ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΑΤΤΙΚΗΣ

ΤΜΗΜΑ ΜΗΧΑΝΙΚΩΝ ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ

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Blockchain Disruption and Decentralized Finance

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Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου».

Ο Δηλών
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(Υπογραφή)

ΕΥΧΑΡΙΣΤΙΕΣ

Φτάνοντας λοιπόν στο τέλος ενός πολύ όμορφου ταξιδιού που ολοκληρώθηκε με πολλή προσπάθεια και θυσίες, θα ήθελα και εγώ με τη σειρά μου να ευχαριστήσω όλους εκείνους που με στήριξαν και με βοήθησαν στην εκπόνηση της διπλωματικής μου εργασίας.

Αρχικά θα ήθελα να ευχαριστήσω θερμά τον επιβλέπων καθηγητή μου, κύριο Κόγια Δημήτριο, για την αμέριστη βοήθειά του και την επιστημονική του καθοδήγηση. Όσες φορές χρειάστηκα την βοήθειά του ήταν εκεί άμεσα για να μου λύσει οποιαδήποτε απορία είχα εμπνέοντάς μου σιγουριά για να συνεχίσω το έργο μου. Επίσης, θα ήθελα να ευχαριστήσω τον καθηγητή μου κύριο Παναγιώτη Γιαννακόπουλο για το αμείωτο ενδιαφέρον του και τις κρίσιμες παρεμβάσεις για την δομή της διπλωματικής μου εργασίας.

Κλείνοντας δεν θα μπορούσα να μην αναφερθώ στους πολυαγαπημένους μου γονείς καθώς και στη σύζυγό μου που ήταν δίπλα μου σε όλη τη διάρκεια του μεταπτυχιακού μου και με τη στήριξή τους και την βοήθειά τους εκπλήρωσα έναν ακόμη στόχο μου.

Blockchain Disruption and Decentralized Finance

Abstract

We are currently being overtaken by technological revolutions brought on by a number of novel and inventive technologies that have either transformed or will soon affect the way we live. Blockchain technology is one of the cutting-edge and quickly evolving technologies that we plan to discuss in this literature review. Because blockchain has managed to alter the financial market while garnering recognition as an innovative technology. Blockchain technology has the ability to offer a new basis for decentralized business models by lowering transaction costs, building distributed trust, and enhancing decentralized platforms. Blockchain technology is facilitating the emergence of decentralized financial services in the financial sector, which are typically more decentralized, innovative, interoperable, borderless, and transparent. Decentralized financial services, enabled by blockchain technology, have the ability to increase financial inclusion, improve open access, promote unlicensed innovation, and open up new business opportunities for innovators and entrepreneurs.

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1. Introduction

In recent years, the emergence of blockchain technology has ushered in a new era of disruption and innovation across various industries. One of the most prominent and transformative applications of blockchain is in the realm of decentralized finance (DeFi). Decentralized finance refers to the shift from traditional, centralized financial systems to decentralized platforms built on blockchain networks. This paradigm shift has the potential to revolutionize the way we interact with and participate in financial services.

Blockchain technology, at its core, is a distributed and immutable ledger that enables secure and transparent transactions without the need for intermediaries. By leveraging cryptographic techniques and consensus algorithms, blockchain ensures trust and eliminates the reliance on centralized authorities. This disruptive technology has paved the way for the development of decentralized finance, which aims to democratize financial services and provide greater financial inclusion.

Decentralized finance platforms utilize blockchain's decentralized nature to offer a wide range of financial services and products, including lending, borrowing, trading, asset management, and more. These platforms operate through smart contracts, which are self-executing agreements programmed on the blockchain. Smart contracts automate various financial processes, eliminating the need for intermediaries and reducing costs, while enhancing security and efficiency.

One of the key advantages of decentralized finance is its accessibility. Traditional financial systems often impose stringent requirements, excluding a significant portion of the global population from accessing financial services. However, with decentralized finance, individuals can participate in financial activities using only a smartphone and an internet connection, bypassing the barriers posed by traditional banking systems.

Furthermore, decentralized finance promotes financial autonomy by allowing individuals to maintain control over their assets. Through the use of blockchain technology, users can securely manage their funds without relying on centralized entities. This has the potential to reduce the risks associated with traditional financial systems, such as hacking, fraud, and censorship.

However, the rise of decentralized finance also brings about new challenges and considerations. Regulatory frameworks, scalability issues, and security vulnerabilities are among the hurdles that need to be addressed for widespread adoption. As the industry continues to mature, collaborations between blockchain innovators, traditional financial institutions, and regulatory bodies are crucial for fostering an environment that ensures both innovation and compliance.

In conclusion, blockchain disruption and decentralized finance have the potential to reshape the financial landscape as we know it. By leveraging the power of blockchain technology, decentralized finance platforms offer a more inclusive, accessible, and secure financial ecosystem. As the industry continues to evolve, it is essential to navigate the opportunities and challenges ahead to unlock the full potential of decentralized finance in transforming the way we interact with money and financial services.

2. Blockchain

Blockchain is a specific type of distributed ledger and a way of ordering, verifying and verifying transactions in blocks, and each data block is created by processing transaction information with specific encryption algorithms.

Transactions are made directly between users rather than through a central server and each transaction information is forwarded to all other nodes. Each node in the blockchain has the right to access the entire database and contributes to the calculation and verification of the new block created from the collected transactions. Transactions are made securely and protected in case of breach, revision or repetition. In other words, it is a distributed digital system that enables various transactions to be made, permanently recorded and distributed to a community without the need for a manual registration agreement. To achieve the above, a network of computers maintains and validates a consensus record of these transactions using encryption.

Once a transaction has taken place, its terms cannot be rewritten by any transacting party. Based on the international literature and the various definitions that have been expressed from time to time for Blockchain, some indicative formulations are listed below. According to KPMG, a distributed ledger database called a blockchain keeps track of a continuously expanding list of written transactions that are grouped into blocks for protection against tampering and revision.

A blockchain is a piece of technology that enables strangers to trust a shared record and record of occurrences. There is no requirement for an external agent to serve as an intermediary because this common record, or the universal, is distributed across a network to all participants who use their computers to validate the transactions.

Blockchain is a technology that permits peer-to-peer (P2P) data storage and exchange, according to PricewaterhouseCoopers (PwC). Structured algorithms based on participant agreement allow for the sharing and security of blockchain data. It eliminates the need for middlemen or other reliable third parties when used decentralized. Various encryption algorithms and consensus mechanisms are applied to guarantee the records in the database. It is extremely difficult for any single party to tamper with or delete the records, as they are associated with every written transaction made before them.

Blockchain, according to Tapscott and Tapscott in their book Blockchain Revolution, is a sizable, worldwide distributed ledger or database that operates on millions of devices and is accessible to everyone, allowing anything of value to be moved and stored anonymously and securely. In his book Mastering Blockchain, Bashir discusses two definitions of blockchain:

A layman's explanation that is intended to be understandable by everyone and a technical definition that uses precise terminology (technical definition). The former describes Blockchain as a developing and secure system with shared records, in which each data user maintains a copy of the records. Records can only be altered if all parties involved in a transaction agree to do so. The Blockchain is a peer-to-peer (user-to-user) distributed ledger that is cryptographically secure, immutable (it is challenging for someone to be able to change it), data is added to it in chronological sequential order (append-only), and it can only be updated through a consensus protocol between users.

Blockchain is a software protocol that cannot work without the internet. Blockchain-based systems consist of many pieces, such as software applications, databases and many connected computers known as lodgers (i.e. they host the above). Although Blockchain could be created with different programming languages, Solidity, which is a high-level object-oriented programming language, is the main and most basic programming language for many blockchain developers (Musleh & Muyeen, 2019).

The process by which the blockchain works is initiated by any user and it is a transaction request by that user, which may be for cryptocurrencies, contracts, records or other types of information.

The transaction request is then sent to all users on the network. During the verification process that follows, all nodes verify the transactions through hashes. Once the verification is complete, the transaction is contained in a new block that is linked to the previous blockchain and makes it permeable and immutable. The use of hashes provides an effective method for blockchain security. However, it has been observed that hackers have been able to change information in a single block and then recalculate the hashes of the subsequent blocks in the chain, resulting in problems. To create consensus mechanisms, a number of algorithms are introduced to the process. In essence, the transactions are verified before they are uploaded to the blockchain, ensuring their security (Salman et al, 2019).

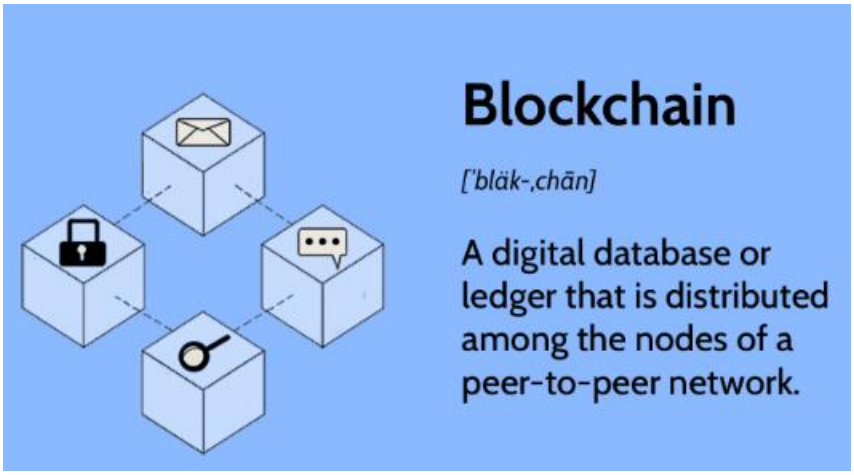

Figure 1: Blockchain facts. Source: Investopedia.com

It's critical to comprehend the terminology used to describe blockchain technology. A block is initially just a collection of transactions that have been rationally categorized and arranged. An event is recorded as a transaction when it is done, such as when money is transferred from the sender's account to the beneficiary's account. A block is made up of transactions, and the size of a block varies depending on the blockchain's kind and layout. Unless it is a genesis block, the block additionally contains a reference to a preceding block. The initial block on the blockchain that is encoded at the precise instant the block was begun is known as a genesis block. The kind and layout of a blockchain affect the structure of a block as well. The block header, timestamp, nonce, Merkle root, and block content, which contains transactions, are the only attributes that are typically required for a block to work.

An exclusive identification or number known as a nonce is generated and used solely once on the network. The nonce is widely utilized in many cryptographic operations to offer encryption, replay protection, and authentication. It is utilized in Blockchain for transaction replay protection and PoW consensus techniques. A Merkle tree's nodes are hashed together to form the Merkle root. Merkle trees are frequently used to quickly and securely validate transactions. In a blockchain, the block header section contains the Merkle root. This means that rather than having to validate each transaction individually, the Merkle tree simply has to have its Merkle root verified (Nakamoto, 2008).

Depending on the role it plays, the term "node" in a blockchain network is used to indicate a variety of activities. To promote consensus and secure the blockchain, a node can propose and validate transactions. In order to accomplish this, a consensus process is used (most commonly followed by PoW). Depending on the type of blockchain being used and the job given to the node, nodes can also carry out additional tasks including validation, simple payment verification (lightweight nodes), and many more tasks. Nodes also carry out the task of transaction signing. To prove their ownership of the object they desire to transfer to another node on the blockchain network, nodes first make the transaction and then digitally sign it using their private keys. Typically, this item is a token or a digital asset like Bitcoin, but it can also be any physical object (Nakamoto, 2008).

The term peer-to-peer means that there is no central controller in the network and that all participants communicate directly with each other. This feature allows cash transactions to take place directly between members without the interference of a third party, such as a bank.

A peer-to-peer electronic cash system would enable internet payments to be made directly from one party to another without going via a banking institution, as Nakamoto explains (Bashir, 2021).

The phrase "append-only" refers to the need that data be added to the blockchain in chronological sequence, thus it is important to grasp what it means. According to this feature, data that has been added to the blockchain can be essentially considered unmodified and is nearly difficult to change. They can be altered, however, in exceptional circumstances if a series of measures taken against the network are successful in capturing more than 51% of its power. Additionally, there may be certain justifiable grounds for changing data after it has been added, such as the General Data Protection Regulation's definitions of the right to be forgotten and the right to be erased (GDPR).

However, these are some individual cases, which are treated separately and require a specific technical solution. A key and integral feature of Blockchain technology is the term cryptography, which is mainly used to offer confidentiality services, which provide the assurance that information is only available to authorized entities. At the same time, it offers integrity, as information can only be changed by authorized entities, and authentication, the identity of the entities and the validity of the messages. There are two types of authentication, that of the entities (participants) and that of the origin of the data. In the same context, participants do not have the right to deny a previous commitment or act if there is indisputable evidence that it happened and

can be confirmed, as they assume their responsibilities, since the acts that affect the security of the system can be attributed to the responsible parties (Bashir, 2018).

Blockchain uses asymmetric encryption to authenticate, verify and validate transactions without revealing the identities of users. Asymmetric encryption was originally introduced by Diffie and Hellman in 1975 and is still widely adopted. Asymmetric encryption is achieved by using two different keys, one public and one private. Each user secretly keeps a private key and the public key is available on the blockchain network. The keys are used to work with messages that support the functions of encryption and decryption. The public key is used as the sender's address when the sender initiates and transmits a transaction message (Upadhyay, 2019).

The message consists of two elements, firstly the message itself and secondly the encrypted digital signature of the message corresponding to the hash value, which is signed by the private key. The recipient must generate the hash value of the message and then decrypt the message using the sender's public key. When both hash values are synchronized, then the transaction is approved. To avoid double spending in the transaction, the blockchain uses a user account transaction history and an incentive process. The transaction corresponds to the hash value, which is digitally signed, and then the network can distinguish that the accounts belong to the user since the transaction history is publicly available (Carr & Marshall, 2016).

The term hash essentially means the digital signature associated with the sender's address. It is a mathematical transformation that converts large documents of text and other characters into a much smaller, fixed string of text and numbers. It is unique to the original document and can be stored on the blockchain in much less space. Hash algorithms are used to make sure that all blocks are well-formed and not tampered with, and thus the blockchain is kept secure and essentially unbreakable. A hash represents the exact content of the original file. Anytime the content needs to be reconfirmed, the same algorithm is run over the file and the hash signature will be the same if the file has not been changed (Bashir, 2018).

A brief mention can be made of the most well-known hash algorithms (SHAs). First, SHA-0 is a 160-bit function introduced by NIST in 1993. SHA-1 was introduced in 1995 by NIST as a replacement for SHA-0 and is also a 160-bit hash function. It should be noted that SHA-1 is no longer considered secure and is being phased out by certificate authorities. SHA-2 includes four functions defined by the number of bits in the hash: SHA-224, SHA-256, SHA-384 and SHA-512.

SHA-3 consists of SHA-3-224, SHA-3-256, SHA-3-384 and SHA-3-512. SHA-3 is a NIST standardized version of Keccak. Keccak uses a new approach called sponge construction instead of the Merkle-Damgard transformation commonly used (Bashir, 2018).

The technique through which new blocks are added to the blockchain is called mining. The network's mining nodes use the blocks' transactions to validate them during the mining process. After being "mined" and verified, the blocks are added to the blockchain, which causes the blockchain to expand. The miner who creates the first legitimate block in various blockchain applications, like Bitcoin, is rewarded. This incentive is provided by the system and typically forms a component of the requirements for receiving funds for financial applications. One of the most fundamental ideas in blockchain technology is mining. It enables nodes to produce blocks that other nodes will verify. The new block gets added to the blockchain database if it is legitimate. The term "mining node" refers to nodes that try to form blocks. In order to receive the reward, the mining nodes work as quickly as they can to validate the transactions and produce a new block (Salman, 2019).

The phrase "consensus mechanism" refers to a technique for authenticating and confirming a value or transaction on a distributed ledger or blockchain without depending on or believing in a centralized authority. Consensus methods are essential to the operation of any distributed ledger or blockchain. According to renowned sociology and social thought scholar Edward Shils, for decisions to be made without conflict, the following three conditions must be met: first, participants must follow and accept the rules and any laws and regulations; second, they must accept the institutions and organizations that carry out these laws and regulations; and third, they must feel a sense of identity and unity, recognized by others. Now that it has been adopted by computer science, the idea of consensus serves to define distributed ledger technology in particular.

On an abstract level, a typical monetary system may be described as a collection of states and transactions that characterize the transition from one state to another. This transition can be thought of as the "transition from one state to another." For the purpose of illustration, a state in a payment system is a collection of all of the accounts in the system together with their respective balances. The movement of money from one account to another is outlined by transactions. Traditionally, the major nodes in the financial system have been financial intermediaries. These nodes are

responsible for controlling the correctness of client accounts, performing duties related to accounting, and ensuring that unauthorized individuals do not have access to an account. This centralized method of accounting was the only alternative that was practical for a considerable amount of time. However, recent developments in technology have made it possible to use an alternate architecture for storing and managing information. In this design, no one entity has complete authority over all of the states and transactions, nor does it have power over any subset of them. Instead, a number of independent entities known as validators each keep their own copy of the state and work together to determine whether transactions are legitimate. The term "Distributed Ledger Technology" was used to describe this design (DLT) (Makarov & Schoar, 2022).

A blockchain is a kind of distributed ledger technology (DLT) in which every transaction is recorded and stored in blocks that are cryptographically connected to one another. The blockchain technology was first implemented, and the most well-known implementation of it now is the cryptocurrency known as Bitcoin. One of the most significant benefits of using DLT is that it does away with the need for a single point of failure. The blockchain's integrity can be maintained even if a single node or a single copy of a record is compromised since numerous copies of the information already exist. In point of fact, the blockchain protocol allows for numerous points of failure or corruption as long as the majority of validators are not tainted. This is the case provided that the majority of validators are not contaminated. In particular, it permits validators to be parties that do not trust one another or even are competitors with one another. Permissioned and permissionless ledgers are the two primary classifications that are often used to categorize blockchains.

These classifications are based on the set of organizations that are permitted to function as validators. A coordinating organization, which may be a commercial company or a consortium of institutions, grants authorization to a group of validators in order for them to participate in a permissioned blockchain. A permissionless blockchain, on the other hand, does not place any ex ante limits on the quantity or identity of the people who may validate transactions.

In addition, blockchains may be classified as either private or public ledgers depending on the use case. Everyone who uses a public blockchain gets complete access to all of the information that is

kept on the blockchain. On the other hand, with private blockchains, transaction observation is restricted to just those parties who have been granted permission (Makarov & Schoar, 2022).

Permissioned blockchains are often used for private transactions, whereas permissionless blockchains are used for public transactions. Permissioned blockchains still need faith in the coordinating authority that certifies validators, which is seen as a fundamental problem by a significant number of crypto enthusiasts. Permissionless blockchains, on the other hand, do not depend on confidence in any specific validator, creating what is sometimes referred to as a "trustless" trust architecture. On the other hand, the "trustless" trust comes at a very high price. Because anyone can become a validator in a permissionless blockchain, the system has the potential to be susceptible to a Sybil attack. This is a type of attack in which an adversary attempts to subvert the system by producing a large number of pseudonymous validators and using them to gain a disproportionately large amount of influence over the consensus protocol. Proof-of-Work (PoW) and Proof-of-Stake (PoS) are the two primary strategies that have been suggested as ways for permissionless protocols to withstand a Sybil assault. (1) Proof-of-Work (PoW) (PoS). The primary goal of both of these ways to verifying transactions is to incentivize validators by providing them with a payment for their work and to make it difficult for potential adversaries to amass a majority stake in the network in order to undermine its integrity. The award is intended to serve as a financial incentive for validators to do their duties in an ethical manner. Typically, the reward is comprised of two components: transaction fees, and a predetermined sum, which is also referred to as a block reward. The block reward is often valued in the local currency of the platform, and it is funded by the production of new coins. As a result, the block reward functions as a type of dilution tax that is levied upon all users (Makarov & Schoar, 2022).

The distributed nature of the ledger has ramifications for the scalability of the underlying network as well. Intuitively, as the ledger grows more decentralized, there will be a greater need to distribute a greater number of copies and spend a greater amount of resources in order to establish protocol consensus and ensure the security of the blockchain. In the early days of Ethereum, Vitalik Buterin, one of the co-founders of Ethereum, notably established the trade-off between decentralization, security, and scalability. This trade-off became known as the scalability trilemma (or sometimes as the blockchain trilemma). The trilemma has garnered a lot of interest, and a

significant number of innovative blockchain solutions are now being developed in order to concurrently accomplish all three of the aims (Makarov & Schoar, 2022).

2.1 Blockchain Keywords - Analysis

Node:

It is the most basic element of the blockchain structure, where data is stored and transactions are passed. The node is responsible for authenticating transactions as well as maintaining and updating the distributed ledger. There are different types of nodes, depending on the amount of data stored and the processing capacity.

Mining:

Mining means the process followed in order to add a new block to the blockchain. Mining confirms to the rest of the network that new unique transactions have taken place and also serves to secure the cryptocurrency system from fraudulent double spending transactions. That is, if a malicious user tries to spend their cryptocurrency to two different recipients at the same time, this is double spending. The blockchain and block mining are there to create a general consensus on the network about which of the two transactions will be confirmed and considered valid.

It is a complex process that requires a significant amount of computational energy and a considerable amount of time. For all the effort miners put in, by offering their computing power, they receive a percentage of the new cryptocurrencies created through this process as a reward. Of course, nowadays it is difficult to mine from a single computer and mining pools are usually created in order to have the processing power needed to carry out the mining.

Miners receive two types of rewards for mining: new coins created with each new block and transaction fees from all transactions included in the block. For this reward, miners compete to solve a difficult mathematical problem based on a cryptographic hash algorithm. The solution to the problem, called Proof-of-Work, is included in the new block and serves as proof that the miner

put in significant computational effort. The process of creating new coins is called mining because the miners' reward is designed with diminishing returns, just like mining precious metals.

Token:

Technically, "token" is just another word for cryptocurrency or cryptoasset. But increasingly it has started to take on some more specific meanings depending on one's context. The first is that the term token can be used to describe all cryptocurrencies except Bitcoin and Ethereum (although they are technically tokens too). The second is to describe certain digital assets that operate on top of the blockchain of another cryptocurrency but can be exchanged or held like any other cryptocurrency.

Cryptocurrency Exchange:

Cryptocurrency Exchanges are websites or services that allow the exchange of digital crypto goods for cryptocurrencies and vice versa, or the exchange of physical money (e.g. dollars or euros for crypto assets) (money-market, 2021).

Fees:

Fees are essentially processing fees that are embedded in the networks that hold the cryptocurrencies. In addition, third-party services such as exchanges, trading apps and ATMs charge their own fees - commissions. The more popular a blockchain system becomes and the more you use it and especially the more you use it, the more its parity rises, the higher its fees will rise (Vigna, 2021) and they are:

- Deposit Fees refer to commissions that the platform withholds every time you want to deposit cryptocurrencies or money to it.

-The Withdrawal Fees refer to commissions that the platform withholds every time you want to withdraw cryptocurrencies or money from it.

- Trading Fees are the commissions that the platform charges its customers every time they make a trade.

Fork:

It is a blockchain that along the way at some point splits into two and follows parallel directions. A fork, is an operating system operation that creates an alternative version of the blockchain, allowing two chains to run in parallel in different areas of the network (money-market, 2021). We have two types of Fork:

a) Accidental forks

A new block may occasionally be mined simultaneously by two or more miners, as a result an unintentional fork. When additional blocks are added to one of the chains, the issue is resolved. When it occurs, the network stops working on the shorter chain and resumes work on the longer chain.

b) Intentional forks

Blockchain engineers utilize this kind of fork to implement protocol modifications. For instance, programmers might create an intentional fork in order to increase block size, decrease block time, or even build a completely different consensus process.

Altcoin:

Altcoin (Alternative Coin) means any cryptocurrency other than Bitcoin. That is, any cryptocurrency founded after Bitcoin in 2009 can be considered an Altcoin. Yes, they share common features with Bitcoin, but in many ways they are different. For example, many Altcoins are built on a different technology (blockchain) than Bitcoin. Different functions and consensus mechanisms can create an altcoin. Depending on these variations, altcoins can fall into more than one category.

2.2 Blockchain Applications

In the last decade blockchain technology has become widespread in the IT and computer industry. The benefits and risks of using this new technology has been the subject of study by many researchers. The main benefits are set out below.

Today we rely on powerful intermediaries to establish trust and verify identity in financial transactions. These intermediaries are the ultimate "arbiters" for access to basic financial services, bank accounts and loans (Weston, 2022).

Blockchain completely eliminates, trust in certain transactions. This technology, will also allow peers, to create identity that is verifiable, robust and cryptographically secure and establish trust when it is required. (Authentication of Identity and Value). Also, every day, money is transferred in the financial system all over the world.

Blockchain is becoming the common standard for the circulation of any value - cash, stocks, bonds and securities - in large and small batches, over distances near and far, and in places known and unknown. Thus, this technology can move value at much lower cost, with greater speed and, most importantly, enhance economic growth (Moving Value). Financial institutions act as "warehouses" of value for people, institutions and governments. For the average citizen, a bank stores value in safes or savings accounts. For large institutions that want liquidity with the guarantee of a small return on their cash flows, so-called risk-free investments such as mutual funds or Treasury accounts will feel the big change. Individuals need not rely on banks as primary stores of value, but with blockchain technology they will have a more efficient mechanism to buy and hold risk-free financial assets (Store of Value). Further, the above institutions facilitate the issuance of credit such as credit card debts, loans, private bonds, government bonds and bills. The business activity on lending has created a plethora of firms engaged in the evaluation and approval of all such lending services.

In blockchain technology, anyone can transact and approve a traditional loan directly, reducing the risk and speed of issuance. Consumers can be accessed directly from nodes in the blockchain. This is a very important benefit for entrepreneurs around the world (Lending Value). Trillions of dollars in financial assets move around the global markets every day. Buying or selling assets within the financial sector are done for the purpose of investment, distribution and profitability among customers. The blockchain reduces transaction execution time from weeks to minutes and seconds. This creates opportunities for all parties involved to prosper more easily (Exchange of Value). Finally, book value is the visualization of the activity of each business which acts as a transfer of financial information between businesses. Traditional asset valuation methods will not be able to survive with the evolution of this technology. New methods will be applied in the era of

Blockchain so that shareholders of each company will have a complete picture of each company's financial actions (Accounting Value). According to a report in the Financial Times, seven major European banks have commissioned IBM to create a blockchain-based platform to be used in trade finance matters. Deutsche Bank, HSBC, KBC, Natixis, Rabobank, Societe Generale and Unicredit are to use this technology in the field of cross-border transactions between SMEs.

Blockchains (blockchain technology) are transforming key sectors of economic life. Companies in various sectors, from financial institutions to energy and from healthcare to food, are beginning to be attracted to this technology, seeing opportunities to reduce costs, share information more efficiently and securely and introduce new products quickly. As an example, the new technology is being applied in the following areas:

Food:

The French multinational food company Carrefour is using blockchain technology initially for a range of chicken with the intention of extending it to other food products such as eggs, cheese, milk, oranges, tomatoes. As explained by the company's general secretary and head of food quality and safety, Laurent Vallee, "it is the first innovation of this type in Europe and will provide consumers with guaranteed and complete transparency when it comes to the traceability of our products. Each product label will carry a QR code, which will be scanned by consumers via smartphones and will provide them with all the necessary information about the product and its journey to the shelf."

Shipping:

Maersk, the world's largest shipping company, has completed a trial of using a chain of blocks to track its cargo. The trial involved not only the above company but also third parties such as Dutch Customs and the US Department of Homeland Security, all of whom monitored containers remotely. Cryptographic signatures make it more difficult to tamper with the labels while the cargo is in motion, resulting in a reduction in transit time.

Banks:

The banking industry consists of slow systems that take hours and even days to validate basic transactions such as selling shares and transferring money. The use of blockchains by banks will result in an increase in the speed of banking services and intermediaries will no longer be necessary. Thus, banks can save several billions every year by minimizing settlement time, "settlement fees" and "cross-border" payments. Already many banks are considering using block chains to convert the SWIFT system, which is used for global interbank transactions.

Keeping registers:

Since, blockchain technology is essentially a new way of recording and storing information, in such a way that an interlinked data chain is created, preventing duplicate entries, bad entries, etc. its application in maintaining registers such as land registry, company registry, tax registry would be significant. The technology could also be applied to company accounting records, as it would significantly reduce the possibility of errors and ensure, at least to a greater extent than current practices, the integrity of the records.

Health services:

The use of blockchain technology in health services help in creating health records with all the historical data and history of everyone. The doctors go to this universal health record to look up e.g. blood group. So, the patient has an accurate picture of who requested and holds their medical information.

Fair enough:

All kinds of agreements - from property sales to business purchases to employment contracts require lawyers and courts to enforce. Plus, more and more companies are experimenting with smart contracts that execute themselves. A blockchain system can, for example, release security money as soon as a party transfers a title to property.

Cloud computing:

Cloud computing, is a wide range of internet services that assist business operations. It includes servers, data warehouses, networking, databases and software applications. The blockchain system can greatly improve functionality or performance due to its unique features. With the blockchain several computers can work simultaneously on one task, such as data processing or storage, which can shorten the entire operation's duration and speed up data processing and uploading. No central server for managing data, so no risk to lose your data, as multiple copies of the data are present on multiple nodes.

Supply Chain Management:

Blockchain is well suited for tasks like real-time tracking of items as they move and change hands across the supply chain because of its immutable ledger. The use of a blockchain expands the possibilities available to businesses that deliver these items. Entries on a blockchain can be used to queue up events with a supply chain – distributing commodities recently received at a port to different.

Insurance:

Smart contracts are the most significant blockchain use for the insurance industry. Customers and insurers can manage claims in a clear and secure manner thanks to these contracts. Since the blockchain would reject numerous claims on the same accident, all contracts and claims could be stored there and verified by the network. This would eliminate any claims that were invalid.

2.3 Blockchain & Cryptocurrencies

Modern cryptocurrencies were developed in 2008 using the Blockchain concept in conjunction with a number of other technologies and computational ideas; the Bitcoin network debut in 2009 helped this technology gain widespread recognition. The development of various cryptocurrency systems, including Bitcoin and Ethereum, has been made possible by blockchain technology. As a result, Blockchain technology is frequently seen as being connected to the Bitcoin currency or even other cryptocurrency products generally.

The technology is being investigated for use in a number of different economic areas, though it is available for a larger range of applications. It might be challenging to comprehend the components of Blockchain technology due to its reliance on distributed networks and cryptographic primitives.

To comprehend a complex system, each component can be easily explained and used as a building block. Informal definitions of blockchains include: Blockchains are distributed digital structures made up of blocks of cryptographically signed transactions. Each block is validated and given a consensus decision within the context of a transaction before being cryptographically linked to its predecessor. Older blocks can no longer be modified as new blocks are added.

It is true that there were other electronic cash systems in existence before Bitcoin (such as ecash and NetCash), but none of them were able to achieve widespread adoption. Bitcoin operates in a distributed fashion thanks to the usage of a Blockchain, meaning no single person has sole authority over the digital currency. Its key benefit was that it made it possible for users to transact with one another directly without the need for a third entity to mediate the transaction, like a central bank. Additionally, it made it possible to offer new encryption guidelines in a structured manner to users who successfully post new blocks and maintain copies. In Bitcoin, these people are known as "miners." Automated payments to "miners" made it possible for the system to be managed decentralized rather than centrally. A self-policing technique was developed using a Blockchain and a consensus maintenance policy to guarantee that only legitimate transactions and blocks were added to the Blockchain framework. The Blockchain, for instance, permitted users to assume a pseudonym when using Bitcoin. Users are therefore not identifiable, but their account IDs are not. All transactions are also openly accessible. Due to the ease with which accounts may be formed without the need for identity or authorization, Bitcoin is now able to provide a form of pseudo-anonymity.

These features offer a level of confidence between the parties without requiring prior knowledge of the other party as a user in permissionless Blockchain networks, which permit anyone to create accounts and participate anonymously. This trust may enable direct interactions between people and businesses, which may result in quicker and more affordable transactions. These features contribute to enhancing user trust in a Blockchain network where access is more strictly regulated (referred to as licensed Blockchain networks).

The language used to describe Blockchain technology differs depending on the application.

The well-known "Cryptocurrencies" provide a way to reward Blockchain users. Initial Coin Offerings (ICOs) have developed into a useful technique for raising funds. The overall plan is similar to parties exchanging bonds in a financial exchange, except in this situation, customers also become investors.

Since there would be no way to keep track of these exchanges without the Blockchain, cryptocurrency needs to "operate" on it. The market value of digital currencies increased significantly, we had $18 million in 2017, $800 in 2018, $826.6 in 2020, $910.3 million in 2021 and estimated to grow to $1,902.5 million in 2028.

Figure 2 Source: blockzeit.com

The top 10 cryptocurrency list currently trading and their market prices as of January 2023.

Name	Market Cap (in USD)

Bitcoin	$452.1 Billion
Ethereum	$200.0 Billion
Tether	$70.9 Billion
BNB	$47.9 Billion
USDC	$42.4 Billion
XRP	$19.3 Billion
Cardano	$12.6 Billion
Dogecoin	$10.8 Billion
Polygon	$10.7 Billion
Binance USD	$10.6 Billion

Table 1: Top 10 cryptocurrencies. Source: forbes.com/advisor/

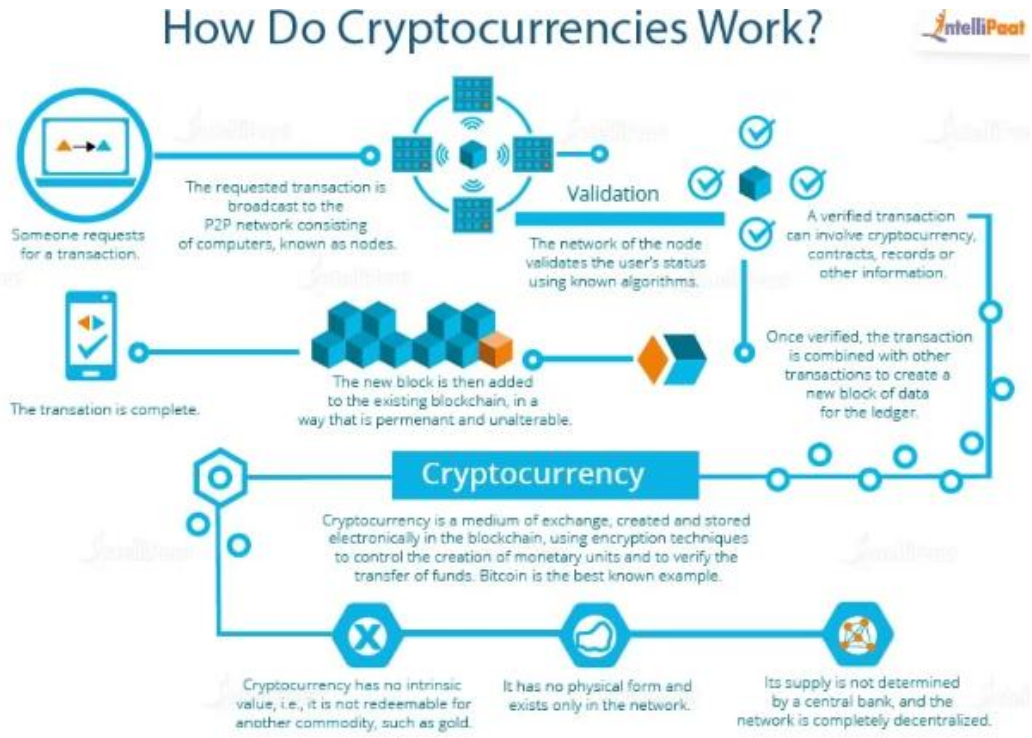

Figure 3: How do cryptocurrencies work? Source: https://intellipaat.com/blog/tutorial/blockchain-tutorial/what-is-blockchain-cryptocurrency/

Bitcoin (BTC)

The intriguing aspect of the first cryptocurrency, Bitcoin, which was invented in 2008, is that no one knows its creator.2017 (R. Vinga).

The most well-established digital currency, Bitcoin boasts the largest network of engineers and financial specialists working to enhance its development.

- The official economy takes Bitcoin into account. Many businesses have begun dealing using Bitcoin, including Bloomberg, Microsoft, Overstock.com, Expedia.com, and many more.

Negative characteristics of Bitcoin: Time scaling in transactions for Bitcoin is extremely challenging. A Bitcoin trade typically takes nine to ten minutes, and the system can only handle seven exchanges per second.

- The "mine," a key activity for any digital currency, has advanced toward intense concentration. Only highly expensive, extremely advanced equipment that makes use of computer power may currently be used for bitcoin mining.

- Bitcoin transaction costs are likewise at an unprecedented high level.

Ethereum (Ether)

After Bitcoin, Ethereum is the most lucrative cryptocurrency. It was created in 2015 by Vitalik Buterin and is much more than just digital money. Ethereum is a cryptocurrency platform built on the Blockchain with the aim of developing decentralized applications.

Advantages of Ethereum:

Advantages of Ethereum Compared to Bitcoin, Ethereum exchanges more quickly.

Negative characteristics of Ethereum:

- Like Bitcoin, Ethereum also has tough challenges with adaptability. However, it still relies on an antiquated method of exchange verification called Proof-of-Work. Ethereum merely provides linguistic support.

Tether (USDT)

Tether's origins may be traced back ten years to J.R. Willet's efforts to create alternative cryptocurrencies based on the Bitcoin technology. Willet put this concept into practice with Master coin, and one of its founding members would go on to co-found Tether in 2014.

Advantages of Tether:

Tether (USDT) is a stable coin, which means it's backed by fiat currencies like U.S. dollars and euros and theoretically maintains a value equal to one of those denominations, unlike certain other types of cryptocurrencies. As a result, investors who are cautious of the severe volatility of other coins choose Tether because its value is theoretically expected to be more stable than other cryptocurrencies.

Negative characteristics of Tether:

Anonymity feature. If someone wants to open an account and purchases USDT, needs to provide various documents confirming the buyer's identity.

Cardano (ADA)

Charles Hoskinson founded Cardano, and he's also a co-founder of Ethereum. Cardano was introduced in 2017 with the aim of enhancing the capabilities that Ethereum initially lacked.

Advantages of Cardano:

One of the eco-friendliest blockchain platforms is Cardano. Hoskinson asserted that Cardano is 1.6 million times more energy-efficient than bitcoin in a 2022 interview with Forbes.

Negative characteristics of Cardano:

It is still a young network that serves as more of a research project than it does real-world utility comparable to today's top blockchains like Ethereum, it is also slow to release new features and updates and this can be frustrating for users who are looking for quick progress and innovation.

Avalanche (AVAX)

In September 2020, the open-source, programmable smart contracts platform Avalanche has been released. Avalanche promises to offer a scalable blockchain solution that is quicker and less expensive than earlier layer-1 smart contract technologies.

Advantages of Avalanche:

Fast transaction processing times. Avalance claims that the transactions (4,500 transactions per second) are faster than Ethereum (30 transactions per second).

Negative characteristics of Avalanche:

The minimum amount required to stake to become a validator is 2,000 AVAX.

Uniswap (UNI)

Uniswap is the largest decentralized trade mechanism running on the Ethereum blockchain and was introduced in 2017. Learning how to utilize the Uniswap app doesn't take long because of how user-friendly it is. Connecting a crypto wallet, exchanging one cryptocurrency for another, or adding your cryptocurrency to a liquidity pool is simple.

Advantages of Uniswap:

Trading or earning through liquidity.

Negative characteristics of Uniswap:

Risk of impermanent loss with liquidity mining.

Binance Coin (BNB)

The native cryptocurrency of the Binance exchange, used for trading fees and other transactions on the platform. BNB was created in 2017 by Binance as an ERC-20 token on the Ethereum blockchain, but it has migrated to its own blockchain, called Binance Chain.

Advantages of Binance Coin:

BNB is a desirable utility token since it can be used for many different transactions inside the Binance ecosystem, like paying for trading fees and listing fees.

Negative characteristics of Binance Coin:

Although Binance Coin can be used to pay for trading fees, purchasing goods and services from select merchants, the use cases are still limited compared to other cryptocurrencies.

2.4 Blockchain in Finance

About ten years after the global financial crisis (GFC), a new financial industry that applies technology to improve financial operations (also known as FinTech) began to shake the global financial community. It is one of the most innovative, disruptive and enthusiastic phenomena since

it is reshaping the way each of individuals, businesses and financial institutions interact financially with each other. Indeed, it has succeeded in making the financial industry see it as a new post-crisis paradigm that revolutionizes the traditional concept of financial service delivery and its regulation.

Taking advantage of new opportunities arising from digital technologies, FinTech is a widespread industry that is growing in many different areas, from payments, to P2P lending and equity finance, to cybersecurity.

Financial technology, "FinTech," is more particularly the use of software or other technological tools to support the financial sector. The phrase was first used in the early 1990s and although it was first only used in relation to the financial sector, it quickly began to be used in other extremely diverse industries. Since early 2014, the industry has drawn the interest of regulators, business leaders, consumers, and academics. Initially associated with Bitcoin's distributed ledgers, blockchain in FinTech has recently caught the interest of practitioners and scholars (Du, et al, 2019).

Due primarily to the advancement of blockchain technology, financial institutions and other market participants are now backing FinTech and the necessity of academic research given the consequences of this technology.

FinTech is described by Rebecca Menat (Chisti, S., 2016) as a recent wave of businesses that are altering how consumers pay, transmit money, borrow, lend, and invest. The top FinTech hub at the moment is London, which is followed by New York, Paris, Hong Kong, and Singapore. Financial innovation has been sparked by the financial crisis, which decreased public confidence in institutions. Through platforms and mobile apps, fintech has evolved to offer new financial services at cheaper prices. Particularly, FinTech businesses provide technology, trust, and transparency. FinTech advances like peer-to-peer lending and crowdfunding make it simpler for people to get loans and increase their investment opportunities. As a result, FinTech aspires to enhance its financial services by implementing cutting-edge technologies in order to compete with conventional financial techniques and enhance financing in the market.

FinTech aims to improve financial services to the general public through the use of smartphones for mobile banking, investment services and cryptocurrencies. Already, there is a sustainable upward trend in the number of FinTechs. The FinTech sector attracted over $107.8 billion global investment in 2022 compared with $13.1 billion in 2016, nearly eight times the investment made six years earlier, reinforcing the belief that FinTech will disrupt the banking system. An essential part of FinTech is open banking. The latter uses open source technology to enable third-party developers to build applications and services around financial institutions and improve financial transparency for account holders.

In open banking, data is shared through application programming interfaces (APIs) between two or more unconnected parties to deliver enhanced capabilities to the market. APIs (Application Programming Interfaces) have been around for decades, but have been used for sharing information rather than transferring funds. What is different today is that APIs are used to transfer monetary balances. In an effort to promote its development and use in innovative online and mobile payments through open banking, the European Parliament adopted a revised Payment Services Directive (PSD2) in 2015. Today there is already a large number of the world's population where they do not have access to a bank account or other type of contact with financial institutions This exclusion usually refers to either the lack of a current account or lack of access to financial institutions.

FinTechs are coming to fill this gap by providing money services via mobile phones. One such application is Agent banking, where it involves a financial service provider engaging third parties, such as stores, gas stations, and post offices, to provide financial services on their behalf. The question that now arises is how Blockchain technology can help and enhance the FinTech sector.

Blockchain technology has been heralded as the next big revolution in financial services. Some of its potential uses may indeed bring huge benefits to the industry and give birth to a whole new generation of services. The blockchain enables the development of immutable transaction records that are visible to all network users. A blockchain is a database made up of many "chained" blocks, each of which records one or more transactions, or modifications to the list of asset owners. Through a consensus mechanism, users of the blockchain network agree transactions are valid before adding new blocks to the existing chain. A network that is "completely peer-to-peer, without

any trusted third party," such as a government organization or financial institution, can be created thanks to the technology.

The potential uses of blockchain in the financial markets are numerous, despite the fact that everything is still in the early phases of development. Since the blockchain has been used most extensively in the bitcoin ecosystem, the financial technology and larger financial services communities are becoming increasingly interested in this technology.

Businesses that presently depend on expensive intermediation, like the financial services industry, could benefit greatly from blockchain technology. Any implementation, though, will come with its share of difficulties. The Payments and Markets Commission is one of the regulatory and policy-making bodies. The issues that may arise from potential blockchain uses are now being considered (Bank for International Settlements, 2017). The following are some possible uses for blockchain technology:

• Digital assets. Every time an event is traded, physical assets (such as real estate, stock certificates, gold, etc.) need to be thoroughly verified. As a result, each transaction takes longer to complete and settle. But for trading and record-keeping reasons, DLT can transform tangible assets into digital ones. Such digital assets might effectively serve as online financial instruments that trade hands each time the owner of the asset listed in a ledger changes (Zhang & Gourley, 2009).

• Digital coins. We are already in the era of real currencies being used in internet banking, payments, and transactions. Different types of cryptocurrencies have been used for actual transactions in recent years. Cryptography is the foundation of cryptocurrencies, and it is used to create transactions and validate their value. They are not supported by the central bank and run independently of it. Some central banks are experimenting with releasing digital fiat currencies backed by the government, including those in China, the UK, South Africa, and the Netherlands (Frankenfield, 2020).

• Digital record keeping. The fact that blockchain keeps a record of every transaction's audit trail as well as the identities of the people involved is one of its fundamental advantages. Blockchain blocks will produce records that are uniform, unchangeable, and simple for stakeholders to access if they are properly planned and implemented.

• Added transaction security: Financial institutions are frequently the target of fraud. Particularly when they go through banks and payment processors, digital payments reduce the danger of having their information stolen.

• Automation through smart contracts. Smart contracts as a use of blockchain are legal contracts written in computer code that are automatically executed when particular circumstances, described in the contract, are met in order to fully achieve their potential to be realized through blockchain technology. As a result, distributed ledgers can incorporate smart contracts enabling self-execution based on the data in the ledger. As a result, procedures that presently require manual intervention might be able to be automated as a result.

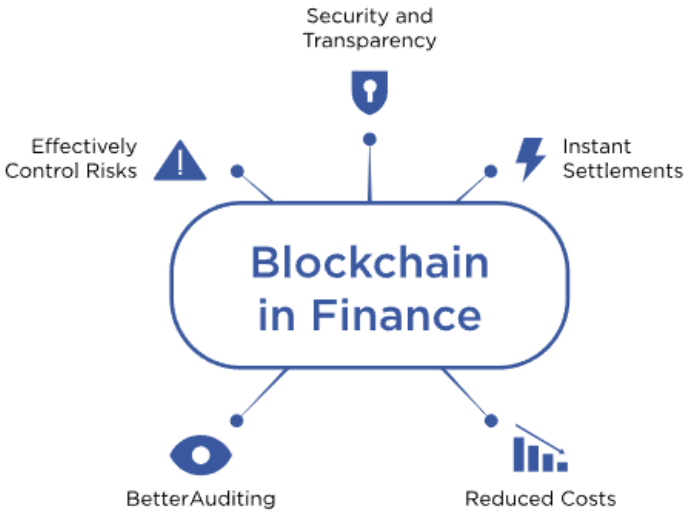

Figure 4: Blockchain in Finance. Source: https://www.leewayhertz.com/10-use-cases-of-blockchain-in-finance/

2.4.1 Fintech Challenges

The role of Fintech, as shown by the analysis so far, through the continuous development of technology, will be crucial for the new digital era. At the same time, however, it will also confront us with serious challenges such as the effects on the labor market, ethical issues arising from the use of massive data and the development of algorithms. Several economists stress that the introduction of more and more tools in the production process, related to artificial intelligence and machine learning, will radically change the global labor market. Recent research shows that there

are increasing levels of stress among workers caused by anxiety about new technologies and automation. The basic idea is that applications of artificial intelligence will displace workers by reducing jobs and wages. For example, why would a company hire a worker for risk management when an algorithm can provide the same services? If this happens, then we expect both wages and the share of labor in total output to decline. However, countervailing forces may offset the negative effects of automation and AI on the labor market. As the cost of production through automated processes will fall, it is reasonable to expect that the demand for labor in sectors that cannot be automated will increase.

Also, the accumulation of physical capital, caused by the expansion of automation, will lead to an increase in the demand for human capital. Finally, the use of new technology can deepen automation in production processes that are already automated, without affecting other sectors to a large extent. Of course, the process of reversing the effect of displacement on the labor market is neither automatic nor immediate. State intervention is crucial. More on this issue will be discussed in the next section. An important challenge also arises from the use of massive personal data by companies and organizations. The daily use of digital technology by almost the entire global population leaves digital footprints revealing personal data and leaving citizens exposed to malicious actions (Bollaert et al., 2021).

The challenges associated with the use of personal data are many. First, citizens/consumers should be fully aware of the use of data, especially when the data is sold to third parties. Special attention should also be paid to the manipulation of consumer choices through the use of bulk data. It is perhaps more feasible today for businesses to decode consumers' true preferences and how they make decisions. On the one hand, this is positive, because they can offer more personalized products and services, increasing consumer utility, but on the other hand, it increases the risk of manipulating their choices and decisions and, therefore, reduces consumer surplus. The use of algorithms already has a major impact on many aspects of people's daily lives. Ethical issues may arise from the reliable or unreliable development and use of algorithms. For example, an algorithm can choose who gets hired or promoted in a job if they are trustworthy, as well as determine which political advertisements and news articles to watch. Algorithms do not have a neutral footprint but produce actions and consequences that enhance or undermine moral principles and secure or violate the rights of individuals.

Companies should be responsible not only for the economic value of an algorithm but also for the who-does-what design within the algorithmic decision. In other words, such as in a decision-making process, what percentage is decided by the algorithm and what percentage is decided by the individual. Therefore, companies that develop algorithms are responsible for their design and if an algorithm is designed to exclude individuals from the context of a decision, then the algorithm designer should be held accountable for the ethical implications.

Finally, it is important, because of the specialized knowledge required to develop an algorithm, that companies or developers consistently and accurately provide information about how the algorithm works, so that there is no risk of asymmetric information between the algorithm's creators and its users (Bollaert et al., 2021).

3. Decentralized finance (DeFi)

DeFi has always-open marketplaces and no centralized authority that may prevent you from making payments or gaining access to anything. Now since services are managed by code that anybody can view and analyze, they are automated and safer than before when they were previously sluggish and susceptible to human mistake. DeFi refers to financial services provided on open blockchains, particularly Ethereum (or "decentralized finance"). With DeFi, it is possible to earn interest, borrow money, lend money, buy insurance, trade derivatives, trade assets, and engage in a variety of other activities, but the process is speedier and requires no formalities or a third party. Similar to crypto generally, DeFi is available to everyone, peer-to-peer (i.e., directly between two people, not channeled through a centralized system), global, and pseudonymous [1]

[1] https://www.coinbase.com/learn/crypto-basics/what-is-defi

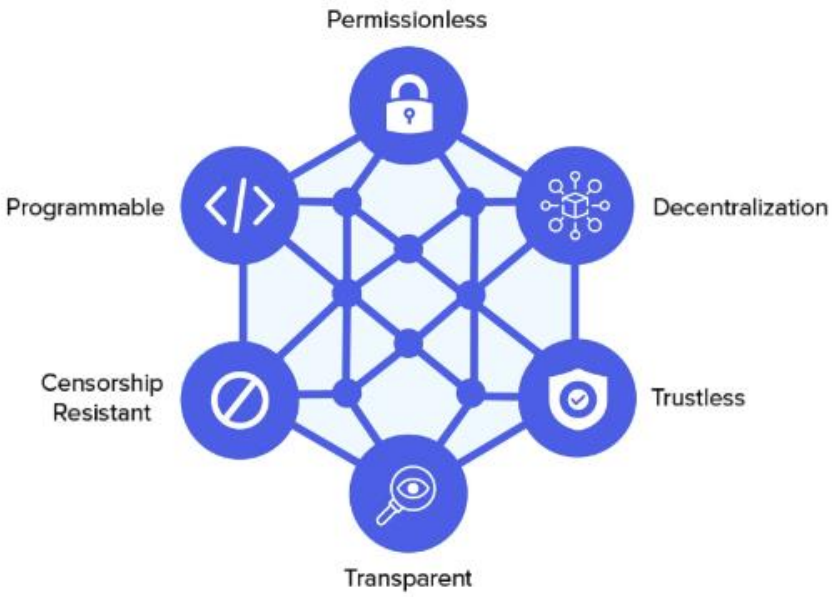

Figure 5: DeFi. Source: https://appinventiv.com/blog/decentralized-finance-defi-guide/

The bitcoin market is booming, and we may lend, borrow, trade, make money, and more there. Crypto-savvy Argentinians are using DeFi to avoid catastrophic inflation.[2] Companies have started broadcasting employee salary in real time to their workforce. Some people have even returned multi-million dollars debts without divulging their personal details [3]

It is possible that blockchain technology may provide a new basis for decentralized business models since it has the ability to lower transaction costs, build distributed trust, and empower decentralized platforms. In the kingdom of finance, blockchain technology makes it possible for decentralized financial services to proliferate. These services are often more decentralized, inventive, interoperable, borderless, and transparent than their centralized counterparts. Decentralized financial services, which are enabled by blockchain technology, have the potential to increase the number of people who have access to financial services, facilitate open access,

[2] https://www.coinbase.com/learn/crypto-basics/what-is-defi

[3] (https://ethereum.org/en/defi).

encourage permissionless innovation, and create new opportunities for business owners who are interested in innovation (Chen & Bellavitis, 2020).

When it comes to lowering transaction costs and increasing the number of possible transactions, intermediaries often play critical roles. It is common practice in business dealings for intermediaries to assist the parties involved in the transaction in locating one another, establishing confidence in one another, and settling agreements. It is possible that the parties involved in a transaction may be unable to establish connections, create contracts, or enforce agreements if intermediaries are not present (Chen & Bellavitis, 2020).

The use of blockchain technology may result in the birth of new business models that were previously impossible to sustain. The use of blockchain technology in the financial sector has the potential to lessen the role played by centralized institutions, boost the appetite for experimentation, and increase access to financial services (Chen & Bellavitis, 2020).

3.1 DeFi' s differences from traditional finance

Understanding the current issues is one of the finest ways to appreciate DeFi's potential.

- Some persons are not permitted to utilize financial services or open a bank account.
- Not having access to financial services might make it difficult for people to find work.
- Financial services may prevent you from receiving compensation.
- Your personal information is a hidden cost of financial services.
- Markets may be shut down at any time by centralized organizations and governments.
- Trading hours are frequently restricted to certain time zone's business hours.
- Money transfers can take days due to internal human processes.

- Financial services are more expensive since intermediate organizations seek to make a profit. [4]

In many respects, the first DeFi application was Bitcoin. You can really own and control value with Bitcoin and transmit it anywhere in the world. This is accomplished by giving a mechanism for many individuals, who don't trust one another, to concur on a ledger of accounts without the necessity for a reliable middleman. Anyone may use Bitcoin, and nobody has the power to modify its operating principles. The rules of Bitcoin, such as its scarcity and openness, are included into the technology. It's not like traditional finance, where corporations can close markets and governments can generate money that devalues your wealth.

Ethereum advances from this. The rules are unchangeable, and everyone has access, like Bitcoin. However, it also makes this digital currency programmable through the use of smart contracts, allowing you to do more than just store and transmit value. [5]

3.2 DeFi's opportunities & operation

For the majority of financial services, there is a decentralized alternative. However, Ethereum also offers the chance to develop wholly original financial solutions. This list is always expanding.

- Transfer money internationally
- Distribute money globally
- Use secure currencies
- Take out a loan with collateral
- Obtain credit without security
- Begin your crypto savings
- Trading cards

[4] https://ethereum.org/en/defi

[5] https://ethereum.org/en/defi

- Expand your holdings
- Finance your concepts
- Obtain coverage
- Control your investments.

DeFi leverages smart contracts and cryptocurrency to offer services without the need of middlemen. Financial institutions serve as transaction guarantors in the modern financial environment. The fact that your money passes through these organizations gives them a tremendous amount of influence. Additionally, billions of people worldwide lack even basic access to a bank account.[6]

In DeFi, the financial institution is replaced in the transaction by a smart contract. A smart contract is a specific kind of Ethereum account that may retain money and send or reimburse it in accordance with the predetermined criteria. When a smart contract is live, no one can change it; it always functions as intended.

A contract that is intended to distribute pocket money or an allowance may be set up to transfer funds from Account A to Account B each Friday. And it will never stop doing that unless Account A has the necessary amount. Nobody may alter the agreement and add Account C as a receiver in an attempt to steal money.[7]

Additionally, contracts are open to everyone's inspection and review. Bad contracts will therefore frequently be the subject of rapid public examination.

The open-source community serves as a check on developers, but as smart contracts become simpler to understand and substitute methods to demonstrate the reliability of code are created, this necessity will eventually disappear. [8]

[6] https://ethereum.org/en/defi/

[7] https://ethereum.org/en/defi/

[8] https://ethereum.org/en/defi/

3.3 DeFi's importance & benefits

DeFi expands on Bitcoin's core concept of digital money to produce a full-fledged digital alternative to Wall Street without any associated fees (think office towers, trading floors, banker salaries). This could result in the growth of more open financial markets that are available to anybody with an internet connection.

Benefits:

- **Open**: Regardless of their location or financial situation, DeFi provides financial services to everyone with an internet connection and a digital wallet. Those who might not have access to traditional banking services now have access to financial services. There is no requirement that you "open" an account or submit any applications. Access is only granted after creating a wallet.
- **Pseudonymous**: Your name, email address, or any other private information is not required. The users who participate in DeFi transactions use digital wallets linked to public addresses, which a set of characters that operate as the individuals' blockchain ID. The user's actual identity is not revealed by the public address and it is not connected to any personally identifying data.
- **Flexible**: You have the freedom to move your assets at any time without obtaining authorization, having to wait for protracted transfers to finish, or having to pay high fees.
- **Fast**: Benefits and interest rates frequently shift quickly and can be substantially higher than on traditional Wall Street (as frequently as every 15 seconds).
- **Programmability**: DeFi protocols are based on smart contracts, which can be programmed to execute financial transactions automatically. This allows for more complex financial instruments to be created and executed without the need for intermediaries.
- **Transparent**: The public blockchain network, on which DeFi runs, offers a high level of transparency and auditability. Users can view and validate every transaction on the blockchain, increasing system trust and lowering the possibility of fraud. The full list of

transactions is accessible to all parties (private corporations rarely grant that kind of transparency). [9]

Downsides:

- **Trading costs:** Due to the erratic transaction speeds on the Ethereum blockchain, active trading may become expensive.
- **Complexity**: DeFi is a technology that needs to be used and understood by those with a particular level of technical expertise. For those unfamiliar with the technology, this may be difficult to access and operate it.
- **Liquidity Risks:** Liquidity hazards are present in some DeFi protocols, especially when market volatility is strong. Users may find it challenging to purchase or sell assets at a reasonable price as a result of this.
- **Volatility**: Cryptocurrencies, which are known to be extremely volatile, are the foundation of decentralized financial protocols. This implies that investments' values may change greatly, subjecting investors to significant amounts of risk. Due to the novelty of the technology, depending on the dapps you use and how you use them, your investment may experience extreme volatility.
- **Regulatory Risks**: Regulation issues can arise because decentralized finance protocols operate in a largely uncontrolled environment. Legal and regulatory concerns may result from this, which could undermine the system's stability. Regulations may vary depending on where you are.[10]

[9] https://www.coinbase.com/learn/crypto-basics/what-is-defi

[10] https://www.coinbase.com/learn/crypto-basics/what-is-defi

3.4 DeFi's Protocols & Examples of DeFi's Use

A blockchain's financial transactions and services are governed by a set of rules and smart contracts known as the DeFi's protocols. Decentralized and trustless DeFi protocols are made to automate and duplicate several traditional financial activities like lending, borrowing, trading, and more. Below we will briefly describe some of the well-known Defi protocols.

Compound:

One of the emerging decentralized finance (DeFi) protocols, enables the necessary lending and borrowing without the use of a financial intermediary like a bank by using numerous encrypted assets to offer this function. Compound enables users to deposit cryptocurrencies into lending pools so that borrowers can access it. The assets that lenders deposit is then paid interest on.

Aave:

Is another lending and borrowing platform that includes features like flash loans, variable interest rates, and collateral swaps. Aave lets users lend or borrow cryptocurrency without going to a centralized intermediary. Aave was first deployed on Ethereum network early on 2020 and Ethereum is the largest market of Aave.

Synthetix:

The DeFi revolution is being led by Synthetix, which makes it possible to create and trade synthetic assets that mimic actual assets like equities, commodities, and fiat money. Users can access different markets through these synthetic assets, sometimes known as "synths," without owning the underlying assets themselves.

MakerDAO:

The creator of the first decentralized stablecoin DAI, has significantly contributed to the stability and liquidity of the DeFi ecosystem. This protocol governs the stablecoin DAI, the value of which is linked with the price of US dollar.

0x Protocol:

Users can transfer assets from Ethereum to Polygon via 0x, where transaction costs are frequently lower. A system called 0x makes peer-to-peer (P2P) trading of Ethereum-based assets possible.

The protocol, created by 0x Labs, is an open standard and fundamental DeFi building component for any developer in need of exchange capability.

Yearn Finance:

The Yearn finance has redefined yield farming by automating the process of yield optimization. Users can deposit assets on its user-friendly platform, which moves them across several DeFi protocols to maximize returns. Yearn Finance is anticipated to introduce new strategies, provide integration with more DeFi protocols, and apply governance enhancements in order to increase its value proposition as yield farming becomes more approachable and user-friendly.

Overall, DeFi protocols have gained significant attention for their potential to disrupt and democratize traditional financial systems. However, users must conduct thorough research, understand the protocols they engage with, and be aware of the inherent risks associated with DeFi activities.

Lending

Open lending protocols are among the most common applications in the DeFi ecosystem. Open, decentralized lending has many advantages over the traditional credit system. These include direct transaction settlement, lack of credit checks and the ability to secure digital assets.

Since these lending services are based on public blockchain, they minimize the amount of trust required and are secured by cryptographic verification methods. Lending markets on the blockchain reduce counterparty risk and make lending cheaper, faster and available to more people (Binance Academy, 2019).

Monetary banking services

As DeFi applications are, by definition, financial applications, monetary banking services are an obvious use case for them. These may include stablecoin issuance, mortgage services and insurance.

As the blockchain industry matures, there is an increased focus on stablecoin creation. They are crypto assets that are typically linked to real-world assets that are easily transferred through digital means. As cryptocurrency prices can fluctuate rapidly from time to time, decentralized stablecoins could be adopted for everyday use as digital currencies that are not issued and monitored by a central authority.

Due to the number of intermediaries involved, obtaining a mortgage is costly and time-consuming. With smart contracts, coverage and legal service fees can be significantly reduced.

Insurance on the blockchain could eliminate the need for intermediaries and allow risk sharing among multiple participants. This could lead to lower premiums with the same quality of service.

Decentralized markets

Some of the most popular DeFi applications available are Decentralized Exchanges (DEX), such as Binance's DEX. These platforms enable users to trade digital assets without needing a trusted intermediary (the exchange) to hold their funds. Transactions are made directly between users' wallets with the help of smart contracts.

Some exchanges, known as Automated Qualified Market Makers (AMMs), use liquidity pools to facilitate trades without needing a counterparty to directly match your transaction. Uniswap and Pancake Swap are two of the most well-known examples. Since they require less maintenance and administration, decentralized exchanges typically have lower transaction fees compared to centralized exchanges.

Blockchain technology can also be used to issue and hold a wide range of standard financial instruments. These applications would operate in a decentralized manner that excludes custodians and eliminates individual points of failure.

For example, security token issuance platforms can provide issuers with the means and resources to release tokenized securities on the blockchain with customizable parameters.

Other projects may enable the creation of derivatives, synthetic assets, decentralized prediction markets and many others.

Performance optimization

DeFi's dApps can be used to automate and optimize the compounding of returns earned from staking actions, reward pools and other interest-bearing products. The user may sometimes hear performance optimization referred to as performance subcontracting.

4. Decentralized autonomous organizations

Figure 6: How to build a Decentralized Autonomous Organization? Source: https://moralis.io/how-to-build-a-decentralized-autonomous-organization-dao/

DAOs are blockchain-native, decentralized organizations that are collaboratively owned and governed by its members using smart contracts. DAOs are a revolutionary organizational paradigm that has the potential to profoundly alter how companies function.

A revolutionary technology infrastructure enables organizational advances related with the emergence of DAOs. On the basis of blockchain technology, DAOs are established. Blockchain technology refers to a digital distributed ledger that records transactions in a transparent and unchangeable manner.

The introduction of this technology had a significant impact on the business world and is one of the major pillars of the movement towards a decentralized economy (Sydow, Sunny, and Coffman 2020) and a decentralized financial system (Cumming et al. 2022), partially driven by the tokenization of new ventures through initial coin offerings (ICOs) (Bellavitis, Fisch, and Momtaz 2022).

The DAOs' blockchain-based nature has a number of consequences that separate them from conventional organizations. First, organizational governance differs dramatically from present, more conventional approaches of organization governance. Traditional corporations are driven by top-down, private, and centralized decision-making, but DAOs function via public and distributed decision-making, where generally any DAO member may propose and vote on any form of business decision. This structure allows cooperation and community participation among all DAO

members who share similar aims and values. Diverse objectives are defined in the underlying smart contracts of DAOs. DAOs may, for instance, seek to solicit and distribute contributions or to gather and invest capital in potential venture initiatives (Bove 2022). ICOs (Bellavitis, Fisch, and Momtaz 2022) and non-fungible token (NFT) sales are often used to finance DAOs (Chalmers Chalmers et al., 2022).

These token sales allow companies to obtain huge sums of financing from a community of investors, with cash accessible only with members' consent or the activation of a smart contract. Voting rights may be attached to the tokens sold, and there are numerous voting procedures, some of which are quite inventive. The organizational governance of DAOs is also distinct from other contemporary trends such as crowdfunding or ICOs. Both financing sources are novel, yet they depend on more traditional corporate governance systems. With the use of crowdfunding (e.g., Angel List) or ICO (e.g., Coinbase) platforms, businesses raise capital via the public through crowdfunding or ICOs. In both instances, a controlling party (i.e., the corporation that seeks cash) determines the business plan. In rare instances, the CEO or entrepreneur may attempt to interact with their community by, for instance, surveying investors or consumers on particular areas of the business, such as product development.

Yet, in crowd-funded or ICO-funded companies, the decision-making process is mostly centralized and top-down. A DAO is an advancement. In this situation, the organization obtains funds via the sale of tokens to a large number of investors, similar to an ICO, but governance is totally public and decentralized. Second, the decentralized structure of DAOs permits the development of new business models that facilitate greater disintermediation. Some of the most successful businesses in 2022 will be intermediary platforms, such as Amazon. Disintermediation has initiated the disruption of intermediated business models and sectors dominated by such platforms (Bellavitis, Fisch, and Momtaz 2022).

At the heart of the push toward increased disintermediation is the promise of more advantageous rent sharing, as entrepreneurs, investors, or sellers and purchasers would be able to enjoy the transaction excess without having to pay for intermediary services, owing to smart contract technology (Momtaz 2022). Markets, industries, and whole economies might theoretically be administered by smart contracts, powered by robots, and autonomously regulated by the DAOs' members. Consider Amazon as an example: Jeff Bezos is now Amazon's largest shareholder, the

Amazon CEO is the management, and Amazon merchants are the company's service providers. Amazon sellers may collaborate and share decision-making via a DAO, and any Amazon seller could be a shareholder, manager, and service provider simultaneously.

The number of DAOs and their influence are expanding quickly. In 2021, a Constitution DAO offered $40 million for an original copy of the U.S. constitution, illustrating the power of fund-raising efforts (Bove 2022). Similarly, as we detail below, the number and value of DAOs have increased exponentially since 2019. In light of this context, this note tries to introduce DAOs.

Specifically, we intend to describe the benefits of DAOs as a novel organizational structure, provide a first empirical look at their prevalence and operation, and highlight some of their limits. By doing so, we want to present an early, introductory perspective on DAOs that future research may use to build innovative research topics in order to investigate DAOs and their underlying processes in depth (Bellavitis, Fisch, and Momtaz 2022).

5. Centralized Exchanges (CEX) και Decentralized Exchanges (DEX)

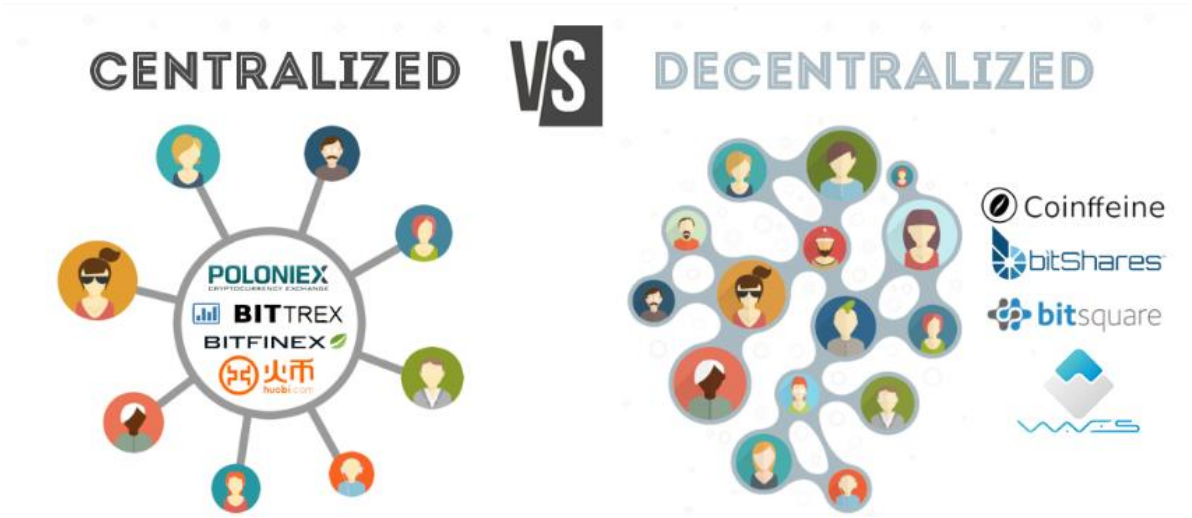

Figure 7: Centralized Exchanges vs Decentralized Exchanges
Source: https://www.cryptowisser.com/news/centralized-exchanges-vs-decentralized-exchanges/

Over the last five years, decentralized exchanges (DEXs) have emerged to challenge traditional centralized exchanges (CEXs). Briefly, DEXs attempt to provide cheaper transaction costs, let users to directly control their own assets, and circumvent some regulatory restrictions. On the other hand, companies must compensate their liquidity providers for a unique risk known as "permanent loss" at a cost (Benedict & Bochan, 2022).

CEXs also give benefits. Most centralized exchanges have a business strategy comparable to that of established institutions such as the New York Stock Exchange, a structure that traditional investors may find more familiar and comfortable. Their interfaces and applications tend to be more beginner-friendly and user-friendly, and they often provide greater liquidity and better regulatory certainties, which may be particularly significant for institutional customers. However, this also implies that the central exchange operator has a great deal of authority and responsibility for the exchange's financial health and stability (Benedict & Bochan, 2022).

DEXs attempt to process transactions more rapidly and affordably than centralized exchanges. They do this by eliminating the middleman firms that get a portion of transaction fees on CEXs. The 2018 whitepaper of the biggest DEX in the world, Uniswap, asserts "zero rent extraction." It tries to shield its consumers from the extra expenses associated with producing profits for the CEXs' middlemen. Bancor, which began in 2017 and calls itself the first DEX, argues for the

decentralized method as follows: "Liquidity on conventional asset exchanges has traditionally been supplied by a limited number of professional trading businesses with restricted access and specialized tools. This concentrates liquidity in the hands of a few players who may remove their assets during volatile times and limit trade of an asset when consumers want it."(Benedict & Bochan, 2022).

Late January 2021, the top DEX Uniswap charged a transaction fee of 0.05% on the $100,000 deal tested by the international accounting firm KPMG. CEXs Binance, Coinbase, and Kraken have respective fees of 0.1%, 0.2%, and 0.2%.

DEXs use "automated market maker" methods to decide the pricing of assets in the absence of a central authority coordinating deals. A prevalent method is the "constant product" mechanism, which establishes prices based on the ratio of the DEX's total reserves of each asset involved. This has the benefit of tending to maintain a relative balance of reserves: if any asset became scarce, it would become prohibitively costly (Benedict & Bochan, 2022).

However, DEXs continue to provide nearly the same asset values as CEXs. This is because vigilant traders or bots may benefit fast from any price disparity via arbitrage. If a particular pool had relatively little ETH, it would have to allow traders to sell ETH into the pool at a greater price than suggested by the broader market. Traders may easily generate a profit by purchasing the commodity on the open market and selling it to the pool. As they did so, the pool's volume would increase, lowering its offered price until it matched the market as a whole (Benedict & Bochan, 2022).

DEXs may have more difficulty than CEXs when dealing with bigger investors. Currently, they cannot compete with the major CEXs in terms of scale, hence they cannot provide comparable liquidity. Large orders that encounter inadequate liquidity may incur unanticipated extra charges known as "slippage." Moreover, institutional investors have their own AML and other regulatory obstacles and may find it difficult to work with exchanges that do not adhere to comparable regulations.

Last year, Sergej Kunz, co-founder of liquidity aggregation DEX, observed that banks and hedge funds have been sluggish to adopt decentralized finance (DeFi) due to their own regulatory

obstacles. Although it is a DEX, his firm create 1inch Pro, a compliance device designed exclusively for these customers.

New aggregator methods, like as 1inch, have arisen to aid bigger investors in avoiding liquidity issues while using DEXs. In 2020, 1inch secured $12 million in investment headed by Pantera Capital (Benedict & Bochan, 2022).

The emergence of aggregators enables consumers to simultaneously access liquidity from DEXs and CEXs. DiversiFi, which is essentially a DEX, pools liquidity from both types of exchanges to facilitate more efficient execution of bigger deals by its customers. This helps investors avoid the fees incurred when an exchange's liquidity is insufficient for their order.

When determining the sort of exchange to use, two factors are decisive: If we are mainly concerned with usability and are uncomfortable being in complete charge of our wallet, a CEX is likely our best choice. If fewer costs and more control over own assets are our top priorities, a DEX is our best option. Regardless of our decision, we must know how to move our cryptocurrency from an exchange to cold storage in order to preserve our capital over the long term (Benedict & Bochan, 2022).

Before discussing the distinction between DEX and CEX, let's review the fundamentals of crypto exchanges. Cryptocurrency exchanges are essentially the stock markets of the cryptocurrency world. Similar to how you may buy and sell assets such as stocks and derivatives on stock markets, you can buy and sell blockchain-based tokens and coins on crypto exchanges. First-generation platforms, which were more centralized in design, and the range of decentralized exchanges that have emerged in recent years are the two main sorts of bitcoin exchanges (Weston, 2022).

While both CEX and DEX crypto exchanges provide the ability to trade cryptocurrencies, they vary in a variety of important ways. For instance, the kind of exchange is vital in deciding how a particular transaction operates. In addition, the user features and flexibility of the two kinds of exchanges vary significantly. In light of this, a comparison between the two kinds of crypto exchanges may be framed most effectively by a basic review of each (Weston, 2022).

Centralized exchanges are crypto exchanges built by centralized companies that exercise control over the exchange's ownership. The centralized entity mediates between customers and sellers. Coinbase, Gemini, and Binance are prevalent instances of centralized exchanges.

The most notable distinction between DEX and CEX would be how centralized exchanges really function as banks. You may deposit your cryptocurrency in the exchange's central wallet, which remains under the jurisdiction of the centralized organization. Centralized exchanges also ease crypto deal paperwork and execution on internal platforms (Weston, 2022).

Centralized exchanges provide several advantages, including the fact that they are excellent for crypto novices. The user-friendly interfaces and assistance provided by the centralized corporation behind CEXs facilitate the recovery of your cryptocurrency holdings. In addition, centralized exchanges provide a higher level of liquidity due to the greater number of users on their platforms.

In a discussion between centralized and decentralized exchanges, however, centralized exchanges are not without defect. Centralized exchanges, for instance, demand KYC verification, which breaches the fundamental principles of cryptocurrencies, such as user anonymity. Moreover, centralized exchanges place all deposited coins under the jurisdiction of the exchange's operator. On centralized exchanges, crypto owners do not have total control over their holdings (Weston, 2022).

The answers to the question "What is DEX and CEX?" are necessary for establishing a fundamental understanding of their probable distinctions. After the definition and review of centralized exchanges, now we will describe decentralized exchanges. Decentralized exchanges are, as their name indicates, centralized exchanges with a separate organizational structure. It is obvious that decentralized exchanges, which serve as intermediates, are not governed by a single institution. In reality, decentralized exchanges are smart contracts designed to facilitate peer-to-peer transactions.

The nicest aspect about DEXs is that no KYC verification is required to connect with them. We have a clear response to the question, "What is the difference between CEX and DEX in terms of user anonymity?" The two most noteworthy types of decentralized exchanges are order book DEXs and AMM DEXs, or automated market makers. The first generation of decentralized exchanges used the typical order book methodology utilized by centralized exchanges (Weston, 2022).

Examples of typical order book DEXs are the Gnosis Protocol and LoopRing. Instead of centralized platforms, order book DEXs depend on algorithms to find and move transactions between individual users. Smart contracts assisted in the documentation of order book DEXs

transactions. Order book DEXs thus replaced the centralized organization with an algorithm and assured decentralization. Regardless of the advantages of decentralization, the order book approach fails in terms of efficiency.

As a consequence, Automated Market Maker DEXs seemed to address a significant problem with decentralized exchanges, namely liquidity. Compound, Uniswap, and SushiSwap are examples of typical Automated Market Maker or AMM DEXs. AMM DEXs are a focal point in CEX vs. DEX crypto exchange discussions due to their effectiveness in replacing order books. Automated Market Maker focuses on liquidity pools generated by users as opposed to waiting for buy and sell orders to be matched. Those that put their assets in the liquidity pool obtain governance tokens, which also guarantee the exchange's decentralized governance (Weston, 2022).

Figure 8: Top 10 countries of Global Crypto Index in 2022

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Country	Overall index ranking	Centralized service value received ranking	Retail centralized service value received ranking	DeFi value received ranking	Retail DeFi value received ranking

Vietnam	1	5	5	7	6
Philippines	2	4	4	13	5
Ukraine	3	6	6	10	14
India	4	1	1	1	1
United States	5	3	3	3	2
Pakistan	6	10	10	22	16
Brazil	7	7	7	8	7
Thailand	8	12	12	5	3
Russia	9	8	8	11	12
China	10	2	2	6	4

Table 2: Top 10 countries of Global Crypto Index. Source: news.bitcoin.com

6. Conclusions

The process of creating value has been profoundly affected by the rise of e-commerce and the rapid advancement of technology. To effortlessly offer goods and services to their clients, many firms show a strong reliance on technology. The design of new goods and services, the quality of data, and the effectiveness of production procedures can all be improved with the aid of emerging technology. New technologies have also fundamentally changed the field of marketing and introduced new phrases and strategies. Today, brands are utilizing technology more and more to expand their reach globally by entering new areas and stimulating customer demand.

The Internet has made it possible for marketers to reach consumers through more effective electronic communications and interactive media during this process. Consumers can now make decisions in a simple way after being more aware of the options available to them. Businesses have used big data and data mining tools to make inferences about customer demands and wants. Through predictive analytics, analysis of large data sets assists organizations in gaining actionable insights. Blockchain technology is an innovation that can help businesses better understand and target their customers while also giving consumers back control over their business operations.

Last but not least, there is the decentralized economy, which was advertised as a Blockchain-based method of business funding. The installation of Blockchain was also discussed as a way to lower transaction costs and establish a distributed system of trust. Additionally, how financial services have the potential to be innovative, decentralized, open, and useful. Finally, the decentralized economy's present market position was discussed while introducing a number of fresh and significant business ideas, including decentralized money, decentralized payment systems, decentralized fundraising, and decentralized contracts. In recent years, the idea of blockchain technology has begun to gain traction on the international market. This is what it has accomplished: it has raised the bar for the financial market. Companies, banks, and governments have already incorporated it into their strategies because of this. There is considerable anxiety about whether this technology will actually be able to bring about the changes it can support, despite the fact that there is no clear framework for its application and potential uses. Regarding the transaction rate, energy costs owing to high electricity consumption, the security it provides, and the potential connection of this technology with criminal activity in some applications, such as

cryptocurrencies, there are still a lot of issues that need to be resolved. Nevertheless, the financial sector's perspectives, possibilities, and threats are listed below.

With the absence of intermediaries and the decentralized nature of blockchain technology, the system itself is trusted. With so many parties participating in the financial industry, employing technology allows for process simplification, time savings, cost savings, and a decrease in fraud. The players in the blockchain technology share a common universal through the platforms that have been developed for it, and as a result, they can always observe its history.

The transfer of documents between the two parties is transparent and secure because information stored on a blockchain cannot be removed or changed. using the data stored on the blockchain to make predictions about the future, to improve workflows, and to boost productivity. Processes are automated and payments are quickly carried out in accordance with the agreements made between the parties thanks to the usage of smart contracts.

The competitive environment that will be created in the global market through the digitization of processes is yet another opportunity that blockchain technology offers to the financial sector. As a result, with the digitization of assets or other assets and records, new smaller companies are given the chance to compete in the game of the global financial market.

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