuanced their choice, saying that one should not strive towards replaceable governance but make it updatable instead.

Those respondents who see governance as situational motivate their position by stating that situational governance can

guide technology much better than the other way around. Keep restarting the governance until you find a way that makes it work. Technology will naturally change and progress, and we as a society can only take advantage of it if we have a (flexible) governance model that allows for that. Also, the other way around - restarting a new governance model each time the technology changes - is not only much harder but also time-consuming according to this respondent. Another respondent took the community angle and argued that governance can more or less constantly change or evolve as the community forms a social consensus based on its needs. Technology changes only on the basis of upgrades and updates. An interesting observation of this respondent was that the effects of evolving the governance are less dangerous than evolving the technology, for instance, by updating the mining algorithm. The lesson learned should be to recognize that governance needs to evolve, but not to strive for its evolution.

When both governance and technology were seen as situational, respondents see governance and technology as intertwined. Governance and technology only have meaning in the context of its users and its environment, so cannot be split, nor should they be seen apart. When both governance and technology are seen as situational, adaptability is enhanced. Seeing governance and technology as intertwined and situational leads to robustness of the technology, which in turn results in more decentralization as it respects, for instance, open source development and community participation. As a general observation, it was mentioned that it is important to acknowledge evolution and the evolutionary nature of both technology and governance. They only have meaning in the context of their environment and their community, or as another respondent put it, technology and governance are in no way mutually exclusive.

One respondent took a more philosophical approach and stated that although the blockchain is an immutable, and thus perpetual system, it is important to see and treat both blockchain and governance as ephemeral. There is no need to focus on trying to solve every possible problem right now, but simply solving the problems relevant to the current matter and only for as long as it exists. That means that there is a need to plan and prepare for deprecation and subsequent migration to new systems. This will lead to inevitable fragmentation and chaos, but that is ultimately a good thing.

D. Follow-up question 4: Does ephemerality solve the immutability constraint of blockchain?

Most of the respondents found that ephemerality solves the immutability constraint of blockchain. None of the respondents disagreed with the premise of the question. The results are given in figure number 5. The respondents who agree with the premise of the question, namely seeing ephemerality as solving immutability constraints, all pointed towards forking as the reason of their choice. Forking and migration are great examples of why nothing is truly permanent according to one response. Even for something seen as permanent, if everyone decides to stop using it, it was not as permanent as thought.

Does ephemerality solve immutability constraints of a broad governance solution?	
Yes	6
No	0
Sometimes	1

Fig. 5. Responses to ephemerality.

The fork must be seen as the ultimate counterbalance tool for the community when there is poor governance or insufficient decentralization to still express their views. Additionally, forking is also a tool as it gives freedom to experiment and provides a way forward when there is not enough consensus. It was also observed that a nice side effect of a fork is that the original chain remains in existence and remains immutable. Lastly, it was noted that if there is a fork, which means there is a new blockchain, that will come with its own and new governance.

However, respondents also made some nuances to the notion of constraints. To begin with, it should be noted that forking may be a solution, but it also does not solve the underlying problem that led to the forking in the first place. Furthermore, a certain degree of flexibility, or adding a flexible component to an immutable system design, can help relieve some of the downside of immutability, as a fork is a drastic and permanent solution. Having a governance model that does not need to fork and can be migrated instead remains therefore a strong aspiration.

The respondent who felt that ephemerality sometimes solves the immutability constraint of blockchain felt that although ephemerality can solve the constraints of immutability, it can often introduce new social problems. A fork or development of off-chain activities negates some of the key positives that blockchain delivers like immutability, according to this respondent.

As a general observation, it was pointed out that technology remains immutable, even after forking, regardless of whether it is used or not. Also, nothing is permanent, and forking – love it or hate it – proves just that.

VI. Discussion

The author supports the general sentiment of the respondents and does not see a paradox. The respondents made some very apt and to the point comments and observations. Together, these comments can be broken down into three reasons why the paradox needs to be rejected. To begin with, the interpretation the respondents have of Lehdonvirta's definition of governance as a control mechanism is not necessarily applicable to the setting of the blockchain. Additionally, the reality of the blockchain shows clearly differently. People in large groups, spread all over the world, can work together and still arrive at decisions. Furthermore, the paradox, by its sheer nature, already lacks nuance as it is never so black and white. This nuance should be applied to both accepting and rejecting the paradox. Accepting the paradox would imply that there cannot be blockchain governance. On the other hand, rejecting the paradox and ignoring its possible consequences

is naive and can seriously jeopardize decentralization. Nuance, looking at different perspectives, is useful.

In explaining their choice in more detail, the respondents mention that governance should not be seen purely as an authority in decision-making. Even more so, equating governance with making decisions would be a flawed assumption. Governance in itself does not provide decisions; it provides boundaries and guidelines for a procedure for those who do. Bitcoin demonstrates that governance can be decentralized, and the blockchain is a learning entity that aligns governance and decentralization in a constant and ongoing experiment. Apart from these reasons, the main objection to the paradox is that it is a generalization that omits the principle of compromise. The principle of compromise and, related to that, the consensus mechanism, lie at the core of the decentralized blockchain. A key principle of decentralization is that at no point in time anyone can take control over the system or reduce the voting power of any other stakeholders. If these principles are not compromised, the paradox simply cannot be true. In short, governance is a means that gives legitimacy, not a means that gives control. In this research, it was found that the distinction between legitimacy (the procedure) and control (taking decisions) is important and, therefore, agrees with the respondents. The premise of Lehdonvirta that humans need to be governed was seen as questionable by respondents. It might be that Lehdonvirta had a statism perspective on governance. The author would not be surprised that this was perhaps driven by sentiment that blockchain was in its early days, and there simply were, apart from bitcoin, not that many reliable projects around to disprove the paradox.

Technology is constantly updated, evolving, and often moving in a fast way. That can be challenging, as regulators often realize [5]. That regulators are often forced to catch up with technological innovations should also be an indication for the blockchain community to constantly be alert for their governance. Here, too, complacency can be potentially detrimental. There is simply no one-size-fits-all governance model or a forever governance model. If the technology - or market in which it operates, for that matter - changes, the governance needs to be reviewed and possibly updated. Technology, its use cases, the market in which it operates, the community, and its governance model can be seen as a fine balance, an equilibrium. If one component is changed, it will inevitably have an effect on the other components.

One particular aspect needs to be pointed out, that is, the blockchain community. The blockchain community is seen here as an important representative and guardian of decentralization. The outright nature of blockchain is the phenomenon of being permissionless. This means that people can freely join a blockchain, but also freely leave. In that sense, there is no commitment or obligation from the community to actively participate, engage, or be scrutinous. In a way, decentralization and its future are put in the hands of the community. Those who decide to show up can determine the outcomes, which is an Achilles heel of blockchain. Or, as Plato put it, "The price good men pay for indifference to public affairs is to be ruled by evil men" [21].

Finally, the author also suspects that the blockchain track record might play a role in reviewing governance. For example, there have been numerous blockchains that have turned out to be fraudulent [29]. It would be inaccurate to see these deliberate fraudulent blockchains as a proof of ineffective governance or the validation of the paradox. Malicious actors will always see opportunities, irrespective of the channels they use. That negative focus is not reflected in the blockchain or its governance, as the whole concept of Bitcoin, for instance, is to establish a robust and temper proof system and avoids fraud altogether.

VII. Critical reflection on findings

When discussing the findings of the research with peers, the findings themselves were considered logical and acceptable. The questions that were raised were centered on the methodology. The author feels that it is therefore warranted to apply a critical self-reflection on the methodology that was followed. In any research, it is crucial to be transparent and critical of the methodology applied. Results can only be taken seriously when and if the research methodology is followed lege artis. This study has tried to apply the highest standards possible in order to ensure an acceptable outcome. However, there is always room for critical reflection of its findings. This study is no exception to this.

An important element are the respondents used in this research. The respondents enjoy anonymity and can therefore not be named. There are valid reasons why this is so, for example, in researching sensitive topics. Anonymity should be seen as an ethical research principle that cannot be compromised and helps provide credibility [10]. Lack of it can cause harm to respondents, which should be avoided at all times. But not knowing who the respondents are can also hamper credibility. The author has been actively involved in the decentralized blockchain for more than ten years and has built an extensive network. The respondents used for this research have been recruited from that network. By naming the projects in which the respondents have participated/are involved, the author hopes to mitigate this concern.

As to the projects in which the respondents participated, that has not necessarily been an inclusion criteria. The respondent's track record and reputation were more important than the project he or she represented. In other words, the reputation of the project does not reflect on the person who participates in it.

There may be concerns that the number of participants in the Delphi group was not enough to validate its findings. In the available literature, there are conflicting numbers of participants required, as Manyara points out [15]. The author believes that the quality of the respondents is more important than the quantity.

The methodology followed may also be of interest. In an early stage, close cooperation was established with empirical and data management support from the author's department. The author was supported throughout the research by them,

which has been of great value. Obviously, approval was sought and given by the Ethics Committee. Lastly, the author has been in close contact with the other member of the research team from ideation to execution, reflecting on the methodology, the questions, the respondents, the responses, and all other research-related issues, providing ample critical and above all useful reflections.

It is also important to reflect on the questions asked in this research. Again, the questions in this paper provide insight in the paradox, but are part of a larger study. The main topic of the research, decentralized blockchain governance, has been a topic of interest to the author for many years and is driven by practical experience and observations. Especially having observed that blockchain governance is variable, open to interpretation, and can be impacted by different factors motivated this study. The paradox has been a topic of personal interest as it forces us to critically reflect on the essence of governance and decentralization. The questions have been tested in a close setting to ensure that the questions were understood and provided relevant input. This validated the questions.

For the first part of this study, defining blockchain governance, the respondents were invited to reflect and comment on each other's findings, and form a consensus opinion, which is an intricate part of the Delphi study. Later questions, like discussed in this paper on the paradox, did not seek a consensus and can in that sense be seen as a survey more than Delphi.

VIII. Conclusion

The results of this empirical study reflect on the relationship between governance and decentralization. This was done by examining the paradox. The purpose was to provide more clarity on the way blockchain governance and decentralization interact. The author rejects the premise of the paradox and sees that governance and decentralization coexist. There might be a challenging relationship, and oftentimes there is a fine balance between them, but the author finds them harmoniously existing alongside of one another. If an open source code-base with thousands of developers around the world, where people can voice their opinions, discuss, and ultimately suggest code, can work together and improve a decentralized protocol, this surely is proof of how decentralization and governance coexist.

Thinking critically about governance and decentralization is an essential step in the development of a sustainable blockchain ecosystem. As one respondent pointed out, ignoring the paradox is naive. Critical thinking is especially important in the blockchain, as there is already a high reliance on, and subsequent confidence in the underlying technology. Not challenging technology, not challenging governance, and not challenging the level of decentralization is a deference to a potentially unwanted reality. This is in a neat way related to what Lehdonvirta meant when he said that it is not only important to review how rules can be changed, it is more important to look at how these rules were made in the first place [17]. The above could be summarized into the popular phrase, don't take things for granted. As Andy Grove famously said, complacency breeds failure [7]. This makes the paradox a cautionary tale, and by doing so it becomes important and relevant for the future of the blockchain.

On a final note, the sheer fact that Lehdonvirta and Werbach identified the tension between governance and decentralization is precisely what is needed to ensure a successful and sustainable blockchain of which governance is an intricate part. For that alone, bringing the topic to light has had and will have great value.

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