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 Gitcoin 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.
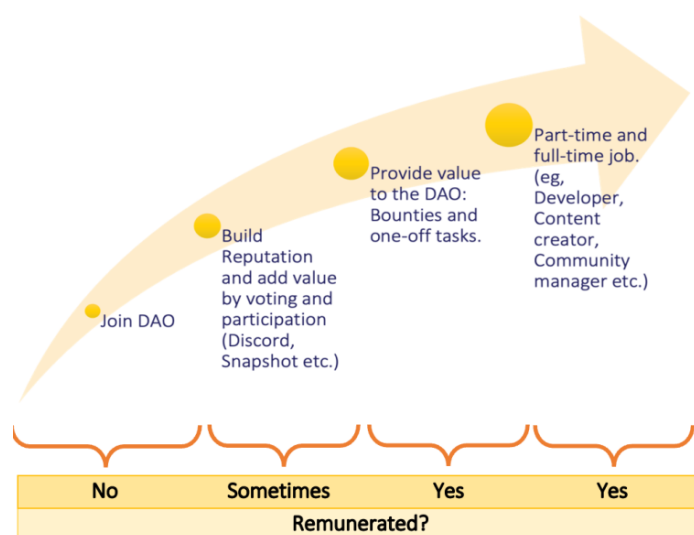

Figure 1. Work for DAO lifecycle.

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

[1] Calculated by author based on the data in Bankless (2021)

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 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.

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