Blockchain as a Disruptive Technology in Healthcare and Financial Services - A Review based Analysis on Current Implementations

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ABSTRACT

Blockchain is a time-stamped series of immutable records it is managed by a cluster of computers owned by different entities it allows only authorized participants to access data and log of all entries. Multiple industries are adopting blockchain technology to innovate the way they function. over two decades the hospitals function is the same. This space is rife with vertical innovation moreover, are lag with horizontal innovation patient identification and information blocking which is a huge problem in the healthcare industry. With blockchain the healthcare sector can achieve data efficiency, data access flexibility, interconnection, transparency, security, and more. Global economic slowdown has taken a toll on financial services. Forcing Indian companies to expose in the global economy. In the case of finance blockchain help reduce potential costs, labor savings, safe, secure, decentralized, transparent and more. The purpose of this paper is to review the development of blockchain and healthcare, financial services and to provide some references for the possible application of blockchain technology to the healthcare and financial services. secondly, several application scenarios of blockchain in healthcare and financial services are put forward, Finally, the challenges that still exist when applying blockchain technology based on its current implementations in healthcare and financial services.

Keywords: Blockchain technology, Healthcare, Financial services, Distributed Ledger, Current implementations, Challenges.

1. INTRODUCTION :

Blockchain is one of the undeniably clever innovations under general purpose universal technology called Information Communication and Computation Technology (ICCT) [1-4]. Blockchain has been implemented over a decade. Like any blockchain digital technology, recognition experiments were carried out in various industries before successful use. Each block stores the transaction information, each block is saved with a single code called “hash”. A blockchain-based system is a publicly shared system (i.e. a decentralized one) in which all participants are distributed geographically and linked across different network types. Blockchain networks can be segregated and permitted into two key styles as permissioned & permissionless Open-ended systems like Bitcoin and Ethereum are permissionless. They are open to the public. Any node will carry out transactions and also engage in a phase of consensus to advance the blockchain. permissioned registered Networks, such as Hyperledger Fabric and Multichain, are aimed at consortia where limited options exist. Even though customers are permitted to request transactions, the blockchain's development is restricted to a defined community of peering nodes run by consortium members. Indian healthcare system has been one of the rapidly growing sectors with this year's goal of reaching 280bn. The financial industry acknowledges blockchain technology's disruptive effect in generating new revenue, improving process performance, enhancing end-user experience and rising business operating risk. Blockchain implementations would enable banks to make saving on cross-border settling transactions of up to $27 billion by the end of 2030, cost reduction by more than 11 percent,

according to a study from Jupiter research.

Block chain-based framework lets users to script transactions & contracts to enable transactions that go beyond money. Here the required verification resource would be ledger depending on the script size specified by the user [5]. Chaum's work on the decentralized essence of the payment system enables the blockchain to inaugurate a new age beyond global payments [6]. Blockchain can indeed be called a public ledger, as well as all agreed transactions is stored in a blocklist. The chains grow as it continually adds new links. Asymmetric encryption and distributed consensus algorithms were implemented for the user security and accuracy of a ledger. Usually, the blockchain has core characteristics of decentralization, longevity, accountability, and auditability. With these devices, Blockchain can significantly save on costs and increase efficiency [7]. Since it enables payment to be done without any bank or intermediary, blockchain can be used in various financial services, such as digital assets, transactions, and electronic payments [8], [9]. Blockchain is the decentralized transaction mechanism for Bitcoin, built to distribute and pass money for holders of the Bitcoin currency. This technique would support the public ledger for all ever-executed Bitcoin transactions, with no third-party entity control, the advantage of Blockchain is that after all nodes have approved the data, the public database cannot be modified or withdrawn. Blockchain is now well known for its data privacy and security features. Blockchain technology can also be applied to other applications. It has built an ecosystem within a cloud service for digital contracts and peer-to-peer data sharing [10]. BCT acts as a digital exchange for healthcare while allowing patents to retain excessive control over their information, exposure to medical data and promote the transition to patients. [11]. In some medical systems, smart contracts could be used, like payment & insurance, that allows automate the process and reduce costs. We later see several companies leveraging smart contracts to create solutions in subsequent sections [12].

2. OBJECTIVES OF THE STUDY :

This study is limited to the Blockchain technology in healthcare and financial services. The main objectives are :

(1) To learn Blockchain and Distributed Ledger Technologies.
(2) To Review the current application of such technologies in Healthcare and Financial services sector.
(3) To Review the studies conducted upon blockchain in the Healthcare and Financial services
(4) To identify the challenges of blockchain technologybased on its current implementations in healthcare and financial services.

3. OVERVIEW OF BLOCKCHAIN TECHNOLOGY :

Blockchain, though introduced in 2008, a revolutionizing technology is widely known after the introduction of a Bitcoin network in 2009. With such an, incredibly transparent ledger system developed for Bitcoin and operating on the blockchain is therefore no longer just associated with cryptocurrencies, but the technology that is permanent, open, and stable makes it more relevant to various industries. Satoshi Nakamoto released the Bitcoin White Paper in 2008; 2009 saw the first Bitcoin block created. Because the Bitcoin protocol is open source, anybody can take the protocol, fork it (modify the code), and create their own P2P money version. BC is a shared ledger or system of records. This can also be referred to as blocks in a chain where, prior to them, the respective blocks apply to the blocks. If the specifics of the transactions or events are fed into the Blockchain, it is impossible to modify the data being exchanged with the network members. Blockchain network users are fully aware of the occurring transactions. For example, consider, book-based data structure where every page of the book corresponds to a paragraph of the previous edition. Here, the ledger refers to the Database, page refers to the ledger and the database transaction refers to an entry in either document. Whether a page or block has been tampered with or not is easy to detect. Pages can be organized in any way so pages in a distributed ledger aren't relevant. Currently, each block is constructed on top of the preceding block in Blockchain and it uses the nonce and signature of the latter as a key to go into the next block. Network miners do the job of constructing a block and connecting the block to the chain. A random string or nonce is easy for the miners to guess to tamper with the block just by knowing the signature in a Public Blockchain. Adding blocks in the Blockchain isn't easy and there is a 12.5 bitcoins incentive for that. The miners are granted a contract in a private blockchain, and as a result, they can connect to the chain on blocks. It can therefore also be described as a consensus-oriented public / private distributed ledger that stored data across a peer-to-peer network [13].

Blockchain is temper-clear and temper-protecting ledgers implemented in a distributed mode that involves how well it operates through ledgers for full transactional background with a protected feature and distributed between numerous parties with various categories of blockchain i.e. permissionless and permissions that seem complicated but when examined it seems easy to use hash functions[14]. The framework with traditional consensus algorithms used in various private public and consortium blockchains continues to pose some technological challenges such as scalability, privacy leakage and selfish mining [10]. Main concept of blockchain is a distributed database with transactions and records most work is based on network efficiency protection and creative applications basic problems in blockchain techniques are generally not appropriate for the Internet of Things (IoT) due to limited computing capacity are very limited powered [11]. Blockchain is a platform for decentralized network storage applications. Blockchain, however, not only is used for financial applications. But you could also build a transaction to fit in with our application. Blockchain. Yes. Trust and traceability are the two basic blockchain promises obtained from the box that solves the problem of generic trust at all levels of the public, federated, and organization. These features, however, aren't always enough to have a complete solution, and that is why we always see blockchain combined with strong cryptographic protocols such as zero-knowledge proofs [15].

4. TECHNOLOGIES OF BLOCKCHAIN :

Like any other technology blockchain uses different technologies :

4.1 Consensus mechanism

Consensus is a method for validation in time for the completion, modification, or development of requests, transactions (deployment and invoking) and details. Proper ordering is important because ownership and additional rights and obligations can be established. On the blockchain network, there really is no centralized hub or authority that determines the transaction order, recognizes transactions, and defines rules about how nodes communicate. Alternatively, a network consensus protocol is implemented with multiple validating 'parent' nodes, and all nodes have the knowledge available – restricted to their authorization. The documents are also transparent and trackable. In addition to the various forms and approval protocols proposed so far, the agreement guarantees that the node quorum agrees on the exact order of new records to the shared ledger [16].

Table 1: Typical consensus algorithm comparison

Property	PoW	PoS	PBFT	DPoS	PoET	Ripple
Blockchain type	Permission-less	open	permissioned	open	open	open
Transaction finality	probabilistic	probabilistic	probabilistic	probabilistic	probabilistic	probabilistic
Transaction rate	Low	High	High	High	Medium	High
Token needed	Yes	Yes	No	Yes	No	Yes
Cost of participation	Yes	Yes	No	Yes	No	Yes
Scalability of peer network	Yes	Yes	Low / High	Yes	Yes	Yes
Trust model	Untrusted	Untrusted	Semi- trusted	Untrusted	Untrusted	Untrusted
Adversary	< = 25%	< 51%	< 33.3%	<51%	Unknown	<20%
Example	Bitcoin	Peercoin	Hyperledger fabric	Bitshares	Hyperledger fabric	Ripple

4.2 Decentralized ledger system :

Referring explicitly to a distributed network technology that allows users to upload programs and abandon

programs to self-execute, maintains a persistent and transparent record with current and past system states, uses public key cryptography, and uses economic incentives to ensure that the network retains technology. Therefore, the Decentralised ledger system is broad enough to cover the blockchain underpinning the application for bitcoin payments, which is currently receiving incredible attention, but is not so narrow as to exclude other forms of the technology or other practical applications other than payments [11].

4.3 Decentralized data mining :

Data mining helps to automatically discover new information that is useful in describing or predicting unknown phenomenon from vast quantities of data. Decentralized data mining is especially suitable for applications which usually handle very large quantities of data (e.g. transaction data, science simulation and telecom data) that cannot be analysed in a reasonable period using a conventional paradigm. [17].

4.4 Decentralized data storage :

Security breaches have occurred since the internet was introduced and organizations have managed to cope with them, but it is worth noting that new technology may help repair parts like decentralized storage system that can store files without having to react to massive centralized data collections and do not compromise important values such as privacy and freedom of information [18].

4.5 Encryption algorithm :

An algorithm is a collection of instructions which produce a result or an output. It can be a simple script, or it can be a complex program. The algorithm in the blockchain verifies signatures, confirms balances, decides if a block is legitimate, specifies how a block is validated by miners, defines the protocol for telling a block to pass. Establishes the process for generating new coins, and informs the system how consensus algorithms can be decided to tell the miners how to validate a block. They set conditions, as do protocols, but the instructions are central, and there is a desired outcome: processing transactions, deciding the blocks join the chain and reaching consensus on which chain is correct.

4.6 Smart contracts :

Smart contracts are a form of digital electronic contract wherein the terms of the transaction are encoded into computer code to be performed automatically by the software upon receipt of a specific input. Smart contracts are, in their simplest form, a set of digital commitments, including protocols in which the parties fulfil certain promises [19]. Smart contracts are programs which execute on blockchains autonomously. The primary intended uses (e.g. financial instruments) allow data from outside the blockchain (e.g. stock quotes) to be accessed. This will make trustworthy data feeds that serve a wide range of data requests important for smart contract ecosystems [20].

5. DISTRIBUTED LEDGER TECHNOLOGY :

A technology that can be easily understood to be a database that exists through several locations or amongst several participants is achieved by (remunerated) consensus by the network of users rather than having to rely on confidence in a third party intermediary users may 'deposit' digital assets (e.g. documents, actions, and statements) on the ledger [21].

Table 2: Blockchain and Distributed technology terms

S. No	Term	Description
1	**DApp (decentralized applications)**	System device that stores network-wide data [22]
2	**Blockchain**	A form of DLT where blocks of data are added sequentially & linked together with respective hash values [23]
3	**Transparent**	The ledger share of the decentralized network can be seen by everyone in the node [24]
4	**Miner**	Transaction verifier [25]
5	**Nonce**	A random value used once to ensure the correct hash value is set during blockchain mining [26]
6	**Consensus**	A system used for the transaction verification [27]
7	**Smart contracts**	Programme or scripts are written on Ethereum blockchain that execute if a given set of specific requirements are met & that

		require no governing body to ensure their 'payouts' are met properly [28]
8	**Forks**	The issue ascends when a node is used for different blockchain versions [29]
9	**Hash**	One-way hash function to test transaction/message integrity [30]
10	**Node**	The blockchain ledger [31]
11	**Timestamp**	Date and time of the transaction in the computer system used as electronic timestamp [32]

6. BLOCKCHAIN IN HEALTHCARE :

Blockchain has the potential to preserve an incorruptible, open, immutable database of all data that includes an individual's private and concealing identity with complex and protected codes that can protect the security of medical data. The collaborative design of the system also helps patients, physicians, and healthcare professionals to easily and safely share the same information.

Table 3 : Review on the important contribution of blockchain technology in Healthcare

S. No	Contribution	Reference
1	Using blockchain MedRec created to handle EHR more efficiently which provides patients a comprehensive, immutable log and easy access to their medical information across providers and treatment sites. it incentivises stakeholders to participate in the network as blockchain "miners". Enables the emergence of data economics, supplying big data to empower researchers while engaging patients and providers in the choice to release metadata.	Ekblaw, A., et al. (2016) [33]
2	EMR data sharing between healthcare providers and for research studies, a framework is proposed managing and sharing EMR data which can reduce the turnaround time for data sharing and cost reduction for cancer patients and oncology-specific data management.	Dubovitskaya, A., et al. (2017) [34]
3	Blockchain would likely not completely replace the current system in healthcare but act more so as a supplemental vehicle.	Pirtle, C., & Ehrenfeld, J. (2018) [35]
4	Describes a set of seven evaluation metrics, from both the technical and domain perspectives, to assess healthcare DApps using this novel technology and serve as an initial guide for creating future apps in this domain.	Zhang, P., et al. (2017) [36]
5	DASH app is given a try to solve the interoperability issues learned that the public, immutable, and verifiable properties of the blockchain allow for a more interoperable environment that is not easily achieved using traditional approaches that mostly rely on a centralized server or data storage.	Zhang, P., et al. (2017) [37]
6	Identify the potential use of blockchain cases in healthcare related to benefits such as its decentralized application enables improved data security and privileges for patients to view their own data with robotic verifiability limitations, and enhancements include interoperability, security and privacy, scalability, speed, and patient engagement.	Agbo, C. C., et al (2019). [38]
7	Architecture of Patient-Centric Worker. The system consists of BSN, smartphones (Sensor Data provider). BSN is a resource restriction network in the eHealth Care framework, which focuses on the concept of lightweight encryption and authentication for Patient Tracking Continuous with PCA (Block Network to Smartphone channels)	Uddin, M. A., et al. (2018) [39]
8.	The different stakeholders of healthcare like hospitals, suppliers, patients and payers with technologies proof of work which is normally used focused	Witchey, N. J. (2019) [40]

	mainly on transaction processing and authentication.	
9.	Interoperability means the ability of software to exchange and make use of the system. There is a shift from an institution driven interoperability to patient driven interoperability patient driven and patient cantered which bring new challenges like privacy, incentives, technology and governance and how blockchain can tackle these problems with providing permission to digital access for clinical data, data availability, rapid access to clinical information and patient identity.	Gordon, W. J., & Catalini, C. (2018) [41]
10.	A blockchain based smart contract is proposed based on Ethereum protocol where the sensors communicate with a smart device that calls smart contracts and writes records of all events on the blockchain which will support real time patient monitoring and medical interventions by sending notifications to patients.	Griggs, K. N., et al. (2018) [42]
11.	An introduction of blockchain to healthcare would bring some improvements which are estimated to enable sharing of information with stakeholders, ensure data integrity and protecting patient privacy.	Engelhardt, M. A. (2017) [43]

7. CURRENT IMPLEMENTATIONS OF BLOCKCHAIN IN HEALTHCARE :

A blockchain is a chain of blocks apparently secured by cryptographic techniques. His immutability is among the most desirable aspects of this to other businesses. No alteration can be made to the data added to the blockchain therefore, a consensus-based, verifiable and reliable database can be created. This makes blockchain especially ideal for tasks where data integrity is of utmost importance a practical illustration of this immutability is ProvChain, an infrastructure developed on the blockchain to provide data artifacts on the cloud with a chain of custody [44-46]. The advantages of blockchain are enormous in biomedical situations. Blockchain is suitable for implementations whereby biomedical / health care stakeholders independently regulated for example hospitals, manufacturers, patients, and contributors) choose to work together without giving power to a central management intermediary. Blockchain only allows functions that are very difficult to change data or registers to be developed and interpreted. As an unchangeable archive to store confidential information, blockchain is perfect for the example the history of insurance claims. Only under the cryptographic protocols can the owner change its ownership. The source of the assets can also be traced, which can be confirmed as sources or as data and documents, improving the reusability of the validated data, such as insurance transactions. Blockchain is, therefore, suitable for use in sensitive digital asset management for instance patient consent documents. The data redundancy can be accomplished by each node with a full copy of the historical data. Blockchain thus is perfect for maintaining and continued information availability for example EHR. The key advantage is to keep records secure with the use of cryptographic Algorithms [47]. In order to exchange and collaborate on personal health care data, a mobile, blockchain-based mechanism will be placed in place, a Hyperledger Fabric system will be introduced, which is a licensed blockchain requiring verifications of network nodes, and a privacy-providing personal health infrastructure with broader coverage of the health environment from the end-computer to cloud [48]. Blockchain can fit into interoperability as the right player by hashing the existing MPIs in the form of blocks to help reduce clinical costs, maintaining access to large population data in a decentralized format through which the gap between interoperability and predictability can be filled, and multi-source data from smart wearable devices to mobile devices can be achieved with blockchain because they can co-operate with blockchain [49, 50].

8. BLOCKCHAIN IN FINANCIAL SERVICES :

Blockchain holds permanent records available to all participants, improving data consistency, confidentiality, and helping to reduce fraud risk. One of the major advantages of blockchain technology is that it's both safe, secure, decentralized, transparent, and relatively cheap.

Table 4 : Review on the important contribution of blockchain technology in financial services

S.no	Contribution	Reference
1	Countries and international financial institutions have set up blockchain labs and conducted in-depth research. R3The consortium Blockchain affected leading financial institutions in the world. Blockchain has broad applications within financial institutions to resolve issues such as point-to-point transfer, bank credit records, data ownership establishment, and data sharing promotion.	Guo, Y., & Liang, C. (2016) [51]
2	There are few opportunities for financial services from blockchain like cost reduction in syndicate loans, equity and debt and insurance markets, regulatory compliance for record validation, self-executing contracts to reduce fraud.	Shrier, D., Sharma, D., & Pentland, A. (2016) [52]
3	Blockchain technology can simplify business processes in the banking and financial services sectors while creating secure, confident records of agreements and transactions.	Treleaven, P., et al. (2017) [53]
4	Blockchain technology with its transparency, decentralization, tamper-resistance, accountability, and privacy can help all stakeholders in the mutual fund industry.	Manda, V. K., & SS, P. R. (2018) [54]
5	Blockchain uses smart contracts to speed up the claim, and anybody can inspect smart contracts to understand the insurance policy.	Gatteschi, V., et al. (2018) [55]
6	A data stream can be "trusted" for exactness by Blockchain. The transfer of assets from one group to the other will easily be identified.	Henk, M. A., e al. (2019) [56]
7	with blockchain auditors have a third validation point that has not previously existed and can make auditing and monitoring work simpler by explicitly encoding rules in particular processes.	Brender, N., et al. (2018) [57]
8.	A power trading framework is chosen as the blockchain network called Multichain. In a blockchain, Multichain may identify and use two or more assets to exchange energy and money. It can also be processed faster and more scalable than Bitcoin Core or Ethereum.	Oh, S. C., et al. (2017) [58]
9.	Blockchain has introduced innovation payments and new business models for payments such as new cross-border service introduction and cross-currency contracts and transactions leading to fintech's market entry through the use of blockchain technology	Holotiuk, F., et al. (2017) [59]
10.	The technology can be leveraged with approved ledgers, smart contracts, and smart property applications to create a decentralized network that can improve transparency and confidence in bank-wide loan management.	Dhar, S., et al. (2016) [60]
11.	Letter of credits is paper-based with a blockchain-based letter of credit relating to a trade transaction contract between the seller and the consumer with links to a commercial transaction, a documentary flow event, and a supply chain flow event linked to the bill of lading.	Dowling, M. D., et al. (2018) [61]

9. CURRENT IMPLEMENTATIONS OF BLOCKCHAIN IN FINANCIAL SERVICES :

"Blockchain," every big financial institution nowadays is dealing with this new technology with the term on the streets from Goldman Sachs to NASDAQ. It combines a number of computer technologies, including distributed data storage, point-to-point transmission, consensus mechanisms and encryption algorithms. It has also been identified as a disruptive innovation of the Internet age. Blockchain technology has made many promises both to the financial sector, in particular its financial market infrastructure and to the insurance industry. At the heart of this enthusiasm for DLT is the new decentralized transactional model that technology allows, the principles of which are based upon Satoshi NAKAMOTO'S white paper [62]. The emergence of DLT follows the rise of the trend of disintermediation, one symptom of which is that shadow banking has become increasingly market share in global finance, a trend that some have even called

for the "end of the banking process" [63]. In recent years this trend has probably been steadily developing new forms of digital financing, such as crowdfunding or peer-to-peer (P2P) lending, in which lenders and lending companies can deal with each other directly without bank intermediation. This is far from reducing. [64]. The impact of blockchain as an invention was first viewed as the greatest challenge for major businesses by the banking and trading sector; the new long-term process. The key threat of blockchain was the Bitcoin. Some banks already have applied technologies such as R3, Microsoft, and IBM to this Blockchain [65] a simple scenario in which standard insurance operations (client registration, assignment of policies, payment premium, claim submission, processing refunds, etc) are the main processes (transactions). The blockchain ensures that each transaction is performed and outcomes are preserved so that the client does not blame the insurance provider unintentionally and that the insurance company is responsible for all services provided [66]. Confidence is a key factor that helps depositors to trust in a bank's money protection. Market participants think their business will be done according to a consistent set of rules in equal measure. Financial organizations must trust expensive back-office processes to implement organized ledgers and accounting systems. Institutional actors, such as major banks, exchanges, clearinghouses and central banks and new companies, are pursuing DLTs to address various costs, with a view to challenging traditional business modelling. With DLT, customers of all the financial institutions with which they intend to work can securely share the results of the core KYC review. This system allows for increased efficiency, cost savings, enhanced client experience, or greater accountability in the process of customer boarding [67].

10. CHALLENGES OF BLOCKCHAIN TECHNOLOGY :

While blockchain has huge potential for innovation and added value. A number of challenges must be addressed:

Interoperability is the ability of various information and communication technology systems and software applications to communicate, exchange data correctly, efficiently, and reliably and use the exchanged information [68]. Interoperability has no doubt a great positive impact on healthcare. The lack of interoperability in healthcare systems and services, though, has long been identified as one of the major healthcare challenges. Blockchain also suffers from the interoperability problem [46] That means that blockchains from different providers of communication and services communicate seamlessly and properly with each other. This challenge creates obstacles to effective data sharing [69]. The information is vulnerable to possible protection and privacy threats. Given that all nodes can access the transmitted data from one node, in blockchain the privacy of the data is not intact. A patient must choose one or more members, who will be able to access the data and the medical record under his / her name in an emergency, for the lack of a third party for authorisation. Now this representative can also allow a number of people to access the patient's records which can create an enormous threat of data protection and safety [70]. There are a large number of data in the health sector which have to be processed daily. All data must be accessible to all nodes within the chain, which needs a large amount of storage, ranging from patient information, clinical history and test results to MRI scans, X-rays and other medical images [71-72].Therefore, the databases used in the technology tend to grow rapidly, with the blockchain being based on transactions. The increased database size contributes to low record search and access speed, which is highly inappropriate for file-transaction forms. A blockchain solution, therefore, must be resilient and scalable [73]. The blockchain is susceptible to attacks by selfish miners involved in collusion. In general, it is convinced that the blockchain will reverse nodes with more than 51 percent computing power [74]. Current Regulations Problems the characteristics of a decentralized system will weaken the capacity of the central bank to control economic policy and the amount of money, which makes the government cautious about blockchain technologies, authorities will have to investigate this new issue, speed up the formulation of new policies, otherwise there will be a risk on the market, integrated cost problem will have a lot of costs [32]. Blockchain Scale As the blockchain expands, data gets bigger and bigger, the loading of store and processing also gets harder and harder it takes a lot of time to synchronize data, but at the same time, the data continues to develop [75].

11. FINDINGS BASED ON THE REVIEW :

(1) Adoption of blockchain in healthcare helps in establishing medical records which reduces the costs and also proper health data utilisation.

(2) Blockchain can help healthcare in maintaining health records, drug data, patient data and insurance information.
(3) Transparency has the main function of blockchain helps to keep the information between medical facilities, insurance providers, and patients transparent.
(4) There are no universal health records for health data appropriate medical data management but blockchain has the potential to solve this problem.
(5) Understood about Blockchain technology and Distributed technology and how these technologies are changing the healthcare and financial services work.
(6) Interoperability being a major problem in healthcare blockchain can providing permission to digital access for clinical data, data availability, rapid access to clinical information, and patient identity and solve the problem.
(7) Blockchain improves contractual performance due to smart contracts
(8) Blockchain is mainly looked forward to the reason that it provides security
(9) When it comes to both healthcare and financial services blockchain promises security, transparency, trust, programmability, privacy, high performance, and scalability.
(10) Due to programmable capabilities of blockchain, the code that addresses KYC can be built into assets themselves.
(11) Blockchain has become a disruptive technology with being used for different purposes from cost reduction to security in healthcare and financial services.
(12) The interest in testing and using the technology has drastically grown.
(13) Interoperability problem arises in blockchain because most of the blockchain work in silos and do not communicate with other peer networks as they are incapable of sending and receiving information from another blockchain based systems.
(14) The technology works on proof of work which needs a lot of computational power to solve complex mathematical puzzles, verify, and to secure the entire network.

12. CONCLUSION :

This study analysed the emerging blockchain technology and its potential ramifications in healthcare and financial services. The blockchain technology provides a decentralized network and is considered to have tremendous potential for use in healthcare and financial services, due to the sensitive nature of the collection and management of data. The review aimed at defining the existing state of blockchain in healthcare and financial services and the current implementations in these industries. To achieve this aim, we have taken into account numerous scholarly publications concerning healthcare and financial services and challenges. Our findings indicate that blockchain technology has tremendously changed the healthcare sector and financial sector in the area of storage of data, processing of data, transaction, security, and so on based on its current implementation stage. Therefore, Blockchain technology help replaces paper-based and manual transaction processing in financial services and healthcare provides new models for electronic medical records and financial payments.

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