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Blockchain and Banking: An Analysis

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ABSTRACT

Blockchain is a cryptographic technology that simply substitutes the physical world's security requirements like locks, vaults and signatures in the digital world. Though it was initially introduced as a technology to underpin cryptocurrencies, it has the potential to change the face of business and finance in the coming decades.³ It is a decentralized technology where the computer networks verify, monitors and enforces the transactions without the presence of a trusted third party or a central institution.⁴ The technology consists of chains of blocks that stores information referring to a transaction and is connected which can be traced back to the pathway of a basic transaction. Due to the cryptographic nature of the technology, it becomes impossible to hack, delete or edit a transaction that is stored in blocks, as it requires the approval of all the networks collectively involved in the chain.⁵ The revolutionary nature of blockchain technology derives its authenticity from two key features used for the recording of the flow of assets: (i) Distributed Ledgers and (ii) Cryptography which will be dealt with in detail in the due course of the paper.⁶

Blockchain technology finds a clear potential in the Banking sector due to the 'decentralized trust' factor. This feature eliminates the reliance on a centralized agency to facilitate transactions and rather work with a distributed ledger technology with participants across the network that authorises and verifies the transactions.⁷ The distribution of data across the ledgers rather than centralized storage eliminates the chances of corrupted transactions and enhances legitimacy. The technology also fits for core banking functions such as payment clearing and settlements. The distributed ledger technology would also provide a tool to surmount the pain points in cross border

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³ Don Tapscott and Alex Tapscott, 'The Impact of the Blockchain Goes Beyond Financial Services' [2016] *Harvard Business Review*, <https://hbr.org/2016/05/the-impact-of-the-blockchain-goes-beyond-financial-services> accessed 14 July 2021.

⁴ Michael Crosby, 'BlockChain Technology: Beyond Bitcoin' 16.

⁵ Pierluigi Martino, 'Blockchain Technology and the Banking Industry' in Pierluigi Martino (ed), *Blockchain and Banking: How Technological Innovations Are Shaping the Banking Industry* (Springer International Publishing 2021) <https://doi.org/10.1007/978-3-030-70970-9_3> accessed 14 July 2021.

⁶ Ryan, R., & Donohue, M. (2017). Securities on Blockchain. *The Business Lawyer*, 73(1), 85-108 accessed July 14, 2021, from <https://www.jstor.org/stable/26419192>

⁷ Cheng, J., & Geva, B. (2016). Understanding Block Chain and Distributed Financial Technology: New Rails for Payments and an Analysis of Article 4A of the UCC. *Business Law Today*, 1-5. Retrieved July 14, 2021, from <https://www.jstor.org/stable/businesslawtoday.2016.03.06>

payment systems particularly high costs and indefinite delays as the network is frictionless and is equipped with global interoperability.⁸ The Indian banking sector has progressively detected the power of this technology and is in the process of explorations and adaptations.

The aim of this paper is manifold. First, shaped by the traditional banking methods, the paper attempts to highlight the benefits of blockchain technology by emphasizing on its application in the Indian banking sector. Second, given that there is no statutory basis for its application in India, the paper traces the regulatory framework for the technology in the banking sector and its contour in the Indian fiscal context. Third, the paper also explores the possibility of the emphasizing on introduction of an incumbent payment system based on a national digital currency by weighing the cost and benefits of transacting with virtual currencies. The paper also contemplates the application of an existing regulatory framework to virtual currencies. Fourth, the paper analyses the issue presented by blockchain technology. It looks into the application of more efficient modes of transactions, verifications and title transfers. It also explores more advanced aspects of the technology, an understanding of which is essential for its sensible adoption to the banking sector.

I. INTRODUCTION

Blockchain is a cryptographic technology that simply substitutes the physical world's security requirements like locks, vaults and signatures in the digital world.⁹ Though it was initially introduced as a technology to underpin cryptocurrencies, it has the potential to change the face of business and finance in the coming decades.¹⁰ It is a decentralized technology where the computer networks verify, monitor and enforce the transactions without the presence of a trusted third party or a central institution.¹¹ The technology consists of chains of blocks that store information referring to a transaction and is connected which can be traced back to the pathway of a basic transaction. Due to the cryptographic nature of the technology, it becomes impossible to hack, delete or edit a transaction that is stored in blocks, as it requires the approval of all the networks collectively involved in the chain.¹² The

⁸ Catherine Martin Christopher, 'THE BRIDGING MODEL: EXPLORING THE ROLES OF TRUST AND ENFORCEMENT IN BANKING, BITCOIN, AND THE BLOCKCHAIN' 17 42.

⁹ Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System' 9.

¹⁰ Don Tapscott and Alex Tapscott, 'The Impact of the Blockchain Goes Beyond Financial Services' [2016] *Harvard Business Review* <<https://hbr.org/2016/05/the-impact-of-the-blockchain-goes-beyond-financial-services>> accessed 14 July 2021.

¹¹ Michael Crosby, 'Blockchain Technology: Beyond Bitcoin' 16.

¹² Pierluigi Martino, 'Blockchain Technology and the Banking Industry' in Pierluigi Martino (ed), *Blockchain and Banking: How Technological Innovations Are Shaping the Banking Industry* (Springer International

revolutionary nature of blockchain technology derives its authenticity from two key features used for the recording of the flow of assets: (i) Distributed Ledgers and (ii) Cryptography which will be dealt with in detail in the due course of the paper.¹³

Blockchain technology finds a clear potential in the Banking sector due to the ‘decentralized trust’ factor. This feature eliminates the reliance on a centralized agency to facilitate transactions and rather work with a distributed ledger technology with participants across the network that authorises and verifies the transactions.¹⁴The distribution of data across the ledgers rather than centralized storage eliminates the chances of corrupted transactions and enhances legitimacy. The technology also fits for core banking functions such as payment clearing and settlements. The distributed ledger technology would also provide a tool to surmount the pain points in cross border payment systems particularly high costs and indefinite delays as the network is frictionless and is equipped with global interoperability.¹⁵The Indian banking sector has progressively detected the power of this technology and is in the process of explorations and adaptations.

The aim of this paper is manifold. *First*, shaped by the traditional banking methods, the paper attempts to highlight the benefits of blockchain technology by emphasizing on its application in the Indian banking sector. *Second*, given that there is no statutory basis for its application in India, the paper traces the regulatory framework for the technology in the banking sector and its contour in the Indian fiscal context. *Third*, the paper also explores the possibility of the emphasizing on introduction of an incumbent payment system based on a national digital currency by weighing the cost and benefits of transacting with virtual currencies. The paper also contemplates the application of an existing regulatory framework to virtual currencies. *Fourth*, the paper analyses the issue presented by blockchain technology. It looks into the application of more efficient modes of transactions, verifications and title transfers. It also explores more advanced aspects of the technology, an understanding of which is essential for its sensible adoption to the banking sector.

II. THE SCIENCE BEHIND BLOCKCHAIN TECHNOLOGY

The very first reference of blockchain technology was found in a paper distributed by an

Publishing 2021) <https://doi.org/10.1007/978-3-030-70970-9_3> accessed 14 July 2021.

¹³ Ryan, R., & Donohue, M. (2017). Securities on Blockchain. *The Business Lawyer*, 73(1), 85-108 accessed July 14, 2021, from <https://www.jstor.org/stable/26419192>

¹⁴ Cheng, J., & Geva, B. (2016). Understanding Block Chain and Distributed Financial Technology: New Rails for Payments and an Analysis of Article 4A of the UCC. *Business Law Today*, 1-5. Retrieved July 14, 2021, from <https://www.jstor.org/stable/businesslawtoday.2016.03.06>

¹⁵ Catherine Martin Christopher, ‘THE BRIDGING MODEL: EXPLORING THE ROLES OF TRUST AND ENFORCEMENT IN BANKING, BITCOIN, AND THE BLOCKCHAIN’ 17 42.

anonymous group under the pseudo name Satoshi Nakamoto in late 2008.¹⁶ The paper introduced the technology as a novel and elegant way to the creation of a decentralized digital currency, named bitcoin, which started its open software in 2009 and has been in widespread operation ever since. Despite its application in the transaction of cryptocurrencies, it has been only a few years that the financial institutions, regulators and central banks have identified the whole potential of the technology. Since then, the world is on the run to study technology and to adapt it to various sectors.¹⁷ The primary reason for the popularity of the technology is the decentralized nature, anonymity, security and the boosted performance associated with it. It was after the introduction of blockchain technology that a secure electronic transaction occurred without the intervention of a third-party intermediate for the first time in history.¹⁸ As the intermediaries maintain a centralized ledger to track and authenticate transactions, the riddling problem of double-spending prevailed for decades. The centralized ledgers are prone to destruction, manipulations and hackings and can be replaced by new and inaccurate data. Therefore, the reliance and trust on such ledgers are always in question. The introduction of technology with a public decentralized ledger ensured security in electronic transactions without double-spending.¹⁹ The Blockchain technology incorporates three primary features: (A) distributed ledger, (B) Consensus, (C) Smart contracts.

A. Distributed Ledger Technology

A blockchain is a distributed ledger where any participant in the network has access to and can maintain an instantiation.²⁰ The nodes, i.e., the computers participating in the network are in constant communication with each other to maintain synchronization.²¹ In DLT, rather than obtaining confirmation from one hierarchically structured storage device as with the centralized ledger, the consensus of all the interconnected nodes are required to authenticate a transaction. Thus, the blockchain serves as a repository of multiple data points stored in a specific order. Each block is separately encrypted that contains a timestamp and a link to the previous block which protects the data from cyber-attacks as it requires the manipulation of whole blocks of data.²²

¹⁶ *Supra* Note 1.

¹⁷ 'BPF-Blockchain-2. Pdf' <<https://www.akingump.com/a/web/41568/BPF-Blockchain-2.pdf>> accessed 14 July 2021.

¹⁸ Jonathan Katz and Yehuda Lindell, *Introduction to Modern Cryptography* (2nd edn, 2015).

¹⁹ *Supra* Note 1.

²⁰ Paul Vigna and Michael J. Casey, *The Age of Cryptocurrency: How Bitcoin and Digital money are challenging the Global Economic Order* (2015).

²¹ Albert Wenger, *Bitcoin: Clarifying the Foundational Innovation of the Blockchain*, CONTINUATIONS (Dec. 15, 2014), [<https://perma.cc/8JXA-WRGN>].

²² Paul Baran, 'On Distributed Communications: I. Introduction to Distributed Communications Networks' <https://www.rand.org/pubs/research_memoranda/RM3420.html> accessed 14 July 2021.

B. Consensus

Consensus protects the whole ledger by affirming the integrity of each transaction. Every block in the immutable chain is cryptographically signed with hashes of the previous blocks. To hack the system, an attacker has to obtain the computing power of the majority participating in the network.²³ The network is open-source with total transparency and cannot be manipulated by the government or central control.²⁴ The cryptographic nature of blockchain consensus derives its insights from gaming theory and is efficient in responding to Sybil attacks.²⁵ The trust factor is protected by techniques like proof of work, where the miners who solve the cryptographic puzzles in the hashes are rewarded and proof of stake, where the authenticators lose their existing awards in an attempt to cheat. As the whole process requires massive consumption of computing power, the chain is protected from Sybil attacks due to the higher costs for the attack and lower benefits obtained from it.²⁶

C. Smart Contracts

Smart contracts are computer protocols that are designed to secure contractual relationships that are capable of automatic execution without bearing additional costs of enforcement and monitoring.²⁷ Smart contracts leverage a secure public ledger by facilitating, verifying, executing and enforcing the terms of a commercial agreement.²⁸ They are autonomous software agents with which the ledger becomes a distributed computer. Identical computations are recorded in an identical order on every copy of the ledger followed by an algorithm of consensus. Smart contracts have received special interest in the community owing to their potential of reducing transaction costs concerning contracting and transferring titles.

The primary value propositions behind the gaining popularity of the technology are avoiding dependence on intermediaries and the creation of the universal trust. All the intermediaries work by imposing a cost in exchange for their services. This factor of the convenience fee is eliminated in the system of blockchain. The next appealing aspect of the technology is its

²³ ARVIND NARAYANAN ET AL., BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES 2 (2016), 88-90.

²⁴ Kevin Werbach, 'Trust, but Verify: Why the Blockchain Needs the Law' <<https://lawcat.berkeley.edu/record/1128548>> accessed 14 July 2021.

²⁵ Douceur J.R. (2002) The Sybil Attack. In: Druschel P., Kaashoek F., Rowstron A. (eds) Peer-to-Peer Systems. IPTPS 2002. Lecture Notes in Computer Science, vol 2429. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-45748-8_24

²⁶ DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN IS CHANGING MONEY, BUSINESS, AND THE WORLD 8-9 (2016); at 259-63.

²⁷ Tim Swanson, 'Great Chain of Numbers: A Guide to Smart Contracts, Smart Property and Trustless Asset Management' 130.

²⁸ *Id* at 11.

potential for speed and efficiency. A conventional transaction process involves several interconnected trusted parties that further add delay and complications to the reconciling of transactions. But the blockchain transaction updates the network as a whole through a synchronizing process which makes it a viable option to the banking industry.

III. THE INDIAN BANKING SCENARIO

An increase in globalization and developments in Information and Technology has employed enormous pressure on Indian banks to ensure their sustainability. From previous experiences, the banking sector has realised the necessity of a sound and efficient banking system to ensure economic stability in the country. Though the banking sector in India is a robust one and is progressive in encouraging economic growth, the increased burden of Non-Performing Assets has created unending stress for years. The industry has several weak banks that hamper the overall growth due to the misallocation of the limited available resources. Intra-industry heterogeneity exists in the banking sector due to a wide technological gap formed by the usage of non-uniform production technologies across different sub-sectors.²⁹ The Government of India and RBI are in constant efforts to bridge these gaps and increasing efficiency but still, there has been a lack of digital fluency and technological expertise in the working of Banks in India.

The primary concern of the banking industry that exists in the banking industry is the erosion of customer base as the customer satisfaction index is low for the majority of the Indian banks due to the repeated process of identity verification and transactional delays. Banking on blockchain will increase operational efficiency by simplifying the process and ensuring transparency. The communication barrier that exists today in the banking sector could be resolved by blockchain as there are multiple visibilities for the participants in the network. The friction that exists in the Indian banks could be significantly reduced as blockchain eliminates manual paper works and can facilitate cross border payment systems, digital identification and trade finances.

Blockchain technology has become increasingly popular in the Indian banking sector for the past two years. The first-ever blockchain kinked load system was formed by a consortium of India's eleven largest banks including ICICI Bank, Kotak Mahindra Bank, HDFC Bank, Yes Bank, RBL Bank, Standard Chartered Bank, South Indian Bank and Axis Bank. In 2017, SBI and twenty-six other banks collaborated to form a consortium called Bankchain to explore the

²⁹ A. Bhattacharyya, C.K. Lovell, P. Sahay, *The impact of liberalization on the productive efficiency of Indian commercial banks*, Eur J Oper Res, 98 (2) (1997), pp. 332-345.

roads for the implementation of the technology in the sector. Recently, fifteen banks including ICICI, Kotak Mahindra Bank, RBL Bank, HDFC Bank, Standard Chartered Bank, Indian Bank, Bank of Baroda, State Bank of India, IDFC First Bank, Federal Bank, South Indian Bank, Yes Bank, Indusland Bank and Axis Bank have come forward to form a company called Indian Banks Blockchain Infrastructure Pvt. Ltd to increase digitisation and automation of trade-related finance processes. The project will also work on expanding the application of technology on letters of credits, GST bills, invoices etc. Though there has been active participation by all the major working banks in India for promoting blockchain, the technology is still in its nascent stage when it comes to potential implementation in the industry. The lack of a framed policy has been hampering the technology from becoming the mainstream. The questions revolving around regulations have been slowing down the technological potential of blockchain due to the lack of an effective road map to be followed.

IV. BANKING ON BLOCKCHAIN

Blockchain creates a common platform for many countries and competitors to co-invest and work together using a decentralized database.

A. Bringing back trust

Conventional banking places its trust in a centralized intermediary to eliminate credit risks and facilitate transactions. Banking and financial intermediaries operate through a central authority, not because it is the most efficient method, but the trust and authority that they place on them.³⁰This system does not guarantee the performance of the transaction on both sides. The concept of the delivery v payment system on DLT records simultaneous changes to the ledger leaving no ambiguity and providing visibility to this change of status to both parties. The creator of blockchain technology is committed to replacing this trust factor from the central intermediaries to the autonomous, decentralized and self-driving ledger technology. A major problem that affects millions worldwide are the data dumps and hackings as the majority of the financial intermediaries store an enormous amount of assets and data by acting as a single point system that makes it prone to large scale infiltrations.³¹ The blockchain offers a solution to the problem by distributing data on each network and is under constant updates and verification that reduces the risk of losing any money or data. The

³⁰ 'Beyond Bitcoin: An Early Overview on Smart Contracts | International Journal of Law and Information Technology | Oxford Academic' <<https://academic.oup.com/ijlit/article-abstract/25/3/179/3106217?redirectedFrom=fulltext>> accessed 14 July 2021.

³¹ Elizabeth S. Ross, *Nobody Puts Blockchain In A Corner: The Disruptive Role of Blockchain Technology In The Financial Services Industry And Current Regulatory Issues*, 25 CATH. U.J.L. & TECH. 353, 360-61 (2017).

apps work on a ‘trust less trust’ by constantly checking and underlying the code of the chain. An attack on the network can only happen if a weighting to the network that holds more than 51% of the computing power occurs. Such infiltration is less likely to occur as the power and electricity required for tampering the network weighs more than the benefit derived. In a banking initiative, the consumer data and identity information could be stored in a ledger by maintaining transparency and thereby will restore the trust factor that is diminishing in the modern-day banking sector.³²

B. Applications to Banking Sector

The application of blockchain technology on cross border payment systems will help the banking sector to alleviate the pain points of inefficiency and higher costs. The key issues that prevail with the current system of cross border payment systems are the costs of transfer and their duration. The additional costs of regulatory requirements such as Basel III and the slow-moving nature of these remittances force the bank to hedge against the volatile nature and foreign risks. India is home to the world’s largest cross border remittance market would be benefitted from the technology as there is no concept of transaction size which significantly reduces the cost of transaction and helps Indian banks to save around US\$80 million annually.

Trade finance is the next potential area for the application of technology. The main complexities that exist in the sector are the massive requirement of documentations and contractual obligations which can be resolved by switching to blockchain that records documents digitally. A trade transaction through blockchain ensures transparency by making it visible to various participants in the network. Smart contracts can be enabled in such transactions to ensure compliance and securely move the securities or assets in seconds or minutes, with automatic clearing and settlement upon trade execution. The technology can bring greater transparency and efficiency to the banking sector by complying with KYC (Know Your Customer) obligations. KYC verifies personal identity by authenticating various government authorized documents such as passport, Aadhaar or driver’s license. The major disadvantage of traditional KYC systems is that each organization authenticates individuals independently and each check takes time and money. The transfer of personal credentials from the client-server to an external server additionally increases the risk from interceptions and hackers. A blockchain architecture for KYC will ensure that the collected data from various service providers are stored in a cryptographically secured database and does not

³² “Off The Chain! A Guide to Blockchain Derivatives Markets and the Implications” by Ryan Surujnath’ <<https://ir.lawnet.fordham.edu/jcfl/vol22/iss2/3/>> accessed 14 July 2021.

require third-party authentication.

C. Vendor financing, Customer Loyalty programs and Syndicate Loans

Vendor financing is the lending of money by a vendor to a business owner who uses the capital to purchase the products or services of that specific vendor. Indian banks provide structured financial services and credit facilities such as Bill discounting, letters of credit and financing against purchase and order. The process of vendor financing requires manual documentation throughout the lifecycle from raising purchase orders to submission of invoices and transport documents to banks. Due to the volume of paper works involved, the manual processing of the transaction takes a minimum of five days which affects the working capital situation due to the blockage of funds during processing. It also lacks a mechanism to track the status of real-time transactions as it is known to the participants only through mails. There is a greater potential of fraud in the process as the documentation changes multiple hands throughout the life cycle of a transaction and a tamper of the same is difficult to be tracked.

Blockchain helps the vendor financing process to go paperless by eliminating the manual steps involved in the transaction. A real-time settlement of transactions can be implemented where clients transfer their invoices to the network that is authenticated by a smart contract and followed by the funds being disbursed to the vendor within few hours. The relevant parties to the transaction can keep a real-time check on the funding process by verifying it. As there is only one source of truth in the ledger technology, the vendor financing becomes fraudproof as the transaction cannot be processed further unless all the parties agree to the authentication.

Indian banks use loyalty points as an important strategy for customer retention and satisfaction. Reward points help in increasing the stickiness of the customer base by tokenizing them with the portion of the amount spend. Banks transfer loyalty points to the customers which are redeemable at specific merchants that they have tie-ups with. However, a lack of interoperability exists in such a rewarding strategy. The loyalty points offered by the banks are merchant-specific in most cases which can't be used in any other category. If the customer doesn't want to utilize the services of a merchant offered by the bank, the reward points might get expired and the customer might not be able to avail of the benefit. Due to the lack of instant gratification, 70% of the consumers end up abandoning the points accumulated by them. The loyalty programs are also prone to threats due to the large-scale accumulation of personally identifiable information. The unused reward points also add to the

unwanted liability of banking institutions.

Blockchain can create an algorithm-generated loyalty token which can be used to execute and initiate any transaction and acts as a base for all type of rewards. The banks can accommodate multiple organizations and merchants into their blockchain network. This network facilitates convertibility and exchange of the profits through a consensus among the merchants and can solve the issue of interoperability. The multiple involvements of parties in the network eliminate the need for coordination with various participants and ensure customer satisfaction through faster redemption.

Banks offer loans by forming syndicates that work together to provide funds for large scale projects such as the development of roads, airports, factories business centres etc. The selection of members based on financial soundness and industry expertise along with the evaluation of the borrower's financial background is a time-consuming process. The appointment of agents and intermediaries for the process further increases the cost of operations. As it is a paper-intensive process, it opens doors to document duplications that lead to risks of fraud. Smart contracts can be a solution by using automatic selection criteria for syndicate formation that digitalizes agreements, contracts, terms and conditions and automates validations and checks. The immutable nature of the blockchain protects the multiple copies of the same document being held in the network which prevents document duplication. The execution of loans through smart contracts can significantly reduce the hassle of loan funding and the settlement process.

D. Can Smart contracts replace clearing houses?

The large volume of transactions that happens through Indian banks is cleared through a system developed by the National Payment Corporation of India known as National Automated Clearing Houses (NACH). It functions as an electronic clearing service that facilitates high volume interbank electronic transactions. They are mainly used for bulk and repetitive transactions such as distribution of interests, dividends, salaries, subsidies, pensions etc. Though the implementation of NACH was an incredible innovation towards progressing to a cashless economy, time-sensitive transactions through the system tend to be unsuitable. The transactions on NACH are processed in batches and the same will not take place if the threshold is not reached or completed during the banking hours. Thus, the recipient will not be in a position to know about the declined transaction if the seller lacks funds due to the delay in the processing of the batch even after the product or service is delivered. Therefore, risk from an involved party can cause substantial financial losses to the other party.

The trust less settlement process in blockchain will radically decrease the counterparty risk as the delivery of the asset is directly linked to the instantaneous payment. The technology ensures that both transfers have to happen and eliminates the need for a third-party intermediary. The cryptographically encrypted smart contracts can perform functions of matching and affirmation, generating confirmation, default management and post settling processes. Thus, with appropriate regulatory backup, blockchain has the potential to replace clearing houses in the coming years.

V. NEEDS AND GROUNDS FOR REGULATORY INTERVENTION

The major issue that exists in the adoption of blockchain on a large scale is the lack of a legal framework that covers the entire spectrum of the technology. As the banking laws and regulations differ between jurisdictions, there is an increased difficulty in applying the technology uniformly. Though blockchain technology has not faced a major security failure so far, the same cannot be guaranteed in the future. Therefore, banking industry requires a thorough analysis of privacy and data protection risks before switching in entirety to the novel technology.

A. Blockchain v Internet: An analogy

When the internet was introduced in the late 1990s, it was seen as a technology that undermined regulatory intervention through decentralization. But the governments and private organizations intervened in the regulation of online activities and hence proved their power of intermediation.³³ Today, several control points regulate internet services that range from managing the flow of services to targeting online activities.³⁴ A similar pattern is expected to be followed for blockchain due to the large scale applications of the technology that entitles the government to intervene by citing needs of extreme security and legal obligations. Though the decentralized consensus mechanism acts as a firewall preventing government intervention, an inherent conflict between the innovative scope of the technology and public policy considerations always exist.

B. Liability risks associated with the ledger technology

With the enhanced level of trust and transparency that the technology offers, there exists a predominant question on the legal risk that it poses on protecting users from data privacy and cyber risks. Due to the lack of a regulatory framework, the chances of violation of data

³³ Kevin Werbach, *The Song Remains the Same: What Cyberlaw Might Teach the Next Internet Economy*, 69 FLA. L. REV. 887 (2017).

³⁴ Jonathan Zittrain, *Internet Points of Control*, 44 B.C. L. REV. 653, 655-73 (2002)

protection are higher and deprive the participant in the network of legal protection. The immutable nature of blockchain also raises significant concern over transferring of defective titles, fraudulent transfers and illegal transactions over the network. Therefore, the banking industry has placed the technology in a grey area for its inability to rectify errors due to the lack of a legal framework. In addition, the Distributed Ledger Technology poses the following risks

(a). *Cyber risks*: The expansion of data over multiple nodes in the ledger does not guarantee complete protection as there is always a scope for cyberattacks that could target the devices determining the governance of blockchain.³⁵ The data spread over multiple nodes facilitate access to private data sets³⁶. The promised trust can thus be hampered by adopting practices like identity theft. The security of the technology that is primarily placed on the private key has the potential to divert assets through identity theft and the lack of a central ledger authority further widens the problem. The dependency of the system of proof of work to obtain the consensus to verify a transaction reduces the reliability of this technology. Thus, an attack on a node that possess the required consensus to authenticate a transaction can led to a compromise in the chain.³⁷

(b). *Operational risks*: An error in the implementation of the code can easily spread to the whole system of the network that affects the performance of the software and make it prone to attack by hackers. A governance deficiency in such cases could open the door for system hacks. The application of blockchain on banking involves large scale transactions of assets, services and data which raise the question of placing the responsibility if the ledger fails to meet the standard. Banking involves large scale usage of valuable and sensitive information and thus the shared and public feature of the ledger technology may facilitate illegal practices like insider trading, market manipulation and financial abuses in the absence of a legal safeguard.

C. Legal uncertainties of smart contracts

A smart contract works on a digitalized, distributed and decentralized blockchain network and consists of all the agreement terms that exist between a buyer and seller. The lines of code in the contract effectively implement the obligations automatically and ensure that these

³⁵ David Yermack, *Corporate Governance and Blockchains*, 21 REV. FIN. 7, 10 (2017).

³⁶ Garry Gabison, *Policy Consideration for the Blockchain Technology Public and Private Applications*, 19 SMU Scl. & TECH. L. REV. 327, 330-35 (2016).

³⁷ Dirk A Zetzsche, Ross P Buckley and Douglas W Arner, 'The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain' [2017] SSRN Electronic Journal <<https://www.ssrn.com/abstract=3018214>> accessed 14 July 2021.

transactions can be tracked and are irreversible. When the conditions for a contract are met, the obligations that are coded in the computer, self-executes and becomes enforcing. No further amendment or modification is possible once the obligations are computer coded. The basic ingredients of a smart contract are the same as that of a traditional contract which requires a valid offer, acceptance, consideration, lawful object and valid consent.

In India, smart contracts have legal enforceability under the Indian Contract Act, 1872 and the Information and Technology Act, 2000. Section 10 of the contract acts recognises all agreements to contract if they satisfy the ingredients of consent, consideration and a lawful object.³⁸ Additionally, Section 5 and 10 of the IT Act provides legal protection to digital signatures and identifies a contract enforced through electronic means to be legitimate³⁹. A conflict as to a smart contract can be taken up by courts by the virtue of Section 65B of the Indian Evidence Act, 1872 which provides for the admissibility of digital contracts⁴⁰.

However, a contradicting clause exists under Section 35 of the IT Act which states that a digital signature can be obtained only from a certifying authority designated by the government. The authentication of a smart contract is commenced through the generation of a hash key and currently, there is no legal authority that sanctions such electronic signatures. Thus, the digital records of smart contracts will have to face further complications during its admissibility in the court as it has no protections under the IT Act. Therefore, a widespread adoption of the technology in banking and associated sectors requires an amendment to the existing laws and the establishment of an intricate framework.

In banking, transactions and deals are based on a contract that defines the rights and duties of the participant. Therefore, the adoption of smart contracts in banking will be of immiscible value to the industry. However, the autonomous nature and the lack of flexibility of the technology make it impossible to rectify an error that generates a long-term inconvenience for the concerned parties. The accuracy of the credentials of a smart contract wholly relies on those who enter the information and default on their part could cause an owner to lose his title over the property. The network in the blockchain can only verify whether a transaction can occur and not look into the credibility of information input. The decentralized nature of blockchain thus raises questions regarding jurisdiction as to where the contract was formed and the application of territorial laws⁴¹.

Anonymity in smart contracts can create possible opportunities for criminal activities. The

³⁸ Indian Contract Act, 1872, s 10.

³⁹ Information Technology Act, 2000, s.5.

⁴⁰ Indian Evidence Act, 1872, s. 65(B).

⁴¹ Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305, 317 (2017).

users of a contract are identified as public keys which makes it difficult to trace back to the origin. This could make it difficult for the enforcement authorities to investigate financial crimes like money laundering, securities fraud and tax evasions. Innocent users could get harmed who will be left with no reasonable way of finding the person on the other end of the blockchain. Therefore, a legal framework for a blockchain should be capable of resolving ambiguities regarding the origin of a contract. Identity disclosure requirements have to be integrated into the technology to prevent unlawful users from circumventing the network. The traditional contract laws are not competent enough for their application on blockchain and a new smart contract doctrine have to be constructed for efficient governance.

VI. DIGITAL CURRENCY: DOES INDIA NEED ONE?

The Government of India had proposed a Cryptocurrency and regulation of official digital currency Bill early in 2021 to facilitate the introduction of a digital currency by the Reserve Bank of India and to prohibit all cryptocurrencies in the country. Digital currencies are cryptographic digital payment systems issued by the central bank of a country. The currency is programmable on a decentralized ledger technology and is leveraged by a smart contract. It reduces the risk of volatility due to regulatory intervention and acts as a potential alternative to cash. The current structure of cross border payment system could be eased by the introduction of a digital currency which would allow the central banks of two countries to form a consortium by sharing digital identity infrastructure and a shared set of data standards. Digital currencies ensure traceability of transactions and help in complying with the anti-money laundering regime. It would help the country to attain financial stability by ensuring inclusion and facilitating a resilient and secure payment structure.⁴²

In India, the number of mobile connections and banks accounts stands at 1.2 billion and 582 million respectively. The wide gap that exists between these numbers exposes the lack of financial inclusion in the country. A digital currency could help bridge the disconnect as it would only require an active internet connection and a mobile phone to facilitate payments. This would help the Reserve Bank of India to progress towards a cashless economy by controlling the cash supply on a blockchain network. A national permissioned blockchain that incorporates fingerprint-like hashes to the network would ensure trust and efficiency.⁴³

⁴² Olav Gunnarson Jevne Brokke and Nils-Erik Engen, 'Central Bank Digital Currency (CBDC): An Explorative Study on Its Impact and Implications for Monetary Policy and the Banking Sector' <<https://openaccess.nhh.no/nhh-xmlui/handle/11250/2646955>> accessed 14 July 2021.

⁴³ 'Permissioned and Permissionless Blockchains: A Comprehensive Guide' <<https://www.blockchain-council.org/blockchain/permissioned-and-permissionless-blockchains-a-comprehensive-guide/>> accessed 14 July 2021.

However, digital currencies have the potential to cause a detrimental impact on the Indian Banking Sector. Commercial banks would be under if customers start withdrawing their bank deposits to switch to digital currency savings. To cope up with such transition, banks would be under a pressure to increase interest rates and rely on overseas funding. Therefore, the regulatory framework has to be designed to mitigate adverse effects on the banking system. Before starting to experiment with digital currencies, policymakers have to study and examine the issues and after-effects of digitisation and disintermediation through a blockchain network.

VII. MULTIJURISDICTIONAL ANALYSIS OF BLOCKCHAIN LAWS

Luxembourg

In January 2021, the legal framework of Luxembourg was amended to recognise the use of blockchain technology and the issuance of dematerialised securities through a Decentralized Ledger Technology. The amended legislation had bridged the gap left by the previous legislation by permitting central account keepers and settlement organisations to resort to DLT. The blockchain Act, 2021 amended Article 1(10) of the Dematerialised Securities Act 2013 and Article 28-12 of the Banking Act 1993 to expand the definition of central account keepers to include investment firms and credit institutions to bring them under DLT operation. DLT account holders are further exempted from obtaining additional authorisation from the Central Financial Authority. It can be considered as an important innovation to the blockchain regulatory framework as it equips financial participants with additional capabilities and offers a wide range of services to its clients in the rapidly evolving FinTech market. The Act has also helped the country to strengthen its position as one of the powerful financial hubs in the European Union.

Liechtenstein

The Blockchain Act of Liechtenstein was entered into force in January 2020, providing a regulatory framework for all blockchain model business operations in the country. With the introduction of the act, Liechtenstein became the first country to have a defined framework for the regulation of the token economy. The act has opened doors to the full application potential of token economy by defining the term in the act. The act has adopted a technology-neutral perspective by not differentiating between private and public blockchain and has used the word 'trustworthy technology' instead. The act aims at strengthening legal certainty by providing a legal classification of elements on the blockchain. To ensure asynchrony between the physical world of cash and the digital world of tokens, the government has amended their

civil laws which make it a best in the class framework.

Belarus

Belarus is one of the first countries to enact a regulatory framework for the promotion of trade using digital tokens called the Digital Economy Development Ordinance. The decree was passed by the president and places its prime focus on blockchain innovations in the country. The bill has special provisions of legal and tax regimes for blockchain-based businesses and is given a tax break till 2023. As per the act, companies intending to switch their operations to blockchain have to pass an audit check by one of the four auditing organizations in the country. The progressive part of this act is that it has managed to recognize the specifics of blockchain and has not underpinned it with crypto operations. The legitimisation of smart contracts at the state level and prioritizing security and anti-money laundering provisions has made the act a role model for other countries.

Gibraltar

Gibraltar is one among the few countries to have a regulatory framework for blockchain operations that does not extend its applications to cryptocurrencies and digital wallets. The government started its experience with the private sector to identify an appropriate form of regulation that suits the economic environment. The elementary aim was to develop a flexible framework to adopt the rapid technological innovation in the FinTech sector. The enshrines nine DLT principles and the applicant has to demonstrate how his business will satisfactorily comply with each of these principles. The DLT firms are regaled by the Gibraltar Finance Service Commission.

VIII. CONCLUSION

The era of global banking and innovation powered by rapid progress in Financial Technology has just scratched the surface in determining the potential and conveniences that these new-age tools are capable of. Debate on the integration of blockchain into banking is not concentrated on the adoption of FinTech into the banking sector, but on how smarter the industry can function. The minimum intervention of regulatory bodies and automated inter organisation processes will substantially help Indian banks to achieve better performance and efficiency. Safe banking requires a major reconstruction in the sector through regulation, innovation and due diligence. There should be an encouragement for regulation to mitigate the risks of such a powerful and foundational technology. To shift the whole sector to the blockchain, technological expertise is a necessary factor. Blockchain experts have to be appointed at all levels to ease the complexity of the process. Though 'trust' is a highlighted

feature in the technology, key regulatory requirements have to be enabled to keep a check on money laundering and safeguarding the money and assets of clients. India should work towards eliminating the barriers that stand as an impediment to innovation and permit the use of blockchain to avoid the morass of paper-based records.

The banking sector could witness a revolution in the coming years as there would be a complete restructuring of the whole system of capital and securities market. The financial sector could be benefited at all levels by the careful and regulated adoption of the technology. This requires the cooperation of all participants and the resources for experimentation. The primary focus should be placed on bridging the gap that exists in rural India by creating a financial ecosystem that ensures inclusion of both the banked and unbanked population. Though the technology will be debated on its efficiency, regulation and security, the country must strengthen its economy and increase the flexibility of the banking sector. The technology has to be looked into from a future perspective to revive the Indian financial sector and reduce the impact of the Covid-19 Pandemic. Like the internet, the impact of this novel technology has the potential to reach every corner of the world.
