

Blockchain Technology: A Catalyst for Change in Finance

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ABSTRACT

Blockchain is one of the most disruptive innovations in the field of technology in 21st century. Blockchain, a distributed ledger technology (DLT) and smart contracts, has emerged as a ground-breaking application in the financial sector. The three key properties of Blockchain technology, Decentralization, Transparency and Immutability have created a huge impact on the banking and finance industries. As technology is the main driving force in Blockchain and its various applications, it will also act as an enabler to sustainable finance which will ultimately lead towards achieving sustainable economy and also sustainable development. This study is an attempt to understand the far-reaching potential of Blockchain technology and its applications such as Bitcoin in the banking and financial services sector. This study has also highlighted the benefits and disadvantages of using Blockchain technology on the banking and finance industries. This study is entirely a theoretical overview based on the available research in the area of Blockchain technology and its application in financial sector. This study will help to understand the future of financial sector in the advent of incorporation of Blockchain technology.

Keywords: *Blockchain, Distributed Ledger Technology (DLT), Financial Sector, Blockchain Technology, Sustainable Finance, Sustainable Economy, Sustainable Development, Bitcoin*

JEL Classification: *E42, E58, G12, G18, G21, G22, G23, G28, G32, G38, K22, K24, L50, M48*

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INTRODUCTION

The concepts of Blockchain were first proposed in 2008 by a pseudonymous person Satoshi Nakamoto. Nakamoto described how cryptology and an open distributed ledger can be combined into a digital currency application where he has suggested an online payments system of electronic cash directly from one party to another known as peer to peer without any intermediaries authenticated through digital signature (Nakamoto, 2008). This technology became popular in 2009 when it was used for the cryptocurrency Bitcoin. Blockchain is a ground-breaking technology for recordkeeping. Garzik and Donnelly (2018) has stated that Blockchain technology has the prospect to transform many industries. The two core components of Blockchain technology are distributed ledger technology (DLT) and smart contracts. The three key properties of Blockchain technology, Decentralization, Transparency and Immutability have created a huge impact on the banking and finance industries. Eyal (2017) has supported to the fact that cryptocurrency Blockchain protocols or DLT has got a huge potential for FinTech sector. The traditional finance system is high volume, costly, time-consuming, and operated with a centralized database, exchange of value typically with a single point of authority where two or more parties need to agree on the value whereas Blockchain technology is a protocol of the exchange of value over the internet without any intermediary. Yaga, Mell, Roby and Scarfone (2019) has termed it as, “tamper evident and tamper resistant digital ledgers”. Blockchain technology has been signalled the transformation of shape and size of the banking and finance industry. Prewett, Prescott and Phillips (2020) have claimed in their study that adoption of Blockchain technology is inevitable for business enterprises. They have opined that the challenges and risks involved in adoption and using Blockchain technology need to be addressed properly for its long term success. This study is an attempt to understand the far-reaching potential of Blockchain technology, the benefits and disadvantages of using Blockchain technology and its applications such as Bitcoin in the banking and financial services sector. This study is descriptive in nature mainly based on the available research in the area of Blockchain technology and its application in financial sector. This study will help to understand the future of financial sector in the advent of incorporation of Blockchain technology.

OBJECTIVES

- To understand the far-reaching potential of Blockchain technology;
- To elucidate the applications of Blockchain technology the banking and financial services sector;
- To enumerate the benefits and disadvantages of using Blockchain technology on the banking and finance industries;
- To understand the future of financial sector in the advent of incorporation of Blockchain technology.

MECHANISM

The name 'Blockchain' has evolved from the technological architecture of this technology – a chain of blocks. A Blockchain is a unique type electronic database known as distributed ledger of cryptographically signed transactions that are grouped into permanent blocks stored on a computer system or network in table format published and stored in multiple locations with encrypted algorithms. Each transaction stored linearly and chronologically in a block and each block store a list of transactions created and exchanged by peers of the Blockchain network removing the necessity for any central node. Each block holds time stamped digital data. Each node store information and forward it to all other nodes. Each block is cryptographically linked to the previous one referring to its hash value. Once the new blocks are added, older blocks become more challenging to alter. It retains the full history of transactions. All parties in the network must validate each transaction through consensus mechanism, which can help create trust among parties but none of them has a single point of control over it. All authorized parties in the network have access to a shared, single source of truth where every entry can be audited and verified. A unique 30-plus-character alphanumeric address identifies each node or user on a Blockchain. Transactions are taking place between Blockchain addresses. Transactions represents a transfer of the cryptocurrency or crypto-exchanges such as Bitcoins are not limited to financial transactions only. All the computers or nodes in a Blockchain are governed by a smart contract, a set of rules that participants have collectively agreed upon, recorded in computer language and can be executed automatically. Bitcoin is today's most known and used virtual currency based on the Blockchain technology. The second largest Blockchain after Bitcoin is 'Ethereum' which distributes a virtual currency called Ether. Few more

known cryptocurrencies are Litecoin (LTC), Cardano (ADA), Polkadot (DOT), Bitcoin Cash (BCH), Stellar (XLM), Chainlink, Binance Coin (BNB), Tether (USDT), Monero (XMR), Ethereum Classic (ETC), Dash (DASH), Ripple (XRP), etc.

Blockchain are of two kinds – public and private. Bitcoin and Ethereum are examples of public Blockchain. In case of public Blockchain also the identity of the persons who are using it will remain unknown to everyone. Private Blockchains are used by industry groups and governments, similar to a corporate intranet, users are known and credentialed (Swan, 2017).

KEY FEATURES OF BLOCKCHAIN TECHNOLOGY

Following are the key aspects of using Blockchain technology which has considered as the evolution in the field of banking and financial sector:

- Blockchain is a decentralized, cryptographically signed secure time stamped tamper evident and tamper resistant electronic database known as distributed ledger;
- It is published and stored in multiple locations with encrypted algorithms.
- All parties in a distributed network can share the same, enables transactions to be faster and less expensive;
- A massive ledger of transactions verified by a global cryptographic peer-to-peer (P2P) network;
- The cryptography provides a single source of truth, assures immutability and irreversibility;
- The ledger can be private or public, permissioned or unpermissioned;
- All parties in the network must validate each transaction through consensus mechanism;
- Transactions are not limited to financial transactions only, business transactions can also be possible with the help of Blockchain;
- Every entry can be auditable and verifiable;
- Blockchain are governed by a smart contract, a set of rules that participants have collectively agreed upon, recorded in computer language and can be executed automatically;
- Identity of the parties using Blockchain will remain unknown to everyone;
- Blockchain facilitates better compliance.

APPLICATION OF BLOCKCHAIN TECHNOLOGIES IN FINANCE

Tapscott and Tapscott (2017) has mentioned in their article that many firms in the financial industry such as banks, insurance companies, audit firms and several other professional service firms have started investing in Blockchain technologies. Renowned financial companies like JPMorgan Chase, Citigroup, Credit Suisse, Goldman Sachs, NASDAQ, Inc., Intercontinental Exchange, the American holding company that owns the New York Stock Exchange etc. have also invested in Blockchain technology. They have also referred Blockchain technology as a ‘real game changer’. Many countries like US, UK, Japan, China, Russia, India, South Africa, etc. have already started taking initiatives on research in Blockchain technology (Guo & Liang, 2016). Varma (2019) has indicated it as an alternative way to organize modern finance with lot of potentials. According to him, the Global Financial Crisis of 2007–2008, the Eurozone Crisis of 2010–2012, etc. were the financial events which had raised lot of questions related to the trust factor associated with the different financial institutions. Because of the three key properties, Decentralization, Transparency and Immutability, Blockchain technology has gained immense popularity in the banking and other financial sectors.

Traditional finance mainly follows centralized and multi-layered strictly regulated and conservative financial system. Financial data mostly stored in a centralized database and mostly circulated through multiple intermediaries. As a consequence there is a lack of transparency and huge security issue is involved. In traditional financial system, financial institutions act as intermediaries in intermediating and structuring economic transactions by connecting various market participants. Trust is the most important factor before executing any transactions. As intermediaries, financial institution plays a significant role in building trust amongst the market participants and also by reducing transaction cost (Shiller, 2012). In case of traditional financial system multiple stakeholders, excessive paperwork and data breaches are the main causes resulted in a huge amount of loss in case of financial industry. Chen and Bellavitis (2020) has considered the developments in the Blockchain Technology as a new paradigm based on the key features of Blockchain technology such as decentralization and disintermediation. They have also stated that the incorporation of Blockchain technology has facilitated the financial services to become more decentralized, innovative, interoperable, borderless, and transparent which has led to an advent of an alternative decentralized financial system across the global financial and economic systems.

With the advancements of technologies the internet-fuelled financial technology (FinTech) sector has also experienced lots of transformation over the years though the older forms of currency remains as the main mode of transaction (DeVries, 2016). Xu, Chen and Kou (2019) have stated that the applications of Blockchain technology have expanded from virtual currencies to financial applications to every sphere of the society. They have also talked about three generations of Blockchain – Blockchain 1.0, 2.0, and 3.0. Blockchain 1.0 is related to virtual/digital currency such as Bitcoin, the first application of Blockchain technology. At this stage Bitcoins are mainly used as cryptocurrency in cryptocurrency ecosystem. Few of the commercial applications of the same were for small-value payments, foreign exchange, gambling, and money laundering. Blockchain 2.0 version has brought Bitcoin 2.0 version with some special features like smart-contracts, smart-property, decentralized applications (Dapps), decentralized autonomous organizations (DAOs), and decentralized autonomous corporations (DACs). Blockchain 2.0 used in the areas such as securities trading, supply chain finance, banking instruments, payment clearing, anti-counterfeiting, establishing credit systems, and mutual insurance. Blockchain 3.0 has shown its applicability not in the area of currency and finance but many other areas such as government, health, science, culture, and the arts (Swan, 2015).

Swan (2017) has mentioned about four types of application of Blockchain technology in the area of finance – real-time money transfer and payments, property registries, contractual agreements, and identity confirmation. With the help of the application termed as ‘digital asset registry’ smart assets, the assets which are registered to a Blockchain, easily verified and transferred such as titles for automobiles, homes, and land through distributed ledger technology to record and transmit digital goods over the Internet. A Blockchain can record, transfer, and verify asset ownership through digital asset registry. Another key application as mentioned in the study was ‘leapfrog technology’, a FinTech solutions used for global financial inclusion. eWallet banking services, identity registration, land titling, etc. are some notable use of leapfrog technology. Another application was long-tail economic services in digital market places. Another application mentioned in this study was payment channels and peer banking services. A payment channel is a financial contract. As mentioned it is executed in three steps: “i) one party opens up a payment channel with one or more parties and posts a pre-payment escrow balance on file, ii) the party consumes against this credit over time, until iii) the

closing transaction in which aggregate activity is booked in one net transaction to close the contract”.

Scott (2016) has described the fundamental difference between the traditional bank run financial system and Bitcoin oriented bank run financial system. In normal banking system one person has an unique bank account number, having a password or PIN to prove his/her authenticity as an account holder, bank has all the account related personal and financial details kept in a separate ledger or a personal internal database, the account holder can transact through his/her bank account physically or via online mode after proving his/her authenticity as an account holder, once the transaction will take place the related parties involved in the transaction including banks will change the database through private intermediaries editing private databases and informed the account holder regarding the successful completion of the transaction. Whereas in case of Bitcoin system by using a special Bitcoin network software where the persons who are involved in any financial transaction should have a separate public address and a private key which will identify them in Bitcoin network and transact the digital token in peer to peer mode without the intervention of any centralized regulator. The miners are responsible to do the necessary post transaction changes in widely distributed, highly visible, public ledger or database validated by digital signature.

Casey, Crane, Gensler, Johnson and Narula (2018) have described about various costs related to trust factor associated with the traditional financial system as vault doors, cyber security, settlement procedures, user identification, compliance teams, anti-fraud regimes, etc. They have stated that Blockchain technology can alleviate the cost of trust of depositors in safety of their deposits in banks, trust of market participants regarding fair execution of their trades according to norms, trust of financial institutions on the processes and systems, custody and insurance.

Kowalski, Lee and Chan (2021) highlighted few positive sides of Blockchain which are really effective for financial sector. In their study they have stated that the use of Blockchain technology will improve the security of any transactions and exchange of data, improve the communication quality and efficiency, enhance the goodwill, increase the predictability regarding the trading partner.

The areas where application of Blockchain technology has already been implemented in the financial sector of various countries in the world are self-authorizing sub-ledgers for receivables and payables, investments, merchants, brokerage, trade finance, intercompany accounting and

consolidations, soft wallets, payroll, insurance, betterment of working capital and cash-cycle, trading platforms, hard wallets, micro transactions, capital markets, ATMs, retail banks, corporate banks, money services, detection of fraud and risk, managing revenue cycle, etc. Deloitte, Ernst & Young, KPMG, and PWC, the 'Big Four' accounting firms, has started exploring Blockchain technology alongwith the American Institute of Certified Public Accountants (Woodside, Augustine & Giberson, 2017).

Let us see how does the Blockchain technology has been implemented in banking and financial sector over the years. The first Bitcoin transaction mined in January, 2009, known as 'Genesis Block'. Almost on the same time the first Bitcoin transaction takes place between Hal Finney and Satoshi Nakamoto. Finney had received 10 Bitcoins from Nakamoto on 12 January, 2009 (Forsström, 2019). On 31st October, 2009 the first New exchange (Bitcoin Market) market, Bitcoin currency exchange site, owned and operated by Bitcointalk was formed. On May 22, 2010 Bitcoins are used by Laszlo Hanyecz for ordering two pizzas from Papa John's for 10,000 BTC. Laszlo Hanyecz is considered as the first buyer of a good with Bitcoin. To commemorate the transaction, May 22 is called Bitcoin Pizza Day. On 9th February, 2011, for the first time Bitcoin exchange value reaches equivalence with the US dollar. On March 2013 Bitcoin's market capitalisation of reaches \$1bn. On October, 2013 Kraken partners with Munich-based Fidor Bank to set-up digital currency exchange to offer Bitcoin trading services in the EU and enables P2P Bitcoin trading. Prior to this in July, 2013 the Fidor Bank has entered into a partnership with German Bitcoin marketplace Bitcoin.de, operated by Bitcoin Deutschland GmbH. On 2014 Fidor Bank become the first bank to use the Ripple payment protocol of Ripple Lab, San Francisco-based decentralized payment network provider, which facilitated the customer instant fund transfer in any currency at a lower cost. On September, 2014 two other banks, CBW Bank and Cross River Bank, joined with Ripple Lab for cross-border payments. On June, 2014 Estonia's LHV Bank supported a project to create a financial services platform and money-transfer wallet app built on Bitcoin's Blockchain by way of coloured coins assisted with the creation of the Cuber platform built in partnership with Chromeway. The bank has also announced creation of an experimental type of digital security. The first significant virtual currency theft took place in June, 2011 when 25,000 BTC stolen from Allinvain, a member of the BitcoinTalk forums wallet. On December, 2013 Ethereum, the second largest Blockchain after Bitcoin, was introduced by Vitalik Buterin. The

Ethereum Project was launched via crowdfunding in July, 2014, the first smart contract. In the same year Central Bank of China imposed restriction to financial institutions from handling Bitcoin. In September 2014, the Bank of England, described the Blockchain as a “significant innovation”. On December, 2014 three Dutch banks, ING, ABN Amro and Rabobank, confirm Blockchain experiments to improve their payments systems with the Ripple payments network. The Dutch Central Bank (DNB) cautioned the financial institutions of that country about the risk involved in Bitcoin and also that it does not ponder Bitcoin a viable alternative to fiat currency. On January, 2015 the private equity subsidiary of Spanish multinational bank Banco Bilbao Vizcaya Argentaria (BBVA), BBVA Ventures, invests in Coinbase. On March, 2015 three startups working on Blockchain-related products and services, Bitcoin exchange Safello, Bitcoin-based debit card creators Atlas Card, and Blocktrace, which targets to arrange for Blockchain solutions for the insurance industry have been selected to join Barclays Accelerator in London. Almost around same time International Business Machines Corp (IBM) has decided to adopt Blockchain to create a digital cash and payment system for major currencies. On April, 2015 NASDAQ begins a Blockchain trial. In the same year UK innovation lab operated by Swiss banking giant UBS in collaboration with Blockchain startup Clearmatics started developing a Blockchain on a cryptocurrency and partnering with BNY Mellon for specific Blockchain projects. In May, 2015 a San Antonio, Texas-based financial institution, USAA, incorporated the Blockchain into its existing infrastructure to help the company and its banking, insurance, and investment management subsidiaries more efficient. The Commonwealth Bank of Australia (CBA) has started performing tests with cryptocurrency technologies in partnership with RippleLabs. The U.S. stock exchange NASDAQ launches private market, a joint venture with SharesPost for trading pre-IPO shares. Euro Banking Association (EBA) published a report where they have mentioned Blockchain tech could improve banking as Blockchain has the potential to reduce costs, improve products and provide faster time to market. European Central Bank described digital currencies as “inherently unstable”. On June, 2015 two of Australia’s ‘big four’ banks, Westpac Banking Corporation and the Australia and New Zealand Banking Group, experimented with Ripple to develop low-cost, cross-border payments platform regarding peer-to-peer transfers on the Ripple protocol. Amid growing interest by financial institutions in Blockchain technology and Bitcoin, on July, 2015, Deutsche Bank also

started exploring the same and suggested that the DLT will improve the efficiency of the bank in terms of payment and settlement of fiat currencies, asset registries, the facilitation of regulatory reporting and the issuance, transfer and clearing of securities as well as banks' internal pre and post-trade work flows. Citigroup has developed 3 Blockchains and an equivalent to Bitcoin called Citicoin, Major financial institutions and banks, including the NASDAQ and Santander also started exploring DLT into digitalizing payments and transactions. One of France's biggest banks, Société Générale (SocGen), posted a job listing to hire a developer with a focus on Bitcoin. BNP Paribas explores faster transactions with Blockchain with a dilemma whether Blockchain is an opportunity or disaster to financial services. On September, 2015 a patent filed by US financial services giant Bank of America to protect a Wire Transfer System by which cryptocurrency would be selected as the preferred option for transmitting funds using cryptocurrency technology. Nine of the world's largest banks, Barclays, BBVA, Commonwealth Bank of Australia, Credit Suisse, JPMorgan, State Street, Royal Bank of Scotland and UBS, collaborate with financial innovation startup company R3 to develop a consortium on research, experimentation, design, and engineering to test and validate distributed ledger prototypes and protocols. At the end of the month 13 more banks have joined in the consortium. Next month 3 more banks have also joined the collaboration. 5 more banks join hands in the month of November. In collaboration with Blockchain technology startup Chain with support from Visa – and contributions from global design and innovation firm Ideo, NASDAQ unveils its new Blockchain-based platform named Linq which will enable share transfers and sales on its private market. Visa and DocuSign collaborated to digitizing the process of leasing a car with the help of the Bitcoin Blockchain for recordkeeping. Visa, NASDAQ, Citi and other industry players invested \$30 million in a Blockchain developer platform, Chain.com. On November 2015 Royal Bank of Canada (RBC) announced their Blockchain technology based loyalty program. Visa Europe partnered with Epiphyte, a Blockchain-based software provider to facilitate a solution for immediate financial transactions. On December, 2015, The Linux Foundation launched an umbrella project of fastest growing open source Blockchains and related tools, the Hyperledger Project. To back the collaborative development of Blockchain-based distributed ledgers it has received contributions from IBM, Intel and SAP Arriba. A group of seven large European banks, HSBC, Dutch institution Rabobank, French financial institutions Société Générale and Natixis, Italian banking group UniCredit and Belgium-based KBC,

has signed a MoU to develop a Blockchain technology based cross-border trade finance platform, named 'Digital Trade Chain' (DTC) for small and medium-sized companies in Europe. In Japan Virtual currencies are officially recognized in April, 2017. 11 companies were officially recognized by Japan's Financial Services Agency as registered cryptocurrency exchange operators. On January, 2018, The Swiss municipality of Chiasso has announced that it will begin accepting Bitcoin as a form of taxation payment. The EU Blockchain Observatory and Forum was formed in February, 2018 to observe growth, evaluate movements and address emerging issues of Blockchain technology and to record key initiatives in Europe and beyond. In 2019 global bank Goldman Sachs Group Inc. planned to develop a strategy for distributed ledger technology and also announced to develop its own digital coin for payments. In February, JPM Coin was developed by JPMorgan Chase & Co. for its clients to use in cross-border payments. A plan to launch a new coin for payments called Libra was announced by Facebook Inc. in the same year many large Bitcoin exchanges introduced margin trading. On October, 2019 UNICEF became the first UN Organization to hold and make transactions in cryptocurrency. In 2020 Fintech Company Square invested of \$50 million in Bitcoin whereas PayPal has allowed its users to buy and sell Bitcoin. As per the report and survey of the Bank for International Settlements, 80% of the world's central banks are dealing with some form of digital currency. San Francisco-based Bitwise Asset Management has launched a crypto index fund in this year.

In 2021 the New York Stock Exchange (NYSE) files to list shares on behalf of the investment firm, Valkyrie Digital Assets, for its Bitcoin exchange-traded fund (ETF). Now the concern is whether the SEC will approve it or not. Prior to this SEC has rejected every Bitcoin ETF application. On 24th April, 2021 Mr. Eun Sung-soo, chair of the Financial Services Commission (FSC), suggested that all crypto exchanges could be shut down as none of the crypto exchange had applied for its Virtual Asset Service Provider (VASP) license as per the amended regulations.

As per Cryptoreport 2019, there are almost 1200 cryptocurrency exists at present. UTKUROVNA (2020) has stated that the financial sector in England, Japan, USA, China and other countries have already implemented Blockchain technology.

Ghosh, Gupta, Dua and Kumar (2020) has explained few techniques such as smartpool, quantitative framework, oyente, hawk, etc., which are

used for the purpose of security enhancement in the field of Blockchain. Many countries have tried to come up with some regulatory norms to dealing with the cryptocurrency. In absence of any centralized authority it is really a biggest issue to form uniformity in terms of regulations related to the operation of Blockchain technology as well as cryptocurrency.

Goitom (2018) on behalf of in The Law Library of Congress, Global Legal Research Center, conducted a study on “Regulation of cryptocurrency in selected jurisdictions”. In this study he has discussed about some key regulatory bodies and the various regulatory initiatives taken by them regarding implementation of Blockchain in the financial and banking sector with respect to few countries. As per the study Argentina though have recognized electronic currency formally by the Unidad de Información Financiera (UIF) (Financial Information Unit) of the Ministry of Finance through Resolution 300/2014, but they have also differentiated clearly between electronic currency and virtual currency. Argentina has started thinking to regulate the transactions through Bitcoin by amending the Law on Money Laundering. In Australia the Australian Taxation Office (ATO) has already issued several guidelines related to digital currency. The Senate committee has already recommended bringing the business of digital currency exchange under the purview of the anti-money laundering and counterterrorism financing (AML/CTF) legislation. The risks of investing in digital currencies related guidance has published by The Australian Securities and Investments Commission on its website. In December, 2014 the ATO has finalized the taxation rule related to Bitcoin and other cryptocurrency. The Brazilian Securities and Exchange Commission has clearly mentioned not to consider digital currency as financial assets. Virtual currencies are not regulated, supervised or licensed to function by the Bank in Brazil. Canada has already started using cryptocurrency though it has yet to get the legal tender. The Canada Revenue Agency has considered cryptocurrency as a commodity and tax law also enforced on the same. On June 19, 2014 amendments to Canada’s Proceeds of Crime (Money Laundering) and Terrorist Financing Act treats virtual currencies as “money service businesses”. From the point of view of investor protection and financial risk prevention China has already imposed an embargo on activities related to cryptocurrency. China’s central bank, the People’s Bank of China (PBOC) has planning to launch its own cryptocurrency. In France cryptocurrency is largely unregulated though limited guidance was issues in terms of taxation of cryptocurrency. The profit from sale of cryptocurrencies is considered under the purview of wealth tax taxation

in France. Handling cryptocurrencies are strictly prohibited by all Iranian financial institutions as per the directives provided by the Central Bank of Iran (CBI). In Japan since April, 2017 the Japanese Payment Services Act is regulating the cryptocurrency exchange businesses. The Financial Services Agency (FSA) is the key authority to look after the regulatory issues related to cryptocurrency exchange businesses. According to the taxation authority of Japan, the National Tax Agency (NTA), the profit on sale of cryptocurrency considered as miscellaneous income. In March 2018 Mexico's central bank, Banco de México, is granted broad powers as per Mexico's Law to Regulate Financial Technology Companies regarding regulation of virtual assets or cryptocurrency. Subramanian et al. (2020) in their study have discussed the regulatory initiatives taken by US in cryptocurrency. In US the initiatives were mainly taken by the Federal Reserve, the Securities Exchange Commission, the Treasury Department and relevant state regulators. As per the study the Securities and Exchange Commission (SEC) views crypto-assets as securities. The Bitcoin was considered as digital currency by the Court of Justice of the European Union in 2015 and exempted it from VAT. FinCEN, Internal Revenue Service (IRS), SEC, CFTC, Consumer Financial Protection Bureau (CFPB) are few government bodies who have taken the initiatives and offered guidance for virtual currencies (Kiviat, 2015).

In India RBI has raised a concern against cryptocurrency way back in 2013. An International Blockchain Congress hosted by The NITI Aayog of the Government of India in 2018. First Blockchain finance transaction was performed by HSBC Bank and Reliance Industries. The first Blockchain-enabled Letter of Credit Transaction supported the consignment between Reliance Industries and Tricon Energy. The first industry transaction in the Blockchain platform integrated with Bolero's electronic Bill of Lading (eBL) (Rathore, Kumawat & Umamaheswari, 2021). The Central Board of Direct Taxes (CBDT), Department of Revenue, Ministry of Finance has conducted surveys of nine cryptocurrency exchanges to assess the possibility of tax evasion in December, 2017 (Kshetri, 2018).

Knezevic (2018) has represented the transformation financial services using Blockchain technology originally adapted from a study conducted by Tapscott and Tapscott (2017) as follows:

Table 1: Blockchain Transformation of Financial Services

Function	Blockchain impact	Stakeholders
Authenticating Identity and Value	Verifiable and robust identities, cryptographically assured	Rating agencies, consumer data analytics, marketing, retail banking, payment card networks, regulators
Moving Value – make a - payment, transfer money, and purchase goods and services	Transfer of value in very large and very small increments without intermediary will dramatically reduce cost and speed up the payment	Retail banking, Wholesale banking, Money transfer services, payment card networks, telecommunications, regulators
Storing Value – currencies, commodities, and financial assets are stores of value, Safety deposit box, a savings account etc.	Payment mechanism with a reliable and safe store of value reduces needs for financial services; ban savings and checking accounts will become obsolete	Retail banking, brokerages, investment banking, asset management, telecommunications, Regulators
Lending value – credit card debt, mortgages, corporate bonds, municipal bonds, government bonds, asset backed securities, and other forms of credit	Debt can be issued, traded, and settled on the blockchain; increases efficiency, reduces friction, improves systemic risk. Consumers can use reputation to access loans from peers; significant for the world's unbanked and for entrepreneurs	Wholesales, Commercial, and retail banking, public finance, microlending, crowdfunding, -regulators, credit rating agencies, credit score software companies
Exchanging Value	Enhancing speed dramatically	All industries
Funding and Investing	New models	Investment banking, venture capital, legal, audit, property management, stock, exchange, regulators
Management Risk	Lowering risk	Insurance, risk management, wholesale banking, brokerage, clearinghouses, regulators
Accounting for value	Dramatically improved reporting	Audit, accounting, regulators

Source: Knezevic (2018); Originally adapted from Tapscott, and Tapscott (2017, June). Realizing the Potential of Blockchain. In World Economic Forum.

Nofer, Gomber, Hinz and Schiereck (2017) has pointed out the financial applications of Blockchain in a tabular form as depicted below:

Table 2: Financial Applications of Blockchain

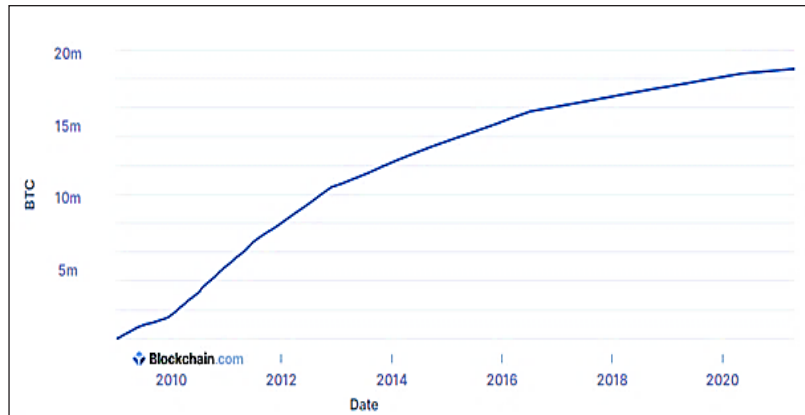
Type	Application	Description	Examples
Financial applications	Crypto-currencies	Networks and mediums of exchange using cryptography to secure transactions	Bitcoin Litecoin Ripple Monero
	Securities issuance, trading and settlement	Companies going public issue shares directly and without a bank syndicate. Private, less liquid shares can be traded in a blockchain-based secondary market. First projects try to tackle securities settlement	NASDAQ private equity Medici Blockstream Coinsetter
	Insurance	Properties (e.g., real estate, automobiles, etc.) might be registered using the blockchain technology. Insurers can check the transaction history	Everledger

Source: Nofer, Gomber, Hinz and Schiereck (2017). Blockchain. Business & Information Systems Engineering, 59(3), 183-187.

In a recent study conducted by Chang, Luo and Chen (2020) has highlighted how Blockchain technology has added a new dimension to trade finance in special context with letter of credit (L/C). In case of traditional mode of trade finance it is dependent comprehensively on an authorized central party such as banks as intermediary, paper-based documentation, manual processing, lengthy delivery across borders, expense of time and cost, complex trade processes, etc. The Blockchain enabled trade finance ensured trust through tamper-proof immutable, consensus-based digitized distributed shared ledger with smart contract which mitigate risk, reduced time of transfer and delivery and help to build up trustful trade environment. They have also stated that adoption of Blockchain L/Cs enable distributed governance and process automation in global trade finance. They have also expressed their views on the innovative prospect of Blockchain technology on process simplification and removal of intermediation in trade finance with reference to L/Cs.

Laroiya, Saxena and Komalavalli (2020) explained in their study about the various application of Blockchain technology in the area of banking and finance such as verification and processing of cross border transactions, smart bonds, point of sales system that allows the merchants and users to accept cryptocurrency as payment, speedy, transparent, smooth, reliable, verifiable and secure lending and borrowing, new and innovative way of securities trading over digital platform, smooth, automated, efficient and frictionless clearing and settlements, help to save cost and time of bookkeeping and auditing, minimizing the investment risk in a decentralized hedge funds, easy to get credits and their approval by any individual/entrepreneur/organization, etc. this study has also highlighted several banking related areas as well where Blockchain technology has its application such as trade Finance, Cross Border Payments, FX trading, capital market operations, consortium accounts, etc. the study have also focussed on the application of Blockchain technology in insurance sector in underwriting, payments, claims and reinsurance processes because of efficiency, security, and transparency related to the information.

Fig. 1 has depicted the total number of mined Bitcoin circulating on the network over the time. It gives a clear indication of the gaining popularity of Blockchain technology as well as the growing use of Bitcoin:



Source: <https://www.Blockchain.com/charts/total-Bitcoins> (Retrieved on 26th April, 2021)

Fig. 1: Total Circulating Bitcoin

BENEFITS OF USING BLOCKCHAIN TECHNOLOGY IN BANKING AND FINANCIAL SECTOR

As Blockchain is based on decentralized DLT hence any financial documents can be reviewed and sanctioned by all the parties involved near real time. As all the related parties in the network have the access of all the information hence transparency can easily be maintained which is the most important factor in Banking and Financial Sector. Both the owners as well as the regulators can easily access the required documents and identify the location of the assets at any point of time. It reduces the counterparty risk by eliminating the double spending. No central authority or intermediation is required. It helps to execute any transaction in real time at a much cheaper cost. Depending on the requirements the smart contract can be executed. It follows consensus mechanism such as proof of work (POW) which mitigates the cost of trust to a large extent.

CHALLENGES OF USING BLOCKCHAIN TECHNOLOGY IN BANKING AND FINANCIAL SECTOR

Though most of the researchers have talked about the Blockchain technology as game-changing innovation which has got a huge application

not only in the area of finance and banking but also in several other areas as well but again almost all the researchers have raised serious concern about the security aspects and also various technical challenges of the same. Choo, Ozcan, Dehghantanha and Parizi (2020) have mentioned that similar to other technologies Blockchain has also security and privacy issue. There are numerous technical challenges involved with Blockchain technologies (Frizzo-Barker et al., 2020). VP and Head of Banking & Financial Services in the UK & Ireland, Cognizant, Mr. Tony Viridi has considered scalability, transactions verification time, the cost of transactions and security as the key challenges of Blockchain technology (Viridi, 2015). In 2011 the first major hacking took place in Blockchain technology when 'Allinvain', a member of the world's first Bitcoin mining pool called Slush Pool, hacked by the attackers experienced a loss of 25,000BTC. In the year 2014 \$460 Million disaster happened with the Tokyo-based Bitcoin exchange Mt. Gox due to hacking. 119,756 Bitcoins worth \$72 million were stolen from Hong Kong-based cryptocurrency exchange Bitfinex on August 2, 2016. About \$530 million worth cryptocurrency, NEM, were stolen from Japanese crypto exchange Coincheck on January 26, 2018. The NiceHash Bitcoin wallet washed out by the hackers worth about 4,736.42 BTC or about \$62 million on December 6, 2017. A venture capital firm for the crypto and decentralized technology space, the Decentralized Autonomous Organization (DAO), an on the Ethereum network, faced another hacking attack of 3.6 million Ether, worth about \$70 million. Lack of proper standards and regulation in many countries for the implementation of Blockchain is another big challenge (Akram et al., 2020). The study has also mentioned few security issues such as openness at endpoints, public and private key theft, untested code, etc. Hewa, Ylianttil and Liyanage (2020) in their study mentioned about different disadvantages and issues related to various smart contract platforms such as computational overheads, storage overheads, network overheads, data privacy, varying transactions approval time from seconds to minutes, integration of Blockchain with the existing systems, lack of governance, etc. Pseudo-anonymous characteristic of Blockchain technology is another biggest challenge for banking as well as for financial services to prevent money laundering and other illegal activities. The cryptocurrency transactions cannot be reversed. Ammous (2016) has mentioned costly redundancies, irreversibility, serious scaling problems, substantial obstacles to meet the terms with regulations, security liability, etc. as key issues related to Blockchain technology. Smith, Xiong and Medlin (2020) has mentioned high set up cost as another

challenge in Blockchain technology adoption. Drastic price movement of cryptocurrency, cybertheft, fraud, lack of regulations, dependence on technology, restricted usage by limited companies, etc. are also considered as few challenges of using Bitcoin (Laroiya, Saxena & Komalavalli, 2020). Benedetto (2020) has mentioned the concern regarding the ethical consideration of Blockchain technologies and raised the voice for the code of conduct requirement of Blockchain technology.

CONCLUSION

Blockchain technology and cryptocurrency has gained a huge popularity worldwide within a very short span of time. Considering all the aspects related to Blockchain technology many researchers has agreed to the fact that this technology still in its nascent stage. Though several weak points have also noticed regarding Blockchain technology. Instead of using it as medium of exchange, cryptocurrency mostly used as a speculative financial instruments till date. In the advent of improved technology financial and banking sector has observed many significant changes over the past few years. Internet has changed the entire mechanism of the financial transactions. Blockchain technology also being a part of this disruptive innovation in the field of finance has given a new dimension not only to financial services and banking sectors but many other sectors as well. In financial transactions trust between the related parties is the most important aspect. In Blockchain technology this trust factor is the most challenging issue as the identity of the parties involved are remain undisclosed to everyone. Increasing cybercrimes, anonymous hackers, money laundering need to be address with the help of improved technology. Many countries are still reluctant to use Blockchain technology. Proper regulatory guidelines are highly essential to become a widely used trustable mode of transaction. As cryptocurrency and usage of Blockchain technology is mainly technology driven which do not have any direct relation with environment degradation and as it is a paperless technology hence Blockchain technology can contribute towards green finance which can lead to sustainable development.

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