Real News: How Blockchain could Revolutionize Social Media

A Review Discussing the Concepts of Swarm Intelligence and Sweat Equity in Blockchain Social Media

Seminar: Blockchain Economics and Radical Markets

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Abstract

Today's social media platforms face a variety of problems. On the one hand they are made responsible for allowing the spread of fake news and hate speech, while on the other hand being criticized for censorship. At the same time, it seems impossible for the platforms to gain control over the millions of posts per day. In addition, the centralized data collection causes concerns related to missing data ownership guidelines, data monetization and the vulnerability to hacker attacks. However, the new category of blockchain-based social media may provide a promising alternative due to their decentralized structure and the use of blockchain technology. Consequently, this literature review provides an overview over some of the main problems of current social media platforms and discusses in how far blockchain social media may solve these issues. To illustrate the mechanisms of these networks, it uses Steemit as a best practice use case. Thereby, it focuses on the voting mechanism and the reward system of the community to demonstrate how the ideas of swarm intelligence and sweat equity can be implemented in a social network. It further combines these findings with the concepts of "quadratic voting" and "data as labor" proposed by Eric A. Posner and E. Glen Weyl in their book "Radical Markets – Uprooting Capitalism and Democracy for a Just Society". The paper finds that blockchain-based social networks may solve some of the problems of current platforms, as they provide a more decentralized and democratic solution. Additionally, the functionalities of these communities may reduce the problems of fake news and censorship. Nevertheless, it also observes some obstacles of blockchain-based social media.

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1. Introduction

The world we see today is fundamentally different from the world people used to live in twenty years ago. The omnipresent existence of the internet in people's everyday lives has changed the way we consume and express information fundamentally. While twenty years ago people used to call their friends, send postcards when on vacation and watch the news on their television, social media websites as Facebook, Twitter or Instagram combine all these functionalities in one medium. Although this has brought a lot of convenience to people's lives, it has also developed as a source of many threats to democratic societies.

While increasingly many people use social media platforms as their main news source, the spreading of fake news arises as a major problem of these websites. During the Covid-19-pandemic this problem has gotten even more prominent. Social media platforms became the main distributors of conspiracy theories and disinformation, which in turn may have even worsened the spread of the virus and decreased the trust in democratic political systems. Due to the enormous amount of content, which is created every second, it seems impossible for the platforms to gain control over the millions of posts per day. Facebook and Co. address these issues by extending their pool of moderators. However, this does not seem to solve the problem in a sufficient way. Additionally, the employees in these positions report symptoms of post-traumatic-stress-disorder due to the large amount of traumatizing content, they consume all day. Furthermore, it may be concerning that a small group of people decides about which voices get heard in a democracy and which do not.

Another concern of users is the sheer amount of personal data that the websites collect. The posting, liking and commenting done by users everyday helps the platforms to learn about their behavior and to sell this information to third parties for market research and marketing purposes. While this business model earns Facebook billions, the users are not compensated at all for the information they deliver. Furthermore, there have been serious problems with data leaks in the past years, which stresses the security issues of the centralized data collection by social media platforms. Hence, it may be advantageous to question whether the centralized structure of current platforms caters the needs of democratic societies in a sufficient way.

With blockchain-based social media, there has been a new category of social networks established. As a decentralized technology, the blockchain can involve the users in the moderation of content. This can contribute to not only make the network more democratic, but to also detect malicious behavior more effectively and make the need for professional moderators obsolete. At the same time, due to its immutability, the blockchain can enable a censorship-free network. Furthermore, the decentralized nature of the technology can help to

decentralize the data collection, which can not only help to make the network more resilient to hacker attacks, but also allows users to own their personal data and to get rewarded for their contributions.

Consequently, this paper aims to give an overview over current problems of social media and to discuss in how far these may be solved by a decentralized blockchain-based approach. Additionally, it combines these findings with the concepts of “quadratic voting” and “data as labor” proposed by Eric A. Posner and E. Glen Weyl in their book “Radical Markets – Uprooting Capitalism and Democracy for a Just Society”. Finally, it discusses potential concerns regarding blockchain social media.

2. The Crisis of Social Media

Current social media platforms are experiencing many problems. One of the main obstacles is the spreading of malicious content such as fake news and hate speech and the content moderation thereof (Collins et al., 2021, Bilewicz and Soral, 2020, Masnick, 2019). Another important aspect is the centralized data collection and related concerns regarding privacy and data monetization (Guidi, 2020, Chen and Cho, 2021). This section discusses these issues and links them to the platforms' centralized nature.

2.1. The Fake News Epidemic

Today, social media is not only an important part of people's social life but has also become a central source for news consumption. In a survey among social media users, 60,8 percent of the participants reported that they used the platforms as a main news source (Alkawaz et al., 2021). While the use of social media is growing fast, the trust of the public in mass media is decreasing (Fraga-Lamas and Fernandez-Carames, 2020). However, in contrast to traditional media, social networks are facing increasing problems regarding the trend of fake news, where malicious content and false information are spread (Collins et al., 2021). In the survey conducted by Alkawaz et al. (2021), 58,8 percent of social media users report that they had been a victim of fake news. The spread of this type of information can have serious consequences, since it attempts to cause insecurity, hate or polarization (Fraga-Lamas and Fernandez-Carames, 2020).

The motives of the creators of such content can vary. Many fake news created on social media are politically motivated (Collins et al., 2021). For example, during the COVID-19-crisis, many conspiracy theories related to the pandemic were spread (Frenkel et al., 2020). Regarding this phenomenon, Fraga-Lamas and Fernandez-Carames (2020) speak of a "misinfodemics" (Fraga-Lamas and Fernandez-Carames, 2020, p.55), where misinformation about the outbreak of the coronavirus were shared and might have further enabled the spread of the virus. Another common motivation is the promotion of clickbait to achieve financial gains. This type of content uses catchy headlines to motivate users to click on a link, which in turn produces income for its owner (Collins et al., 2021).

In social media, these clickbait news only take a short period of time to become viral worldwide (Shovon et al., 2019). Shovon et al. (2019) argue that this is due to people's tendency to spread appealing stories even if they do not know whether they are real or which consequences the sharing of them may have. Another reason why fake news spread exponentially, is that many users lack awareness of this type of content (Alkawaz et al., 2021). Furthermore, automated

techniques enabling a strategic sharing of malicious content have been developed (Fraga-Lamas and Fernandez-Carames, 2020). For example, automated bots are used to spread disinformation more effectively (Collins et al., 2021).

In addition, artificial intelligence can help to create sophisticated fake news (Fraga-Lamas and Fernandez-Carames, 2020). This makes it difficult for users to differentiate fake news from reliable information, which affects the trustworthiness of the whole online community (Zheng and Boh, 2021). Collins et al. (2021) find that this uncertainty causes users to stop sharing information because they fear that it may be false. Another reason for the rapid spread of fake news can be found in the way that the platforms select content. Thai (2020) criticizes that Facebook uses an algorithm to present posts to their users in accordance with their interests and liking behavior, which in turn leads to politically biased content bubbles.

In addition to the problem of fake news, current social media platforms face an increasing production of hate speech. Since the political news consumption has shifted from traditional media to social networks, many constraints preventing abusive language are no longer present. This has led to an increase in prejudices and biased views of minorities (Bilewicz and Soral, 2020). Bilewicz and Soral (2020) find that citizens who use social media as a primary political news source see hate speech more as a social norm than as malicious behavior. They explain this by the low level of regulation in social media and state that the users might have become less sensible to hate speech because of the large number of hateful comments (Bilewicz and Soral, 2020). These contributions highlight that current social media platforms are facing serious problems due to malicious behavior of its users and the spread of disinformation.

2.2. The Downside of Centralized Content Moderation

Social media platforms respond to these issues by hiring thousands of professional content moderators and investing large amounts of money in moderation technology (Masnick, 2019). However, this system does not solve the problem in a satisfying way. Firstly, a centralized pool of professional moderators fails to detect malicious content in a sufficiently short period of time due to the large quantity of posts and the number of employees still being too small (Collins et al., 2021). Secondly, the people working in these jobs report serious mental health issues due to the large amount of traumatizing content they consume all day. This issue gained public attention when Facebook and YouTube made their professional moderators sign a declaration which informs them about the possibility of their jobs to cause post-traumatic-stress-disorder (BBC News, 2020). Thirdly, human moderators may be biased in the way they view certain content. Most of them have often been criticized for being prejudiced and political (Collins et

al., 2021). At the same time, technological solutions fail to take context into account and to understand satire or hyperbole (Masnick, 2019).

Another common criticism, which this system faces, is the lack of transparency. Although social media platforms have become central to democratic societies and free speech, there is not much information on the way they moderate the content generated by their users (Klonick, 2018). Many users who experienced censorship from social media platforms report that they had not been educated about why their content had been removed from the website, which in turn leads them to feel confused and frustrated (Myers West, 2018). In some cases, social networks even delete user accounts, which can have wide-reaching consequences for people's lifes. These users not only lose their opportunity of self-expression but also their community since many of them rely on the websites to communicate with their friends and families (Myers West, 2018).

The debate becomes even more difficult when considering how to handle the accounts of politicians. Thai (2020) criticizes that Facebook excludes politicians from its community standards and its fact-checking policy. The author states that "this selective hands-off approach perversely skews public debate amplifying the expressive power of already dominant speakers in our society" (Thai, 2020, p. 1642). However, the platform announced that, following the ban of US-president Donald Trump's account, it would introduce a new policy which allows to also moderate posts made by politicians. Under this new policy, the Politicians' posts would still be excluded from the fact-checking policy but malicious behavior as bullying could be prohibited. This is seen as a turnaround for the company, since until then Facebook executives had stated that private companies should not censor politicians' speech (Heath, 2021). These discussions suggest that it may be problematic to let one authority decide about who gets the allowance to speak and who does not in a democratic society.

Due to these concerns Klonick (2018) demands equal access for users to participate in these processes and more direct accountability of the platforms to their users. In a survey among social media users whose content had been banned from the website because of a violation of the platform's standards, many participants expressed the intent to act as a member of a community. Some of them stated that they wanted to learn from their mistakes so that their accounts would not get censored in the future, while others expressed their willingness to participate in the shaping of these moderation policies (Myers West, 2018). The author therefore highlights the importance of a system which educates and allows for user engagement and criticizes the lack thereof in current platforms (Myers West, 2018). These findings suggest that a moderation system which engages users in the process and allows for greater transparency could help to not only make the platforms more democratic but to also reduce the production of malicious content.

2.3. The Data Monopoly of Platforms

As social media has become central to people's everyday life and the number of users is growing, there is an enormous amount of personal data, which is generated every second. However, current platforms lack a clear guideline of data ownership (Zheng and Boh, 2021). Furthermore, since the data is stored in centralized servers, it can be managed, sold or stolen without the user's control (Guidi, 2020). One of the most prominent examples of data misuse was the Cambridge Analytica scandal, where a political data firm used private information on more than 50 million Facebook users in the 2016 election campaign of former US-president Donald Trump. Thereby, voters' personalities could be analyzed to influence their voting behavior (Granville, 2018). Still, social media platforms lack an adequate data protection regulation (Fraga-Lamas and Fernandez-Carames, 2020).

Additionally, the centralized data storage makes it difficult for users to save their content in case of a server crash down (Chen and Cho, 2021) and makes personal data vulnerable to hacker attacks (Guidi, 2020). In April 2021, the personal data of over 500 million Facebook users was leaked in a hacking-forum. Users' phone numbers, full names, locations, email addresses, and biographical information could be accessed for free and used for malicious interests such as fraudulent behavior (Holmes, 2021).

Another issue related to the collection of user data is the monetization thereof by the platforms (Guidi et al., 2021). Users often need to agree to the websites' terms and conditions to be allowed to use their services. This in turn gives the platforms the right to use their personal data for different purposes such as advertisement (Chen and Cho, 2021). Since this process lacks transparency, it is difficult for users to track how their data is used (Fraga-Lamas and Fernandez-Carames, 2020). At the same time, the advertising revenue of platforms as Facebook is growing rapidly. From 2016 to 2020, the company's average advertising revenue per user doubled (Tankovska, 2021, 2). In 2020, this amounted to a yearly advertising revenue of over 84 billion US-dollars (Tankovska, 2021, 1). Guidi et al. (2021) therefore stress the importance of asking whether this system respects people's privacy and whether its business model is fair. Indeed, these findings make it necessary to ask whether users should get the opportunity to control the use of their data and to profit from its monetization.

3. Blockchain Social Media – A Potential Solution

This section presents the idea of blockchain-based social media as a possible solution to the problems of current platforms discussed above. Blockchain-based social media are decentralized social networks, which use the blockchain technology to overcome problems as censorship and fake news (Guidi et al., 2021). The Blockchain can be thought of as a growing list of blocks, in which every newly added block is chained to the previous one (Guidi and Michienzi, 2020). Since every change in a former block would result in a change of all following blocks, it guarantees transparency and data security (Chen and Cho, 2021). Thereby, it allows for a decentralized network, in which no central managing authority is needed (Fraga-Lamas and Fernandez-Carames, 2020). In blockchain social media the technology further enables a system for the rewarding of users' contributions, which in turn aims to incentivize the production of high-quality content (Guidi et al., 2021).

This paragraph especially addresses the issues related to malicious posts and content moderation by promoting the idea of a moderation process, which uses swarm intelligence to fight fake news and hate speech. Furthermore, it promotes a possible solution to the problems of missing data ownership guidelines and financial rewards for content creation. For these matters, the paragraph presents Steemit as a best practice use case, since it is one of the most prominent blockchain-based social networks (Guidi et al., 2021) and most of the research on blockchain social media focuses on it. Related to the implementation of financial rewards, it further discusses Cent as an alternative to Steemit. In addition, the ideas of "quadratic voting" and "data as labor" proposed by Eric A. Posner and E. Glen Weyl in their book "Radical Markets – Uprooting Capitalism and Democracy for a Just Society" are discussed in relation to the functionalities of blockchain-based social media.

3.1. Swarm Intelligence – The Network as Moderator

Current social media platforms use a centralized content moderation system with the capability to immediately delete unwanted content (Fraga-Lamas and Fernandez-Carames, 2020). However, as discussed in the previous paragraphs, these systems do not seem to stop the spreading of fake news and hate speech (Collins et al., 2021, Masnick, 2019). Furthermore, there is a lot of debate about whether one authority should decide about which voices are heard in a democracy (Klonick, 2018, Thai, 2020). It is therefore important to ask, whether a decentralized solution, which includes the users into the moderation process, would be advantageous. This would allow to give the power and decision-making to the users instead of keeping it to a single platform (Masnick, 2019). The idea behind a decentralized or

crowdsourced moderation approach is to use the "wisdom of the crowd" (Collins et al., 2021), or as it is called in this paper, "swarm intelligence". It is based on the idea that no matter how intelligent an individual may be, the collective effort of a crowd will always exceed the intellectual capacity of an individual (Collins et al., 2021).

The use of blockchain technology makes it possible to create social networks which use this phenomenon to their advantage. On a blockchain anyone can participate and validate transactions, or in this case moderate content, without the need of a central authority (Fraga-Lamas and Fernandez-Carames, 2020). Current blockchain-based social media let their community rate the quality of the content and reward the producers of positively evaluated posts with cryptocurrency-payments. This process aims to incentivize the production of high-quality content and to limit the spread of fake news (Guidi et al., 2021). Additionally, Blockchain-based social media use the immutable nature of the blockchain to guarantee for censorship-resistant publishing and free speech (Guidi and Michienzi, 2020). While current social media platforms are being criticized for the censorship of their users' content, it is impossible for anyone to edit or delete information once it has been stored on the blockchain (Zheng and Boh, 2021). It is therefore important to have a closer look at blockchain social media as a potential alternative to centralized platforms.

3.1.1. How Steemit Uses Swarm Intelligence

One of the most prominent examples of blockchain-based social media is the Steemit network with over one million users (Guidi et al., 2021). The network is based on the Steem blockchain, which describes itself as "a blockchain database that supports community building and social interaction" (Steem, 2018). Steemit lets its users not only act as content creators but also as content moderators (Zheng and Boh, 2021). For this matter, the users can up-vote and down-vote the content produced on the website (Guidi and Michienzi, 2020). However, the power of a user's vote depends on its Steem Power, which is a currency generated by content creation as well as financial contributions (Steem, 2018). In addition, every account is assigned a reputation level, which is determined by the votes it gets for its content. An upvote increases the reputation, while a downvote decreases the reputation. Still, this only applies if the reputation of the user expressing the downvote has a better reputation than the creator of the post. While the reputation level does not influence any mechanism of the network, it gives an idea of the user's behavior on the website (Guidi and Michienzi, 2020).

Furthermore, the immutability of the Steem blockchain enables free speech and makes content immune to censorship. Every action on the Steemit network such as creating content, upvoting a post or following other users is stored as a transaction on the blockchain and can therefore not

be deleted or changed (Guidi et al., 2021). Since all these mechanisms only rely on the evaluation by the members of the community and are not moderated by a central authority, it can be argued that the Steemit network uses swarm intelligence to curate its content.

3.1.2. Quadratic Voting – A Concept for the Use of Swarm Intelligence

Eric A. Posner and E. Glen Weyl promote a related concept in their book "Radical Markets – Uprooting Capitalism and Democracy for A Just Society". They criticize that current social media platforms as Facebook, Reddit, Twitter and Instagram only allow users to like a comment but do not give them the opportunity to express more intense emotions like enthusiasm or distaste. They therefore discuss the idea of allowing users to express their attitude towards a particular content by voting for or against it (Posner and Weyl, 2018, p. 117). This can be compared to the voting mechanism used on Steemit, where members can up- or downvote the posts produced by others (Guidi and Michienzi, 2020).

Additionally, Posner and Weyl (2018, p. 117) propose a concept called "Quadratic Voting", which adds different weights to the users' votes. This, in turn, is comparable to the introduction of Steem Power in the Steemit network, which makes some votes more powerful than others (Guidi and Michienzi, 2020). However, there is a fundamental difference. As the Steem Power is allocated to a user and not to a specific vote, some users will be more powerful than others in any voting situation (Guidi and Michienzi, 2020). Quadratic Voting in contrast allows the votes of one decision-maker to be differently powerful, depending on how high their interest in expressing their opinion on a specific issue may be. This in turn allows the voting behavior of people to reflect the strength of their preferences (Posner and Weyl, 2018, p. 106). To express their opinion regarding a certain issue, voters can buy a specific number of votes paying with their budget of "voice credits". However, the cost in voice credits is equal to the square of the number of voices (Posner and Weyl, 2018, p. 105). This rule causes the marginal cost of an additional vote to grow proportionally to the number of votes and therefore incentivizes the voters to reveal their true preferences (Posner and Weyl, 2018, p. 107). Steemit uses a similar mechanism. To avoid excessive voting by individual users, they distribute a fixed amount of voting power to each user. The more posts a user votes for, the less their individual vote will count (Steem, 2018).

Nevertheless, the voting mechanism of Steemit is being criticized for the inequality between the power of users (Guidi et al., 2021). If a user with lots of Steem Power upvotes a post, it is very difficult for users with less influence to counteract it with downvotes (Guidi et al., 2021). Quadratic Voting, in contrast, gives anyone the ability to buy as much voting power as needed (Posner and Weyl, 2018, p. 105). It even makes it possible to solve the problem of the "tyranny

of the majority", as it enables a minority with strong preferences to outvote an indifferent majority (Posner and Weyl, 2018, p. 106). This could potentially be used to protect political minorities in social networks. Since social media users may become used to hate speech if they are constantly exposed to it (Bilewicz and Soral, 2020), they may not show enough engagement to downvote a comment, in which a political minority is being discriminated. Members of this minority could then use more votes to outvote the indifferent majority.

Furthermore, the system proposed by Posner and Weyl (2018, pp. 105) may be fairer than the system of Steem Power. While one's budget of Steem Power can also be increased by buying Steem Power with the Steem cryptocurrency (Guidi and Michienzi, 2020), Posner and Weyl (2018, p. 110) propose that every voter should receive an equal endowment of voice credit. However, Posner and Weyl (2018, p. 117) suggest that social media users should be able to earn more voice credits by contributing to the network. This is an analogous idea to the generation of Steem Power through the creation of content by users in the Steemit network. To summarize, it may be advantageous to consider the implementation of quadratic voting in Steemit's voting mechanism to make it fairer and to reveal the users' true preferences.

3.2. Sweat Equity – The Rewarding of the Network

As discussed in the previous section, many problems arise due to the centralized data collection by current social media platforms (Guidi, 2020). In contrast, the decentralized nature of a blockchain-based social network allows to store data in a distributed way, which gives the control back to the community members (Chen and Cho, 2021). In blockchain social media, the data generated belongs to its creators and there is no central authority who decides about its usage (Zheng and Boh, 2021). Moreover, the decentralized data storage makes the network more resilient to data breaches and hacker attacks as it has "no single-point of failure" (Guidi, 2020, p. 4). Since every transaction is stored on the blockchain and cannot be modified, it also becomes impossible to manipulate data (Guidi, 2020).

Another advantage of the data ownership by its producers is that users can get rewarded for their contributions to the network (Zheng and Boh, 2021). While current social media platforms commercialize the data generated by their members to earn money for themselves, the main goal of blockchain-based social media is to honor users for their activity on the network (Guidi and Michienzi, 2020). One of the first networks, which uses such a rewarding system is Steemit (Guidi and Michienzi, 2020). Steem criticizes existing social media platforms as Facebook for distributing profits over shareholders only instead of giving back to the users, who they mainly owe their value to (Steem, 2018). In contrast, Steem uses the "sweat equity principle" (Steem, 2018, p. 5). This means that all types of equity are equally valuable. Users, who contribute to

the community with their time and attention are honored just as much as the contributors of cash (Steem, 2018). The term "sweat equity" generally refers to the effort somebody contributes to the value of a business for less than an opportunity wage. In the case of startups this type of equity is often rewarded with a share of the company's future value (Myers, 2000). Comparably, on blockchain social media users get rewarded for their effort with cryptocurrency payments (Guidi et al., 2021).

As the value of the rewards earned depends on the quality of the users' activities, the system motivates them to produce high-quality content with an extrinsic incentive (Zheng and Boh, 2021). Since all information is stored on the blockchain, this process is transparent and can be tracked and audited by all members of the network (Guidi, 2020). As a result, the combination of the appreciation of content creation and the ownership of data, encourages the engagement of users in the network (Zheng and Boh, 2021).

3.2.1. How Steemit Rewards Sweat Equity

Steemit rewards its users for different activities in the network. This can be the creation of posts as well as the moderation thereof (Kim and Chung, 2018). To incentivize the production of high-quality content, Steemit hands the highest financial rewards to the best content discovered by the voting mechanism (Zheng and Boh, 2021). These rewards are payed in the Steem cryptocurrency (Kim and Chung, 2018), which has a concrete economic value and can be transferred into another currency. In addition, the most successful content creators are rewarded with Steem Power, which gives them more voting power on the network (Steem, 2018). The network thereby not only incentivizes the creation of high-quality content but also the identification thereof as the reward is split into an author reward and a curator reward. The latter is payed to the users who up-voted the post. Members who expressed a down-vote are not rewarded since their feedback is negative (Guidi and Michienzi, 2020). With their reward system, Steem wants to "produce the best discussions on the internet" (Steem, 2018). Furthermore, the network encourages the support of voices outside the mainstream by donating a much higher payment to the first curators of a post (Guidi and Michienzi, 2020).

3.2.2. Data as Labor – A Concept for the Rewarding of Sweat Equity

In their book "Radical Markets – Uprooting Capitalism and Democracy for A Just Society", Eric A. Posner and E. Glen Weyl also criticize that platforms like Facebook collect and use personal data without having to pay for it. They argue that a small group of people earns all the profits this data generates but those who produce it are not rewarded at all (Posner and Weyl,

2018, p. 209). To overcome this inequality, they propose a concept called “Data as Labor”, which states that the production of data should be valued as work and should be financially rewarded (Posner and Weyl, 2018, p. 223). Furthermore, the authors argue that by not compensating users for their effort, current platforms do not provide proper incentives to produce the best data possible (Posner and Weyl, 2018, p. 220). Blockchain-based social media as Steemit however, already recognize the value of the data production by their members and therefore reward their activity on the network (Guidi and Michienzi, 2020). Additionally, they design the financial rewards for their members in a way that motivates them to supply high-quality content (Zheng and Boh, 2021). Another aspect, highlighted by Posner and Weyl (2018, p. 223) is that the financial appreciation of data production may enhance a sense of social contribution to users (Posner and Weyl, 2018, p. 223). This phenomenon can also be observed in blockchain social networks. Zheng and Boh (2021) find that the financial compensation and the thereby increased interaction between users encourages a sense of social belonging.

As a possible obstacle for the implementation of their concept, Posner and Weyl (2018, p. 244) name the need for a technology which traces and tracks the contributions by different users. However, the blockchain technology may solve this problem since all data stored on the blockchain is time-stamped and immutable, which makes it possible to track users’ activities (Zheng and Boh, 2021). The authors further state that it may be difficult for platforms like Facebook to determine the value of every single post (Posner and Weyl, 2018, p. 244). Still, in networks as Steemit, the community itself decides about the value of a post by the up- and downvoting of content (Guidi and Michienzi, 2020).

Nevertheless, another concern expressed by Posner and Weyl (2018, p. 247) may also account to blockchain social networks. They argue that not all people may have the ability to produce high-quality data and may therefore not be able to profit from this concept. Since Steemit gives the highest financial rewards to the best content discovered by the voting mechanism (Zheng and Boh, 2021), this problem may arise in the network as well. In turn, these differences in abilities could lead to large inequalities between data producers (Posner and Weyl, 2018, p. 247). However, an idea provided by Posner and Weyl (2018, p. 244) may help to overcome this issue. They state that some type of data should be compensated with an average price to guarantee that all users get rewarded for their effort (Posner and Weyl, 2018, p. 247). When transferring this idea to the Steemit network, it can be argued that a “minimum wage” for all active members may ease the inequality among users.

3.2.3. Cent – Another Blockchain Social Network Rewarding Sweat Equity

Another blockchain social network, which rewards its users' sweat equity, is Cent. The network is built on the Ethereum blockchain (Lau, 2019). Comparable to Steemit, it wants to incentivize and monetize the creativity of its users. At first, the founders of Cent expected it to be mainly used as a Q&A service, where users could ask questions and request answers by the community (Brody, 2017). However, today Cent describes itself as "The first network for creators experimenting with NFTs" (Cent.co). NFTs are non-fungible tokens, which means that they are unique digital items with a clear ownership guaranteed by the blockchain. This can be, for example, digital art, domain names or game items (Finzer, 2020). In addition, Cent even makes it possible for users to buy and sell tweets autographed by their creators (Cent.co). With this functionality the network gained great attention when the founder of twitter Jack Dorsey sold his first tweet as an NFT on Cent for 2,9 million dollars (Silberling, 2021). The selling and buying of NFTs on Cent represent a large difference to the content ownership on Steemit. While NFTs can be traded (Finzer, 2020), the content posted on the Steemit network will always belong to its producer (Zheng and Boh, 2021). Nevertheless, Steem also announced the introduction of NFTs. Still, these will not be traded on the Steemit network, but on the blockchain's platform Steem Engine (Hoogendoorn, 2020).

Another difference of Cent compared to Steemit can be found in the way the website incentivizes the contributions of its users. Cent allows users to invest in creators, who they see as high potentials. Thereby, users can subscribe to other members, or "seed" them as it is called on Cent. While seeders need to pay a fee of at least one dollar per month to the creator, they will receive a portion of the creator's future income in return (Silberling, 2021). This can be compared to the curator rewards on Steemit. However, while the curator reward on Steemit is linked to a single post, the return for the seeder on Cent is related to the creator.

In addition, community members of Cent can "spot" other people's posts. Thereby, they allow that a payment equivalent to one cent will be transferred from their crypto wallet to the creator (Silberling, 2021). Another fundamental difference to the rewarding system of Steemit is that creators can also reward their supporters. To do so, users can add a financial "bounty" to their post, which will be paid in the Ethereum cryptocurrency to the producer of the best response to the post (Brody, 2017). Thereby, creators can incentivize thoughtful comments and increase their visibility (Lau, 2019). However, not the creator of the post, but the community decides about which comment is seen as the best response (Brody, 2017). Therefore, it can be argued, that, like Steemit, Cent also uses swarm intelligence.

A potential concern, which may arise regarding the setting of bounties is that wealthier users may effort to set higher bounties than others and may therefore get more responses and visibility for their posts. To address this issue, it may be advantageous to instead hand a fixed budget for the setting of bounties to each user, comparable to the budget of voice credit in quadratic voting, discussed in a previous paragraph. This would give the same power to each user and incentivize them to allocate the highest bounties to the posts which are most important to them.

4. Potential Concerns about Blockchain Social Media

Although blockchain social media may have a wide variety of advantages compared to current platforms, there may also be disadvantages. This section discusses potential concerns related to the use of swarm intelligence and the rewarding of sweat equity as proposed in the previous paragraphs. Particularly, it investigates weaknesses of the decentralized content moderation and the financial incentivization, while providing potential solutions to these issues. Furthermore, it discusses possible threats to the censorship-resistance promoted by blockchain social media.

4.1. How Intelligent is the Swarm?

As discussed in a previous paragraph, there are many issues concerning the spread of fake news and hate speech in current social media platforms (Collins et al., 2021, Bilewicz and Soral, 2020). However, the decentralized content moderation used in blockchain social media may be a promising alternative to traditional moderation techniques, which do not seem to solve the problem in a sufficient way (Guidi et al., 2021). Nevertheless, it is important to ask whether this approach would lead to a satisfying outcome. Since there is no authority who can block malicious members from the network, it can be argued that the problem of undesirable content may even become worse. As every user can spread whatever content without a central control, there may occur a spam problem which could in turn motivate users to leave the network (Zheng and Boh, 2021).

Networks as Steemit try to fight this by financially incentivizing the production and upvoting of high-quality content (Zheng and Boh, 2021). Still, since the network decides about which posts are evaluated as high-quality, it is important to ask whether the content upvoted by the network would be free of fake news and hate speech. As people have the tendency to share attractive news without considering its consequences or evaluating whether the news is true (Shovon et al., 2019), it could be argued that the spreading of fake news may even increase. In addition, many users lack awareness of this type of content (Alkawaz et al., 2021) and may therefore not be able to identify fake news. However, also professional moderators are often being criticized for making the wrong decisions (Collins et al., 2021). Additionally, Pennycook and Rand (2019) find that the aggregated rating of the trustworthiness of news outlets done by laypeople is strongly correlated with the rating of professional fact checkers, despite the difference in the familiarity with the news outlets. The authors therefore suggest that including laypeople in the rating process of news would reduce the spread of misinformation on social media (Pennycook and Rand, 2019).

As discussed in a previous paragraph, another problem that may arise if the network moderates the content, is that the majority may tolerate a post discriminating a minority. Since Bilewicz and Soral (2020) find that people who use social media as their main source of news consumption, become less sensible to hate speech, it could be assumed that these problems become even worse if the moderation is done by the network. Nevertheless, the phenomenon which Posner and Weyl (2018, p. 106) call the tyranny of the majority, could be solved with the use of quadratic voting. If most users tolerate a post which discriminates a minority, this group may invest more votes to downvote the content.

However, the content, which is downvoted on social media networks as Steemit is not censored due to the immutability of the blockchain (Guidi et al., 2021). While this is an important feature to guarantee free speech, it also allows malicious content to stay on the website (Zheng and Boh, 2021). A solution which may provide a compromise between the emphasis on democracy and the avoidance of bad content, is a hybrid-model combining the swarm intelligence of the network with the ability of a management team to delete malicious content. Chen and Cho (2021) propose a model for a blockchain-based social network in which all users can upvote and downvote the posts produced by the community. However, they introduce a management team selected from the members which takes responsibility for the content on the website, and which can delete illegal posts or comments. If a member of the management team shows a malicious behavior, the network will be able to impeach it (Chen and Cho, 2021). This hybrid-model would support the emphasis on democracy made by blockchain social media without the need to accept the immutability of illegal content.

4.2. Do Financial Rewards Set the Right Incentives?

As the reward system of blockchain social media such as Steemit aims at incentivizing the contribution of high-quality content (Zheng and Boh, 2021), it is also important to ask whether these incentives lead to the desired outcome. Thelwall (2018) studies the characteristics of Steemit posts and the financial value associated with these. His findings suggest that posts which focus on interpersonal communication gain higher rewards than posts which provide informative quality content. Therefore, he argues that this may lead to a long-term problem of the website as users may focus more on network building instead of high-quality content creation, which is the original goal of the network (Thelwall, 2018). Furthermore, the extrinsic incentives may undermine the intrinsic motivation of users to contribute to the network (Zhen and Boh, 2021). Zhen and Boh (2021) therefore stress that blockchain social media should not only focus on financial rewards but should also find ways to enhance their users' enjoyment of content creation and prosocial behavior.

Another way in which members may try to cheat the system is by using bots, which upvote content for payments or try to accumulate wealth by upvoting posts expected to reach high rewards (Guidi and Michienzi, 2020). If a post is automatically upvoted by a bot it can gain visibility in the network even if most users would view it as low-quality content (Guidi et al., 2021). This may be an even larger problem than the creation of malicious content itself (Collins et al., 2021). Nevertheless, Guidi and Michienzi (2020) find significant differences in the behavior of humans and bots on Steemit. They observe that bots are much more active compared to human users, especially regarding the number of comments and reblog operations. Additionally, bots seem to follow a smaller number of accounts although they tend to be followed by a consistent number of users. These differences in the behavior of human members and bots may help to detect bots in the network (Guidi and Michienzi, 2020). If the network introduced a management team with the ability to ban accounts which show malicious behavior, as proposed by Chen and Cho (2021), it may use these findings to detect and delete accounts owned by bots. Another concern is that the rewarding system may attract attacks by greed driven hackers, who may try to exploit vulnerabilities of the website. Therefore, it is important for the network to constantly upgrade their defense against such attacks (Zheng and Boh, 2021). These findings highlight the importance for networks to consider, whether the financial rewards really lead to the user behavior they want to incentivize.

4.3. How Democratic are Decentralized Networks?

Since one of the main characteristics of communities as Steemit is the decentralization of power and influence on the network, it is also important to investigate whether the network is as democratic as it promotes to be. Kim and Chung (2018) state that although the network makes an emphasis on decentralization, the inequality between users may undermine this vision. This especially accounts for the distribution of financial rewards. Guidi et al. (2021) find that the richest users on Steemit are not those who are most socially active. They explain this phenomenon by the possibility to buy the cryptocurrencies paid on the network. In addition, they find no clear correlation between the number of upvotes, and the rewards generated by a post. The authors argue that this may be due to the possibility of buying upvotes from other users or casting upvotes for one's own content (Guidi et al., 2021).

The inequality on the network becomes even more problematic when considering that the users' voting power depends on their Steem Power (Guidi et al., 2021). Since Steem Power is not only determined by the users' behavior on the network but can also be bought (Steem, 2018), this may cause serious problems. If for example a user with a high amount of Steem Power upvotes a post, it will be difficult for other users with less Steem Power to downvote it (Guidi et al.,

2021). This may become even more problematic if the post upvoted contains malicious content. Therefore, it may be advantageous to consider whether someone's voting power should be determined by their reputation level instead.

Shovon et al. (2019) propose a model for the detection of fake news, which uses a similar concept. They suggest that random users could be selected from the network as news validators. After all news validators assign a correctness value to some news, its authenticity rating is determined by the weighted average of the values assigned by the validators. In turn, the weight of the individual user reflects the quality of their work as a validator. The more their rating deviates from the average value assigned to the news, the more their weight will be reduced (Shovon et al., 2019). Using a similar mechanism for the weighting of users' votes on social networks may assure that the influence of users, who upvote malicious content, decreases.

However, the rewarding and moderation of content are not the only aspects which may be negatively influenced by the inequality on the network. A recent example shows that the problems related to the limited democracy on Steemit become even more serious when it comes to decisions regarding the governance of the network. After the announcement that the entrepreneur Justin Sun had acquired Steemit, many members feared a misuse of his newly earned power on the network (Li_KungFu and Bitguy, 2020), as he also acquired the platform's founder reward, which are 20 percent of the total Steem token supply (Haig, 2020). Although there existed a social contract with the community that these assets would never be used for voting in any decisions concerning the governance of the network, the community did not trust him and used the power of the community's witnesses to block the voting rights of these tokens (Li_KungFu and Bitguy, 2020). Witnesses are community members, who are voted by the Steemit network to take care of the creation of new blocks on the Steem blockchain and changes in the business logic (Steemitguide, 2016).

Justin Sun, however, who regarded this action as an illegal hacking attack (Shevchenko, 2020), urged powerful members of the network to vote out the top 20 witnesses. This further reduced the trust of the community in Sun's decision-making, which led a group of members to build a new network called "Hive" (Li_KungFu and Bitguy, 2020), which runs on the blockchain of the same name. The Hive blockchain is based on the Steem code and was launched following the conflict concerning the takeover by Justin Sun. Therefore, the only difference between the Hive and the Steem blockchain can be found in the fact that Hive has no official leadership, which represents its main selling point (Dalton, 2020). Hence, the new website is an identical copy of the Steemit network, where all existing user accounts were replicated. However, the founder's reward owned by Justin Sun was not transferred to guarantee complete decentralization (Li_KungFu and Bitguy, 2020). In addition, Hive announced that it would let

the community decide about future developments and improvements of the network (Shevchenko, 2020). This example highlights that it is important to investigate whether blockchain-based social media as Steemit are as democratic and decentralized as they promote to be.

4.4. Is Complete Censorship-Resistance Possible?

One of the characteristics that networks as Steemit promote as their main advantages is the censorship-resistance due the use of the blockchain. However, many blockchain social media fail to really guarantee for a censorship-free network because they store data centrally (Zuckerman and Rajendra-Nicolucci, 2020). Therefore, it is important to ask how Steemit stores the content produced by its users and which actions are finally going to be on the blockchain. Steemit not only stores money transfers but also users' contributions, as writing and upvoting a post or following another user, as a transaction on the Steem blockchain (Guidi et al., 2021).

Still, since all data on the blockchain is stored in text format images or videos uploaded to the Steemit community are not hosted by the network itself but are provided by third-party hosting services with embedded links (Steemitguide, 2017). Hence, Steemit only stores the link to an image but not the image itself on the blockchain. This, in turn, makes it theoretically possible to censor images uploaded to the Steemit community by attacking the servers of the third-party hosting services (Mynameisbrian, 2016). However, there are some options for users to make their visual content censorship resistant. For example, one opportunity is to use IPFS to store images on the network. IPFS is a distributed peer-to-peer file system, which allows to store images and videos with a high security due to its distributed structure (Hsynterkr, 2018). Another opportunity is to convert the visual content into text form to make sure that it will be stored on the Steem blockchain. To do so, users can refer to encoding schemes such as Base64 to transfer their pictures into written data. This will ensure the censorship resistant storage of the image and allow other users to view the content using a decoder (Mynameisbrian, 2016).

Another advantage of the data storage on the blockchain is that it allows for greater transparency. With websites like Steemd, users can access information on the data stored on the blockchain. Thereby, users can for example view the author of a post, the date of its creation and the date when it was modified or its file size. Still, it is important to mention that most people will not have the necessary technical understanding to fully read the Steem blockchain (Steemitguide, 2017).

Another aspect, which may threaten the censorship resistance of the Steemit network, is the time a post takes until it is unchangeably stored on the blockchain. Although, a new block is

produced every three seconds on the Steem blockchain (Steem.com), there is a seven-day waiting period before a post is stored on the blockchain and its creator is rewarded for it. During these seven days the author is still able to delete or edit the post (Kenmelendez, 2017). This may be a threat to an authentic discussion as well. For example, if a user changes a post which gets criticized, the other users will not be able to see the original post anymore. Therefore, it can be summarized that although blockchain social media as Steemit make an emphasis on the immutability of their users' speech, there are still some potential obstacles for the censorship-resistance of the network.

5. Conclusion

This review finds that current social media platforms face a variety of problems due to their centralized structure. It further suggests that the use of blockchain technology may help to solve some of these issues. In particular, the decentralized nature of the blockchain allows to use the swarm intelligence of the network in the content moderation process. This not only makes the network more democratic but also seems to solve the problem of malicious content more effectively. In addition, the understanding of data creation as sweat equity combined with the possibility to transfer cryptocurrency payments on the network, make it possible to reward users for their contributions. This not only enables a fairer business model, but also incentivizes the production of high-quality content.

Nevertheless, the review also observes some potential obstacles of blockchain-based social media. Firstly, the findings suggest that using swarm intelligence for the moderation of content may cause some additional issues related to the detection of fake news and the avoidance of hate speech. However, these problems may be reduced with further measures such as the introduction of an elected management team with censoring capabilities, the implementation of quadratic voting as proposed by Eric A. Posner and E. Glen Weyl or the weighting of votes related to the users' reputation levels. Secondly, the findings of some papers in this review suggest that the financial rewards provided for users' sweat equity on the network may partly fail to set the right incentives, as they may motivate users to try to cheat the system or to focus on financial gains instead of high-quality contributions. Thirdly, the inequality between users of the community may undermine the democratic idea of decentralized networks and reduce the members' trust in the website's mechanisms. Finally, there may still be some obstacles for the censorship-resistance of blockchain social networks due to the partly centralized data storage and the authors' editing capabilities of their posts.

To summarize, blockchain-based social media may be a promising alternative to centralized platforms, as they provide solutions to many problems as the detection of fake news, the criticism of censorship or the incentivization of high-quality content production. Nevertheless, it is important to also evaluate potential concerns related to this new type of communities.

Due to the length of this paper, it only presents a selection of research papers and focuses on a few characteristics of blockchain-based social media. It does not aim to give a complete overview of all functionalities of Steemit or Cent nor to cover the whole landscape of blockchain social networks. However, it provides evidence for some advantageous characteristics of blockchain social media compared to current centralized platforms. For further research it would be interesting to compare the findings on the Steemit network with

other blockchain-based social networks. Additionally, it would be beneficial to design a concrete social media network, which combines the ideas discussed in this review aiming to reduce the problems of Steemit, such as the application of quadratic voting or the link of users' voting power to their reputation level. Finally, it would be interesting, to investigate whether these measures lead to the desired results in real world.

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