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Blockchain in Finance

Literature Review

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Contents

Abstract

Decentralized databases such as blockchains allow for quick and reliable transactions without the need for oversight from a central authority. No matter how fascinating cryptocurrencies becomes, its importance in different financial and non-financial industries should not be undervalued.

A new generation of financial services powered by blockchain technology will be more decentralized, creative, interoperable, and transparent than those currently available. With the use of blockchain technology-based decentralized financial services, entrepreneurs and innovators will be able to access a wider range of financial services, encourage open access, and adopt permissionless innovation. The benefits of decentralized finance are examined in this thesis, as are the challenges and limits of current business structures. While decentralized finance is still a young field of financial technology, it has the potential to change the present financial landscape and create new opportunities for entrepreneurship and innovation.

Fig 1 Future of block chain

"It is hard to picture the future as something that can easily be predicted. One simple prediction is that blockchain will be useful in the financial industry over the next several years".

Introduction and Background

Blockchain started in 2008 when Satoshi Nakamoto published a paper (Nakamoto, 2008) with the aim of leading a revolution in payment systems and laying the foundation for a revolutionary cryptocurrency scheme Bitcoin.

A blockchain is a shared, decentralized database that allows for the documenting of network transactions. The transactions are stored in an immutable block that holds all of the transaction's information. Inside the network, any valuable transaction or knowledge may be registered and exchanged. Previous techniques of transaction recording are centralized, inefficient, costly, and repetitive, which is where blockchain steps in. Bitcoin, a decentralized peer-to-peer digital currency, is a common example of blockchain.

Bitcoin is based on the blockchain technology. The base and means for storing bitcoin transactions , which can be used to record transaction data are provided by blockchain.

Blocks on the Blockchain are used to solve difficulties in a wide range of sectors. Blockchain's two most notable properties are decentralization and immutability. It aims to decentralize processes so that data may be shared among all stakeholders rather than being kept in a single ledger. It enables the creation of a peer-to-peer networking network without the involvement of third parties. Due to the absence of a third party, the procedure goes more quickly and for less money. One more interesting feature is immutableness, that says if the contract between the two or more group or individuals are done that will not be changed. If it require to update it than the new contract will be establish and will be share with whole network. Because as it is decentralized, so verification will be done by other computers and that will be unchanged in future. As a result, it provides exceptional security and confidence to the users.

In industries that presently need expensive intermediation, such as financial services, blockchain technology has the potential to deliver significant efficiency improvements. Any implementation, however, will be met with a number of difficulties. Blockchain technology is being studied by regulators and policymakers, such as the Committee on Payments and Market Infrastructures. They are looking at both possible uses and problems.
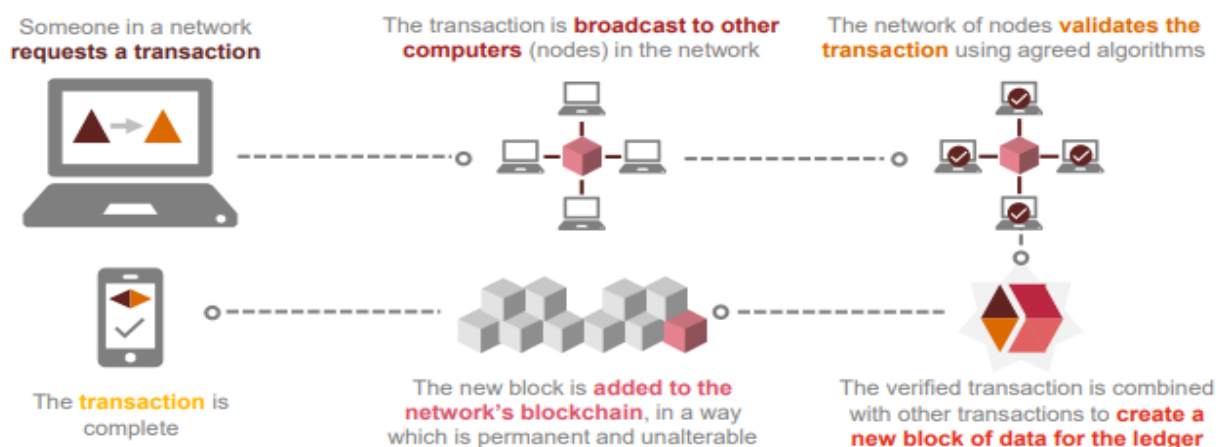

Fig 2 Transaction process in blockchain (Digital vidya)

How does it works?

The name comes from the way it operates, which is by connecting blocks to form a chain. As hash is the digital signature of the earlier block, and the record of all legitimate operations or transactions are all used with any transaction registered in a block. The hash ties the blocks together and confirms the previous block's authentication. As a response, an irreversible blockchain is established.

Five concepts of blockchain are network of nodes, tokens, a structure, a consensus mechanism, and rules. Each computer in a network is referred to as a node in the network. The nodes communicate with one another and verify the authenticity of transactions. The stronger the network, the higher the node relation. Second, tokens, also known as digital money or cryptocurrencies, represent a form of value ownership. It can be used to exchange value and can represent capital or some other kind of commodity. Following that, the blockchain's structure is an orderly sequence of transactions. Each block is linked together to form a blockchain.

Proof-of-work and proof-of-stake are the two types of mechanisms. To connect new blocks to the blockchain, the proof-of-work process requires a network of nodes to solve complex problems. This is the reason; changing the transfers is impractical because the third party would outperform the whole network. Bitcoin makes use of it. Proof-of-stake is a form of cryptocurrency that is built on token ownership. More blocks can be generated by the network with the highest token. Finally, laws are a series of guidelines that govern how the parties communicate. It gives ledger structures their personality. A blockchain is made up of all five terms together.
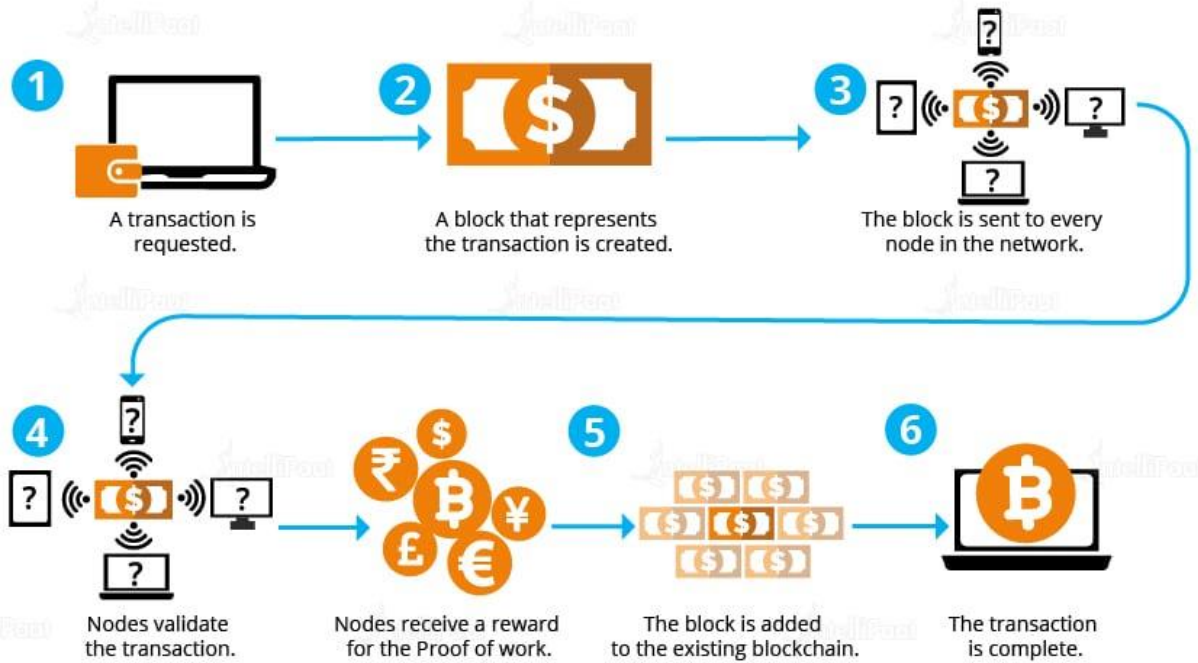
How Do Blockchains Work?

1 A transaction is requested.

2 A block that represents the transaction is created.

3 The block is sent to every node in the network.

4 Nodes validate the transaction.

5 Nodes receive a reward for the Proof of work.

5 The block is added to the existing blockchain.

6 The transaction is complete.

Fig 3 How Blockchain works (Intelli Path)

Structure of Blockchain

Blockchain

Connection of Blocks

Block 1 Header		Block 2 Header		Block 3 Header
Hash Value of the Previous Block Header	H	Hash Value of the Previous Block Header	H	Hash Value of the Previous Block Header
Root of Hash Tree		Root of Hash Tree		Root of Hash Tree
TX1-1		TX2-1		TX3-1
TX1-2		TX2-2		TX3-2
TX1-3		TX2-3		TX3-3

Hash Value

H Hash function

Collection of Transactions

Hash Value · Hash Value

Hash Value · Hash Value · Hash Value · Hash Value

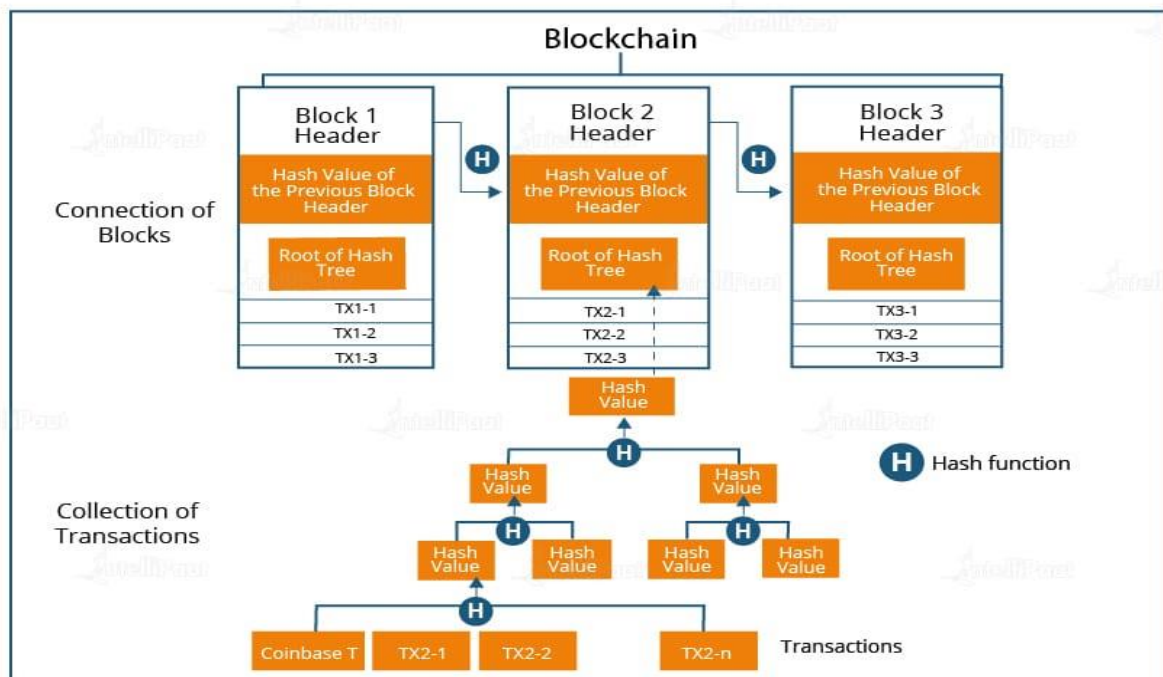Coinbase T · TX2-1 · TX2-2 · TX2-n   Transactions

Fig 4 Structure of Blockchain with hash and nodes (Intelli Path)

Blockchain Currencies

Bitcoin

As a decentralized currency founded on blockchain technology, bitcoin may function as a means of exchange without the need for a dependable intermediary, like a bank. Bitcoin is decentralized. A virtual currency may be used in the same way as cash instead of relying on a fiat currency. As of now, Bitcoin is the most well-known and frequently utilized digital money.

To use Bitcoin, you'll need a network of machines called "nodes" or "miners," which run the bitcoin code and keep a copy of the blockchain. Blockchains may be thought of as a system of blocks on some level. There are a lot of transactions in a block of data. Because all computers utilizing the blockchain have the same list of blocks and transactions, new blocks and transactions may be viewed immediately by all machines.

Using peer-to-peer technology, Bitcoin was one of the first digital currencies to allow instantaneous transfers of funds. "Miners" in the Bitcoin network are in responsible of processing transactions, and in exchange for their efforts they are paid with new bitcoin and transaction fees charged in Bitcoin.

Ethereum & Ether

A distributed computing platform with its own complete programming language. Any participating node runs and executes scripts or contracts, which are then paid for using the local cryptocurrency 'ether.' Ethereum, which was officially unveiled in 2015, has piqued the attention of many developers and institutional actors.

According to (Rocket Lawyer, 2014), a contract in the conventional sense is "an agreement between two or more parties to do or not do something in exchange for something else." Because of this, each component must have faith in the other. A contract is void if even one of the parties fails to fulfil their end of the bargain.

As far as we know, Smart Contracts are not a new idea. Nick Szabo, a computer scientist, invented the phrase in 1993 to highlight what he saw to be highly developed patterns of contractual agreements in the creation of electronic commerce

protocols between strangers on the Internet. As defined by Szabo's concept, he did not have a sufficient foundation for implementing smart contracts in his initial paper (trust in a central authority had to be assumed to some extent). Since the advent of crypto currencies, the concept of smart contracts has grown in relevance and viability since they offer a safe means of demonstrating performance in a decentralized framework. It's hardly a secret that Contracts become smart contracts when used in a Blockchain environment. Rather than just buying or selling a cryptocurrency, smart contracts on the Blockchain allow users to do more complex transactions.

Public Blockchain

Anyone may access a public blockchain since it's decentralized and open to everyone, no matter what their background may be. Transactions are openly validated and accessible to the public at all times, even after they've been completed. Financial incentive and consensus mechanisms are incorporated into the system to maintain its integrity and validate transactions. Public blockchains, which are not under the jurisdiction of any private or governmental body, have the benefit of crowdsourcing. Because a public blockchain is open to everyone, any member may contribute to making it better. It is more likely that public blockchain networks will be used in a larger range of applications because of open access. Public blockchains have the added benefit of potentially lowering transaction costs. Typical credit card transactions cost more than 0.35 cents, whereas the average processing charge on the Bitcoin network is around 0.04 cents.

Private Blockchain

Private blockchains are those that are created and managed by an individual or organization. Security protocols regulate and restrict access to just those who are allowed to do so. In the private blockchain, transactions are validated and can possibly be modified within that private network, allowing operators to remedy mistakes. It is not permitted on public blockchains, in part because it poses a security risk to users' data and information. Private blockchains may be divided into two categories: consortiums, which comprise members from a range of organizations who have been pre-selected, and totally private blockchains, which are confined to

participants from a single organization alone. Unlike public blockchains, private blockchains may authenticate transactions more quickly, generally within seconds, because they run on networks that are more controlled and comprise fewer machines than public blockchains. The authentication of a Bitcoin transaction, on the other hand, can take as long as two hours since it takes place on a publicly accessible, globally distributed blockchain involving thousands of unaffiliated computers.
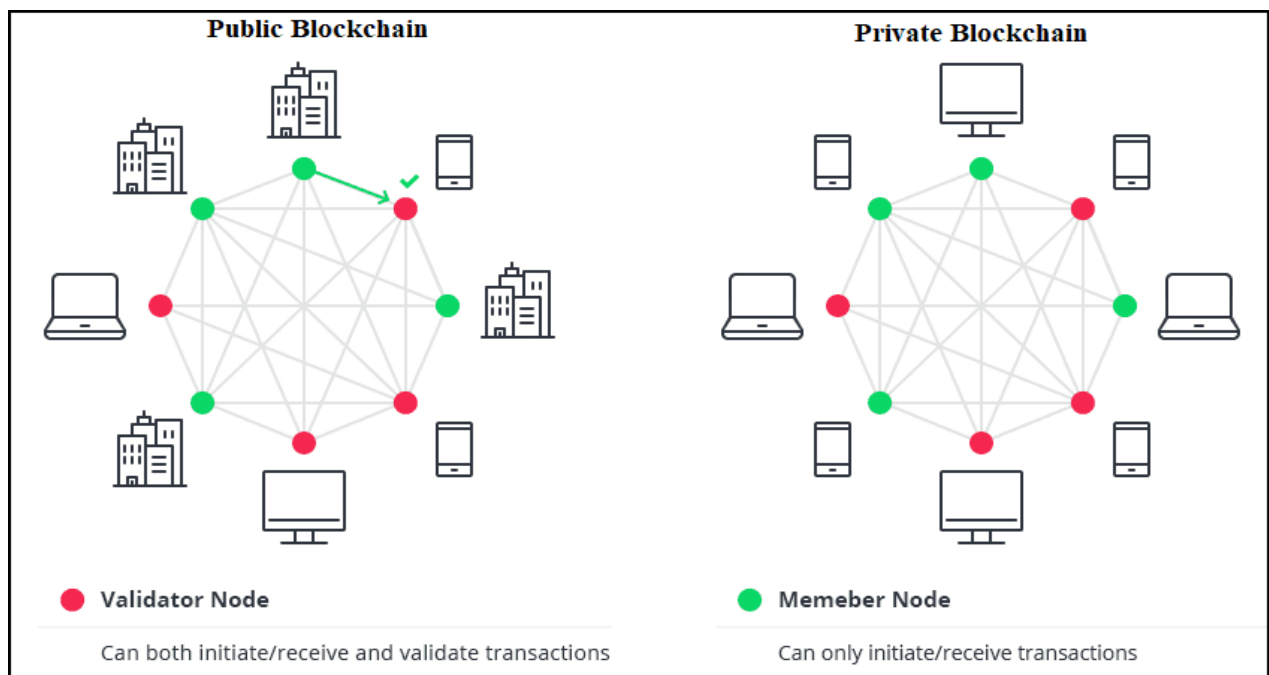

Figure 5: Public Blockchain vs Private blockchain

Is Blockchain Technology essential for banks?

Banks are the world's largest and most powerful financial institutions. The financial sector has been transformed by digitalization, which has fundamentally altered the banking environment. Commodity money replaced barter, and fiat money has substitute of barter, now digital payments or we can say currencies has become replacement of fiat money. Customers can also use ATMs, automated fund transfers, automated payment services, real-time gross settlement, internet and mobile banking, electronics chip cards including credit and debit cards, thanks to technological advancements. As we know, now days banks are totally dependent on technology, so we can say this is the correct time for the revival of blockchain in

banking world. It enables for the permanent storage of transactions in a block. It prevents the existence of third parties. In principle, blockchain could revolutionize the finance\banking and investment industries. Blockchain has capability to cause major disruption in the banking industry.

Technology has advanced and innovated at a breakneck pace over the past decades. The advancement of technology has impacted almost every industry. Because of oversight and enforcement, it was difficult to get into the banking industry, but now Fintech is posing a significant threat. Fintech is a term coined by combining the words finance and technology to describe businesses that use cutting-edge technology. Fintech poses a challenge to banks because it is fast, inexpensive, dependable, and clear. From the long time we are dependent on banks for the payment business, but Fintech firms are now winning a large share of the market. Fintech makes payments quicker, cheaper, and simpler. Fintech also offers clearing and payment options that are quicker than banks. The use of digital wallets and currencies is on the rise. Furthermore, businesses such as Apple provide their customers a virtual wallet that can be used for some kind of purchase or loan. In 2021, Facebook plans to introduce Libra, a digital currency that will make payments easier. Banks are expected to face stiff competition as confidence and confidence in Fintech grows.

Digital wallets on the blockchain enable those who wish to keep cryptocurrencies such as Bitcoin, Ethereum, or any other type of digital asset to do so securely and conveniently. These wallet owners are secured by private keys, but they also have their own unique public address, which they may use to send and receive money from others.

Blockchain technology allows wallet holders who own their private keys to be the only owners of their assets; in contrast to traditional currency, there are no banks to take on the duty of holding your money in trust.

The use of blockchain technology will be crucial in resolving existing banking issues. Performance, cost savings, accountability, and the absence of third parties are the key benefits of blockchains. To begin with, blockchain increases transaction reliability by eliminating decision making time. Data maintaining and management can be streamlined and done more quickly than personnel allow. Second, it reduces

the expense of transactions and operations. Payment and mediation should be completed without the involvement of a third party or the payment of hefty broker fees. Cryptography is used in blockchain to provide third-party trust. Finally, blockchains are distributed, allowing all sides to see real-time transaction history, resulting in clarity.

While the current crypto-market meltdown has played a role, it's also owing to technical improvements and an improved knowledge of Blockchain's potential that people are turning away from cryptocurrencies.

A decentralized database is now the most sought-after use case for Blockchain in the banking industry. For storing and distributing information, blockchain is proven to be more convenient, safe, and cost-effective.

Each node in a Blockchain-based distributed ledger database works together to reach the same conclusions by maintaining, calculating, and updating new entries, which provides intrinsic security for the network. Records may be accessed by anybody on the site, but they are also unchangeable.

The "proof of stake" duty employed by Blockchain for this purpose is cheaper and uses less energy than the "proof of work" requirement utilized by Bitcoin. As a result, it's easier to scale and more cost-effective to use.
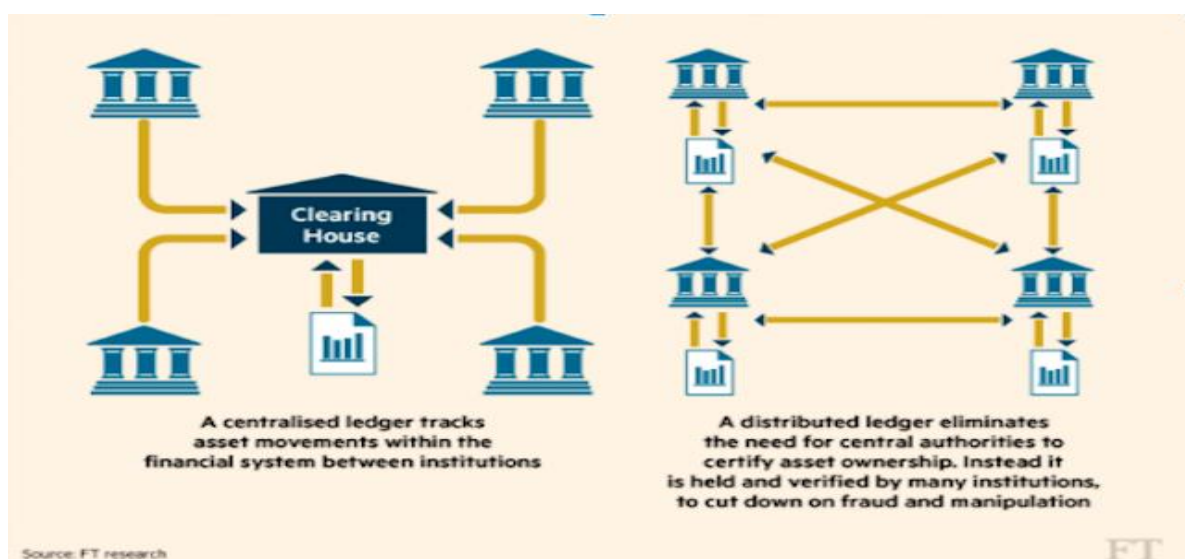

Figure 6 centralised and distributed ledger

Decentralized Finance (DEFI) and centralized finance (CEFI)

The financial sector is one of today's most important and delicate ones. The financial sector is always on the lookout for secure and convenient technology that can be applied to make processes easier and increase safety as more individuals move their funds from physical to digital forms.

Decentralized finance, most commonly abbreviated as DeFi, is a novel approach to handle money decentralized and completely eliminate the need for middlemen. It is gaining popularity as a result of its benefits and characteristics. DeFi is an acronym that stands for Decentralized Finance. It is a method of financing that intends to eliminate middlemen and establish a financial ecosystem that is transparent, open source, permissionless, and decentralized.

The decentralized finance system operates independently of a central authority, which means that it is open to everybody. As a result, individuals may exercise complete control over their assets, perform peer-to-peer transactions and exchanges, and utilize and build decentralized apps.

DeFi facilitates finances by eliminating financial middlemen such as exchanges, banks, and brokerages. Individuals may use DeFi to borrow money from one another, exchange cryptocurrencies, insure against risks, earn high interest, and speculate on asset price fluctuations.

Numerous benefits accrue to individuals when money is decentralized. However, in order to comprehend it fully, we must first grasp how it differs from centralized finance (CeFi).

Centralized finance is referred to as CeFi. It's a centralized financial system, as the name implies.

DeFi and CeFi are diametrically opposed in many ways. Let's talk about them thoroughly to have a better understanding of them.

The names DeFi and CeFi imply plainly that there is a substantial difference between them. Compared to CeFi, DeFi is more decentralized. CeFi is a permissioned

network, as opposed to DeFi's lack of it. In CeFi, only authorized people may carry out specified tasks, but in DeFi, no central authority figures are present.

DeFi is open-source, which means it promotes unrestricted collaboration among its user community. As a result, unfettered cooperation isn't possible with CeFi, and all choices must be approved by particular individuals. Open-source DeFi, on the other hand, is immune to censorship, whereas CeFi is susceptible.

Blockchain in Finance sector

Throughout the day, our global economy provides assistance for billions of people by transporting trillions of dollars throughout the world. It has flaws, and as a result, it boosts costs by imposing penalties and delays, produces friction by necessitating time-consuming documentation, and creates an atmosphere where fraud and criminal activities flourish. While 37% of all businesses are affected by economic crime each year, only 20% of technical services and 27% of the technology industries see an increase in economic crime due to financial intermediaries like payment networks or stock exchanges. As expected, compliance expenses are on the increase and a major source of anxiety for bank executives. As a result, consumers will be stuck with a higher bill. Because of this, our financial system is inefficient to say the least. The first problem is that it's an outmoded mix of industrial technology and paper-based procedures dressed up in a digital guise of finesse. The second is clustered, making it more resistant to transitions but also making it more vulnerable to device crashes and attacks. Third, it is exclusive, preventing billions of people from accessing fundamental financial tools due to its restricted character. This sort of messy creative disruption is necessary for economic health and development, but bankers have traditionally avoided it. Ledger technology may be the answer to getting out of this creative impasse, though.

To ensure the security of payments, modern electronic payment systems depend on trusted central third parties. It was in an effort to reduce the transaction costs that banks began to entertain claims against one another. With this discovery, merchants no longer had to change paper money to gold in order to perform financial transactions. While this worked, as soon as a different bank sent a note, a new

difficulty emerged: the payee's bank was exposed to the payer's bank until a gold settlement arrangement could be worked out. Acceptance of notes might be managed symmetrically in a small number of financial institutions. Due to a growth in the number of banks in the system, interbank transfers grew more complicated, which compelled financial institutions to find a more effective way of moving cash.

The emergence of digital currencies like Bitcoin, which integrate new currencies with decentralized payment networks, has occurred recently as a result of recent technical developments. While digital currencies' monetary components have garnered a lot of attention, the distributed ledger technology that underpins their payment systems represents a big step forward. The vast majority of financial assets today are nothing more than digital records, comparable to how money is stored in bank accounts today. DLT may therefore have a more significant impact on the banking sector as time goes on The types of distributed ledger are closed and private, closed and public, and open and public ledgers it totally depends in amount of participation and ownership limitations in the distributed ledger (which is implemented as a blockchain). After receiving permission, it is now open to the public. According to this definition, only individuals who have been given the go-ahead to take part in the system are allowed to participate. Private ledgers have another drawback: they can only be owned by a select group of individuals, whereas public ledgers are open to everybody. The banking industry uses a closed distributed ledger for financial activities including interbank payments and global financial transactions.. Blockchains based on a closed distributed ledger where only authorized employees may join are preferred above other forms of technology due to the nature of financial services, where dependability, stability and efficiency are crucial. Only a small number of specialized companies can engage in a closed system in order to reduce the risks associated with openness. First and foremost, it exists to ensure technical advancement and standardization. Because of the paucity of other standard procedures, open type is complicated to standardize as a consequence of technological advancement, whereas closed type is simple in terms of achieving agreement on and acceptance of technical standards among participants. First and foremost, it is capable of achieving great levels of efficiency and independence. A consensus structure eliminates the need for agency involvement in an open type, although the efficiency structure is less efficient than in

a closed type when employing one. It's possible to make changes to an already closed transaction. In contrast to open type transactions, which cannot be changed in the spreadsheet and can only be corrected by reverse trading, a closed type transaction may be amended by mutual agreement in the financial sector, using a closed distributed ledger for this purpose.

Financial services will be revolutionized by Blockchain Technology

Instead of (clearly) decentralisation of information collection and storage, which may indicate a looser connection with their data, blockchain technology for banks is decentralisation of information collection and storage, which may imply a looser relationship with their data. In contrast, they are interested in developing a more efficient and secure method of accomplishing this by minimizing the number of intermediaries involved in each transaction and drastically reducing the number of reconciliation procedures required when utilizing decentralized or private databases, as opposed to the current method. In the case of Blockchain, it may be feasible to rapidly examine and verify if the information, asset, or ownership claimed by the counterpart is accurate and verifiable simply by checking the block in the chain that corresponds to it, as shown in the diagram below. For banking transactions, it is possible that the clearinghouse and the majority of their activities will be eliminated, resulting in considerable cost savings for the financial institutions involved.

A rise in the usage of blockchain-based technology is being seen in non-financial areas as well, including ride-sharing firms like La'Zooz, home automation utilizing the Internet of Things like Chimera, and digital archives like the UK government's digital archives. The Financial Services business, on the other hand, looks to be the most likely to reap the benefits of widespread use of blockchain technology, according to the evidence.

One of the major reasons may be that, being a relatively new technology, it needs massive expenditures in an environment of high uncertainty (given how far we are from knowing the outcome), and that only giant businesses can afford to make such enormous investments. As reported by current statistics, capital market expenditure

has risen at an impressive rate (by 50% year-on–year in 2015), and it is expected to reach $400 million by the end of 2019.

A major step forward has been the formation of the R3 Distributed Ledger Group, a collaboration of over 40 worldwide institutions with the goal of studying Blockchain technology, setting utilization standards, and developing common solutions on a global scale. The formation of the R3 Distributed Ledger Group has been the most significant step forward in this direction. According to current information, each bank is working on a separate subject with the objective of exchanging findings in real time in order to arrive as fast as possible at definite conceptions and practical implementations of the shared ledger architecture, according to the shared ledger architecture.

Blockchain in Accounting and Auditing

When it comes to attestation and accounting, Smith (2018) looks at the impact of blockchain technology and the implications it has. In the current audit approach, there are two flaws: transactions and accounts are only sampled for verification, which implies that all transactions and accounts have not been examined. Rather than a complete evaluation of a business' performance, auditors may only give reasonable guarantees. Blockchain technology can be used to fix these problems. Once the transaction parties have confirmed the data, the consensus mechanism has already accepted it on the blockchain. Because the data is time stamped and hashed, auditors have a ready-made audit trail to look at. Also, confirmations will be unnecessary as a result of this. The creation of continuous auditing of, say, inventory is also made possible by blockchain. As an example, consider Smith (2018).

Currently, all of the Big 4-audit companies are working on blockchain-based apps. To begin automating and simplifying audit procedures and exams, KPMG collaborated with IBM Watson in 2016 and began working on a blockchain. Already in 2014, Deloitte and PwC began developing blockchain applications. For its customers, PwC tests and advises on a variety of blockchain technology. An internal app is being created by Deloitte. EY has teamed together with Accenture to test out editable blockchain technology. Each of the Big 4 firms appears to be aware of the

disruptive potential of blockchain technology.. They are experimenting with several blockchain technologies, including permissioned, private, and public.

(Karajovic, Kim and Lasksowski, 2017)

It's early days for digitalisation in the accounting system, but other industries, like finance, have seen major disruptions due to technological developments. There will be a movement in accounting practices from double entry to triple entry as a result of blockchains and Distributed Ledger Technology (DLT). All financial records are stored on the blockchain for everyone to see and verify thanks to blockchain technology, which enables comprehensive, conclusive verification without the need of a trusted third party. When firms use DLT to input their transactions directly into a joint register (DLT), an interlocking system of lasting accounting records is created, rather than retaining separate records based on transaction receipts as they now do.

A double entry method underpins modern financial accounting. For double entry accounting to work, the company's financial information must be trusted to independent public auditors. A corporate audit is a time-consuming and expensive activity that ties up the accountants' resources for an extended length of time. Additionally, the Blockchain may be a huge asset in today's accounting frameworks since it serves as a source of confidence. External auditors will be unnecessary in the long run if transactions in the blockchain are recorded using an immutably time-stamped and tamper-proof digital fingerprint. As a result of the blockchain's openness and trustworthiness, the network itself will serve as auditors and a watchdog for financial stability.

Transfer of financial assets through Blockchain

Consumers and banking organizations face several difficulties and hurdles when sending money to another country. Every year, hundreds of billions of dollars are sent overseas, and the procedure is often time consuming, costly, and prone to mistake. All of that may be altered thanks to blockchain technology. International payments using blockchain technology have been implemented by several large institutions because it saves both time and money. By transferring funds using a blockchain, consumers may save the time and hassle of going to a money transfer

facility, standing in line, and handing over money to complete a transaction. Blockchain has the potential to revolutionize banking in more ways than just money transactions. Using blockchain technology, it is possible to keep track of transactions and have accurate, secure data such as smart contract and title details.

An example of a blockchain-based financial application.

Since its start a decade ago, blockchain technology has seen significant evolution in the financial services business. Because of tweaks and improvements to the distributed ledger technology, it's now used as the foundation for several new goods and services aimed at exchanging data and information rapidly, securely, and affordably than it was before Bitcoin was invented.

Small payments have become more inexpensive thanks to distributed ledger technology (also known as blockchain), which eliminates the need for manual work. As processing times decrease, broker involvement becomes less essential. Existing institutions and new entrants, such as the P&C insurance business, have been made aware of the possibilities of the technology. In the underwriting process, the insurance industry relies on third parties to provide risk, asset, and loss data. Data collection and claim submission necessitate manual labor, which raises the risk of human error and fraudulent activity. There can be smart contracts that free loss adjustors from having to go through each claim with distributed ledger technology involvement.

Distributed ledger technology can improve the efficiency of export/import in the trade finance sector by simplifying access to trade-related documents, speeding up settlement, and increasing capital efficiency. Smart contracts can reduce the number of counterparties, remove the need for middlemen, and speed up settlement even for post-trade operations.

Consortium

As a result of the growth of internet technology, the financial industry must take proactive efforts to decrease client turnover and commission income. As a result, the

financial industry must develop its operating platform in order to keep up with technological developments. Developing a competitive firm platform or strategic alliances has lately emerged as a critical competency in deciding on business objectives, and it is becoming more important. As a result, an international collaboration was created with the goal of developing a standard blockchain platform that would be available to large financial institutions and global corporations. To ease complex interbank procedures, the financial industry is already taking steps to incorporate blockchains, create a "R3CEV practice" (Crypto, Exchanges, and Venture practice), form a consortium, and develop a blockchain-based trading platform. The financial industry will almost probably take the brunt of the damage. The world's largest financial endeavor, "R3CEV," is the result of a collaborative effort between R3 and some of the world's most famous financial institutions. R3 is in charge of the overall design and technological development of the system, while worldwide banks are in charge of testing and designing user interfaces. Twenty-two large banks, Barclays bank & RBC bank, are working with R3, a FinTech firm, to develop a blockchain-based platform that anybody can use.

Hyperledger, which IBM funded, was developed in collaboration between the Linux Foundation and IBM. The "Hyperledger initiative," which comprises 48 companies like as Intel and Wells Fargo, aims to standardize blockchain technology worldwide. IBM is one of the most recent entrants. With the creation of the IBM Blockchain laboratory, IBM wants to participate in financial markets and related services in the United States, Europe, and Asia. This has led to predictions that, in addition to financial transactions, the blockchain would be used in the future to handle a variety of operations such as legal transactions, copyright protection, and identity management.

Payment and remittance

It is extremely likely that blockchain technology will be utilized in financial systems such as micropayments and large payment systems in the future. Now that it has been used in financial transactions. Because they allow direct operations between parties, not including the middleman due to participation in various institutions, high-commission foreign remittance services are the most effective implementation of

blockchain technology. Private blockchain banknotes are quite likely to be developed. Using blockchain technology, Ripple, a payment-related FinTech business with headquarters in the United States, hopes to build a worldwide payment network system. Along with remittance services, this global network technology is aimed at international currency settlement and foreign exchange markets. Additionally, start-up firms are increasingly creating blockchain-based remittance services.

The foreign currency market is also anticipated to undergo changes as a result of this. Visa and MasterCard are working with Singapore-based virtual money settlement service provider TenX to develop a solution that would let customers pay with virtual currency over a traditional credit card network. If a TenX check card user spends $10 at a convenience store, your account will be debited by $10 in virtual money. While the convenience shop receives virtual money from the card issuer, it also receives legal currency in the form of $10. When a party uses a virtual money card, the business owner has no way of knowing whether or not they've withdrawn cash from the virtual money account they were using. The virtual money settlement service uses an existing card payment system whether or not the authorities approves of it. It's up to the customer whether they wish to use their bank account to pay a fee to the bank or refresh their check cards whether traveling overseas or domestically.

Security exchanges

Using the blockchain as a financial trading tool implies having transparent pricing, new marketplaces, quicker payment processing, and immutable records of all transactions made. Using Blockchain's ledger technology, individuals may now transact at lower prices and with more speed than ever before. When it comes to crypto-trading platforms or smart contract tools, blockchain continues to show its tremendous future potential in financial trade. Institutional investors now have a safe and reliable infrastructure thanks to the rapid digitalization of financial markets. Institutional investors are drawn to the bitcoin market by rising trade volumes. As crypto assets accumulate in the investment portfolios of big market players, prices will stabilize and volatility will be reduced. Increased trading instruments that bring new participants to the exchange market will help make trade exchanges more

visible to the general market. It was well-known that Nasdaq was collaborating with seven major cryptocurrency exchanges, including Coinbase. Instead than focusing on the New York Stock Exchange, Nasdaq has shifted its attention to investing in blockchain startups and firms to offer them with matching or surveillance technologies to help its customers expand their marketplaces. Bakkt, the NYSE's new trading platform, allows users to manage their cryptocurrency assets. Such investments have had a significant influence on bitcoin's status as the most liquid digital currency. Some of the platform's investors include ICE as well as Starbucks, Microsoft, and BCG, amongst others. Such a rise in corporate interest in digital assets shows how valuable it is to make such investments. Thailand's Stock Trading is working on artificial intelligence (AI) and machine learning (ML) techniques to include into its digital asset exchange platform.

Smart contracts

One of the most notable features of the blockchain is its capacity to handle smart contracts of any complexity. Smart contracts are used in property operations, official agreements, and commercial trading when the conditional and contents of transactions are recorded, suitable regulations principle and processes are utilised, in outcome is informed to the individuals involved. In comparison to traditional physical exchange activities, the goal of smart contracts is to make physical and visible transactions easier and more cost-effective. Platform-based blockchain is of interest to corporations like as Microsoft and IBM, which are aiming to combine and market their own blockchain platforms as a unit. Microsoft and ConsenSys, an Ethereum-focused start-up, are partnering on a project to provide a "smart contract function" that processes transactions automatically when encountered specific condition. Many efforts were put together to make smart contract uncomplicated, but all attempts were unsuccessful. Ethereum is a fantastic blockchain technology due to its adaptability for smart contracts. Music sharing, insurance contracts, marriage reports, and smart grid billing are all examples of things you can do using Ethereum. Blockchain has the potential to be a game-changer because smart contracts increase trust in financial transactions. Smart contracts are comparable to physical contracts in that the contract's conditions are completed in real time since they use

the blockchain rather than paper contracts. The financial industry stands to benefit the most from smart contract adoption for a variety of reasons, including Once all prerequisites are met, these agreements can be concluded rapidly without the involvement of a middleman, providing improved security as a result. Before any money is invested in a business, terms and conditions are agreed upon. To use the blockchain's computer network to verify that all contractual responsibilities have been performed, the contract must be clear and unambiguous.

Cyber securities in Blockchain

Using centralized data repositories and single points of failure allows hackers to take down whole networks, tamper with data, lead unsuspecting users into cybertraps, steal and fake identities, and perform other malicious activities. Identity theft, data manipulation, and Denial-of-Service assaults may all be thwarted with the help of blockchain technology's increased security. The financial system will be more secure as data is decentralized and distributed throughout the whole blockchain network, and as each transaction is cryptographically secured.

Cyber security experts have a lot they can do to reduce the hazards that come with blockchain technology. In order to install blockchain as safely as feasible, IT professionals will need to have honed their analytical and technical abilities.

Encryption is a crucial step that cyber security experts should take. Cyber security experts can assist reduce some of the inherent dangers by further encrypting the data transferred via blockchain technology.

Professionals in cyber security can also utilize their communication skills to explain to their customers the dangers they may be facing. Before adopting a new blockchain platform, advise a firm to thoroughly research providers and mention cyber security concerns. Using pseudonyms in online transactions is a common-sense information security technique that a cyber security professional can recommend.
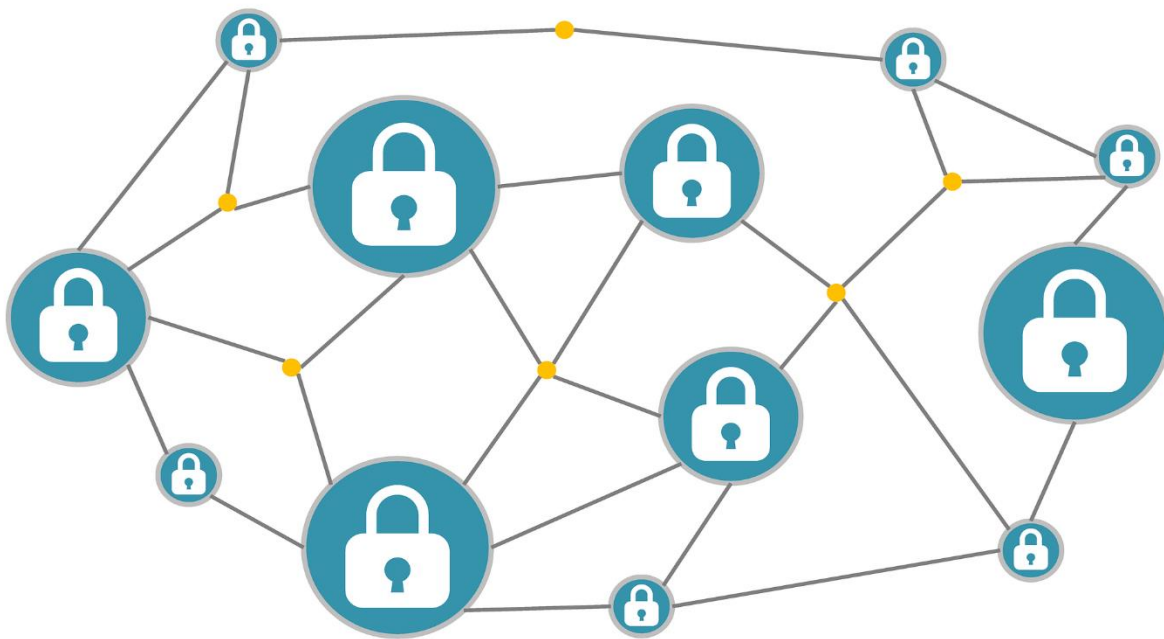
Figure 7 security in blockchain

Trade execution and settlement are carried out using blockchain technology

The use of blockchain technology will allow for speedier settlement at reduced costs, all while reducing fraud. Some businesses will come out with innovative and potent trade and settlement solutions. It's an example of how the public blockchain of Nasdaq can maintain track of changes in ownership of shares granted to founders, early investors, and workers even if they haven't been listed yet on the public exchange. Similar to this, Ripple has built a robust value exchange network that allows financial institutions to trade money, cryptocurrencies and commodities in real time without the need of traditional international financial system intermediaries such as SWIFT (SWIFT). However, Overstock.com used a blockchain-based method to issue private bonds, which were certified by the US Securities and Exchange Commission (SEC) for use in issuing and recording business shares on the blockchain.

Each time, the blockchain is updated to reflect the change in ownership, and payment and settlement are completed at the same time.
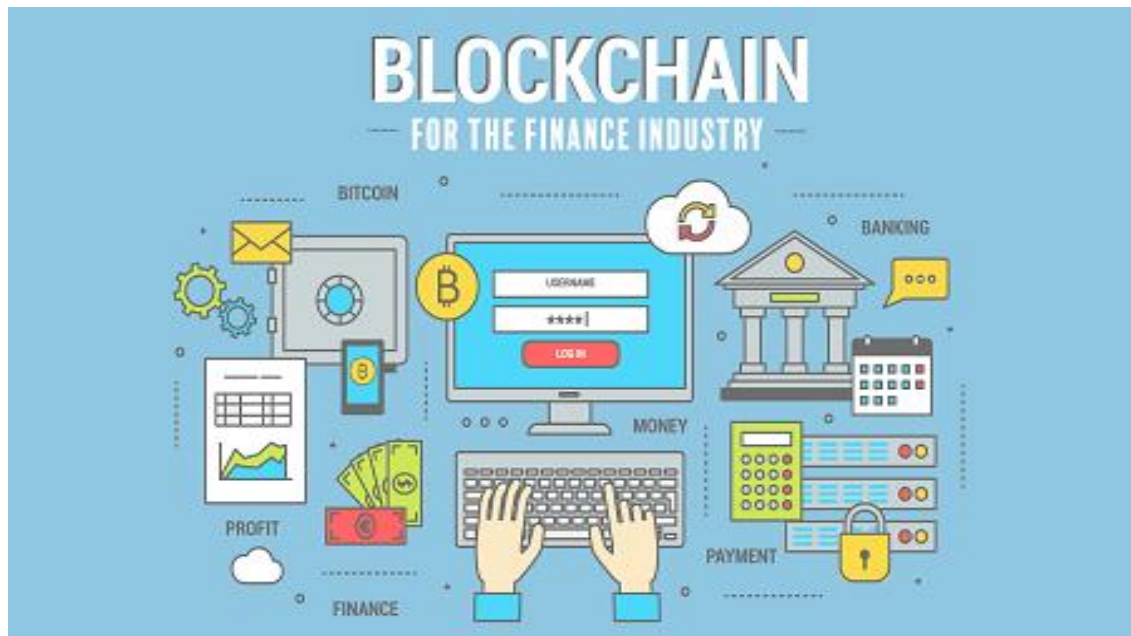

Figure 8 Blockchain for finance industry

The use of blockchain technology in finance is rapidly expanding

Significant alliances and consortiums have been formed, which will almost certainly result in exponential expansion in the usage of Blockchain technology across industries, including the financial industry.

SBI Holdings, a Japanese conglomerate, collaborated with Ripple last year to launch SBI Ripple, the company's first digital asset, on the market. Ripple makes use of cutting-edge Blockchain technology. It is now feasible for Asian financial institutions and remittance transfer providers to make use of Ripple's platform. Additionally, American Express corporate clients in the United States may now utilize Ripple to make rapid payments to firms in the United Kingdom.

New projects demonstrate how quickly Blockchain is taking root in the financial sector. The fact that more governments are embracing distributed ledger technology for applications comparable to those in the financial and energy industries may be the most telling sign of its legitimacy and robustness.

Governments may be able to get more access to and control over data using Blockchain, allowing them to analyze public policy's impact more accurately and deliver more useful services. If the government backs the technology and it is developed with national legal requirements in mind, its credibility will only grow.

Blockchain platform Alastria, which was formed in 2017 as a non-profit organization in Spain, became the "world's first regulated national network on Blockchain." Main Spanish financial, energy and telecoms firms support it. It makes use of digital ID to provide people full transparency and control over their personal data. To supply services and utilize applications in a cross-sectional environment, members can employ "smart contracts," which certify and guarantee each member's ID.

According to a report by CryptoSlate, the Spanish government also submitted a proposal in July 2018 to integrate Blockchain technology into its public administration in an effort to improve cybersecurity, simplicity of use, efficiency, and safety.

State-backed Blockchain is also being investigated by other countries, such as Dubai, China, Australia, and the United Kingdom. Even though GovCoin was put through its paces in the welfare and benefits system by the United Kingdom government in 2016, the results of the experiment have yet to be released.
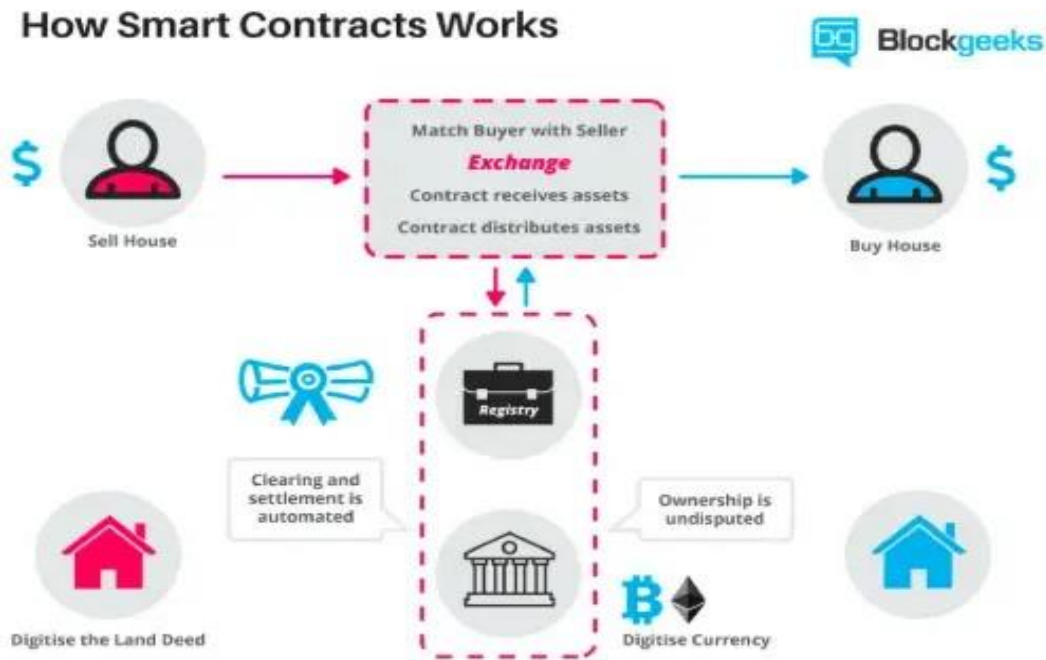
Fig 9 How Smart Contract works

NEW CONCERNS RELATED TO IMPLEMENTATION OF BLOCKCHAIN

Creating new blockchain-driven financial services and enterprises will provide a number of obstacles, some of which are listed below.

First and foremost, there are difficulties of a technological kind. Using blockchains for financial transactions necessitates implementing access restrictions and concealing transaction information. Performance and reliability enhancements will be required for other use cases as well.

Second, there are logistical and organizational issues to contend with. For trade finance procedures such as those detailed in Chapter 2, while blockchains enable impartial execution, a variety of unusual activities such as amending contract details and dealing with inconsistencies may emerge in real practice It will be necessary to investigate how to cope with these procedures by use of blockchains and ancillary processes. In order to meet the transaction characteristics, blockchains will need to

support numerous laws, regulations, and industry standards that regulate financial transactions.

Third, coordinating with other systems is difficult. Unlike securities exchanges and the Bank of Japan Financial Network System (BOJ-NET), which provide matching and netting services, blockchains are primarily a transaction logging tool (the financial system network operated by the Bank of Japan). The separation of blockchain functions and associated tasks will need to be structured, and an overall architecture will need to be created, because blockchains cannot replace all financial infrastructure operations. In order to coordinate with the IoT, ID management technology, which uniquely defines each object on a blockchain, will be required. Another difficulty for industry cooperation will be the mechanism utilized to coordinate with other systems and blockchains.

The user's point of view may also present additional problems. P2P transactions on the blockchain, for example, might raise the workload of individual users if smart contracts are used to perform contracts between people. As consumers become concerned about how the system collects and keeps various transaction history data and links to other users, their support of blockchain technology may begin to wane. It will be necessary to investigate technologies and services that can handle such a shift in values.

A major modification or replacement of current systems is required for blockchain applications to be effective. Prior planning by financial institutions will help them make the transition smoothly.

Private or permission blockchains and strong encryption are available, but before the general public can put their confidence in a blockchain solution with their personal data, there are still cyber security issues that need to be solved.

Only those with the proper checks and screenings should be allowed to participate in the blockchain. Legitimate legal institutions with a proven track record of accomplishment are unlikely to drop out.

Apart from the core software, the majority of blockchain systems also include traditional "shadow" databases, communication protocols, and other components. From the standpoint of networking, a secure communication route between the

components of various nodes is highly recommended. The network has to be resilient to both external and internal attacks.

Smart contracts are pre-programmed computer programs that behave as agreements, with the conditions of the agreement being self-executed and self-enforced. The use of smart contracts to transfer money is becoming increasingly common. Programmers use C++ and JavaScript among other programming languages to create smart contracts. They also make use of other languages like Go and Python. Similarly to any other computer program, the creator of a contractual program has the risk of purposefully or inadvertently creating a flawed program that puts the contract's assets at risk.

Financial institutions cannot operate without the security of their financial transactions. It is important for the company's accounting and record-keeping systems to be accurate and immutable at all times. Unwanted parties must be prevented from gaining access to transaction information by encrypting it.

Future Expectations with Blockchain

There is already a surge of tech-based financial innovation disrupting banks and finance thanks to blockchain and cryptocurrency ledger technology. Comparisons to the 1980s computer revolution are easy, but they understate the magnitude of what's coming. Back offices of financial organizations continued to run as usual when computers replaced paper-based records-keeping. So, for example, conducting a securities transaction now requires substantially the same procedures as it did 50 years ago; computers have just improved the pace at which trades are executed. Blockchain, in contrast to traditional financial transactions, reorganizes financial transaction mechanisms in ways that were unimaginable only a few years ago.

Taking into account all of the advantages and dangers of blockchain will take time for institutions. While some companies can afford to wait for complete certainty before deploying new technologies, most can't. In the next years, innovation will pick up speed as financial services and technology come together more closely. Companies' success will be determined by their ability to make sound decisions based on past experience. In other words, institutions must actively participate in this innovation

and disruption cycle in order to understand how technology is altering the industry and to be prepared to recognize and seize opportunities as the environment develops. Similarly, if the problem changes before a flawless solution can be implemented, it will be pointless to focus on developing one.

When it comes to the future of blockchain-based solutions, the possibilities are nearly limitless. Financial services and fintech businesses will face a new set of challenges as the blockchain revolution takes hold. These include identifying problems that call for novel solutions rather than just fashioning answers to existing problems. Companies that embrace fintech and the blockchain revolution will have a competitive edge.
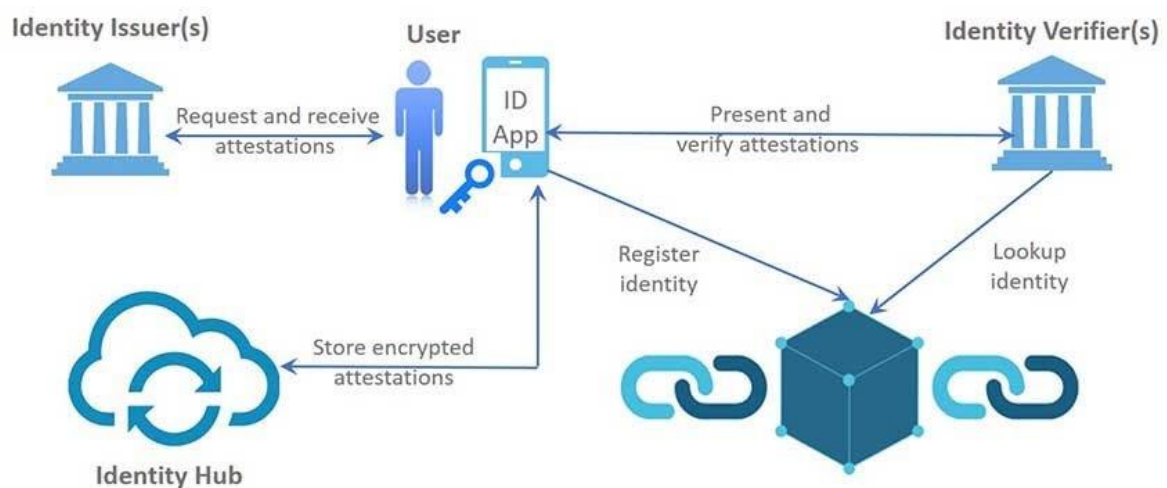

Fig 10 Digital identity check in blockchain

References

- Andolfatto D. Blockchain: what it is, what it does, and why you probably don't need one. *Review.* 2018;100:87–95. doi: 10.20955/r.2018.87-95.

  https://files.stlouisfed.org/files/htdocs/publications/review/2018/04/16/blockchain-what-it-is-what-it-does-and-why-you-probably-dont-need-one.pdf

- Antonio M., DiNizo Jr. 2018. From Alice to Bob: The Patent Eligibility of Blockchain in a Post-CLS Bank World.

  https://scholarlycommons.law.case.edu/jolti/vol9/iss1/2

- Gupta, A. & Gupta, S. 2018. Blockchain technology: Application in banking sector.

  https://www.delhibusinessreview.org/V19n2/dbr_V19n2g.pdf

- Krause, E.G., Velamuri, V.K., Burghardt, T., Nack, D., Schmidt, M. & Treder, T.M. 2016. Blockchain Technology and the Financial Services Market State-of-the-Art Analysis. Infosys Consulting
  https://www.infosys.com/consulting/insights/Documents/blockchain-technology.pdf
  https://www.crowdfundinsider.com/wp-content/uploads/2017/04/Global-Cryptocurrency-Benchmarking-Study.pdf

- Smith, S. (2018). Blockchain augmented audit – benefits and challenges for accounting professionals. Journal of Theoretical Accounting Research, 14(1), 117-137.
  https://poseidon01.ssrn.com/delivery.php?ID=110099072074091022015074069088084070021078038028040067091087014081115031103002003087041045016000015111098003001114119122124089026059004029003112093104000091004081089070036030114006073070092124099092082076067074100086073089125064114086081122114094096029&EXT=pdf
  https://www.researchgate.net/profile/Shailak-Jani/publication/327230927_Applications_of_Blockchain_Technology_in_Banking_Finance/links/5b8241b492851c1e12330229/Applications-of-Blockchain-Technology-in-Banking-Finance.pdf

- Karajovic, M., Kim, H. and Lasksowski, M. (2017) Thinking Outside the Block: Projected Phases of Blockchain Integration in the Accounting Indusrty (June 12, 2017) Retrieved from: SSRN:

- Biais B., Bisiere C., Bouvard M., Casamatta C. The Blockchain folk theorem. *Rev. Financ. Stud.* 2019;32(5):1662–1715

  https://academic.oup.com/rfs/article/32/5/1662/5427771?login=true

- Jackson, R., 2018. Scalability is Blockchain's Biggest Problem But it Can Be Resolved
  https://cryptoslate.com/stablecoins-101-the-who-what-why-and-how/

- Rocket lawyer 2014
  https://www.globallegalpost.com/big-stories/online-lawyers-to-offer-smart-contracts-next-year-4593250/

- Nick Szabo
  https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html

- How blockchain is changing finance
  https://capital.report/Resources/Whitepapers/40fc8a6a-cdbd-47e6-83f6-74e2a9d36ccc_finance_topic2_source2.pdf

  News and Magazines

  https://www.nytimes.com/2021/09/05/us/politics/cryptocurrency-explainer.html

- Figure 1
- https://www.businessworldit.com/blockchain-cryptocurrency/blockchain-in-finance/
- Digital vidya
- https://www.digitalvidya.com/blog/introduction-to-blockchain/
- Intelli Path
- https://intellipaat.com/blog/tutorial/blockchain-tutorial/how-does-blockchain-work/
- Figure 5 Picture Public and Private blockchain

- https://datascience.foundation/sciencewhitepaper/top-5-use-cases-and-platforms-of-blockchain-technology
- Figure 6
- https://www.cbinsights.com/research/blockchain-disrupting-banking/
- Figure 7 cyber security picture
- https://www.paymentsjournal.com/howboost-cyber-security-with-the-blockchain/
- Figure 8
- https://defi-planet.com/2021/08/application-of-blockchain-technology-to-finance/
- Figure 9
- https://blockgeeks.com/guides/blockchain-and-finance/
- Figure 10
- https://customerthink.com/top-5-thought-provoking-use-cases-of-blockchain-in-banking-finance-sector/

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