
MAIN ISSUES FOR ADOPTION OF CRYPTOCURRENCIES AS PAYMENT MEANS

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Abstract: In our research we have investigated the main issues that drive or limit further adoption of cryptocurrencies, specifically as means of electronic payments. The original intention of Bitcoin, the first decentralized cryptocurrency, was to serve as electronic payment system but it still hasn't (entirely) fulfilled its mission regardless it is sporadically used for payments. Recent studies reveal that the cryptocurrencies and the blockchain, as promising new technology, are starting to have noticeable adoption worldwide, but even with many noted advantages, this technology is not yet matured and still lacks the expected mass adoption, especially in the area of the electronic payments. Bitcoin and many newer digital currencies are more acknowledged and accepted as an investment asset but not that much as a payment method. Regarding the online payment facet of the cryptocurrencies, there are still several issues that need to be addressed in a proper way in order to ensure further adoption of this technology and to successfully compete, or even disrupt, the currently dominant electronic payment systems as digital wallets, banking cards, banking transfers and even cash on delivery. The adoption issues, that we examine in this paper include the following: decentralization, volatility, legislation, trust, security, fees, speed of transactions, scalability, interoperability and energy consumption. Relevant and current literature was studied to identify the main properties of the leading cryptocurrency projects, advantages and disadvantages of the blockchain technology, utilization for electronic payments, adoption drivers and current state of adoption. Additionally, at least 31 different cryptocurrency projects (whitepapers, websites and communities) and several relevant web resources were investigated in order to draw conclusions regarding the main adoption issues. Our findings suggest that crucial issues that still need to be solved in order to achieve wider adoption of cryptocurrencies for payments are (i) the high volatility of their value and (ii) the unfavorable legislation worldwide. The other important issues are mostly technical and since the technology is still in development and not fully matured, there is still room for further improvements before it gets ready for mass adoption. Our research adds to the existing cryptocurrencies and blockchain studies by identifying, summarizing and envisioning possible solutions for the issues for further cryptocurrency adoption. Besides for academic researchers this study may serve as a reference for blockchain developers, cryptocurrency advocates and policy makers.

Keywords: bitcoin, blockchain, cryptocurrency, electronic payments, money.

1. INTRODUCTION

The inventor(s) of the first decentralized cryptocurrency, named as Satoshi Nakamoto, envisioned Bitcoin as “an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party” (Nakamoto, 2008).

Since the introduction of Bitcoin in 2009, more than 6000 new cryptocurrencies based on the new blockchain technology emerged (CoinMarketCap, 2020), of which dozens are specifically trying to address the P2P (peer-to-peer) payments in the same or a similar way as Bitcoin intended to do. The blockchain technology, that is the backbone of the cryptocurrencies, is a type of a distributed ledger (maintained by numerous nodes) that store encrypted, consecutive blocks of transactional data in order to achieve secure, transparent, trusted, fast and low-fee online transactions. Besides as digital money and payment means, other use cases of the blockchain technology include storing value, interbank remittance, trading financial assets and instruments, safe data storage, supply chain management, supercomputing power, decentralized notary, digital identity, voting, crowdfunding, stock share issuing, insurance and many more (Zile & Strazdina, 2018). In this paper we focus on the issues for adoption of cryptocurrencies particularly as a payment method.

Several studies identify the advantages and the disadvantages of the cryptocurrencies based on the emerging blockchain technologies (Dumitrescu, 2017; Golosova & Romanovs, 2018; Vovchenko, Andreeva, Orobinskiy, & Filippov, 2017; Niranjnamurthy, Nithya, & Jagannatha, 2019). The advantages include transparency, speed, low fees, privacy, peer-to-peer payments, security, etc. The disadvantages, on the other hand include high volatility, unfavorable legislation, illicit activities, scalability, high energy consumption etc. There are some other issues that can be perceived as both, positive or negative, depending on the point of view as the decentralization, trust or

irreversibility of the transactions. Proponents of cryptocurrencies argue that the blockchain technology is promising and potentially disruptive for the current monetary system since they offer secure, fast and low-fee payments while bypassing the intermediaries (Giudici, Milne, & Vinogradov, 2020). On the other hand, the opponents observe the cryptocurrencies more as speculative asset than a new type of money (Yermack, 2015) and unnecessary waste of energy (Urquhart, 2016).

Nevertheless, currently leading payment methods for e-commerce worldwide include digital wallets 41,8%, credit and debit cards 39,8%, bank transfers 9%, cash on delivery 4,5% etc. (Clement, 2020), while cryptocurrency share in the online payment transactions are less than 1% , as estimations suggest (Bezovski, Davcev, & Mitreva, 2021). Additionally, researchers found out that less than 10% percent of the world population owns cryptocurrencies (Exton & Doidge, 2018) and only 2% of USA customers used cryptos to pay for goods and services (Foster, Greene, & Stavins, 2019), what further speaks about the low adoption of the cryptocurrencies especially for online payments. On the other hand, the currently dominant electronic payment systems may seem reliable, fast, secure and highly functional but still face some issues as (1) high fees, (2) low accessibility in undeveloped countries, (3) costly, slow and opaque across borders payments, (4) high diversity of systems and low interoperability etc. (BIS, 2019) that, as proponents of cryptocurrencies believe, could be bypassed using blockchain technology. If the current banking system don't get upgraded and digitized soon enough it could be challenged and protentional disrupted by the emerging cryptocurrencies (Laboure & Reid, 2020).

While it is evident that the general adoption of the cryptocurrencies worldwide is steadily rising (Bezovski, Davcev, & Mitreva, 2021), several challenges like volatility, legislation, energy consumption, etc., keep Bitcoin and the other cryptocurrencies from achieving their full potential especially in their utilization as online payment method.

For cryptocurrencies to compete and challenge the current electronic payment means they need to capitalize on their advantages and to overcome the perceived disadvantages. Main issues, as we identify in our research, for adoption of cryptocurrencies as means of payment (positive and negative) include; (1) decentralization and volatility, (2) legislation, (3) trust and safety, (4) performance (speed, fees, scalability), (5) interoperability and (6) energy consumption. The way cryptocurrencies address these issues may lead to higher or may limit their adoption as electronic payment means. Another thing to note, regarding our findings, is that there are many cryptocurrencies that may have similar or significantly different properties and therefore we are elaborate the main issues mainly based on Bitcoin's and Ethereum's prominent features, but we also examine cryptocurrencies that may address certain issues better than these two leading projects.

2. DECENTRALIZATION AND VOLATILITY

The decentralization of the blockchain technology is seen as one of the main and most important features by the proponents of this emerging technology. "Decentralized payment systems inherently exhibit a number of desirable properties: (i) the diffusion of control among stakeholders; (ii) the ability to engage in trusted commerce without a centralized intermediary; (iii) the potential to disrupt the rents extracted by centralized intermediaries facilitating commerce; and (iv) global consistency and transparency on a shared ledger" (Fanti & Viswanath, 2019). On the other hand, opponents of total decentralization perceive decentralization as one of the main weaknesses since it results in volatility and there is no entity to be monitored and considered as liable and accountable by the authorities. They believe that tried, trusted and resilient way to provide confidence in money is an independent central bank whose role includes ensuring that the payment system operates smoothly (BIS, 2018).

Regardless that Bitcoin and Ethereum, the two largest cryptocurrencies, are envisioned as fully decentralized since anyone with suitable hardware can become a miner (permissionless blockchain), they are often criticized that that's not the case in practice because they have "fairly centralized mining processes" (Gencer, Basu, Eyal, Van Renesse, & Sirer, 2018) since they are upheld by several mining pools. While Bitcoin and Ethereum are still perceived as the most decentralized blockchains with largest number of nodes, there are opinions that some projects like Tezos, IOTA, Holochain, Elastos, Dash etc. handle decentralization in a better way (Quora, 2020). Other cryptocurrency projects as EOS with only 21 nodes, NEO with 7 and TRON with 27 nodes, impose different approach/protocol for decentralization where the determined number of nodes that maintain the blockchain (miners) are delegated to known participants (permissioned). These semi-decentralized systems may solve the liability and accountability issue and improve the speed of transactions, but they are not fully decentralized, and still don't solve the volatility issue.

The high volatility, the unpredictable and high changes of prices in both directions, is perceived as one of the main obstacles for mass adoption of the cryptocurrencies especially as means of payments (Mita, Ito, Ohsawa, & Tanaka, 2019). While decentralization may be an indirect cause/consequence for volatility other more direct reasons include but are not limited to lack of intrinsic value, unmaturred technology, small market size, speculations, lack of regulation and institutional capital etc. We may expect that some of these issues may gradually improve, for

example the growth of the market size, entrance of institutional capital, maturity of the technology or presence of revenue/profit sharing tokens that would have intrinsic value like KuCoin Shares (KCS). On the other hand, it is hard to prevent speculations or to assume that the regulation would stabilize the market in the future.

Stablecoins are an approach to address the problem of price volatility where the cryptocurrency price is pegged to another asset like gold or fiat currency like the USD. There are two general types of stablecoins, collateralized (by fiat, commodity or other crypto(s)) and non-collateralized with algorithmic stabilization (protocol or application layer). According to Mita et al (2019), collateralized stablecoins are not suitable for Decentralized Payment Systems since they are not decentralized, on the other side, the non-collateralized stablecoins, while promising, are still in development. The most prominent USD collateralized coins include Tether (USDT), USD Coin (USDC), TrueUSD (TUSD) and Binance USD (BUSD) are highly centralized where the highly dominating Tether by market capitalization (79%) and trading volume (94%) (CoinGecko, 2020), even fails to provide independent audit of the collateral in possession (Vitaris, 2020). Other notable stablecoins include Dai (DAI), pegged to the US dollar but collateralized by Ethereum, then PAX Gold (PAXG) and Tether Gold (XAUT) collateralized by gold. To the best of our knowledge, none of the stablecoins has notable acceptance as electronic payment means yet.

A promising project that intends to solve the volatility issue and to serve as global payment system, on expense on full decentralization, is the Libra project initiated by Facebook. The Libra coin(s) are planned to be collateralized by the world leading fiat currencies and governed by the Libra association members (permissioned) that currently count 26 out of the planed 100 or more (Libra.org, 2019) where Facebook is only one of the members with equal rights avoiding high centralization of power of any entity. The Libra association changed its name to Diem association in December 2020.

3. LEGISLATION

According to a recent research (Bezovski, Davcev, & Mitreva, 2021) it is evident that authorities are becoming aware of the unavoidable existence and the significance of the blockchain technology. They overcame the initial fear of possible illicit activities, started to accept cryptocurrencies as reality and imposed legislation to regulate their status and usage. However, the simplicity of acceptance of cryptocurrencies as means of payment is still questionable. According to our findings, it seems that current legislation, even in countries that legalized cryptocurrencies, is not favorable for accepting cryptos as means of payment as they are accepted as investment assets. While use of cryptocurrencies for payments could be legal, their treatment as commodity, asset or property may bring complexities with taxation and bookkeeping. Therefore, we consider that one of the main barriers, if not the biggest one, for wider adoption of cryptocurrencies as means of payment is the unfavorable legislation and the attitude of the authorities. Positive scenario for cryptos would be that the future legislation changes could be more favorable and could lead to higher adoption or vice-versa, the higher the adoption is - the legislation may become more favorable to accept cryptocurrencies for payments. The only country in the world that accepts Bitcoin as legal tender become El Salvador, where the adoption is still considered as experimental (Pérez & Ostroff, 2021),

Regarding the status quo situation with the worldwide legislation, cryptocurrency projects like Ripple (XRP) and the Diem association, instead of waiting for more favorable legislation, tend to work together with all stakeholders (including the legal authorities) in order to get the regulation right (Sharma, 2020; Libra.org, 2019). Anyway, if the authorities see the crypto payments as treat to the existing monetary and fiscal system, they may not improve the legislation or may even ban cryptocurrencies for payments as China and Russia did.

4. TRUST AND SECURITY

Cryptocurrencies and blockchains are specifically designed to ensure trust in the technology and the system without involvement of third trusted party. This is achieved by a transparent and accessible ledger and precisely defined consensus algorithms. Besides the decentralization, transparency, auditability and reliable consensus algorithm the trust should be also ensured by the security and stability of the system guaranteed by number of distributed nodes resilient to hacking (Nakamoto, 2008). However, these theoretical foundations may be compromised in practice.

The trust in the cryptocurrencies relies, not only on the technology, but also on perception of the decentralization (positive or negative), their legality (acceptance from the authorities) and volatility, issues that we spoke about earlier and currently are not very favorable. Additionally, scams, fraud, phishing, illicit activities and hackings that took place in the domain of cryptos further compromises the trust in this technology. The large blockchains like Bitcoin and Ethereum may be considered as genially safe since they employ large computing power but some smaller blockchains already suffered from the “51% attack” as Bitcoin Gold (BTG), Verge (XVG) and Ethereum Classic (ETC) did (Sayeed & Marco-Gisbert, 2019) where millions of dollars were stolen. Having in mind the difficulty and the expenses associated with blockchain attacks (engaging computing power), hackers direct their

activities toward crypto exchanges, individual cryptocurrency holders (wallets and private keys) and bugs in smart contracts hosted on networks like Ethereum (Orcutt, 2019; Nikolić, Kolluri, Sergey, Saxena, & Hobor, 2018). Regardless that some of the above-mentioned illicit activities are not typical only for the cryptocurrencies and the blockchain, but for the online environment in general, it is evident that further improvement in this technology and its safety is needed in order to attract more users.

5. PERFORMANCE (FEES, SPEED, AND SCALABILITY)

High speed of transactions and low fees are supposed to be among the most important features of the blockchain technology and the cryptocurrencies. Contrary, the two largest cryptocurrencies, Bitcoin and Ethereum during high traffic volume faced congestion and scalability issues that led to low speed of transactions and high fees (Huberman, Leshno, & Moallemi, 2019).

As a comparison, Bitcoin has capability to make 7 transactions per second while Ethereum 11 (or more), what is way far behind the Visa's payment processing system that achieved 47,000 TPS (Vujičić, Jagodić, & Randić, 2018). One possible solution for this issue, regarding the hardly scalable blockchains like Bitcoin and Ethereum, are second layer protocols. The Lightning Network for example, that works on top of the existing blockchains, should enable instant transactions and low fees even when the network is busy (Seres, Gulyás, Nagy, & Burcsi, 2020).

While these second layer protocols that could enable fast and low fee transaction are still in development there are other blockchains specifically designed for scalability, fast transactions and low to zero fees. Ripple (XRP), the third largest cryptocurrency, designed for low fee cross border settlements and payments in general, claims that consistently handles 1500 TPS but it could scale up to 65,000+ TPS (Ripple.com, 2020). Ripple uses own consensus protocol with ≈ 40 validators/nodes and is not a typical blockchain, but a consensus ledger, and is often criticized that is highly centralized. Projects that promise high speed (instant) transactions and zero fees include IOTA and NANO.

Blockchains specifically designed to address the scalability issues, not only for the speed of payments but also the data processing capacity of the blockchain, include but are not limited to Cardano (ADA), Enrold (EGLD), Polkadot(DOT), Cosmos (ATOM) etc. These blockchains use sharding, breaking the database in smaller pieces delegated to different nodes in the system, in order to improve speed and throughput (Burdges, et al., 2020).

6. INTEROPERABILITY

In order to achieve the effect of the network (higher value if more participants join), what could lead to mass adoption, either some cryptocurrencies should become ubiquitous and bear the adoption process; or various blockchains should achieve high(er) interoperability. It is hard to believe that the largest cryptocurrencies Bitcoin and Ethereum, with all issues they face, would lead to mass adoption without the help of other projects especially in the area of the payment processing. It is also hard to believe that the third largest cryptocurrency Ripple or any other existing or new-coming cryptocurrencies could overtake the throne and lead the adoption race alone.

In such diversified surrounding with thousands of cryptocurrency projects, interoperability could play an important role. There are already promising projects that aim to achieve interoperability among blockchain networks (Johnson, Robinson, & Brainard, 2019) and uninterrupted flow of data and exchange of different cryptocurrencies what could draw more users to join, regardless on which blockchain project. As an example, the Chainlink (LINK) project not only aims to achieve interoperability among different blockchains but also intends to bridge the blockchains with external data sources and existing payment processing systems like SWIFT (Khan, 2019). Other notable projects that promise to solve the interoperability problem among blockchains are Cosmos (ATOM) and Polkadot (DOT).

7. ENERGY CONSUMPTION

The Bitcoin's proof-of-work (PoW) consensus protocol is demanding in both, computing power and electricity consumption. This is one of the strongest points for criticizing Bitcoin and other power demanding cryptocurrencies. The estimation only for Bitcoin's yearly electricity consumption range from 14.19 TWh to 63.99 TWh while Ethereum consumes 3.5 times less (Li, Li, Peng, Cui, & Wu, 2019) what is comparable to total electricity consumption in smaller nations like Switzerland with 58.46 TWh or Ireland's 25,68 TWh per year (McCarthy, 2019). As response to these critics, advocates of blockchain technology state that the mining process itself and additionally the application of blockchain technology projects in the electric power industry could help promote energy reallocation, further development of the renewable energy collection, wider access to renewable energy and reshape of the energy market (Li et al, 2019). Anyways, beside the proof-of-work, there are other consensus protocol used by other cryptocurrencies that require less computing power and consume significantly less energy. These protocols include Proof of Stake -PoS (Algorand – ALGO, NXT), Delegated Proof of Stake – DPoS (NANO, EOS,

BitShares- BTS), Practical Byzantine Fault Tolerance – PBFT (Zilliqa – ZIL, Stellar - XLM) and Ripple (XRP), where the last two require “negligible” power (Zhang & Lee, 2020).

In order to cut the high energy consumption substantially, Ethereum plans to move from PoW to PoS by the end of 2020 (Fairley, 2018). On the other hand, if Bitcoin developers fail to find a solution for the high energy consumption issue (de Vries, 2019) could compromise the future of this leading cryptocurrency where other may take over. For example, Bruno Garcia (2018) claims that their NANO coin, that works on DPoS, would spend only 0.024TWh per year, what is more than 1000 time less than Bitcoin.

8. CONCLUSION

Regardless of the promises of numerous blockchain projects to solve the need for cheap, fast, secure, transparent and trusted electronic payments, the expected mass adoption of the cryptocurrencies as payment means is still far behind. While some noticeable movements toward wider adoption of cryptocurrencies, especially as investment assets are evident, it seems that the technology is still not mature and needs further improvements. Additionally, few nontechnical issues need to be addressed in a proper way too, in order to prepare this technology to serve as an efficient mean for payments.

In our research we have investigated and elaborated the main issues that drive or limit further adoption of the cryptocurrencies, specifically as means of electronic payments. The issues we identified as most important include the following: decentralization, volatility, legislation, trust, security, low fees, transaction speed, scalability, interoperability and energy consumption.

Our findings suggest that crucial issues that still need to be solved in order to lead to wider adoption are (1) the high volatility and (2) the unfavorable legislation. Other issues like decentralization, security, low fees, transaction speed, scalability, interoperability and energy consumption are mostly technical in nature and already have sound solutions or projects that intend to solve them in a more efficient way in the near future. The trust in the cryptocurrency as an issue depends not only on the transparency of the distributed ledger but on other issues too, as lack of centralization, security, speed, and especially low volatility and legality.

The way the noted issues are addressed would pave the road for further adoption of the cryptocurrencies in general and specifically as payment means. If we don't see sound solution for the volatility issue and more favorable legislation for accepting the cryptos for payments, we cannot expect improvements in the slow adoption anytime soon.

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