

The Rise of Cryptocurrencies: Exploring the Power of Blockchain

Submitted By:

Sicio, Aaron Paul M.

Icario, David Louis A.

Nacario, Patrick I.

Submitted To:

Prof. Peragrino Amador

I. Introduction and Background

History

In 1991, Stuart Haber and W. Scott Stornetta developed what many today refer to as the blockchain. Their initial project required creating a chain of blocks that was cryptographically secure and prevented tampering with document timestamps.

The system was modified in 1992 to include Merkle trees, which increased performance and allowed for the accumulation of more documents on a single block. However, it is in 2008 that Blockchain History begins to gain significance, largely because of the efforts of Satoshi Nakamoto or his or her organization. Blockchain technology is credited to Satoshi Nakamoto as its creator. There isn't much information available about Nakamoto, who is thought to have worked on Bitcoin, the first use of digital ledger technology.

Nakamoto conceptualized the first blockchain in 2008, from which the technology evolved and found its way into many applications beyond cryptocurrencies. Satoshi Nakamoto released the first whitepaper about the technology in 2009. In the whitepaper, he provided details of how the technology was well equipped to enhance digital trust given the decentralization aspect which meant nobody would ever be in control of anything. Ever since Satoshi Nakamoto exited the scene and handed over Bitcoin development to other core developers, the digital ledger technology has evolved resulting in new applications that make up the blockchain History.

What is Blockchain Technology?

In the simplest terms, Blockchain can be described as a data structure that holds transactional records while ensuring security, transparency, and decentralization. You can also think of it as a chain of records stored in the forms of blocks which are controlled by no single authority. A blockchain is a distributed ledger that is completely open to any and everyone on the network. Once information is stored on a blockchain, it is extremely difficult to change or alter it.

Each transaction on a blockchain is secured with a digital signature that proves its authenticity. Due to the use of encryption and digital signatures, the data stored on the blockchain is tamper-proof and cannot be changed.

Blockchain technology allows all the network participants to reach an agreement, commonly known as consensus. All the data stored on a blockchain is recorded digitally and has a common history that is available for all the network participants. This way, the chances of any fraudulent activity or duplication of transactions are eliminated without the need for a third party.

To understand blockchain better, consider an example where you are looking for an option to send some money to your friend who lives in a different location. A general option that you can normally use can be a bank or a payment transfer application like PayPal or Paytm. This option involves third parties to process the transaction due to which an extra amount of your money is deducted as transferring fee. Moreover, in cases like these, you cannot ensure the security of your money as it is highly possible that a hacker might disrupt the network and steal your money. In both cases, it is the customer who suffers. This is where Blockchain comes in.

Instead of using a bank for transferring money, if we use a blockchain in such cases, the process becomes much easier and more secure. There is no extra fee involved as the funds are directly processed by you thus, eliminating the need for a third party. Moreover, the blockchain database is decentralized and is not limited to any single location meaning that all the information and records kept on the blockchain are public and decentralized. Since the information is not stored in a single place, there's no chance of corruption of the information by any hacker.

Blockchain Characteristics and Components

1. **Ledger:** Any file with a constantly growing record related to the transaction.
2. **Permanent:** transaction means that once the transaction goes inside a Blockchain, it is stored permanently in the record and immutable.
3. **Secure:** Information is stored securely through this technology as highly advanced cryptographic techniques are used to ensure that your information is locked within the Blockchain.
4. **Chronological:** It means every transaction occurs after the previous one.

How does Blockchain work?

A blockchain is a chain of blocks that contain data or information. Despite being discovered earlier, the first successful and popular application of Blockchain technology came into being in the year 2009 by Satoshi Nakamoto. He created the first digital cryptocurrency called Bitcoin using Blockchain technology. Let's understand how a blockchain works.

Each block in a blockchain network stores some information along with the hash of its previous block. A hash is a unique mathematical code that belongs to a specific block. If the information inside the block is modified, the hash of the block will be subject to modification too. The connection of blocks through unique hash keys is what makes blockchain secure.

There are nodes on the network that validate transactions even though they happen on a blockchain. These nodes, known as miners in the Bitcoin blockchain, process and confirm network transactions using the proof-of-work principle. Each block must refer to the previous block's hash for a transaction to be legitimate. Only if the hash is accurate can the transaction proceed. The hash associated with a block will change if a hacker attempts to attack the network and alter the data of any block.

The updated hash won't match the original one, making the intrusion obvious. By reflecting any changes to the chain of blocks across the whole network and making them easy to identify, this assures that the blockchain cannot be changed.

In a nutshell, here's how blockchain allows transactions to take place:

1. A blockchain network makes use of public and private keys to form a digital signature ensuring security and consent.
2. Once authentication is ensured through these keys, the need for authorization arises.
3. Blockchain allows participants of the network to perform mathematical verification and reach a consensus to agree on any value.
4. While making a transfer, the sender uses their private key and announces the transaction information over the network. A block is created containing information such as digital signature, timestamp, and the receiver's public key.

5. This block of information is broadcasted through the network and the validation process starts.
6. Miners all over the network start solving the mathematical puzzle related to the transaction to process it. Solving this puzzle requires the miners to invest their computing power.
7. Upon solving the puzzle first, the miner receives rewards in the form of bitcoins. Such kind of problems is referred to as proof-of-work mathematical problems.
8. Once most nodes in the network come to a consensus and agree to a common solution, the block is time-stamped and added to the existing blockchain. This block can contain anything from money to data to messages.
9. After the new block is added to the chain, the existing copies of the blockchain are updated for all the nodes on the network.

II. Objectives of the Topic

Blockchain technology is a newer technology that emerges to assist us to transition from physical transactions to digital ones. According to Parry and Collomose (2020), Digitalization is changing the way we work, shop, collaborate, and create value. With the ever-developing technology, our society has adapted to be able to function along with said technology, however, they also stated that even though digital technology is crucial in our society, no centralized figure has any control over it, even the government. Knowing this, we as citizens and users should be aware of the possible risks of said technology as well as its benefits. Blockchain, even though still a new technology, has been incorporated in various fields such as healthcare, business, and cyber security. However, blockchain technology still has its flaws and is still not efficient enough to guarantee that it is totally safe and secure. We as a group will discuss both the positives and negatives of blockchain technology and its contribution in our society.

III. Scope of the Topic

What is Cryptocurrency?

Crypto and currency combine to form the word cryptocurrency. While the definition of currency is obvious—it is money—crypto means written in codes or encrypted. Therefore, the definition of a cryptocurrency is a digital asset with monetary worth. It is designed to facilitate simple trading, which is where blockchain enters the picture.

Blockchain technology is used to track every cryptocurrency transaction that occurs. Bitcoin, the original cryptocurrency, came to be equated with the blockchain. Since then, the market has seen the entry of thousands of cryptocurrencies.

Blockchain and Cryptocurrency

The central ledger for a cryptocurrency is called the blockchain, and it typically keeps track of all previous exchanges and activity to verify who owns each unit of money at any given time. A cryptocurrency's whole transaction history is recorded on the blockchain. It is finite in length and contains a finite number of transactions, which inevitably increase over time. Every node of the cryptocurrency's software network has identical copies of the blockchain. Tech-savvy people or groups of persons called miners oversee managing this network of decentralized server farms. Cryptocurrency transactions are authenticated and recorded continuously by miners. Technically, a blockchain currency transaction is not complete until it has been recorded on the blockchain. The transaction is often closed in an irrevocable manner. Most cryptocurrencies lack built-in refund or chargeback features, in contrast to conventional payment processors like PayPal and credit card means of transactions.

While Bitcoin transactions appear secure, there are some characteristics that raise doubts about their veracity. To address these authenticity claims, it was necessary to create a flawless solution that would not only make Bitcoin transactions online secure but also create an impenetrable firewall that hackers can't breach. Blockchain dominated this situation. Blockchains ensured that transparency is essential to all Bitcoin transactions in addition to offering a secure platform. Anyone with access to the Internet can view transactions that have taken place on a cryptocurrency unit since its creation thanks to blockchain technology. Users can now navigate transactions invisibly thanks to this. Additionally, every computer in the entire world can copy the ledger. This indicates that there isn't a single, centralized location where a hacker may use it to alter transactional data.

IV. Uses and Functions

Transactions involving cryptocurrencies are permanently recorded on the base of blockchain. The 'chain' is extended by adding 'blocks,' which are collections of transactions, verify the legitimacy of the transactions and maintain network availability. Each batch of the shared ledger, which is open to the public, keeps track of transactions. Anyone may visit and view the transactions taking place on the main blockchains, including Ethereum (ETH) and Bitcoin (BTC).

Through Blockchain technology, we can create a safe, dependable, and decentralized autonomous ecosystem for a variety of uses, especially for better utilization of existing hardware, infrastructure, and resources. However, there are some drawbacks that are needed to consider such as the high cost of implementation, environmental impact, and storage problems, to name a few.

As mentioned before, cryptocurrency utilizes blockchain technology to add and validate transactions online, providing a decentralized network that in turn creates a safe and secure environment for its users. Here are several benefits as well as drawbacks of blockchain technology in relation to cryptocurrency:

Advantages

1. Blockchain's main advantage is the capacity to carry out any transaction without depending on a third party. Blockchain users feel confident that nobody is tampering with transactions, viewing personal information, or acting in any other way that compromises their security and privacy.

This implies that blockchain-based apps have the potential to provide stronger security than conventional systems, even though the security of such applications depends on how well their developers design secure code. Thanks to blockchain, you can be more confident in your identity and data.

2. Blockchain embeds documents, agreements, or transactions within the system; there are no payment processing or banking fees because it establishes peer-to-peer transactions without third-party approval; blockchain encryptions are more secure against identity theft than traditional payment systems; and it reduces overhead costs because it has no centralized authority or servers to maintain operations.
3. As blockchain has a decentralized network, it is unlikely to cause failure. It is not centralized, instead, being in a distributed form. It saves the data if the network fails as hackers cannot break into the central grid and affect any connected accounts. It also provides better security than regular networks, providing an option of up to 8-character long passwords (numbers and letters are included).
4. Transactions can be processed by blockchain significantly more quickly than by traditional banks. Because of this, companies who use blockchain rather than banks can save a lot of money on costs.

According to a Deloitte report, businesses might save up to billions in banking fees because of blockchain technology. Due to its decentralized nature, blockchain

eliminates the need for large data centers and pricey third-party verification. It also reduces the number of individuals responsible for keeping an eye on the transactions.

5. Blockchain technology offers greater transparency than conventional payment methods like credit cards and cheques, even without anonymity features turned on; you don't need a bank intermediary (or their permission) to know what or to whom you sent or received the money.

Everybody has access to the public ledger that contains the blockchain transactions' records. Everyone can see how much money is in the wallet, but no one can tell who the owner is.

Disadvantages

1. One of the main problems with blockchain technology is how much energy it consumes. Mining requires powerful equipment that consumes a lot of electricity since the rewards require miners to solve difficult mathematical puzzles.

Some blockchains are consequently very expensive to operate, especially for individuals or small businesses. You must pay for your blockchain upfront; changes cannot be made once it is already online.

2. There is a lot of excitement surrounding the initiatives of these businesses to use blockchain. Even though the technology is useless for their industry, businesses employ it and waste their resources, leading to unnecessary rivalry between them. Businesses will be forced to make significant investments if they want to remain competitive.

3. The speed of blockchain technology is another important drawback. Blockchains need miners, or users of powerful computers and specialized software, in contrast to centralized databases, who solve computational puzzles in return for fresh crypto tokens.

Simply said, transactions on the blockchain take longer than those made with cash or credit cards, or other conventional payment methods. If you're considering using blockchain technology as a regular payment method, this may be disheartening.

4. In many regions of the world, regulations for blockchain continue to provide difficulties. Additionally, the usage and implementation of blockchain technology are prohibited by various regulatory requirements in different nations and areas.

Of course, blockchain technology is the wave of the future. However, you must be aware of its drawbacks if you plan to buy it or use it. Technology is still in the early stages of development and is evolving quickly.

5. The amount of data that each block can store varies. Transaction validation becomes extremely laborious and slows as a result. On a blockchain, it is impossible to raise the block size. Ethereum, which is well renowned for its poor network speeds, can have its transaction speed increased with the help of networks like Polygon. The primary issue is still unresolved, even though this may be a short-term fix.

Blockchain technology and cryptocurrency are great innovations both in technology and business applications. The development of blockchain technology today makes it the greatest option for companies looking to benefit from its distributed ledger capabilities. Advantageous as it may be, we still must consider its limitations and risk when implementing the technology.

Given its explosive growth in popularity over the past 10 years, saying that blockchain is the next big thing in technology may be an understatement. Blockchain technology has applications in virtually every sector of business imaginable, including identity management, banking, healthcare, and government. Bitcoin, its most well-known application, is excluded from that.

Each Blockchain block has a unique 32-bit whole number called a nonce, which is connected to a 256-bit hash number attached to it. These blocks are connected to each other using a chain of a cryptographic hash function, which links each block to its previous block. These three components together ensure security in the blockchain. A blockchain is created as a chain of blocks where each of these blocks has some digital information.

Blockchain is distributed, therefore in the event of a public blockchain, everyone gets a copy. As a result, it is very difficult to change the data in the blockchain because doing so would require changing every copy in every location, which is practically impossible. This makes the blockchain distributed and immutable while also preserving transparency because the information in the block is not concealed in any way. Since blockchain has all these characteristics, it guarantees the highest levels of security, which is why it is so well-liked in many applications that place a high value on security and transparency.

Listed below are some of the real-world applications of blockchain technology.

1. **Asset Management**

Blockchain plays a crucial role in asset management, just like it does in the financial sector. The processing and trading of numerous assets that a person may possess, such as fixed income, real estate, stock, mutual funds, commodities, and other alternative investments, constitutes asset management in general. Trading in normal asset management can be expensive, especially when it includes several countries and cross-border payments. Blockchain can be a tremendous help in these situations because it eliminates the need for middlemen like the broker, custodians, brokers, settlement administrators, etc. The blockchain ledger, in contrast, offers a clear and open process that leaves no opportunity for error.

2. **Healthcare**

Blockchain is also incorporated in the field of healthcare with the introduction of smart contracts. Smart contracts are computer programs or protocols that enable automated transactions between parties without needing an intermediary. The terms of the contract are known to all parties, and it is automatically implemented when its requirements are satisfied. Personal health records can be encrypted using Blockchain technology so that they are only available to primary healthcare practitioners with a key. This can be very helpful in the healthcare industry. Additionally, they support the HIPAA Privacy Rule, which guarantees privacy and restricted access to patient information.

3. **Cryptocurrency**

Blockchain's popularity skyrocketed due to cryptocurrency, who hasn't heard about Bitcoin and its tremendous popularity? One of the numerous benefits of adopting blockchain for cryptocurrencies is that it has no geographical restrictions. As a result, cryptocurrency can be used for transactions everywhere. Exchange rates and the possibility that some people may lose money during this process are the only essential considerations. This alternative is superior to regional payment applications.

4. **Internet of Things**

The Internet of Things is a network of interconnected devices that interact with one another, collecting useful data/information and connecting to the Internet. They are objects embedded with sensors, software, and connectivity functions. Blockchain plays a crucial role in providing security to the said systems. The security of an IoT system is only as strong as the weakest link, or device, in the chain. In this

case, blockchain can make sure that the data collected by IoT devices is secure and accessible to only the right people.

5. **Online Identity Verification**

Without online identity and authentication, no financial transaction may be completed online. And this is true for any potential service providers that any user in the banking and financial sector might have. Blockchain can, however, centralize the online identity verification process, allowing individuals to share their identity with whatever service provider they want after just having to authenticate it once using the blockchain. Additionally, users have a choice of identity verification techniques, including user authentication, facial recognition, etc.

V. **Importance and Benefits**

These past few years, blockchain technology has emerged as advanced innovation that have caught the attention of the industry as well as individuals. It provides the potential to bring significant changes in our lives. Blockchain is based on principles like transparency, security, and decentralization. In our rapidly increasing connected and digital economy it is undoubtedly that blockchain plays a major role in addressing problems related to trust, security, and efficiency.

Blockchain increases trust, security, transparency, and the traceability of data shared across a business network — and delivers cost savings with new efficiencies. Blockchain is also known for its ability to have various benefits:

1. **Enhanced Security:** Our data is sensitive and critical, and blockchain has the potential to substantially alter how our critical information is seen.
2. **Greater Transparency:** Without blockchain, each organization must maintain its own database.
3. **Instant Traceability:** Blockchain creates an audit trail that documents the provenance of an asset at every step of its journey.
4. **Increased efficiency and speed:** Using traditional paper-intensive process are time-consuming, prone to human error and always make third party intervention.

So, we might also want to ask, "How industries benefit from blockchain?" As from what we have said earlier, there are several ways in which industries can reap the rewards of adopting blockchain technology.

First is blockchain benefits in supply chains and food chains. Building trust among trading partners, offering end-to-end insight, optimizing processes, and resolving issues more quickly all contribute to stronger, more robust supply chains and better business partnerships. Furthermore, in the event of an interruption, players can act faster. Blockchain can help maintain food safety and freshness while also reducing waste in the food business. Food contamination may be tracked back to its source in seconds rather than days.

When financial institutions use blockchain to replace old processes and paperwork, the benefits include reduced friction and delays as well as increased operational efficiencies across the industry, including global trade, trade finance, clearing and settlement, consumer banking, lending, and other transactions. In a nutshell, we can also say that blockchain benefits the banking and financial industries.

In some ways, blockchains also benefit the healthcare and pharmaceutical industries. In a field plagued by data breaches, blockchain can help healthcare enhance patient data security while making it easier to share records across doctors, payers, and researchers. The patient retains control over access, which increases confidence. In addition, every action taken by pharmaceutical items as they transit through the supply chain is documented. The ensuing audit trail allows an item to be traced from origin to pharmacy or merchant, assisting producers in locating a recalled product in seconds.

In summary, blockchain benefits industries by increasing transparency, improving security, streamlining procedures, and improving collaboration. As blockchain technology advances, its potential impact on sectors grows, opening new opportunities for growth, innovation, and efficiency.

Well of course, we it seems like a sin when we forgot how cryptocurrencies benefits us from our daily lives. Over the past several years, cryptocurrency has gained enormous popularity, but many investors and consumers may be confused by all the fuss. Why would somebody pick cryptocurrencies when their native money is perfectly adequate for the majority of uses? Why would a person buy cryptocurrency?

Using and investing in cryptocurrencies has many benefits. Here are the top five advantages to think about.

1. **Transaction Speed:** If you want to send someone money in the United States, there are few ways to move money or assets from one account to another faster than you can with cryptocurrency.
2. **Accessibility:** Anyone can use cryptocurrency. All you need is a computer or smartphone and an internet connection.
3. **Security:** Unless someone gains access to the private key for your crypto wallet, they cannot sign transactions or access your funds.
4. **Transparency:** All cryptocurrency transactions take place on the publicly distributed blockchain ledger.
5. **Transaction cost:** The cost of transacting in cryptocurrency is relatively low compared to other financial services.

VI. Literature Reviews

Technology Observations

According to Bholane (2021), Cryptocurrency refers to the technology that acts as a medium for facilitating the conduct of different financial transactions which are safe and secure, and it is one of the tradable digital forms of money allowing the person to send or receive the money from the other party without any help of the third-party service.

Technology Literature Reviews

According to Mahdi Miraz, Maaruf Ali (2018), Blockchain (BC) is a technology that powers Bitcoin and is known for its potential to provide improved security and, in some cases, untraceable privacy for various applications, including the Internet of Things (IoT). Both academic and industry researchers are actively exploring the use of blockchain in different fields. One crucial element of blockchain security is Proof-of-Work (PoW), which involves solving cryptographic puzzles to maintain a secure and tamper-proof record of transactions. Additionally, blockchain utilizes a changeable Public Key (PK) to record users' identities, adding an extra layer of privacy. Blockchain has been successfully adopted not only in cryptocurrency but also in diverse non-monetary systems like distributed storage, proof-of-location, healthcare, and decentralized voting. Recent research articles and projects have examined the implementation of blockchain for enhanced security, identified associated challenges, and proposed solutions for creating secure systems using blockchain technology.

Surveys and Technology Evaluation

Research by Monrat, Schelen and Andersson (2019) supports the possibilities and benefits of the blockchain along with its tradeoffs are discussed through a comparative survey study. In addition, the transaction process, system architecture, application areas and consensus mechanisms of blockchain are also explained. There are still many open issues that need to be further researched and analyzed to create more workable and effective industrial applications that can fully benefit from the use of blockchain and achieve the intended goals. Examples of these open issues include security, privacy, scalability, energy issues, and integration with other systems and, more specifically, with regulatory issues. Future work in this field is required to address these issues and close the gaps for more efficient, scalable, and secure blockchain industrial applications.

Features of Cryptocurrency

- 1) Cryptocurrencies are based on blockchain technology and operate through decentralized networks.
- 2) Digital currency is highly secure. The encryption codes protect them.
- 3) Cryptocurrency transactions cannot be undone.
- 4) Their incredible speed is yet another fantastic quality. A transaction is immediately accepted by the network after being initiated, and it is confirmed within two minutes.
- 5) The physical location of the owner is irrelevant to cryptocurrencies.
- 6) Cryptocurrencies are typically kept as assets in online wallets that let users manage and exchange their holdings.
- 7) A distributed ledger and peer-to-peer review are used to construct them.

VII. Summary

Blockchain technology has emerged as a powerful and transformational breakthrough with multiple applications across industries. Its transparency, security, and decentralization principles address critical trust, security, and efficiency concerns. Blockchain's enhanced security features safeguard data integrity and privacy, making it difficult for criminals to breach critical data. Because transactions are stored immutably and shared across the network, blockchain eliminates the risk of fraud. Industries can track the provenance of

assets instantly, maintaining ethical standards and avoiding risks. Furthermore, blockchain boosts efficiency and speed by streamlining procedures, decreasing paperwork, and allowing for faster clearing and settlement.

Cryptocurrency serves as a medium of exchange, a store of value, and a unit of measure. While cryptocurrencies have little inherent value, they are used to price the value of other assets. Bitcoin is a cryptocurrency (means of payment) but it can be seen as a speculative commodity (how much is it trading for), it was launched in 2009 and it is widely considered the first digital asset. Digital assets, also known as crypto assets, are digital representations of value made possible by cryptography and blockchain. Their original intent was to serve as a vehicle for transferring value without the use of a bank or other trusted third-party entity.

VIII. Conclusion and Recommendation

Blockchain technology has emerged as a powerful and transformational breakthrough with multiple applications across industries. Its transparency, security, and decentralization principles address critical trust, security, and efficiency concerns. Blockchain's enhanced security features safeguard data integrity and privacy, making it difficult for criminals to breach critical data. Because transactions are stored immutably and shared across the network, blockchain eliminates the risk of fraud. Industries can track the provenance of assets instantly, maintaining ethical standards and avoiding risks. Furthermore, blockchain boosts efficiency and speed by streamlining procedures, decreasing paperwork, and allowing for faster clearing and settlement.

Given the potential benefits of blockchain technology, it is suggested that businesses investigate and embrace its use. However, while deploying blockchain, it is critical to proceed with prudence. Companies should perform extensive research, identify their specific needs and restrictions, and create a detailed plan for incorporating blockchain into their operations. Collaboration and collaborations among industry participants, technical specialists, and regulatory agencies are critical for developing rules and frameworks that allow disparate systems to operate efficiently and in accordance with regulations. Furthermore, to fully reap the benefits of blockchain technology, firms should spend time teaching their staff about it and its possible uses. Industry can uncover new opportunities, promote innovation, and create more transparent and secure ecosystems by embracing blockchain technology.

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