Identifying Influence Mechanisms in Permissionless Blockchain Communities: The Bitcoin Case

Completed Research Paper

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Abstract

Research on Bitcoin blockchain suggests that the inner-working of Bitcoin is not decentralized. Building on such findings from previous research, this paper identifies 'Bitcoin influencers' who are central to the operation of Bitcoin. These influencers are identified by performing social network analysis on the mailing list conversation during the implementation and activation of two Bitcoin blockchain rule changes i.e. 'Versionbits' and 'Segregated Witness', and implementation of one Bitcoin blockchain rule 'Taproot'. This paper further examines the activities of these Bitcoin influencers on a mailing list and IRC chat. Our findings suggest these Bitcoin influencers are steering the decisions to enact new rules for the Bitcoin blockchain. In order to do so, these influencers are using various tactics to seek support from other members and enact the Bitcoin blockchain rules. In this way, this paper argues Bitcoin influencers are guiding the operation of Bitcoin blockchain nodes, thus, governing the Bitcoin community.

Keywords: Bitcoin, Influencers, Governance, Decision-making

Introduction

Permissionless blockchains are understood to be an organizational technology that can algorithmically govern its members' interactions without intervention from governing bodies or centralized authorities (Miscione et al. 2019). Instead, the participating members self-organize following peer-to-peer principles (Andersen and Ingram Bogusz 2019). Thus, blockchains facilitate distributed participants with various interests and motives to agree on and follow shared organizing principles without direct authoritative intervention (van Pelt et al. 2021), confirming Clark's motto "We reject: kings, presidents, and voting. We believe in: rough consensus and running code" (Clark 1992).

Bitcoin – the first blockchain-based cryptocurrency, was introduced in 2009. Bitcoin has been designed as an open-source, decentralized cryptocurrency that renders intermediary financial institutions such as banks superfluous for performing financial transactions (Nakamoto 2008). This vision dates back to *cyberpunks* and *crypto-anarchy* movements in the early 1990s, which envisioned a free market and a society that will be governed and managed by algorithmic code (Swartz 2018). The governance of the Bitcoin blockchain follows peer-to-peer principles, putting trust on honest network nodes (Maurer et al. 2013). Such a governance mechanism implemented in the Bitcoin infrastructure is supposed to distribute power

into the hands of users rather than being concentrated in the hands of intermediaries or governing bodies (Nakamoto 2008; Zamani 2019). However, recent research suggests that this vision does not reflect the reality of the Bitcoin community (Vidan and Lehdonvirta 2019). Results suggest that a few powerful individuals pull the strings in Bitcoin and look after the Bitcoin operation (Filippi and Loveluck 2016; Musiani et al. 2018; Parkin 2019). Prior work studied technical and social issues in Bitcoin and concluded Bitcoin has a micro-hierarchical structure (Musiani et al. 2018). It stated the core maintainers are in a superior position. Similar insights were observed by other researchers (Filippi and Loveluck 2016; Parkin 2019). Furthermore, Zamani (2019) highlighted that power in Bitcoin is not decentralized but possessed by certain groups such as mining pool operators, core maintainers, and Bitcoin traders. Such insights were also captured by Vidan and Lehdonvirta (2019) in their study of Bitcoin, concluding that there is a gap between Bitcoin's promise of decentralization and its actual implementation. These researchers have noted that the mining process is defacto centralized in mining pool operators, users' voice is spoken by business firms or traders, and the development process is centralized in core maintainers. They have postulated that mining pool operators, Bitcoin traders, and core maintainers have the power to decide on behalf of the community. However, it remains unclear who these influential individuals (henceforth "key members") are and how they achieve and leverage their influence to steer decision-making in Bitcoin.

This gap encouraged us to delve into the organization of the Bitcoin members and investigate how the final decisions on blockchain rule changes have been made in Bitcoin. In this regard, this research builds on the findings of Filippi and Loveluck (2016). They studied Bitcoin's block size debate and stated that it has two highly interdependent governance layers: 'governance by infrastructure' and 'governance of infrastructure'. The 'governance by infrastructure' layer is comprised of *users* and *miners* as blockchain network nodes. In contrast, the 'governance of infrastructure' layer includes *software developers* and other stakeholders (can be miners' representatives or users' representatives). Software developers devise new rules, and for its enactment, they need the support of the *miners* and *users*. Hence, the governance of infrastructure is materialized in the rules of the technology artifact imposed upon the users and miners (Rossi et al. 2019). Following the work of Filippi and Loveluck (2016), we will look into the governance of Bitcoin's blockchain infrastructure and uncover how decisions in Bitcoin are made highlighting the role of key members during the process. In this way, we show how these key members influence the key decisions and persuade Bitcoin members to join the crew. We aim to answer the following two-pronged research question: *How can the key members in Bitcoin be identified? How do these key members influence important decisions in Bitcoin?*

We address these questions by examining the Bitcoin mailing list, internet relay chat (IRC), podcasts transcripts, and grey pieces of literature over a period of 6 years (2015 – 2020). In this period two important rule changes – 'Version bits' & 'Segregated Witness' – have been activated and one new rule 'Taproot' has been implemented in the Bitcoin blockchain. By sampling communication data and performing social network analysis (SNA) on mailing list data and discourse analysis from the mailing list, IRC chat logs, and podcasts, we are able to uncover how these decisions were debated and negotiated before they were finalized. Our analysis shows that only a few individuals belonging to the software developers group are instrumental in influencing the key decisions in Bitcoin. Furthermore, we uncover the tactics they employ while steering the decision on implementing and activating new Bitcoin rules.

Theoretical Background

Blockchain Governance

A blockchain follows peer-to-peer principles and facilitates the recording of immutable transactions in a decentralized database. The immutability and authenticity of the recorded transactions are guaranteed through cryptographic hash functions. A peer-to-peer network of nodes possesses information of transaction blocks and blockchain, thus can execute transactions on the blockchain (Neitz 2019). These nodes access the blockchain using client software, in which the governance mechanisms of the blockchain such as rules for coordination and interaction between blockchain's nodes are defined (van Pelt et al. 2021). For continuous and effective running of the blockchain rules, the role and engagement of the community members are essential. Moreover, the community members facilitate creating, modifying, and deciding about these blockchain rules. Therefore, an additional governance mechanism facilitating coordination of the community members is needed in the blockchain community (Yeung and Galindo 2019).

These two governance mechanisms have been coined 'on-chain governance' and 'off-chain governance' (Filippi and Mcmullen 2018; Reijers et al. 2018). On the one hand, 'on-chain governance' concerns the coordination rules and interaction processes that are embedded in the blockchain infrastructure for facilitating interoperability of the blockchain nodes. On the other hand, 'off-chain governance' concerns rules and decision-making processes outlined for the development and maintenance of blockchain infrastructure and community. Similarly, van Pelt et al. (2021) identified three governance layers in the blockchain: (1) 'off-chain community' – covering governance on a wider community level, (2) 'off-chain development' – covering the development process of the blockchain software, and (3) 'on-chain protocol' – covering the governance of the blockchain nodes. The 'off-chain community' and 'off-chain development' layers cover similar insights to 'off-chain governance' layer presented by Reijers et al. (2018) as well as Filippi and Mcmullen (2018). Researchers have examined the interplay of these two blockchain governance layers and stated the output of the off-chain community would be an input for governing on-chain nodes (Reijers et al. 2018; van Pelt et al. 2021). Moreover, a decision on implementing new blockchain infrastructure rules is drafted by off-chain community members i.e. software developers and other stakeholders. After the community members agree on new rules, the rules are implemented into the infrastructure, and these rules exert the mechanism for governing blockchain nodes (Filippi and Mcmullen 2018)**.** Once all blockchain nodes adopt the new rules, this becomes the governing mechanism of the entire blockchain (Rossi et al. 2019). While drafting new rules by the off-chain community, conflicts arise and negotiations often take place. This can be because engaging members seek different incentives (Islam et al. 2019), therefore, these members constantly negotiate on new rules. Also, in such a setting, existing rules are considered as a reference for developing new rules (Musiani 2015).

Ziolkowski et al. (2019) define blockchain governance as a mechanism that provides decision-right to different members, which also holds these members accountable for their roles. This definition of blockchain governance suggests that there is a decision-making process and members have designated roles (Beck et al. 2018). In this paper, we adhere to this definition of blockchain governance, and highlight how the roles of the few key members and their decisions can be crucial for 'off-chain governance', and ultimately for 'on-chain governance'.

Bitcoin – a permissionless blockchain, is governed in a layered architecture (Filippi and Loveluck 2016) and Bitcoin governance is contingent on the actions of the community members (Nabilou 2020). The inner working of Bitcoin is based on "deliberation, persuasion, volition, and choice of the members" (Nabilou 2020 P. 30). The Bitcoin blockchain rules are developed by off-chain governance members, however, it is activated only with the support of on-chain governance members (Filippi and Loveluck 2016; Parkin 2019). On-chain governance mechanisms in Bitcoin can not entirely resolve the community dispute and conflicts. Thus, Bitcoin relies on off-chain governance for resolving disputes and conflicts, also for the development of new rules. The important decisions in Bitcoin are made by the off-chain members who can persuade the members to join the new chains or fork the project (Nabilou 2020). Therefore, the roles and decisions of off-chain members are instrumental in the governance of Bitcoin.

Decision-making in Bitcoin

The Bitcoin community disregards the presence of centralized authority for its operation, which is similar to open-source software (OSS)[1] development. Thus, we argue decision-making in the Bitcoin community is similar to that of OSS. In such a setting, a consensual agreement with a majority of community members is reached before enacting a decision. Such a mechanism is also termed explicit decision-making (Eseryel et al. 2020), as any participating members can influence the decisions.

Blockchain members' have diverse interests and motives to participate in the project, and their roles are different. The software developers implement the rules, however, they are not the sole decision-makers. The developers are neither authoritative figures, who decide which rules are deployed, nor do they direct and control the activities of the other members (Ziolkowski et al. 2019). Instead, the decision for new rules is dynamically negotiated between all members; once agreed, the rule is implemented and activated. The

[1] We understand OSS development follows 'do-ocracy' model of governance. See: https://wiki.p2pfoundation.net/Do-ocracy

new rule will recursively govern the organization of blockchain nodes, thus facilitating a stable governance structure (Andersen and Ingram Bogusz 2019).

A similar mechanism is followed in the Bitcoin community. However, Parkin (2019) states few members representing the members' group are having an impact on the decisions made in Bitcoin. Such representative members are in a leading position of the respective group through 'obligatory passage point'[2]. For instance, 'core maintainers' are representing software developers, 'mining pools' are representing miners, and 'traders' are representing users. Moreover, the consensual agreement of the core maintainers, mining pools, and traders can be the final decision for the entire community. Such decision-making is achieved through bitcoin improvement proposals (BIPs) (SFOX 2019). Following the mechanism outlined by BIP, the Bitcoin community reaches a consensual agreement while enacting new rules to the Bitcoin blockchain network. However, the mechanism outlined via BIPs provides high-level insight on how changes are made but does not provide insight into the micro-level organizational process employed while agreeing to a decision in Bitcoin. Therefore, in order to uncover the nuances of decision-making in Bitcoin, we borrow the OSS decision-making framework developed by Eseryel et al. (2020). The framework delineates project-level decision-making in OSS communities practicing internal governance. The framework comprises of four phases: (1) identification – covers problem identification in the current state of software, (2) development – covers discussion and development of the solution, (3) evaluation – covers evaluation and analysis of the developed solution, (4) announcement – concerns the final announcement of implementing the developed solution on a team level. These four phases help to uncover how new changes are implemented in Bitcoin client core software, but they do not cover how consensus on activating new changes i.e. process of transitioning to new rules is achieved in Bitcoin.

In the Bitcoin community, the new blockchain network rules are only activated after the agreement and support from miners and users (Narayanan et al. 2016; Parkin 2019). This is what differentiates the organization of Bitcoin members from other OSS. Therefore, we propose an additional phase 'activation', which covers the process employed for activating a particular proposal or changes in Bitcoin. For this phase, we will adapt the notion of 'lateral influence' used in organizational settings (Ngwenyama and Nielsen 2014).

Lateral Influence

In an OSS community, all members are organizing horizontally and the influencers do not have authoritative control towards the target (O'Mahony and Ferraro 2007). In this sense, the influencers do not possess coercive or reward power to influence the target. As a result, the notion of lateral influence enables uncovering influence mechanisms in such hierarchy-less communities. In the lateral influence process, the influence tactics adopted by the agent can impact the agent itself, the target of influence, and the social environment (Cohen and Bradford 1989).

Ngwenyama and Nielsen (2014 P. 208) have identified five tactics deployed for lateral influence in an organizational setting. These are: (1) rational persuasion – the agent uses logical arguments and factual evidence to persuade the target that a proposal or request is viable and likely to result in the attainment of task objectives, (2) personal appeals – the agent appeals to the target's feelings of personal loyalty and friendship when asking for something, (3) reciprocity – the agent offers an exchange of favors, indicates a willingness to reciprocate at a later time, or promises a share of the benefits if the target helps accomplish a task, (4) alliance – the agent seeks the aid of others to persuade the target to do something, or uses the support of others as a reason for the target to agree as well, (5) use of intermediaries – the agent seeks help from others to persuade the target to accomplish a task.

This notion of lateral influence can be used to describe the influence process in the Bitcoin community because there is no established hierarchy among the Bitcoin participants and all the members are equal peers. Furthermore, the initiator can be selective in using different tactics depending on their nature of the relationship with the peers and the importance of the target for achieving the initiator's objective. Therefore, the initiator should carefully employ influence tactics. This is because some tactics can result in resistance, dispute, or retaliation (Ngwenyama and Nielsen 2014).

[2] Obligatory passage point is path through which coercive actors undertake different strategies to control and guide the operation of the group for obtaining the mutual benefit

Research Method

The Bitcoin Case

Bitcoin blockchain incorporates the engagement of three member groups: (1) software developers – defacto lawmakers as they develop the client software and deploy the rules that govern the Bitcoin blockchain; (2) miners – contribute computational resources to sustain blockchain, also generate new blocks for recording transactions and follow the rules; (3) users – can be categorized into two categories – active and passive users. Active users execute transactions and follow the rules, whereas passive users interact with the blockchain via representatives (Narayanan et al. 2016; Parkin 2019). Figure 1 captures the roles of these members in the Bitcoin blockchain. In addition, all these members should adhere to the Bitcoin blockchain rules, which encompasses information such as block data format, block size limits, mining rewards, transactions signatures, etc. (Lombrozo 2017). These rules are implemented into the blockchain infrastructure via client core software.

Any member can initiate a rule change request via the Bitcoin mailing list (*see: https://lists.linuxfoundation.org/mailman/listinfo/bitcoin-dev*), which is a space for discussing new rules for Bitcoin. All members can discuss the proposal and show their agreement or disagreement with it. If the majority of members agree to this proposal, further development is carried out in GitHub. Particularly, the proposal needs to be approved by the BIP editor – a designated position with the responsibility of examining the proposal and assigning a BIP number. After the completion of the development of new rules, it is implemented to the client core software. This process is led by the core maintainers, who belong to the software developers group.

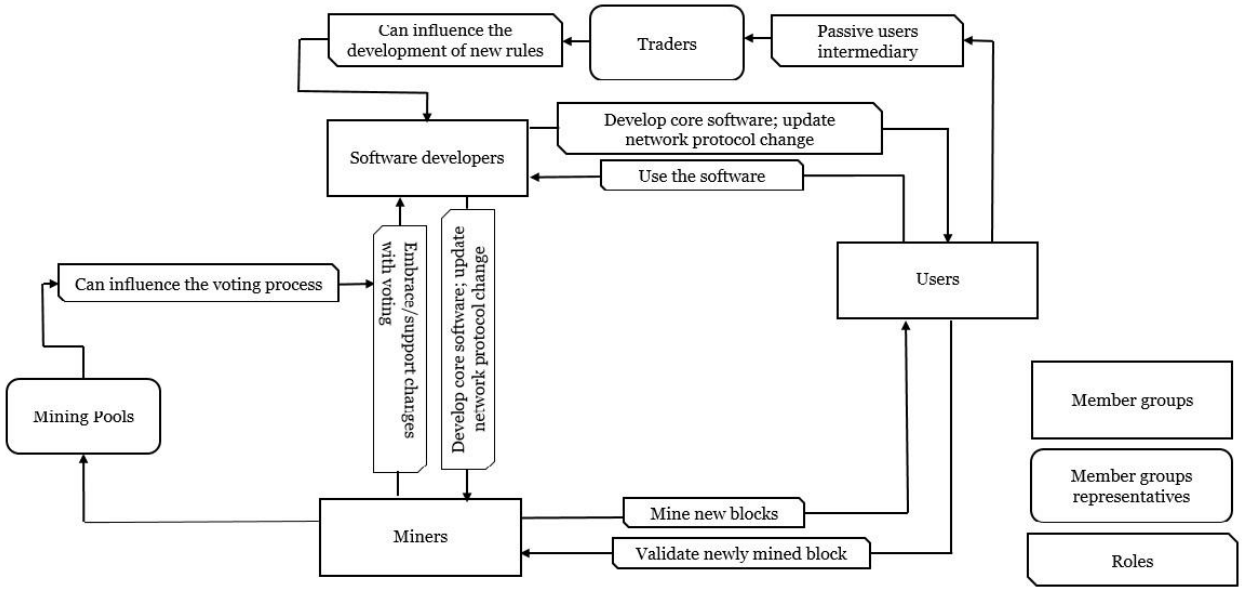

Figure 1: Bitcoin Member Groups, Member Groups Representatives and their Roles

The information of Bitcoin blockchain rule changes is communicated via a mailing list, and an agreement on the implementation and activation process is explored in the same channel. Notably, the software developers group seeks agreement from users and miners. During this process, it is likely that two member groups representatives (1) traders, who represent passive users; (2) mining pools, who represent miners (see Figure 1) can have an impact during the implementation and activation of new rules. On the one hand, traders who obtain transactional benefits from passive users can lobby the development of new rules as they employ the core maintainers. On the other hand, mining pools comprise of many miners and accumulate computational resources, can influence the voting process while activating new rules. In this way, these user's and miner's representatives can influence the implementation and activation of the new Bitcoin rules. Once all members agree on the activation process, the miners can signal support to the new

rules by mining new blocks adhering to the new rules, and the users can signal support by using the updated version of the core software.

Important Changes Affecting Governance Mechanism of the Bitcoin Blockchain

Since its inception in 2009, several protocol changes were made in Bitcoin that have affected the governance mechanism of Bitcoin. We identified three BIPs that we consider important as they brought new dynamics into governing the infrastructural layer i.e. in the interaction of miners and users. BIP 9 gave miners a technical voice for supporting or aborting new rule changes in Bitcoin (Torpey 2016). BIP 141 increased transaction speed by improving Bitcoin block size (Sanghvi 2020). BIP 341&342[3] provided smart contract flexibility and provided transactional privacy of users (van Wirdum 2019). At the time of writing this paper, the Bitcoin community is yet to reach a consensus on the activation of BIP 341&342.

Examining these BIPs provide us with insights into how new protocol changes were debated, met with resistance, ultimately accepted, implemented, and activated. For instance, while activating BIP 141, the community had a turf war between the members' groups, and the activation of this BIP led to Bitcoin split in the form of 'Bitcoin Cash'. Table 1 below provides a brief overview of three selected BIPs.

BIP number and name	**Description**	**Authors**	**Implication of the BIP to the community**
BIP 9 'Version bit'	BIP 9 lays the process of activating soft-forks[4]. BIP 9 allows the parallel deployment of multiple soft-forks.	*M1, M16, M2 & M5*	The application of BIP 9 requires 95% of miners hashing power to activate soft-forks; otherwise, the activation process fails. Thus, opting this BIP to activate soft-forks gave miners legitimate power, which enabled a democratic mechanism for activating soft-forks in Bitcoin. *Benefiting group: Miners*
BIP 141 'Segregated Witness'	BIP 141 saves block space by separating transaction signature into a separate chain. This enabled an increase in the number of transactions that can be recorded in a single block. Also, this BIP provided transaction malleability[5] protection.	*M1, M50 & M4*	BIP 141 brought various benefits to the network such as laying a foundation for layer-two payment protocols like the lightning network (Faltibà and Lo Cigno 2018). Lightning networks facilitate off-chain scaling, but at the same time, it benefits traders because traders can create a separate chain to trade bitcoin with (passive) users and act as an intermediary to (passive) users and the Bitcoin network. *Benefiting group: Traders*
BIP 341 & 342 'Taproot'	BIP 341 & 342 conceals the amount of information about the spending conditions of a transaction output in the Bitcoin network.	*M1, M70 & M39*	This BIP provides user privacy, as the Bitcoin nodes' information such as the type of wallets used and coin spending conditions are not publicly revealed. Thus, this BIP was much appreciated by the developers and users. *Benefiting group: Users*

Table 1. Important Rule Changes in Bitcoin Blockchain

In the Bitcoin community, all protocol-level changes and consensus-level discussions need to be communicated via the mailing list. Thus, it incorporates the conversation of all Bitcoin members. Prior research has argued mailing list archives can contain hidden information that can provide insights into

[3] BIP 341 & 342 concern the development of Taproot. Thus we consider these two BIPs as a single BIP.

[4] Soft-forks is a process of making a previously valid transaction block invalid. It is backward compatible i.e. the old nodes are interoperable with new nodes. Hard-fork, on the other hand, makes previous valid block invalid i.e. only nodes following new rules are compatible.

[5] For more information see: https://wiki.bitcoinsv.io/index.php/Transaction_Malleability

consensus building and decision making, conflict resolution process, group dynamics, or power concentration (Oever et al. 2020; Sharma et al. 2020). We follow this argument and regard the Bitcoin mailing list as a reliable source for understanding the Bitcoin governance mechanism.

Data Collection

We investigated Bitcoin community activities of 6 years from 2015 to 2020. In this period, BIP 9 and BIP 141 were activated and BIP 341&342 was implemented. We manually extracted the relevant conversations from the mailing lists and IRC chat archives by employing different filtering/search approaches depending on the data source. **Firstly**, we looked into the date of implementation and activation of the BIPs and identified the email threads where the discussion and decision relating to these BIPs have happened. The conversation relating to BIP 9 happened in 2015–2016, the conversation relating to BIP 141 happened in 2015–2017, and BIP 341&342 happened in 2018–2020. **Secondly**, we sample the data on a thread level from the mailing list. The email threads that relate to the discussion concerning BIP 9, BIP 141, BIP 341&342 have been manually extracted from a mailing list based on the BIP number as well as name (see Table 1) and all threaded conversations were stored in an excel file. Email threads that do not include either the BIP number or name were excluded for the analysis. One thousand email conversations are selected for the analysis. **Thirdly**, we locate relevant IRC conversations of the Bitcoin core developers by examining the weekly meetings of the developers within the relevant period for each selected BIP because major decisions about Bitcoin core are made by core maintainers in these meetings. Minutes from 350 IRC meetings composed of 3000 pages are considered for the analysis. **Fourthly**, we read blog posts and articles on 'Medium' *(medium.com)*, 'CoinDesk' *(coindesk.com)*, 'BitcoinMagazine' *(bitcoinmagazine.com)*, and extracted the contents relating to these BIPs. In these grey pieces of literature, we carefully looked into the articles that feature stories relating to these BIPs. We listened to the podcasts of core maintainers, miners, and users from the 'StephanLivera' *(stephanlivera.com)* platform and captured the missing linkages. A hundred pages of podcast transcript are considered for the analysis. Beyond mailing list and IRC chat, these additional data sources helped to follow agreement and disputes of the Bitcoin members' groups, and capture the missing linkages.

Data Analysis

We adopt a sequential mixed-methods approach, starting with quantitative insights, which are complemented and substantiated theoretically through an in-depth qualitative inquiry (Venkatesh et al. 2013). **Firstly**, SNA on a thread level of Bitcoin mailing list members is performed along with the computation of the two centrality measures betweenness and eigenvector centrality. Performing SNA on mailing list data can enrich the understanding of the structural position of the Bitcoin members during mailing list conversations. The outcome of the SNA helped to identify the key members of Bitcoin, however, could not show their influence mechanisms. We suspected that these key members identified by the SNA possess the capability to influence key Bitcoin decisions and convince the members to join the crew. Therefore, **secondly**, we performed a discourse analysis of mailing lists, IRC conversations, podcasts transcripts, and grey pieces of literature to unpack the nature of engagement of the identified key members in the Bitcoin community. Although the identity of the Bitcoin key members is openly available, we anonymized their identity (eg. M1, M2, M5 in Table 1 and Table 2) following the social media ethics framework (Townsend and Wallace 2016).

Social Network Analysis

A social network can be described as a graph in which a network member is represented as a node and the relationship of the nodes is identified by the lines connecting them (Yong et al. 2007). Analyzing the social network of the Bitcoin mailing list members helps to uncover evolving relationships of the members, their reply relationships, the structural basis of discourse, and power relations among the actors (Oever et al. 2020). Since our data format is a threaded conversation, we created a reply network. We follow the pattern outlined in Hansen et al. (2010) while creating a reply network. NodeXL 1.0.1.446 software (*https://nodexl.com/)* was used to perform SNA.

For each email thread of each BIP, a graph of reply relationships is created. In this graph, a directed tie or an edge is a link between two members that is constituted by at least one message sent or received. Such a graph for each thread highlights the engagement of members per thread. These smaller graphs are

subsumed into a single graph by computing the union of distinct graphs for each BIP. Afterwards, the betweenness centrality and eigenvector centrality are computed to identify the Bitcoin community's key members based on Burt's structural holes theory (Burt 2009). Betweenness centrality operationalizes weak ties and brokering positions, typically assumed by online leaders who fill structure holes (Faraj et al. 2015). Eigenvector centrality operationalizes strong ties, typically assumed by influencers (Faust 1997). Both centrality measures are commonly considered in online social media research to identify influencers (Probst et al. 2013).

Discourse Analysis

Based on the result of the SNA, we have performed discourse analysis of the extracted conversations from the mailing list, IRC chat, podcasts transcripts, and grey pieces of literature. Although the understanding of discourse can vary, we understand discourse as "an interrelated set of texts, and the practices of their production, dissemination, and reception, that brings an object into being" (Phillips and Hardy 2002 P. 3). In line with this understanding, we analyze the conversation content from these different data sources and uncover the actions of the Bitcoin influencers while steering the decision-making.

We iteratively read all the mailing lists and IRC conversation contents and coded the texts in line with the OSS decision-making framework (Eseryel et al. 2020) and lateral influence tactics (Ngwenyama and Nielsen 2014). During the process of coding the texts, we followed the recommendation from previous work (Stein et al. 2015). The first author read all the extracted text iteratively and developed a descriptive code that relates messages with similar actions. Afterwards, these descriptive codes are merged into a higher-level descriptor. These higher-level descriptors are matched with the codes provided from the OSS decision-making framework (Eseryel et al. 2020) as indicated in section 'decision-making in Bitcoin' and lateral influence tactics (Ngwenyama and Nielsen 2014) as indicated in section 'lateral influence'.

The reliability of the developed codes is established by evaluating the table comprising of the messages, descriptive codes, and higher-level descriptors by two co-authors individually. During the process, the co-authors aligned with some codes but also disagreed over few other codes. Individually developed codes were shared between the three authors. Subsequently, the three authors looked through the messages and the codes together and removed the codes containing ambiguous meanings.

Bitcoin Influencers and their Mechanisms of Influence: Analysis

We computed 'betweenness centrality' and 'eigenvector centrality' scores of all mailing list participants in each BIP and picked the top 10 participants for the analysis following the recommendation from previous work (Sharma et al. 2017). These top 10 participants are the key Bitcoin members (see Table 2, where M means member). Afterwards, we performed the discourse analysis on the data from different sources – mailing list, IRC, podcasts transcripts, and grey pieces of literature, and showed the way these influencers are steering the key decisions in the Bitcoin community.

BIP 9	Betweenness centrality	Eigenvector centrality	BIP 141	Betweenness centrality	Eigenvector centrality	BIP 341 & 342	Betweenness centrality	Eigenvector centrality
M4	187.761	0.131	M1	392.761	0.054	M1	394.415	0.100
M1	143.773	0.047	M6	378.597	0.052	M54	222.038	0.079
M5	46.378	0.043	M43	370.432	0.041	M2	209.765	0.046
M22	44.833	0.025	M2	299.212	0.062	M36	174.943	0.048
M8	44.242	0.071	M45	278.455	0.011	M65	118.572	0.056
M6	43.142	0.101	M44	249.367	0.029	M71	102.113	0.048
M7	42.231	0.063	M73	249.000	0.002	M60	88.538	0.051
M12	31.00	0.004	M36	234.347	0.035	M48	72.205	0.054
M15	31	0.011	M37	195.434	0.031	M59	56.893	0.021
M9	27.833	0.046	M35	192.816	0.029	M39	48.472	0.047

Table 2: Top 10 Key Members in BIP 9, BIP 141, and BIP 341&342

Implementation and Activation of Version Bits 'BIP 9'

'Influencers' During the Implementation and Activation of Version Bits

During the implementation and activation of BIP 9 'Version bits', M4 and M1 are identified as prominent members (see Table 2). Other than these two members, the betweenness centrality value of other members is significantly lower. This signals that M4 and M1 have higher social capital and thus, possess the ability to guide the implementation and activation of BIP 9. Other members such as M5, M22, M8, M6, and M7 have similar betweenness scores, who engaged moderately while activating BIP 9 (see Figure 2). Below, we will explain the engagement of these influencers during the implementation and activation of BIP 9.

Mechanisms of Influence

Before BIP 9, with IsSupermajority new rules can be activated in Bitcoin in which the miner's role was important, but the core maintainer's role was decisive. Moreover, the power to enact changes was in the hands of core maintainers. Such a mechanism created an issue for the effective running of the Bitcoin blockchain[6]. To resolve such issues and enable a more democratic mechanism for a rule change, an initiative was taken by M1. M1 appeals, "*if Bitcoin requires central control over its rules by a group of developers, it is completely uninteresting to me. Consensus changes should be done using consensus, and the default in case of controversy is no change*." (Excerpt from a mailing list). He makes a personal appeal to the community to look for consensual agreement before enacting new changes. This would give power to the users and miners, which could facilitate the longevity of Bitcoin. In this way, by signaling **political neutrality** (see Table 3), he is looking to attain the trust of Bitcoin members. Afterwards, a proposal for BIP 9 was initiated; authored by M1, M21, M2, and M5, in which miner's hash power support is decisive to activate Bitcoin soft-forks.

There were not any confrontations from Bitcoin members on this proposal. Member M24 tries to negotiate the proposal. He suggests changes on the BIP 9 proposal "*At 75%, you have a pretty solid super-majority. You can safely reject blocks that have the bit set but are invalid according to the new rule (as long as everyone who sets the bit does it too)"* (excerpt from a mailing list). To which, M6 responds "*No, 95% is safer and will produce less orphaned blocks. o%is fine to do it in your own blocks*." (Excerpt from a mailing list). With such a persuading argument, M6 is looking to **shepherd the community** (see Table 3). M4 supports the argument made by M6. M4 evaluates the proposal "*it's about the deployment of fairly uncontroversial changes with the minimum amount of negative disruption. If we have reason to believe a particular BIP stands little chance of hitting the 95% mark relatively quickly, it's probably better not to deploy it…so this mechanism is most useful for adding fairly uncontroversial features provided as default settings in product releases - and measuring adoption as best we can before activating these features*." (Excerpt from a mailing list). Such a conversation resonates with the point raised by M1. Also, M4 and M6 are not reverting from 95% to 75%, which illustrates Bitcoin influencers are **sticking to the laid plan** (see Table 3). Since the influencers are on the same side, there was no further negotiations on BIP 9 proposal. However, M5 communicates that a slight improvement in the proposal is needed, "[*M1] and [M4] pointed out that the current BIP has miners turning off the bit as soon as it's locked in (75% testnet / 95% mainnet). It's better for them to keep setting the bit until activation (2016 blocks later), so network adoption is visible*." (Excerpt from a mailing list). M5 signals that M1 and M4 possessed the technocratic ability to look after the activities in Bitcoin and they are working on improving the BIP. These authors of the BIP have allied, and use this as a veto to convince other members to adhere to the outlined BIP proposal. Such message instance highlights that the core maintainers have a similar view on the proposal and seek similar understanding towards it from other groups. The community did not witness any criticism on this proposal, thus, development was carried out.

Afterwards, the BIP editor M3 seeks consensus on activating it "*If there are no objections, I plan to update the status to Final for BIPs 9, 68, 112, and 113 in one month. Since all four BIPs are currently Draft, I also need at least one author from each BIP to sign-off on promoting them to (and beyond) Accepted.*" (Excerpt from a mailing list). With this, the BIP editor is using a **participative approach** (see Table 3) to reach a consensual agreement to activate BIP 9. There was no objection to activating this proposal, as it was

[6] Nabilou (2020) and Musiani et al. (2018) provide insight into Bitcoin involuntary fork happened in 2013

beneficial to all community members, particularly miners. Consequently, BIP 9 'version bits' was activated in Bitcoin in 2016.

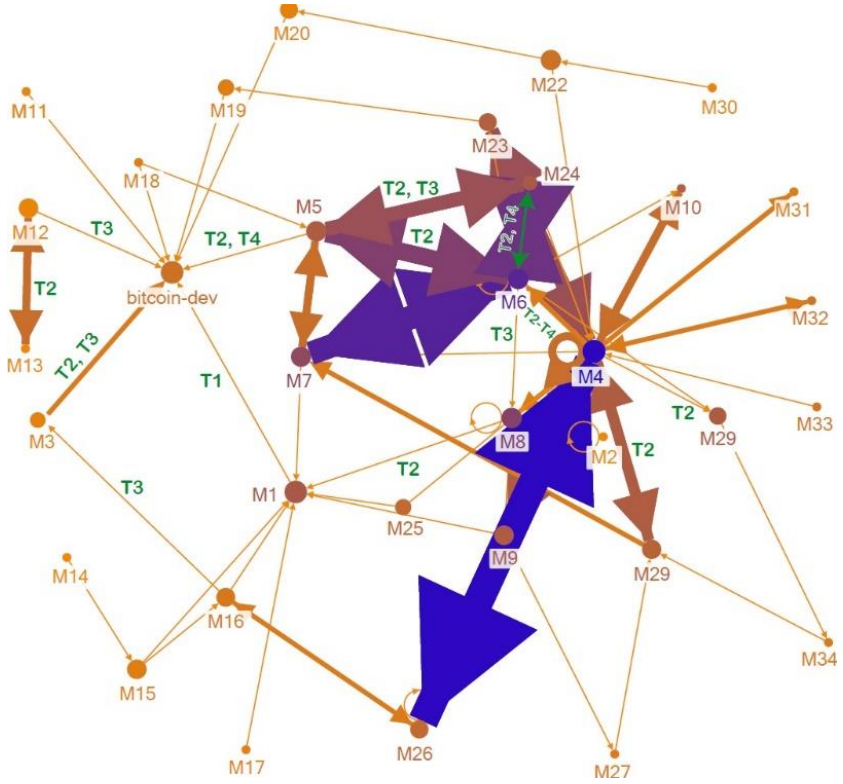

Figure 2: Bitcoin Influencers and their Tactics During the Implementation and Activation of BIP 9

Figure 2 portrays the network analysis of the mailing list participants during the implementation and activation of BIP 9, where Node 'M' stands for members, 'T' on the arrow stands for tactics employed by influencers, and edge thickness is the frequency of email exchanges. These tactics manifested in BIP 9 discussions highlighted using green are presented in Table 3. Also, the description of how tactics are derived is provided beneath Table 3.

Implementation and Activation of Segregated Witness 'BIP 141'

'Influencers' During the Implementation and Activation of Segregated Witness

BIP 141 'Segregated Witness' (SegWit) is the most controversial and debated BIP in Bitcoin. Our network analysis on the conversation of this BIP showed that M1, M6, and M43 are the prominent members (see Table 2). In addition, M2 has the highest eigenvector centrality value, which implies that M2 has direct relationships with other central members. Compared to BIP 9, the difference of betweenness centrality value among the members is small. This suggests, all the members were equally bridging the connections of the disconnected members during the implementation and activation of BIP 141. The link[7] portrays the network analysis of mailing list participants during the implementation and activation of BIP 141.

Mechanisms of Influence

Before drafting this BIP, the Bitcoin community had a contested blocksize debate. Because of the disagreement with the core developers over a block size, Bitcoin XT (a Bitcoin hard-fork, see: https://en.bitcoin.it/wiki/Bitcoin_XT) was created. Thus, the community needed a viable solution that

[7] Network analysis available here: https://doi.org/10.6084/m9.figshare.16457922

would accommodate the interest of all members group. A Bitcoin scaling conference was held in Hong Kong where all members presented the scaling proposal.

M2 initiated a mailing list thread where he summarized the takeaways of the Hong Kong scaling conference and **laid a plan** (see Table 3), and asks the community to move forward with his idea, *"I think this would be a good time to share my view of the near term arc for capacity increases in the Bitcoin system. I believe we're in a fantastic place right now and that the community is ready to deliver on a clear forward path with a shared vision that addresses the needs of the system while upholding its values. The next thing is that, at Scaling Bitcoin Hong Kong, [M1] presented on bringing segregated Witness to Bitcoin. What is proposed is a _soft-fork_ that increases Bitcoin's scalability and capacity by reorganizing data in blocks to handle the signatures separately, and in doing so takes them outside the scope of the current blocksize limit*." (Excerpt from a mailing list). He aligns with M1's proposal and asks to reunite the community members towards the soft-fork SegWit path. "*I propose we work immediately towards the segwit 4MB block soft-fork which increases capacity and scalability, and recent speedups and incoming relay improvements make segwit a reasonable risk*." (Excerpt from a mailing list). As such M2 opts for a **participative approach** (see Table 3) and seeks inputs from the community members for collective action.

However, this proposal was debated as other members were seeking either a hard-fork version of SegWit or a sudden increase in blockchain block size. For instance, M41 shows disagreement, "*So that all our code that parses the blockchain needs to be able to find the sigwit data in both places? That doesn't really sound like an improvement to me. Why not just do it as a hard fork? They're really not that hard to do*". He seeks a hard-fork version of SegWit. In addition, in an interview for Bitcoinmagazine, ViaBtc mining pool's CEO accuses the core maintainers of having so much power in Bitcoin and says that a soft-fork SegWit is not good for the Bitcoin ecosystem. He signals the core developers should hard-fork Bitcoin and increase the blockchain block size (van Wirdum 2016). Such requests for a hard-fork version of SegWit became prevalent in the Bitcoin mailing list; confrontations among the members' groups were seen in mailing lists and other platforms. Responding to these, M1 writes in an empathic tone on the mailing list thread that showed the hard-fork and soft-fork polarity among the members, "*Better late than never, let me comment on why I believe pursuing this plan is important. For months, the block size debate, and the apparent need for agreement on a hardfork has distracted from needed engineering work, fed the external impression that nothing is being done, and generally created a toxic environment to work in. It has affected my own productivity and health, and I do not think I am alone. I believe that soft-fork segwit can help us out of this deadlock and get us going again. It does not require the pervasive assumption that the entire world will simultaneously switch to new consensus rules like a hardfork does, while at the same time: * Give a short-term capacity bump * Show the world that scalability is being worked on * Actually improve scalability (as opposed to just scale) by reducing bandwidth/storage and indirectly improving the effectiveness of systems like Lightning. * Solve several unrelated problems at the same time (fraud proofs, script extensibility, malleability, ...). So I'd like to ask the community that we work towards this plan, as it allows to make progress without being forced to make a possibly divisive choice for one hardfork or another yet*." (Excerpt from a mailing list). With such a message he appeals to the community members to work towards the soft-fork version of SegWit. He looks to **shepherd the community** by outlining that soft-fork SegWit movement would show cohesiveness among the members. At the same time, he opts for a **participative approach** (see Table 3) – looking for inputs from the community members towards soft-fork SegWit. With this message, he signals his emotional attachment towards Bitcoin stating this would make block size off-topic, which will be better for Bitcoin. Along with providing logical reasoning for why the community should pursue this solution, he softly tries to **develop a reciprocal relationship** with traders, hinting this would facilitate the lightning network. The lightning network enables traders to act as an intermediary between Bitcoin blockchain and passive users, thus benefiting transaction fees from the users (Faltibà and Lo Cigno 2018). Consequently, several wallet companies started stating that they are waiting for SegWit to be activated in Bitcoin. These include Msigna, GreenAddress, GreenBits, Blocktrail, BitGo, and Blockcypher.

Contrarily, the miner's group was against soft-fork SegWit. However, the decision on SegWit development was reached and it was implemented to the client core software version 0.13.1. M1 announces this information "*We're getting ready for Bitcoin Core's 0.13.1 release - the first one to include segregated witness (BIP 141, 143, 144, 145) for Bitcoin mainnet, after being extensively tested on testnet and in other software. Following the BIP9 recommendation to set the versionbits start time a month in the future and*

discussion in the last IRC meeting, I propose we set BIP 141's start time to November 15, 2016, 0:00 UTC." (Excerpt from a mailing list). While announcing it to the community, he states the decision on the activation process is made in a **participative** way after receiving BIP 9 recommendation from other members in the IRC chat meeting. Before this announcement, a **reciprocal** deal was made by core maintainers with miners groups in Hongkong[8]. As a part of the deal, miners would signal support for soft-fork BIP 141, and core maintainers would create a BIP to hard-fork Bitcoin. The deal collapsed, as both groups did not adhere to the made promise. Thus, another meeting between core maintainers and miners was held in California (van Wirdum 2017), and the same agreement was made. However, only 30% of miner's hash power support was seen and the core maintainers group did not create a BIP to hard-fork Bitcoin.

To overcome such political battle between the core maintainers and miners; an anonymous person Shaolin fry created BIP 148[9] to activate SegWit. However, this BIP divided the community into factions; active users showed support to it as it enabled them to activate soft-forks, whereas miners were against it. As a result, there was a turf war between members' groups. To rescue this, M74 created BIP 91 that favored miners. With the use of BIP 91, miners were able to activate soft-forks with 80% hash power support. BIP 91 restored miners' power of activating soft-forks in Bitcoin. At this point, the price of Bitcoin was decreasing; fearing they would lose money, miners showed support for SegWit with BIP 91. Thus, SegWit was activated in the Bitcoin network.

In such a political battle, the influential members were **politically neutral** (see Table 3) in the mailing list conversation. A member asks M1 about his view on BIP 148 in IRC to which he replies in IRC "*no politics here, the core only integrates clearly uncontroversial rules*". He further states, "*BIP 148 would go against the principle of Bitcoin core*". With such conversation, M1 is advocating him and the core team to be **politically neutral** and only looks for the betterment of Bitcoin rather than favoring groups. Thus, the influential members are alleging that they only work for the betterment of Bitcoin core. M30 says in IRC chat "*We don't influence people but we influence projects*". The influencers were looking to activate SegWit only with the application of BIP 9, which illustrates that they are **always sticking to the laid plan**.

Implementation of Taproot 'BIP 341&342'

'Influencers' During the Implementation of Taproot

Taproot 'BIP 341 & 342' is the desired BIP from the users and developers as this conceals the transaction spendability information. Our network analysis showed that M1, M54, M2, and M36 are the prominent members while activating Taproot (see Table 2). In this particular BIP, M1 and M54 have a higher eigenvector centrality score; this implies they are better linked with other prominent members, thus are leading the implementation process of this BIP. The link[10] shows the network analysis of the mailing list participants during the implementation of BIP 341&342.

Mechanisms of Influence

Before initiating the BIP proposal for Taproot, M2 communicates the idea via a mailing list to the community members. His idea for Taproot catches attention from other members, to which he clarifies "*You're reading too much into a description of the idea. It's not a BIP or a spec; I tried to provide enough details to make the general idea concrete. I didn't dive into details or optimizations*" (excerpt from a mailing list). M2 acknowledges the need of the community, thus initiates the discussion on Taproot and solicit responses. As such M2 is **shepherding the community** outlining the next changes needed in Bitcoin. In such a discussion, M54 interacts empathically evaluating the proposal, "*Good morning [M2], I am probably being exceedingly naïve, but I would like to compare Taproot to a generalization of funding transactions.*"

Since this proposal is desired by the users, the community did not witness group battles or confrontations. Also, before drafting the proposal, a detailed discussion with the community members was carried out. In

[8] https://medium.com/@bitcoinroundtable/bitcoin-roundtable-consensus-266d475a61ff

[9] See this link to understand how BIP 148 activates SegWit: https://www.buybitcoinworldwide.com/uasf

[10] Network analysis available here: https://doi.org/10.6084/m9.figshare.16458081

such a discussion, the influencers were seeking responses from the members and guiding the next steps. Consequently, M1 initiates the Taproot thread "*Hello everyone, Here are two BIP drafts that specify a proposal for a Taproot softfork. A number of ideas are included: (presents technical detail of Taproot)*" (excerpt from a mailing list). He further communicates, "*I'm not sure there is much to gain here. There is perhaps a minimal fungibility improvement by not having another bit (P2SH or not) that can leak some information about the software you're using. On the other hand, until native taproot outputs are common, choosing P2SH wrapped ones leak less information at output creation time. Apart from that, I think it would only minimally impact implementation complexity. Are there other advantages I'm missing?*" (Excerpt from a mailing list). Such conversation illustrates that there's changing influence mechanism of the influential members over a period. Along with **shepherding the community**, a **participative approach** of engaging members into devising new rules was central to the mechanism of influence. The developed solution is vividly discussed with the members and their feedback is considered important. This approach is different from the enactment of the final decision on BIP 9 and BIP 141. The community publicly announced information about meetings that are being held to decide on the activation process of this BIP. However, a concrete decision to activate this BIP is yet to be reached.

Bitcoin Influencers Tactics

Message instance example	**Sources of influence**	**Tactics**	**Occurrence**
I am fully in support of the plan laid. This plan provides real benefit to the ecosystem in solving a number of longstanding problems in bitcoin. It improves the scalability of bitcoin considerably.	Personal appeals; rational persuasion	Political neutrality (T1)	BIP 9 & BIP 141
The issue isn't really whether it's 1MB or 2MB or 4MB or 8MB or whatever. First of all, the burden of justifying this change should be on those proposing a hardfork. The default is to not have a hard fork.	Identification, development, evaluation; rational persuasion	Shepherding community (T2)	BIP 9, BIP 141, BIP 341 & 342
If necessary, it's possible to keep verification compatible by still hashing the implied "even" byte inside the scheme (which commits to the pubkey), but if we're going to change things, it's perhaps best to do it as cleanly as possible and also drop that byte. Opinions?	Alliance; rational persuasion	Participative approach (T3)	BIP 9, BIP 141, BIP 341 & 342
This start time seems reasonable to me. It is mostly in line with BIP 9's proposed defaults, which seems like an appropriate choice.	Personal appeals; alliance; solution evaluation	Stick to the laid plan (T4)	BIP 9, BIP 141, BIP 341 & 342
[Core developers] will continue to work with the entire Bitcoin protocol development community to develop, in public, a safe hard-fork based on the improvements in SegWit … as a recommendation to Bitcoin Core within three months after the release of SegWit.	Reciprocity	Developing reciprocal relationships (T5)	BIP 9 & BIP 141

Table 3: Bitcoin Influencers Tactics Manifested During the Implementation and Activation of BIPs

Table 3 summarizes the influence tactics employed by Bitcoin influencers while steering the decision during the implementation and activation of new Bitcoin rules. The derived tactics build upon the decision-making framework provided by Eseryel et al. (2020) and the lateral influence tactics identified by Ngwenyama and Nielsen (2014). The tactic **political neutrality** stems from the personal appeals and rational persuasion of the influencers in which they convey the message stating they only favor Bitcoin as a whole but not any members' groups. **Shepherding the community** relates to the influencer's engagement in identifying the Bitcoin issues and showing the steps to resolve them by making convincing comments. This tactic stems

from identification, development, evaluation, and rational persuasion. The **participative approach** stems from the influencer's approach of seeking help from Bitcoin members and engaging them for enacting collective action; once input is received, they use it as a medium of alliance formation to convince others to join the development. **Stick to the laid plan** relates to the influencer's approach to sticking to the made agreement. This tactic stems from personal appeals and solution evaluation. **Developing reciprocal relationships** stems from reciprocity i.e. influencers are making a deal with members or members groups to enact the desired changes.

Discussion

This research builds on the findings from previous research (Filippi and Loveluck 2016; Musiani et al. 2018; Parkin 2019) and advocates that a few Bitcoin members 'influencers' are central to the activities in Bitcoin. These influencers are steering the decisions to implement and activate new Bitcoin blockchain rules. As such, these influencers have a central role in the governance of the Bitcoin blockchain infrastructure. Thus, our findings counter the Bitcoin community's claim that Bitcoin operates in a decentralized manner (see: https://bitcoin.org/en/). Consequently, this research makes three major contributions.

Firstly, we identified the influential members of Bitcoin. Among all the engaging members of Bitcoin, *M1* stands out and actively pushes the enactment of three important BIPs. Other influential members uncovered from our network analysis are: M4, *M5, M6, M43, M2, M36,* and *M54* (see Table 2). These members are prominent during the implementation and activation of Bitcoin blockchain rules. Our SNA result showed they are bridging the connections between the disconnected members, thus, facilitating information flow in the mailing list conversations, and sharing their ideas with disparate Bitcoin members. Such activities of Bitcoin influencers are comparable to the notion of 'opinion leaders' (Katz 1957).

Secondly, our discourse analysis was instrumental to identify the influence mechanisms employed by these influencers while steering the decisions to implement new Bitcoin rules. Our consideration of the OSS decision-making framework (Eseryel et al. 2020) and adaptation of lateral influence tactics (Ngwenyama and Nielsen 2014) is beneficial to identify their influence mechanisms. We built on these and identified five different tactics (see Table 3) employed by Bitcoin influencers. While making a new rule change in Bitcoin, the influencers are the first to communicate the idea to the community, and the proposal is evaluated by all members belonging to different groups. At this phase, the influencers are opting for **political neutrality, participative approach,** and **shepherding community** tactics (see Table 3). Manifesting such tactics can be instrumental to draw member's attention and bring them into a communication network, and persuade the members to be aligned with the outlined proposal. These tactics are employed by influencers while discussing the change proposal. The influencers are also seen **sticking to the laid plan**, while convincing other members. Furthermore, the community members consider the proposal from these influencers as appropriate and genuine[11]. This suggests that, in Bitcoin, the allocation of decision-making rights is given by members to these influencers and they are held accountable for their roles. This can be because financial interest is binding all members together, and they trust the expertise of these influencers[12]. Upon the agreement on the proposed solution, a development process is carried out, thus, a final announcement is made to the community. This is different from the OSS development process where the development process is carried out before evaluating the solution (Eseryel et al. 2020). Furthermore, for activating the implemented changes the influencers are opting for **political neutrality, stick to the laid plan,** and **developing reciprocal relationships** tactics (see Table 3). Using **political neutrality** tactic, the influencers signal to the Bitcoin members that they only favor Bitcoin and look for its longevity. Also, during the discussion for BIP activation, they do not breach the reached agreement. And in the case of controversial changes, they are moreover employing **developing reciprocal relationships** tactic. Employing these tactics can be a trump card for influencers in activating rule changes. Furthermore, except **developing reciprocal relationships**, other tactics are vividly manifested on the mailing list and IRC conversations. The influencers acted in concealment while making a 'reciprocal deal' with members group to activate BIP 141 - a controversial change (van Wirdum 2017). The use of **developing reciprocal relationships** in concealment for activating controversial changes suggests that Bitcoin influencers seek

[11] M75 explains these in a podcast conversation. See: https://stephanlivera.com/episode/242/

[12] M76 explains these in podcast conversation. See: https://stephanlivera.com/episode/229/

to implement and activate the desired network rules by any means necessary. Such tactics of influencers could be motivated by their affiliation to private companies or for financial motives. For instance, *M1* is co-founder of Blockstream, M36 & *M2* are employed by Blockstream (see the link[13] for more information). On a similar note, M6 (Bitcoin influencer) writes on a mailing list "*There's a Bitcoin incentive as part of my Blockstream's contract, so I have a financial incentive for Bitcoin's price to increase, but, in fact, when I started contributing to bitcoin core my bitcoin holdings where extremely low*" (excerpt from a mailing list). Such a message highlights that other than sticking to Bitcoin's ideology these Bitcoin's influencers' engagement also relates to a financial incentive[14]. However, this needs further exploration.

Thirdly, combining our SNA and discourse analysis result, we illustrated that in addition to filling the structural holes in the communication network, Bitcoin influencers are using different tactics to enact Bitcoin blockchain rules (see Figure 2). These insights complement the conclusion drawn by Nabilou (2020), where he states Bitcoin governance relies on "deliberation, persuasion, volition, and choices of members" (Nabilou 2020 P. 30). Bitcoin influencers are able to convince the Bitcoin members towards the change as desired by them. With this, they can use the inputs from the members to activate the new rules. Furthermore, the role dependency of the member groups is a distinctive feature of blockchain governance (Ziolkowski et al. 2020). In other words, new rules can only be activated upon the technical support of blockchain nodes. This is what differentiates organizing in blockchain from organizing in market, hierarchy, and network (Ziolkowski et al. 2018). Our findings illustrate, in Bitcoin, beyond facilitating the coordination of off-chain members, influencers are persuading the members to align together for enacting new Bitcoin on-chain rules. Thus, the influencers and their engagements are at the core of organizing in Bitcoin. This suggests that although Bitcoin is architecturally decentralized, few influencers guide the community, and the governance of Bitcoin is contingent on these influencers. In this way, this research extends the understanding of blockchain and Bitcoin governance (Filippi and Loveluck 2016; Musiani et al. 2018; Reijers et al. 2018; van Pelt et al. 2021; Ziolkowski et al. 2019) and argues that the role and decision of key members are instrumental for permissionless blockchain governance.

Conclusion and Limitations

We identify the inner working of Bitcoin is de facto centralized to a few influencers. These influencers are the key members and lead the interaction process in the Bitcoin blockchain using different tactics. Initially, they persuade others with logical arguments and Bitcoin's roadmap. However, in the case of disagreement and dispute, while enacting the desired changes, they are either forming alliances or developing reciprocal relationships with interested parties (i.e. miner's representatives or user's representatives). These meetups are concealed from the mailing list conversations, which is the prime channel to communicate Bitcoin rule changes with all Bitcoin members. Such concealed interaction illustrates few key Bitcoin members are the central actors for directing and guiding Bitcoin operations. In addition, our results can be extended to uncover the roles of these influencers for a broader Bitcoin ecosystem.

A limitation of our study is that we have only considered three BIPs to identify influence mechanisms in Bitcoin. We acknowledge analyzing the conversations beyond these three BIPs can aid to capture any missing linkages that may provide substantial backing to the identified tactics. Since we have only considered publicly available data; conducting interviews with these influencers, Bitcoin traders, and mining pool operators may increase the robustness of our results.

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[13] https://blog.bitmex.com/who-funds-bitcoin-development/

[14] On IRC chat M4 asks M16 "*wanna help implement that, [M16]?*". To which he replies "*yes, but note that I have no funding right now for core dev work, so I can't promise anything"*

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