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Impact of Blockchain Technology on Financial Services

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Abstract –

This paper is written to provide an insight on how blockchain technology has a very high potential in providing an alternative way to attractively organize the modern finance. Blockchain today is not merely bitcoin or other crypto currencies. It impacts various other sectors such as supply chain management, voting mechanisms, original content creation, secure sharing of data, etc. But this paper relates to today's world of fluted, along with blockchain. It rightly points out the flaws associated with the current financial world and how blockchain provides a solution to it. This paper also demonstrates the various applications of blockchain in finance such as De-Fi (Decentralized Finance), Dapps (Decentralized Apps), Smart contracts, cross border payments, NFTs, DAOs (Decentralized Autonomous Organizations). It also shows how blockchain can bring out a more efficient and secure finance industry. It also contains information on crypto currencies, their various usages, and their underlying fundamental principles. The paper also describes some insights into blockchain security issues and remedies.

Keywords **- blockchain, ledger, bitcoin, crypto currency, NFT, DAO.**

I. Introduction

Blockchain is basically a digital ledger of transactions which is decentralized, distributed and public. These factors in turn give blockchain the properties of being programmable, unanimous, secure, immutable, anonymous or pseudonymous, time stamped and secured. Hence blockchain can be thought of as functioning on the Distributed Ledger Technology (DLT). Here the transactions are recorded using cryptographically immutable signatures known as hash.

Today, the financial industry has been plagued with lots of paperwork, redundant processes and data leaks which has not only led to losses in the industry but has severely affected the trust of the consumers. Therefore, by using blockchain, we can go a long way out in solving these problems [1]. The main problems of centralized systems of the financial industry are its opaqueness, and its dependency on intermediaries for the purpose of security and data storage. Blockchain solves all these problems in one go as the data becomes immutable (ensuring data becomes difficult to change and hence making it more authentic, more secure and more correct), improves the privacy factor as well as bring out the zero-knowledge proof factor.

The blockchain can reduce the risks associated with the financial industry by making every stakeholder a node, which in turn will enable the peer to peer (P2P) transactions by removing all the intermediaries associated in between, hence lessening the extra cost associated with each transaction [2]. Cross border payments can be carried out very easily and smart contracts can work around facilitating the tedious financial settlements involving multiple layers of scrutiny. The process of auditing can be improved a lot using the blockchain and hence transparency can be promoted in financial systems.

II. HOW THE BLOCKCHAIN WORKS

Here is a basic look on how blockchain technology works. As the name suggests, Blockchain is made of two words viz. block and chain. The list of records called as blocks are linked together as a chain using cryptography. Every block contains the previous block's cryptographic hash, transaction data and a timestamp (which proves the existence of data when block gets published into its hash) [3].

Therefore, this makes blockchains immutable because the data once recorded cannot be altered without making significant changes to all subsequent blocks. And even if we manage to make this change possible at a certain node (many nodes verify and validate the transactions), even then, it is not possible to make this change work because we can't manage to hack all nodes and modify their recorded data. Therefore, the node where the data is modified can be tracked down. Below is a diagrammatic representation covering how a particular transaction is completed in blockchain.

III. BENEFITS OF BLOCKCHAIN

Blockchain removes the need to have centralized data storing entities. It removes the middlemen, and the costs associated with it thereby. Yet regarding the future of blockchain, it can't be rightfully said at present whether it is the replacement of the current monetary exchange systems — owing to some problems like scalability, security and the threat posed to the environment. But all these sectors are being looked into and hopefully there will be fruitful results coming. out in the near future [4].

Decentralized systems like blockchain reduce the need for trust becoming attractive because of the manner in which trust in centralized entities was being questioned after the financial crisis of 2008. Blockchain is also partition resistant, i.e., even if a node fails to connect to a network or gets disconnected from it; other nodes can continue to function irrespective of them as all of them have the copy of the same data. Another benefit of blockchain may be the foundation it provides for smart contracts. These are nothing but contracts embedded in computers instead of legal bindings. These smart contracts in turn reduce small transactions costs making them economically viable by automating their negotiations and enforcement [5].

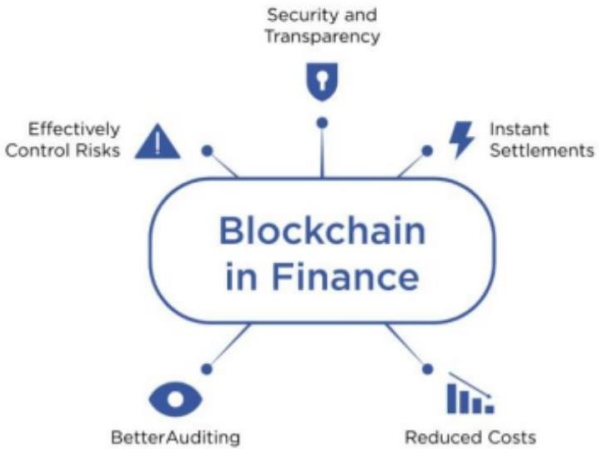

Figure. 1.0. Blockchain in Finance

Another benefit of blockchain is the Byzantine Fault tolerance which deals with nodes that function maliciously or malfunctions. This is different from the partition resistance which deals with the nodes which cease to function. This came to prominence as backing and cybercrimes rose. Terrorists tend to bring catastrophic damage by destroying or corrupting data. Thereby, blockchain serves defense against these kinds of attack as data have been replicated among large number of nodes which run on different machines and ensuring cryptographic integrity checks.

IV. REAL WORLD USE-CASE/APPLICATIONS OF THE FINANCIAL BLOCKCHAIN

A. Smart contracts

This term was coined by Nick Sbazo two decades ago when Internet was at its infancy. Smart contracts are nothing but a combination of the protocols and the user interfaces which formalize and secures relationships over the computer network. Business forms, accounting controls and law contracts have long formalized and secured this type of relationship in the paper-based world [6].

Now smart contracts can operate without blockchain just as computer databases can work without blockchain. But the problem arises regarding trust. That is where blockchain comes into play and solves this problem. The blockchain not only acts as shared database but also as a shared computer. Therefore, Sbazo says that a blockchain computer is a computer based on cloud, and it is shared among many traditional computers, protected by cryptography and also has a consensus technology [7]. On the other hand, a contract was just the written document in legal language which represented the meeting of the minds. But, with the passage of time, it was seen that instead of legal language, the computer code language turned out to be more helpful in better describing financial contracts. Even the US SEC once proposed that most asset backed securities should be disclosed in computer coding format using the Python language [8].

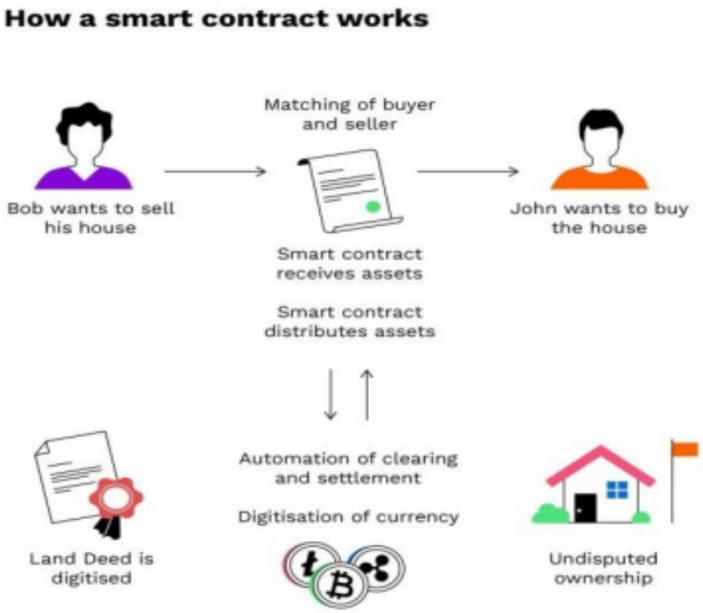

Figure. 2.0. Workflow of Smart Contract

B. NFTs and its marketplaces

NFTS basically stand for Non-Fungible Tokens. These are unique records of ownership that are stored on blockchains, which makes them unforgeable. It can be any kind of digital asset which we can think of. But it cannot have its duplicate. It should be one of its kinds. Regarding NFTs, big companies are still on their way to figure out how they can leverage NFTs to their own business model. Early NFT investments include that of Cryptopunks, Bored Apes Club, etc [9]. The technology first came out in 2017 when Cryptokities were carved out of Ethereum blockchain. Since then, many industry leaders have played their own way out. E.g., In 2020, NBA Top Shot was launched by NBA after its partnership with Dapper Labs. It had billions of dollars' worth of basketball collectibles. Similarly, NFTs can help out the music industry. Original creators can get paid in the form of royalties when their creation gets sold [10]. There are many NFT marketplaces which have been built over different blockchains. One major being Open Sea, built on Ethereum, crossed around 40000 users in January 2022. This shows how NFTs are there to stay for a long time. Below chart shows involvement of people with NFTs from March 21 to March 22.

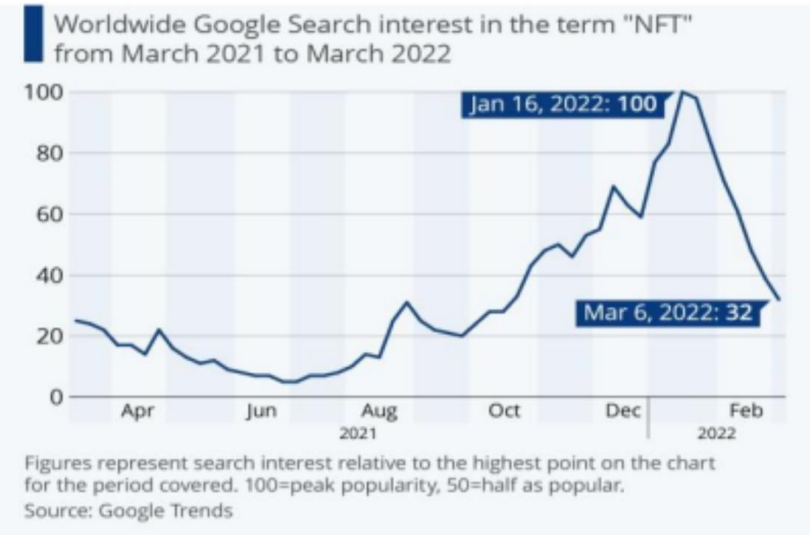

Figure. 3.0. Involvement of people with NFT

It seems NFTs were just this piece of digital arts but it is worth more than that. We can see how Coca-Cola auctioned their NFT collection and raised money for charity; how virtual lands are being sold as NFTs over games like Decentraland. So, we can see the scope is limitless and it will be more so in the upcoming times.

C. Cross border payments

Currently, cross-border payments take an undecided amount of time along with hefty charges sometimes from the sender, or sometimes from the receivers or sometimes even both. Money has to go through various financial institutions which in turn make the payments expensive and slow. This is where blockchain comes into play. There are various blockchain networks like Stellar and Ripple which makes cross border payment settlements quick

and also cost effective. Even other cryptocurrencies like Bitcoin and Ethereum take nominal fees in P2P transactions and hence they can also be used for payments. We can all see how recently in Russia Ukraine war, when all banks and ATMs had to close down (due to suppression by USA on SWIFT system), how donations in the form of cryptocurrencies poured in from all over the world aiding in rescue and relief of people [11]. There has been a 46% increase in cross border payments from US Exchanges in the last two years.

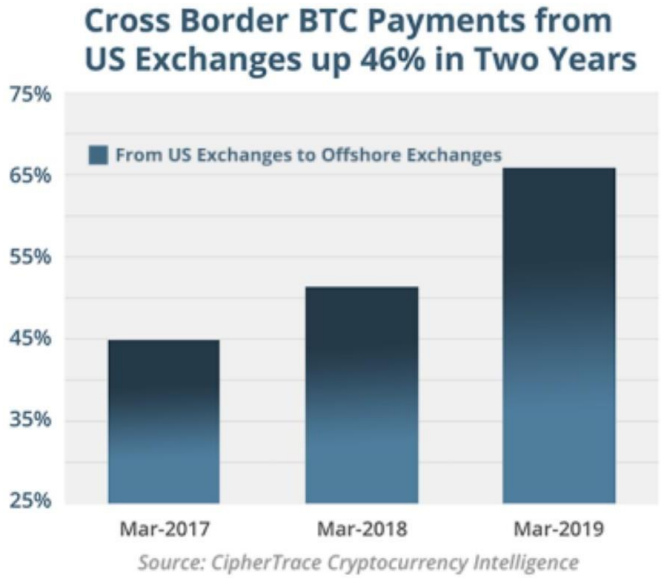

Figure.4.0. BTC Payments from US Exchanges

D. DAO

DAO (Decentralized Autonomous Organization) is a new decentralized business model for organizing both non-profit and commercial business enterprises that doesn't have a legal entity or a formal organizational structure and consists only of smart contracts. DAOs seem to be a promising area of research and development in the upcoming times.

E. Anti-Money Laundering Tracking system

Companies such as Ocular whose anti money laundering compliance platform leverage security enabled by blockchain for ensuring non manipulation of data. Technology scans faces and biometrics of users while applying for government issued IDs like passports, DL, etc. Hence, they aid in providing anti money laundering platform as well as lead to catching of thieves who forage fake IDs from other countries [12].

F. Cryptocurrency Exchanges

Licensed virtual assets exchanges such as Gemini and many others out there let users buy, sell and store bitcoin, ethereum, and other cryptocurrencies. It also offers certain rewards in form of earnings like 7-8%.

G. Lending platforms

Before blockchain came to existence, people used to borrow and lend by involving a third party or intermediaries which created trust among them and hence facilitated the transaction. However, now the borrowers and lenders can deal with each other directly by executing smart contracts of an immutable nature. These smart contracts will facilitate the negotiation in the process of lending. If the borrowers fail to repay within the due date, then the smart contract would devise a late fee to the actual amount to be paid. Popular banks like Credit Suisse and ING have become successful in swapping 25 million Euros liquid assets with a blockchain based lending application. Thus, trust is added to the system and that too without any third party or intermediaries [13]. E.g., SALT lending platform is one such platform.

H. Tokenization

Finance is all about money and the world could have a much better financial system if fiat money (euros, dollars, rupees, etc.) could be brought into blockchain and transactions are made possible. The way to move forward is called tokenization, where fiat money is tokenized and then transacted on blockchain. Now, there are three ways to do this. First is that the central banks issue their own digital currency which can be forward is called tokenization, where fiat money is tokenized and then transacted on blockchain [14].

Now, there are three ways to do this. First is that the central banks issue their own digital currency which can be transacted on blockchain. Second, some large and trusted institution could issue crypto-tokens fully convertible into fiat money with it being. 100% backed from fiat reserve. Third, a decentralized smart contract can be used to create a token which is pegged to a certain fiat currency. E.g., the Dai stable coin.

I. Real Estate processing platforms

Propy is a real estate global marketplace where the title registry system is decentralized. This leads to instantaneous title issuance, and it also offers cryptocurrency enabled properties, i.e., the properties that can be bought using cryptocurrencies [15].

J. Blockchain Interoperability

Currently there are different blockchains operating differently under network isolation. It is not a cumulative system. Hence there is a difficulty faced in blockchains communicating among each other. This problem is solved by the emerging cross-chain technology which lets blockchain communicate

among each other. This cross-chain tech facilitates the transfer of data and values among different blockchains.
Let us consider the blockchains bitcoin, Solana and ethereum. These networks allow their users to trade their tokens on blockchain but there are several issues underlying such as scaling, which creates it difficult for the user to work on. Therefore, users do not get full results because these chains work separately.

Therefore, with interoperability solutions, these problems are overcome. They work on the principle of atomicity. They help in improving efficiency and also reduce segmentation. Interoperability solutions connect two or more independent blockchain networks, provide better scalability and also allow enhanced flow of data transfer and tokens. Cross chain technology also creates stability around the financial markets of the world as it discourages the monopoly of large corporations in the world [16]. As cross chain technology is an emerging phenomenon, it has a long way to go facilitating interoperability. It is very essential for institutional as well as retail investors as well as large corporate entities to participate actively in token trading. Certain tokens facilitating interoperability are Quant, Cosmos, Polkadot, etc.

K. Metaverse

Finally, there comes the word of the year — The Metaverse, the word which has shaken up the world of stock markets, sending the Facebook's stock prices soaring high. The word, which has skyrocketed the prices of certain cryptocurrency tokens such as MANA (Decentraland), SAND (Sandbox). But what is Metaverse? Metaverse is nothing but a shared, immersive and virtual world. NFTs will be the lynchpin of the metaverses, and it will have its own currencies through which digital assets can be bought and sold.

The biggest of the tech companies are already in the business of building their own metaverses. Recently Facebook (now known as Meta- short form of Metaverse) announced its work in and around metaverse development thereby renaming itself to Meta. Even Apple and Microsoft are busy in developing Metaverse. Involvement of these big companies and the brains behind them makes one thing sure — Metaverses are nowhere fraud and soon we all will be having our very own digital identity.

According to some people, a time will come when we will value our digital identity more than our physical identity. This sentence may be true or not — time will tell but one thing is for sure — Metaverse is an interesting concept and will surely rule the gaming industry and also the financial industry to some extent [17]. This is because of the entry of banks like J.P. Morgan Chase & Co. into this sector. We have already heard how famous celebrities like Snoop Dog, Will Smith, etc. has already purchased lands in the virtual world and how developments have been made in the already existing metaverses — Sandbox and Decentraland. Metaverse economy is projected to be a 5 trillion-dollar industry by 2025. So, blockchain technology is going to have a great impact on world finance through meta verse.

V. INVOLVEMENT OF THE WORLD

According to Google trends, people started searching for "blockchain" in 2013, i.e., 5 years later Satoshi Nakamoto drafted the Bitcoin white paper. This kept on increasing consistently until summer of 2017, after which there occurred a search explosion [18]. Today many of us know about bitcoin and the technology associated with it. Many of us may have even invested in it in some or other way. But 10 years back it was not the same as it is today.

Lloyd Blankfein, the senior chairman of Goldman Sachs, once said regarding bitcoin that something which moves 20% in a night cannot be a currency. Rather it is a vehicle to perpetrate fraud. This statement was made during the famous bull run of bitcoin in 2017. But even now, the success of bitcoin hasn't much moved him and recently he told CNBC that he had been a regulator, he would be hyperventilating at the success and arming himself to deal with it [19].

These misgivings around the Deli space and the cryptocurrency space are not entirely baseless or unfounded. There are many hacks and frauds that have occurred and have left people split into two groups whether to support it or not. Frauds amounting to approximately 24-0 million dollars have occurred between January to April 2021, which has increased to an even bigger number to January 2022.

So, it can be seen that there is volatility and fraud occurring in and around the world of cryptocurrencies but there is much more to blockchain instead of these opportunistic investments. This has led to boom of institutions adopting technology (mainly the financial institutions). Finextra once pointed out that the Distributed Ledger Technology can help reduce storage overhead costs of banks by 15 to 20 billion dollars per year by 2022. A report published by IBM suggests that around 90% of the banks have invested in research around blockchain and this increase in adoption points out to one sure thing — normalization of blockchain technology usage in the financial sectors [20].

Switzerland has shown great progress in the development of blockchain. Switzerland's crypto valley, located in Zug, has come out as an example for implementing a successful blockchain regulatory environment where projects are encouraged, and they have even moved on into incorporating blockchain into civil life after successfully trying blockchain based e-voting. Self-executing contracts, manual processes like claims and compliance, payments become easier, swift and secure with blockchain technology, which in turn can promote better governance around data sharing. Another great milestone for the development of blockchain technology has been setup by El Salvador. It became the first nation in the world to allow people to transact in cryptocurrency, alongside the US dollar. The IMF in fact urged El Salvador to reverse its decision of making bitcoin a legal tender [21]. President Nayib Bukulele even announced of building up a bitcoin city in El Salvador at the base of a certain volcano by using cryptocurrency to fund the project ($1 billion would be funded using bitcoin funds). Certain bitcoin ETFs have also been accepted by financial institutions. A developing country like ours has also proposed taxes on cryptocurrencies referring them to as virtual digital assets. And India is also coming up with its own digital

currency, the CBDC. This is a way moving forward which increases enthusiasm among the youth. Whereas there are countries like China, bitcoin is completely banned. So, we can rightfully say that, still the world is in a dilemma, but with a tilt towards the positive effects brought up by the blockchain technology.

VI. COMPANIES PROMOTING BLOCK CHAIN

There are hundreds of companies that use the blockchain or promote the use of it or even invest in it. Since we are talking about the financial companies, some of the famous companies promoting bitcoin and blockchain are HSBC, Square, Micro strategy, VISA, American Express, Barclays PLC, etc. VISA launched Visa B2B connect, for business-to-business payments [22]. It has launched cryptocurrency credit and debit cards. VISA also became the first payments giant to settle the transactions with cryptocurrencies in 2021. Barclays PLC had invested heavily into research involving cryptocurrencies and it filed a patent in 2018 for blockchain use in streamlining the process of KYC. Barclays PLC has also invested in Fnality which is conducting research so as to create a stable cryptocurrency backed by USD. American Express is also offering credit cards, loans and banking services.

Figure. 5.0 List of Companies Promoting Block Chain Technology

Am-Ex also worked with another company called Hyperledger to create its own blockchain and also tested it with an online grocery delivery platform, Boxed. It then billed the customer through a smart contract.

VII. ETHICAL AND PRIVACY CONCERNS WITH BLOCKCHAIN TECHNOLOGY IN FINANCIAL SERVICES

The decentralized and transparent characteristics of blockchain technology has led to its widespread use in financial services, especially in domains like digital identity management, smart contracts, cryptocurrencies (like Bitcoin), and cross-border payments [23]. But in spite of its potential, blockchain raises a number of privacy and ethical issues, particularly when it comes to financial services.

1. **Privacy Issue:** Transparency is a fundamental characteristic of blockchain. All parties have access to the transaction history since transactions are documented on a public ledger. Although this encourages accountability and trust, it poses significant privacy issues, especially with relation to sensitive financial data.
2. **Regulatory Compliance:** A number of nations mandate that financial institutions abide by data protection rules, such as the General Data Protection Regulation (GDPR) of the European Union. The immutability of blockchain technology, which makes it difficult to change or remove data after it has been written, makes it difficult to comply with the GDPR's "right to be forgotten" clauses [24].
3. **Hacking of Private Keys:** Private keys are frequently used to secure assets in blockchain-based financial systems. An attacker can take complete control of the related assets (such as bitcoin holdings) if a user's private key is compromised, which could result in financial loss.
4. **Smart Contract Vulnerabilities:** Malicious actors may be able to take advantage of faults or vulnerabilities in smart contracts, which are self-executing agreements with the terms of the agreement explicitly encoded into the code. These weaknesses may result in manipulation or monetary loss.
5. **Money Laundering and Illicit operations:** Because blockchain transactions are pseudonymous, they are appealing for illegal operations including fraud, money laundering, and terrorism financing. Although it does not provide total anonymity, blockchain's transparent ledger makes it more difficult to track the source and destination of money [25]. Vulnerabilities may result in manipulation or monetary loss.
6. **Environmental Impact:** The environmental impact of blockchain technology, especially proof-of- work cryptocurrencies like Bitcoin, is one of the ethical issues surrounding it. Significant amounts of energy and computational resources are used in cryptocurrency mining, which increases carbon emissions and degrades the environment.

VIII. REMEDIAL APPROACHES FOR SECURING BLOCKCHAIN TECHNOLOGY

Now a day blockchain technology is widely used in various area of IT industry and transaction. Due to major use of blockchain technology user facing many issues. So, to solve these issues we need to understand some remedial approaches. Some are discussed below-

1. **Blockchain Models for Preserve Privacy:** A number of strategies can help safeguard privacy while utilizing the security and transparency of blockchain technology. Some techniques are ZKPs (Zero- Knowledge Proofs), Confidential Transactions and Permissioned Blockchains.
2. **Tokenization and Data Encryption:** Financial information vulnerability can be reduced by employing tokenization, which uses tokens to represent real-world assets, or by encrypting sensitive data before storing it on the blockchain.
3. **Improved Private Key Management:** Security regarding the handling of private keys can be increased by utilizing hardware wallets, multi-signature wallets, and decentralized key management systems.
4. **Know Your Customer (KYC) and Anti-Money Laundering (AML) Compliance:** In order to track and report suspicious activity, many blockchain-based financial systems now require KYC verification from their users and adhere to AML standards [26].
5. **Blockchain Forensics Tools:** To detect illegal activity, businesses are creating blockchain analytics tools (such as Chainalysis and Elliptic) that can monitor and trace cryptocurrency transactions.
6. **Transition to Eco-Friendly Consensus Mechanisms:** Networks such as Ethereum (Ethereum 2.0) are already implementing proof-of-stake (PoS) and other energy-efficient consensus mechanisms (such as Proof of Authority) as alternatives to proof-of-work. Energy usage is greatly decreased by these processes.

IX. CONCLUSION

Blockchain technology offers endless benefits which can help transform the whole finance industry by a leap. KPMG says that blockchain can reduce capital consumption by up to 75%, errors by up to 95% and increase efficiency by 40%. It can help government entities and financial institutions to cut down costs, bring transparency and improve trust. But blockchain is currently an evolving technology and therefore is in an immature phase, making it hard to predict its success in due course of time. But history has shown that great things take time, sometimes even decades, so who knows what's in for blockchain technology and what will become in upcoming times. But we can only hope enough research is conducted with time, which will help it become mature and aid humankind with its promising inventions. Blockchain will not replace the existing financial systems completely anytime soon. But financial companies are expected to use it in test runs to see the capabilities and then gradually integrate it into the existing systems. When big players in industries perform tests to discover innovative opportunities and use cases, we will see more solutions based on blockchain for accessible, transparent, reliable and trustworthy financial transactions. This study has covered a wide range of topics, including improving operational effectiveness and financial stability, managing the complex regulatory environment, and resolving ethical issues.

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