

## BLOCKCHAIN TECHNOLOGY APPLICATION IN INDIAN BANKING SECTOR

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**PURPOSE**  
*BANKING and technology are very closely associated and innovations have changed the framework of banking process drastically. The digital innovations in the banking sector started with the introduction of money that replaced the barter system and then the gradual replacement of wax seal with digital signatures. One such disruptive innovation which is changing the banking sector globally is Blockchain Technology (BCT). The paper aims to provide an overview of Blockchain Technology with its benefits and emphasizing on the applications of the technology in the Indian Banking Sector. The paper gives the insight of various challenges and global perspective of Blockchain Technology in banking industry.*

**Design/Methodology/Approach:** *The paper presents a conceptual study of potential of Blockchain Technology in revolutionizing the existing financial business applications in India.*

**Findings:** *The study concludes that, Blockchain will evolve as a disruptive force in transforming Indian Banking Sector by making banking transactions more secure, faster, transparent, and cost effective.*

**Research Limitations:** *The authors have used secondary data for the current study. An empirical research can be undertaken in future to present the growth of Bitcoin Technology in India with respect to other developing countries.*

**Practical Implications:** *Study is based on Secondary data and an empirical research can be undertaken in future to present the growth of Blockchain Technology in India and abroad.*

**Originality/Value:** *The paper presents the original viewpoints of the authors.*

**Key Words:** *Applications, Banking, Blockchain, Bitcoin, Distributed Ledger Technology.*

### Introduction

Banks are amongst the oldest and biggest financial intermediaries in India. Since liberalization, several significant changes have occurred in the working of the banking sector. Banks in India have witnessed a radical change from 'conventional banking' to 'convenience banking'. Under the headship of Dr. C. Rangarajan, RBI set up a committee on computerization in 1988. The purpose was to improve the customer service, book-keeping, and MIS reporting. Banks started their journey towards Information Technology with the introduction of Standalone PCs, followed by Local Area Network (LAN), and the

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adoption of core banking; which proved to be the promising step towards enhancing customer convenience through ‘Anywhere - Anytime Banking’. Moreover, the move towards computerized banking accelerated with the entry of private sector banks and foreign banks in 1991. Banks benefitted with respect to time and cost by the adoption of new technologies such as e-banking, MICR based cheque processing, Electronic Funds transfer, Inter-connectivity among the bank branches, and implementation of ATM (Automated Teller Machine). The banking system gained digital revolution by adopting payment through NEFT (National Electronic Fund Transfer), transferring funds through ECS (Electronic Clearing Service), and RTGS (Real Time Gross Settlement). Banks adopted cheque truncation system for clearing. The Indian banking system also gained wide acceptance of online banking, mobile banking, debit cards, credit cards, prepaid cards, etc. The launch of United Payments Interface (UPI) and Bharat Interface for Money (BHIM) by the National Payments Corporation of India (NPCI) are significant steps for innovation in the payment systems domain (RBI, 2017). Thus, there is remarkable progress with respect to digital revolution in the banking sector. Today, the bank’s aim is to provide fast, error free, and quality service to their customers.

The key innovations that will change the future of banking by 2020 are Artificial Intelligence, Blockchain Technology, Robotics Process Automation, and Cyber-Security. The Banks are moving ahead on digitalization through the application of Blockchain Technology, which is the most innovative phenomenon and is being considered as a global force of disruption (Gupta, 2017 and Bhattacharyya & Pradhan, 2017). The Blockchain Technology will spark the fourth Industrial Revolution across the globe.

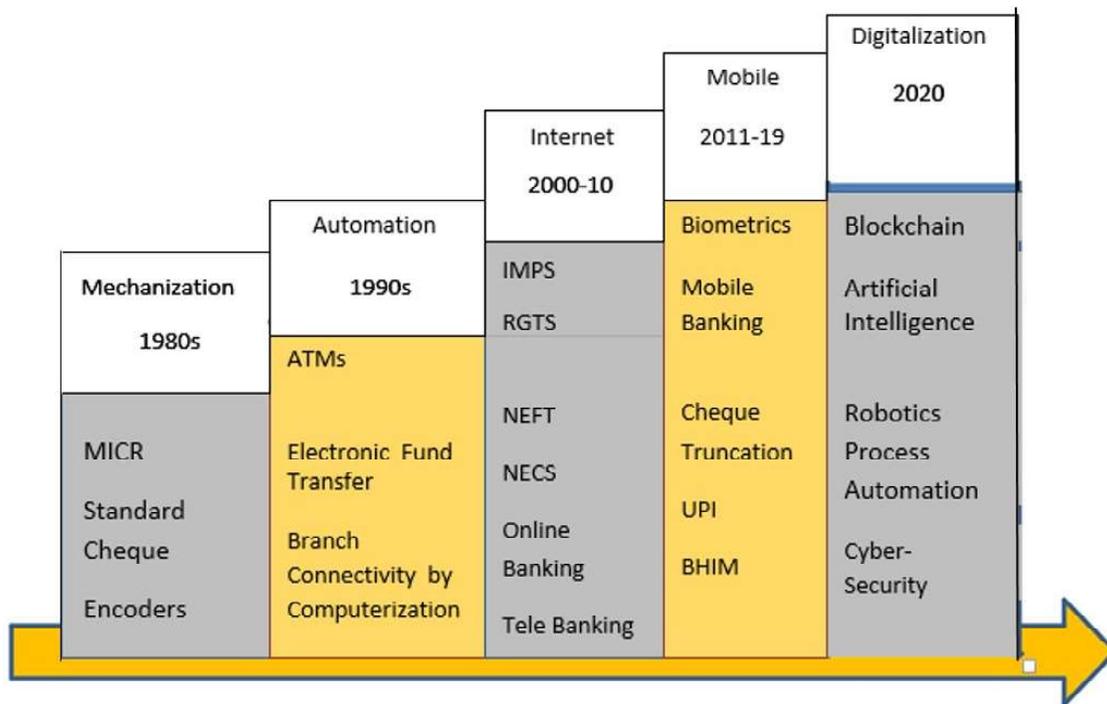


Figure No. 1: Technological Development in Indian Banking Sector

Source: Venkatesvaran (2017)

Blockchain Technology is a new technology which is based on mathematical, cryptographic, and economic principles for maintaining a database between various participants without the requirement of any third party or central authority. It is a secured distributed database, wherein, the validity of a transaction can be verified by parties in the transaction. Each group of these transactions is referred to as a “block”.

A Block records some or all of the recent transactions and goes into a Blockchain as a permanent record once completed.

The utility of Blockchain is that, the financial transactions no longer requires any central authority and are immediately validated, cleared, and settled. Blockchain Technology appears to be an innovation which promises a major change for capital markets and other financial services. Blockchain is going to disrupt the banking industry in coming years. The World Economic Forum (2017) estimated that, by the end of 2017 most of the banks would initiate projects related to Blockchain. In the past few years, Fintech startups working on Blockchain have got the venture capital funding of more than \$1.4 Billion. During the same period, more than 2,500 patents have been filed and over 90 Central Banks are presently engaged in discussions on Blockchain worldwide. Moreover, the latest statistics show that 69-percent banks are experimenting with Blockchain (Ball, 2017). The above statistics justify the evolution of the technology whose first contours were defined at the time of global financial crisis in 2008.

### **Objective of Paper**

The objective of this paper is to provide the overview of Blockchain Technology with its benefits, emphasizing on the applications of the technology in the Indian banking sector. The paper gives the insight of various challenges and global perspective of Blockchain Technology in banking industry.

### **The Review of Literature**

Since 2008, Blockchain Technology had been the interesting and most demanding topic of research.

Nakamoto (2009, p. 3) in his white paper proposed “a peer-to-peer version of electronic cash which would allow online payments to be sent directly from one party to another without going through a financial institution or third party”. This emerged as a foundation for the most popular Blockchain application i.e., bitcoin (Barber, Boyen, Shi, & Uzun, 2012).

Swan (2015, p. 45) explains that the “Blockchain is a decentralized public ledger that can be used for the registration, inventory, and the transfer of all assets in finances, property as well as in intangible assets such as votes, software, health data, and idea”. He considered the theoretical, philosophical, and societal impact of cryptocurrencies and Blockchain technologies.

Olnes (2015) studied the potential use of the Blockchain Technology to enable governments to utilize the secure, open, distributed, and inexpensive database technology. It was emphasized that Bitcoin could be a promising technology for validating many types of persistent documents in the public sector.

Yli-Huumo, Ko, Choi, Park, & Smolander (2016) extracted 41 primary papers from scientific databases and studied the current research, drawbacks, and the future perspective of Blockchain Technology from the technical point of view. The statistics shows that 80-percent of the research is only on Bitcoin as compared to other Blockchain applications. Most of the studies are focussing on benefits of Blockchain Technology. However, many of the Blockchain scalability related challenges have been left unstudied.

Zhao, Fan, & Yan (2016) gave an overview on Blockchain Technology research and development. The study show that, the widespread use of Bitcoin in the financial and business sector will open new ways for business innovations and research.

The Institute for Development and Research in Banking Technology (IDRBT), established by the RBI (2017) has conducted an extensive research to explore the applicability of Blockchain Technology in Indian banking and financial industry. The white paper explains all the aspects of Blockchain like concepts, advantages, applications, challenges, and future of Blockchain Technology in Indian banking sector.

## **Benefits of Blockchain**

Blockchain is an emerging technology which can radically change the banking and financial sector, providing ample opportunities for growth and innovation, and is capable of reducing risk and cost. It will bring a major transformation across the banking sector and will make various current systems and processes redundant and obsolete. Some of the advantages brought by Blockchain Technology are as follows:

- **Reduced transaction costs:** Blockchain Technology gives an opportunity to market participants to directly access dematerialized assets and stored information. It saves the cost of reconciliation for banks and prevents losses arising due to frauds. Blockchain ensures that payment and settlement takes place simultaneously which leads to a reduced cost in management of funds by the treasury. Blockchain applied in cross border remittances can help users to get best exchange rates from foreign- exchange marketplace due to near- real time processing of transactions.
- **Efficiency:** Blockchain improves the speed of processing of transaction as it reduces the time of decision making across the organisations with minimal human intervention. It reduces the requirement of duplicate record keeping, reduces reconciliations, and minimize errors & frauds leading to faster payment and settlement. In case of any unfortunate event like war, flood, earthquake, etc. at one location, the remaining participants in Blockchain can approve a transaction.
- **Eliminates intermediaries:** Trust is a foundation of business. Blockchain which is based on cryptography replaces third party intermediaries as the keeper of trust. It will reduce the overheads costs when parties transact directly with each other without the need of central authority or middleman.
- **Transparency:** Blockchain helps in maintaining irreversible record of transaction event in sequential order which brings more transparency in business transactions. It provides the details of origin of messages in the area of payment which leads to transparency and reduction in risks.

## **Application of Blockchain Technology**

Blockchain Technology can be applied across various industries in India and industry leaders are customizing the applications of Blockchain as per their industry requirements. Some useful cases of Blockchain Technology and their suitability with respect to the banking sector are discussed below:

**Digital Currency:** Cryptocurrency acts as a medium of exchange, making use of cryptography to make the transaction more secure, and to regulate the creation of additional units of currency. Some of the most popular cryptocurrencies are Bitcoin, Ethereum, Ripple, Litecoin, etc.

Cryptocurrencies helps us to overcome the identity theft, as users have control over their transactions. It protects the merchant from the risk of fraud as the transactions cannot be reversed once executed and do not possess any personal information with them. It also allows sending and receiving money anywhere in the world at any given time without the involvement of central authorities. The transactions are immediately verified and are visible to all participants. Also, the transaction cost involved in converting into fiat money is very low.

However, digital currencies have certain limitations. The demand for digital currency is increasing day by day whereas, there are only limited amount of digital currency. This has led to high volatility and risk in digital currency. The Reserve Bank of India has also cautioned users of virtual currencies from time to time against potential financial, operational, legal, customer protection, and security related risks. Since cryptocurrencies don't have any intrinsic value of their own, the holders of currency may face greater risk associated with price volatility and liquidity. It is difficult to satisfy the Anti-Money Laundering (AML)/ Combating of financing of terrorism (CFT) requirements in relation to

digital currency transactions. The privacy issues related to digital currency schemes has also discouraged various financial system participants to use it for their own or for their customers.

In order to reap the benefits of Blockchain Technology, many central banks across the globe has started developing a digital version of their fiat currency. For example, the Central bank of Canada has developed CADcoin as a digital version of Canadian Dollar, Dutch Central Bank is experimenting with DNB coin virtual currency.

The price of Bitcoin has risen at an exponential rate from \$0.04 in 2008 to \$19,700 in December 2017. Cryptocurrency was first started in 2009 in the form of Bitcoin and presently, around 1380 such cryptocurrencies are circulating in the market having the market capitalization of \$550 Billion as on December 2017. The top ten cryptocurrencies on the basis of market capitalization are mentioned below.

**Table No. 1: Top 10 Cryptocurrencies (As per market Capitalisation)**

S. No.	Cryptocurrency	Market Cap	Price
1.	Bitcoin	\$2,37,62,41,82,230	\$14,176.50
2.	Ethereum	\$72,95,33,25,114	\$755.55
3.	Bitcoin Cash	\$48,52,00,98,413	\$2,875.28
4.	Ripple	\$40,80,16,16,919	\$1.05
5.	Litecoin	\$15,36,34,39,033	\$282.10
6.	Cardano	\$10,19,45,24,136	\$0.39
7.	IOTA	\$9,99,27,17,116	\$3.60
8.	NEM	\$9,72,61,19,999	\$1.08
9.	Dash	\$9,41,13,38,564	\$1,210.64
10.	Monero	\$5,34,24,96,468	\$344.21

Source: CoinMarketCap (2017)

**Trade Finance:** It is the most suggested application of Blockchain Technology. A complex transaction of the letter of credit can be made more simplified and prompt if all the big corporates, the big shippers, and manufacturers as well as the custom authorities are on-boarded at Blockchain network. The information is shared on private distributed ledger by the exporters, importers, and their respective banks. After satisfying certain conditions the trade deal can be automatically executed through various smart contracts. The respective parties can view data as well as actions performed on their systems.

Barclays and an Israel-based start-up company have successfully executed a trade transaction using Blockchain in less than four hours which generally takes 7 to 10 days. The Bank of America, Merrill Lynch, HSBC, and the Infocomm Development Authority of Singapore has applied Blockchain in processing trade transaction using a paper-less letter of credit.

In order to make international payments easier and faster, Ripple is using Blockchain Technology to transform the cross- border payment business. It has added more than 100 banks and financial institutions to its network. The vulnerabilities in cyber-attacks in cross-border transaction banking can be overcome by this technology.

Under foreign exchange trading, there is creation and reconciliation of multiple records for currency trade for buyer, seller, broker, clearer, and third parties. Foreign exchange Blockchain startup Cobalt DL eliminates multiple trade records using Blockchain. As compared to existing infrastructure, technology is much more efficient as it will cut unnecessary licence fees, ticketing charges, overheads, etc.

**Blockchain Technology in Capital Markets:** Blockchain Technology has a great potential to revolutionize the capital market trading processes. Presently, various intermediaries involved in capital market transactions update their respective ledgers based on messages exchanged amongst them for correct accounting and to execute business transaction. This is a time consuming and a costly process. Sometimes, there is an even additional delay in the transaction settlement as for some transactions, intermediaries may need to fulfil additional formalities.

Blockchain can be applied in Trade and securities servicing. KYC checks can be done much faster and economically with the help of KYC data stored in Blockchain. Blockchain will bring in transparency, reduced credit exposures, real time matching of transactions, and a prompt irrevocable settlement. It eliminates intermediaries resulting in a reduction in margin and collateral required.

Blockchain can be applied in custody and securities services. Securities are issued on the Blockchain platform to the parties involved, which will make it simple for accounting and administration of securities due to automatic processing of subscriptions and redemptions.

Blockchain can also be applied in the initial public offering of shares. NASDAQ Blockchain based service i.e. 'Linq' has successfully completed and recorded a private securities transaction for chain.com. Financial services giant, 'Mizuho' has started trials for Blockchain based syndicated loans. State Bank of India Securities and IBM have collaborated to test the commercial viability of trading in bonds using Blockchain platform (IBM, 2016a,b,c).

**Supply Chain Financing:** Small and Medium size Enterprises (SME) faces lot of issues in accessing credit due to lack of sufficient collateral and credit history. Blockchain can boost supply chain finance by providing greater security, efficiency, and better decision making. According to the Global Trade Review (2015), a number of institutions including Standard Chartered Bank, DBS Bank, and Infocomm Development Authority of Singapore are developing a Blockchain-based invoice trading platform.

**Monitoring of Consortium Accounts:** One of the most important applications of Blockchain Technology is to prevent the diversion of funds. The end use of funds is not tracked by the lender as the borrower makes multiple transactions in moving funds from one bank to another. Blockchain Technology helps in monitoring of end use of funds of a borrower which is funded by a consortium of banks. It will lead to a reduction in Non-Performing Assets (NPA) as the banks can have an eye on the end use of funds. The information related to movement of funds is made available to all group members and it also helps in strengthening the monitoring mechanism.

**Know Your Customer (KYC):** Banks are very much concerned about the rising cost that they have to bear to comply with Anti-Money Laundering (AML) and Know Your Customer (KYC) norms. The KYC process has to be performed individually by every bank and financial institution. Presently, banks have to upload the KYC data to the central registry that can be accessed by banks to perform due diligence for existing or a new customer. This duplication of efforts would be removed by Blockchain Technology. All clients' updates will be available to all banks on real-time basis. It will help in reduction of frauds and NPAs with which Indian banking sector is struggling over a period of time.

Top banks of India such as ICICI Bank, Yes Bank, Kotak Mahindra Bank, and Axis Bank are increasingly recognizing the immense potential of Blockchain Technology. They do believe that Blockchain Technology is going to revolutionize the banking industry. They are using the technology for vendor financing and for financing international trade. ICICI bank successfully executed its pilot executed its pilot project

with Dubai's largest Bank - Emirates NBD in cross border remittances. By using the Blockchain Technology, the time required to settle cross border remittances has reduced from two days to few minutes. Axis Bank Ltd. and Kotak Mahindra Bank Ltd. have jumped onto the Blockchain bandwagon in association with global financial institutions. They are mainly working in cross-border remittance and the trade finance industry.

Yes Bank has successfully implemented a Blockchain transaction for Bajaj Electricals to digitize vendor financing. Infosys and TCS are developing Blockchain solutions in areas such as anti-money laundering, cross border remittances, asset registry, and loan syndication. The State Bank of India (SBI) has become the first Indian bank in establishing a financial Blockchain consortium of ten commercial banks, IBM, Microsoft, Skylark, and KPMG in 2017. The consortium completed its first project in June 2017, enabling its members to share KYC, AML, and CTF (Know Your Customer, Anti Money Laundering, and Combating the Financing of Terrorism) details over a Blockchain.

### **Challenges of Blockchain Technology**

Blockchain Technology has enormous potential, but there are various challenges that may dampen the technology's adoption rate. The challenges include:

- **Interoperability:** The technology does not have an international standard for competing Blockchain systems. Greater interoperability is needed to make the Blockchain compatible with the wider web and to integrate them into existing practices and processes. Operational feasibility can be attained if parties are on the same Blockchain network. With an increasing number of competing Blockchain networks, the issues of interoperability are also increasing.
- **Privacy:** Data on Blockchain Technology is inherently shared publically among all the participants of the system. There are various problems with respect to transaction privacy on Blockchain as the data is made public and anybody can see it. Private Blockchains are much secure but, it faces interoperability issues with other Blockchains.
- **Encryption:** There are many issues related to encryption of Blockchain data. If the key is made public, anybody can access the encrypted data and if someone loses the key to unlock the Blockchain, it is impossible to get it back. Encryption used in Blockchain technology may be broken through loopholes in the system as people may find out new ways to manipulate or misuse the data.
- **Security:** Blockchain is supposed to be very difficult to hack due to complex cryptography. Any security breach requires huge computing power by cyber security attackers. Multi-level security must be in place which encompasses authorization of parties accessing Blockchain, security from malicious insiders, cyberattacks, transaction security, and infrastructure security. Blockchain systems can be permission less or permissioned, depending upon the nature of transactions.
- **Scalability:** With growth in Blockchain applications, the need for a larger Blockchain database is required along with the speed of access to database. Speed and accuracy of processing of a transaction will be of utmost importance to make it commercially viable. The processing speed of Blockchain Technology needs to be very high to handle enormous volumes of data as handled by the current system.
- **Energy Consumption:** There is enormous consumption of energy in the use of Blockchain Technology. Technology leaves a massive carbon footprint of its own. It requires huge computing power greater than the world's fastest supercomputers.
- **Legal Framework:** Blockchain Technology and its applications lack national and international regulations. Though various governments across the globe are exploring the applications of Blockchain still, more clarity is required on the legal aspects of Blockchain Technology.

The above limitations or challenges may dampen the enthusiasm for Blockchain potential but, same can be taken care of with the improvement in the Blockchain framework over a period of time.

### The Global Scenario

Across the globe, banking industry is investing resources in exploring the impact of Blockchain Technology on their business. The top banks in the United States and Europe are exploring the applications of Blockchain in partnership with startups and innovation labs. R3 consortium, a Blockchain startup is working with over 100 banks, financial institutions, regulators, and trade associations. It is also in the process of developing commercial applications for banks and financial institutions. Santander Bank has identified around 25 cases focussing on international payments and smart contracts. Barclays Bank is experimenting on 45 internal use financial institutions like UBS and Deutsche Bank. JP Morgan and the Bank of America are also working on Blockchain applications.

Year	Annual Deal Share					
	South America	North America	Europe	Australia	Asia	Africa
2013	2.10%	78.50%	8.50%	2.10%	8.50%	Nil
2014	1.40%	64.30%	13.30%	1.40%	18.90%	Nil
2015	1.20%	56.50%	21.70%	3.70%	14.30%	2.50%
2016	2.30%	49.20%	20.50%	0.80%	22.70%	4.50%

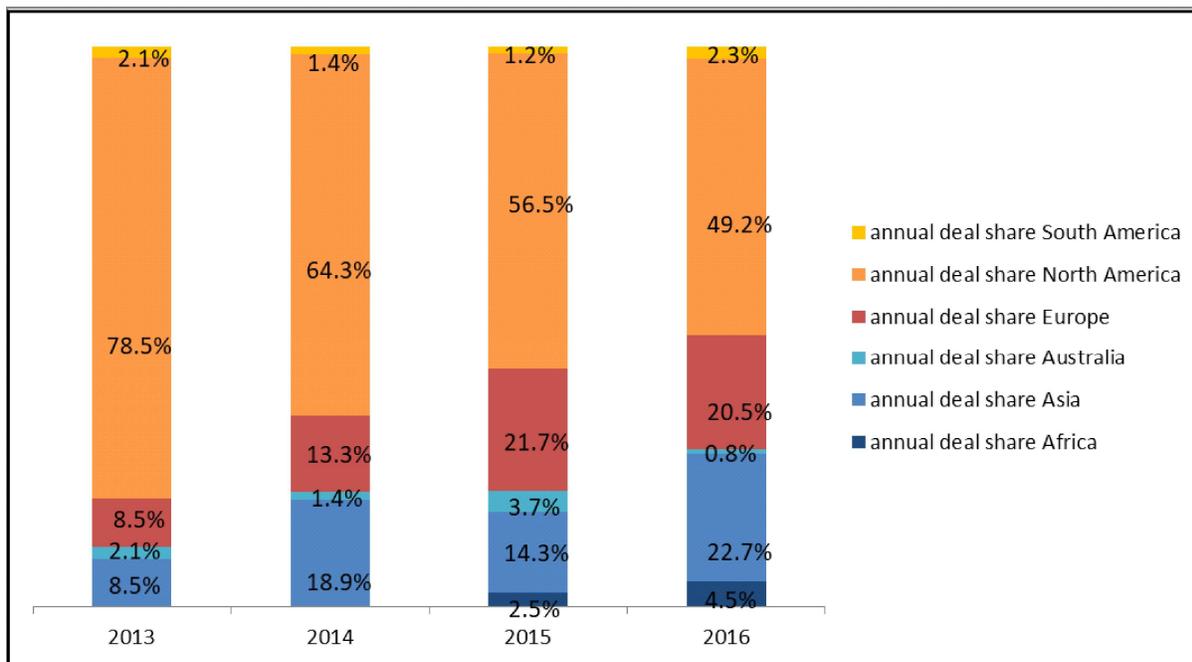


Table No. 1 & Figure No. 2: Bitcoin And Blockchain Annual Deal Share

Source: CB Insights (2016)

As per figure no. 2, Blockchain innovation landscape is dominated by USA and Europe. The United States represents 49.2 percent of Blockchain global deal share. This dominance is challenged by Asia,

according to CB Insights (2016) analysis of venture capital financing. It shows that, Asia driven by China has increased its share from 14 percent in 2015 to 23 percent in 2016. Sub-Saharan Africa with 70 percent unbanked population provides enormous potential for Blockchain applications in the field of alternative payment solutions. Asia is becoming a global leader for venture capital investment and Blockchain solution testing. China having largest banking system in the world is the dominant Bitcoin trader across the globe. IT research firm, Gartner, predicts that Blockchain will add \$176 billion in business value by 2025 and \$3.1 trillion by 2030 (Lovell, Reynolds, Granetto, Kandaswamy, 2017).

## **Conclusions and Recommendations**

Blockchain is going to bring a major transformation in the Banking Sector. It has the potential to disrupt the traditional business models and make the existing systems obsolete. A secured database of client information should be developed and shared by different banks which will help in reducing time, effort, and cost in interbank transactions. In a bid to evolve towards cashless society, this is an appropriate time for initiating suitable efforts towards digitizing the Indian rupee through Blockchain technology. Fintech and startups should closely work with government agencies and regulators to ensure that the legal and regulatory framework supports the use of Blockchain applications. Industry needs should be accessed and customised Blockchain solutions should be developed to address current inefficiencies and problems. Adoption of Blockchain has some challenges like security, privacy, and scalability which needs to be tackled to make it commercially viable. Awareness of Blockchain should be spread through various trainings, workshops, and by incorporating it in the curriculum in educational institutions.

Extensive Research and pilot projects needs to be undertaken to commercialise the Blockchain solutions at large scale. In the years to come, Blockchain will evolve as a disruptive force in transforming Indian banking sector by making banking transactions more secure, faster, transparent, and cost effective. We can strongly recommend that the current time is apt for adoption of Blockchain in India.

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