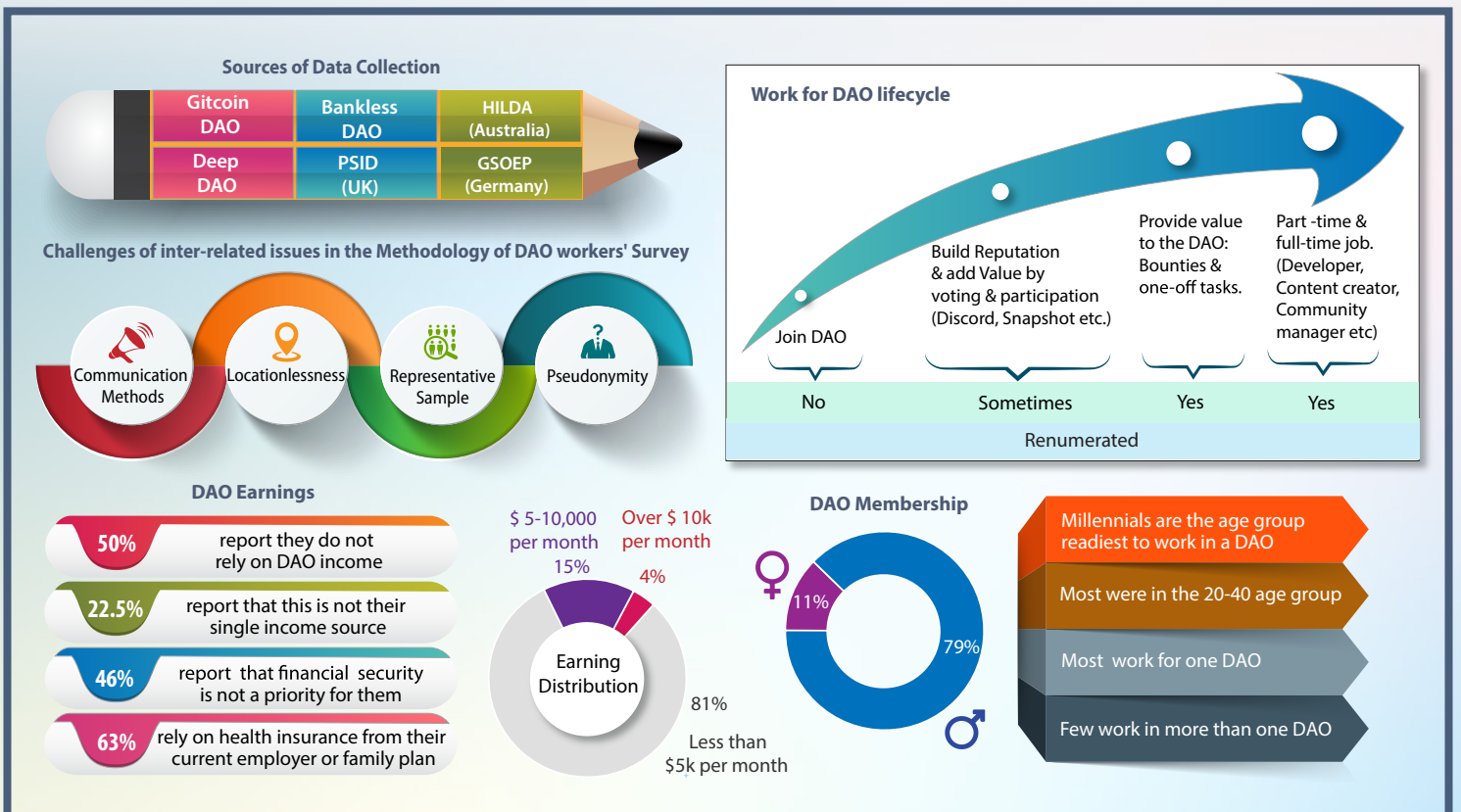




WORLD'S FIRST PEER-REVIEWED BLOCKCHAIN JOURNAL AVAILABLE IN PRINT & ONLINE

DECENTRALISED AUTONOMOUS ORGANISATIONS: Labour Economics of Web3's Distributed Digital Workforce



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Compensation in DAOs: A Proposal

The Tokenomics Audit Checklist: An Audit of DeFi projects, Terra/Luna and Ethereum 2.0

Rewarding Honesty: Incentive Mechanisms to Promote Trust in Blockchain-Based E-commerce

Decentralised Autonomous Organisation: Labour Economics & Decentralised Digital Workforce

DAO Treasuries and Native Governance Token Reporting Practices

Web2 V Web3 Paths to the Metaverse: An Analytical Essay

Proceedings of 3rd Annual BAF Summit on Promise of Web3: Innovation & Policies Making

6th Blockchain International Scientific Conference ISC2024, 19 April 2024, Singapore

PUBLISHED BY



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All-Party Parliamentary Group



The British Blockchain Association
Advocating Evidence Based Blockchain



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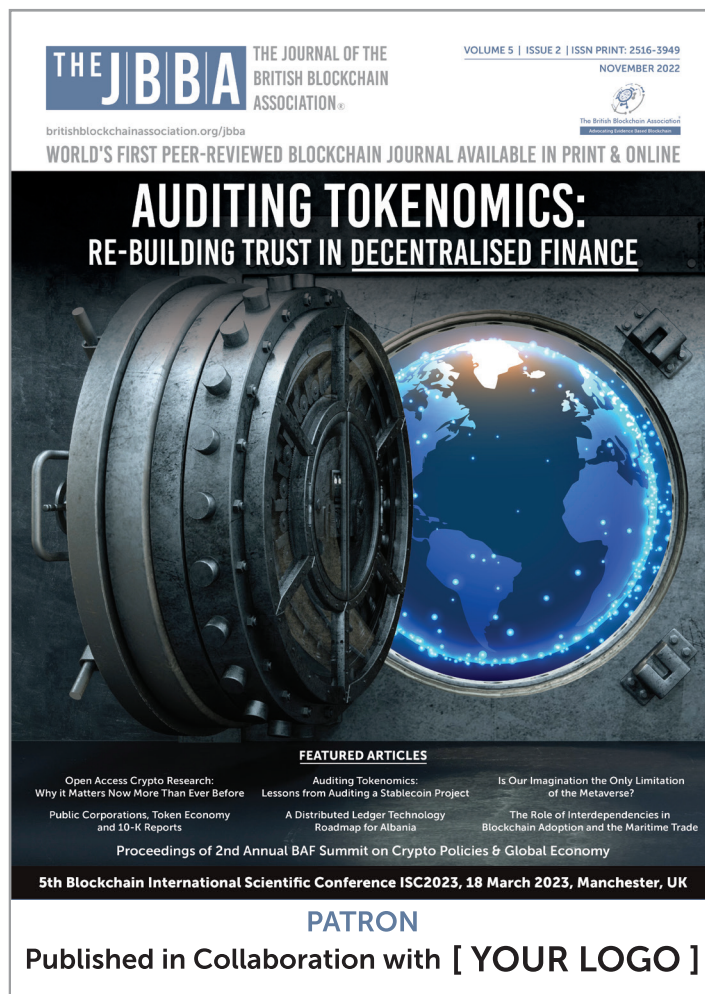
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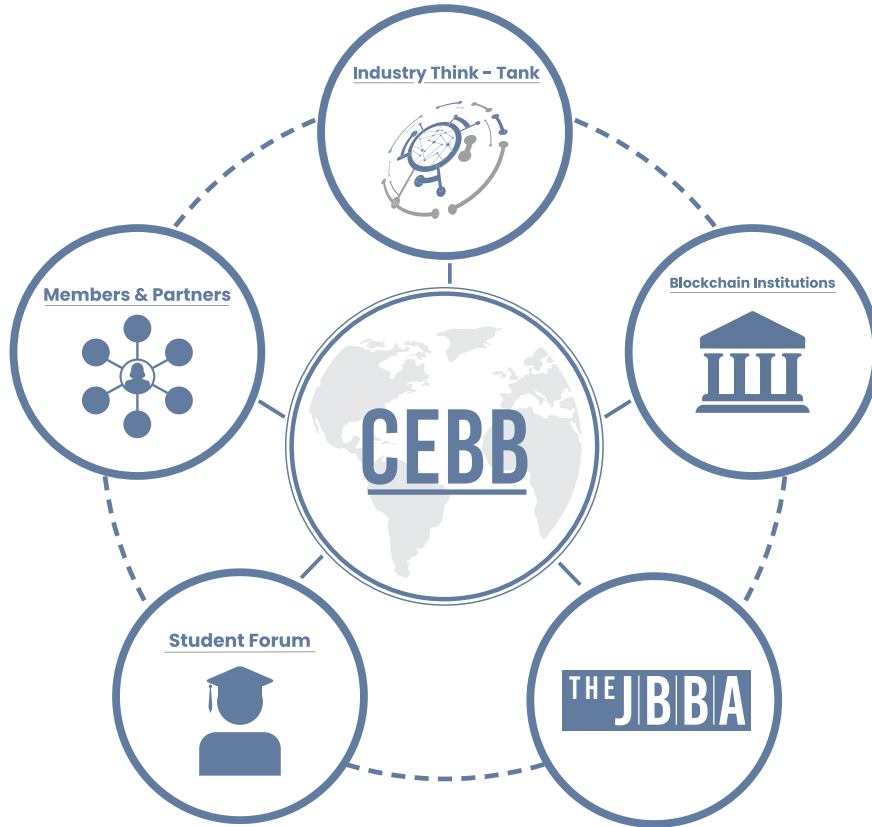
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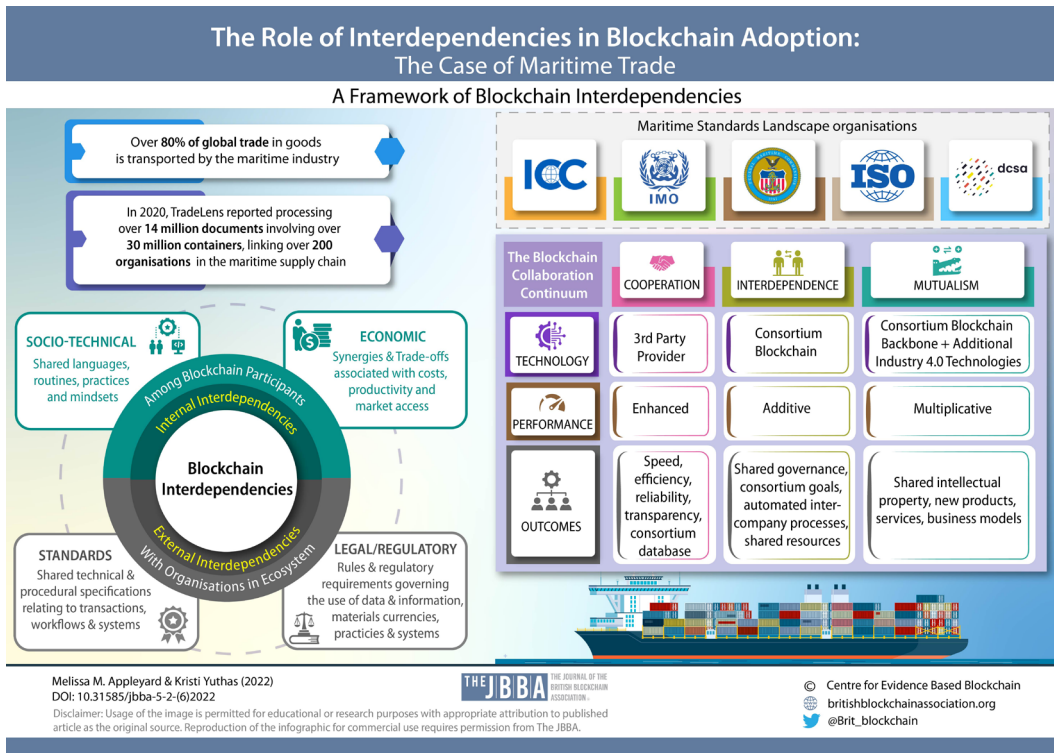




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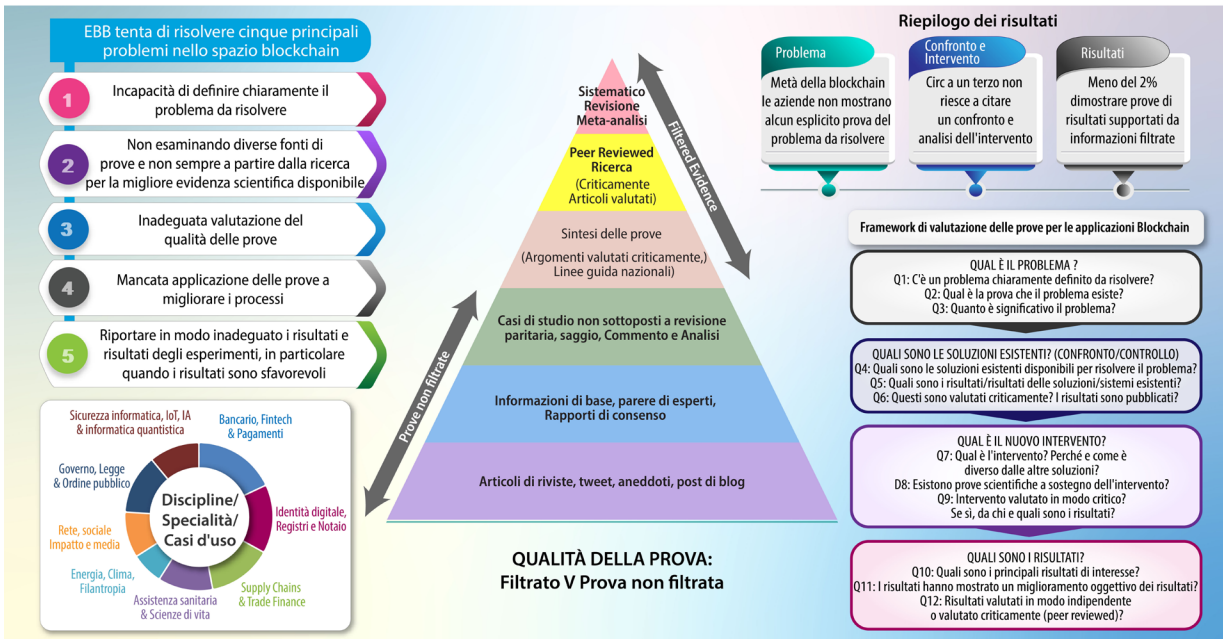
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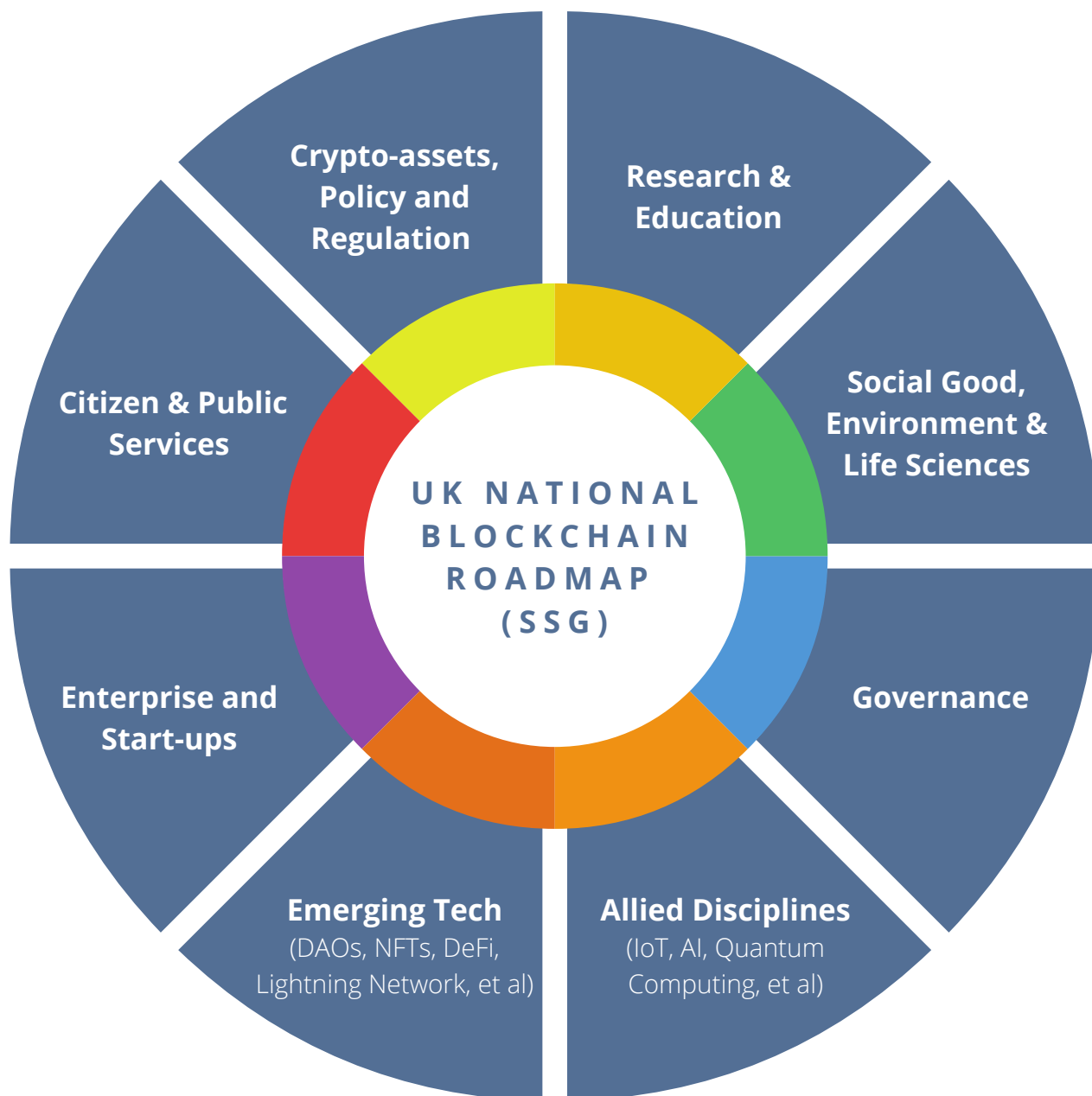


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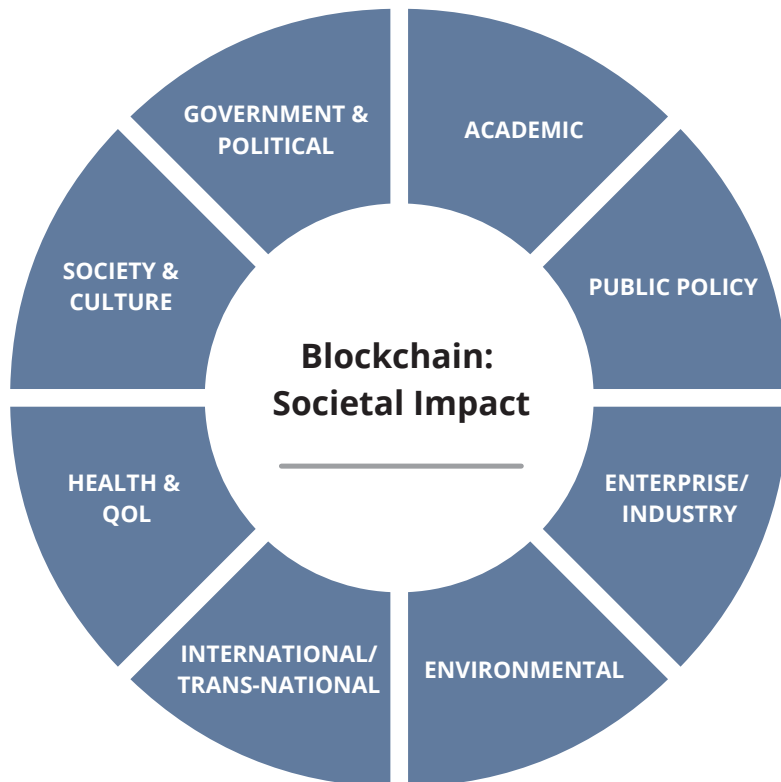
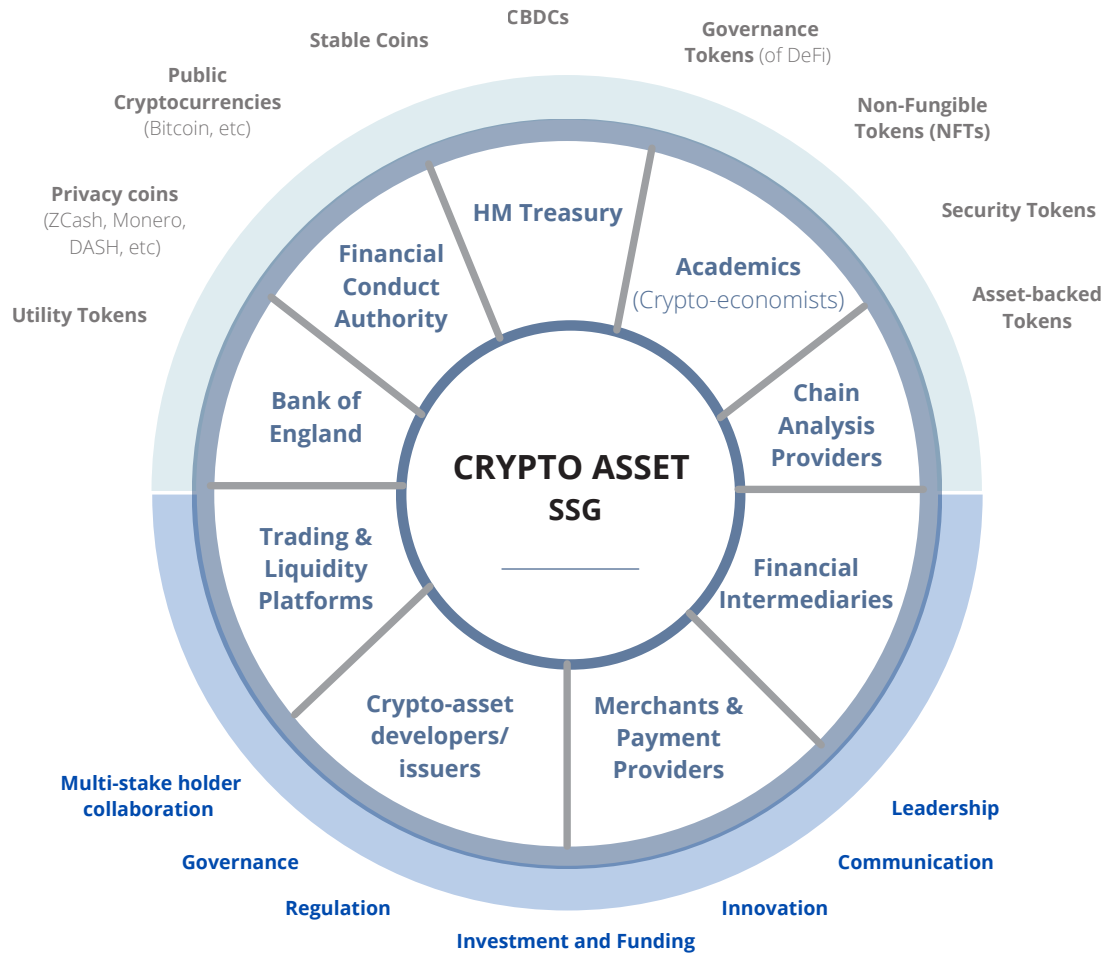
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EDITORIAL

I am pleased to author the editorial for the *12th* issue of the Journal of the British Blockchain Association (JBBA). I recall the inaugural issue published in 2018, which featured Lord Chris Holmes of Richmond on the cover. Although blockchain technologies have evolved since then, JBBA's mission remains steadfast: to curate and disseminate evidence-based research. Quoting Lord Holmes from that first issue, "Peer review is a critical part of the process of becoming a trusted source of information."

Managing a high-quality, peer-reviewed journal like the JBBA is no easy task. The journal's success hinges on the goodwill and cooperation of its editors, authors, reviewers, and readers. I am pleased to announce, through this editorial, that I have now contributed to all four of these roles. From my perspective, the success of JBBA is primarily due to the dedication, hard work, and commitment of its Editor in Chief, Professor Naseem Naqvi, as well as his close-knit team of associate editors and staff—namely, Dr Mureed Hussain, Professor Marc Pilkington, Professor David Lee, Sharmila Mary, et al. While they handle the arduous task of producing the journal, they are quick to redirect attention away from themselves and toward the work done by the authors. I will follow their example by highlighting the contributions in this issue.

Three of the peer-reviewed articles in this issue are about Decentralized Autonomous Organizations (DAOs).

DAOs are applications deployed on decentralised platforms, most commonly on Ethereum, with the purpose of transparently organizing and governing various human endeavours. As a novel form of social organization, DAOs present numerous opportunities for societal benefits, including global participation (inclusion), shared governance, reduced overhead costs, lower barriers to entry, and immutable rules that participants can rely on. However, as an emerging technology, DAOs are not without their challenges. Some are coded with vulnerabilities, low voter turnout can compromise democratic governance, volatile token economics may discourage good behaviour, and the legal status of many DAOs remains uncertain.

In this issue, authors of three papers contribute to our knowledge of DAOs:

Sinclair Davidson's article, "Compensation in DAOs: A Proposal," addresses the issue many DAOs face with time-based vesting schedules: they incentivize short-term behaviour, such as cashing out quickly, over long-term behaviour, like holding onto tokens. Sinclair proposes that DAOs could benefit from value-based vesting schedules, which would align contributors' compensation with the long-term success of the DAO. Hamman Schoonwinkel's article, "Towards Fair Presentation of DAO Treasuries: An Evaluation of Native Governance Token Reporting Practices," addresses the challenge of accurately assessing the value of tokens held in a DAO's treasury. He compared reports from DAO treasuries to the recommended practices set forth by the International Financial Reporting Standards (IFRS) and found that many DAOs likely overvalue their assets. Schoonwinkel calls for further research on reporting practices related to liability claims, income, and incurred expenses.

Nataliya Ilyushina's article, "Work for Decentralised Autonomous Organizations: What Empirical Labour Economics Can Tell Us About the Decentralised Digital Workforce," explores the unique aspects of labour markets within DAOs. Specifically, it discusses how DAOs offer a hybrid combination of ownership, volunteering, freelancing, and traditional employment. The author notes the existing information gap concerning DAO workers. While the website DeepDAO is useful for tracking treasury holdings, the number of token holders, and vote counts, Ilyushina

advocates for a more comprehensive investigation into the nature and roles of DAO workers.

David Lee, Kuo Chuen, Yang Li, and Weibiao Xu co-authored the fourth peer-reviewed article in this issue, titled "Rewarding Honesty: An Incentive Mechanism to Promote Trust in Blockchain-Based E-Commerce." This paper tackles an important issue within blockchain networks: how to incentivise honest behaviour. Although Nakamoto designed a system to encourage honesty within the Bitcoin network, many other types of decentralised applications continue to grapple with fraudulent activity. The authors suggest that a trusted third party could be given governance rights to reward honest users with tokens, for instance, when a user reports malicious behaviour.

This issue of the JBBA also features a case study by Stylianos Kampakis and Linas Stankevicius, titled "The Tokenomics Audit Checklist: Presentation and Examples from the Audit of a DeFi Project, Terra/Luna and Ethereum 2.0." The authors have developed an auditing framework that assigns an overall letter rating, ranging from a triple-A rating for the best score to a D rating for the worst score. They applied this framework to analyse Algem (a DeFi protocol), the failed Terra/Luna token, and Ethereum 2.0, awarding these projects scores of AAA, BB, and A (or higher), respectively.

Finally, I am pleased to be a co-author of an analytical essay titled, "Web 2 vs. Web 3 Paths to the Metaverse: Who is Leading? Who Should Lead?" by Le Kuai, Mary Lacity, and Jeffrey K. Mullins. In this essay, we explore the current frontrunners in the development of the metaverse along two evolutionary paths: Web 2 and Web 3. Drawing upon regulatory reports, corporate press releases, and patents, we find that only a few Web 2 companies are fully committed to the metaverse; among these, Meta stands out as a likely dominant platform provider. Based on metrics such as market capitalisation, user activity, and patent holdings, only a handful of Web 3 communities are emerging. Despite the prevailing hype, we are still in the early stages of metaverse development on both fronts. In terms of who should take the lead, we advocate for Web 3, as it offers greater benefits to users, content creators, and businesses. However, it remains challenging for Web 3 communities to produce platforms and experiences as rich as those funded by Web 2's venture capital and corporate backing.

In addition to the articles, I look forward to the other content that makes a JBBA issue special, such as the infographics created for articles and the colourful summaries of recent meetings of the British Blockchain Association.

In the end, I would like to thank all editors, reviewers, authors, journal admin staff, and readers once again for their support of the JBBA.

Until next time,

Mary

Professor Dr Mary Lacity PhD FBBA
University of Arkansas, USA
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Evandro Pioli Moro, Blockchain Researcher, British Telecommunication (BT) Applied Research

Work for Decentralised Autonomous Organisation: What Empirical Labour Economics Can Tell Us about the Decentralised Digital Workforce

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Abstract

A decentralised autonomous organisation (DAO) is a new type of digitally native organisation with a membership base that has been rapidly growing throughout 2022. A new organisational structure also leads to a new way labour is organised, hired, demanded and supplied. There are, however, some differences in human capital accumulation and employee decision-making. These issues fall in the domain of labour economics. Existing theories of labour economics are tested on conventional labour market data. However, DAO work differs from the traditional post-industrial labour market employer-employee relationship. It can be described as a hybrid of ownership, volunteering, freelancing and traditional employment in different proportions for different people. Whether those differences change how the labour market operates in DAOs needs to be examined. To understand this, we need more information on DAO workers, specifically labour and socio-economic survey data, which needs to be collected. This paper identifies the need for a large-scale survey of DAO workers, discusses the motivation and challenges of data collection specific to DAOs and some important labour economic policy questions that DAOs might face in the near future that rely on empirical data. Next, the paper critically reviews and summarises the existing small-scale data on work for DAO parameters. Lastly, the article outlines issues with empirical data collection and why current methods should be modified to gather and analyse economic data on DAO work. Overall, the paper aims to determine the way ahead for the applied labour economic analysis of DAO labour.

Keywords: *Decentralised autonomous organisation, Blockchain, Labour market, Labour economics, Data, Survey.*

JEL Classifications: *J21, J22, J23, J24, J46, J49, C83.*

1. Introduction

The year 2022 was coined as “a year of a DAO” [1], and the number of DAO members has been growing rapidly, reaching 6.4 million members [2]. The size of DAO membership has been growing at a pace between 100,000 and 200,000 monthly for the past year [2]. Many of those members are paid contributors with a wide array of employment arrangements. And we do not even know approximately how many of them are getting paid for work, meaning even the size of the DAO labour force remains unknown and can be any number between 0 and 6.4 million. While still relatively small for a global labour market size, it is already bigger than, for example, the labour force size of Norway [3].

DAO is a digitally native organisational structure where members govern themselves through tokens and smart contracts encoded on the blockchain [4–6]. Distributed ledger technology such as blockchains enables the coordination of economic transactions and social interactions that allow DAOs to exist [6]. Blockchain also enables decentralisation instead of central management, by allowing all members to participate in the decision-making [7].

DAOs operate for a wide range of purposes, both profit and nonprofit. Value-adding activity involves members contributing, in other words, “working” towards value creation. DAO work has characteristics of ownership, volunteering, freelancing and full-time work [8]. The key difference in a labour organisation is a flat structure that is enabled by

decentralisation. The absence of a hierarchy creates a fairer future of work [9]. All members are co-owners and co-managers and can become co-workers if they want to add value to the DAO [8]. The by-product of the flat structure is that the hiring decisions, among other governance matters, are decided by community voting [10, 11]. Therefore, it is often required to be known to the community and gain a reputation before first paid tasks are assigned. Being a digitally native organisation implies that there is no physical office space; hence, DAO members can work from anywhere. DAO typically does not have a physical location or head office unless some brick-and-mortar assets are required for its core project operations.

To better understand what employment in DAOs looks like and how it differs from the employment and hiring process in the traditional firm, the paper describes the lifecycle of DAO employment (see Figure 1). The process usually starts with joining the DAO by purchasing a governance token. Then a member can choose the extent of how involved they want to be in the governance and whether and how much they would like to contribute to the DAO. Contributions at the beginning usually are unpaid and involve participating in discussions (e.g. Discord, Discourse, Twitter) and voting (e.g. Snapshot) [12]. That is when a member starts being known to the community and builds a reputation. Unlike in the conventional labour market, reputation is critical in securing paid employment in DAOs. Reputation also plays an important role in all aspects of being part of the DAO community, and its accumulation continues throughout the employment lifecycle. Typically, the first paid work in DAO is a bounty – a small, disconnected task [13]. Completing bounties leads to further accumulation of reputation in the DAO. Members can secure part-time

and full-time work arrangements when they have established themselves sufficiently. While rare, the ongoing full-time work in DAOs is typically well-paid [14].

2. Literature Review

While the literature on DAOs is growing, some have already pointed out “the lack of empirical and field research on DAO communities” and pointed at DAO work as a gap in the existing research [15, 16]. The number of contributors in DAOs that add value and receive remuneration has been proliferating as DAOs numbers soared to 6.4 million in 2023 [2], surpassing the size of a labour force of a small European country. While we know the number of DAOs and the number of members, we have limited knowledge of how many people work for DAOs, who they are, how much they earn and other characteristics of working for a DAO. Furthermore, the DAO organisation structure is different from a firm [17], raising the question of what does work for DAO means and resulting in characteristics that did not exist previously.

It is important to study this new DAO labour market empirically for the same reasons labour economists want to know about any other labour force – to study labour market outcomes [18]. Namely, understanding the decisions around human capital accumulation, labour supply, labour and leisure trade-offs, labour productivity, the effect of demographic and socio-economic characteristics on labour market outcomes, satisfaction with work and wellbeing, unemployment and underemployment rates and spells [19–22]. Volunteering literature also applies to some unpaid contributions that are common in the early stages after joining the DAO community [23].

Further, it is critical to understand the transition processes from working for a firm to working for DAO. For example, questions that arise are: who are the people who transition, what determines the decision to switch to working for a DAO, how long do they work for both traditional firms and DAO simultaneously before committing to DAO-only employment and what determines their choice and what makes the transition easy? Next, empirical data can be used to analyse the labour market failures such as inequality, discrimination and job insecurity, such as casualisation of the labour force. Finally, the DAO labour market data will inform the research on the globalisation of labour and the digital economy transformation.

The scope of labour market issues that can be overlooked without adequate data collection and analysis is vast. Without sufficient data, researchers may fail to inform policymakers about a wide range of issues, including exploitation, discrimination and negative impacts on physical and mental health. These issues are often neglected in black markets [24], and if they go unaddressed in the growing DAO ecosystem, the number of individuals who could be affected will continue to increase. Therefore, there is an urgent need for social welfare considerations to monitor the characteristics of the DAO labour market, just as it is done for conventional labour markets.

Labour economics relies on empirical analyses more than other economic disciplines and uses a wide range of econometric methods in its analysis [25, 26]. The econometric analysis requires a large panel and longitudinal datasets that are derived through surveys such as HILDA in Australia, PSID in the UK, GSOEP in Germany etc. None of those large nationally representative surveys currently captures DAO or web3 labour. HILDA first asked digital platform or web2-type work questions for the first time in their survey in 2020 [27]. The only survey that exists on DAO labour is a survey of 422 “DAOs: *The New Coordination Frontier*” conducted by Bankless DAO and Bitcoin DAO [28]. It might not be suitable for econometric analysis due to the small sample size. For example, a simple linear regression with age (4 categories) and gender (2 categories) variables requires around 100 individuals surveyed [29, 30]. Only 256 individuals responded to gender question. If we add size of earning variable, which has 9 categories in the survey, that will require between 170 and 280

observations, but still yield rather basic analysis of the socio-economic relationships. Other issues include non-response numbers and bias and the lack of publicly available details on the methodology. Therefore, the questions above cannot be answered without an extensive data collection exercise preceded by in-depth methodological considerations.

Although empirical labour economics in DAOs is still in its early stages, there is a growing imperative to better comprehend who is being affected and how. One key aspect that is not yet fully understood is the extent to which DAO work can provide a secure and reliable source of income. According to the results of the Bankless and Github Survey, however, approximately half of the respondents rely on DAO work as their primary source of income [28]. It is crucial for researchers and policymakers to have data on the characteristics and demographics of DAO workers in order to design policies that promote equity, diversity, and fair working conditions, and prevent exploitation of workers.

Furthermore, it is important to understand the advantages and flexibility of the DAO labour market, which can serve as a foundation for designing government policies and incentive schemes. Such policies can facilitate maximising the potential benefits of the new organisational arrangements and DAO tools, both for the workers themselves and the broader society.

The paper is structured in the following way. First, it discusses in more detail the definition of DAO labour. Understanding the differences is important to inform the survey methodology about what methods might not work and what new issues that only exist in the DAO space need to be covered. Next, the paper critically appraises the existing attempts at data collection on DAOs. Lastly, the paper offers suggestions for the survey methodology development based on the differences in the DAO labour market and the drawbacks of the existing data sources.

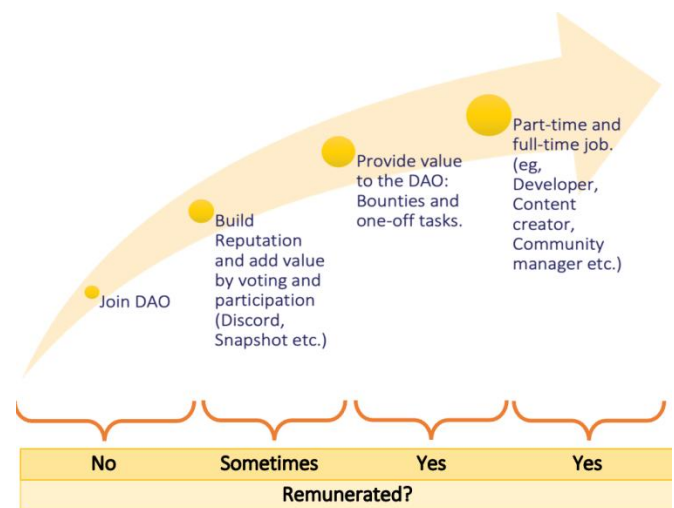


Figure 1. Work for DAO lifecycle.

3. Implications of Work for DAO Lifecycle for the Definition and Sampling of the “DAO Worker”

In the context of employment in DAOs, it is difficult to establish a clear equivalence with traditional firms, which presents a challenge for data collection methodologies. The conventional definition of employment involves being in a paid job for at least an hour within the last week [31]. Most of the time, workers in a traditional firm start work on the date outlined in a contract or when a person starts performing duties and earning wages. However, this definition only corresponds to the least common form of employment in DAOs, leading to potential data collection issues. Narrowing DAO employment to this definition may result in a statistically insignificant sample and an inadequate and biased representation of DAO

organisations since some DAOs do not practice ongoing employment arrangements. For instance, dOrg DAO only hires staff on a casual basis. Therefore, it is crucial to develop a more comprehensive definition of DAO employment to capture the diversity of the arrangements and accurately assess the characteristics and impact of DAO labour markets.

Unpaid work done shortly after joining a DAO and before starting to get the “bounties” (Figure 1) is a substantial part of learning and understanding work for DAO. Unpaid contributions, while resembling volunteering, have a different purpose. Volunteering is, usually to a great extent, driven by altruistic motives [23], while unpaid DAO contributors are seeking to build a reputation and become known to the community. Many of them are contributing for free because they are ideologically aligned with the main project of the DAO, making it often look similar to volunteer work. However, even in that case, the contributors are still co-owner of the DAO.

To conduct effective surveys on the work of DAOs, it is advisable to broaden the scope of the definition of a DAO worker. This would involve expanding the category of DAO workers to include any active member or contributor, regardless of whether they receive remuneration or have formal work arrangements. Such an approach would align with the broader economic definition of work, which considers any productive activity as work [32].

By adopting this more inclusive definition, researchers would be able to capture a broader range of perspectives and experiences related to DAO work. This could provide valuable insights into the nature of work within DAOs, including the ways in which workers engage with the organisation and contribute to its activities. Additionally, it could shed light on the motivations and incentives that drive participation in DAOs, as well as the challenges and opportunities associated with this type of work.

4. Existing Data on Work for DAO

In the DAO space itself, but outside the scope of academic research, there have been a few productive efforts in the initial data collection of on DAOs. This section provides an overview of the existing data sources relevant to work for DAO and offers a critical evaluation of the data. Mapping the existing data landscape offers a preliminary quantitative snapshot of the DAO labour market and provides the foundation for further directions for data collection methodology.

4.1 DeepDao

DeepDao is an online database that offers an overall basic real-time quantitative snapshot of the DAO ecosystem. It lists the parameters such as the number of DAOs, DAO treasuries, the number of DAO members, DAO governance tools used by each DAO etc. [2]. The paid version has more detailed information on governance and treasuries over time. The following variables can be found on the publicly available DeepDAO website that are relevant to the economics of labour market analysis:

- Number of active voters and proposal makers
- Governance token holders
- List of top 250 DAO members, the number of DAOs each is part of and their voting activity.

DeepDAO data is a valuable resource that provides real-time information on critical characteristics of DAOs. DeepDAO takes advantage of the transparency of transactions offered by blockchain technology. It sources data directly from the blockchains on which DAOs operate. This information is often used to discuss the magnitude and sample size of the DAO landscape in academic research, including economic papers [6, 33]. It serves as a beneficial source for obtaining primary descriptive statistics and establishing a quantitative understanding of the DAO space, including the DAO workforce.

However, it is essential to note that DeepDAO data has limitations. It provides only basic information that does not support cross-sectional or time-series statistical analyses of critical socio-economic characteristics, such as gender, age, salaries and wages, work hours, employment type, transitions, job satisfaction, etc. It is limited to the blockchain-based transactions recorded in the ledgers.

Despite this limitation, the DeepDAO data on the number of DAO members and active DAO members, and the DAOs each member is affiliated with, offer a solid foundation for developing methodologies for further DAO data collection through interviews and surveys. By leveraging this information, researchers can gain insights into the nature of work within DAOs and the motivations that drive participation in these organisations.

In summary, DeepDAO data is a valuable starting point for researchers seeking to understand the DAO landscape and workforce. While it has limitations, it can provide critical initial information for further data collection and analysis that can improve our understanding of the socio-economic characteristics of the DAO workforce.

4.2 “DAOs: The New Coordination Frontier” Survey: Findings and Critical Evaluation of the Survey

In September 2021, Gitcoin and Bankless DAOs conducted the first-ever survey of DAO members. This survey included 422 respondents from 233 DAOs, representing 290 cities [28]. The survey provided valuable insights into DAO members' demographic and socio-economic characteristics. It covered essential questions related to DAO work, including the compensation earned by members in a DAO and whether this is their primary source of income, the tools used for compensation and the specific roles members hold in the DAO.

The survey addressed the traditional variables related to employment and examined unique DAO-specific questions that are irrelevant to mainstream labour relationships. By exploring these questions, the survey provided a more comprehensive understanding of the nature of work within DAOs and the motivations behind participation in these organisations.

Overall, the survey conducted by Gitcoin and Bankless DAOs was a significant step towards understanding the DAO landscape and the socio-economic characteristics of the DAO workforce. It serves as a valuable reference for researchers seeking to explore the rapidly evolving world of decentralised organisations and their impact on labour relations.

The Gitcoin and Bankless Survey offers some key essential insights into DAO membership. They identified the age and gender issue in the DAO space, reporting that 79% of the respondents identified as males and only 11% as females, while most members were in the 20-40 age group. They found that most respondents work for one DAO and a few in more than one DAO, but they also commented that it is hard to participate in more than two DAOs meaningfully.

The first and most obvious drawback is the total sample size – 442 respondents. While a great number for the first survey in the space for a general audience, it will not be sufficient to address many of the typical issues in economics research. Many questions, such as age and gender only answered by 256 members. This can cause significant issues if any inferential statistics method, such as simple linear regression, is applied.

Notably, a diverse selection of DAOs is represented in the Bankless survey. Even though the highest number of respondents were from Bankless and Gitcoin DAOs, they managed to collect responses from 233 different DAOs. They also covered a wide range of DAO types, such as NFT, social, investment, protocol and service DAOs.

The survey claims to have respondents from 290 different cities. While that might seem like a tremendous geographical variation, looking at the map, it appears that the majority of respondents are from China, HK, the USA and Canada. Moreover, looking at the breakdown by cities, it appears there are some duplicates, such as “HK” and “Hong Kong,” hence the total number of cities might be overestimated. It is impossible to say at this stage if that is a bias in the data, or DAO members are geographically concentrated in certain regions.

The survey offers solid insight into contributors’ earnings. It provides earning distribution and uncovers that about 15%¹ of the respondents earn 5-10,000 USD per month and about 4% over 10,000 USD per month. While the majority did not seem to earn a living wage approximately a half also reported they do not rely on DAO income and of those who rely on DAO income, 55% report that this is not their single income source. Hence, DAOs are yet far to provide financial security. Having said that, approximately 46% of the respondent report that financial security is not a priority for them, and the majority (63%) rely on health insurance from their current employer or family plan. This data is important to underpin future research on job security, self-selection in DAO and equality of opportunity.

The survey conducted by Gitcoin and Bankless DAOs stands out as the most comprehensive and successful attempt to date in collecting data on members of DAOs. Despite its notable achievements, however, the survey presents certain limitations that may impede economists from using it as a primary data source for drawing statistically reliable conclusions. Therefore, a detailed examination of the survey’s strengths and weaknesses provides valuable insights for the design of future DAO surveys. In fact, to date, the Gitcoin and Bankless survey is the closest data collection exercise to what could be considered an academic dataset.

4.3 Other Data

There are other surveys that can indirectly provide data on DAO work. For example, Governance Learning Forum released a report providing statistics about DAO governance based on a survey of 109 respondents [34]. While focusing on governance, they also provided some insight into the DAO work. For example, they asked what the respondent’s area of expertise is. They also tried to address the issue discussed earlier in this paper about the breadth of the definition of a DAO worker. To do so, they assigned one of the questions with quite a detailed answer options reflecting on the degree of involvement in the DAO. “DAO lurker” and “DAO core team” [34].

Metis DAO conducted another survey that is related to DAO work. It aims to understand the general population’s sentiment towards remote work and how it fits with the DAO work opportunities. The “Remote Work Survey” was conducted using a conventional method, where a representative sample of the general population and administered via the popular online tool SurveyMonkey [35]. The commonly used data collection method was appropriate for that research question. They found that every four out of 1,112 people surveyed see DAO as a future of work, and almost half reported that they are open to considering working for a DAO [35]. Further, they found that millennials are the age group that is the readiest to work in a DAO, and that corresponds to the Gitcoin and Bankless survey of the DAO members that reported that most DAO workers are 20-40 years old [28, 35]. The Metis DAO survey exemplifies that the choice of methodology stems from the research question and that not all DAO work questions require an innovative approach. The general population survey data can offer some insights about DAO work and its future.

5. DAO Labour Data Collection and Methodology Issues

There is a clear need for further data collection to obtain a data set suitable for quantitative academic research, applying labour economic theories and

addressing socio-economic policy questions relevant to work in DAOs. Nevertheless, the application of conventional survey and interview methods that are effective in the traditional offline labour market can be a time-consuming and laborious endeavour or even not feasible. Drawing on the analysis of the previous sections of this paper, this section discusses the differences that need to be considered when developing a survey methodology for the DAO workforce and considerations for the survey design based. While the ensuing discussion attempts to address the majority of issues with the DAO survey, it should be noted that the novelty of this research area means that some or many issues remain unencountered.

This section discusses interrelated issues for the methodology of DAO workers survey:

- Communication methods
- Locationlessness
- Representative sample
- Pseudonymity

The approach to contact and recruit the survey respondents used by the mainstream data collection agencies might not be suitable for DAO surveying. The key issue is those companies’ sampling, communication channels and attachment to a specific country or region. The survey is typically conducted by a company that contacts the marketplace agency with a database of contacts who expressed interest in participating in surveys. Those databases can yield nationally representative samples by demographics, socio-economic status or other desirable for the research parameters.

However, the method described above has a high risk that it won’t yield a statistically significant sample of DAO workers because of such a low proportion of people are part of DAOs. Even with a reasonable response rate, there will be a tiny proportion of respondents in the general population who are members of DAOs. Next, even with the small number that will be found, they all will be restricted to a specific geographical zone, e.g., Australia, where the survey company operates. Since DAOs are digitally native and distributed, they do not have a geographic location. At this stage of DAO research, it is unclear whether attachment to a particular country will introduce any bias in the understanding of trends in the “locationless” organisations. With the small number of DAO members as a proportion of the general world population, a survey of that kind is more likely to describe the proportion of DAO members. They fail to deliver a sizeable enough sample of DAO members for statistical analysis. Lastly, DAO workers will be less likely to provide their details to a survey company, especially if it requires disclosing their identity. DAO members typically act under a pseudonym, and many are reluctant to disclose their identities.

Successful surveying of DAO workers requires an appropriate choice of communication channels. Most modern surveys are conducted online and contact potential respondents via email because of their convenience and low cost. Some are done over the telephone and in person. The mode of the survey plays an important role in both the response rate and the precision of the answers [36]. For example, the nationally representative Household, Income, and Labor Dynamic Survey (HILDA) are partially administered as an in-person interview but also contains a self-completion questionnaire [37]. The self-completion questionnaire addresses questions that people are less comfortable answering in person, such as mental health-related questions. This is a good example of considering the comfort and convenience of the respondent when choosing the communication channel and mode of data collection. Same principle should be applied when interviewing DAO workers.

When considering the best mode of conducting the DAO members survey, the first consideration is that the in-person mode is practically not applicable. The reason is that the DAO members are distributed all over the world, which would make it prohibitively costly to travel to

contact them. Further, they are used to and more comfortable with online communication. Careful consideration should be given to the online web3 platforms for survey data collection in DAOs. A significant number of DAOs are using Discord as their primary communication channel. Each DAO typically has one Discord server that consists of many channels. Some channels are public, others private, to maintain the privacy and confidentiality of their members. Discord should be the primary choice of platform for surveys. Firstly, since some of the channels are public, there is always an opportunity for the researcher to advertise the survey. Secondly, Discord has a private chat function where a survey can be sent or an interview can be conducted. Next, if a member stays within the Discord platform, their pseudonymity is maintained. And, most importantly, a platform that typical DAO members are familiar with. Research pointed out that DAO toolkits, such as Discord, are designed to be user-friendly and modifiable [12]. Hence, there are fewer barriers to participating in the survey when it is conducted in Discord. Other commonly used by DAO workers and web3 community communication tools, such as Slack and Telegram, should be considered in the survey method design.

Pseudonymity has advantages and disadvantages for survey data collection. On the one hand, pseudonymity removes the issue of dealing with identification data. That alleviates privacy concerns and simplifies dealing with them. Additionally, that should make the respondent more open to answering questions honestly. On the other hand, there is no mechanism to check if you are not surveying the same person twice if they have more than one account/nickname in the DAO space. It circles back to the question of how to contact them, as a conventional marketplace of survey respondents might not be able to have contact with people who want to stay anonymous or pseudonymous. Further, it can underestimate the response rate, where the person has already completed the survey and is being contacted under another nickname. This issue is less concerned with the interviews than surveys, where it is easy to identify the double counting. In addition, some academic research requires interview participants to sign the consent form, which raises the question of the appropriate way to sign – with their real name or nickname, and what are the legal implications of that for the ethical compliance of the research.

Another issue is, what is the appropriate way to define the representative sample of DAO workers? A representative sample is a critical concept for data collection methodology. For example, when collecting data on the nationally representative sample of the population, a researcher makes sure that the key parameters, most often age and gender distribution, are not statistically different from the general population. The parameters for the general population are normally obtained from census data usually available from government statistical agencies' websites. The only census-style data we have on the whole DAO ecosystem workers is the number of token holders and active voters [2]. Until more DAO-wide parameters on DAO members are collected, it will be impossible to statistically infer whether the sample is biased, e.g., might not be able to address questions like: Are we oversampling US-based respondents, or are there more US residents working for a DAO?

In the context of DAO work, while some conventional survey questions such as socio-demographic characteristics, job title and income remain applicable, there are features that are unique to DAO work. A salient example of such a feature is reputation, which has no equivalent in traditional labour markets. In conventional markets, human capital is a crucial parameter that is formalised through CVs, which include an individual's education and work experience. However, in DAOs, CVs are irrelevant, and it is often inconvenient or even impossible to verify formal degrees due to the pseudonymous nature of DAOs. Consequently, DAOs rely on reputation to select their workers. As highlighted in Section 1 and Figure 1, a DAO member must establish a reputation by engaging in community discussions and voting before being offered the first paid task. Reputation becomes the primary asset enabling DAO workers to obtain paid work. Although similar to human capital and social capital [38, 39], reputation is not identical, and

collecting data on this unique feature requires an innovative approach.

However, in some cases, conventional data collection is still appropriate in the context of DAO work. Some research questions on work DAOs do not require a large sample of DAO workers and can still be conducted in the usual way. For example, the Metis DAO survey managed to gather the attitudes towards working for DAO in a representative sample of the US general population of 1,112 respondents. They have many variations in the variables about the attitudes towards work for DAO that can be used for the economic analysis. However, finding a thousand DAO members through survey agencies or using a common online survey tool like Survey Monkey will be challenging.

6. Conclusion

DAOs are the frontier type of blockchain-based organisation. Without distributed ledger technology, such as blockchain, it would not be possible to establish coordination and governance among individuals over the Internet [40]. An important part of governance is workforce and labour market coordination. This paper explored the key underlying obstacle to understanding the workforce processes in a DAO – lack of data and discussed the way forward. The number of DAO members is growing rapidly, as reported by DeepDAO [2]. Moreover, smaller-scale data collection efforts suggest that many people work for DAOs and that some make a living doing so. A survey also shows that the general population views DAOs as a viable future of work. Acknowledging DAO work as a substantial labour market necessitates economic analysis that cannot be carried out without large-scale data collection. While most data collection efforts are currently conducted by DAOs themselves, there is a clear need for academic data collection to move forward with analysis.

7. Areas of Future Research

There are several obstacles to data collection in DAOs, including contacting DAO members, the challenge of pseudonymity, locationlessness and the absence of census-style data on DAO members that would enable researchers to assess the representativeness of the sample. Moreover, there are unique labour market parameters that are specific to DAOs, such as reputation, that require novel approaches for surveying and analysis. This paper outlined the most pressing issues that must be addressed to enable full-scale labour market data collection for DAOs and avenues for future research for empirical labour economics.

References

- [1] "Crypto Theses for 2022: Key trends, people, companies, and projects to watch across the crypto landscape, with predictions for 2022," *Messari Crypto News*, 2021. Accessed: Dec. 10, 2022. [Online]. Available: <https://messari.io/crypto-theses-for-2022>.
- [2] DeepDAO. Accessed: Feb. 1, 2023. [Online]. Available: <https://deepdao.io/organizations>.
- [3] "Data, labor force, total - Norway," *The World Bank*. [Accessed: Feb. 2, 2023]. [Online]. Available: <https://data.worldbank.org/indicator/SL.TLF.TOTL.IN?locations=NO>.
- [4] S. Davidson, P. De Filippi, and J. Potts, "Blockchains and the economic institutions of capitalism," *J. Institutional Econ.*, vol. 14, no. 4, pp. 639–658, 2018.
- [5] Hassan, S., and P. De Filippi, "Decentralized autonomous organization," *Internet Policy Rev.*, vol. 10, no. 2, pp. 1–10, 2021. Accessed: Oct. 18, 2022. [Online]. Available: [doi:10.14763/2021.2.1556](https://doi.org/10.14763/2021.2.1556)
- [6] A. Wright, "The rise of decentralized autonomous organizations: Opportunities and challenges," *Stan. J. Blockchain L. & Pol'y*, vol. 4, no. 2, pp. 152–176, 2021.
- [7] D. W. Allen, C. Berg, and A. M. Lane, *Cryptodemocracy: How Blockchain Can Radically Expand Democratic Choice*. Rowman & Littlefield, Lanham: Lexington Books, 2019.
- [8] N. Iyushina and T. Macdonald, "Decentralised autonomous organisations: A new research agenda for labour economics," *The Journal of the British Blockchain*

Association, Apr. 2022.

- [9] K. Nabben, N. Puspasari, M. Kelleber, and S. Sanjay, "Grounding decentralised technologies in cooperative principles: What can 'decentralised autonomous organisations' (DAOS) and platform cooperatives learn from each other?" SSRN Electronic Journal, 2021. [online] Available: <http://dx.doi.org/10.2139/ssrn.3979223>.
- [10] K. Nabben, "Governance of algorithms, governance by algorithms: Are 'decentralised autonomous organisations' a blueprint for participatory digital organisation?" SSRN Electronic Journal, Apr. 2022. [online] Available: <http://dx.doi.org/10.2139/ssrn.4037825>.
- [11] X. Zhao, P. Ai, F. Lai, X. R. Luo, and J. Benitez, "Task management in decentralized autonomous organization," *J. Oper. Manag.*, vol. 68, no. 6–7, pp. 649–674, 2022.
- [12] D. Allen and J. Potts, "WEB3 toolkits: A new theory of crypto dynamics," SSRN Electronic Journal, May 2022. [online] Available: <http://dx.doi.org/10.2139/ssrn.4118296>.
- [13] J. Wisler, "What it's like to work as a dao bounty hunter," *CoinDesk Latest Headlines RSS*, Jun. 2022. Accessed: Dec. 22, 2022. [Online]. Available: <https://www.coindesk.com/layer2/futureofworkweek/2022/06/29/what-its-like-to-work-as-a-dao-bounty-hunter/>.
- [14] N. Ilyushina, "Toss in your job and make \$300K working for a dao? Here's how," *Cointelegraph Magazine*, Sep. 2022. Accessed: Nov. 19, 2022. [Online]. Available: <https://cointelegraph.com/magazine/toss-in-your-job-and-make-300k-working-for-a-dao-heres-how/>.
- [15] C. Santana and L. Albareda, "Blockchain and the emergence of decentralized autonomous organizations (daos): An integrative model and research agenda," *Technol. Forecast. Soc. Change*, vol. 182, p. 121806, Sep. 2022.
- [16] Q. DuPont, "Experiments in algorithmic governance: A history and ethnography of 'The DAO,' a failed decentralized autonomous organization," in *Bitcoin and Beyond*, Malcolm Campbell-Verduyn, New York, Routledge, pp. 157–177.
- [17] A. Sims, "Blockchain and decentralised autonomous organisations (daos): The evolution of companies?" SSRN Electronic Journal, 2019. [online] Available: <http://dx.doi.org/10.2139/ssrn.3524674>.
- [18] O. Ashenfelter and L. P. R. G., *Handbook of Labor Economics*. Amsterdam: North Holland, 2010.
- [19] G. S. Becker, *Human Capital a Theoretical and Empirical Analysis, with Special Reference to Education*. Chicago, IL: The University of Chicago Press, 1993.
- [20] M. R. Killingsworth, *Labor Supply*. Cambridge Cambridgeshire: Cambridge University Press, 2008.
- [21] C. A. Pissarides, *Equilibrium Unemployment Theory*. Cambridge, MA: MIT Press, 2017.
- [22] K. Cole, A. Daly, and A. Mak, "Good for the soul: The relationship between work, wellbeing and psychological capital," *Int. J. Soc. Econ.*, vol. 38, no. 3, pp. 464–474, 2009.
- [23] L. S. Unger, "Altruism as a motivation to volunteer," *J. Econ. Psychol.*, vol. 12, no. 1, pp. 71–100, 1991.
- [24] B. Anderson, "Migration, immigration controls and the fashioning of precarious workers," *Work Employ. Soc.*, vol. 24, no. 2, pp. 300–317, 2010.
- [25] J. D. Angrist and A. B. Krueger, "Empirical strategies in labor economics," in *Handbook of Labour Economics*, O. C. Ashenfelter and D. Card, Eds. Princeton, NJ: Industrial Relations Section, Dept. of Economics, Princeton University, 1999, vol. 3, pp. 1227–1366.
- [26] A. C. Cameron and P. K. Trivedi, *Microeconometrics: Methods and Applications*. Cambridge: Cambridge University Press, 2020.
- [27] R. Wilkins, E. Vera-Toscano, F. Botha, M. Wooden, and T.-A. Trinh, *The Household, Income and Labour Dynamics in Australia Survey: Selected Findings from Waves 1 to 20*. Melbourne Institute: Applied Economic & Social Research, University of Melbourne, 2022.
- [28] Bankless, *DAOs: The New Coordination Frontier*, 2021. Accessed: Nov. 21, 2022. [Online]. Available: https://docs.google.com/presentation/d/1fLJvPOvibcCUpj9ES44_cdoX5Hb7LpDaloGWz5FbUEM.
- [29] E. Burmeister and L. M. Aitken, "Sample size: How many is enough?" *Aust. Crit. Care*, vol. 25, no. 4, pp. 271–274, 2012.
- [30] S. B. Green, "How many subjects does it take to do a regression analysis," *Multivariate Behav. Res.*, vol. 26, no. 3, pp. 499–510, 1991.
- [31] "Unemployment: Its measurement and types: Explainer: Education," Reserve Bank of Australia, Feb. 2022. Accessed: Feb. 5, 2023. [Online]. Available: www.rba.gov.au/education/resources/explainers/unemployment-its-measurement-and-types.html#:~:text=Employed%20%E2%80%93%20includes%20people%20who%20are,are%20not%20looking%20for%20work.
- [32] A. R. Herzog, J. S. House, and J. N. Morgan, "Relation of work and retirement to health and well-being in older age," *Psychol. Aging*, vol. 6, no. 2, pp. 202–211, 1991.
- [33] V. Laturnus, "The economics of decentralized autonomous organizations," SSRN Electronic Journal, Jan. 2023. [online] Available: <http://dx.doi.org/10.2139/ssrn.4320196>.
- [34] J. Esmail, "The problems of DAO governance: GLF22 survey results," *Governance Learning Forum*, 2022. Accessed: Jan. 21, 2023. [Online]. Available: <https://glf.digital/ja5a954c2cfd429ba60122cc3ac3189e>.
- [35] MetisDAO, "Is the World Ready for Decentralized Organizations?" rep., Dec. 2022. [Accessed: Jan. 13, 2023]. [Online]. Available: <https://koris.docsend.com/view/kye2n83f87pum6cc>.
- [36] N. Watson, "The impact of the transition to CAPI and a new fieldwork provider on the HILDA survey. HILDA survey discussion paper no. 2/10. Melbourne Institute: Applied Economic & Social Research, University of Melbourne, 2010.
- [37] N. Watson and M. P. Wooden, "The Hilda survey: A case study in the design and development of a successful household panel survey," *Longitudinal and Life Course Studies*, 2012, vol. 3, no. 3, pp. 369–381.
- [38] B. H. Erickson, "Good networks and good jobs: The value of social capital to employers and employees," in *Social Capital*, Bonnie H. Erickson, London: Routledge, Taylor & Francis Group, 2017, pp. 127–158.
- [39] G. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Columbia University Press, New York, 1964.
- [40] A. Wright and P. De Filippi, "Decentralized blockchain technology and the rise of lex cryptographia," SSRN Electronic Journal, 2015. [online] Available: <http://dx.doi.org/10.2139/ssrn.2580664>.

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Towards Fair Presentation of DAO Treasuries: An Evaluation of Native Governance Token Reporting Practices

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Abstract

Decentralised Autonomous Organisations (DAOs) are rapidly gaining popularity in the blockchain ecosystem. Given the widespread use of reported data to make informed decisions related to these entities, it is imperative to address the lack of reporting guidance for key metrics of DAOs. Currently, any governance tokens minted but not yet distributed by the DAO is recorded as an asset held in the DAO's treasury. As the value attributed to these undistributed tokens is material, poor reporting practices of this economic phenomenon would negatively impact the decisions made by users of this information. This study undertakes a qualitative non-empirical investigation to evaluate the reporting practice of recording native governance tokens held in DAO treasuries. The study identifies the reporting practices by examining websites that report on DAO treasuries, and the practice found is evaluated against the International Financial Reporting Standards (IFRS) to ensure fair presentation. The results of the study reveal that the current practice of recording all native governance tokens held as assets in the treasury fails to achieve fair presentation, as many governance tokens might fail the definition of an asset, and some might be required to be measured at cost rather than market value. As a result, the treasuries of DAOs are materially overstated, and investors may be relying on misleading information.

Keywords: *Decentralised Autonomous Organisations; Blockchain; IFRS*

JEL Classifications: *G32, G38, M41, O33, P2*

1. Introduction

Decentralised Autonomous Organisations (DAOs) have emerged as a rapidly growing phenomenon in the financial landscape. With the market capitalisation of the top 10 DAOs now exceeding \$14 billion [1] and the number of governance token holders increasing from 1.7 million in early 2022 to 6.4 million in early 2023 [2], the importance of accurate and transparent reporting practices cannot be overstated. Token holders rely on publicly available data to make economic decisions regarding DAOs, and one of the critical metrics being reported is the size and composition of their treasuries, which finance the DAOs' activities [3]. Despite the significance of DAO treasuries totalling \$13.4 billion [2], no prior research has been conducted on the reporting practices of these treasuries. This constitutes an important gap in the scientific literature, as poor disclosure practices could negatively impact the decisions made by token holders.

In reporting on the total value of DAO treasuries, reporting websites such as DeepDAO [2], DefiLlama [4] and OpenOrgs.info [5] include in their calculation any native governance tokens held by the DAO, which significantly impacts the reported total value. The top 10 DAOs hold a total treasury value of \$9.6 billion [2], of which \$8.0 billion consists of undistributed governance tokens minted by the DAOs themselves (calculated using the breakdowns provided by DeepDAO). This study seeks to answer whether this disclosure practice of recording the DAOs' undistributed governance tokens as part of its treasury leads to unfaithful presentation and therefore DeFi investors trading on misleading information. If it is found that the inclusion of these native tokens in reporting on the value of the treasuries held leads to unfaithful presentation, the value of DAO treasuries is being significantly overreported.

The present study aims to address the lack of guidance on faithful reporting of DAO treasuries, as noted in previous research [6]. This study will fill the gap in existing knowledge by evaluating current accounting practices employed by reporting websites. The findings of this study will provide the initial guidance to reporting websites for accurately reporting on DAO treasuries, with the goal of enhancing the usefulness of information provided to existing and potential investors.

Additionally, this study will contribute to the emerging field of research on DAOs, which has gained increasing attention among researchers across multiple fields [7]. The value of DAO treasuries is often used as a metric in DeFi research [8], making this study relevant and important to this growing area of research.

Furthermore, this study serves as an initial foray into the accounting literature on DAOs, thereby providing a foundation for future research in the financial reporting of DAOs. By investigating the current reporting practices, this study aims to lay the groundwork for the development of an established framework for the reporting of DAO treasuries.

The main research question this study seeks to answer is as follows: Does the current common disclosure practice of recording the DAOs' undistributed governance tokens as part of its treasury lead to unfaithful presentation and therefore DeFi investors trading on misleading information?

The article proceeds as follows: Section 2 provides the research methodology. Section 3 provides background on how DAOs operate and the current reporting practices of DAO treasuries. Section 4 establishes a framework of what constitutes "faithful presentation." Thereafter, the current reporting practices of DAO treasuries are analysed against this

framework. Finally, the article concludes whether DAO treasuries are currently being faithfully reported, with further recommendations on how to improve the usefulness of the information being reported.

2. Methodology

This study employed a non-empirical qualitative approach based on a literature study of pure theoretical aspects. First, a literature review was performed to provide the necessary context to define and understand how Decentralised Autonomous Organisations (DAOs) originated with the evolution of blockchain technology, how they are structured and what role the economic phenomena of governance tokens and treasuries perform in their operations.

To evaluate whether the current reporting practices on DAO treasuries achieve faithful presentation, the following steps were then followed:

Step 1: Identify sources that report on the treasuries of DAOs. To identify sources that report on the treasuries of DAOs, this study employed an ad-hoc approach based on a literature review of existing research in the field. This involved examining references cited in the literature to identify sources that report on DAO treasuries. Additionally, a web search was conducted using keywords such as “DAO treasuries reporting” and “governance token reporting” to locate websites and publications that have reported on DAO treasuries in the past. The criteria used to select sources included a focus on websites and publications with a reputation for being trustworthy and reliable sources of information in the blockchain and cryptocurrency space. Ultimately, this approach led to the identification of three sources that will be used to evaluate the reporting practices surrounding native governance tokens held in DAO treasuries. This ad-hoc approach was necessary given the relatively new area of research on DAO treasuries and the lack of established methods for identifying sources in this field.

Step 2: Identify the reporting practices surrounding native governance tokens held in DAO treasuries of the sources identified in step 1. Specifically, it will be determined whether native governance held by the DAO in are included in the total treasury value reported, and if so, at what amounts.

Step 3: Identify an appropriate framework to be used to evaluate whether the reporting practices as identified in step 2 achieve faithful presentation. This study initially considered two accounting frameworks: the Generally Accepted Accounting Principles (GAAP) and the International Financial Reporting Standards (IFRS). After considering the characteristics of DAOs as identified in the background literature review, as well as the differences between GAAP and IFRS, IFRS was ultimately selected for use in this study. It is important to recognise that compliance with accounting standards is often linked to the legal jurisdiction in which an entity is registered [6]. Since DAOs frequently operate without a formal legal structure, these entities are not legally obligated to produce financial information according to established accounting standards [6]. However, the lack of formal regulation does not preclude the evaluation of DAO treasury reporting with respect to IFRS. While such an evaluation may not serve to ensure legal compliance, it is nonetheless valuable in assessing the accuracy and reliability of financial information provided by DAOs to their stakeholders. The aim of this paper was to examine the adherence of DAO treasury reporting to the IFRS framework in order to identify any potential sources of misinformation that may affect user decision-making.

Step 4: Identify the criteria for faithful presentation as set out in the framework chosen in step 3. Since this study aims to assess the faithful reporting of assets held in DAO treasuries, the recognition criteria for classifying an element as an asset were considered relevant. Additionally, the classification of the type of asset is also important as it will impact the value at which the asset may be reported (measurement).

Step 5: Apply the criteria for faithful presentation identified in step 4 to the reporting practices on DAO treasuries as identified in step 2, to determine whether native governance tokens held in DAO treasuries are being faithfully presented.

Step 6: Make a conclusion on whether governance tokens held in DAO treasuries are being faithfully presented and provide recommendations on how to enhance the faithful presentation thereof.

3. Decentralised Autonomous Organisations (DAOs)

3.1 The evolution of Decentralised Finance (DeFi)

In 2009, the first cryptocurrency, Bitcoin, was introduced with the objective of creating a peer-to-peer electronic cash system, devoid of intermediaries [9]. This was achieved through the implementation of a distributed ledger technology, later termed “blockchain.” Bitcoin transactions are facilitated using public-key cryptography. The transactions approved by nodes across the globe are recorded on a decentralised ledger referred to as the blockchain. Each node maintains a copy of the ledger, and the honesty of nodes is ensured through the consensus algorithm (Proof-of-Work in the case of Bitcoin), for which detailed exploration falls outside the scope of this study.

In 2015, another blockchain, Ethereum, was launched. Ethereum utilises two types of accounts: externally owned accounts (EOAs) and smart contracts [10]. EOAs function similarly to Bitcoin addresses, as they are controlled through private keys. EOAs can be used to transfer Ether, the blockchain’s native cryptocurrency, or any other data to another EOA or smart contract. Smart contracts, on the other hand, are not controlled by private keys but rather by code. They are deployed by sending their bytecode from an EOA to “address zero.” The code determines the fate of any cryptocurrency or data received from another address. As smart contracts are stored on the blockchain, its code cannot be modified, and is entirely transparent.

Templates exist for writing code into smart contracts, which enable the creation and maintenance of tokens. The rules of token ownership are enforced by the code and typically ownership is automatically transferred to the address from which Ether is received. The smart contract maintains a record of the addresses that own the tokens stored within it. As smart contract syntax is Turing-complete, loops can be coded to automate state changes to the tokens based on predetermined conditions. The Ethereum blockchain records not only transfers of Ether across addresses but also any changes in state of smart contracts. The emergence of financial instruments as tokens in these contracts provided the technical foundation for a range of blockchain-based financial products beyond electronic cash, known as Decentralised Finance (DeFi) [11]. As of February 1, 2023, the total value locked in DeFi applications is estimated to be \$47.75 billion [12].

3.2 DAO structure

A protocol within the DeFi ecosystem refers to a set of smart contracts that collectively serve a specific purpose [13]. These protocols enable users to interact with one another without the intervention of central authorities. The two primary categories of DeFi protocols, as measured by total value locked, are Decentralised Exchanges (Dexes) and Lending protocols [14]. A Dex is a type of protocol which enables users to exchange cryptocurrencies in a peer-to-peer manner. A Lending protocol allows users to lend and borrow assets among each other.

Most DeFi protocols are structured as Decentralised Autonomous Organisations (DAOs) [13]. In contrast to traditional organisations, decision-making and administrative processes in DAOs are automated through a set of smart contracts, rather than being carried out by

conventional management structures [7]. The rules encoded in the smart contracts, which are determined by the DAO members through a voting mechanism, form the basis for the operation of the DAO [15].

The smart contract of a DAO protocol mints governance tokens, which may be sold in exchange for capital or distributed to users as a reward for interacting with the protocol, also known as an “airdrop” [16]. The activities of the DAO are funded by its treasury, which is a smart contract [3]. The DAO treasury is sustained by capital raised from the sale of governance tokens and profits generated from the services provided by the DAO [8].

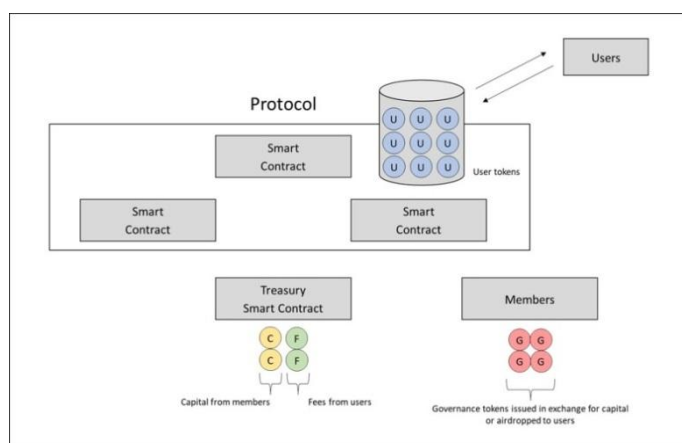


Figure 1: Structure of a DAO, adapted from [13]

Figure 1 depicts the structure of a DAO, specifically how users interact with the protocol and how the DAO is funded by its treasury and owned by its members. As mentioned earlier, governance tokens are originally minted by a smart contract of the DAO protocol and then distributed to members. Any governance tokens minted but not yet distributed are kept in the treasury of the DAO.

3.3 Rights of governance token holders

Holders of governance tokens have certain rights as determined and enforced by the smart contract. While a comprehensive taxonomy of governance token rights has yet to be developed, these rights can include the ability to vote on proposals that affect the direction and operations of the DAO, such as the interest rate model for the Compound protocol [17]. Additionally, token holders may have access to rewards based on their participation or contributions to the network, such as a share of the fees generated by the Curve Finance platform for CRV token holders [18]. In addition, governance tokens may also confer governance over the DAO’s treasury, allowing holders to vote on how funds are allocated, such as the allocation of funds from the Aave ecosystem reserve for new features or protocols [19].

3.4 Current reporting practices of DAO treasuries

Websites dedicated to reporting on DAOs play a crucial role in furnishing users with the requisite information to facilitate their economic decision-making regarding DAOs. Despite the visibility of on-chain data, the transparency of such data is somewhat limited, as conducting an analysis of on-chain transactions is a technical and laborious process [6]. To circumvent this issue, DAO reporting websites obtain pertinent data from blockchains and DAO documentation, thus offering valuable and comparable insights to users. This practice allows potential investors, who may not possess technical expertise, to gain a comprehensive understanding of DAO-related information in a user-friendly manner.

DeepDAO is a leading data analytics platform for DAOs. It aggregates information on over 10,000 DAOs and profiles of over 4.6 million

participants, offering a comprehensive overview of key metrics such as treasury value, number of token holders, proposals and votes [2]. The data reported by DeepDAO has been widely recognised and quoted by reputable media outlets, including Forbes [20] and The New York Times [21]. DeepDAO defines a treasury as the “total assets that the DAO may use at its own discretion” and calculates the value by obtaining the crypto assets held in the DAO’s smart contract and multiplying it by the market values of corresponding tokens. This calculation includes any native governance tokens held in the treasury smart contract. Thus, any governance tokens minted but not yet issued are reported as assets held by the DAO.

DefiLlama is an established platform that has gained a reputation as a reliable source of DeFi data and has been cited in numerous academic and industry publications [22]. DefiLlama reports on the treasuries of 125 DAOs, breaking down the assets into categories of stablecoins, major cryptocurrencies such as BTC and ETH, the DAO’s native governance token, and other assets [4]. The total value of each DAO’s treasury is then also reported, which includes the DAO’s own native governance tokens held.

OpenOrgs.info is another website that offers valuable insights into the treasuries of DAOs. Its homepage succinctly highlights the emerging trend of DAOs as new forms of companies and asks the critical question: “What’s on their balance sheet?” [5]. The website ranks 46 DAOs based on the size of their treasury and provides a detailed breakdown of each DAO’s assets. This includes the DAO’s native token, which is considered part of the reported value.

The treatment of native governance tokens held in DAO treasuries as assets held by the DAO by leading data analytics platforms therefore suggests that this is a common reporting practice. While these platforms provide valuable insights into the treasuries of DAOs, it remains unclear whether including governance tokens in the reported value leads to an accurate representation of the assets held by DAOs. This study seeks to address this gap in the literature by examining the impact of including native governance tokens in the value of DAO treasuries on the fairness of DAO reporting.

4. Framework for Faithful Presentation

4.1 Choosing an appropriate framework for faithful presentation

The absence of specific reporting guidelines for DAOs [6] necessitates the use of available accounting standards to evaluate the faithful representation of DAO treasuries. The Securities Exchange Commission requires domestic United States-listed companies to abide by the “US Generally Accepted Accounting Principles” (US GAAP) accounting standard [23]. DAOs do not however operate in only one jurisdiction and are run by members across the globe [24]. The International Accounting Standards Board (IASB) issued the International Financial Reporting Standards (IFRS) in 2001, with the aim of setting a single set of accounting standards to be applied globally. IFRS is currently adopted in 144 jurisdictions [25]. It is perceived that while US GAAP follows a rules-based approach, IFRS is principle-based [26]. As neither US GAAP nor IFRS prescribes the treatment of native tokens in DAO treasuries, principles of fair accounting, rather than specific rules of treatment, will need to be applied in this study. IFRS will therefore be used as a framework in this study to evaluate the fair presentation of native tokens in DAO treasuries.

4.2 Faithful presentation

The Conceptual Framework of IFRS posits that information is faithfully represented when it accurately reflects the essence of the phenomena it is intended to represent [27, paragraph 2.12]. To test whether the recognition of native governance tokens as assets held by the DAO leads to faithful

presentation, the criteria for an element to be considered an “asset” is therefore relevant. To ensure faithful representation, information must be complete, neutral, and free from error [27, paragraph 2.13]. IFRS has different measurement criteria for different asset classifications. As an example, inventory should be measured at the lower of cost and net realisable value [28, paragraph 9], whilst intangible assets should be measured initially at cost [29, paragraph 24], and afterwards at either cost less accumulated amortisation [29, paragraph 74] or fair value [29, paragraph 75]. None of the websites reporting on DAO treasuries classify governance tokens in any such categories. However, as the classification will influence the value at which the governance tokens should be included in the treasury, these classifications will be explored in this study, to determine whether the amounts reported by these websites achieves fair presentation in accordance with IFRS.

4.3 Definition of assets

The Conceptual Framework defines an asset as a present economic resource that is controlled by the entity as a consequence of past events [27, paragraph 4.3]. An economic resource refers to a right that holds the potential to generate economic benefits [27, paragraph 4.4]. Many rights are established through contracts [27 paragraph 4.7]. It should be noted that an entity cannot have the right to obtain economic benefits from itself, thus debt or equity instruments, such as treasury shares, that are issued and held by the entity, are not considered economic resources of that entity [27, paragraph 4.10]. An entity has control over an economic resource if it has the current capacity to direct the use of the resource and derive the economic benefits that may ensue from it [27, paragraph 4.20].

4.4 Classification of asset

Crypto assets can either be classified as inventory, financial assets, or intangible assets [30]. IAS 2 defines inventory as an asset “held for sale in the ordinary course of business, in the process of production for such sale, or in the form of materials or supplies to be consumed in the production process or in the rendering of services” [28, paragraph 6]. A financial asset is “any asset that is cash, an equity instrument of another entity, or a contractual right to receive cash or another financial asset from another entity” [31, paragraph 11]. An intangible asset is a “non-monetary asset without physical substance” [29, paragraph 8]. The standard for intangible assets (IAS 38) should only be applied if the asset is not within the scope of another standard [29, paragraph 2]. In the context of this study, the crypto asset will only be deemed an intangible asset if it was already determined that it is not inventory or a financial asset.

5. Application of Framework to Governance Tokens

5.1 Are the governance tokens “assets held” by the DAO?

For an item to be classified as an asset, it needs to be an economic resource (a right that has the potential to produce economic benefits) controlled by the entity as a result of past events. The item in question is the native governance tokens held in the treasury, i.e. tokens minted but not yet distributed. The item originates from the minting of the tokens, which is an event in the past.

5.1.1 Does the item have the potential to produce economic benefits?

Economic benefits can be realised through the sale of the item to new or existing investors, leading to the receipt of capital. Additionally, the distribution of accumulated profits of the DAO to governance token holders could also be considered as a source of economic benefits for the tokens held in the treasury. However, as these accumulated profits are already recorded in the treasury, it would constitute double accounting to then also record a right to those profits as an additional asset in the treasury. Hence, it is suggested that the only economic benefit that could potentially

be derived from the tokens is capital through their sale. If it is the intention of the DAO to airdrop the governance tokens to the community at no compensation, no future economic benefits will flow towards the entity.

5.1.2 Does the entity have a right to the item?

With regards to the determination of rights over economic resources, it is commonly established through contract. In this case, the native tokens are held within a smart contract that constitutes the treasury of the DAO. The UK LawTech Delivery Panel has opined that smart contracts are legally binding and have the capability to enforce rights and obligations, similar to traditional contracts [32]. The panel recognises that the English law has the necessary framework to deal with both bilateral smart contracts and those structured around DAOs. Hence, for the purpose of determining whether the native tokens held are assets, it could be argued that the DAO does possess a right to it.

However, the Conceptual Framework stipulates that an entity cannot have a right to obtain economic benefits from itself. This means that any debt or equity instruments that are issued and repurchased by the entity are not considered as economic resources of that entity. Whether the governance tokens of the DAO should be considered debt or equity instruments is a crucial factor in determining whether these tokens held in the treasury should be considered assets.

IAS 32 defines an equity instrument as any contract that evidences a residual interest in the assets of an entity after deducting all its liabilities [31, paragraph 11]. If therefore the holder of a governance token has the right to the residual assets of the DAO, which will perhaps be the case if the smart contract grants its members significant discretion in the deployment of treasury funds, the token will be regarded as an equity instrument, in which case such native tokens held by the DAO will be equity instruments that have been issued and held by the entity, and therefore fail the definition of an asset.

IAS 32 defines a financial liability as a contractual obligation to deliver cash or another financial asset to another entity [31, paragraph 11]. If therefore the holder of a governance token has a right to cash or another financial asset from the DAO, which will perhaps be the case if the holder has a right to a share of the fees generated by the protocol, the token will be regarded as a debt instrument, in which case such native tokens held by the DAO will be debt instruments that have been issued and held by the entity, and therefore fail the definition of an asset.

5.1.3 Does the entity control the item?

According to the Conceptual Framework, an entity has control over an economic resource if it has the present ability to direct the use of the resource and receive the economic benefits derived from it. In some instances, governance tokens are distributed according to a predetermined supply schedule [33]. In such situations, it could be argued that the DAO lacks the ability to direct the use of the minted but still held native governance tokens. However, in other scenarios where the DAO has the discretion to sell the governance tokens, either democratically by its members or through a group of multi-signature holders, the DAO could be considered to have control over the native governance tokens held.

5.2 Classification of asset type

If the native governance tokens held does meet the definition of an asset, the classification of asset as either inventory, intangible assets or financial assets should be determined, as this will impact the amount at which the item should be recognised in reporting the treasury value of the DAO to ensure “fair presentation” in accordance with the IFRS framework. This study submits that native governance tokens held by the DAO cannot be classified as financial assets, as an entity cannot have an equity

instrument in itself or a contractual right to receive cash or another financial asset from itself. Therefore, if the native governance tokens held meet the criteria of an asset, they can only be classified as inventory or intangible assets.

If the DAO holds the governance tokens “for sale in the ordinary course of business,” it will be classified as inventory. Given the novelty of DAOs, determining when the criteria are met may be challenging. IAS 2 does not explicitly require that the selling of items must be the primary business model of the entity for those items to be classified as inventory. Therefore, it is not a requirement for the DAO’s main business to be creating and selling governance tokens in order for the tokens to be classified as inventory. The term “ordinary course of business” is not defined in the standard, but it implies that the item is held for the purpose of resale and not for long-term holding. If the DAO therefore holds its native governance tokens with the intention of selling it to fund its short-term activities, it will likely be considered as inventory. In all other cases, such as the DAO reserving governance tokens for future developments in the long-term, these governance tokens will default to being classified as intangible assets.

The classification of native governance tokens held as either inventory or intangible assets has significant consequences on the measurement thereof. Whilst the measurement of intangible assets at fair value is allowed, inventory can only be measured at cost price. IAS 2 allows for the capitalisation of the costs incurred in bringing the inventories to their present location and condition [28, paragraph 10]. In the case of a governance token, the costs will likely mostly comprise costs incurred to develop and audit the smart contract code to mint the tokens. IAS 38 requires the fair value of intangible assets to be measured by reference to an active market [29, paragraph 75]. Governance tokens therefore classified as intangible assets should be valued according to the price at which it trades on an exchange, despite prior research suggesting that DeFi tokens are overvalued compared to their theoretical value as determined by fundamental and comparable analysis [34].

A summary of the findings is provided as a decision-tree in Figure 2.



Figure 2: Decision-tree to classify native governance tokens held

As noted earlier, platforms currently include native governance tokens at their market value, in reporting the value of a DAO’s treasury. Based on the

classifications determined in this study in accordance with IFRS, platforms thereby treat all native governance tokens held as intangible assets. No governance tokens are treated as debt or equity instruments, which would require the exclusion of these tokens from treasury valuation, and no tokens are treated as inventory, which would require the inclusion of these tokens at cost price, rather than market value. It is therefore submitted that the current reporting practice of treating all native governance tokens held in treasuries as assets held by the DAO does not achieve fair presentation in accordance with IFRS.

6. Conclusion

The growth of DAOs highlights the importance of accessible and meaningful information regarding their financial position and performance for both current and potential investors. Despite this, there are currently no established reporting guidelines for DAOs. This study makes a significant contribution to the accounting literature by examining the reporting treatment of native governance tokens held in DAO treasuries through the lens of International Financial Reporting Standards (IFRS). The findings indicate that recognising all undistributed governance tokens as assets in the DAO treasury at their market value does not achieve faithful presentation, as many governance tokens might fail the definition of an asset, and some might be required to be measured at cost. The treasuries of DAOs are therefore likely being significantly overreported, leading to DeFi investors trading on misleading information.

To obtain a more comprehensive understanding of the classification of governance tokens held by DAOs it is necessary to consider the intentions of the governance token issuer. These intentions may not be explicitly coded into smart contracts or stated in whitepapers, highlighting the need for empirical research. A future study can be conducted using questionnaires to collect data from a sample of DAOs, followed by a quantitative analysis to determine the recommended classification of governance tokens held by the most prominent DAOs. Additionally, the materiality of incorrectly including all native governance tokens in treasury reporting can be assessed by quantifying the impact of removing governance tokens that fail to meet IFRS recognition criteria on the reported total value of DAO treasuries. Such a future empirical study can also aid platforms reporting on DAO treasuries to adopt a more accurate reporting practice that aligns with fair presentation. While it may be impractical for platforms to assess the appropriate treatment of native governance tokens held by each DAO individually (as it would require knowing the intentions of the DAO, and obtaining information relating to the costs incurred to mint the tokens if the tokens are classified as inventory might be difficult), such a study can provide valuable insights to help platforms adopt a standardised reporting practice that moves closer to fair presentation. For instance, if the study reveals that a significant proportion of native governance tokens are classified as equity instruments, it may be less misleading for platforms to exclude all native governance tokens from treasury reporting instead of including them all. This could contribute to greater transparency and comparability among DAOs and their treasuries.

This study also serves as a catalyst for further research into the reporting practices of DAOs, including the reporting of liability claims, income, and expenses incurred by the DAO. Moreover, the study raises questions about the need for financial reporting standards specific to DAOs, and who should be responsible for presenting financial statements given the decentralised governance structure of these entities. In conclusion, this study sheds light on a critical issue that requires further exploration to enhance the transparency and accountability of DAOs.

References:

[1] CoinMarketCap, 'Top DAO tokens by market capitalization', 2023. <https://coinmarketcap.com/view/dao/> (accessed Apr. 04, 2023).
 [2] DeepDAO, 'DeepDAO – Organizations', 2023. <https://deepdao.io/>

- organizations (accessed Apr. 08, 2023).
- [3] C. Bellavitis, C. Fisch, and P. P. Momtaz, 'The rise of Decentralised Autonomous Organizations (DAOs): A first empirical glimpse', *Venture Capital*, pp. 1–17, 2022, doi: 10.1080/13691066.2022.2116797.
- [4] DefiLlama, 'Treasuries', 2023. <https://defillama.com/treasuries> (accessed Apr. 06, 2023).
- [5] OpenOrgs.info, 'DAOs are the new companies. What's on their balance sheets?', 2023. <https://openorgs.info/> (accessed Apr. 06, 2023).
- [6] K. Lommers, M. Ghanchi, K. Ngo, Q. Song, and J. Xu, 'DAO accounting', *SSRN Electronic Journal*, 2022. [Online]. Available: <https://ssrn.com/abstract=4200414>
- [7] C. Santana and L. Albareda, 'Blockchain and the emergence of Decentralised Autonomous Organizations (DAOs): An integrative model and research agenda', *Technological Forecasting and Social Change*, vol. 182, Sep. 2022, doi: 10.1016/j.techfore.2022.121806.
- [8] J. Ziegler and I. M. Welppe, 'A taxonomy of Decentralised Autonomous Organizations', in *ICIS Proceedings*, 2022. [Online]. Available: <https://aisel.aisnet.org/icis2022>
- [9] S. Nakamoto, 'Bitcoin: A peer-to-peer electronic cash system', 2008. Accessed: Apr. 07, 2023. [Online]. Available: <https://bitcoin.org/bitcoin.pdf>
- [10] A. Antonopoulos and G. Wood, *Mastering Ethereum: Building Smart Contracts and Dapps*. O'reilly Media, Sebastopol, California, 2018.
- [11] E. A. Meyer, I. M. Welppe, and P. Sandner, 'Decentralised finance - A systematic literature review and research directions', in *ECIS Proceedings*, 2022, pp. 6–18. [Online]. Available: https://aisel.aisnet.org/ecis2022_rp/25
- [12] DefiLlama, 'All chains TVL', 2023. <https://defillama.com/categories> (accessed Feb. 08, 2023).
- [13] D. Kerr, 'A legal framework for Decentralised Autonomous Organizations', 2022. <https://www.reuters.com/legal/litigation/crypto-user-asks-1st-reuters.com/legal/litigation/crypto-user-asks-1st>
- [14] DefiLlama, 'Categories', 2023, Accessed: Mar. 23, 2023. [Online]. Available: <https://defillama.com/categories>
- [15] N. Ilyushina and T. MacDonald, 'Decentralised autonomous organisations: A new research agenda for labour economics', *The Journal of The British Blockchain Association*, vol. 5, no. 1, pp. 50–53, Apr. 2022.
- [16] P. De Filippi and A. Wright, *Blockchain and the Law: The Rule of Code*, 2018, doi: 10.2307/j.ctv2867.sp.
- [17] R. Leshner, 'Compound governance. Steps towards complete decentralization', 2020. <https://medium.com/compound-finance/compound-governance-5531f524cf68> (accessed Apr. 04, 2023).
- [18] D. Kuhn, 'Curve finance votes to disperse \$3M in fees to governance token holders', 2021. [Online]. Available: <https://www.coindesk.com/markets/2020/11/27/curve-finance-votes-to-disperse-3m-in-fees-to-governance-token-holders/>
- [19] Aave, 'Incentives policy & AAVE reserve - Aavenomics', 2021. <https://docs.aave.com/aavenomics/incentives-policy-and-aave-reserve> (accessed Apr. 04, 2023).
- [20] J. Kauflin, 'DAOs aren't a fad — They're a platform', 2022. <https://www.forbes.com/sites/jeffkauflin/2022/02/03/daos-arent-a-fad-theyre-a-platform/?sh=17e9731c19d0> (accessed Nov. 22, 2022).
- [21] E. Lipton and E. Livni, 'Reality intrudes on a Utopian Crypto Vision', 2022. [Online]. Available: <https://www.nytimes.com/2022/03/08/us/politics/cryptocurrency-dao.html> | <https://www.nytimes.com/2022/03/08/us/politics/cryptocurrency-dao.html>
- [22] J. Piñeiro-Chousa, A. Šević, and I. González-López, 'Impact of social metrics in decentralised finance', *Journal of Business Research*, vol. 158, p. 113673, Mar. 2023, doi: 10.1016/j.jbusres.2023.113673.
- [23] Securities and Exchange Commission (SEC), 'Financial reporting manual', 2019. Accessed: Apr. 07, 2023. [Online]. Available: <https://www.sec.gov/corpfin/cf-manual#regulation-s-x-audit-standards-and-reports>
- [24] H. Axelsen, J. R. Jensen, and O. Ross, 'When is a DAO decentralised?', *Complex Systems Informatics and Modeling Quarterly*, no. 31, pp. 51–75, 2022, doi: 10.7250/csimq.2022-31.04.
- [25] Z. G. K. Eroglu, 'Global adoption of IFRS as an example of international financial law making', *George Washington International Law Review*, vol. 53, no. 2, 2021, Accessed: Apr. 04, 2023. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3986216
- [26] M. E. Barth, W. R. Landsman, M. Lang, and C. Williams, 'Are IFRS-based and US GAAP-based accounting amounts comparable?', *Journal of Accounting and Economics*, vol. 54, no. 1, pp. 68–93, Aug. 2012, doi: 10.1016/j.jacceco.2012.03.001.
- [27] International Accounting Standards Board (IASB), 'Conceptual framework for financial reporting'. <https://www.ifrs.org/issued-standards/ifrs-conceptual-framework/> (accessed Apr. 07, 2023).
- [28] International Accounting Standards Board, 'IAS 2 — Inventories'. <https://www.ifrs.org/issued-standards/list-of-standards/ias-2-inventories/> (accessed Apr. 07, 2023).
- [29] International Accounting Standards Board, 'IAS 38 — Intangible assets'. <https://www.ifrs.org/issued-standards/list-of-standards/ias-38-intangible-assets/> (accessed Apr. 07, 2023).
- [30] EY, 'Applying IFRS: Accounting by holders of crypto assets', 2021. Accessed: Apr. 04, 2023. [Online]. Available: https://www.ey.com/en_gl/ifrs-technical-resources/accounting-by-holders-of-crypto-assets-updated-october-2021
- [31] International Accounting Standards Board, 'IAS 32 — Financial instruments: Presentation'. <https://www.ifrs.org/issued-standards/list-of-standards/ias-32-financial-instruments-presentation/> (accessed Apr. 07, 2023).
- [32] LawTech Delivery Panel, 'Legal statement on cryptoassets and smart contracts', 2019. Accessed: Apr. 04, 2023. [Online]. Available: <https://resources.lawtechuk.io/files/4.%20Cryptoasset%20and%20Smart%20Contract%20Statement.pdf>
- [33] P. Freni, E. Ferro, and R. Moncada, 'Tokenomics and blockchain tokens: A design-oriented morphological framework', *Blockchain: Research and Applications*, vol. 3, no. 1, Mar. 2022, doi: 10.1016/j.bcr.2022.100069.
- [34] T. A. Xu, J. Xu, and K. Lommers, 'DeFi vs TradFi: Valuation using multiples and discounted cash flow', Oct. 2022. [Online]. Available: <http://arxiv.org/abs/2210.16846>

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Rewarding Honesty: An Incentive Mechanism to Promote Trust in Blockchain-Based E-commerce

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Abstract

Building trust is a difficult task among strangers over a network. This is because fraud happens when the temptation to cheat becomes greater than the rewards of staying honest. The enormous growth of e-commerce has resulted in cheating and fraud becoming increasingly important issues. Advocates for blockchains argue that this new technology can effectively eliminate misconduct and promote trust among participants. However, recent field experimental studies show that fraud still exists in the blockchain-based marketplace. This article suggests a new design for the arbitration process. A trusted third party is given the right to resolve disputes and reward blockchain cryptographic tokens to honest users. We show that the optimal strategies of individual users involve delivering quality items as described and leaving honest reviews about purchased items.

Keywords: *Arbitration, Bayesian Nash Equilibrium, Fraud, Utility Tokens*

JEL Classifications: *G32, E51, F30*

1. Introduction

With the expansion of e-commerce, the importance of online trust has heightened. This electronic marketplace, although providing a wealth of business opportunities and a convenient shopping model, introduces significant uncertainties and risks. Blockchains, as an emerging technology, have garnered the attention of e-commerce users. Advocates of blockchains assert that this technology, in tandem with self-enforcing "smart contracts," enables decentralized marketplaces by eliminating counterparty risk without reliance on intermediaries. However, [1] reported that 33% of subjects engaged in deceptive practices during a trading game on a blockchain-based marketplace. Furthermore, their questionnaire survey revealed that participants tend to rely on government entities or corporations to provide trust in resolving disputes rather than individuals. Given these facts, our objective in this article is to effectively mitigate fraud issues without compromising the decentralization property in the arbitration process.

Certain blockchains feature cryptographic tokens. We propose a mechanism to be implemented on the blockchain-based e-commerce platform in which virtuous participants are rewarded with utility tokens. Economically speaking, agents are likely to act virtuously when the rewards of honesty surpass the benefits of cheating. We envision a scenario wherein Alice is the buyer, Bob is the seller, and both participate on the platform operated by the trusted authority, Charlie (representing a government entity). For each dispute-free transaction, Alice and Bob will receive tokens from Charlie. Interestingly, even if Alice receives a low-quality product and chooses not to initiate arbitration, both she and Bob would still receive tokens. However, this is not an optimal strategy for Alice, as we will discuss later. In the event of a dispute, Charlie will reward either Alice for reporting a low-quality item sent by Bob or Bob for reporting a dishonest review left by Alice. Notably, neither Alice nor Bob needs to reveal their identities to any other parties throughout the process. Our analysis reveals that such an incentive mechanism achieves a unique Bayesian Nash equilibrium in which both buyer and seller act honestly.

A. Related work

Over the past decade, due to the popularity of blockchain, it has received considerable attention from both industrial scientists and academic researchers. To date, a growing body of literature has provided a comprehensive survey on blockchain. Various streams of survey papers exist in the literature. In particular, the survey in [2] focuses on the introduction of Bitcoin from a technical perspective. The survey in [3]-[5] provides a comprehensive discussion of security and privacy issues in the blockchain ecosystem. The blockchain applications on the Internet of Things (IoT) are surveyed in [6]. The integrated blockchain and edge computing systems are summarized in the survey [7], focusing on the research issues and challenges. The survey on blockchain from a game theoretical perspective is reviewed in [8].

Customer reward systems, such as bonus points or miles, are widely employed by both online and offline merchants. However, these systems fail to ensure customers' privacy and anonymity. By harnessing blockchain technology, our incentive mechanism ensures anonymity and also rewards honest sellers, thereby fostering trust among participants.

Token economics, though not a new concept, has been proposed in [9]. Research on cryptographic tokens primarily revolves around the creation of value, as discussed in [10] and [11], and the integration of tokens within existing institutions [12] and [13]. A noteworthy development is the use of tokens to incentivize network nodes to relay traffic. In [14] and [15], tokens are used to incentivize self-interested transceivers to provide relay service.

Currently, a functional blockchain-based platform, OpenBazaar (OB), uses multi-signature escrow transactions to manage counterparty risks in online trading. If a buyer or seller encounters issues with the transaction, they can initiate the dispute resolution process. The moderator examines the situation and co-signs with the victorious party to release the funds. This preventive strategy, however, does not completely eradicate counterparty risk. Technically, anyone can impersonate a moderator, or even create

multiple pseudonymous accounts to act as several moderators.

In an effort to safeguard users' privacy and curb information fraud, scholars have concentrated on redesigning reputation systems in the blockchain era. In [16]–[18], the focus is on investigating reputation systems relating to blockchain technology and applications, primarily from a technology-focused perspective intertwined with engineering, programming, and computer science.

To the best of our knowledge, this article is the first to introduce incentive tokens in a blockchain-based e-commerce platform and to use tokens to encourage honesty among participants, thereby promoting trust. Our approach to fraud prevention differs from previous methods in several respects. Firstly, we use tokens to reward participants. Secondly, we examine users' strategic behavior using a Bayesian game-theoretic model. Thirdly, we introduce a third party as a central authority to arbitrate in fraud cases. In the event of a dispute, this authority has the right to cancel the transaction, issue refunds, and reward honest users with tokens.

Our study confirms the importance of trust service providers in providing a reliable blockchain ecosystem. In [19], the fundamental role of trust service providers is comprehensively discussed in essential aspects of systemic trust, law compliance, adequate technical performance, confidentiality of transactions, and long-term preservation of data.

This research also resonates with the mechanism design literature in economics. In [20], it is suggested that the planner's task of implementing the social choice rule can be achieved using a planning mechanism. If the planner adheres to the designed mechanisms, the outcome will be desirable (incentive compatible for individuals).

B. Main contributions

In this article, we primarily introduce a utility token scheme to reward self-interested users for their honesty on a blockchain-based e-commerce platform. In our design, users are primarily driven to maximize their utility and are not compelled to remain honest if they find opportunities for fraud. In essence, the crux of the problem is the marketplace's lack of incentives for individual users to remain honest when the rewards for cheating outweigh those of honesty. Unlike prior solutions, we introduce an authority capable of canceling transactions and rewarding honesty with tokens. This incentive token mechanism can increase the utility of honesty for users, thereby promoting trust among participants in the decentralized peer-to-peer marketplace.

More importantly, we offer a rigorous analysis of our proposed incentive mechanism and substantiate its efficacy. Using a Bayesian game, we affirm that honest behavior is the unique equilibrium and provides the highest payoff for self-interested users. Despite its simplicity, our model offers insightful implications for using tokens as an incentive and can be applied to various market structures.

Consequently, our findings can aid organizations in making strategic and organizational decisions about emerging blockchain technology. Our research also uncovers comprehensive insights that could prove crucial during the technology adoption process of blockchain applications. These insights can guide future blockchain-related research and help practitioners develop robust blockchain applications that are likely to be accepted by users and build trust with them.

C. Structure

The remainder of this article is organized as follows: In Section 2, we detail our incentive mechanism and prove the existence of a unique equilibrium. In Section 3, we conclude the article and suggest directions for future research.

2. Incentive mechanism

In this section, we first conceptualize the incentive mechanism. The objective is to ascertain whether this mechanism encourages users to deliver items of quality as advertised and to leave accurate product reviews. Secondly, we establish that our model ensures the rewards of honesty exceed the benefits of deception, leading agents to conclude that cheating is not optimal, thereby promoting trust among participants.

A. Environment

We analyze a single-instance transaction within an e-commerce platform. Subsequently, we demonstrate that repeating this game results in identical outcomes. A single buyer, Alice, decides whether to transact with a single seller, Bob. Once Bob receives a purchase request from Alice, he delivers the product, after which Alice leaves a review. We assume that Alice cannot ascertain the product's quality beforehand and can only evaluate it upon delivery. Moreover, Alice and Bob aim to maximize their utility and might provide substandard products or fake reviews given the opportunity.

When Alice receives a subpar product, she can initiate a dispute or choose to remain silent. In this scenario, an authority, Charlie, will reward Alice with tokens for reporting. We focus on the incentive mechanism here, leaving the origin and value of the tokens for future work. Similarly, Bob can also appeal to Charlie if Alice provides a malicious review of the transaction. Charlie will again reward Bob for his report. Lastly, both Alice and Bob will be granted tokens automatically if no dispute arises.

The sequence of our analytical model is as follows: (1) The buyer decides whether to transact with the seller. (2) The seller decides the quality of the product to send to the buyer and receives feedback. (3) The authority rewards tokens to consistent performers.

Unlike games such that players know all relevant information about each other regarding strategies (actions), order of play, and payoff function, in our environment both Alice and Bob have private information that is not known by the other. Specifically, Alice does not know if Bob delivers an authentic product or not while Bob is unsure whether Alice leaves a true review. Therefore, we model the environment using Bayesian games with incomplete information and verify that our designed incentive mechanism guarantees the desirable equilibrium in the following subsections, respectively.

B. Game tree

As stated earlier, if Alice chooses not to transact with Bob, we assume their payoffs are both zero. Conversely, if Alice decides to buy Bob's product, he decides on the quality of the product to deliver. Note that Alice would not know the product's quality until she receives it, hence the dashed line connecting Bob's decision nodes in Figure 1.

We assume that if Bob delivers the genuine item to Alice, Bob's payoff is $V_B^T > 0$ and Alice's payoff is $V_A^T > 0$; whereas, if Bob delivers a counterfeit to Alice, his payoff is $V_B^F > 0$ and hers is $V_A^F < 0$.

After Alice receives the genuine item and leaves an honest review, it's clear there's no need for Alice and Bob to arbitrate, and they receive tokens T_A and T_B , respectively. However, if Alice leaves a false review and thus would not report her misconduct, it's optimal for Bob to dispute and receive tokens T_B from Charlie; otherwise, he will receive no tokens, but Alice will be rewarded for malicious behavior.

After Alice receives the inferior product and leaves an honest review, what are the optimal strategies for Alice and Bob? Alice will choose to report fraud and Charlie will cancel the transaction (Alice and Bob receive zero payoff) and send T_A tokens to Alice. From Bob's perspective, he's

indifferent about reporting or not since Alice must report and he receives zero payoffs and zero tokens in either case.

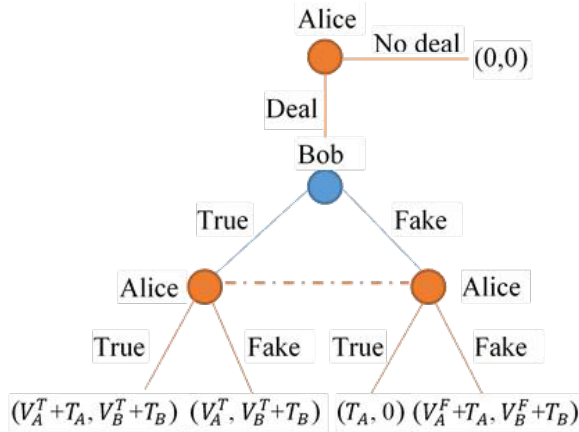


Figure 1. Game tree.

What will happen if Alice leaves a fake comment after receiving forfeits? Needless to say, Bob will not report Alice's misconduct and obtain T_B tokens from Charlie. Given Bob's strategy, Alice will keep the inferior product and receive T_A tokens, which is better than receiving zero (here, we assume $V_A^F + T_A > 0$); but it's easy to demonstrate later that this case cannot occur in equilibrium.

Now, we outline the players' payoffs regarding all possible strategies in this game. Start with Bob, when the transaction is made, if Bob delivers an authentic product (i.e., if Bob is of type true), his payoff would be $V_B^T + T_B$ against any strategy by Alice. In this case, Alice's corresponding payoff would be $V_A^T + T_A$ if she makes a truthful review (i.e., if Alice is of type true); otherwise, it would be V_A^T . On the other hand, if Bob delivers a fake one (i.e., if Bob is of type fake), his payoff would depend on the strategy by Alice. Bob will receive zero payoffs if Alice leaves an honest review and will obtain $V_B^F + T_B$ if Alice decides to leave a false review. In this case, Alice's corresponding payoffs would be T_A and $V_A^F + V_A^T$, respectively.

From here, we will look for strategies such that one is the best reply against the other and vice versa.

C. Equilibrium

In the previous subsection, we discussed and ensured the reporting strategies of Alice and Bob. We now verify their decisions about delivery and feedback, working backward. Given the choice has already been made by Bob, leaving a true comment is a dominant strategy for Alice since we assumed $V_A^T > 0$ and $V_A^F < 0$ (in fact it is consistent with reality). Specifically, when Bob delivers an authentic product, the payoff of leaving an honest review is equal to $V_A^T + T_A$ which is higher than the payoff of leaving a false one for Alice, that is, $V_A^T + T_A > V_A^T$. It means that the best response of Alice is to leave an honest review if Bob delivers the genuine item. Similarly, Alice's best reply to Bob's misconduct is also to leave a truthful review because $T_A > T_A + V_A^F$. In other words, Alice will leave a true comment regardless of the type of item she received.

Now given Alice plays such a strategy, what is the best response of Bob? Apparently, Bob will deliver the genuine item given Alice's optimal strategy (leaving honest feedback) because the payoff is equal to $V_B^T + T_B$ if Bob delivers the authentic product when Alice selects the action of leaving a truthful review; otherwise, the payoff is zero if Bob delivers a counterfeit when Alice chooses to leave an honest review.

Now, look at the initial decision node. It is straightforward to show that

transacting with Bob will yield Alice $V_A^T + T_A$ while she obtains zero if she decides not to make an offer, which suggests that Alice will buy Bob's product. Therefore, we have the equilibrium strategy: (transact and leave consistent feedback; deliver genuine item) and they achieve the highest payoff level $(V_A^T + T_A; V_B^T + T_B)$ intended.

D. Applications

We now discuss some applications of our theoretical model for security issues and mining management in blockchains, respectively. Firstly, our model can analyze strategies of attackers regarding selfish mining, majority attack, and/or denial of service (DoS), and verify the designed mechanism such that the best response of each player is not attacking. Secondly, our methodology can be effectively applied to model the interaction between miners in computational power allocation, chain selection, and pool selection. At equilibrium, the maximum utility of participants can meet.

3. Limitation and future work

In Section 2, we provide an in-depth analysis of the theoretical model and verify that rewarding peers with tokens for reporting malicious behaviors can mitigate misconduct. However, we assume that the size and value of such a token are predetermined, which allows us to focus on the rewarding mechanism and simplify the presentation of the mechanism.

There are some interesting problems that we have not addressed in this work. As future work, in particular, it would be interesting to examine the fundamental concepts of token economics: the demand and the supply sides of the cryptographic token market. Specifically, we would first explore how tokens are created, distributed, and used within our proposed blockchain platform. We would further analyze the complex dynamics in the supply and demand sides to create a sustainable and thriving ecosystem. On the demand side, it is critical to understand what benefits the token provides and to what extent these benefits will grow, which drives people to use or hold tokens. On the supply side, we would discuss what is the appropriate size of the initial lunch of tokens, and what is the desirable token policy to incentivize participants to circulate and trade tokens. What is more important, we would investigate how to match both sides to achieve the design of honest behavior.

Additionally, this mechanism could be shown to be more robust compared to finite repeated games. Finally, potential future work could consider incorporating our optimal token scheme into existing market institutions.

4. Conclusion

Blockchain technology, as found in [1], is a double-edged sword. It safeguards users' privacy while also raising challenges—issues of trust among users. This new technology is advantageous when removing a centralized third party that possesses users' data. Conversely, new mechanisms are necessary to foster trust among strangers. Some peers might not provide the same services as they advertise, and some might be malicious by providing fake reviews. As there is no central authority to supervise peers' behaviors and incentivize them to act rightfully, blockchain technology can help address these issues.

In this article, we examined whether blockchain can serve as the technology underpinning decentralized marketplaces to promote trust. By utilizing tokens as an incentive mechanism, we demonstrated that rewarding peers for reporting malicious behaviors can mitigate misconduct. Despite its simplicity, our innovative token rewarding mechanism can be used to incentivize users to behave consistently and tackle trust issues.

References

- [1] K. Lee, Y. Li, W. B. Xu, and W. Zhao, *Blockchain-based E-commerce: It's an Evolution, NOT a Revolution—Experimental Evidence from Users' Perspective*. Mimeo, 2019.
- [2] F. Tschorsch and B. Scheuermann, "Bitcoin and beyond: A technical survey on decentralized digital currencies," *IEEE Communications Surveys and Tutorials*, vol. 18, no. 3, pp. 2084–2123, 3rd Quart., 2016.
- [3] M. Conti, S. Kumar, C. Lal, and S. Ruj, "A survey on security and privacy issues of bitcoin," *IEEE Communications Surveys and Tutorials*, vol. 20, no. 4, pp. 3416–3452, Apr. 2018.
- [4] M. C. K. Khalilov and A. Levi, "A survey on anonymity and privacy in bitcoin-like digital cash systems," *IEEE Communications Surveys and Tutorials*, vol. 20, no. 3, pp. 2543–2585, Mar. 2018.
- [5] T. Salman, M. Zolanvari, A. Erbad, R. Jain, and M. Samaka, "Security services using blockchains: A state of the art survey," *IEEE Communications Surveys and Tutorials*, vol. 21, no. 1, pp. 858–880, Jan. 2018.
- [6] M. S. Ali, M. Vecchio, M. Pincheira, K. Dolui, F. Antonelli, and M. H. Rehmani, "Applications of blockchains in the Internet of Things: A comprehensive survey," *IEEE Communications Surveys and Tutorials*, vol. 21, no. 2, pp. 1676–1717, Dec. 2018.
- [7] R. Yang, F. R. Yu, P. Si, Z. Yang, and Y. Zhang, "Integrated blockchain and edge computing systems: A survey, some research issues and challenges," *IEEE Communications Surveys and Tutorials*, vol. 21, no. 2, pp. 1508–1532, Jan. 2019.
- [8] Z. Liu et al., "A survey on blockchain: A game theoretical perspective," *IEEE Access*, vol. 7, pp. 47615–47643, Dec. 2019.
- [9] R. C. Winkler, "A theory of equilibrium in token economics," *Journal of Abnormal Psychology*, vol. 79, no. 2, p. 169, 1972.
- [10] C. Catalini and J. S. Gans, "Some simple economics of the blockchain (No. n22952)," National Bureau of Economic Research, 2016.
- [11] J. Abadi and M. Brunnermeier, "Blockchain economics (No. n25407)," National Bureau of Economic Research, 2018.
- [12] A. Tapscott and D. Tapscott, "How blockchain is changing finance," *Harvard Business Review*, vol. 1, no. 9, pp. 2–5, 2017.
- [13] J. Rohr and A. Wright, "Blockchain-based token sales, initial coin offerings, and the democratization of public capital markets," *Hastings Law Journal*, vol. 70, p. 463, 2018.
- [14] J. Xu and M. Van Der Schaar, "Token system design for autonomic wireless relay networks," *IEEE Transactions on Communications*, vol. 61, no. 7, pp. 2924–2935, 2013.
- [15] C. Shen, J. Xu, and M. Van Der Schaar, "Silence is gold: Strategic interference mitigation using tokens in heterogeneous small cell networks," *IEEE Journal on Selected Areas in Communications*, vol. 33, no. 6, pp. 1097–1111, 2015.
- [16] K. Soska and N. Christin, "Measuring the longitudinal evolution of the online anonymous marketplace ecosystem," in *24th {USENIX} Security Symposium ({USENIX} Security 15)*, 2015, pp. 33–48.
- [17] A. Schaub, R. Bazin, O. Hasan, and L. Brunie, "May. A trustless privacy-preserving reputation system," in *IFIP International Conference on ICT Systems Security and Privacy Protection*, Springer, Cham, 2016, pp. 398–411.
- [18] R. Dennis and G. Owenson, "Rep on the roll: A peer to peer reputation system based on a rolling blockchain," *International Journal for Digital Society*, vol. 7, no. 1, pp. 1123–1134, 2016.
- [19] M. Atzori, "Blockchain governance and the role of trust service providers: The TrustedChain® Network," *The Journal of The British Blockchain Association*, vol. 1, no. 1, pp. 55–65, 2018.
- [20] P. Dasgupta, P. Hammond, and E. Maskin, "The implementation of social choice rules: Some general results on incentive compatibility," *The Review of Economic Studies*, vol. 46, no. 2, pp. 185–216, 1979.

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DC conceived of the study and helped to draft the manuscript. YL developed the theory, performed the analysis and wrote the manuscript. WX participated in the design of the study and verified the methods. All authors discussed the results and approved the final version of the manuscript.

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Compensation in DAOs: A Proposal

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Abstract

A decentralised autonomous organisation (DAO) is a new type of digitally native organisation with a membership base that has been rapidly growing throughout 2022. A new organisational structure also leads to a new way labour is organised, hired, demanded and supplied. There are, however, some differences in human capital accumulation and employee decision-making. These issues fall in the domain of labour economics. Existing theories of labour economics are tested on conventional labour market data. However, DAO work differs from the traditional post-industrial labour market employer-employee relationship. It can be described as a hybrid of ownership, volunteering, freelancing and traditional employment in different proportions for different people. Whether those differences change how the labour market operates in DAOs needs to be examined. To understand this, we need more information on DAO workers, specifically labour and socio-economic survey data, which needs to be collected. This paper identifies the need for a large-scale survey of DAO workers, discusses the motivation and challenges of data collection specific to DAOs and some important labour economic policy questions that DAOs might face in the near future that rely on empirical data. Next, the paper critically reviews and summarises the existing small-scale data on work for DAO parameters. Lastly, the article outlines issues with empirical data collection and why current methods should be modified to gather and analyse economic data on DAO work. Overall, the paper aims to determine the way ahead for the applied labour economic analysis of DAO labour.

Keywords: *Blockchain, Compensation, Decentralised Autonomous Organisation*

JEL Classifications: *L86, M52*

1. Introduction

Decentralised Autonomous Organisations (DAOs) have emerged as a novel form of digital organisation, characterised by their decentralised decision-making and transparent governance. Davidson, De Filippi and Potts [1] have described the unique characteristics of DAOs as follows:

A [DAO] is a self-governing organisation with the coordination properties of a market, the governance properties of a commons and the constitutional, legal and monetary properties of a nation state. It is an organisation, but it is not hierarchical. It has the coordination properties of a market through the token systems that coordinate distributed action, but it is not a market because the predominant activity is production, not exchange.

Hassan and De Filippi [2] define a DAO as being ‘a blockchain-based system that enables people to coordinate and govern themselves mediated by a set of self-executing rules deployed on a public blockchain, and whose governance is decentralised’. It is the notion of ‘decentralisation’ that appears to attract most attention when discussing DAOs. When it comes to governance, DAOs are more like markets than hierarchy, i.e., modern corporations or even government.

Where the modern corporation revolves around management having extensive decision-making power, DAOs are centred on a series of smart contracts and voting power that is exercised by token holders in the DAO. There is an intuitive appeal to DAO governance mechanisms over more centralised organisations like traditional firms, not-for-profits, and even government agencies:

- Transparency: DAOs operate on blockchain technology, which

allows for a high level of transparency. All rules and transactions are publicly viewable. By contrast, while corporations must disclose certain information, they are not required (or even intended) to be entirely transparent about all operations or decision-making processes.

- Autonomy: DAOs are autonomous in the sense that they can operate based on their initial coding and subsequent member decisions without the need for a central authority. On the other hand, corporations require management and employees to execute tasks and make decisions.
- Structure and Governance: The key distinction between DAOs and traditional corporations lies in their governance structures. While corporations are managed by a central authority (a CEO, Board of Directors, etc.), DAOs operate on pre-set rules, and decision-making is done collectively by its members, usually via voting.

Feichtinger, Fritsch, Vonlanthen, and Wattenhofer [3], however, suggest that these benefits may be somewhat over-sold.

Notwithstanding these differences and whether DAO governance is sustainable in the long run or whether DAO governance is ‘immature’ as Feichtinger et al. [3] suggest, both traditional organisations and DAOs face a very similar problem: how to compensate participants for their contributions.

Within traditional organisations, investors either earn capital gains, dividends, or interest, while employees earn salaries, and contractors earn fees. While that seems simple enough, there is a massive academic literature on employee compensation and especially executive compensation. Contributors to traditional organisations are usually well-defined and have

well-understood remuneration.

Contributors to DAOs are less well-defined and remuneration is less well understood. In part, this is due to the recent emergence of DAOs as an organisational form, and also due to the lack of academic study that has occurred in this area. Even now it is not clear what it means to 'work for a DAO' [4],[5]. Contributors to DAOs include founders (the equivalent of founding shareholders), investors (shareholders), developers (employees or contractors), curators and proposal submitters (employees or contractors), and service providers (contractors). As we argue below (section 3) how these different contributors get remunerated in DAOs is not as straightforward as might be expected.

This paper applies some of the learning derived from the academic literature into executive compensation in traditional organisations to DAOs. Specifically, this paper proposes a paradigm shift in compensation structures within DAOs by substituting traditional time-based vesting periods to value-based vesting periods (defined below). By aligning compensation with the value created by contributors, this proposal aims to enhance alignment, motivation, and accountability in DAOs.

In 2009, Lucian Bebchuk and Jesse Fried [6] identified two important problems in traditional executive compensation:

A good compensation plan should address two problems: executives' tendency to quickly liquidate large amounts of their equity compensation, and their ability to game the timing of equity awards and the cashing out of such awards.

Some 14 years later, this may still be a problem in publicly listed firms' compensation systems, but the problem is well recognised. It is also a problem in the crypto economy, and although recognised as being a problem, it is little discussed, to the best of our knowledge. Certainly, there is little, if any, academic work that addresses issues relating to compensation within DAOs.

What is particularly problematic in DAO compensation is that contributors are often paid in the native token of the DAO. As is explained below, this can have unintended consequences and result in perverse outcomes.

In section 2 we briefly discuss the extant academic literature on executive compensation and the incentives those compensation schemes are intended to provide. We then introduce, in section 3, the 'problem of DAOs' and the unique challenges that DAOs raise around issues of compensation. In section 4, we discuss the idea of value-weighted vesting periods replacing the current practice of time-weighted vesting periods. A conclusion follows.

2. Compensation and Incentives

Compensation plays a crucial role in large public companies, serving as a mechanism to attract, motivate, and retain favoured or talented employees, as well as align their interests with those of shareholders. Compensation packages usually consist of several components. To spell these out, they consist of cash payments, deferred cash payments, cash payments payable under differing states of nature, options and financial derivatives, equity and low-interest debt, non-cash transfers of value, and post-working life payments. In short, there are a wide variety of mechanisms and instruments to reward employees for their efforts. As we will argue below, DAOs could, but do not, deploy all these mechanisms when designing their own compensation schemes and policies.

It is also true that the compensation mechanisms and policies of large corporations (and increasingly not-for-profits and even government agencies) are often controversial. There is a long-running debate as to whether compensation is overly generous or whether it achieves its stated

objectives.

Jensen and Murphy [7] had argued that traditional compensation mechanisms, which then primarily consisted of fixed salaries, did not effectively motivate senior employees (they were discussing chief executive officer compensation) to maximise shareholder value. They proposed using incentive-based compensation plans, such as stock options and equity ownership, to align the interests of senior employees and shareholders. By contrast, Bebchuk and Fried [8] argue that there is often a significant disconnect between pay and performance. They contend that compensation packages, particularly those based on stock options and equity (i.e., precisely what Jensen and Murphy had proposed) have failed to consistently align employee incentives with shareholder interests.

Nonetheless there is much to learn from examining the arguments of both Jensen and Murphy and Bebchuk and Fried. Both sets of authors highlight issues relating to short-term thinking and the manipulation of compensation structures. Jensen and Murphy caution against short-termism and the focus on immediate stock price appreciation, while Bebchuk and Fried draw attention to the ability of executives to game the timing of equity awards and cash-outs. It is apparent that compensation policies require careful consideration that strikes a balance between providing incentives for performance and addressing concerns such as excessive pay, misalignment of interests, and short-termism. Enhancing transparency, accountability, and shareholder input in compensation decisions, as suggested by Bebchuk and Fried, can help align compensation practices with shareholder interests. Additionally, incorporating longer vesting periods, performance-based metrics, and rigorous evaluation processes can further align executive incentives with sustainable organisational success, as advocated by Jensen and Murphy.

3. The 'Problem' of DAOs

One of the key aspects of DAOs is their emphasis on decentralised decision-making. Rather than relying on a centralised authority or management team [9], decision-making power is distributed among the participants. This decentralised governance model is typically achieved through voting mechanisms, where participants can vote on proposals, changes to the organisation's rules, or the allocation of resources. Participants in a DAO can hold voting rights, propose and debate ideas, contribute their skills or resources, and even receive rewards or compensation in the form of native tokens or digital assets.

There are various compensation mechanisms that DAOs can adopt:

- **Token Compensation:** The most obvious form of compensation in a DAO is through the native token. This can incentivise participants to contribute towards the DAO's success, as the value of their tokens may increase as the DAO grows and succeeds.
- **Bounties:** DAOs can set up bounty programmes for specific tasks or goals, offering an amount of tokens to whosoever completes the task or achieves the goal.
- **Funding Pools:** DAOs could establish funding pools to distribute compensation to participants. For instance, a DAO could collect a percentage of all transaction fees and distribute it among its participants.
- **Revenue Sharing:** DAOs could distribute a portion of their revenue among participants. This could be proportional to the amount of work done or tokens held.
- **Salary or Fee for Service:** Similarly to traditional organisations, DAOs can also set a fixed salary or fee for service for certain roles, like legal or auditing services. This could be paid in tokens or in other cryptocurrencies.
- **Staking Rewards:** Participants could earn compensation by staking their tokens, i.e., locking them up for a period of time

to support network operations such as securing the network or voting. In return, they receive a portion of the DAOs revenue or newly minted tokens.

Clearly these mechanisms are not appropriate for all contributors. Token holders, who provide capital and governance to the DAO should be compensated via some revenue-sharing model such as a buy-back scheme (or even dividends). This both aligns them with their role as stakeholders and motivates them to make decisions that increase the DAO's value. Founders or creators usually receive an initial token allocation for setting up the DAO, which may be subject to a vesting schedule to promote long-term involvement and dedication. Developers may be rewarded through bounties for specific tasks, a regular salary in native tokens or some other cryptocurrencies such as a stable-coin, or a vesting schedule similar to that of founders, all of which incentivise their sustained high-quality work. Curators, who bear the responsibility of filtering and suggesting proposals for voting, should receive a flat fee for each proposal they curate or a consistent salary that aligns their interests with the DAOs success and efficiency. Encouraging members to submit valuable proposals might be achieved by offering a reward for accepted and implemented proposals, whether that is a flat fee or a percentage of any resulting cost savings or generated revenue. Finally, service providers, such as legal counsel or graphic designers, could be compensated on a fee-for-service or contractual basis in alignment with the value they bring to the DAO.

There is an additional challenge, however, as Orlando [10] indicates:

One of the biggest challenges I have seen in the DAO space is compensation; knowing when you will get compensated, how you will get compensated, and trust that it will come in.

These are very different problems to what employees may experience in large corporations. Orlando describes DAO compensation in the following terms:

Many DAO members benefit from the flexibility DAOs offer their contributors. The flexibility is because, unlike traditional organisations, DAOs use multiple unique compensation mechanisms. Their payout models range from paying governance tokens to stablecoins and crypto for grants, bounties, and role-assigned tasks.

While it is clear that DAOs make use of compensation mechanisms that are different to those of traditional organisations, it is not clear that DAOs make use of as many different compensation mechanisms as do traditional organisations. For example, the payment of stablecoins or crypto for grants and bounties is the equivalent of paying cash for project work. That is not quite ongoing employment. Role-assigned tasks are more like ongoing employment but in the DAO context this is problematic – who assigned the tasks? Who decides if the task has been adequately performed? (See [11] and [12] for discussion on these points). But again, the payment of stablecoins is the equivalent of paying cash. The payment of governance tokens could (controversially) be considered as being equivalent to equity grants. All the other mechanisms available to traditional organisations, however, appear to be absent.

Paying employees in the native token (or governance token) could give rise to several problems:

- Uncertainty and instability in income. Many tokens – especially for smaller and younger projects – may have limited usability outside their native ecosystem and may also experience significant price volatility. These problems may well be exacerbated by a lack of liquidity in secondary markets when employees attempt to redeem their tokens for cash that can be expended to defray living expenses.
- Misalignment with the long-term goals of external token holders. Token-based compensation may encourage short-term thinking and a focus on immediate price appreciation rather than the

long-term success of the DAO. For example, DAO contributors might prioritise activities that drive short-term token price increases, potentially neglecting important factors like product development, user experience, or community building.

- Wealth inequality. Token-based compensation can exacerbate wealth inequality within DAOs. If early contributors or founders hold a significant portion of the native tokens, they may have disproportionate influence and financial power compared to later contributors.

It is possible to inform our understanding of DAO compensation by bringing the insights of Jensen and Murphy and Bebchuk and Fried to bear.

Bebchuk and Fried's work highlights the potential misalignment between pay and performance. This concern extends to DAOs, as contributors are often compensated with native tokens. The volatile nature of these tokens raises questions about short-term liquidation and the potential disregard for long-term organisational goals. To address this problem, DAOs often implement vesting schedules but as we argue below, these schedules themselves can be gamed. Jensen and Murphy emphasise the importance of accountability and effective incentive structures in compensation. DAOs must strike a balance between motivating contributors and preventing abuses in timing token awards and cash-outs. Transparent and predetermined processes for token distribution are crucial, ensuring fairness and preventing manipulative behaviours.

It seems that DAOs rely, quite heavily, on vesting as the mechanism to drive incentive compatibility between founders, early contributors, later contributors, and other external token holders. The purpose of vesting schedules is to incentivise long-term commitment, align interests, and prevent immediate liquidation or exploitation of token compensation. A typical example of vesting may be as follows: when an individual joins a DAO as a contributor, they are granted native tokens that are not immediately accessible. The so-called vesting period, possibly spanning months or years, defines when the tokens become available and the rate at which they become available. Some vesting schedules include a 'cliff' period, where no tokens vest initially, ensuring commitment before earning tokens. After the cliff period, vesting commences, facilitating long-term engagement within the DAO. Adding to the complication is that different types of contributors may have very different vesting periods.

The argument set out in the previous paragraph seems reasonable to align the interests of DAO contributor and according to Hedgely Finance [13] those arrangements seem to be typical in the DAO space. The difficulty with this sort of arrangement is that it simply does not address the problem identified by Bebchuk and Fried and cited at the very beginning of this paper. Contributors (especially founders and early contributors) still have an incentive to liquidate their token holding as soon as they can, and they still have control over when they can do so. Early contributors and founders get to choose the timing of their vesting contracts.

4. A Proposal

A possible solution to the timing problem (and favoured employees liquidating their holdings as quickly as possible) – and the proposal contained in this paper – is to link vesting contracts to the value of the underlying token and not simply the passage of time.

Consider the following example: a contributor undertakes to do a job of work that might be valued at, say, \$10. If the DAO token had a current market value of \$1, then the contributor gets paid 10 tokens. There may be a vesting schedule that prevents them from selling the 10 tokens for, say, 6 months. This situation is intended to align the interests of the contributor with the long-term interest of the DAO or other contributors or DAO participants. It also is intended to avoid downward price pressure on the DAO tokens in the present – this is especially important if the DAO is young and the DAO tokens not particularly valuable or currently traded in

illiquid markets.

Now consider an alternative vesting mechanism. The contributor does a job of work valued to be \$10, the current market value of the token is \$1, but rather than receiving 10 tokens, the contributor receives, say, 5 tokens. Now the contributor has no incentive to sell the tokens on the market until they have reached a market price of \$2 each. Alternatively, if they need cash now for living purposes, they can sell their tokens now on the market for \$1 each. In this approach, contributors are paid immediately for their work, but only realise the full value of their payment when all other contributors and DAO participants realise additional value too. Of course, it would be easy to combine this proposal with a deferred compensation mechanism where the previously withheld tokens are paid out when the token price reaches the targeted market price (in this example \$2). This alternative approach offers, at least, three potential advantages:

- **Aligning with performance:** By basing vesting periods on the value accrued to the underlying token, contributors are directly tied to the performance and success of the DAO. If the value of the token increases, it indicates positive outcomes and progress, rewarding contributors accordingly. This approach establishes a direct link between the value created by contributors and their compensation, promoting alignment between their efforts and the DAO's success. Time-based vesting provides, at best, an indirect link between contributors' contribution and value created. Time-based vesting schedules assume that the value of the DAO token will appreciate over time, or at least will not depreciate, and so align interests – but that is an assumption unrelated to value creation.
- **Motivating long-term commitment:** Traditional time-based vesting schedules may not necessarily incentivise long-term commitment or sustained effort. Contributors may (passively) fulfil their time obligations without actively contributing to the growth and success of the DAO. In contrast, value-based vesting encourages ongoing engagement and dedication, as contributors are motivated to enhance the value of the asset to maximise their own compensation. It aligns the interests of contributors with the long-term growth and sustainability of the DAO.
- **Reflecting contribution quality:** Time-based vesting schedules do not differentiate between various levels of contributions, or the quality of work performed. By incorporating the value accrued to the underlying token, contributors who make substantial and impactful contributions can be appropriately rewarded. It provides a more meritocratic approach, where compensation is tied to the value added by contributors rather than simply the passage of time.

The obvious question, of course, is, how can anyone know that a particular contributor was responsible for value appreciation? The answer is that nobody can ever know for certain – yet that is the case under existing compensation schemes. What this proposal offers is a deferred compensation scheme that aligns the interests of contributors with the financial interests of all DAO participants. The question of interest is simply how deep the discount should be when tendering for any job of work. Right now, the question is, 'how long should the vesting period be?' That too is a somewhat arbitrary number, yet by linking vesting to valuation DAOs can establish clear targets and expectations as to value accrual. What is important, however, is that the compensation design space available to DAOs is expanded by having another compensation tool available for use.

5. Conclusion

This paper proposes a simple change to vesting schedules – that they target value and not merely the passing of time. In this way, compensation within DAOs can be better aligned with the long-term interests of other DAO contributors and DAO participants. Furthermore, it better aligns compensation practice with principles that have been learnt from observation of compensation problems in large public corporations.

Compensation is a fraught topic, yet the crypto economy avoids tackling this issue [14]. If DAOs are to provide employment opportunities, going forward it will have to adopt policies and processes that cater to the unique attributes of DAOs while attracting and retaining individuals able and willing to do the work of establishing and running those DAOs.

The paper contains a proposal for DAO compensation. A significant limitation of this proposal is that it is entirely theoretical – no DAO has adopted such a scheme, to the best of our knowledge. Furthermore, it is unclear if contributors to a DAO would be willing to work on such a basis. Nonetheless it is also unclear if existing vesting schedules work as well as intended.

Finally, it is obvious that much more academic work needs to be undertaken to better understand what it is that DAOs do and how they do it, and flesh out what it means to work for a DAO.

Reference

- [1] S. Davidson, P. De Filippi, and J. Potts, "Blockchains and the economic institutions of capitalism," *Journal of Institutional Economics*, vol. 14, no. 4, pp. 639–658, 2018.
- [2] S. Hassan and P. De Filippi, "Decentralized autonomous organization," *Internet Policy Review*, vol. 10, no. 2, 2021. Available: <https://doi.org/10.14763/2021.2.1556>
- [3] R. Feichtinger, R. Fritsch, Y. Vonlanthen, and R. Wattenhofer, "The hidden shortcomings of (D)AOs – An empirical study of on-chain governance," 2023. Available: <https://arxiv.org/abs/2302.12125>
- [4] N. Ilyushina and T. Macdonald, "Decentralised autonomous organisations: A new research agenda for labour economics," *The Journal of The British Blockchain Association*, 2022. Available: <https://jbba.scholasticahq.com/article/35367-decentralised-autonomous-organisations-a-new-research-agenda-for-labour-economics>
- [5] N. Ilyushina, "Work for decentralised autonomous organisation: What empirical labour economics can tell us about the decentralised digital workforce?" *The Journal of The British Blockchain Association*, June 2023. Available: [https://doi.org/10.31585/jbba-6-2-\(2\)2023](https://doi.org/10.31585/jbba-6-2-(2)2023)
- [6] L. Bechuk and J. Fried, "Long-term performance is key," *Harvard Business Review*, vol. 87, no. 9, p. 113, 2009.
- [7] M. Jensen and K. Murphy, "CEO incentives: It's not how much you pay, but how," *Harvard Business Review*, vol. 68, no. 3, pp. 138–149, 1990.
- [8] L. Bechuk and J. Fried, *Pay without Performance: The Unfulfilled Promise of Executive Compensation*. Cambridge, MA: Harvard University Press, 2004.
- [9] A. Alchian and H. Demsetz, "Production, information costs, and economic organization," *American Economic Review*, vol. 62, no. 5, pp. 777–795, 1972.
- [10] H. Orlando, "DAO current compensation and incentivization: How talent are rewarded," *Medium*, 2022. Available: <https://medium.com/coinmonks/dao-current-compensation-and-incentivization-how-talent-are-rewarded-d634e5982dda>
- [11] S. Davidson, "From corporate governance to crypto-governance," SSRN Working Paper, 2021. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3844304
- [12] S. Davidson and J. Potts, "Corporate governance in a crypto-world," SSRN Working Paper, 2022. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4099906
- [13] Hedgey Finance, "The current scene in DAO compensation," *Hedgey Deep Dive*, 2022. Available: <https://mirror.xyz/mikey333.eth/ubHkeUx:AER3Vh2agaiZOgO26-VC-ZdINRKxFC7h4GQ>
- [14] C. Eberle, "DAO compensation: How Yearn is evolving compensation for contributors and core team," 2022. Available: <https://youtu.be/ua5qH6ZnXIQ>
- [15] C. Berg, "The case for generative AI in scholarly practice," SSRN Working Paper, 2023. Available: <https://ssrn.com/abstract=4407587>

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The Tokenomics Audit Checklist: Presentation and Examples from the Audit of a DeFi project, Terra/Luna and Ethereum 2.0

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Abstract

With the increasing popularity of Web 3.0, tokenomics is becoming even more important as a scientific discipline. Tokenomics auditing is a new area of interest in the context of Web 3.0 whose aim is to stress test the design and structure of token economies, to ensure they are robust and safe. The importance of this area has increased considering multiple project failures and fraud that were witnessed in the recent history of the space.

In this paper we present a framework to audit the tokenomics of blockchain-based projects. The auditing framework can be used by stakeholders to audit their tokens and by investors to assess the risks associated with investing in a given token. We demonstrate how this framework can be applied to assess risks and improve the structure of a token economy.

We give three examples: First, an example is based on a real case study of a newly launched DeFi protocol called Algem which was the original inspiration for this protocol. Then, we perform retrospective study of Terra/Luna. Finally, we show how that framework could be used for the analysis of Ethereum 2.0. While the auditing framework is not without its shortcomings, it represents the first attempt at standardising tokenomics auditing. Therefore, this provides a foundation upon which the community will build and improve, as tokenomics auditing matures as a framework.

Keywords: *Tokenomics, Token economics, Agent based, Auditing, Monte carlo*

JEL Classifications: *G10*

1. Introduction

Tokenomics is the study of token economies. It's a field that emerged around 2017 once it became evident that the possibilities that Ethereum provided in creating tokens allowed for the generation of artificial economies that align incentives in novel ways, never seen before [1].

It was in 2018 in the inaugural issue of this journal when the question was asked, "Why do we need tokenomics?" [2]. This question is no longer relevant, simply because everyone in what is now termed the Web 3.0 space believes that we need tokenomics. Indeed, some of the major innovations we've seen in the area of blockchain, such as DeFi, have come primarily as tokenomics innovations, whether we are talking about powerful lending and borrowing protocols or failed experiments like Terra/Luna.

It looks like as we are entering a new era of wider adoption of blockchain, the focus on tokenomics has shifted from simple utility designs to more complicated interconnected economies. Another trend that has been observed is that of tokenomics auditing. Many founders in the blockchain space are better educated on the topic, and can often create interesting designs, without any external help. However, the designs often reach a level of complexity that makes it difficult to validate how well they would work in practice.

This has given birth to tokenomics auditing [3]. The goal of a tokenomics auditor is to analyse a token economy and suggest improvements if it is found that the design does not satisfy the goals. This journal had already published work in this area and outlined some of the techniques that can

be used in auditing.

As the field of token economics matures and auditing becomes more widespread, it feels that the next stage of evolution requires more rigour. Tokenomics auditing must become less subjective over time and be based more on objective criteria agreed upon by experts. In an ideal world, there would be a framework that any tokenomics auditor could follow and would allow the auditor to hand out ratings based on objective criteria.

In order to achieve this goal, the authors are presenting here a simple tokenomics auditing framework. This was applied for the audit of a DeFi project, with a complicated value flow design.

While the tokenomics audit checklist cannot be considered to be exhaustive or the final word on the topic, it nevertheless advances the state of the art on what currently is a green field.

2. Background information

Freni et al. [4] did a great job at summarising the objective of tokenisation:

"tokenization represents a form of digitalization of value and, just like the Internet enabled the free and fast circulation of digitised information, so the blockchain is allowing the almost free and borderless flow of digitised value."

This simple definition captures the plurality of applications that tokens have brought to the Web. However, it is this plurality that can often make standardising tokenomics such a challenging topic.

First, token economies can have radically different goals. For example, a stablecoin has a drastically different goal from a project based around a utility token. This leads to the observation that there are many different types of tokens. Freni et al. provide a framework with many different parameters, shown in Figure 1, which a token can abide by. The total number of possible parameter combinations ranges in the thousands.

TECHNOLOGY			BEHAVIOR							CONFORMATION			
Chain	Permission	Number of Blockchains	Representative Type	Burnability	Exploitability	Spentability	Fungibility	Divisibility	Treasury	Underlying Value	Supply Strategy	Issuance Enablers	Issuance Drivers
New Chain, new code	Permissionless	Single Chain	Common	Burnable	Exploitable	Spentable	Fungible	Fractional	Treasury	Asset-based	Schedule-based	Right to work	Get access (to collaboration)
New Chain, forked code	Permissionless	Cross Chain	Single	Non-Burnable	Non-Exploitable	Non-Spentable	Non-Fungible	Atomic	Non-Treasury	Network Value	Right to use	Get reward	
Forked Chain, forked code							Hybrid	Integer	Delegated	Share-like	Right to vote	Get reward (on-chain existing business)	
											Discretionary	End of account	Get reward (over existing business)
											Marketing channel	Motivation of holding	Disincentivizing (for holding or selling)
											Share of value	Appropriate (governance)	Participate in governance
													Get reputation

Figure 1. Classification of token types.

Secondly, when valuing a token, different tokens can have very different principles upon which they should be valued. For example, recent work investigated valuing NFTs [5], taking as a base their attributes, and then using hedonic regression. Other approaches have used tools from network theory, such as Metcalfe’s law [6], the quantity theory of money [7], to simply using the total value locked or the market cap.

Finally, not all tokens will abide by simple classifications. A good example is the latest white paper by Cosmos [8] presents a token with multiple interlinked utilities: from security to wealth preservation and governance. This makes identifying potential feedback loops and issues more difficult and challenging. An excellent demonstration of the complex value flows that can be created in blockchain projects is shown by Kim et al. [9] who presented a case study of a token economy design from scratch. This is shown in Figure 2.

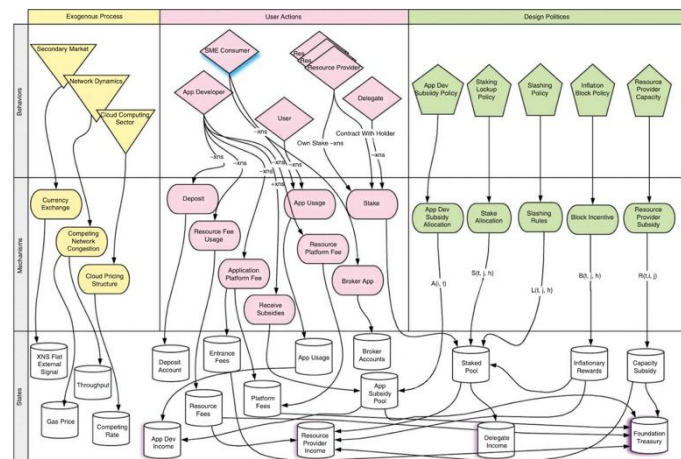


Figure 2. Case study of a token economy designed from scratch by Kim et al. [9]

All the above corroborate the conclusion that it is very difficult to create a simple tokenomics framework that can cover every eventuality. Also, in this discussion, we didn’t mention the complex topic of simulations, where the preferred methodologies can range from agent-based modelling [10] to control theory [11].

Furthermore, we don’t touch upon the complications that other factors can bring into the business, such as the successful execution of marketing, or product considerations.

Therefore, we decided that a framework should focus upon the following

principles:

1. It should be abstract enough so that it can cover existing cases in blockchain, no matter the field: DeFi, GameFi, Layer 2 solutions, etc.
2. It should be simple enough, that at its most basic form, a blockchain project should be able to use the framework with no external help.
3. It should be able to accommodate the results from simulations, if such are available, without being constrained by them.
4. The framework ignores certain externalities, such as product-market fit. Tokenomics interacts with the business model, and this aspect is also recognised in this framework. However, tokenomics cannot replace product-market fit or marketing. Therefore, the framework recognises that such externalities exist, up to a point.

The framework combines various aspects of a project: business model analysis, identification of potential external shocks, token allocation, simulations and more. Since this work is novel, it’s very difficult to cover every potential scenario. Therefore, the main goal of this framework can be summarised in the following sentence:

“Given a set of certain criteria and areas to investigate, would a sceptical reader be convinced that the tokenomics of a project are robust, and achieve the goals of the project?”

Note that we are not naming any specific tools to be used, since the tokenomics auditor is free to use any tools, they deem appropriate. This open-ended definition places weight on both the auditor, but also the user and investor of a project.

We believe that this framework is more useful when identifying potential weak points which a protocol can improve, rather than when a perfect score is achieved. It is unlikely that this set of criteria is going to remain static over time, and it is expected that the tokenomics community is going to improve them.

However, each one of those criteria does cover common issues in tokenomics, and a weakness in any of them is something that must be addressed.

The framework is presented in the next section.

3. The Tokenomics Auditing Framework

The framework comprises an audit checklist that is split into four parts:

1. Business-token interaction
2. Structural analysis
3. Allocation and distribution
4. Stability and stress tests

Each part asks a certain number of questions. The answers are scored on a point system, with more points describing a more positive outlook for the token economy.

The first part (business-token interaction) investigates any relationships that exist between the token economy and the business model. The most important question that it asks is, “Does this business model really benefit from a token economy?”

The second part is the longest and most complicated. It tries to identify issues such as:

1. Ponzi-like elements. Something which protocols like

- OlympusDAO have been accused of [12].
2. Dynamics which can cause an implosion, e.g., the Terra/Luna case. [13]
 3. Demand driver challenges.
 4. Governance issues.

The third part deals with the allocation and distribution of the token.

The final part (stability and stress tests) is the only one that contains questions that do not have a Yes/No answer. Therefore, the fourth part is considered as an extra, since some projects might not have the capability to implement it, and it requires simulations that add a certain element of complexity. Ideally, in the future, the types of stress tests required will be standardised and will become more accessible.

The full questionnaire checklist is shown below so that the checklist can be simply printed. Another section follows with an explanation of the answers. Each section is accompanied by a “rationale” paragraph explaining what the intention behind that section is.

Business-Token Interaction

Rationale: The rationale behind these questions is that the use of blockchain should be a must-have, not a nice-to-have for a project. Obviously, there is a certain element of subjectivity in these questions, but they at least raise awareness of the issues.

1. Do tokens improve the current business model?
2. Is the token nice to have or an essential part of the business model?
3. Can the project gain value (not the token) in fiat terms?

Structural Analysis

Break down explaining main system mechanisms and interactions.

Rationale: The objective of this section is to do a thorough review of the structure of the token economy. This is by far the most important section. We believe that future work is going to expand and add more points to this section, since as protocols develop more and more advanced mechanisms, new points need to be addressed.

In general, we believe that a robust tokenomics structure creates value, while avoiding feedback loops that can cause implosion or explosion of the system, e.g., Ponzi-like elements or overleveraged positions. That's not to say that protocols that might have such elements might still provide value in other ways.

However, from a tokenomics perspective, such mechanisms can leave a system exposed to shocks.

Sections 1 to 3 deal with the utility and the practicalities of a project: Would the project generate cash flow? Does it suffer from feedback loops? Does it generate economic value? Can it control certain demand drivers?

Section 4 deals with governance, whereas section 5 simply asks the question as to whether there is empirical proof that the protocol could work in practice. By empirical proof we refer to any similar protocols that might exist and have produced data that show that a particular design can work. For example, the existence of decentralised exchanges proves that automated market makers can work in practice.

The tokenomics auditor is free to use whatever tool is appropriate for structural analysis, e.g., game theory or mathematical modelling. However, simulations (agent based or otherwise) are explicitly mentioned in the “stress test” section, so they are not officially part of the structural analysis

section, even though they can be used here, as well. The open-endedness of this framework is one limitation which is discussed later in this paper.

1. Cash-flows:

1. Does the token economy have an influx of value (e.g., in fiat) coming in?
2. Does money stay in the token economy, or is there pressure to immediately sell?
3. Are there ponzi-like elements?

2. Mechanisms and all economic agents involved

1. Do interactions generate additional value expressed in fiat?
2. Does the project require a critical mass in order to be able to provide value? E.g., social networks are a good example of this.
3. Are the incentives speculative?

3. Demand Drivers

1. Do the demand drivers depend on controllable factors or uncontrollable factors? An example of an uncontrollable factor is simply conditions.
2. Are there levers the economy can use to influence demand?
3. Do they depend on entities that generate real economic value or more on internal or speculative factors, e.g., expected token appreciation because of rewards?

4. Governance:

1. Can a majority take over?
2. Can governance cause sticky points? E.g., votes need to take place, but no one is voting
5. Empirical proof:
 1. Has there been proof that the mechanisms used in the project can work successfully?

Allocation and Distribution

Rationale: Allocation and distribution are both very important considerations for any tokenomics design. The objective of this section is to primarily deal with the major problem of pumps-and-dumps and excessive market manipulation from powerful actors.

There might be some other allocation considerations that a project might want to consider, for example, how fair an allocation is. These are not addressed in the current framework since the main objective of the framework is to establish whether the tokenomics are robust.

1. Does the allocation favour pump-and-dumps?
2. Does it provide unnecessarily large stakes to certain actors?
3. Does the distribution avoid creating unnecessary sell pressure?

Stability and stress tests

Rationale: Failures in the recent history of tokenomics, such as the Terra/Luna crash, have demonstrated the importance of stress tests. This is by far the most open-ended section, since it is unavoidable that a proper audit would require the use of simulations. It is hoped that this process will be standardised once the tokenomics auditing matures, in a similar way to which central banks might stress test the underlying financial infrastructure of their countries.

1. How exposed to shocks is the token?
2. Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored.
3. Does the system have feedback loops, which could accelerate a crash (e.g., the Terra/Luna case).

4. The Framework with Answers and Guidance

The following section presents the score that is assigned to each question. There is a certain element of subjectivity in the scoring. While other experts in this area might come forward with their own opinions, the authors believe that it would be difficult to assign the same weight to all questions.

As this area progresses, the scoring used in this framework is going to be improved based on data, and the success or failure of the different projects analysed.

Business-Token Interaction

1. Do tokens improve the current business model? Yes: 1, No: 0
2. Is the token nice to have, or an essential part of the business model? Essential: 1, Nice-to-have: 0
3. Can the project gain value (not the token) in fiat terms? Yes: 1, No: -1

Structural Analysis

Break down explaining main system mechanisms and interactions:

1. Cash-flows:

1. Does the token economy have an influx of value (e.g, in fiat) coming in? Yes: 0, No: -1
2. Does money stay in the token economy, or is there pressure to immediately sell? Stay: 1, Sell pressure: -1
3. Are there ponzi-like elements? Yes: 0, No: 1

2. Mechanisms and all economic agents involved

1. Do interactions generate additional value expressed in fiat? Yes: 1, No: 0
2. Does the project require a critical mass in order to be able to provide value? E.g, social networks are a good example of this. Yes: 0, No: 0.5
3. Are the incentives speculative? For example, rewards with no underlying value? Yes: -1, No: 0

3. Demand Drivers

1. Do all the demand drivers depend on controllable factors or uncontrollable factors? An example of a controllable factor is product quality. An example of an uncontrollable factor can simply be the market conditions. Controllable: 1, Uncontrollable: 0
2. Are there levers the economy can use to influence demand? Yes: 1, No: 0
3. Do they depend on entities that generate real economic value or more on internal or speculative factors, e.g, expected token appreciation because of rewards? Real economic value: 1, Speculative: -1

4. Governance:

1. Can a majority take over? Yes: -1, No: 1
2. Can governance cause sticky points? E.g, votes need to take place, but no one is voting. Yes: 0, No: 1

5. Empirical proof:

1. Has there been proof that the mechanisms used in the project can work successfully? Yes: 2, No: 0

Allocation and Distribution

1. Does the allocation favour pump-and-dumps? Yes: -1, No: 0
2. Does it provide unnecessarily large stakes to certain actors? Yes: -1, No: 0
3. Does the distribution avoid creating unnecessary sell pressure?

An example of this can be excessive airdrops. Yes: 1, No: 0

Stability and stress tests

1. How exposed to shocks is the token? Answering this requires simulations. Use a scale from -2 to 2. A 2 represents a token that can withstand huge shocks (e.g, massive bear market), and a -2 represents a token that can only appreciate when conditions are perfect.
2. Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored. Yes: 1, No: -2
3. Does the system have feedback loops, which could accelerate a crash (e.g, the Terra/Luna case)? Yes: -1, No: 1

Points interpretation

The maximum score can be 18.5:

- Business-token interaction(3)
- Structural(10.5)
- Allocation and distribution(1)
- Stability and stress tests(4)

The lowest possible score can be -13:

- Business-token interaction (-1)
- Structural (-5)
- Allocation and distribution (-2)
- Stability and stress tests (-5)

Based on the ratings and most susceptible categories, the auditor should recommend adjustments and tangible solutions to increase the current system's resilience to economic exploitation and harmful feedback loops.

Table 1. Ratings and scores interpretations

Letter rating	Score	Percentage
AAA	16-18.5	86%+
AA	14-6	75%-86%
A	12-14	65%-75%
BBB	10-12	54%-65%
BB	8-10	43%-54%
B	6-8	32%-43%
CCC	4-6	22%-32%
CC	2-4	11%-22%
C	0-2	0%-11%
DDD	-4-0	-21%-0
DD	-8-4	-42%-0
D	<-8	<42%

The maximum score that can be awarded is 18.5. This score can be converted to letter ratings, in a similar fashion to the one that is used in mainstream finance credit ratings. This is detailed in Table 1. The right number is exclusive, that is, 0-2 means that the score is below (but not equal) to 2. The table also contains a column for percentages. This is done for convenience since some questions might have to be removed for certain projects.

The goal behind this table is to simplify the interpretation of the final score. However, a score below AAA shouldn't necessarily be considered

problematic. Going back to this definition:

“Given a set of certain criteria and areas to investigate, would a sceptical reader be convinced that the tokenomics of a project are robust, and achieve the goals of the project?”

it might be the case that a project achieves a score below AAA, simply because of its peculiarities or goals. Again, the investor or user of a project is assumed to be a sceptical reader of an audit, and it’s up to them to decide whether the assessment or risk aligns with their investment profile. This is not different to how investments take place in traditional finance.

5. Case Study: Using the Framework for a Real Audit

The first tokenomics auditing framework was applied for Algem [14] - liquid staking and lending protocol on the Astar Network and Polkadot.

The main goals of this audit were to:

1. Determine whether Algem’s economy is resilient and sustainable.
2. Determine whether Algem’s price can rise or not.
3. Examine whether Algem is vulnerable to overleveraged positions that could destabilise the overall system.

Algem has three main mechanisms:

1. Liquid staking.
2. Liquid lending.
3. Algem stake to earn.

The interconnectedness of mechanisms can be observed in the token value flow shown in Figure 3.

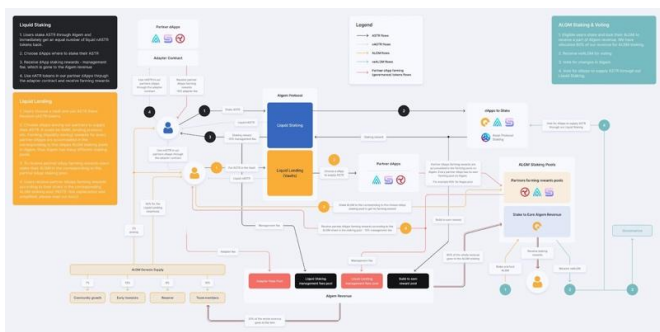


Figure 3. Algem’s token flow.

After the initial audit overview, Algem scored 12.5 out of 18.5:

- Business-token interaction (3)
- Structural (5.5)
- Allocation and distribution (0)
- Stability and stress tests (3)

Algem, like many other early-stage crypto-projects, must use a considerable portion of its supply for investors, airdrops and community rewards in its early phases. This frequently results in an oversupply of tokens, putting downward pressure on the price.

Therefore, this caused Algem to rate low on the demand drivers and the allocation and distribution sections. Algem had issues controlling its own demand, and the original design was increasing sell pressure unnecessarily.

Something which stood out is that Algem did not suffer from any feedback loops. Therefore, it achieved a perfect score to the following questions:

- “Are there ponzi-like elements?”
- “Does the system have feedback loops, which could accelerate a crash?”

The audit resulted in the development of mechanisms for reducing sell pressure and refining token demand. Both systems are controlled by governance and hence adaptable, but they also provide additional incentives and motives for users to participate in governance.

These mechanisms were further investigated using simulations that were necessary for answering the questions in the stress test and allocation sections. It was found that the sell pressure (blue line in Figure 4) did not exceed a critical threshold that would place the project at the risk of pump-and-dump.

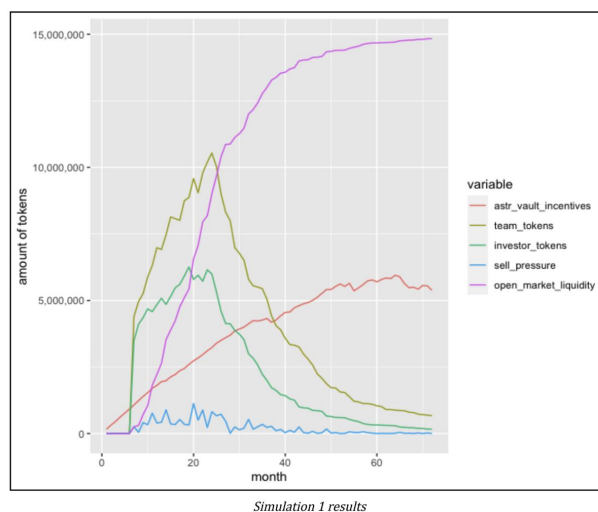
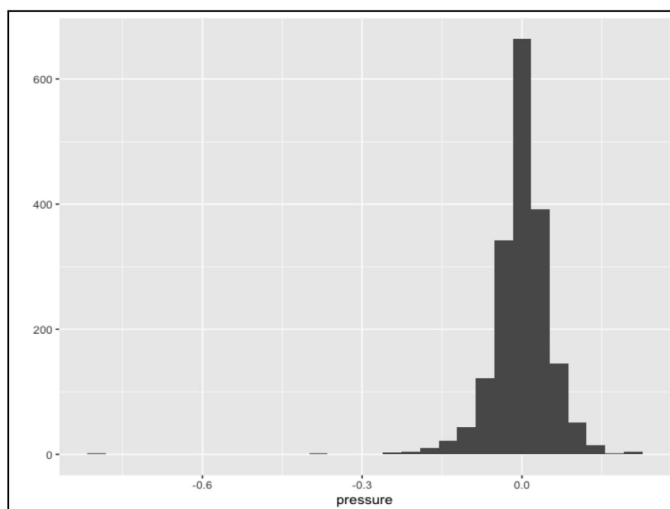


Figure 4. Simulation of sell pressure and demand [15].

The demand and the supply were based upon stochastic assumptions, as well as real data. For example, to simulate the distribution of demand, the authors resorted to extracting data from Ethereum, in order to understand what a realistic distributional shape for the simulation of the demand would look like. The full details of this process are presented in [15].



After these changes, Algem was rated again based on the framework questions. It was discovered to have robust and durable tokenomics after implementing the specified mechanisms. There are no issues with the system’s internal design or the token allocation and distribution mechanism. Additionally, Algem is an adaptive protocol, with governance playing a key

role in some of the mechanisms that control demand and supply.

Any troubles that develop in the project are more likely to be caused by external forces (such as market conditions). As a result, the project's tokenomics clearly pass all checks and receive the highest rating (18.5/18.5), which amounts to AAA.

This presents an example of how the framework was used in practice to rectify some of the weaknesses of a real protocol.

This doesn't imply that the protocol is perfect, or that its success is guaranteed, since there can be other external factors that could constrain its popularity, from market conditions to the core team falling apart.

However, going back to our original definition, as far as a sceptical reader is concerned, the arguments in favour of that rating are placed clearly, and any investor or user that disagrees is invited to make up their own mind.

The Web3.0 community has benefitted from this analysis in two ways:

- The protocol has become more robust, and if it succeeds, then it will generate economic value.
- Users and investors can now read an in-depth analysis about the protocol and decide whether it is investable or not.

6. Other examples: Terra/Luna and Ethereum

Performing a full audit of Terra/Luna or Ethereum would require a whole new paper for each project. However, in this section we present some ways in which this framework could be used.

Terra/Luna

One of the most famous examples of economic exploitation is TerraUSD (an algorithmic stablecoin). TerraUSD was one of the biggest cryptocurrency projects until it lost its peg on the 11th of May 2022 [16]. Terra had a dangerous feedback loop: swapping and burning UST for Luna (their native token) meant minting more Luna, diluting the supply and dropping the price of this token. Additionally, as the price of Luna drops, whenever you swap 1 UST for \$1 worth of Luna, you steadily need more and more Luna to hit that \$1 mark (which means minting even more Luna).

At some time, the price of Luna had fallen so low that there wasn't enough liquidity to provide an escape route for all the UST flowing in. This could have been prevented if the burn-and-mint mechanism had been audited and stress-tested in various supply and demand pressure scenarios. A more detailed analysis is presented in subsequent sections.

The main objective of Terra/Luna was to maintain a stable peg against the US dollar. Therefore, a tokenomics audit should assess how successfully the protocol would be able to perform that role.

We believe that Terra/Luna would successfully pass most of the sections with the exceptions of the following ones:

1. Does the project require a critical mass in order to be able to provide value? *Yes, algorithmic stablecoins require a critical mass of users.* Points retracted: -0.5
2. Do all the demand drivers depend on controllable factors or uncontrollable factors? *Demand is not fully controlled by the protocol.* Points retracted: -1
3. Do they depend on entities that generate real economic value or more on internal or speculative factors. *It could be argued that rewards were largely speculative.* Points retracted: -2
4. Are the incentives speculative? For example, rewards with no underlying value? Yes: -1

5. Do the demand drivers depend on entities that generate real economic value or more on internal or speculative factors, e.g., expected token appreciation because of rewards? Speculative -1
6. Are there ponzi-like elements? Yes: 0. The answer to this question is clearly a yes, as Anchor Protocol was effectively operating as a Ponzi [17].

The question "*Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored.*" must be ignored giving the protocol a maximum potential score of 17.5.

Regarding the question "Has there been proof that the mechanisms used in the project can work successfully?" it could be argued that the seer fact that the protocol had existed for a certain amount of time was proof that it could work. Therefore, if the audit had taken place before the eventual crash, it would pass this question successfully.

Based on that, the project would get a score of 8/17.5 which would rank its tokenomics as BB. This can be interpreted as that the tokenomics are good, but far from perfect. This rating corresponds with what was observed in practice.

The tokenomics of Terra/Luna worked fine until market conditions and externalities caused enough pressure to lead it to complete failure.

The fully answered questionnaire is presented in the Appendix.

Ethereum 2.0

At the time of writing, Ethereum is the second biggest cryptocurrency, and one of the most pivotal ones in the history of blockchain.

Ethereum 2.0 will bring many changes in the underlying protocol and tokenomics, the major one being that it will transition to proof-of-stake. The upgrade has many goals, including decentralisation, improved security and scalability.

However, for the purposes of a tokenomics audit, the main concern is identifying what are the core tokenomics goals and whether they are achieved.

Apparently, the tokenomics goals of Ethereum 2.0 include lower gas fees, and an appreciation in the price of Ethereum, which will make it a more desirable asset.

Also, Ethereum is an established protocol. Therefore, questions around the economic value and the demand drivers do not require much elaboration since the success of the protocol makes the answers self-evident.

From that perspective, the analysis would proceed as follows:

- The business-token interaction gets a perfect score. The same for the allocation and distribution sections.
- The structural analysis sections get all perfect scores except for sections 4 and 5. These sections would require a more in-depth investigation, due to the nature of proof-of-stake, and the untested nature of Ethereum 2.0. A conservative auditor might want to consider giving the worst possible score to those sections.
- The stability and stress tests would require extensive work on simulations to answer properly.

Some other points worth noting are the following. The question "*Do all the demand drivers depend on controllable factors or uncontrollable factors? An example of a controllable factor is product quality. An example of an uncontrollable factor can simply be the market conditions.*" can be answered either way. Ethereum's power over Web 3.0 means that through its adaptive gas fees it has some

power over the supply and the demand.

The question “How exposed to shocks is the token?” can be answered by a score of 1, since Ethereum has already withstood shocks, but the new protocol changes might make it more or less susceptible. Again, that’s a point that would have to be simulated and such as simulation is out of scope for this paper.

Therefore, based on that the conservative auditor would give Ethereum a score of 12.5. Successfully passing the simulations for the question “Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored.” would give a score of 13.5. If we assume that governance is not a concern, then the score goes even higher.

Therefore, even in the worst case, Ethereum 2.0’s tokenomics are ranked at A or higher.

Obviously, a full analysis would require a detailed simulation of the system. However, the use of the framework has quickly allowed us to analyse some of the weak and strong points of the protocol, and give it a positive rating.

Perhaps, future work on this type of frameworks will also include other concerns, such as scalability and security, which can indirectly affect tokenomics.

7. Limitations

While this research is novel it suffers from certain drawbacks. This is a side-effect of being amongst the first of its kind, and it is expected that the community will improve upon this work done. Perhaps, tokenomics auditing will become a regulatory requirement in the future once the process gets standardised.

Some weaknesses of this framework include:

- Lack of standardisation of the tools used to perform the audit. Tokenomists can use a wide arsenal of tools, from game theory to simulations, set up in an arbitrary way. Eventually the community should try to come up with a certain set of standards.
- There are more areas that could be addressed (e.g., decentralisation and scalability), and are not covered in this framework.
- This framework might not be as applicable in specialised cases, like virtual land.
- The framework uses a scoring system which might be objectionable, given that different auditors or even projects, might consider some other questions to be more important than others.

Nevertheless, we believe that the simple existence of such a framework can help identify weak points in tokenomics designs, and would help prevent catastrophic cases, such as the ones that have been witnessed in recent history.

Furthermore, it provides a body of work upon which new research can improve.

8. Discussion and Conclusion

This paper presented a framework for auditing tokenomics, as well as a case study as to how this can be applied in practice.

It’s clear that as Web 3.0 adoption grows, the significance and importance of tokenomics in the world of blockchain will only rise.

The objective behind this framework is to set some standards around how tokenomic robustness is being measured and audited. While this framework is not perfect, it presents a significant advancement over the

current state of tokenomics auditing which lacks any standards at the moment of writing.

Future research should focus on expanding upon this body of work. One clear area that can advance further is the use of standardised simulations and stress tests for auditing token economies. Other than that, as more projects are going live, the field will be able to accumulate more and more data to understand what makes tokenomics more robust and identify vulnerabilities and attack vectors.

The authors hope that this framework would be an important milestone in the standardisation of token economics.

References:

- [1] S. Kampakis, “The data scientist,” 2018. Accessed: 2018. [Online]. Available: <http://thedata scientist.com/valuing-ico-crypto-tokens/>.
- [2] S. Kampakis, “Why do we need tokenomics?” *The Journal of The British Blockchain Association*, vol. 1, no. 1, p. 3636, 2018.
- [3] S. Kampakis, “Auditing tokenomics: A case study and lessons from auditing a stablecoin project,” *The Journal of The British Blockchain Association*, 2022.
- [4] P. Freni, E. Ferro, and R. Moncada, “Tokenomics and blockchain tokens: A design-oriented morphological framework,” *Blockchain: Research and Applications*, vol. 3, no. 1, 2022.
- [5] L. Schaar and S. Kampakis, “Non-fungible tokens as an alternative investment: Evidence from cryptopunks,” *The Journal of The British Blockchain Association*, 2022.
- [6] D. Lehnberg, “Valuing the top 50 Ethereum ERC-20 tokens using Metcalfe’s Law,” 2018.
- [7] L. Chen, “Crypto-asset valuation: A review and analysis of current methods,” *Cryptofinance: A New Currency for a New Economy*, pp. 171–190, 2022.
- [8] Cosmos, “The Cosmos Hub,” 2022. [Online]. Available: <https://gateway.pinata.cloud/ipfs/QmWXkzqM74FCiERdZ1WtU33qdsStUK9d21A8oEvYcnBAHeo>.
- [9] H. M. Kim, M. Laskowski, M. Zargham, H. Turesson, M. Barlin, and D. Kabanov, “Token economics in real life: Cryptocurrency and incentives design for insolar’s blockchain network,” *Computer*, vol. 54, no. 1, pp. 70–80, 2021.
- [10] D. J. Fernandez, T. J. Barbereau, and O. Papageorgiou, “Agent-based model of initial token allocations: Evaluating wealth concentration in fair launches,” 2022.
- [11] O. Akcin, R. P. Streit, B. Oommen, S. Vishwanath, and S. Chinchali, “A control theoretic approach to infrastructure-centric blockchain tokenomics,” 2022.
- [12] W. A. Kaal, “DAO Fallacies,” 2022.
- [13] A. Briola, D. Vidal-Tomás, Y. Wang, and T. Aste, “Anatomy of a Stablecoin’s failure: The Terra-Luna case,” *Finance Research Letters*, vol. 51, 2023.
- [14] Algem, “Algem,” 2022. [Online]. Available: [Algem.io](https://www.algem.io).
- [15] L. S. A. D. Stylianos Kampakis, “Algem tokenomics audit,” Dec. 2022. [Online]. Available: <https://github.com/AlgemDeFi/audits/blob/main/Algem%20Tokenomics%20Audit.pdf>.
- [16] Forbes, “What really happened to Terra/Luna Crypto,” 2022. [Online]. Available: <https://www.forbes.com/sites/qai/2022/09/20/what-really-happened-to-luna-crypto/?sh=104f092c4ff1>.
- [17] The Verge, “How the Anchor protocol helped sink Terra,” [Online]. Available: <https://www.theverge.com/2022/5/20/23131647/terra-luna-do-krwon-stablecoin-anchor>.

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Appendix

Terra/Luna Analysis

Business-Token interaction

- Do tokens improve the current business model? Yes: 1
- Is the token nice to have, or an essential part of the business model? Essential: 1
- Can the project gain value (not the token) in fiat terms? Yes: 1

Structural Analysis

Break down explaining main system mechanisms and interactions:

Cash-flows:

- Does the token economy have an influx of value (e.g., in fiat) coming in? Yes: 0
- Does money stay in the token economy, or is there pressure to immediately sell? Stay: 1
- Are there ponzi-like elements? Yes: 0

Mechanisms and all economic agents involved

- Do interactions generate additional value expressed in fiat? Yes: 1
- Does the project require a critical mass in order to be able to provide value? E.g., social networks are a good example of this. Yes: 0
- Are the incentives speculative? For example, rewards with no underlying value? Yes: -1

Demand Drivers

- Do all the demand drivers depend on controllable factors or uncontrollable factors? An example of a controllable factor is product quality. An example of an uncontrollable factor can simply be the market conditions. Uncontrollable: 0
- Are there levers the economy can use to influence demand? Yes: 1
- Do they depend on entities that generate real economic value or more on internal or speculative factors, e.g., expected token appreciation because of rewards? Speculative -1

Governance:

- Can a majority take over? No: 1
- Can governance cause sticky points? E.g., votes need to take place, but no one is voting. No: 1

Empirical proof:

- Has there been proof that the mechanisms used in the project can work successfully? Yes: 2

Allocation and Distribution

- Does the allocation favour pump-and-dumps? No: 0
- Does it provide unnecessarily large stakes to certain actors? No: 0
- Does the distribution avoid creating unnecessary sell pressure? An example of this can be excessive airdrops. No: 0

Stability and stress tests

- How exposed to shocks is the token? -2
- Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored. Yes: 1, No: -2 – This question is ignored
- Does the system have feedback loops, which could accelerate a crash (e.g., the Terra/Luna case)? Yes: -1

Ethereum analysis

Business-Token interaction

- Do tokens improve the current business model? Yes:1
- Is the token nice to have, or an essential part of the business model? Essential: 1
- Can the project gain value (not the token) in fiat terms? Yes:1

Structural Analysis

Break down explaining main system mechanisms and interactions:

Cash-flows:

- Does the token economy have an influx of value (e.g., in fiat) coming in? Yes: 0
- Does money stay in the token economy, or is there pressure to immediately sell? Stay: 1
- Are there ponzi-like elements? No: 1

Mechanisms and all economic agents involved

- Do interactions generate additional value expressed in fiat? Yes: 1
- Does the project require a critical mass in order to be able to provide value? E.g., social networks are a good example of this. No: 0.5
- Are the incentives speculative? For example, rewards with no underlying value? No: 0

Demand Drivers

- Do all the demand drivers depend on controllable factors or uncontrollable factors? An example of a controllable factor is product quality. An example of an uncontrollable factor can simply be the market conditions. Controllable: 1
- Are there levers the economy can use to influence demand? Yes: 1
- Do they depend on entities that generate real economic value or more on internal or speculative factors, e.g., expected token appreciation because of rewards? Real economic value: 1

Governance:

- Can a majority take over? Yes: -1
- Can governance cause sticky points? E.g., votes need to take place, but no one is voting. Yes: 0

Empirical proof:

- Has there been proof that the mechanisms used in the project can work successfully? No: 0

Allocation and Distribution

- Does the allocation favour pump-and-dumps? No: 0
- Does it provide unnecessarily large stakes to certain actors? No: 0
- Does the distribution avoid creating unnecessary sell pressure? An example of this can be excessive airdrops. Yes: 1

Stability and stress tests

- How exposed to shocks is the token? 2
- Does the token appreciate when simulated? If the objective of the token is to provide a peg or some other functionality, then this question can be ignored. Yes: 1, No: -2
- Does the system have feedback loops, which could accelerate a crash (e.g., the Terra/Luna case)? No: 1

Web 2 vs. Web 3 Paths to the Metaverse: Who Is Leading? Who Should Lead?

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Abstract

Our research investigates two questions: Who is leading the metaverse? Who should lead? The questions are important because metaverse will have significant consequences for individuals, businesses, and society. We examined the current leaders of metaverse on two evolutionary paths, namely Web 2 and Web 3. Based on regulatory reports, corporate press releases, and patents, we found that only a handful of Web 2 companies are “all-in” on metaverse, and at least one of these enterprises, Meta, is on track to end up as a dominant platform provider. Based on market capitalization, user activity, and patents, only a handful of Web 3 communities are emerging. Despite the hype, we are still in the early days for metaverse on both evolutionary paths. As far as who should lead, we advocate for Web 3 because it benefits more users, content creators, and businesses. However, the future of metaverse is not deterministic and it will emerge from the choices we make today. We offer recommendations on how scholars and companies can support the Web 3 path to the metaverse.

Keywords: *Metaverse, Virtual Worlds, Web 3, Virtual Reality, Platforms*

JEL Classifications: *G10, G30, G40, M21*

1. Introduction

Despite all the hype around metaverse and some of the inflated market size predictions—Citigroup thinks the metaverse will be a \$8 trillion to \$13 trillion market by 2030—there remains confusion about what it is and uncertainty about how it will come about (Lacity et al. 2023).

Pertaining to what metaverse is, there is debate as to whether the term “metaverse” is just a rebranded version of the virtual worlds that have been around for nearly two decades, such as Second Life or World of Warcraft, or if it is something new. As of 2023, we don’t know yet—a sentiment shared by Eric Schmidt, former Google CEO: “There’s not an agreement on what the metaverse is” (Sauer 2022).

We don’t even have agreement upon whether the term is singular or plural. Two prevailing approaches attempt to define “metaverse.” One approach has the minimal requirement of a metaverse as any virtual world, i.e., a computer-generated environment, so there are many metaverses here already (e.g., Merriam Webster Dictionary 2023). The other approach defines a single futuristic metaverse comprising a three-dimensional, immersive digital universe that seamlessly connects users to any virtual world (Ball 2021). The requirements for a single metaverse have not yet been achieved, such as interoperability, portability, and real-time rendering (Ball 2022). Gartner (2022) estimates that a single metaverse is more than 10 years away.

Metaverses (plural) are where we are today, with multiple virtual worlds that cannot yet interact with one another, let alone exchange value, or transport our avatars (digital representations of ourselves), virtual goods, and virtual money across worlds.

Currently, metaverses are evolving on two very different paths, namely Web 2 and Web 3 paths.

The Web 2 evolutionary path is led by companies seeking to be centralized platform providers. If they succeed, they will earn the lion’s share of profits, user privacy and autonomy will remain sidelined, and the current Web 2 surveillance capitalism business model will monetize user activity at unprecedented levels; potentially every hand gesture, eye movement, verbal utterance, bodily movement, place visited, and interaction with other avatars and objects will be monitored by the platform provider. We call it surveillance capitalism on steroids, and if one reads Meta’s “privacy” statement for its Quest headsets, this level of monitoring is already happening (Meta 2023a; Meta 2023b).

The Web 3 evolutionary path is led by communities and not-for-profit (NFP) foundations seeking to develop metaverse applications on decentralized architectures and governed by users and developers.

Decentralized architectures (e.g., blockchains) have some advantages over traditional centralized architectures. For example, they are resilient to cybersecurity attacks because the attack surface is diffused across many locations. Cybersecurity gets stronger as more nodes are added to the network because hackers will need to attack more nodes. Another benefit is scalability—just add more machines to the network to increase computing power.

Another potential advantage of the Web 3 approach is decentralized governance via smart contracts and decentralized autonomous organizations (DAOs); users vote on decisions about the platform using governance tokens, which are cryptographically secured to prevent voter fraud (Ausustin et al. 2023; Lacity and Lupien 2022). However, DAOs are not a panacea: consensus among dispersed stakeholders can become difficult to achieve (Chen et al. 2020), and distributing voting power based on vested interest in a metaverse (i.e., wealth via virtual currency, land, etc.) can lead to re-centralization as a plutocracy (Goldberg and Schär 2023).

As to “who” should lead the development of metaverse, we advocate for the Web 3 evolutionary path. Users, content creators, and businesses have much to gain from a decentralized evolutionary path to the metaverse. Users will have control of their digital identities, custody of their digital assets, the ability to monetize their own data, and the freedom to come and go and to buy and sell across virtual worlds in a privacy-preserving manner. Content creators can capture a larger share of profits from their creative works, and companies can compete in a free-market ecosystem based on open standards, rather than being dependent on, and vulnerable to, Web 2 platform providers’ policies and pricing (Cutolo et al. 2021).

Who is leading the metaverse? In this article, we analyze the progress made on both evolutionary paths.

Section 2 examines companies leading Web 2 efforts. We identify the US enterprises primed to dominate the metaverse based on data gathered from US Securities and Exchange Commission (SEC) Form 10-K reports and corporate press releases. Our analysis in this section focuses on US companies because of data availability. From our Web 2 analyses, we conclude that only a few US corporations are seriously committed to metaverse, with Meta being the current leader.

Section 3 examines NFP foundations and start-ups leading Web 3 efforts. We identify the top Web 3 metaverses based on the market capitalization of their native cryptocurrency and reviewed reports on user activity. From this analysis, we infer that market capitalization rates are inflated given the comparatively low number of active daily users.

Section 4 examines individuals and companies with the most US patents related to metaverse. This analysis highlights the Web 2 and Web 3 companies that have been awarded patents.

Section 5 shares the findings from our participant observation research by describing our experiences in Web 2 and Web 3 metaverses. Regardless of the evolutionary path, the metaverses accessed with virtual reality (VR) headsets are far richer than that accessed via a web browser, but there are more obstacles to gain access.

Section 6 summarizes our findings and outlines a path forward for Web 3. For Web 3 to flourish, we need much more investment and engagement from all stakeholders: consumers, creators, businesses, educators, researchers, governments, and nongovernment organizations (NGOs). At the core of Web 3 is the decentralization of control and the inclusion of all. Companies who invest in digital property and other assets, participate in standards efforts, host events, and sell digital goods and services in Web 3 metaverses will help establish and shape the ecosystem needed for Web 3 to prevail.

2. Web 2 analysis: Which US enterprises are leading?

To answer the question, we conducted analyses from two data sources: US SEC 10-K reports and corporate press releases. We chose 10-K reports because US companies are required to report any materially significant activities or threats that could affect future earnings or create significant risks. We chose corporate press releases to gauge a company’s interest in metaverse.

2.1. Web 2 metaverse leaders from SEC 10-Ks evidence

Form 10-K is a report the US SEC requires corporations to file annually. Some of the information a company is required to disclose in the 10-K includes details on the nature of its business, risk factors, financial data, organizational structure, subsidiaries, and management’s discussion and analysis about the financial and operational results. Because it is regulated by the SEC, audited by an independent auditor, and scrutinized by market participants—such as analysts and institutional investors—the 10-K is

considered a credible report and source of information on the operations and financial performance of a firm (Lacity et al. 2022).

We extracted 10-K reports from January 2018 to May 2023 that mentioned the terms “metaverse” or “virtual world,” counted the number of corporations who mentioned them, and the number of times a corporation used them. We found modest results overall. Of the 46,001 10-K and related reports in the database spanning more than five years, only 202 reports mentioned one or both terms (see Figure 1).

The five companies with the most mentions of “metaverse” or “virtual worlds” in their 10-K reports were Ault Alliance (mentioned 158 times), GBT Technologies (156 times), Super League Gaming (113 times), Cinedigm (101 times), and Takung Art Company (101). Notably, Meta ranked 7th, with 54 mentions of the keywords from 2018 to 2023. We summarize what each of the top companies is saying to investors about their metaverse activities. Interestingly, all of these companies describe their metaverse in terms of a “platform.”

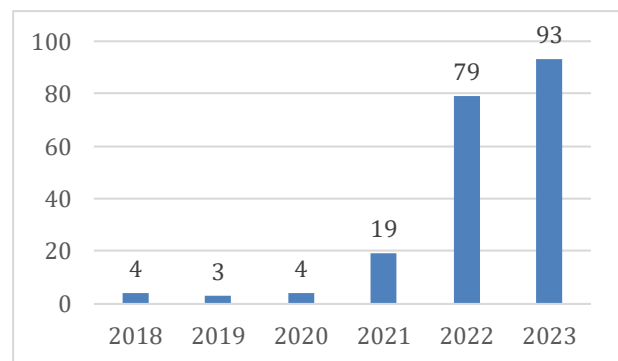


Figure 1. Number of US companies reporting metaverse/virtual world activities in 10-K reports.

Ault Alliance (stock ticker: AULT) is an electronics component company with many subsidiaries, including crane services, oil exploration, defense/aerospace, industrial, automotive, medical biopharma, consumer electronics, hotel operations, textiles, and a Bitcoin mining subsidiary. It earned \$61 million in revenue in 2022. In its 2023 10-K report, most of its mentions of metaverse pertained to its \$11.5 million investment in BitNile Metaverse Inc. (BNC), a decentralized platform for finance (DeFi). The report states, “BNC, an entity in the embryonic stage of development, represents a groundbreaking development in the online metaverse landscape, offering immersive, interconnected digital experiences that are inclusive, engaging, and dynamic. By integrating various elements such as virtual markets, real-world goods marketplaces, gaming, social activities, sweepstakes, gambling, and more, BNC aims to revolutionize the way people interact online... This unique integration establishes BNC as a pioneering platform in the metaverse industry, catering to diverse user interests and needs.”

GBT Technologies (GTCH) focuses on intelligent human body vitals devices, asset tracking IoT, and wireless mesh networks. Earning \$1.2 million in 2022, its 2023 10-K report discusses its joint ownership in Metaverse Kit Corporation. The report states, “The purpose of Metaverse Kit was to develop, maintain and support source codes for its proprietary technologies and comprehensive platform that combines a core virtual reality platform and an extended set of real-world functions to provide a metaverse experience initially within the area of sports and then expanding into virtual worlds of entertainment, live events, gaming, communications and other cross over product opportunities.”

Super League Gaming (SLGG)’s motto is, “We are the Rocketship to the metaverse.” Earning \$19.7 million in 2022, metaverse is its core business. From its 2023 10-K report, Super League Gaming describes itself

as “the leading metaverse advertising platform,” “a leading publisher of games, monetization tools and content channels across metaverse gaming platforms.” “Our strong and growing product-market fit currently reaches over 100 million monthly unique players in Roblox, Minecraft and Fortnite and generates over one billion monthly impressions.”

Cinedigm (CIDM) describes itself as “a leading independent distributor and aggregator of independent music, television, and other short form content rights distributed across digital, over-the-top (OTT), physical, and home and mobile entertainment platforms as well as a leading servicer of digital cinema assets on over 2,843 domestic and several international countries.” It earned \$56 million in revenue last year. From its 2022 10-K report, metaverse is mentioned in terms of its stock purchase in a leading Chinese Entertainment Company called “Metaverse.”

Takung Art Company (TKAT) reports that it “operates an electronic online platform located at <https://www.nftoco.com/> for artists, art dealers and art investors to offer and trade in ownership over valuable artwork in the form of non-fungible token or NFT.” It earned \$3 million in revenue in 2022. Its 10-K report states that it owns Metaverse Digital Payment Co., a company based in Hong Kong.

The five companies with the most mentions of metaverse in their 10-K reports all report revenues in terms of \$ millions and thus they may not have the impact of Meta, which ranked 7th on the list of 10-K reports with the most metaverse mentions. While recent press has criticized Meta’s lack of progress on metaverse, Meta is recognized as the leading Web 2 contender at this point because it has invested over \$10 billion in metaverse, more than any other company (Mac et al. 2022).

Meta Platforms (META): In October of 2021, Facebook’s CEO, Mark Zuckerberg, announced that Facebook was changing its name to Meta. In the video announcement, Zuckerberg said, “I believe the metaverse is the next chapter for the Internet.” (Facebook 2021).

Meta earned \$117 billion in revenue in 2023, which was a nearly 2 percent decline from its previous year. According to its 2023 10-K report, Meta is still committed to building the metaverse. Meta’s mission is “to give people the power to build community and bring the world closer together. All of our products, including our apps, share the vision of helping to bring the metaverse to life... Our vision for the metaverse does not center on any single product, but rather an entire ecosystem of experiences, devices, and new technologies. While the metaverse is in the very early stages of its development, we believe it will become the next computing platform and the future of social interaction.”

To summarize what we have learned from 10-K reports, very few US companies are investing in metaverse at a level significant enough to alert investors. The companies with the most mentions of metaverse (or virtual world) are relatively small except for Meta. Irrespective of any media buzz, Meta’s 10-K report shows that the company is deeply committed to its future as a metaverse platform, which will very likely build upon Meta’s successful Web 2 model.

2.2. Web 2 metaverse leaders from corporate press announcements evidence

Official press releases are also an indicant of a company’s interest in metaverse. We used the Nexis Uni database to identify public announcements related to “metaverse” or “virtual world” from five major news sources: Business Wire, EQS News, GlobeNewswire, London Stock Exchange Aggregated Regulator News Service, and PR Newswire. To narrow the search to focus on corporate press releases, we also use the keyword “ticker” to identify the publicly traded companies since Nexis Uni uses built-in classification to identify whether the news article mentioned any company or ticker in the text. We searched from January 2018 or May

2023. A total of 146 press releases mention “metaverse” or “virtual world” along with one or more publicly traded companies’ tickers (see Figure 2). The press releases may have been issued by a company reporting on itself (e.g., Meta announcing its own news) or by a third party.

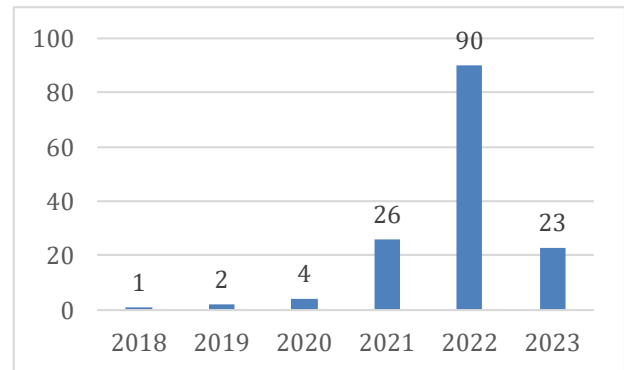


Figure 2. Number of US companies with corporate press releases on metaverse/virtual world (2023 data only up to

The five companies with the most mentions of “metaverse” or “virtual worlds” in corporate press releases were Vision Sensing Acquisition (mentioned in 16 releases), Meta (11 releases), Citigroup (7 releases), Aries I Acquisition (6 releases), and Atari (6 releases).

Vision Sensing Acquisition (VSAC) is a special purpose acquisition, or “blank check” company, meaning that it is publicly traded but has no business plan or operations. Corporate press announcements covered its partnership and \$103 million investment in Newsight, an Israeli-based company focused on depth camera sensors for machine vision, targeting metaverse, robotics, and Industry 4.0.

Meta Platforms (META) receives massive exposure in the popular press, but issues few formal press releases—only 5 before May 2023. Its press release in Q1 2023 results only mentions “metaverse” once and artificial intelligence (AI) three times.

Citigroup (C) appeared in press releases pertaining to their projection that metaverse will be a \$8 trillion to \$13 trillion market by 2030 and that it may have 5 billion users (Citi 2022). One press release was about Citi’s management of the Hiro Metaverse Acquisitions’ (a “blank check” company) IPO.

Aries I Acquisition (RAM) is another “blank check” company. Founded by Thane Ritchie, Aries I invests in aerospace, quantum computing, AI, cybersecurity, metaverse, blockchain, and digital currencies.

Atari (PONGF) announced an NFT project with Brazilian pop culture artist Butcher Billy as part of its 50-year anniversary as a company. The collection of 2,600 unique NFTs is suggested to be worth \$500,000 to NFT holders. Atari also announced it is introducing a free metaverse experience.

3. Web 3 analysis: Which communities are leading?

Web 3 metaverses are based on token economics where users pay for virtual plots of land, services, and experiences (like live concerts or fashion shows) with the metaverse’s native digital cryptocurrency. Within these virtual worlds, blockchain technologies create an immutable record of transactions upon which every user can rely.

To find the Web 3 leaders, we used CoinMarketCap.com. This site ranks the top metaverse cryptocurrencies by market capitalization. On May 29, 2023, CoinMarketCap reported the total market capitalization of Web 3

metaverses at \$13.8 billion. The top five metaverse tokens by market cap were Internet Computer (\$2.1 billion), ApeCoin (\$1.2 billion), The Sandbox (\$1 billion), Render Token (\$926 million), and Decentraland (\$894 million). Among these five, The Sandbox and Decentraland are the only ones with live virtual worlds your avatar can visit today. The other three are tokens that might be used in a future metaverse.

Internet Computer (token ticker: ICP) aims to be the world’s decentralized internet. The white paper was released in April of 2022 by the DFINITY Team. The DFINITY Foundation is a Swiss-based NFP that coordinates the development of Internet Computer. So far, the Internet Computer community has launched a smart contracting language (Motoko), chain key cryptography, the Network Nervous System for blockchain governance, and has launched network nodes. It’s not a metaverse destination yet, but communities could build a metaverse on top of it.

ApeCoin (APE) was launched on Ethereum by the APE Foundation in 2022. ApeCoin is a utility token and a governance token for the ecosystem around the Bored Ape Yacht Club. The ecosystem has NFTs for 10,000 cartoon images of bored apes. It’s not a metaverse, but because it has built such a strong community, some people think it will become a preferred token of the metaverse (Exposito 2022).

The Sandbox (SAND) was launched on Ethereum. It’s a virtual world that allows users to create, buy, and sell digital assets in the form of a game. It uses a play-to-earn business model. According to CoinMarketCap, “By combining the powers of decentralized autonomous organizations (DAO) and non-fungible tokens (NFTs), the Sandbox creates a decentralized platform for a thriving gaming community.” It has partnered with Tony Hawk, Snoop Dogg, Playboy, Paris Hilton, and other influencers to help sell its virtual plots of land. A total of 166,464 plots were created, and someone has paid \$450,000 to be Snoop Dogg’s virtual neighbor (Irwin 2021)!

Render Token (RNDR), according to CoinMarketCap, “is a distributed GPU rendering network built on top of the Ethereum blockchain in 2017, aiming to connect artists and studios in need of GPU compute power with mining partners willing to rent their GPU capabilities out.” Some people claim Render Token will become a dominant currency in the metaverse “because someone is going to need to render all those virtual worlds. With this Render Token distributed rendering network, we could see things being made faster for the Metaverse in a much more cost-effective manner. This is because Render Tokens would cost less than utilizing expensive cloud rendering infrastructure” (Sag 2017).

Decentraland (MANA) is a metaverse platform that was launched with smart contracts on Ethereum and is managed by a DAO. Its 90,000 plots of virtual land are represented by ERC-721 NFTs, can be bought on OpenSea with ERC-20 fungible tokens called MANA, with a total MANA supply of 2.2 million. Decentraland gained media attention when someone paid \$2.4 million for a virtual plot of land in 2021 (Howcroft 2021).

The Sandbox and Decentraland are the only live metaverses among the top five. Despite high market capitalizations, their daily user activity is quite low. DappRadar reported in October of 2022 that each metaverse had fewer than 1,000 daily active users (Cohen 2022). In May of 2023, Sandbox had 4,610 unique active wallets and processed over 2,000 transactions worth \$4.73 million. Decentraland had 2,730 unique active wallets and processed over 35,000 transactions worth about \$25,000. Decentraland contests these numbers, suggesting that a better measure of user activity is unique visitors. Those numbers are still quite low with just 4,405 unique users for May 2023. Overall, the growth in user activity has been slow compared to other recent technological advances such as ChatGPT.

Not all Web 3 metaverse pioneers are associated with a specific cryptocurrency. For example, Lamina1 is building a Layer 1 blockchain

intended to provide infrastructure via interoperating tools and decentralized services for the open metaverse. It was co-founded by Neal Stephenson (who coined the term “metaverse” in 1992) and crypto pioneer Peter Vessenes. Lamina1’s approach to a Web 3 metaverse is succinctly summarized by CEO Rebecca Barkin: “You can’t architect a compelling experience backward from a desired financial outcome” (Stephenson 2023).

4. Web 2 and Web 3 metaverse leaders from US patent evidence

We chose US patents because they indicate which individuals and companies are developing intellectual property related to metaverse.

Individuals and companies seek patents to protect their intellectual property. While this protection may suggest that patent holders aim to create Web 2 metaverses by creating monopolies and by earning money from their intellectual property, some patent holders license their patents for free, so we do not make any assumptions about a patent holder’s intentions based on patent data. Companies, for example, often seek patents as a pre-emptive move to prevent other individuals and companies from submitting patents and charging them fees (or suing them) (Guellec et al. 2010).

We searched the US Patent and Trademark Office (USPTO) Patent Full-Text and Image Database to find issued (i.e., granted) patents that related to “metaverse.” (The patent database cannot be searched easily for compound terms like “virtual world.”)

From 2001 to present, a total of 232 patents were issued which mentioned the keyword “metaverse” in the patent document. Figure 3 shows that 92 patents were issued from 2018 to 2022. (When we search the patent database on issued patents, they are pulled based on the publication filing date. There were no issued patents in 2023 yet because all the patents were filed before 2022.)

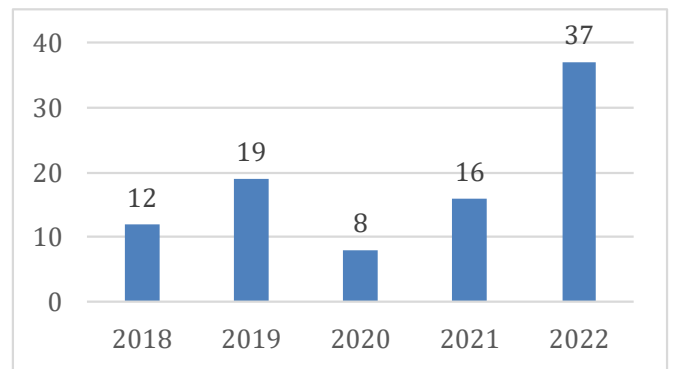


Figure 3. Number of US patents granted that mention “metaverse”.

We were surprised that most patents that mention metaverse were granted more than six years ago. After reviewing the patents, the answer became clear: patent assignees were inspired by science fiction! For example, Kenneth Perlin and Athomas Goldberg were awarded the first US patent that mentions the word “metaverse” in 2001. Their invention is a method and a system for creating real-time, behavior-based animated actors. The patent mentions Neal Stephenson’s 1992 novel, Snow Crash: “The novel ... posits a ‘Metaverse’, a future version of the internet which appears to its participants as a quasi-physical world... The participants are represented by fully articulate human figures, or avatars whose body movements are computed automatically by the system. ‘Snow Crash’ touches on the importance of proper authoring tools for avatars, although it does not describe those tools. The present invention takes these notions further, in that it supports autonomous figures that do not directly represent any participant” (US Patent 6285380).

Kusumoto et al. earned the second US patent that mentions “metaverse” in 2005. The patent is for methods enabling users to create advertising/branding for their avatars, virtual spaces, and virtual objects. The authors also mention “metaverse” in the context of Stephenson’s novel (US Patent 6954728).

Among the top early patents awarded, IBM was awarded three patents prior to 2018 directly related to metaverse. IBM uses the terms “virtual universe,” “virtual world,” and “metaverse” synonymously. They were granted two more patents related to metaverse after 2018.

The top four companies as the original assignees with the most issued patents from January 2018 to May 2023 that mention metaverse are Winklevoss IP LLC (11 patents), Gemini IP LLC (7 patents), Patreon Inc (7 patents), and Ummai Ltd (4 patents). The following companies each have 3 issued patents during this timeframe: Katmai Tech, Starkeys LLC, Roblox, and Meta Platforms.

Patent research based on keywords requires additional analysis to understand what the company is really patenting. For example, the Winklevoss twins are well known in the Web 3 community, as well as from their legal battles with Mark Zuckerberg over the origins of Facebook (Mezrich 2019). The twins are co-founders of two top companies in our patent search, Winklevoss IP and Gemini IP.

Winklevoss IP’s 11 patents focus on digital assets and blockchains; the term “metaverse” comes up because their patents list examples of digital math-based assets, which include Metaverse ETP, a cryptocurrency launched in 2017. Gemini’s patents generally address how to use blockchain technologies to generate a stable digital asset.

Patreon is a Web 2 company that operates a platform for creators. Patreon’s seven patents pertain to membership platforms. Its patents come up in our search because they frequently reference a New York Law School Review paper that has “metaverse” in the title.

Unmai developed an explainable model for tasks like motion detection in AI systems, like a metaverse.

Readers may be surprised that Meta Platforms does not have more patents. The company has many patents, but its issued patents do not mention frequently the specific keyword of “metaverse.” Instead, Meta used terms like “virtual reality” or “virtual environment.”

Looking at the evidence, both Web 2 and Web 3 companies are patent holders; Winklevoss and Gemini’s leaders, for example, are known advocates for Web 3 technologies, with a particular interest in stable coins. Other companies are considered to be Web 2 companies, including Patreon, IBM, Roblox, and Meta Platforms.

5. Web 2 vs. Web 3: Evidence from digital participant observation

We also spent time in several Web 2 and Web 3 metaverses to compare user experiences. Web 2 metaverses on our virtual road trip included Meta’s Horizon Workrooms, Second Life, Roblox, and Victory XR’s Engage platform. Web 3 metaverses we visited include Decentraland, Somnium, The Sandbox, Spatial, and Cryptovoxels. Some metaverses are only experienced with web browsers (e.g., Second Life and Decentraland), others are accessible only with VR headsets (e.g., Horizon Workrooms; Victory XR’s Engage platform), still others provide both web-based and VR-based options (e.g., Spatial). Figure 4 shows some of our avatars.

Overall, metaverse experiences were far richer with VR headsets because we felt a greater sense of presence. While still lagging behind modern video game experiences, VR graphics can be quite rich and beautiful. However, the setup to access the worlds via VR headsets took more work. For Web 2,

this involved accounts and passwords to be established with the centralized platform provider, loading software on the headsets, creating an avatar, and using logon credentials to access the software. For Web 3, it involved downloading a digital wallet, loading the software on the VR headsets, and creating an avatar.

Our best user experience was in VictoryXR’s Metaversity platform because this platform has content relevant to our lives as educators. VictoryXR is a Web 2 content provider that builds virtual educational experiences on the ENGAGE platform and has already developed several college courses. For example, we learned about pig anatomy by climbing inside a virtual pig the size of a room; we used virtual Bunsen burners to perform chemistry experiments; and one of us took an oceanography class where her avatar walked into the ocean to interact with ocean species. According to Pitchbook, VictoryXR has received several rounds of venture capital funding, the most recent of which was \$2.82 million. This level of funding is difficult to match in Web 3 communities.

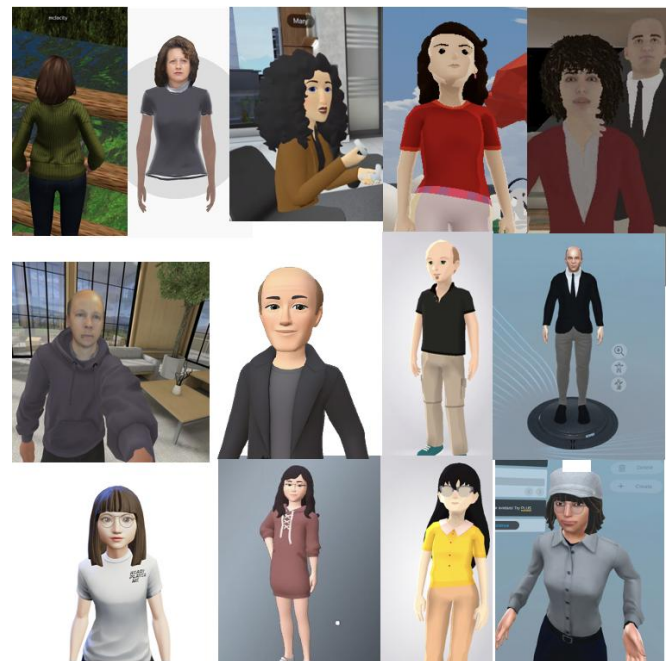


Figure 4. The authors’ avatars.

(Top): Mary Lacity’s avatars in Second Life, Spatial, Horizon Workrooms, Decentraland, and VictoryXR Metaversity; **(middle):** Jeff Mullins’ avatars in Spatial, Horizon Workrooms, Decentraland, and VictoryXR Metaversity; **(bottom)** Le Kuai’s avatars in Spatial, Meta Horizon, Decentraland, and Engage

Overall, we found both Web 2 and Web 3 metaverses to be mostly empty spaces. We were often the only avatars wandering around the different lands once we left the initial “welcome” centers. The only time virtual worlds were busy was when they were associated with well-advertised events, like fashion shows and concerts. While this is currently the case for “open” metaverses, other virtual worlds that can be loosely defined as metaverses (e.g., Roblox, VRChat), and our best user experience in Engage, suggest that compelling experiences will drive metaverse growth.

6. Discussion and path ahead

There is considerable hype around the concept of metaverse. Based on our data and experiences on both Web 2 companies and Web 3 communities, we question the size of metaverse market estimations. Precedence Research (2022) estimated that the global metaverse market will be worth around \$1.6 trillion by 2030. Citi (2022) thinks the metaverse will be a \$8

trillion to \$13 trillion market by 2030, and that it may have five billion users. In contrast to these large numbers, HFS Research estimated the market opportunity to be \$2.45 billion (HFS Research 2023).

The HFS Research estimate seems more accurate to us given the limited number of Web 2 companies focused on metaverse and the limited user activity in Web 3 metaverses we found in our research.

Our primary aim in this article was to compare Web 2 and Web 3 paths to the metaverse to identify who is leading. We acknowledge that our research has several limitations. First, our 10-K report, corporate press releases, and patents only investigated US-based organizations. Second, we have not considered other sources that might inform the analysis, such as venture capital investment. We encourage colleagues to replicate and extend investigations for companies in other jurisdictions; many non-US-based companies and governments are investing in metaverse.

While acknowledging our study's limitations, we do believe that our findings are important and have implications for the future.

Web 2 has an inherent financial advantage because investors have a clear path to returns with platform business models. In contrast, Web 3 is counting on token economics to drive investment. As Forbes contributor Alison McCauley writes, "Web 3 communities are still looking for business models that reduce the cost of decentralization, which inherently shifts the expense of the network to the people who use it" (McCauley 2022).

Moreover, many people are still new to Web 3; the previous Web 3 descriptions in this study are filled with technical terminology many investors and consumers do not understand, such as blockchains, crypto, smart contracts, NFTs, DAOs, cryptography, consensus, and digital wallets. The educational challenges ahead for Web 3 metaverse are significant. As professors, we encourage more faculty to teach metaverse and Web 3 courses (e.g., Rinn et al. 2023; Themistocleous et al. 2023; Triantoro and Jackson 2022).

For companies, most will not want to be beholden to a platform provider. Thus we encourage more companies to participate in standards-making bodies focused on an open metaverse, including IEEE Metaverse Congress, Metaverse Standards Forum, Linux Foundation, and Trust over IP (ToIP) AI & Metaverse Technology Task Force.

We join other researchers who advocate for Web 3 research (e.g., Ausustin et al. 2023; Beck et al. 2018; Lumineau et al. 2020). We support the vision of individuals owning and monetizing their identities, credentials, and digital assets; of freely coming and going across virtual worlds; of securely executing peer-to-peer transactions with low transaction fees; of having a voice in the governance of the applications; and of promoting the inclusion and dignity of all (Lacity et al. 2023). We also support the calls by other scholars for ethical guidelines (Smith et al. 2023).

References

- [1] N. Ausustin, K. Durani, T. Kollmer, and A. Eckhardt, "Examining the use of blockchain technology in virtual worlds: A sociotechnical systems perspective," *Proceedings of the 56th Hawaii International Conference on System Sciences*, 2023, pp. 6035–6044.
- [2] M. Ball, "Framework for the metaverse," *The Metaverse Primer*, June 29, 2021. <https://www.matthewball.vc/all/forwardtothemetaverseprimer>
- [3] M. Ball, *The Metaverse and How It Will Revolutionize Everything*. New York: Liveright Publishing, 2022.
- [4] R. Beck, C. Müller-Bloch, and J. King, "Governance in the blockchain economy: A framework and research agenda," *Journal of the Association for Information Systems*, vol. 19, no. 10, pp. 1020–1034, 2018.
- [5] V. Chandar, "Investing in the metaverse: New opportunities in virtual worlds," *Morgan Stanley*, Dec. 16, 2021, [https://www.morganstanley.com/articles/metaverse-](https://www.morganstanley.com/articles/metaverse-opportunities-virtual-reality-augmented-reality-technologies)

- [opportunities-virtual-reality-augmented-reality-technologies](https://www.morganstanley.com/articles/metaverse-opportunities-virtual-reality-augmented-reality-technologies)
- [6] Y. Chen, J. I. Richter, and P. C. Patel, "Decentralized governance of digital platforms," *Journal of Management*, vol. 47, no. 5, pp. 1305–1337, 2021.
- [7] Citi, "Metaverse and money: Decrypting the future," Mar. 2022. https://icg.citi.com/icghome/what-we-think/citigps/insights/metaverse-and-money_20220330
- [8] A. Cohen, "Metaverse platforms decentraland, the sandbox see less than 1,000 daily active users, according to data from DappRadar," *Sports Business Journal*, 2022. <https://www.sportsbusinessjournal.com/Daily/Issues/2022/10/10/Technology/metaverse-decentraland-the-sandbox-daily-active-users>
- [9] D. Cutolo, A. Hargadon, and M. Kenney, "Competing on platforms," *Sloan Management Review*, 2021. <https://sloanreview.mit.edu/article/competing-on-platforms/>
- [10] DFINITY Team, "The Internet Computer for Geeks," *White paper for Internet Computer*, 2022. <https://internetcomputer.org/whitepaper.pdf>
- [11] A. Exposito, "Crypto and culture intersecting: Could ApeCoin be the go-to token of the Metaverse?" *CoinTelegraph*, 2022. <https://coingecko.com/news/crypto-and-culture-intersecting-could-apecoin-be-the-go-to-token-of-the-metaverse>
- [12] Facebook, "The metaverse and how we'll build it together -- Connect 2021," Oct. 8, 2021. <https://www.youtube.com/watch?v=Uvufun6xer8>
- [13] Gartner, "Gartner hype cycle for emerging tech 2022," 2022. <https://emtemp.gom.cloud/ngw/globalassets/en/articles/images/hype-cycle-for-emerging-tech-2022.png>
- [14] M. Goldberg and F. Schär, "Metaverse governance: An empirical analysis of voting within Decentralized Autonomous Organizations," *Journal of Business Research*, vol. 160, p. 113764, 2023.
- [15] D. Guellec, C. Martinez, and P. Zuniga, "Pre-emptive patenting: Securing market exclusion and freedom of operation," *Economics of Innovation and New Technology*, vol. 21, no. 1, pp. 1–29, 2010.
- [16] HFS Research, "Horizon 3 Showcase: Metaverse BS Buster," 2023. https://www.hfsresearch.com/wp-content/uploads/pdf/Horizon-3-Showcase-Metaverse-BS-Buster_HFS-Horizons-Summit%E2%80%93London.pdf
- [17] E. Howcroft, "Virtual real estate plot sells for record \$2.4 million," *Reuters*, 2021. <https://www.reuters.com/markets/currencies/virtual-real-estate-plot-sells-record-24-million-2021-11-23/>
- [18] K. Irwin, "Someone Paid \$450K to Be Snoop Dogg's metaverse neighbor," *Decrypt*, 2021. <https://decrypt.co/87524/someone-paid-450k-snoop-dogg-metaverse-neighbor>
- [19] M. Lacity, J. Mullins, and L. Kuai, "Evolution of the metaverse," *MIS Quarterly Executive*, vol. 22, no. 2, pp. 165–172, 2023.
- [20] M. Lacity, L. Kuai, and J. Mullins, "How many public corporations recognise 'token economy' technologies as materially significant? Evidence from 10-K reports," *Journal of the British Blockchain Association*, vol. 5, no. 2, pp. 1–4, 2022.
- [21] M. Lacity and S. Lupien, *Blockchain Fundamentals for Web 3.0*. Fayetteville: Epic Books/University of Arkansas Press, 2022.
- [22] F. Lumineau, W. Wang, and O. Schilke, "Blockchain governance—A new way of organizing collaborations?" *Organization Science*, vol. 32, no. 2, pp. 500–521, 2020.
- [23] R. Mac, S. Frenkel, and K. Roose, "Skepticism, confusion, frustration: Inside Mark Zuckerberg's metaverse struggles," *New York Times*, 2022. <https://www.nytimes.com/2022/10/09/technology/meta-zuckerberg-metaverse.html>
- [24] A. McCauley, "The battle for control of the metaverse: Can open innovation outrun corporate domination?" *Forbes*, Mar. 22, 2022.
- [25] McKinsey, "What is the metaverse—and what does it mean for business?" 2022. <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/what-is-the-metaverse-and-what-does-it-mean-for-business>
- [26] Merriam Webster Dictionary, 2023. <https://www.merriam-webster.com/dictionary/metaverse>
- [27] Meta, "Meta's oculus privacy policy," 2023a. https://www.meta.com/legal/quest/privacy-policy-for-oculus-account-users/?utm_source=www.meta.com&utm_medium=organicsearch
- [28] Meta, "Supplemental meta platforms technologies privacy policy," 2023b. <https://www.meta.com/legal/quest/privacy-policy/>
- [29] B. Mezrich, "Inside the decades-long cage match between Mark Zuckerberg and the Winklevoss Twins," *Vanity Fair*, 2019. <https://www.vanityfair.com/news/2019/04/inside-the-mark-zuckerberg-winklevoss-twins-cage-match>
- [30] Precedence Research, "Metaverse market size to worth around USD 1,607.12 Bn by 2030," June 8, 2022. <https://www.globenewswire.com/en/news-release/2022/06/08/2458533/0/en/Metaverse-Market-Size-to-Worth-Around-USD-1-607-12-Bn-by-2030.html>
- [31] H. Rinn, B. Khosravi-Rad, L. Grogoric, S. Robra-Bissantz, and D. Markgraf,

“Virtual worlds in education - A systematic literature review,” *ECIS 2023 Research Papers*, 2023, p. 277. https://aisel.aisnet.org/ecis2023_rp/277

[31] A. Sag, “Render token: The future currency of the metaverse?” *Moor Insights and Strategy*. <https://moorinsightsstrategy.com/render-token-the-future-currency-of-the-metaverse>

[32] M. Sauer, “Ex-Google CEO Eric Schmidt: Despite Facebook’s big plans, “there isn’t an agreement on what the metaverse is” yet,” July 1, 2022. <https://www.cnn.com/2022/07/01/ex-google-ceo-eric-schmidt-theres-no-definition-of-the-metaverse-yet.html>

[33] C. Smith, J. Molka-Danielson, J. Rasool, and J. Webb-Benjamin, “The world as an interface: Exploring the ethical challenges of the emerging metaverse,” *Proceedings of the 56th Hawaii International Conference on System Sciences*, 2023, pp. 6045–6065.

[34] N. Stephenson, “Games and the open metaverse: Neal Stephenson opening keynote,” *D.I.C.E. Summit 2023*, 2023. <https://www.youtube.com/watch?v=gWdDHH-jFY0>

[35] M. Themistocleous, K. Christodoulou, and L. Katelaris, “An educational metaverse experiment: The first on-chain and in-metaverse academic course,” *19th European, Mediterranean, and Middle Eastern Conference, EMCIS 2022*, 2023, pp. 678–690.

[36] T. Triantoro and N. Jackson, “From classroom to metaverse. Towards methodology for upskilling and reskilling in the age of Web 3.0,” *PACIS 2022 Proceedings*, 2022, p. 296. <https://aisel.aisnet.org/pacis2022/296>



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BLOCKCHAIN ASSOCIATIONS FORUM



SUMMIT PROCEEDINGS

Proceedings of 3rd Annual Member Summit of Blockchain Associations Forum (BAF) 20 September 2023

An emphasis on sensible policymaking shines a realistic light on the promise held out by Web3 at the BAF Summit 2023 – and highlights huge regulatory differences in territories around the world.

(Recorded, edited and abridged by Brian Scudder, Deputy Secretary of the British Blockchain Association).

The Promise of Web3: Empowering Societies Through Innovation and Sensible Policymaking was the topic of the third Blockchain Association Forum annual Summit. Speakers from around the world included policymakers, regulatory specialists, and the heads of the national blockchain associations that make up BAF's core membership.

"I was very pleased to hear how countries around the globe are making headway on the adoption of web3," said Naseem Naqvi, President of the British Blockchain Association. *"It was also very evident that there are barriers to effective implementation of web3. Important challenges mentioned by many speakers were education and awareness of this technology – what it can do for society – and of course the cognitive biases that prevent us from looking at emerging technologies from a neutral perspective."*

"We must continue to ensure policymakers are equipped with the fundamental skills of evidence, analysis and evidence-based frameworks to evaluate critically both the problems as well as the possible solutions in this space. Let's continue to play our part in advancing the best standards in Web3 and blockchain."

Simon Callaghan, CEO Blockchain Australia

Blockchain Australia has over 125 business and 100 individual members across a range of different sectors – professional services, legal, accounting, tax consulting, banks, digital currency businesses and exchanges and accounting firms, as well as supply chain management and venture capital. So we really advocate for the industry and work with legislators and policy makers...

Senator Andrew Bragg has really made headwinds in Australia in terms of efforts in championing the technology and the importance of the technology from an infrastructure perspective.

We tend to focus on the regulation of web3, privacy, security and banking is a big issue here in Australia... largely around around scams. You're probably not aware if you're not living in Australia, but they seem to be daily news...

We really focus on the exit points for the scams that we're seeing, So through the system and the banks. So the work that we're doing from a policy perspective in Australia has been around how do we work together with the banking sector, how do we share data, how do we collaborate between the exchanges – who would otherwise be competitors – so that we're able to protect Australian consumers.

And how do we create a data sharing exchange and a facility through which we can use data but protect our consumers and leverage the technology that exists in this industry to try to put a stop to those in real time if possible.

Some of the other key initiatives at the moment that we're waiting on include the Treasury working on digital currency exchange licensing and custody licensing, and those submissions are expected to come out later this year. That could actually change the landscape here in Australia in terms of opening up the space for more regulated entities. If you think that large, traditional custodians might enter this space, it has the real potential to to change things.

Senator Andrew Bragg has put forth a private members bill to really try to drive the conversation for forward as an essential building block. We're hoping that the current Labour Government will look to press forward with things, if not later this year, in the New Year.

The Digital Finance Cooperative Research Centre has piloted projects with a number of entities. There are no immediate plans for ongoing projects around that but my understanding is that the institutional side was particularly successful, which is obviously critical for trade and foreign investment.

Ultimately, I think regulation and clarity and certainty from government is going to be the most important thing affecting how the ecosystem and our industry can evolve over the coming 12 months. That clarity is going to be really, really critical, not just for our local local entities, but also for those foreign direct investment opportunities for overseas businesses looking at Australia.

Damon Hernandez, Spokesperson, Helsinki Blockchain Centre

Helsinki Blockchain Centre supports and assists companies entering the blockchain industry here in Finland and provides a framework for companies like mine for both domestic and international networking.

The Helsinki Blockchain Centre is at the forefront of Finland's efforts to lead in sustainable innovations using blockchain and digital technologies. The goal for us is 'how are we going to hit carbon neutral by 2030?' The capital area of Finland here in Helsinki has the target to become carbon neutral by 2030 and achieving this ambitious goal requires global cooperation and a significant green shift.

Examples of projects using blockchain that are coming to Finland via partnerships with Helsinki Blockchain Centre include a project that essentially tracks materials through their life cycles.

One way that the blockchain centre is looking to grow community and leverage technologies like we're seeing here today [in the Metaverse] is empowering societies through innovations. And so there is a Helsinki Blockchain Centre virtual world using this same platform spatial.io. The Blockchain Centre looks to promote and showcase blockchain companies focusing on Finnish innovation and highlighting international collaborations.

The space provides a digital environment for hybrid events such as hackathons. One event that just finished was with the local chapter of the IEEE – really trying to use these types of virtual world technologies.

We need to prove that the platform economy powered with these solutions will provide reference data that is indisputable to prove the superiority of blockchain technology. We need many of them and quickly to be in place collecting data. An example of this is a solution installed into the Greater Helsinki area Circular Valley project.

Another thing that we see the need for is meaningful collaboration. The operators and companies that already have solutions will come to this excellent market and seek good positions with the new kind of sharing mechanisms to be invented as the collaboration gets deeper.

And we also see that establishing an affordable offering to help involve blockchain and other technology companies to comply with circular economy reporting directives and standards. And by doing so, Helsinki Blockchain Centre is seen as a lucrative place to be, where we can create a competitive advantage in this area.

We call for collaboration. And what we're looking for in the collaboration now is more courses for the education of developers. We want to learn from others.

Audience question: At last year's BAF summit, Markus described the environment in Finland as “hostile” to blockchain. Has that changed?

Markus Lehtonen, CEO, Helsinki Blockchain Centre

In the past 11 months the Finnish government has really made significant change. For example, Sitra, a Finnish state organisation, has done a lot of preparation on future legislative work named Six Plus One Recommendations for Finland. We also have a new government that's been operational for five days now presenting the coming budgets and they clearly want to be driven.

It's a compromise. It's not optimal. But it's already much better than what we have had. We have all the success stories from Finland going abroad to places like Dubai, but we're seeking a new offering, especially here in the virtual worlds. So yes, it has changed a lot here in Finland and that is the reason that our reporting is different.

Professor David Lee, Chair, Global Fintech Institute, Singapore

Thank you, Professor Naseem and members of the British Blockchain Association. I'm honoured to speak to you in the metaverse today about the challenges and opportunities for crypto mass adoption in the digital economy, with a focus on Singapore's efforts.

The emergence of Bitcoin in 2009 was timely. It came after the 2008 financial crisis, which had eroded trust in the traditional banking system. The crisis exposed the vulnerabilities of fractional reserve banking, where banks hold only a fraction of depositors' money in reserve, lending out the rest. This system can lead to liquidity crises if many depositors demand their money back simultaneously.

Bitcoin, with its transparent, peer-to-peer nature recorded on the public blockchain, offered an alternative to the distrustful banking paradigm. With its fixed supply and independence from central banks, Bitcoin provided a secure autonomous financial option.

Governments and regulators have recognized the functions of Bitcoin and the technology behind it. However, the crypto space's demographic has shifted over time. While earlier enthusiasts were driven by the political and economic implications of decentralized currencies, many newcomers are primarily attracted to the technology and financial aspects.

Key opinion leaders in the industry, once champions of decentralization and autonomy, now often align with the financial system, even advocating for regulations if it means broader acceptance and mass adoption.

The journey towards mass adoption of cryptocurrencies is not without challenges. As the industry grows, so do compliance costs with regulatory standards. This raises the question: Is widespread adoption feasible given these escalating costs?

Moreover, there has been a noticeable shift in attitude, with many dismissing innovative ideas centred around privacy protection. Yet technologies like zero-knowledge proofs have gained prominence and educated regulators about their importance. This shows just how far embracing regulation is a two-sided sword.

The crypto community must remain vigilant for illicit activities like money laundering, human trafficking, drug dealings, terrorist financing, gambling and pornography. However, it is essential to strike a balance. I want to be a little more controversial here by drawing attention to how crypto and blockchain community can retain its relevance.

Technologies that enhance privacy should be evaluated for their potential benefits, not just the possible harm they might cause. Dismissing such technologies outright will hinder the growth and value proposition of web3.

Singapore, with relatively stable and sustainable policies, has become a hotspot for Web3 talent. The Monetary Authority of Singapore has struck a balance between regulation and development, fostering a supportive environment for Web3 projects.

The intersection of ethics and legality is complex, particularly in fields like cryptocurrency and technology. Collaboration with regulators and governments is crucial, as it helps create a balanced and fair regulatory framework.

In conclusion, the crypto community should prioritize ethical considerations alongside legal compliance. Collaborative efforts with regulators and a commitment to innovation with ethics in mind will be key to achieving mass adoption and ensuring the industry's long-term sustainability.

Singapore's robust regulatory framework makes it a prime destination for crypto innovators. I invite you to Singapore for our conference next year and to collaborate, innovate, and contribute to the global blockchain landscape. Let's leverage Singapore's and BBA's strengths to foster innovation and make a lasting impact.

Tasos Oureilidis, CEO, Hellenic Blockchain Association

2023 has by far been the most productive year for the Hellenic Blockchain Association. We are currently forming a partnership MOU with the Hellenic Association Catalyst to collaborate on blockchain-related matters with the Ministry of Digital Transformation. We are also planning a series of seminars and collaborations to promote blockchain technology at the IT Departments of Aristotle University of Thessaloniki as well as the National and Kapodistrian University of Athens.

We see positive feedback and support from the public sector – especially since the re-election of the new government two months ago – with very positive feedback and goodwill from the Ministry of Digital Transformation. The government is keen on digitizing and transforming bureaucracy. And we have concluded that the first use case – with the public sector willing to put some serious money into it – is the digitisation-slash-tokenization of the Land Registry.

On another hand, we have also the Athens Stock Exchange – the Athex Group – looking into my publications last year on blockchain, ESG solutions and the tokenization of carbon credits. They are really looking into exploring a partnership with us on a blockchain-based voluntary carbon-credit marketplace.

Audience question: Is the Land Registry project a proof of concept at this stage? Or is that something which is already deployed?

There is currently no digital platform for the land registry. There is still only a paper-based structure. So we said to Ministry that we have a hybrid blockchain ready to go that uses proof-of-work and proof-of-stake to ensure decentralisation and scalability, with a minimal carbon footprint, that can sustain the digitisation of all the documents encrypted into the blockchain. It is at MVP level at the moment.

Audience question: What is the level of support for startups in Greece?

There are few blockchain companies in Greece, so we are working on a membership structure to provide guidance and advice to interested entities. The blockchain ecosystem in Greece is still relatively immature, with a limited number of companies actively experimenting with blockchain technology.

But we are in extensive talks with the Hellenic Capital Market Commission, the Greek SEC, to become their advisors and help work on how to implement and enforce MiCA within Greece.

Almudena De La Mata, Board Member, Alastria Blockchain Ecosystem, Spain

In 2018, Spain witnessed significant developments in the blockchain sector. While the technology gained momentum among regulators and businesses, it remained largely unregulated. Draft bills regarding blockchain received political support, and private sector blockchain initiatives surged, particularly in banking, energy, and shipping. Spain hosted over 200 blockchain and cryptocurrency companies, with financial services being the most concentrated sector.

Regulation and policymaking efforts increased in 2018, with a draft bill for blockchain and digital currencies gaining cross-party support. It advocated for blockchain's cost-efficient payment facilitation and a controlled introduction to the Spanish market.

On 17 September 2020, the Spanish Congress unanimously approved a new legislation to facilitate the digital transformation of the financial system. The new bill introduces a regulatory sandbox for novel FinTech projects, including blockchain and digital currencies. Eighteen total projects have been selected to participate in the sandbox, half of which utilise blockchain technologies in their operation. Of the 67 applicants in total, ten correspond to the Bank of Spain, four are from the Directorate-General for Insurance and Pension Funds, and another four from the National Securities Market Commission.

The sandbox has carried out five calls in which projects related to cryptoassets, blockchain and DLT have had a very relevant impact.

In March 2023, the Securities Markets and Investment Services Law incorporated features related to blockchain and cryptoassets, aligning with EU directives. Regional governments, like Aragon and Madrid, embraced blockchain regulation and development. In February 2021, the Autonomous Community of Aragon approved the regulation of the use of decentralized digital identity and blockchain in the Public Administration.

In April 2022, the Autonomous Community of Madrid created the Blockchain Cluster, made up of 22 companies and institutions to promote the development of blockchain.

Spanish authorities have issued warnings about digital currencies and ICOs to safeguard investors over time. Although Spain lacks local cryptoasset regulation, the Bank of Spain maintains a registry of service providers but lacks regulatory authority over these instruments.

The Spanish Association for Standardization established the first global standard for decentralized identity management based on blockchain technology in December 2020. The country also approved a nationwide technological network project based on blockchain, aligned with the European Blockchain Services Infrastructure.

Prominent players in traditional sectors, including banking, energy, and telecommunications, formed Alastria, a consortium to accelerate digital transformation through blockchain.

Today, Alastria counts more than 500 members from the private and public sectors, has developed a digital identity model, Alastria ID, and has promoted the construction of two blockchain networks (Quorum and Hyperledger Besu) collaboratively among its members, for the deployment of PoC and non-critical use cases. Alastria has more than 60 use cases non-financial developed by its partners in different sectors, many of them related to traceability, certification, identity and tokenization.

Spain is home to over 212 small and medium-sized blockchain and digital currency companies, with diverse applications across sectors like financial services, IT, gaming, and energy, and they've collectively raised over EUR 80 million in funds.

Overall, Spain has made significant strides in blockchain adoption, regulation, and private sector engagement, extending beyond financial services into various industries.

Trishi Sharma, Representative, National Blockchain Project India, and C3i Hub

Let's delve into the world of Web3 and its connection to policymaking, particularly in the context of India. Web3 aims to establish trust on the Internet without relying on centralized entities like governments or large corporations. Blockchain technology plays a vital role in achieving this goal by providing a decentralized way to store and share data.

According to recent research, the global Web3 blockchain market is poised to reach approximately \$23 billion by 2028, presenting a substantial opportunity for India. India currently boasts the world's third largest Web3 pool, constituting 11% of the global Web3 workforce, and this sector is growing at an impressive rate of 120%. In India, we are proud to host more than 450 Web3 startups, which have collectively attracted \$1.3 billion in investments over the past two years, with a remarkable 160 of them established between 2021 and 2022.

However, regulatory ambiguity remains a significant challenge for these startups. A majority of them, precisely 60%, are incorporated outside India due to these uncertainties, even though they employ technical staff within the country. Despite these hurdles, India is emerging as a strong player in the Web3 arena, particularly as a developer and service provider. Yet, achieving mass adoption and expanding the user base within India remains a challenge due to persistent regulatory obstacles. Clear guidelines are needed to foster innovation and ensure industry stability.

Our journey in the Web3 space has been marked by significant volatility. Founders must navigate carefully and add value to succeed in this space over cycles spanning five to six years. While numerous new Web3 startups have emerged in India, only a select few have gained global recognition. Collaboration and community engagement have often played a pivotal role in their success.

Regulatory challenges extend beyond cryptocurrencies, encompassing non-fungible tokens, global licensing, taxation, intellectual property rights, and even geopolitical considerations. Issues related to the metaverse and enforcing end-user license agreements across borders also require immediate attention.

Privacy remains a significant concern, necessitating action from policymakers. A recent report suggests that the Web3 sector in India could generate over 800,000 new jobs, but the absence of a clear regulatory framework is pushing Indian entrepreneurs to seek more favourable jurisdictions abroad like Dubai or Singapore, risking capital flight and talent drain.

To address these challenges, we must focus on applications that utilize Web3 technology, rather than the technology itself. This approach allows for greater innovation and flexibility. Clear guidelines from policymakers are essential for Web3 startup growth, given the increasing talent pool in India. Policymaking should prioritize increasing user adoption and addressing regulatory concerns.

Effective risk management strategies are crucial due to the volatile nature of Web3. Regulations should weed out worthless tokens and scams, ensuring that only valuable projects survive through community building and collaboration. Policymakers should also incentivize early adoption to benefit Indian enterprises that tend to be cautious about new technologies.

Companies should be encouraged to integrate Web3 into their existing operations to gain a competitive advantage. A comprehensive regulatory framework addressing privacy and scam-related issues, aimed at long-term sustainable growth, is needed. Access to popular and legally permitted payment systems should be facilitated for Web3 businesses.

Our journey in the Web3 space is ongoing, and there's still much ground to cover. It's essential that we evolve, understand new technologies, and prioritize ethical and correct policymaking to ensure progress.

Natalie Elphicke MP OBE - Chair, UK All-Party Parliamentary Group on Blockchain Technologies

Good morning everyone. I'm Natalie Elphicke and I am a UK Member of Parliament.

As the chair of the All-Party Parliamentary Group for Blockchain Technologies in the UK Parliament, I'm delighted to be making this keynote speech today on the promise of Web3 in the context of innovation and policy making.

Making policy and implementing legislation is often reactive – responding to dangers, risks or harm to the public or a nation state.

Dangerous dogs, bad employers or the rise of criminal gangs and terrorists using the internet or social media platforms or encrypted applications to communicate and network are some examples.

However, policy can be about creating and supporting opportunities for the new, for innovation and for change. And sometimes policies to prevent harm or effect change need to be trans-national. Addressing climate change is one example. Web3 is another.

Web3 is trans-national: the challenges of trans-national policymaking

Web3 economies, by their very nature, are often trans-national global ecosystems.

Web3 represents a paradigm shift that reimagines the very fabric of the Internet.

At its core, Web3 is about decentralisation, empowerment, and the restoration of ownership and control to individuals.

This paradigm is made possible by Blockchain technologies which introduces transparency, immutability, and improving trust in the digital society.

But they also bring people together around the globe who work in different jurisdictions with different laws, corporate structures and standards. That presents real challenges to policymakers.

Let's take Decentralised Autonomous Organisations.

By way of example, a Decentralised Autonomous Organisations (DAO) founded by developers in Singapore: Managed by a group of DAO voters based in 50 different countries and used by a community of users based around the globe. How do policy makers, whose regulations and policies must be designed to reflect their political national context and domestic priorities, ensure that what they are doing is effective in a trans-national context.

Let's take Decentralised Finance with its permissionless, global, financial infrastructures – which pose their own unique challenges and opportunities for regulators and policymakers. Ensuring transparency, auditability, and accountability in these ecosystems is paramount.

Let's take NFTs. The momentum is building and use cases involving the tokenisation of real-world physical assets are emerging faster than ever before.

It is predicted that the market for tokenised assets could reach \$16 trillion by 2030. It is unquestionable that our world is being tokenised. From real estate to precious metals, from arts and collectibles to education credentials, from stocks and bonds to carbon credits, energy tokens and physical assets. This trend will only grow from here.

Earlier this year, the BBA responded to HM Treasury's call for consultation on how non fungible tokens should be treated, and how we make smart contracts much smarter and practically viable.

Let's take Web3 Governance: And that includes both on chain governance and the audit of smart contracts, as well as off chain evaluation of Blockchain service providers. We can say that "in Blockchain we trust", but how do we establish trust in the individuals and companies that provide Blockchain applications and products?

Regulation and effective policies can certainly help to mitigate some of the risks but cannot eliminate them - FTX is an example.

So we have to devise regulations and policies that can be safe for citizens, fit for purpose and pro-innovation within their own context – be that NFTs, DAOs, DeFi, Metaverse, and other decentralised applications – and also address issues which arise around Intellectual property, ownership, taxation, and the legal position of these entities.

Policy makers have a vital role is deciding where those risks and responsibilities sit.

Key National Priorities

Now when it comes to policymaking for the Web3 economy in the United Kingdom, I believe there are some key national priorities. I am going to outline some of these priorities briefly in my keynote today as well as share an overview of the future direction in the context of the UK economy. The principles here are also broadly applicable to other Blockchain economies.

Growth & Workforce Planning

First: Jobs, skills and growth. Blockchain and Web3 are some of the most sought after and well-paid skills. But Britain is lagging competitors in securing

Blockchain related jobs including Germany, the US and France, as well as the Netherlands, Spain and India.

In the first quarter of 2023, out of a total of around 90,000 jobs globally, the UK ranked at number 12, securing only 2,000 of these.

The talent pool in Web3 is global and every country is bidding for the same talent.

And that's not just in technical skills. It's also educators, lawyers, public relations officers, community managers, metaverse safety moderators, Blockchain ethics advisers and professionalism advocates, and many more - some of these jobs didn't even exist a few years ago.

And that emerging talent pool must be inclusive. For cutting edge technology, it has some prehistoric diversity and inclusivity figures. The latest JBBA research showed that only 11% of DAO members and voters were female.

Another study showed only 6% of C-Suite executives of Blockchain and Web3 firms are women.

So the first UK national priority is Web3 industry growth and workforce planning. Part of that is about making the UK an attractive hub for Web3 founders, CEOs, developers, programmers, and companies to work here, and make positive contributions to the UK economy.

I believe that while we must penalise bad actors, it is equally important to reward good actors. They should be supported, facilitated, hired, and funded so they can help grow the economy. Web3 is global, so if we make and apply laws that stifle innovation and put unnecessary restrictions in place, businesses will go elsewhere.

I was encouraged to see that recently some Blockchain and Web3 firms have made the UK their second home and many more are planning to relocate here. Jurisdictions that are pro-innovation and have a clear regulatory and policy stance will eventually attract businesses and generate revenue that will help to grow a country's economy.

Great Britain, Smart Britain

Secondly, making Britain Smart as well as Great. The UK has the potential to become a Blockchain enabled "Smart Country" for Digital Government, Citizens, and Public Services.

Blockchain-based systems can reduce costs and increase transparency in government and public sector processes. Self-executing algorithms can streamline interoperability, increase trust and efficiency in online civil systems.

Governments around the globe have been exploring how Blockchain could be utilised to streamline and support transparency, efficiency and trust in public services.

These have included:

- For land registration in Georgia, the UK and Sweden
- For digital identity management in Switzerland, Estonia and Luxembourg
- For immigration and border control in Finland
- For taxation records in China
- For pension infrastructure in the Netherlands
- For logistics and transportation in India.

National Blockchain Roadmap

Which takes me to my third national priority – taking forward the National Blockchain Roadmap.

Published in 2021, the UK National Blockchain Roadmap sets out an ambition to build a DLT-based digital nation and put forward various recommendations to construct the key components of the UK's Blockchain economy.

So far, less than a dozen countries around the world have published their National Blockchain Roadmap.

It's vital to learn from other jurisdictions and establish forums such as this one, to meet, discuss and debate joint challenges in the Web3 space.

Thinking globally and acting locally, Blockchain can support UN SDGs, Net Zero, climate mitigation efforts, industrial symbiosis networks and other emerging Blockchain use cases.

While everyone is talking about scams, many people don't know that it was the United Nations World Food Programme in 2016, almost seven years ago, that used iris scans to provide not tokens, but food and groceries to Syrian refugees in Jordanian camps.

Blockchain enabled digital identity is a step forward towards an inclusive global economy.

Industry collaboration, evidence and audit

So moving on to supply chains, trade and e-commerce and how we build and support innovation and excellence: What we learnt from TradeLens is that

while the Blockchain platform managed to track almost 4 billion events, published over 36 million documents, and processed over 70 million containers, there had been challenges around effective industry collaboration.

Quadruple helix Blockchain innovation ecosystems must work together to ensure alignment of incentives and making DLT consortium commercially viable.

That means looking collaboratively and openly at what has worked for enterprise Blockchains and what hasn't (private versus public Blockchains) and why it hasn't, are important resource allocation and policy considerations.

That doesn't always happen. JBBA research showed that many Blockchain companies do not publish their MERL processes – Monitoring, Research, Evaluation and Learning outcomes – which would mean that we will continue to waste precious resources and keep on repeating the same experiments until the lessons are learnt.

In 2018, there were 57 universities on the JBBA mailing list – Now there are more than 800 universities on that list, and it is growing – these are institutions directly involved in Blockchain research and offering postgraduate modules or courses in Blockchain related technologies.

Knowledge networks enable the production of high-quality, peer-reviewed data which in turn helps to direct precious resources to Blockchain programmes that are backed by scientific evidence.

That's the same with the evaluation, appraisal and audit of Blockchain ecosystems. It's crucial that we spend resources on what provides the best value for tax-payer's money and follow the fundamentals of evidence based blockchain – for every £100 pound invested in Blockchain projects, an amount, say for illustration of £2, must be spent on making sure that the other £98 actually works.

Conclusion

To conclude: Building communities, ecosystems, and regulatory infrastructures can take time and patience.

Academics may have the scientific foundations that the industry does not have. Enterprises may have the latest industry data that the policymakers don't have access to. The public and end users may offer valuable insights to barriers to Blockchain adoption. And policymakers have to see how that all works together within the current political and legal constraints as well as with a view to a long-term vision for innovation, change and growth.

It requires all stakeholders to collaborate and play their constructive role in building progressive and resilient Blockchain ecosystems that will benefit domestic and global citizens now and in the future.

Chris Holmes, Lord Holmes of Richmond, BBA Fellow and Parliamentarian

I'm Lord Chris Holmes, and I spend much of my time in Parliament advocating for innovative technologies, including artificial intelligence and blockchain. Today, I'd like to delve into the topic of how we can develop more effective, evidence-based policies for Web 3.0 and its foundational technologies.

To achieve this, we must begin with robust evidence, subject it to peer review, scrutinize it thoroughly, and build our strategies upon it. It's essential to establish a clear vision for Web 3.0 and be utterly truthful about the solid ground on which we stand and then put that plan in place to get from there to the place where I believe so many of us want to get to with benefits for all concerned.

My thoughts on Web 3.0 - I'll do it by: ABCD.

A – Autonomy and accountability: We need to think about its autonomous nature; about artificial intelligence and how we make this an artificially intelligent space as well as a human intelligence space; accountability; and crucially, accessibility. It would be an absolute tragedy if we make a space from scratch which has inaccessibility and exclusion built in from the beginning.

B - Web 3.0 could really be Blockchain's moment. On the positive side, we're through the high end of the hype cycle. We can see a hype cycle with AI at the moment and that's only to be expected. But we're through the high point of the blockchain hype cycle and that enables us to really focus on the use cases and practical applications of Blockchain making a significant difference to society.

C - To the 'C' of cryptocurrencies. Web 3.0 will be made of three elements. Its tokens, its wallet, its digital ID operating in that broader space. And cryptocurrencies are going to be critical to this. Anyone can issue one. It can be considered adopted, commercialised by anyone. What Emmanuel Daniel calls the 'personalization of finance'. We can all appreciate there are a number of pluses and minuses to that, just like any innovation. But cryptocurrencies are critical to the development and operation of Web 3.0.

D - Decentralization: This is an exciting element for many people because it offers not just decentralised possibilities but disintermediation, the potential to link with peers, to cut out costs, to cut out control and to have potentially real meaningful, sustainable, growth-creating relationships.

So, what role can government play in shaping Web 3.0?

In many ways a huge role which is never fully played by government is the communicating and the convening role; communicating the opportunity, convening a consideration of those opportunities, of those risks, and then moving into the standard space, the regulation space and the legislation space to ensure that we're at the forefront.

The UK has a real opportunity here to lead, but to lead in concert with other nations, with other organisations, with other standard setting bodies right around the world.

Cooperation is essential to create a digitally interconnected global landscape, bringing both economic and political benefits.

Let's take the example of the Electronic Trade Documents Act – described as the most important piece of legislation that no one has heard of. Why is it so important? Because it's transforming trade: The most important move in trade for 140 years.

Why is it so important to mention today? Because it's the first time in the UK that we've legislated for the possibilities of these new technologies. And it comes into commencement today. What an auspicious day to have your summit when the Electronic Trade Documents Act comes into force.

Why is it so significant? Because blockchain is at the heart of it and yet is never mentioned in the bill. Quite rightly, it talks about the criteria which are required to successfully have an electronic trade document. Why does this matter? Well, smart contracts have been around for a long time. We've had electronic documents. What's so special about trade documents? What's so special about them is they're possessive in nature.

You hold the paper; you hold the goods. So very different to an agreement, to a contract. We had to have the technology which would enable an individual or an entity to prove beyond doubt, as a consequence of holding electronic trade documents, that you held those goods at that moment in time. And crucially, that document could prove that no one else held those goods.

It's blockchain that enables that. But as I say, the act is clever in that it specifies criteria rather than specific technology. So it's future proof in terms of technological development. We're the first G7 country to pass such legislation. We all need to work incredibly hard to ensure that other nations around the world pass similar legislation so we can all trade as a connected, digitally enabled planet.

Antonio Marcos from the Central Bank of Brazil

Web3 refers to the next generation of the Web's technical, legal and payments infrastructure, including blockchain, smart contracts and cryptocurrencies.

According to many advocates, the peer-to-peer character of Web3 means it represents a more equitable vision for the Web than its current iteration, Web2, which is dominated by powerful intermediary platforms like Facebook, Amazon, Apple, Google.

The majority of existing Web3 projects fit into one of three categories which are decentralised finance, which encompasses peer-to-peer blockchain based financial services, including savings, borrowing payments and credit scoring.

The second category is digital services, which also encompasses decentralised internet service provision, cloud storage, web infrastructure, data analysis, and finally, the category of collectables encompassing digital artwork, sports and visual goods.

There may be a trade off between innovation and financial stability here. It is the assessment of the Central Bank of Brazil that innovation should generate additional benefits to traditional financial services, allowing greater autonomy, security and interoperability. In addition, greater transparency of financial inclusion and of transactions.

In this way, the benefits are intrinsically linked to the development of new and more efficient financial products and services which should allow for greater financial stability.

Naturally there will be challenges to financial stability that are especially acute for emerging markets economics. Policymakers must adapt to prevent greater risks – notably, the appropriate treatment be given to technological financial entities in view of their access to a large volume of data on potential applicants for financial goods and services. This could confer a significant risk of information asymmetry which may prove to be extremely decisive in competition and generate a potential position of market dominance for technology entities.

Policies must anticipate the need for a levelling of information between segments with a view to allowing expanded competition. In this way, the challenge is to delimit the adequate arrangement for the performance of technology entities and traditional financial institutions in the same ecosystem.

Many risks stem from the anonymity or partial anonymity of crypto assets. For instance, the inability to monitor and manage capital flows as well as AML.

There is a legal risk present in anonymity – total or partial – which must be fought by all participants in the ecosystem. Even in decentralised networks. Yet what happens in practice may be less broad given the public history of all transactions, thus allowing for traceability.

What is the upshot of all this? It appears that several authorities must act on crypto activities guaranteeing financial stability, economic competition protections, protection of personal data and combating criminal activities.

The obstacles in achieving international effective and coordinated enforcement loom large. Many crypto activities originate in smaller jurisdictions with little supervisory capacity and may not be fully covered by international standards.

Difference in regulatory models greatly complicate international collaboration on supervision and oversight. Moreover, new international standards and where relevant guidance on existing standards that are currently being developed or updated may take time to implement in individual jurisdictions, especially where it concerns the new legislation.

Depending on the target features of the crypto world. Selective bans, containment and regulation can be combined. And indeed they have been. For

instance within jurisdictions, some of the most harmful crypto activities could be fully banned, such as energy intensive proof of work verification or algorithmic stablecoins not backed by reserves.

Those intermediaries that reach between traditional financial and crypto such as centralised exchange and stablecoins should be subject to regulation. This approach will take time and requires resources and expertise to be deployed, including in the form of standards to make effective international coordination easier.

It is important to emphasise that the regulatory strategies that I advocate are aimed at bringing legal certainty to these important and emerging markets and to ensure that good and efficient companies survive without undue pressure hindering the progress of the decentralised economy.

Professor Naseem Naqvi, BAF Chairman and President of the BBA

I won't delve into Web3 policymaking in the UK since we've already heard from two parliamentarians on this topic. However, I'd like to share my thoughts on Web3 in general and why we're having these discussions today.

To provide some context, this forum was launched in late 2020, aiming to bring together blockchain associations worldwide. This event marks our third summit. Given that Web3 is a global phenomenon, it's essential to closely examine developments in other jurisdictions and learn from their experiences. Nations can benefit from collective wisdom, and I invite countries not yet part of this forum to join and engage in this knowledge exchange. At its core, Web3 embodies decentralization, transparency, immutability, and more – it reduces bureaucratic controls, fosters innovation, and enhances autonomy. Web3 gives us fewer bureaucratic controls. There is less risk of corruption. There is more freedom for innovation. There is more autonomy. But at the same time the organisations that are involved in managing Web3 are very much centralised.

And we see time and again bad actors emerge, such as at some crypto exchanges, as a result. That's not a failure of Web3 or blockchain itself, but of those who provide those services.

The real challenge here is gradual implementation of decentralisation, what I call 'maximum possible decentralisation and minimum viable centralisation'. It is going to be a gradual move.

The next step is that you make laws and you govern the centralised actors. So you're not governing the actual technology itself and making laws for the actual technology itself. You're making laws for the applications of that technology.

Regulation, I believe, is inevitable. But I must say that we need less red tape and more red carpet to allow us to experiment and explore and avoid making it too restrictive and difficult for innovators to put forward new ideas and new services and new products.

Decentralisation does not mean that there is a lack of accountability. It means that accountability now lies on the shoulders of every individual in the ecosystem. And this great privilege, this great power of self-sovereignty that we all talk about, it comes at a price of great responsibility.

The next step towards building web3 ecosystems is laying infrastructural foundations. We what need is open, user-friendly, equitable, interoperable and ideally transnationally agreed standards and frameworks and forums such as this one facilitating discussion.

Since all of us are here are in the Metaverse today, let's take the Metaverse as an example. We are working very closely with other Metaverse standards associations and sets of standards covering governance, dispute resolution, avatars, education, training, 3D assets, technical interoperability and standards for digital assets in the Metaverse, NFT payment standards and so on.

Translating scientific findings into practice is also essential, and our advocacy for evidence-based blockchain remains unwavering. We provide policymakers with easy-to-understand, open-access research summaries and infographics to support better decision-making.

Successful blockchain projects and startups share a common trait: they make better decisions than their competitors. Quality data and evidence drive these decisions, highlighting the importance of evidence-based approaches.

In conclusion, we're at a critical juncture in Web3's development. While challenges persist, the promise of a more inclusive, equitable, and self-sovereign society is worth pursuing. It's a dream worth fighting for, and we've made substantial progress. Collaboration among stakeholders is crucial, and I'm pleased to see the launch of a new All-Party Parliamentary Group dedicated to Blockchain Technologies. I invite all interested parties to get involved.



BLOCKCHAIN ASSOCIATIONS FORUM

Hosted by The British Blockchain Association

3rd ANNUAL MEMBER SUMMIT

20 SEPTEMBER 2023 (METAVERSE)

The Promise of Web3:

Empowering Societies through Innovation & Sensible Policymaking

SESSION 1 (9:00 AM)

CHAIR: AUSTRALIA (BLOCKCHAIN AUS.)
Japan, Taiwan, South Korea, New Zealand

SESSION 4 (10:00 AM)

CHAIR: GREECE (HELLENIC B.A)
Switzerland, Portugal, Italy, Indonesia

SESSION 7 (11:00 AM)

CHAIR: INDIA (C3I HUB, NATIONAL B.P)
South Africa, Poland, Sri Lanka, Kenya

SESSION 10 (12:00 PM) - Chair's Speech

PROF. DR. NASEEM NAQVI MBE
President, The BBA

SESSION 2 (9:20 AM)

CHAIR: FINLAND (BFF/ HELSINKI B. CENTER)
Israel, Turkey, Sweden, UAE, Saudi Arab, Norway

SESSION 5 (10:20 AM)

CHAIR: SPAIN (ALASTRIA)
Denmark, Estonia, Pakistan, Ireland, France

SESSION 8 (11:20 AM)

CHAIR: NIGERIA (SIBAN)
USA, Belgium, Germany, Gibraltar

SESSION 11 (12:20 PM) - GUEST SPEECH

LORD HOLMES OF RICHMOND MBE
UK House of Lords

SESSION 3 (9:40 AM)

CHAIR: SINGAPORE (SUSS NIFT)
Ukraine, Malta, Hungary, Liechtenstein, Singapore

SESSION 6 (10:40 AM) UNITED KINGDOM (HOST)

NATALIE ELPHICKE OBE MP
Member of Parliament, UK

SESSION 9 (11:40 AM)

CHAIR: BRAZIL (CENTRAL BANK OF BRAZIL)
Mexico, Puerto Rico, Brazil, Argentina, Canada

SESSION 12 (12:40 PM)

ROUND TABLE AND CLOSE

Hosted by The British Blockchain Association



SESSION CHAIRS



AUSTRALIA



NIGERIA



BRAZIL



UNITED KINGDOM [HOST]



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SPAIN



SINGAPORE



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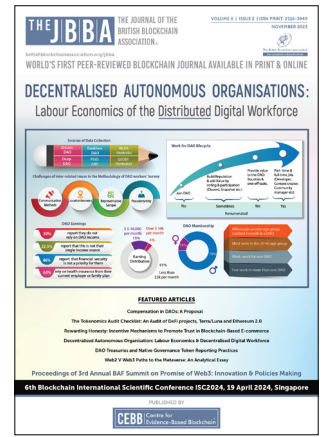
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November 2022



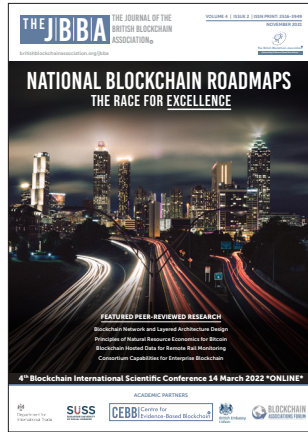
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May 2023



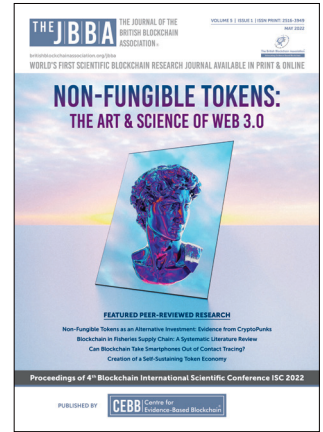
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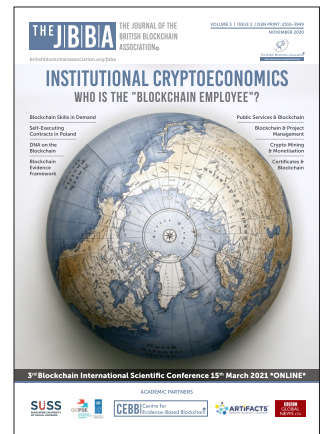
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Volume 2 - Issue 2
October 2019



Volume 3 - Issue 1
May 2020



Volume 3 - Issue 2
November 2020



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July 2018



Volume 1 - Issue 2
December 2018



Volume 2 - Issue 1
May 2019

THE JOURNAL OF THE BRITISH BLOCKCHAIN ASSOCIATION (THE JBBA)

THE BBA JOURNAL CLUB



The British Blockchain Association
Advocating Evidence Based Blockchain

BBA FORUM | MARCH 2022
SUNDAY, 27 MARCH 2022 (5 PM BST)

Registration Link: <https://bit.ly/375Tsc2>

5:00 PM | Welcome
BBA Secretariat

JOURNAL CLUB

5:05 PM | Non Fungible Tokens & Crypto-Punks

Luisa Schaar, University of Law, UK

Author of the 2022 JBBA Paper:

NFT's as an Alternative Investment: Evidence from Crypto Punks

5:20 PM | Blockchain, Contact Tracing and Pandemics

Oritsebawo Paul Ikpobe, The University of Birmingham, UK

Author of the 2022 JBBA paper:

Can Blockchain Take Smartphones Out of Contact Tracing?

5:35 PM | Crypto Governance and Cryptocurrency Exchanges

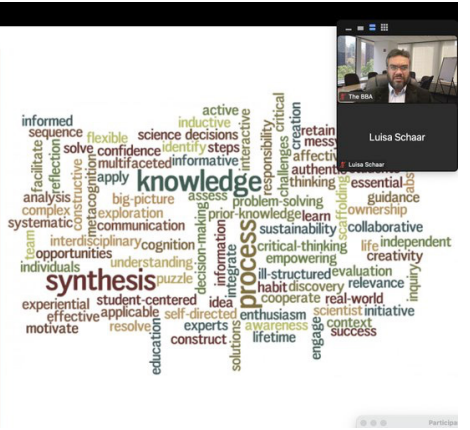
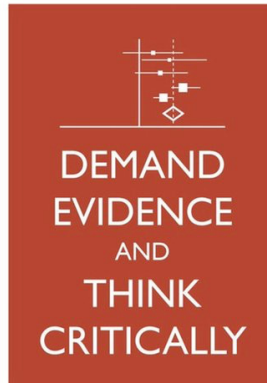
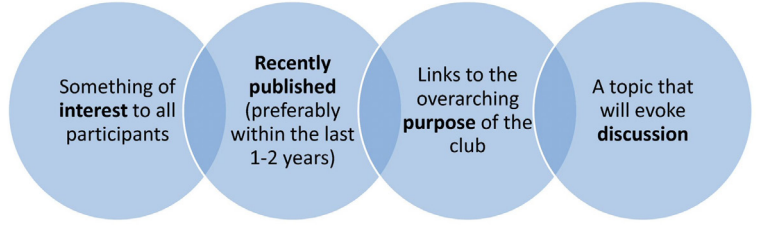
Sabino Correa, London Business School, UK

Author of the 2020 JBBA Paper:

Crypto Governance: Analysing Platforms for Crypto Assets Trading

5:50 PM - 6:00 PM: Open Forum AMA & Close

Blockchain and Crypto-assets Journal Club:



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The What & The Why

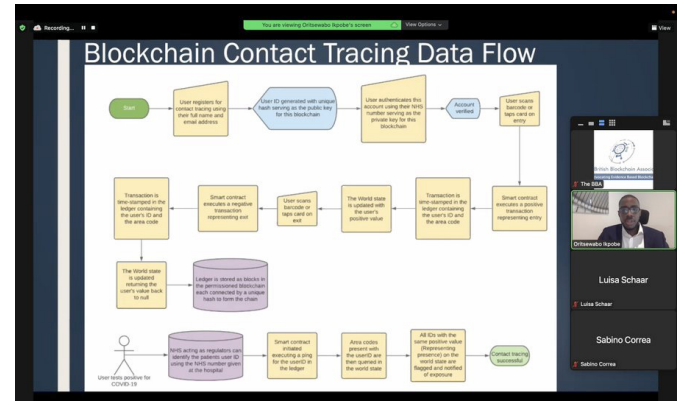
This research is about analysing the Crypto Trading environment under the fundamentals in terms of governance for any business:

Topic	Crypto Exchanges Governance Proposed Key Performance Indicators (KPI)	
	Minimum Points	Maximum Points
Legal Compliance		
Company name and Registry Identification	0	1
Key personnel and Management Identification	0	1
Directors and Investors Identification	0	1
Years of Activity		
Number of Years	0	3
Jurisdiction of Incorporation		
Clear Jurisdiction of Incorporation	0	1
Clarity about Controller Jurisdiction	0	1
Authority Regulation		
Clearly presents as Authority regulated	0	3
Number of Points	0	11

Table 2 - KPI Score Summary

- Sample** • Sample representing 99% of the daily trading volume as of 01-Jan-2020
- KPI** • 78 Exchanges assessed under the KPI
- Fees** • Analyse the fee structure of the group

Cross Results

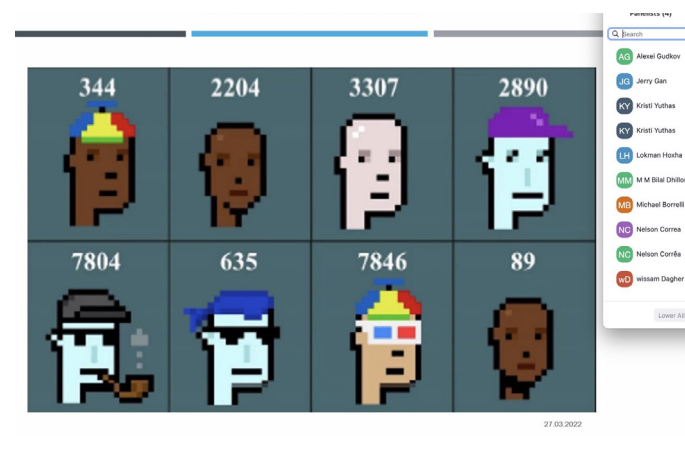


Crypto Governance: Analysing and Comparing Crypto Assets Trading Platforms

Published at the Journal of the British Blockchain Association Volume 3 – May/2020

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Luisa Schaar



THE BBA STUDENT FORUM

A BBA student chapter helps reinforce classroom and experiential learning. In addition to the learning that occurs during chapter meetings, the submission of research articles to the JBBA journal helps develop industry-specific skills, along with skills in project management, technical writing and interpersonal communications.

Chapter activities culminate at the annual scholars in Blockchain conference, where students interact with students from other chapters, BBA members and advisors and network with industry leaders, scientists, and researchers.

The BBA recognises that students are the future leaders of the industry, and treats them as such. Chapters instil future professionals with an understanding of the role that collaboration, research, development and networking plays in blockchain developments and industry progress.

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Encourage student collaboration

Foster dialogue about trends, issues, movements, opportunities impacting the blockchain industry

Connect to industry professionals and career opportunities

Obtain leadership experience driving BBA student chapter activities

Form student and professional relationships across the BBA including those with students from other chapters

Compete in hacking events

Publish papers in the JBBA

For more info, visit <https://britishblockchainassociation.org/starting-a-student-chapter>



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For more information visit: britishblockchainassociation.org/fellowship or contact: fellowship@britishblockchainassociation.org

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