User Accessibility and the Uncertain Future of Blockchain

Does decentralized finance really make finance more readily accessible for users?

Danielle Grossman

The Leonard N. Stern School of Business

Glucksman Institute

Faculty Advisor: Dr. Kose John

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ABSTRACT

Accessibility can mean different things to different people. When it comes to decentralized finance (DeFi), accessibility also has various meanings for the multitude of stakeholders (i.e., miners, users, protocols, etc.) involved in the process. This paper explains the definition of accessibility strictly for users of decentralized finance, in the hopes of answering the following question: does decentralized finance really make finance more readily accessible for users? We explore user accessibility of decentralized finance across a variety of dimensions, ranging from initial barriers to entry to costs for users in the system. In doing so, we evaluate accessibility both siloed and juxtaposed against alternatives (credit cards, bank accounts).

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I. INTRODUCTION

Decentralized finance is based on the premise that financial interactions can occur without the reliance of intermediaries, including brokerages, banks, and exchanges. Instead, transactions occur using blockchain and are solidified through smart contracts. Nakamoto explains that electronic payments without trusted third parties are necessary because there are "inherent weaknesses of the trust based model."[1] Nakamoto goes on to describe the reversibility of transactions, mediation costs, fraud, and uncertainty assumed with additional players mediating disputes and channels. Further elaborated in John, Kogan, and Saleh (2022), smart contracts (and by extension, blockchain technologies and cryptocurrencies more generally) are beneficial because they serve as a means of ensuring credibility of payment without intermediaries and "enable a high-quality entrant firm to enter a market when this would not otherwise occur due to information asymmetry regarding the type of the entrant."[2] From the user's perspective, the emergence of these cryptocurrencies, which are based on blockchain and decentralized finance, mean that users have more opportunities to engage in financial endeavors not previously available to them. Thus, the argument goes that cryptocurrency and blockchain technologies have revolutionized payments for the users. They have better control, more advancements, fewer fees, and new transparency into the system. This access has enabled previously disenfranchised groups to engage in financial markets, exposing them to new opportunities and additional means to expand their funds. With this context in mind, the paper will walk through the user processes to become and stay involved in the cryptocurrency space, including obstacles that users will face along the way, to explain that blockchain technologies are not as accessible as many believe to be true.

[1] Nakamoto (2008)
[2] John, Kogan, and Saleh (2022)

II. DEFINING ACCESSIBILITY

When a user determines she wants to engage in decentralized financial markets and participate in the purchasing and/or sale of cryptocurrencies, she is immediately faced with high barriers to entry. To enter the space, at a bare minimum, the user must have or obtain wireless access (WiFi), devices with internet access, electricity, and a technical education. While these limitations may seem trivial, it is important to highlight that only 63% of the world's population has access to the internet, and likely a similar number own or can obtain appropriate technological devices.[3] In the same vein, approximately 940 million people do not have access to electricity[4] and therefore cannot reach the internet to initial, complete, or withdraw from transactions. Drawing out this point even further, the number of individuals across the world with a technical understanding of how to effectively operate within the decentralized finance space dwindles even further as the complexities of navigating the virtual markets are not forthcoming and requires a baseline understanding of tokens, coins, blockchain, and finance.

Now, assuming a user has met the terms and conditions for accessibility as discussed immediately above, the user must determine accessibility in terms of ease of use and cost. Like a credit card, users need a cryptocurrency wallet and an exchange platform to both trade and use virtual currencies. The process includes becoming verified with the exchange platform and transferring funds into an account.[5] This is not instantaneous. Instead, users must often wait a few days for confirmation before they can begin using the cryptocurrency. Real accessibility of cryptocurrencies would imply immediate entry and use for everyone, meaning no verification is required. Verification is a means of limiting accessibility. Instead, the processes are equivalent to

[3] https://www.statista.com/statistics/617136/digital-population-worldwide/
[4] https://ourworldindata.org/energy-access
[5] https://cointelegraph.com/trading-for-beginners/how-to-trade-cryptocurrencies-the-ultimate-beginners-guide

– if not longer than – those associated with applying for and receiving a credit card. Users must prove their identity before gaining access to the system, demonstrating that the ease of virtual currency trade is not always more accessible than by using intermediaries. Likewise, regarding cost of accessibility, platforms are not free. Coinbase, one of the largest cryptocurrency exchange platforms, generates revenues from transaction fees; the company charges users a volume-based fee for exchanges.[6] User access to engaging in the cryptocurrency market is largely nonexistent without platforms like Coinbase, and access is not free.

After users have met high barriers to entry and obtained their digital wallets through virtual platforms, they are ready to begin engaging in cryptocurrency exchanges. Here, the cost of accessibility for users can be examined through two lenses: transaction costs and waiting time costs. Transaction costs are the user-facing fees that incur for cryptocurrency exchanges to be processed and validated on the blockchain. Transaction fees pay for mining fees and mining incentives. The means of validation for users is not equitable. As described by Nakamoto (2008), transactions are validated by third parties, known as miners, to avoid the double-spend problem and verify signatures in the chain of ownership.[7] Miners are compensated for this validation, and users engaging in transactions are responsible for providing the miners with this compensation. However, miners do not need to validate transactions in any order. As a result, "since validators are not obligated to execute any particular transaction, they must be compensated by users for at least the cost of execution in order to make such execution incentive compatible."[8] In other words, users can offer higher transaction fees to reduce the expected wait time of a miner validating their transaction. Taken a step further, this highlights a key imbalance and inequity of

[6] https://www.forbes.com/sites/greatspeculations/2021/04/14/coinbase-stock-how-does-coin-make-money/?sh=17f032f06327
[7] Nakamoto (2008)
[8] John, Kogan, and Saleh (2022)

user accessibility: users willing to pay higher fees will receive priority and see their transactions completed more quickly. User access on any given cryptocurrency platform is subject to prioritization based on the money they can provide for verification (i.e., miners).[9] Access is unequally distributed for users since users who are unable to or unwilling to compensate miners at a specified price can expect long, unknown wait times for transaction processing. This seamlessly transitions the discussion into accessibility via waiting time costs. Take Bitcoin, for example; since Nakamoto (2008) has imposed a "cost for appending a block by implementing PoW [proof-of-work] as the protocol that governs which Bitcoin blocks can be accepted," only one transaction can be approved at any given time.[10] Proof-of-work, or other validation methods, take time by miners and require acceptance from others on the platform. This time comes at the cost of the user. Transactions are not instantaneous, and waits can vary from minutes to hours to days. Accessibility is mitigated by the elongation of time. If Bob cannot send cryptocurrency to Alice and receive a sandwich in return within a specified period, the transaction is useless. By having to wait for confirmation, the user has diminished returns and cannot continue with his or her daily life. Transactions are not accessible if they are not beneficial to users. Having access to cryptocurrency does not result in the ability to use that cryptocurrency.

Elaborating on the points above even further, accessibility is limited by cryptocurrency's scalability. Because additions to the blockchain require mining and validation, the number of transactions per second is dependent on waiting time and transaction fees. These scalability limitations impact user access, as users cannot quickly and easily conduct exchanges. The prohibitions created through scalability prevent cryptocurrency from being widely used for all payment transactions. Specifically, for smaller transactions (i.e., less currency in the exchange),

[9] John, O'Hara, and Saleh (2022)
[10] John, O'Hara, and Saleh (2022)

users will have high wait times and high transaction fees, which may even surpass the cost of the original transaction itself, because miners will be less inclined to prioritize these transactions. This influences the speed barriers of cryptocurrency mentioned above. Continuing with Bitcoin as the example currency, there is a maximum number of blocks that can be added to its blockchain. Satoshi Nakamoto designed Bitcoin to have a finite quantity where the maximum supply is 21 million bitcoins.[11] Currently, 90% of Bitcoin that will ever exist is in existence, meaning that there is only 10% remaining; it is unlikely that all 21 million coins will be mined, but even if the full supply is mined, there is a clear limit in sight. As a result, it is not sustainable to rely on Bitcoin as a dominant method of payment.

III. ALTERNATIVES AND THEIR ACCESSIBILITY

Many original supporters of cryptocurrency are passionate about this method of exchange because it is decentralized, private, and self-governing. Founding members of the cryptocurrency community, including Nick Szabo and Satoshi Nakamoto, wanted to avoid financial institutions altogether because they had a lack of trust in third parties (i.e., banks). In fact, in 2009, Satoshi Nakamoto posted on a blog stating that, "The root problem with conventional currency is all the trust that's required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust. Banks must be trusted to hold our money and transfer it electronically, but they lend it out in waves of credit bubbles with barely a fraction in reserve. We have to trust them with our privacy, trust them not to let identity thieves drain our accounts."[12] Proving Nakamoto's point even further, data from the Federal

[11] https://bitcoin.org/en/faq#general
[12] https://www.economicsobservatory.com/what-are-the-lessons-from-history-for-digital-currency#:~:text=In%20a%202009%20blog%20post,of%20breaches%20of%20that%20trust.

Deposit Insurance Corporation (FDIC) in 2021 indicates that in the United States, the second highest reason for not having a bank account is lack of trust that individuals have in the bank and the third highest reason is privacy concerns.[13] These points highlight that users are *opting* out of a system as to not rely on trusted third parties (i.e., banks) instead of being *excluded* from the systems themselves. This is not a question of accessibility but rather a matter of personal preference. From the user's perspective, it is important to distinguish between freedom of choice and a restriction of no options, the latter being a restriction of accessibility.

In this section, we will examine two alternatives to decentralized finance – bank accounts and credit cards – and evaluate the accessibility of each medium. Accessibility for each will be based on factors that are out of the user's control. This distinction serves to illustrate how users may have access to financial institutions, such as banks and credit cards, but fail to use the accounts based on personal preference. Many refer to the individuals impacted by accessibility outside of the user's control as those that are "unserved" by the financial services industry. We will describe the accessibility barriers they face to entry, which in turn answers why they are currently unserved.

Before examining the unserved more closely through the lens of accessibility, it is important to note that there are many organizations, companies, and countries working to enhance financial inclusion and remove accessibility barriers that exist within this space. One important organization combatting this issue is the World Bank Group; the group, which is an international partnership of 180+ countries that works closely with the United Nations, is committed to "reducing poverty, increasing shared prosperity, and promoting sustainable

[13] https://www.fdic.gov/analysis/household-survey/2021execsum.pdf

development."[14] In one of their graphics, as shown here, the organization illustrates *how* it is possible to expand financial inclusion with access to trusted third parties.[15]

Figure 1: World Bank Group's Gateway to Financial Inclusion[16]

Likewise, the country of India started an initiative known as Pradhan Mantri Jan-Dhan Yojana (PMJDY) in 2014, which serves to "ensure access to financial services, namely, a basic savings & deposit accounts, remittance, credit, insurance, pension in an affordable manner."[17] Prior to this "great banking experiment," a large portion of India's population did not have a valid ID, let alone a bank account. Under this new scheme, Indians were afforded access to financial services they were previously excluded from as a means of improving financial inclusion and bolstering

[14] https://www.worldbank.org/en/who-we-are
[15] https://www.worldbank.org/en/news/immersive-story/2018/05/18/gains-in-financial-inclusion-gains-for-a-sustainable-world?cid=ECR_TT_worldbank_EN_EXT
[16] https://www.worldbank.org/en/news/immersive-story/2018/05/18/gains-in-financial-inclusion-gains-for-a-sustainable-world?cid=ECR_TT_worldbank_EN_EXT
[17] https://www.pmjdy.gov.in/scheme

economic development in the country. Indian citizens that were previously unserved by traditional financial systems gained appropriate access to the systems in a way that benefitted them.

1. Credit Cards

Users can apply for credit cards via mail or on the Internet, making it easier than opening a cryptocurrency wallet because there is no WiFi requirement as a barrier to entry. However, the process of obtaining a credit card, meaning the acceptance of the application, can be more difficult. Typical credit card applications require a user's income and personal information (i.e., social security number, date of birth, etc.).[18] After the credit card company receives the application, they conduct an independent credit check – often using a third-party vendor – to determine if the user has an acceptable credit score, extending the user a credit card if the score suffices.

A user's credit score is the biggest barrier to entry for obtaining a credit card. According to the Consumer Financial Protection Bureau (CFPB), "a credit score is a prediction of your credit behavior, such as how likely you are to pay a loan back on time, based on information from your credit reports," and companies also use these scores to "determine the interest rate and credit limit you receive" on the credit cards.[19] While it is possible for users to take actions in hopes of improving their credit scores, the scores are a culmination of backward-looking factors on users' history. Therefore, factors such as late payments and outstanding debt greatly influence the ability for users to obtain credit cards. Because credit cards are owned by private companies, the government cannot force companies to extend users lines of credit. Overall, users can be

[18] https://www.nasdaq.com/articles/how-to-apply-for-a-credit-card:-questions-youll-be-asked
[19] https://www.consumerfinance.gov/ask-cfpb/what-is-a-credit-score-en-315/

excluded from the credit card space based on their credit scores. This barrier to entry is different than those in the decentralized finance space because here, the user is rejected from entry based on the will of a private entity. Credit cards can be viewed as "exclusive clubs" where users need authorized personnel to grant them entry. Once users have credit cards, though, this means of payment is often viewed as quick, secure, and even helps build credit. User accessibility lies with a user's credit score.

2. Bank Accounts

Access to a bank account is different than access to a credit card because bank accounts are tied to physical bank locations. While users do not need to go to their specific branch of the bank to withdraw funds, the idea of a bank is often tied to the idea of a brick-and-mortar store. This barrier, which can be viewed as both a mental and physical barrier, is an initial hurdle that is not present with either card cards or cryptocurrency wallets, as both these alternatives are digital. In addition to this challenge, there are numerous barriers to entry for opening a bank account. Of the three financial mediums discussed in this paper, bank accounts are the only one with a direct link to a physical location. The idea that there is an actual place to go withdraw funds may sound nice, but these branch locations are not everywhere. For many, bank branch locations are far, therefore making the accounts largely inaccessible on a regular basis. Barr and Blank (2008) conducted research on this very topic and concluded that, "financial institutions frequently require credit checks to open an account, set high minimum account balances, and have high overdraft fees – characteristics that are ill-suited to those living paycheck to paycheck. Few low-cost and easily accessible savings instruments, credit constraints, and higher cost financial products only increase the economic challenges these families face."[20] The factors listed above,

[20] Barr and Blank (2008)

which the authors refer to as 'supply-side' factors, are typical characteristics of banking institutions and are often viewed as discriminatory to lower-income families who do not have savings. All to say, there are real, difficult barriers to entry into the traditional banking space. While there is no direct comparison between this medium and that of decentralized finance because they have uniquely distinct barriers to entry, both present significant challenges for users, especially users of specific demographics and socioeconomic standing. To that end, we now move the discussion to an evaluation of decentralized finance users and the potential market for this financial alternative.

IV. EVALUATING DECENTRALIZED FINANCE USERS

As demonstrated above, there are still real barriers to entry limiting user accessibility to normalized financial services (i.e., bank accounts and credit cards). As such, there is a place for decentralized finance to fill a user gap in the financial market and support the currently "unserved" as well as those who would like to engage in this space for reasons of personal preference. In that regard, it is important to examine the demographics of decentralized finance users. People that are "unserved" by the traditional banking institutions are likely the users that could benefit from cryptocurrencies the most. However, these are the same people that are most susceptible to cryptocurrency's barriers to entry. These are the users that do not universally have access to free WiFi and cannot afford to pay miners higher transaction fees on their exchanges. Therefore, currently, cryptocurrency is not an accessible form of payment for these users daily.

There is some research available regarding cryptocurrencies' owners and users but given the infancy of many coins and decentralized finance at large, the data is incomplete. Of the data that does exist, 2022 research from JP Morgan and Chase found that "usage of crypto is broader

and deeper for men, Asian individuals, and younger individuals with higher incomes."[21] The two graphs below from the JP Morgan and Chase research provide more detail on how different demographic groups (race and income) have different levels of involvement with cryptocurrency.

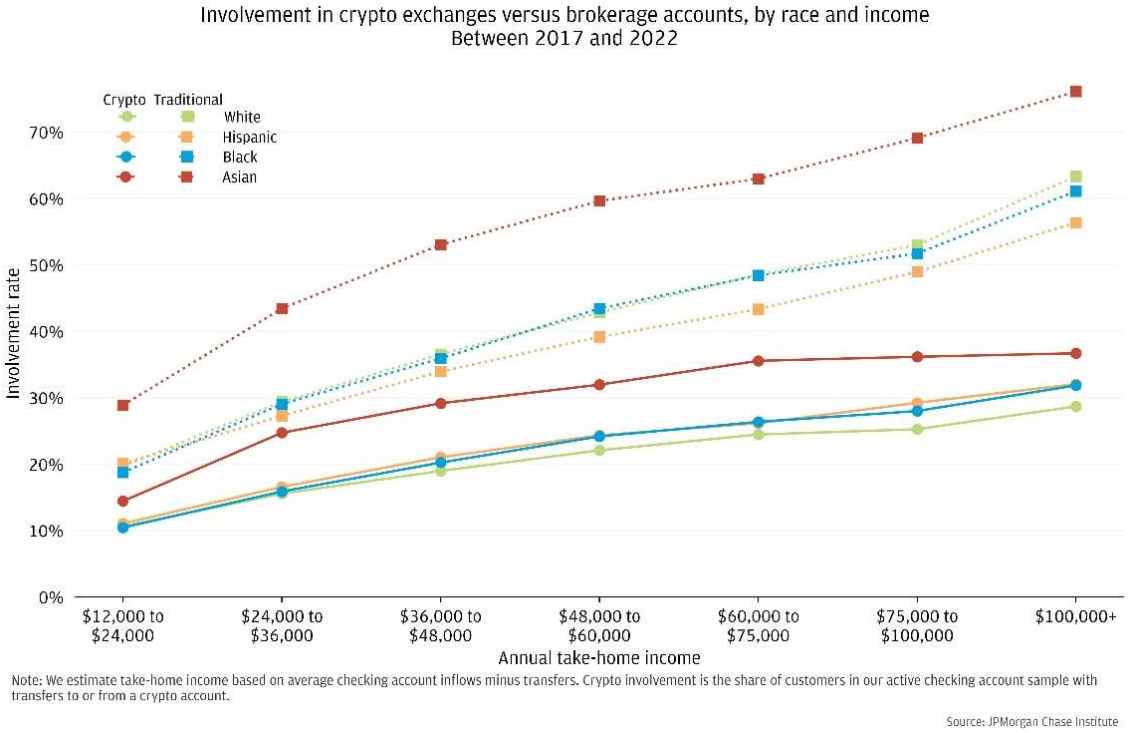

Figure 2: Involvement in Cryptocurrency Exchanges, By Race and Income[22]

[21] https://www.jpmorganchase.com/institute/research/financial-markets/dynamics-demographics-us-household-crypto-asset-cryptocurrency-use

[22] https://www.jpmorganchase.com/institute/research/financial-markets/dynamics-demographics-us-household-crypto-asset-cryptocurrency-use

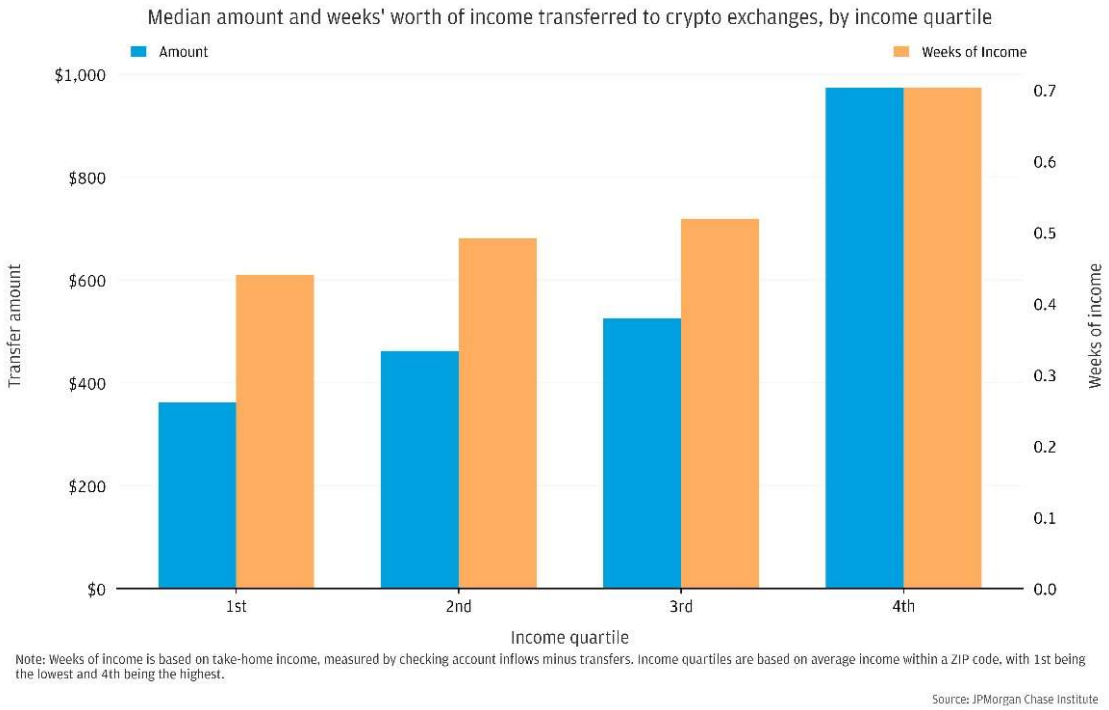

Figure 3: Income Contributions to Cryptocurrency Exchanges, By Income Quartile[23]

None of these demographics represent those who are "unserved" or in need of an accessible alternative to traditional banking. In fact, these demographics highlight systemic inequities in finance regarding accessibility: the same users that are not able to access credit cards or bank accounts do not have access to decentralized finance markets. This point does not need to be true. There are numerous actions that can be taken to foster inclusion and increase accessibility in this space. For example, cryptocurrencies can offer alternative means of rewarding transactions, away from methods that are based on who can offer the highest fee. The decentralized finance market does have the opportunity to be more accessible, but it is not living up to its full potential at the moment.

[23] https://www.jpmorganchase.com/institute/research/financial-markets/dynamics-demographics-us-household-crypto-asset-cryptocurrency-use

Beyond demographics, to successfully utilize decentralized finance, it will be important to better understand the market in terms of size and value. Using this information, decentralized finance could potentially determine a beneficial future state that provides accessibility to all its users, rather than just some (based on factors such as race, gender, income). Identifying the aggregate market value is an indication of how important cryptocurrency is overall, and broken down, determines the importance of each specific cryptocurrency. Using this data, researchers can have a better understanding of the market size in terms of dollar value, the number and type of cryptocurrency exchanges, the countries in which cryptocurrency is used, and the associated number of users in each country. These elements are important to the future of decentralized finance accessibility because they will determine where to address existing user inequities.

V. THE UNCERTAIN FUTURE OF DECENTRALIZED FINANCE

There are many uncertainties about the future of decentralized finance. Every day, cryptocurrency prices are fluctuating (some more than others), new coins are brought to market, and exchanges remain largely unregulated. The decentralization aspect of this market is also coming into question, as large financial institutions – including the big banks like JP Morgan Chase – have made their way into investing in the cryptocurrency space. Assuming that decentralized finance is here to stay, there will continue to be calls for user accessibility globally. To reach its full potential, this market will need to better promote and increase accessibility in the future. To this end, there are a series of questions that will need to be answered. A few are provided below as food for thought. What skills and technology will be necessary to improve accessibility? What does decentralized finance offer to high-income, developed economies and what does it offer to lower-income, developing economies? Do the answers to these questions

differ? How does the influence of traditional financial institutions in this market impact accessibility? Are the pitfalls of technology too great? Can decentralized finance truly be made user-friendly, especially considering the percentage of the world connected to the internet, computers, cell phones, etc.?

Regulation is one element that will determine the future of decentralized finance. Of course, while the "founders" of this industry may be staunchly against government intervention, it is unlikely this trope will hold true for perpetuity. Furthermore, without government regulation, the accessibility barriers present today will remain in place. In my opinion, it is necessary to implement regulation – but only to a certain degree. Defining that "certain degree" is more of an art than a science. On the one hand, if there is no government regulation, there are bound to be people who take advantage of the system (i.e., FTX). These incidents and scandals will likely continue; as this occurs, users will lose trust in the system and leave. Their departure from decentralized finance will hurt the overall market and make an argument of accessibility mute, as no one will want to join the space. However, on the other hand, with too much regulation, the cost of doing business will increase to a degree that will be off-putting to many users. Also, with regulations, new users may want to join the decentralized finance space because they would view these investments as less risky with government oversight. While this could make decentralized finance more accessible, it could also cause harmful congestion to these decentralized systems. In other words, transaction costs and waiting time costs will continue to rise, both of which can have counterproductive consequences for users.

Another element noteworthy of speculative discussion, or at least mentioning, is the introduction of Central Bank Digital Currencies (CBDCs). Numerous countries including India, China, and Australia have introduced CBDC, which is "a digital liability of a central bank that is

widely available to the general public."[24] The introduction of these digital payment methods is counterintuitive to the decentralized nature of cryptocurrency because CBDCs are issued by centralized governments. While many early adapters of cryptocurrency and digital currencies may be opposed to the implementation of CBDC, which does not mean it will necessarily fail; this virtual market has expanded to now include users who are more flexible with how they exchange and utilize currencies. It is currently unclear how the introduction of CBDCs will impact user accessibility because users will still need to overcome some previously described barriers to entry (i.e., use of technology, wallets, etc.). However, because these digital currencies will be state or government issued, there are not likely to be blockchain or mining requirements for ownership. According to an evaluative policy memorandum put out by the United States Government in September 2022, "All should be able to use the CBDC system…The CBDC system should expand equitable access to the financial system. The CBDC system should expand equitable access to deposit and payment products and services, as well as credit provided by banks and other sources."[25] While these are promising words, they should not be taken as true. Both the market itself and the users must accept CBDC for widespread use of these currencies.

[24] https://www.federalreserve.gov/central-bank-digital-currency.htm
[25] https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Policy-Objectives-US-CBDC-System.pdf