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Blockchain Technology for Financial Sector – An Overview

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***Abstract*—** The Blockchain concept permits the simultaneous working of multiple stakeholders of business by eliminating the intermediary. It makes the transaction possible even if the stakeholders do not trust each other. Many companies including the security exchanges have developed blockchain based applications in last two years to make payments internally within the company as well as externally to trade with outside world. However, there are many who are still hesitating in adopting the system. Security and monitoring mechanism to administer blockchain are major issues of concern among the regulators and adopters of the technology. This paper is an attempt to explore the various dimensions of blockchain technology in context of financial sector. The technology is continuously developing and hence a critical understanding is required to reap its all the benefits.

***Keywords*—** Distributed Ledger, Decentralized network, Cryptocurrency, Bitcoin, KYC, Identity, Block, Transaction, Fraud, Security.

I. INTRODUCTION

Blockchain technology is based on the concept of establishing a digital distributed ledger. All the participating members of the network have access to the identical copy of the ledger. The members can read the previous transactions as well as record new transactions into the block. Each block consists of several transactions. As soon as a block gets filled up, a new block is created which is connected with the previous block of transaction. Gradually increasing number of blocks creates a chain of blocks and hence the name is Blockchain. The contents and the connection between the blocks are written in encrypted manner ensuring the security of the system from forgery. As the blocks are created, linked and maintained automatically, it eliminates the involvement of any intermediary. Currently, banks do the task of authenticating the fund transfer among the transacting parties. So bank acts as a trusting authority. However, bank can also impose certain restrictions on the fund transfer. Also cost of mediation is high in terms of transaction cost as well as size of transaction (Nakamoto, 2008). Blockchain technology eliminates this concept of depending on third party to get the trusted information. The said technology directly provides access to the current status of the members and makes the system more reliable. The chances of financial data leakage are reduced significantly.

II. RELATED WORK

Growth:

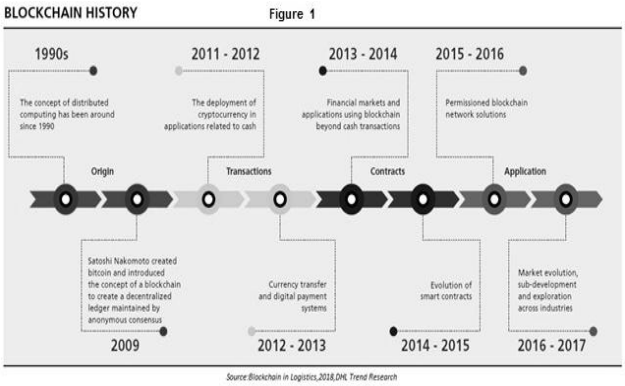

Fig. 1

The idea of blockchain started in the year 2008 through a white paper by Satoshi Nakamoto with the introduction of Bitcoin for the first time (Nakamoto, 2008). As shown in the figure 1, the idea of Blockchain has developed over last 10 years (DHL Trend Research, Germany, 2018). The growth trend has been rapid and has been able to attract the corporate sector towards its adoption. Initially the idea was to create an online version of currency that can be used for digital financial transactions. Gradually it has been noted that online transactions has to face lot of challenges mainly in terms of security, middleman and third party trustworthiness. So the need for independence from the involvement of middleman in online transaction has been identified and Blockchain technology provided an effective way to combat the issue. Over the years the concept of Blockchain has grown from the cryptocurrency to distributed transaction

ledger accouting for e-money transactions in secured manner by successfully bypassing the middleman. It has been further established through the investment trend shown by Corporate sector in Blockchain Technology over last few years (PWC, 2018) as shown in Table 1.

Table 1 : Cumulative Total Investment in BlockChainStartUps (Source: PwC analysis using data from Jan 1, 2011 to Nov. 9, 2017) ***https://www.pwc.com/us/en/industries/financial-services/research-institute/top-issues/blockchain.html***

Year	Investment in Dollars
2011	16m
2012	72m
2013	163m
2014	487m
2015	750m
2016	1.3b
2017	1.6b

III. METHODOLOGY AND STRUCTURE

Blockchain Technology facilitates transparency in financial transactions in secured manner and also the execution of contracts in automated manner improves efficiency of companies in dealing with routine activities. Bitcoins or any type of Cryptocurrencies works on the basis of blockchain technology. The **key features** of such "Middleman-less Technology" can be listed as below (Deloittee UK, 2016) (DHL Trend Research, Germany, 2018) :

1. Digitally distributed ledger technology.
2. Uses many participants in the network to reach consensus.
3. Each participant's identity is verified through cryptography and digital signature.
4. Identical copies of data blocks can be maintained with each member.
5. All participants can review previous transactions and also can transact fresh.
6. Transactions are grouped into blocks and then recorded as chain of blocks thereby creating the blockchain.
7. Each block is well-connected or linked with other blocks.
8. Link between blocks and the block content are protected through cryptography to avoid damage or forgery.
9. Blockchain database retains complete history of all assets and instructions executed upon them, thereby making it robust with time and hence difficult to alter.
10. Ledger and transactions are trusted without any middleman as every data recorded is verifiable and auditable.

The most important component of blockchain technology is the **BLOCK** that records all the information about the assets and the corresponding transactions. Each block consists of two major parts (Deloittee UK, 2016):

a. *Block Header* which consist of metadata i.e. structural data about the block such as uniquely identifiable block reference number, timestamp information about the block creation and record entry, link data for connecting to previous block and the next block.
b. *Block Content* which consists of the validated details of the digital assets and all the instructions that has been executed on those assets till date. It includes all relevant details of the transactions such as transaction amount, transacting party, contract details of such party etc.

In the beginning, there was no **size limit** to a block. This has created the problem of Filler Blocks (containing dust transactions) just to introduce the threat of Denial of Service Attack. The amount of data that can be stored in a block is another major area of concern. In current situation, Bitcoin blockchain can hold up to 1megabyte data (Maderia, 2016). The calculation of number of transactions is done on the basis of the following formula (Bitcoin Plus, 2017):

Average Transactions Per Block =
Maximum Block Size / Average Transaction Size
=1000000 Bytes / 495 Bytes
= 2020 Transactions

Transactions Per Second =
Number of Transactions Per Block / Block Time in Seconds
= 2020 Transactions / 600 seconds[1]
= 3.37 Transactions per second

IV. RESULTS AND DISCUSSION

Financial Sector Use Cases :

Blockchain technology equips the system with two major features. The first one being the faster and secure P2P transactions and the second one being the anti-money laundering thereby increasing the better transparency and trust in online transaction (PWC, 2018).

a. **Cross Border Payments –** It is often a challenging issue to transfer money from one country to another. It causes time delay due to involvement of multiple regulating bodies responsible for fund transfer. The cost of remittance is also considerably high ranging from 5% to 20%. Blockchain technology helps in direct P2P fund transfer thereby reducing the remittance cost significantly within 3%. It makes it faster too. However, there are two significant issues which need attention. Firstly, in case of bankruptcy of any of the wallet provider, there is no bank involved who can reimburse the losses. Secondly, cryptocurrency exchange into local currency adds extra complication to the final value

of the fund (it is subject to fluctuation in exchange rates as well). As more countries open up to adopt this technology, the mentioned issues can be sorted out.

IBM has implemented Blockchain Technology for cross border payments effectively. IBM is providing 24/7 support, streamlined visible transactions, enhanced regulatory compliance, real-time settlement processing, reduced cost and single exchange fee between major currencies (International Business Corporations, 2018). A consortium of local banks, Monetary Authority of Singapore and BOA Merrill Lynch are working on a prototype to implement decentralized payments in secured encrypted manner (Lindner, 2018).

b. **Share Trading** – Share trading is such an area that depends a lot on the middleman (specially brokers) for its execution. Blockchain technology provides a way to perform the transactions directly and gives a power to the participant to validate the transaction. This helps to achieve more trade accuracy and better market management. As soon as a transaction takes place, the information will be broadcasted over the distributed network and every participant comes to know about the current status of the market. It addresses the issue of double spending. Also, facilitates automated transactions to be executed on the basis of conditions pre-stated. Colored bitcoin can also be used to mark various type of assets and thereby making the transactions more understandable and auto-executable.

Stock exchange operations will change dramatically in near future, as the technology is capable of reducing and re-molding the role of middleman noticeably.
Nasdaq stated that blockchain will be used to enhance equity management capabilities in Private market Platforms. Nasdaq introduced LINQ in October, 2015 as a solution that enables private companies to digitally represent the ownership of shares using blockchain technology (NASDAQ, 2016). It also supports scalability along with interoperability across network platforms and eases information transmission. It is believed that it will bring efficiency to the high volume of stock market operations and in future has lot of potential of providing maximum value to its participants.

c. **Smart Contracts** – Smart Contract represents the logic based software / programs that can facilitate evaluation of various clauses (such as payment terms, liens, confidentiality enforcement etc.), verify and then enforce the execution in fully automated / semi-automated manner (Szabo, 1996). It provides a smarter way to handle contracts in more economic manner. However, the smartness depends on the manner in which the clause of the contract is defined. The flaws in the logic of the smart contract will automatically result in poor performance of the technology. It is very useful in the sectors where the contracts with clients work on the basis of clearly defines clauses (Cheng & Song, 2018).
For example in insurance sector, the insurance document clearly states all the clauses beforehand and hence auto-execution can be a smart choice. In case of cargo shipping also, documents are prepared on the basis of agreed upon protocols and hence, smart contracts can be very advantageous. Smart contracts can also keep track of the ownership of the content and hence can play pivotal role in protection of copyrighted content. (DragLet, 2018).

d. **KYC and Online Identity Management** – In online environment, users needs to establish and prove their identity in order to perform any task. Also it has to be done repeatedly on every new website by the user to intended activities. Blockchain technology requires user to prove their identity once in the beginning. Once the identity has been established (through valid legal documents), authenticated (through user) and authorized (through levels of access permissions), blockchain itself provides the source of truth to every service provider of their choice (Boersma, 2018). The challenge here is the protection of private key (used for securing the user data) and ensuring data privacy. Another difficulty is to determine the extent to which data is to be shared with service providers and with whom. Loss of private key or identity data leads to serious problem of Identity Theft.

Identity Management can be used actively in the sector where user needs to identify themselves with number of stakeholders. For instance, for ecommerce transactions, if a user identifies himself with a bank once, in blockchain scenario, no further identity proof is needed anywhere. Also in insurance sector, if a user identifies once with any one blockchain application, the same can be used with any other service provider. Deloitte has developed an application "Smart Identities" service which can be connected to various type of organizations and software. It enables the individuals as well as their legal representatives to be connected through this service (representatives e.g. lawyer, doctor, family members for elderly people and so on for those who are not well-versed with internet). Deloitte also developed "KYC Light" for micro-insurance sector and identifies insurer on the basis of "social points" that is calculated from their public profile on social media (e.g. Facebook). It is also connected with a camera through which user can be actively connected and traced (Boersma, 2018).

e. **Loyalty and rewards –** Mere activities of generating output and profit can not keep the users engaged with a business. Performance management system has its advantages of retaining the users (customers as well as employees) with the business for long. The users feels

motivated if their act of sharing knowledge, doing their duties in time, providing valuable feedback on various issues etc. is recognized and well appreciated in terms of reward. Blockchain technology has the capabilities of tracking and tracing every activity performed by the users starting for the first activity. Cryptocurrency can be a very motivating reward for online users and play significant role in keeping the users loyal.

Deloitte has developed crytocurrency in line with bitcoin to encourage its users for their timely and responsible acts (Smolenaers, 2016).

f. **Fraud Reduction –** Financial sector suffers from the serious threat of cyberattacks. There are few key issues that are vulnerable to cyber attack and blockchain presents a viable solution to those. Usually, banking and financial service providers work in centralized system and thus having a central point of failure. Blockchain works on distributed network premise and hence does not have any single point of failure. Copy of the data is available with multiple members. Another major issue is involvement of multiple intermediaries in online transaction. Blockchain reduces middleman significantly and provides P2P fund transfer with minimum hurdles. Also blocks maintained are timestamped. Hence, every change in the data can be traced and tracked. It makes the data maintained in blockchain auditable and verifiable by default thereby minimizing cybercrime instances.

Banks such as HSBC, Tokyo Mitsubishi are already on a trail in Asian markets on distributed ledger platform (Lindner, 2018) .

V. CONCLUSION AND FUTURE SCOPE

Blockchain is a powerful way of storing list of records in decentralized manner without any single point of failure. Amazingly the records are continuously reconciled and hence are traceable and auditable by default. The data stored in secured through cryptography and the problem of cyber crime reduces significantly. It is also noticeable that the time and cost required in completing national as well as international transactions drops drastically due to reduction in number of middleman. Direct P2P transaction with minimum yet confirmed identity verification makes the system very efficient. However, there are certain issues that needs to handles with utmost care in order to make the system the future path of online transactions. The privacy of data, protection of private key, proper KYC and identity management, link management etc. are of critical importance. Blockchain is capable of providing much secure, cheaper yet very efficient platform for handling large volumes of transactions, huge money and countless number of users, the key features of Financial sector (Lindner, 2018). With blockchain, Banks and financial service provider can be in a position to provide new services and offers to their customer to have better experience with more transparency and security.

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