



Can Blockchain and Cryptocurrencies truly be integrated with Banking?

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ABSTRACT

This paper explores the novel technologies of Blockchain and Cryptocurrencies and their potential usage in the banking industry. First, we understand what these technologies are and how they work. Next, we take a brief look at their history before moving on to talk about their applications in banking. Then, we discuss the shortcomings of the current banking system and how blockchain and crypto could potentially help address them. Next, we look at a few challenges that this technology faces in being used for financial purposes. Towards the end, we look at how there could be a future for blockchain and cryptocurrencies in banking.

1. Introduction

Blockchain is one of the most talked about forms of technology in the world currently. Proponents argue that it holds the potential to change the world as we know it, whereas opponents believe that it has more drawbacks than advantages. Cryptocurrency is another topic in the public eye that is widely being discussed, especially after the boom of early 2021.

Many proponents of Blockchain and Cryptocurrency believe that these two innovations can revolutionize the entire system of Banking, which has been known to have several shortcomings of its own. [1] Since 2015, several financial institutions have identified the opportunity and have begun to formulate plans for the blockchain sector. Furthermore, stock exchanges such as the NASDAQ and NYSE (New York Stock Exchange) are conducting in-depth research and NASDAQ even announced the completion of its first securities transaction using the blockchain transaction platform Linq. Various consortiums to help promote the development of blockchain are also emerging with the R3 Blockchain Consortium being the most influential amongst them. This shows that leading financial institutions recognize the upsides Blockchain and Cryptocurrency have on offer.

2. How Blockchain and Crypto work

According to Pilkington (2015), “The blockchain is a chain of transactional records that a subset of network participants (miners) enriches by solving difficult computational problems [8].” Each blockchain consists of a chain of blocks containing data for a set number of transactions and each block is connected to the previous block through a hash number.

Blocks on the network are validated by cryptographic means and each block contains a timestamp, the hash value of the previous block and a nonce - a random number for verifying the hash. This concept ensures the integrity of the blockchain through to the first (genesis) block [6].

Miners fiercely (and anonymously) compete on the network to solve the mathematical problem in the most efficient way, thereby adding the next block to the blockchain [8]. Miners are rewarded for actively verifying, and thus facilitating, transactions by receiving coins or tokens (for example, miners on the Ethereum network are rewarded by Ether).

This is where Cryptocurrency comes in. According to J.H. Short (2014), “Cryptocurrency is a digital medium of exchange – a digital currency. Cryptocurrency can be thought of as digital 'points' - These points, often

referred to as 'coins' can be traded from person to person (peer to peer) to transact value. For value to be transacted, the digital currency itself must have value.”

Cryptocurrencies have no intrinsic value. Their primary value is created by the faith in the technology and applications of each currency. This digital existence of currencies helps detach this form of technology from the government and Bitcoin was initially created to support this libertarian viewpoint.

The non-engagement of government in this entire process brings in issues of taxation and illegal usage which have resulted in strong opposition to the idea of Cryptocurrencies.

2.1 History

The first form of cryptocurrency, Bitcoin, emerged in the year 2009 after the financial crisis of 2008. It was introduced by Satoshi Nakamoto, a group or an individual whose identity remains a secret to this day [4].

But the idea of a currency operating on the principles of cryptography began with David Chaum, an American cryptographer. In 1983 he developed a cryptographic system called eCash, and 12 years later he developed DigiCash - a system that used cryptography to make economic transactions confidential. However, the term 'cryptocurrency' was coined in 1998 after Wei Dai began to think about developing a new payment method based on cryptography and decentralization [14]. But Wei Dai's idea of this virtual currency architecture called b-money was never developed and used as a means of exchange. In fact, no true cryptocurrency came to light until the late 2000s when Bitcoin was introduced [15].

Blockchain was first described by Stuart Haber and W Scott Stornetta in 1991 in their paper titled “How To Time-Stamp a Digital Document”. Their main objective was to develop some sort of technology that could help in time-stamping digital documents so that they could not be backdated or tampered with [16]. In 1992 they incorporated Merkle Trees into the system which enhanced efficiency and helped store more documents in a single block [17].

The technology of Blockchain, however, did not gain any real relevance until Satoshi Nakamoto introduced Bitcoin. Since then, this piece of technology has increased in usage and has been integrated in industries such as Finance and Healthcare.

2.2 Financial Applications

The advancement of FinTech in recent years has been an inevitable trend. If internet finance was FinTech 1.0, then we are currently at FinTech 2.0 which emphasizes revolution in the underlying technology.

According to Ye Guo and Chen Liang (2016), Blockchain is one such technology which can connect to a variety of scenarios in the Finance industry. It can achieve asset digitization and point-to-point value transfer, thereby reconstructing the financial infrastructure.

Private Securities

As is widely known, taking a company public is an expensive process. Working with investment banks, obtaining underwriting services, promoting the issue and the entire documentation process can have a considerable impact on a company's finances.

Now, it is possible for companies to directly issue shares using the technology of Blockchain. The shares can then be sold and purchased in secondary markets which sit on top of these blockchains [5].

Smart Contracts

In 1997, Szabo introduced the concept of Smart Contracts - computer protocols with user interfaces to execute the terms of a contract [6]. This technology aims to eliminate middlemen in the execution of contracts and holds the potential to replace lawyers and banks that are involved in contracts for asset deals. The decentralized platform, Ethereum, was created with the primary objective of enabling developers to build and publish smart contracts. The usage of Smart Contracts will help save time and other resources which are spent in verifying whether the terms of a contract have been completed or not.

Any asset, physical or digital, can potentially be registered with the blockchain. As a result, smart contracts can be utilized by insurers to verify ownership of an asset and trace its transaction history.

R3 Consortium

[23] R3 is a financial firm that leads a consortium partnership consisting of over 100 of the world's leading financial institutions to design and deliver distributed ledger technologies to the global financial markets. It was established in 2014 by industry giants such as JP Morgan, Credit Suisse and Goldman Sachs with the main aim of applying blockchain to commercial markets.

R3 improves cross-border exchange, lowers cost of auditing, and improves the speed of interbank fund transfer and settlement. It has also built a blockchain platform called Corda for financial institutions. According to [24], “Corda is a next-gen blockchain platform that delivers privacy, scalability, and security, making it the DLT platform of choice for financial services and beyond.”

Business Transactions

The financial applications for blockchain can apply to almost any kind of transaction processing [18]. Firms can use public blockchains such as Ripple, or develop and use private blockchains suited to their needs, known as business blockchains. For example, Ripple, a public network created by Ripple Labs, is a platform which facilitates the movement of value amongst financial institutions.

Business blockchains, although private, operate on DLT (Distributed Ledger Technology) and can be used for functions such as trade finance, intercompany transactions, reconciliation and order to cash [18].

3. Shortcomings of the current banking system

After the financial crisis of 2008, the inner workings of the global banking system were exposed and even the largest financial institutions could no longer be trusted. This disaster led to the birth of Bitcoin, taking the world into the age of Blockchain and Cryptocurrencies. In this section I will highlight the major shortcomings of the financial system and how Blockchain and Crypto could serve useful in eliminating them.

Operating Expenses

[10] Traditional banking tends to involve high operating costs; since in addition to having administrative offices, they also have offices to serve their clients in person. This is primarily because the more branches a bank has, the wider its reach, thereby increasing the customer base. Their main operating expenses include rent, security, stationery, pay-roll to employees and plastic used to issue credit and debit cards.

Operating Inefficiencies

Banks are notoriously known for the amount of time involved in settling transactions and performing other actions. Apart from that, some processes require the person's offline presence within 'banking hours' which often coincide with the working hours of other companies and businesses.

Apart from the long time taken, banks also charge high commissions on transactions.

Limitations in Online/Virtual Banking

Although some functions of banking are now available online, they are still very limited. Apart from most activities requiring you to be a debit/credit card holder, there are also certain limits on the number of transactions per day as well as problems in transferring money internationally.

Centralization

Since bank servers are centralized they are susceptible to fraudulent attacks. Centralization also causes a lack of transparency, leaving most of the banks' activities behind the curtains. This lack of transparency has led to several disasters in the past, such as the 2008 crisis [2].

Documentation

Offline transactions involve multiple documents which are mostly paper-based. Storage of these records adds to the operating costs.

Since documentation is paper intensive and manual, it takes a great deal of time for transactions to settle making the process time consuming.

3.1 How Crypto and Blockchain can solve these problems

Banking has been known for its own set of shortcomings, some of which we discussed in the last section. The rise of Blockchain and Crypto could help address some problems with this age-old industry.

Payments

With the help of DLT, Blockchain and Crypto make the process of transactions between peers easier and more cost efficient. Since there is no centralized server and the network is decentralized, your transactions are comparatively more secure. [13]

[2] Blockchain also eliminates the need for middlemen used for verifying and processing transactions, thereby reducing costs and lowering latency.

[13] Public blockchains such as Bitcoin and Ethereum allow users to send currency to anyone from any part of the world. Since the transactions are verified through the 'proof of work' mechanism, third-party costs spent in verifying transactions are cut down.

[13] Transactions through banks take 3 days to settle on average. Bitcoin on the other hand processes and settles transactions in around 10 minutes. [4] In addition, cryptocurrency can be operated for 24 hours a day, 7 days a week throughout the year.

Safety and Security

[1] Since banks store data and process transactions from a centralized network, it is much more dangerous compared to the technology of blockchain. Through blockchain, the data is stored in a decentralized network which can not be easily tampered with. It is secured through asymmetric encryption which ensures safety and security of a user's personal information.

The process of blocks being verified before being added to the chain discussed in '*2. How Blockchain and Crypto Work*' make the network secure from hacks and frauds. [2] The hash/ pointers of the records written on the

Blockchain are immutable and irreversible, not allowing modifications and eliminating risk of fraud. The public ledgers help in increasing transparency.

[4] Cryptocurrency algorithms are more secure and are better than using credit cards. Even though certain measures have been taken in reducing credit card fraud, the system is more vulnerable when compared to blockchain. The system applied by the credit card technology is still not secure as the cryptography technology possessed by cryptocurrencies.

Loans and Credit

[13] Traditional banks and lenders underwrite loans based on a system of credit reporting. Blockchain technology opens up the possibility of peer-to-peer (P2P) loans, complex programmed loans that can approximate a mortgage or syndicated loan structure, and a faster and more secure loan process in general.

In the current loan system if one mistake brings down an individual's credit score below a certain threshold, they can face a tough time recovering from it. In the future, either they won't be able to get loans or the interest charged will be higher.

In most countries, data about customers is concentrated in the hands of a few institutions which makes it easy to manipulate and increases vulnerability

[13] Alternative lending using blockchain technology offers a cheaper, more efficient, and more secure way of making personal loans to a broader pool of consumers. With a cryptographically secure, decentralized registry of historical payments, consumers could apply for loans based on a global credit score.

Documentation

Blockchain eliminates the need for paper intensive work as all data related to the transaction will be available on the network. This makes the system more transparent and manipulation of records more difficult. Online storage of documents is also more cost and time efficient.

Smart Contracts can be used for the company's dealings which require no paper documentation [2]. Contracts can be programmed onto the network itself, reducing manual processing as well as time spent in verifying if the terms have been met or not. [7] The adoption of a smart contract executed within a Blockchain platform removes duplications and possible inconsistencies. These contracts, instead of being programmed on a public blockchain, could be implemented through platforms such as Corda which is a permissioned blockchain.

Customer KYC and Fraud Prevention

Know-your-customer, or KYC, refers to the process that all banks have to carry out for each new customer. It involves the collection of information, identity verification and making sure that all information provided is accurate.

[9] A Thomson Reuters survey shows that banks on average spend USD 50 million on KYC annually, but this figure also goes up to USD 500 million for some banks. [13] Banks can spend up to 3 months on this process, and according to another Thomson Reuters survey, 12% of companies said that they had changed their bank due to delays in the KYC process.

[9] Blockchain gathers information from various authorized sources into one single, cryptographically secure database; this ensures that KYC validation can be quicker, more secure and more effective than current validation systems.

Blockchain based KYC gives individuals more control over their identity compared to traditional methods where all information is controlled by a few organizations. [13] Using blockchain for KYC purposes could reduce personnel requirements for banks by 10%, equating to cost savings of up to \$160M annually. [13] By decentralizing the storage of information, blockchain technology helps prevent a hacker from gaining easy access to all information at once.

4. Challenges faced using Crypto and Blockchain in Banking

While Crypto and Blockchain have a plethora of potential applications in the banking system, they also have their own set of drawbacks.

Cost and efficiency

The Crypto 'mining' process takes up a lot of energy, which has led to public discussions about its harmful carbon emissions. Even Elon Musk who is widely believed to be a proponent of Cryptocurrencies such as Bitcoin and Dogecoin has raised concerns about the environmental effects of using Crypto.

[19] According to a scientific journal Joule, as stated by Reuters, Bitcoin production is estimated to generate between 22 and 22.9 million metric tons of carbon dioxide emissions a year, which is between the levels produced by the nations of Jordan and Sri Lanka.

Apart from high costs associated with mining and its harmful effect on the environment, the entire process is considered to be inefficient. [11] This inefficiency arises because each node on the network performs the same

task as all other nodes in an attempt to be the first one to find the solution. For example, the Bitcoin network, which uses the proof-of-work mechanism to verify transactions, is associated with USD 600 million per year in costs for verifying and sharing transactions. Therefore, individual nodes may work extremely hard but end up contributing very little to the network.

[20] Bitcoin can only handle up to a maximum of 7 transactions per second. [12] Compared to the legacy payment-processing systems which can handle tens of thousands of transactions per second, this value is dwarfed.

Regulation and governance

China has completely banned the usage of Cryptocurrencies, and others such as Russia and Vietnam have made it illegal to use Bitcoin for payments. The world's first cryptocurrency has now been around for over 10 years, but governments worldwide still don't have explicit systems that restrict, regulate or ban the cryptocurrencies.

[4] Fiat money comes under the regulation of the government and is thus safe to use for consumers. But with cryptocurrencies, there are no regulatory authorities to assist you in cases of theft or fraud, which have been on an upwards curve recently.

Regulation of cryptocurrencies is proving to be challenging due to the decentralized and novel nature of the technology. Most governments are still analyzing ways to regulate or ban crypto and very few have released official stances. [3] Due to this uncertainty, most individuals and organizations are refraining from usage.

Overall, it still remains a gray area legally for people around the world.

Security and privacy

While some people believe that no form of technology is completely secure, no one yet has managed to break the encryption and decentralized nature of blockchain [11].

Public encrypted blockchains, which are decentralized and shared on a peer-to-peer network, are impervious to hacking; however, private blockchains with centralized management, such as cryptocurrency exchanges, are very vulnerable to hacks [12]. In total, hackers have stolen nearly \$2 billion worth of cryptocurrency since the beginning of 2017, mostly from exchanges, and that's just what has been revealed publicly [A19].

Apart from hackings of private blockchains, individuals have also been subject to various frauds. In the U.S. alone 82,135 crimes involving cryptocurrencies such as Bitcoin, Ethereum, and other digital currencies were reported [22].

Price Volatility of Cryptocurrency

The following extract from [4] represents the concerns of experts regarding the high volatility and uncertainty associated with Cryptocurrency tokens. *“According to Fama (1970) an efficient market is where past information is available that can fully reflect the prices of its history. Cryptocurrency is said to be a weak form of commodity because investors are not able to predict the future prospect because there is no available information from the past (Urquhart, 2016). This is true since the inception of cryptocurrency has only emerged in 2009, nearly a decade ago. An investment in this short length of time surely has no past records and investors cannot rely on the history to ensure the investment can be profitable. Fry and Cheah (2015) and Urquhart (2016) postulated that, if cryptocurrency had a true form of account and storing value, it would not be so volatile. Such as facing risk of crashes and bubbles.”*

Due to cryptocurrencies being very volatile, they tend to be unsuitable for the general population when it comes to financial transactions, which is a major drawback.

Consumer Confidence and Acceptance

Due to the increasing number of frauds and scams associated with Cryptocurrencies, the confidence of people on the entire technology is bound to be affected in some way, especially the ones who have been subject to this type of activity. According to a Kaspersky report from 2019, the major reason for people not using and/or investing in cryptocurrencies is lack of trust. Trust is something people have in fiat money largely because it is regulated and recognized by governments as official tender, something which lacks in cryptocurrencies. Consumer confidence, or lack thereof, will be instrumental in predicting what the future holds for Cryptocurrencies.

[12] Cooperation between banking and other industry sectors will be required if cryptocurrencies are to be as successful and widely used as fiat. This could prove to be a tough task because of the existing monopolies in currency exchange markets which are largely dominated by central banks.

5. A common future for Crypto and Banking

Blockchain holds the potential to revolutionize the age-old industry of banking by upgrading and transforming the current methods followed. It is based on the principle of decentralization, which is nothing but establishing multiple verifying parties instead of a single one. This alone addresses several drawbacks associated with banking and its lack of transparency.

[1] Almost every financial innovation in the past has been questioned on problems of efficiency, security and regulation and the same can be seen with this form of technology. However, many financial innovations which were highly debated upon earlier are now standard procedures in the industry as their challenges were ultimately resolved. The same could potentially happen with blockchain and cryptocurrencies and it could prove to be a

daunting task. But, history shows that such obstacles have never stood in the way of innovation as they are eventually overcome through collaboration.

According to [7], Blockchain could be used in Big Data by integrating it with large enough NoSQL servers to provide Big Data services. This could open the way for a variety of financial services which are currently considered unfeasible.

Blockchain could help streamline most of the services offered by banks and increase the efficiency of these processes. As discussed in Section 3.1, it has a variety of applications in the banking world and could potentially change it for the better.

6. Conclusion

In this paper I talked about the technologies of blockchain and cryptocurrencies and how they could potentially be used to revolutionize the entire system of banking. While the disadvantages carry a significant weight, the advantages are too many to be ignored. By addressing the challenges to these technologies, banking could become easier, more transparent, more efficient, and more secure. For the people who have difficulty placing sensitive information in the hands of centralized organizations, blockchain could be an excellent alternative.

I feel that these two technologies are here to stay and will change the world for the better.

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