Applications of Blockchain Technology in Banking & Finance

Technical Report · February 2018

DOI: 10.13140/RG.2.2.35237.96489

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APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN BANKING & FINANCE

Tejal Shah 1, **Shailak Jani** 2,

Under the guidance of Dr. P K Priyan (Professor @ GHPIBM dept Management Studies)

Assistant Professor 1, Post Graduate Student 2,
Faculty of Management Studies 1, 2,
Parul University, Vadodara, India.

Abstract- A new disruptive force of digital technology is changing the business models and increasingly becoming a crucial factor around the world. Blockchain technology is generating significant interest across a wide range of industries in India. As the field of applications for Blockchain grows, industry leaders are customizing and tailoring the technology to fit multiple use cases. The Blockchain technology is responsible for developing a next step in the decentralized approach for creating applications. This paper aims at explaining the architecture of Blockchain Technology as well as how it works. Besides various features of the Blockchain, the benefits derived from it are also discussed. The use cases and Blockchain fit assessment has also been performed for few banking transactions. In the last section we also have a look at the security aspects of the Blockchain.

Index Terms- Applications of Blockchain, Blockchain, Benefits from Blockchain, Decentralized consensus, Features of Blockchain, Security Aspects of Blockchain, Smart contracts, Trusted Computing, Banking.

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1 INTRODUCTION

Blockchain, mostly known as the backbone technology behind Bitcoin, is one of the emerging technologies currently in the market attracting lot of attentions from enterprises, start-ups and media. Blockchain has the potential to transform multiple industries and make processes more democratic, secure, transparent, and efficient. With high volumes of data getting generated every day owing to digitization of records, it becomes important for every organization to effectively manage the security threats and achieve significant cost efficiencies. This is where Blockchain, with its promises of decentralized ownership, immutability and cryptographic security of data, is catching the attention of the C-suite executives. Multiple use cases are also getting explored across industries as everyone has started realising the disruptive potential of this technology. Financial players are the first movers to capitalize on this technology even though it is still in a nascent stage. A study by the World Economic Forum predicts banks and regulators around the world are poised to experiment multiple Blockchain prototypes in 2017. With 90+ central banks engaged in Blockchain discussion globally, 2500+ patents filed over the last three years and 80% of the banks predicted to initiate Blockchain and distributed ledger technology (DLT) projects by 2017, the Blockchain technology is on its course to become the new normal in the world of financial services. Many companies, from a plethora of nonfinancial services industries like telecom Cyber Security, Supply Chain Management, Forecasting, Insurance Industry, Private transport and Ride Sharing, Cloud Storage, Crowd Funding, Voting, Governance, Energy Management, Retail, Real estate are on its way to establish the potential Blockchain use cases to positively disrupt their traditional business models or already implemented their pilot Blockchain use cases.

2 LITERATURE REVIEW

No	Journal/ Conference	Title	Author	Year	Conclusion/Result
2.1	Mannheim	A Compreh	Stefan	Nove	Researchers agree that the Blockchain technology has certain features that is well applied within the financial

	University, Department of Information Systems	ensive Literature Review On The Blockchain As A Technological Enabler For Innovation	K. Johansen	mber 2017	industry, but still lacks to find the appropriate use of large scale Blockchain usage within modern society. By looking at the main concepts, we find that New innovation, Decentralization and Digital Innovation is amongst the most common concepts found in the literature. Research also points towards the technological features as becoming drivers for disruption and innovation for the technology. One of the main issues of Blockchain technology is scalability which is furthermore backed by researchers who argues that for assuring the theoretically achievable security of the Blockchain, a large number of full nodes are required. Davidson et al. furthermore argue that the Blockchain technology makes possible new forms of institutional innovation. Furthermore, by looking at the research, we find that practitioners propose many areas of which the Blockchain possibly will have a disruptive effect, for example information and communication.
2.2	New European	Application Of Blockchain Technology In Crowdfunding: A Case Study Of The Eu	Dr. Michael Gebert	March 2017	Crowdfunding is a critical utility particularly for small market enterprises as the new venture amidst a pervasive threat of employment crisis and insecurity. It is thus vital for governments to facilitate access to funds by small enterprises. Notwithstanding the favourable environment of the EU, crowdfunding has not been very successful in the region. The tenacious growth of the sector further illustrates that the practice is a necessity that entrepreneurs expect to raise the capital to operate. Traditional crowdfunding in EU has been thwarted by concerns of malpractices such as money laundering, information asymmetry, and fraud that prompts legislative restrictions on the fundraising activities. Nevertheless, the blockchain technology is a tool that provides immense hope for a revival of crowdfunding across the world. The technology is a revolutionary and disruptive innovation targeting the reduction of bureaucracy and regulation without compromising legal provisions on business conduct. The blockchain technology provides a distributed public ledger that enhances transparency such that participants can conduct affairs without concerns of imposition over the internet. Most importantly, blockchain technology eliminates information asymmetry in its entirety thus suiting every stakeholder's needs for proof of authenticity.
2.3	White Paper-Infosys	Blockchain Technology and the Financial Services Market	Dr. Eric G. Krause, Denny Nack, Dr. Vivek K. Velamuri, Moritz Sch	September, 2017	The technology could remove trusted third parties, decrease costs and ultimately increase profits for various players within the industry. Although public blockchain provide high data security and transparency, they are relatively slow if a high number of transactions needs to be processed. Private blockchains instead enable higher transaction speeds and more privacy but often come along with lower security standards. Furthermore, the technology is still in an early stage and has to prove itself in practice. The time horizon for the technology's availability for broad use in financial services is estimated to be 5-10 years. In the field of payment transactions, it could reshape the current correspondent banking processes and lead to cost savings. In trade finance, it improves the segment by providing trust, security, risk mitigation and fast processes at low costs. In over-the-counter markets, the technology has the potential to redesign the market infrastructure and lead to the elimination of obsolete market participants. Moreover, it could enable the automation of contracts and

			midt		facilitate cost savings through lean back- office processes. One major requirement and challenge while creating and redefining these new business models is to manage the transition phase from old to new processes that incorporate blockchain solutions efficiently. One way of achieving this will surely be the cooperation with regulators in order to establish the legal framework that is urgently needed.
2.4	INCITE Conference, Amity University, India	Future Applications Of Blockchain: Toward A Value-Based Society.	Dr. Gareth R.T. White, Kevin Brown	October 2016	The defining characteristic of a blockchain is that it is a trustworthy open ledger of work or transactions that are independently verified by multiple agents. Independent verification imbues the blockchain with a degree of robustness that enables its contents to be trusted. However, a blockchain could be constructed that comprised records of other forms of activity, such as instances of voluntariness or exchange and barter between individuals or groups. Such acts may be recorded within a blockchain and form an approach by which individuals accrue recognition of their acts that are beneficial to their society. Other individuals within the society would act as independent verifiers of those acts and thus provide robust and trusted confirmation of the blockchain records. Social blockchains would then act as open ledgers of people or groups that have value to society. Individuals or groups would obtain increased social value by engaging in acts that were sociably valuable. These may be acts of provision of hygiene factors such as shelter, sustenance or support.
2.5	International Conference on Exploring Services Science, Italy 2017	Blockchain Technology as an Enabler of Service Systems: A Structured Literature Review	Stefan Seebacher and Ronny Schüritz	May, 2017	Blockchain technology creates a trusted environment through its transparent nature, making information publicly available thought out its entire network, while also assuring the integrity and immutability of data. Decentralization allows for the protection of privacy, through pseudonymization, and creates a reliable and versatile setting. The identified characteristics were subsequently assessed in the context of a service system. Blockchain technology addresses many important aspects, which support the functioning of a service system, such as facilitating co-creation of value, ensuring availability of information and offering mechanisms of coordination. Therefore, the technology is expected to have an extensive impact on current and contribute to the formation of new service systems. As for further research, it would be of interest to explore blockchain technology's contribution within real world use cases. Hence, insights are to be generated by performing a large-scale empirical analysis on existing areas of application.
2.6	Consumer Finance Law Quarterly Report	Is Disruptive Blockchain Technology the Future of Financial Services?	Lawrence J. Trautman	May 2017	This article examines some of the disruptive changes that are likely to occur in financial services due to rapid technological advances. In addition, virtual currencies and the genesis of Bitcoin are examined, along with an explanation of blockchain technology, e.g., what it is and why its important. The article includes a brief mention of the regulatory challenges to the adoption of this new technology. Many policymakers are seeking to gaina better understanding of the likelihood that the use of bitcoin (or other crypto currencies) will gather momentum in their respective jurisdictions. He said that “laws and regulations could be programmed into the blockchain itself, so that they are enforced automatically. In other situations, the ledger can act as legal evidence for accessing (or storing)

					data, since it is (Computationally) tamper-proof.”
2.7	White paper- Geroget own Universi ty, Chambe r of Digital Comme rce .	Block Chain & Financial Inclusion	Prof . Ree na Agg raw al	Ma rch 20 17	A world bank report, 2014 said that around 2 billion individuals who don't have access to banking services. From which 20.6% unbanked individual are form India. In the paper, they discussed that block chain can play significant role in the financial Inclusion process. They said that FI using block chain for internal and cross border payments can lower costs, shorten settlement time, and provide better user experience. They concluded that regulators should engage, intervene at early stage and shape the innovation.
2.8	Guo and Liang Financia l Innovati on	Blockcha in applicatio n and outlook in the banking industry	Ye Guo and Che n Lian g	2 01 6	In this paper Ye Guo and Chen Liang, had presented their idea by examining Chinese Banking sector. They said that Blockchains could revolutionize the underlying technology of the payment clearing and credit information systems in banks, thus upgrading and transforming them. Blockchain applications also promote the formation of “multi-center, weakly intermediate scenarios, which will enhance the efficiency of the banking industry. It is worth noting that the problems of regulation, efficiency, and security have always sparked extensive debate in the process of each new financial innovation. However, history is not stopped by current obstacles, as the technical, regulatory, and other problems of blockchain technology will ultimately be resolved. Hence, the prospect of integrating blockchain technology into the banking industry will most likely occur in the near future.

3. WHAT IS BLOCKCHAIN

A Blockchain is a digital, immutable, distributed ledger that chronologically records transactions in near real time. The prerequisite for each subsequent transaction to be added to the ledger is the respective consensus of the network participants (called nodes), thereby creating a continuous mechanism of control regarding manipulation, errors, and data quality. It creates a digital ledger of transactions and thereby allowing to share it among a distributed network of computers and it also maintains a continuously-growing list of records called generally called "blocks" which are secured from tampering and revision. A blockchain implementation comprises of two kinds of records: blocks and transactions. In each block contains a timestamp and a link to a previous block is provided by the secure hash algorithm. The prime advantage is that it uses cryptography which allows different users to modify the transactions on a secured network each one accessing their node of data. If majority of nodes agree that the transaction performed looks valid, identifying information which matches the blockchain's history and thus a new block is added to the chain. Blockchain configurations are divided depending on the type and size of the network and then majorly by the use case of a particular company.

The two types of blockchain are public and private. Ledgers are public if:

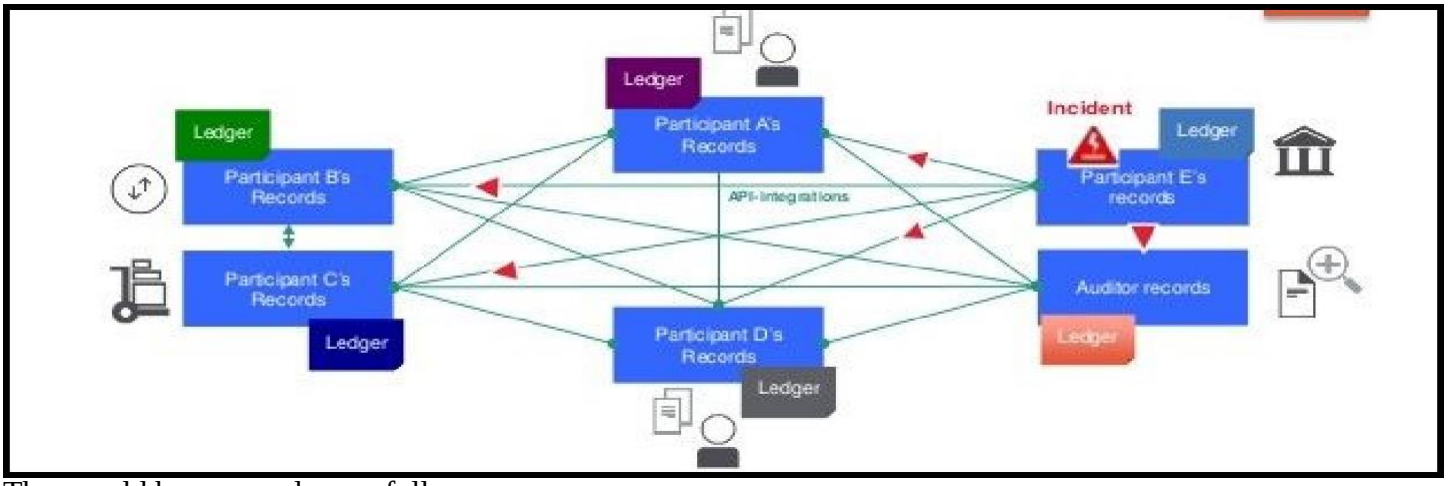
1. Anyone can write data, without permission granted by another authority.
2. Anyone can read data, without permission granted by another authority

For example, bitcoin is designed as a ‘anyone-can-write' blockchain, where participants can add to the ledger without needing approval, there is no superior authority to decide, and it imbues a defence mechanisms against attacks. As a result there is an increased cost and complexity in implementing this blockchain.

In Private Blockchain network the participants are known and trusted and there is a level of confidentiality. For example, in a conglomerate, many of the mechanisms aren't needed or they are replaced with legal binding contracts making everyone whoever has signed the contract to abide to these rules. It rapidly changes the technical decisions used to build the solution.

3.1 Need for Blockchain:

The major question that arises is to why use blockchain when already the market has flourishing plethora of other databases. What substantial importance it holds against the competing products. For this let's understand the problem with the existing systems.

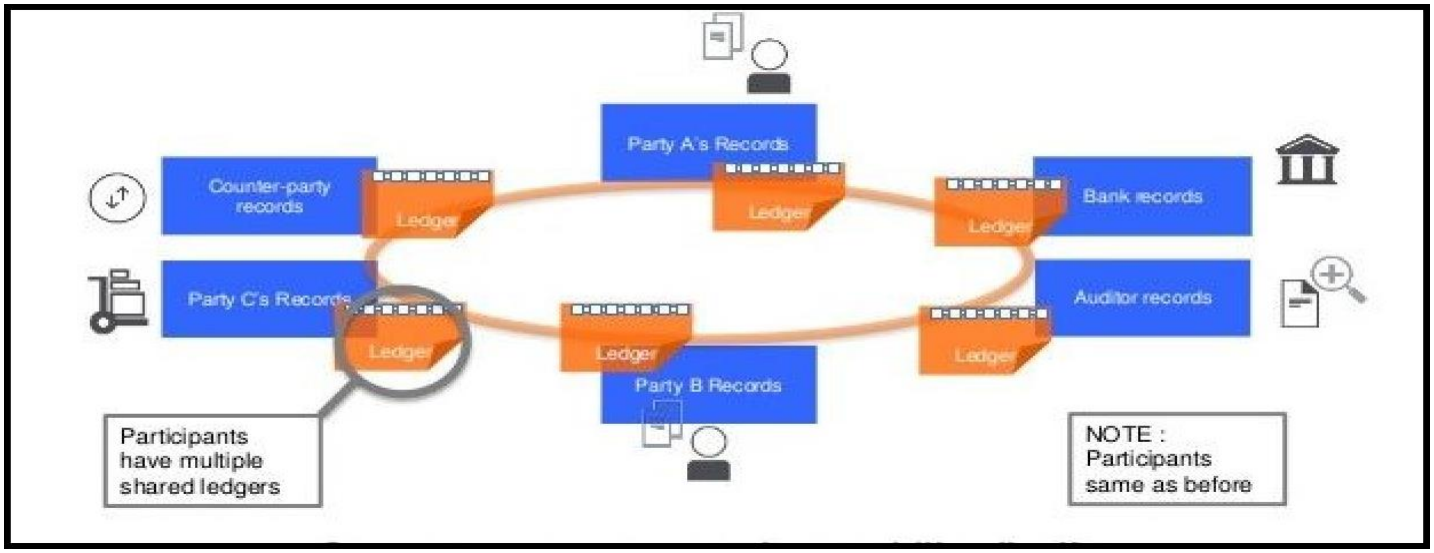


They could be summed up as follows:

(i) Difficult to monitor and evaluate asset ownership and its transfer in a trusted business network.

(ii) Inefficient, expensive, vulnerable: All these factors extremely hinder the performance and thereby destroying the progress.

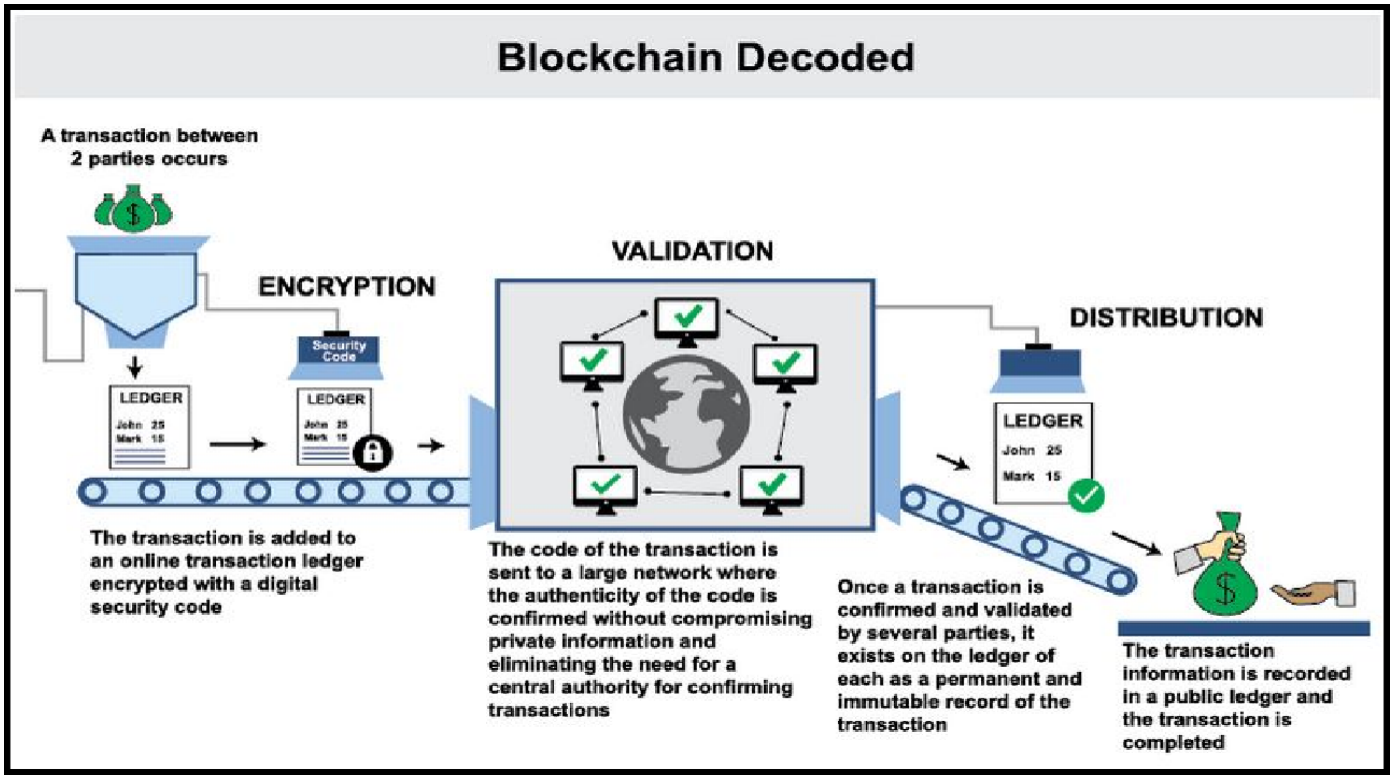
3.2 Solution offered by Blockchain:



Blockchain unlike traditional systems is dynamic enough to become a leader in implementation in a mercurial market scenario. In a blockchain the supreme advantage it ensures is that each party has a record which is maintained in a ledger available to each one. It is a ledger widely passed between different users thereby creating a shared database which is replicated to these users and who can access it only after they have the access right for it. *Consensus, provenance, immutability, finality* are the various aspects into which it works, making sure that all these facets work together into a reasonable amalgamation.

3.3 Anatomy of the Blockchain architecture

The blockchain architecture consists of a few fundamental concepts like decentralization, digital signature, mining and data integrity.



(i) *Decentralization:* Rather than one central authority overpowering others in the ecosystem, blockchain explicitly distributes control amongst all peers in the transaction chain.

(ii) *Digital signature:* Blockchain enables an exchange of transactional value using public keys by the mechanism of a unique digital sign i.e. code for decryption known to everyone on the network and private keys known only to the owner to create ownership.

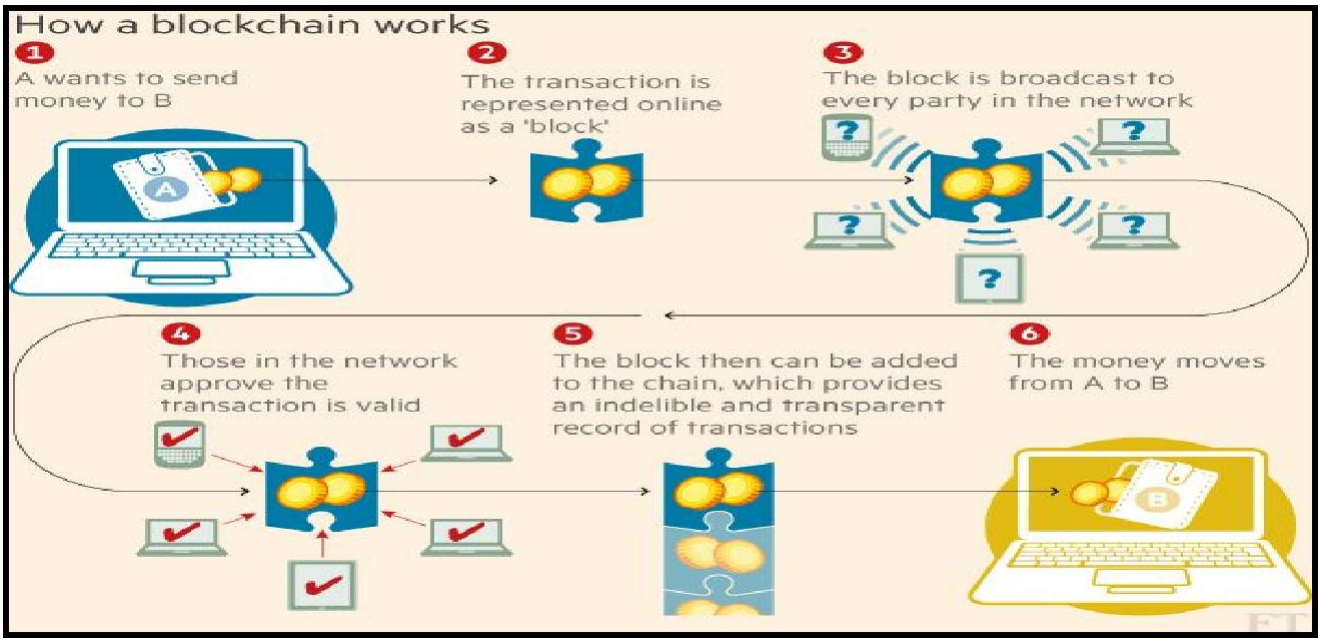
(iii) *Mining:* In a distributed system every user mines and digs deep into the data which is then evaluated according to the cryptographic rules and it also acknowledges miners for confirmation and verification of the transactions.

(iv) *Data integrity:* Complex algorithms and agreement among users ensures that transaction data, once agreed upon, cannot be tampered with and thus remains unaffected. Data stored on blockchain acts as a single version of truth for all parties involved hence reducing the risk of fraud.

4 . HOW BLOCKCHAIN WORKS

As described above the block chain is nothing but a distributed shared decentralized public ledger which is open to all. It is a data structure which is perceived to be robust and immutable. The essence of the blockchain as showcased in its most famous implementation to date is that the data is replicated. Every participant in the network has the same list of bitcoin transactions. In a blockchain we check if the ledger is verifiable by a majority of the participants in the network. In the bitcoin network, this majority of participants is replaced by important members designated as the Validators in the networks. These validator nodes checks and then pass around the payments and the block data. This is because to maintain the essence of the blockchain philosophy, the bitcoin system aim to decentralized, thus not giving control to one single authority.

The working of a blockchain be it public or private is as described below:



Let us consider 5 participants in our blockchain, A, B, C, D, E who are on a decentralized, distributed network. This blockchain example will implement the blockchain technology in the bitcoin system.

(1) A wants to send 50 bitcoins to B.

(2) This transaction of 50 bitcoins is represented online as a block.

(3)This block is then broadcasted to each and every participant in the network [C, D and E].

(4)In this example, C, D and E will serve as the validators in our network. This approve that the transaction is valid.

(5) This block containing the transaction them is added to the blockchain.

(6) The 50 bitcoins are transferred from A to B.

In Step 4, the validator, C, D and E execute cryptographic algorithms and conduct an evaluation and verification of the history of the individual blockchain under consideration. If the evaluation proves that history and the hash values are all valid, then the transaction is accepted. This is known as distributed consensus.

If C, D and E for some reason cannot validate the information in the blockchain, then the data is rejected and entry for the block is denied and it is not added into the blockchain.

Here, one must note that each block is like a page in a book. Just like a page contain two main characteristics, name a header containing book name/chapter name and page number, and the contents of the book which is the story, the block in the blockchain contains the header which is the hash value of the previous block and the content which is the bitcoin transaction itself. So the Block 2 contains the hash value of Block 1, Block 3 contains the hash value of Block 2, Similarly Block N contains the hash value of Block N-1.The first block is called the genesis block and it is different from the other blocks in the sense that it does not contain a hash value of another block and hence, produces an unspendable subsidy. The new blocks are added and linked to the older blocks of the blockchain. This chain is continuously updated so that every ledger remains the same. The presence of this hash value is what makes the blockchain robust. If say Block 3 is to be modified, then the hash values in all of its subsequent blocks (Block 4, Block 5….. Block N) is also modified, thus giving rise to a regenerated blockchain. This decentralized, transparent mechanism makes the blockchain secure, robust and free from damage. The validators and the generators add to the blockchain only if they verify that it is the latest block in the longest valid change. Another point to be noted here is that in a blockchain, the length of the blockchain is not the number of blocks but the combined difficulty of the blocks.

A blockchain is said to be valid if:

(1) All the blocks in the blockchain are valid.
(2) All the transaction contained in the blocks are valid.
(3) The blockchain starts with the genesis block.

5. BENEFITS FROM BLOCKCHAIN

Blockchain, as discussed in the above section by virtue of its design and architecture, offers some inherent benefits which the industry has been looking for quite some time now. The distributed nature of Blockchain brings in a lot of transparency in processing and thereby reduces the need for manual verification and authorisation. The key features of the Blockchain include following:

***5.1 Near real time*:** Blockchain enables the near real-time settlement of recorded transactions, removing friction, and reducing risk.

***5.2 No intermediary*:** Blockchain technology is based on cryptographic proof instead of trust, allowing any two parties to transact directly with each other without the need for a trusted third party.

***5.3 Distributed ledger*:** The peer-to-peer distributed network records a public history of transactions. The blockchain is distributed and highly available. The blockchain does not typically preserve the identities of the parties or the transaction data, only the proof of the transaction existence.

***5.4 Irreversibility & Immutability*:** The blockchain contains a certain and verifiable record of every single transaction ever made. This prevents past blocks from being altered and in turn stops double spending, fraud, abuse, and manipulation of transactions.

***5.5 Smart Contracts*:** Stored procedures executed in a Blockchain to process pre-defined business steps and execute a commercially/legally enforceable transaction without involvement of an intermediary.

6. BLOCKCHAIN FIT ASSESSMENT FRAMEWORK

Banks across the country have successfully initiated collaboration with specialized firms (Fintech) and/or consulting firms to build proof-of-concepts and explore various potential use-cases. This implies the seriousness of banks towards the Blockchain technology and its eagerness to understand how Blockchain can address and resolve few pain points in the current state process.

6.1 Major issues that banks face today

The Indian banking industry today is faced with issues such as rising costs of operations, increasing susceptibility to fraudulent attacks on centralized servers and challenges in ensuring transparency. All this, primarily because most of the banking transactions – from opening customer accounts to making global payments – may require intensive manual processing and documentation, involve costly intermediaries and is time consuming as these transactions need to be validated by various participants at various point in time causing the delay thereby resulting in almost lack of fraud proof real time solution.

6.2 What are banks looking for?

Banks are continuously exploring new ways to perform transactions quicker for an enhanced customer service, while ensuring cost efficiency in its operations and assuring transparency to customers and regulators.

For this, Blockchain potentially provides a solution for banks as it inherently helps eliminate intermediaries, maintain immutable log of transactions and also facilitates real-time execution of transactions. This could potentially reduce the TAT for banking transaction, reducing costs of manual work, and leading to enhanced customer service and satisfaction. Like any other industry, choosing the right ‘use case' is the key for Banks to leverage full value of Blockchain.

6.3 The Blockchain Fit Assessment Framework

Based on the above discussion of what are the current pain points of Banking Industry and benefits of blockchain, a Blockchain Assessment Framework is developed to evaluate whether a particular process or use-case is the right fit for a Blockchain based solution. For a process or a use-case to classify as Blockchain-fit, majority of the questions provided in the framework need to be answered in the affirmative. As we can see from the framework, each of the evaluation factors uncovers a pain point in the current state process, which could be resolved by a feature of the Blockchain solution. The resulting impact of implementing a full-fledged Blockchain solution is summarized below:

Factor	*Assessment Framework*	*Impact of Blockchain Fit*
Intermediary	• High fees for intermediary? • Latency due to processing through intermediary? • Does the intermediary exist due to lack of trust?	Blockchain's distributed ledger technology facilitates disintermediation, thereby reducing costs and lowering latency.
Transparency	• Are multiple participants involved? • Does increase in transparency into the transaction help the participants	The hash/ pointers of the records written on the Blockchain are immutable and irreversible, not allowing modifications and eliminating risk of fraud.
Information Storage	• Is the same information being stored in multiple locations? • Is data consistency an issue?	Blockchain's distributed ledger and consensus mechanism allows data consistency across multiple participants.
Manual Processing	• Does the process involve manual operations? • Is the cost of Reconciliation high?	Blockchain maintains automated audit trail of transactions, thereby reducing manual processing for data validations and reconciliations.
Trust	• Is there trust among participants? • Do multiple participants have the right to modify transactions? • Is there a risk of fraudulent transactions?	Smart contracts allow codification of business rules, validations and reconciliation, thereby reducing manual processing.
Documentation	• Is the documentation paper-based? • Is there a large number of documents / reports required to be generated?	Smart contracts allow business validations and automated reconciliation for straight through processing.
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	Blockchain enables the near real-time settlement of recorded transactions, reducing risk and providing an enhanced customer experience.

7. USE-CASES OR PROCESSES WHERE BLOCKCHAIN CAN PLAY A KEY ROLE

Presented below are some specific use cases, where we believe that Blockchain can play a key role for helping Indian banks and financial institutions realize significant benefits.

7.1 Consortium Banking

Corporations undertake multiple large projects such as development of roads, train systems, airports, factories, new business centres, etc., which requires large-scale financing. Procuring these large funds necessitate the institutions to come together to form consortium and diversify the financial risk among its members. Such participation in lending will enable a bank to limit the commitment in respect of any one party. The leader bank or members by rotation could do the work of inspection and verification of securities.

Various regulatory prescriptions regarding conduct of consortium / multiple banking / syndicate arrangements were withdrawn by Reserve Bank of India in October 1996 with a view to introducing flexibility in the credit delivery system and to facilitate smooth flow of credit. However, Central Vigilance Commission, Government of India, in the light of frauds involving consortium / multiple banking arrangements which have taken place recently, has expressed concerns on the working of Consortium Lending and Multiple Banking Arrangements in the banking system. The Commission has attributed the incidence of frauds mainly to the lack of effective sharing of information about the credit history and the conduct of the account of the borrowers among various banks.

We have examined this landscape using our assessment framework and find a near-perfect candidate for adoption of a Blockchain based solution.

Factor	*Assessment Framework*	*Consortium Banking Fit*
Intermediary	• High fees for intermediary? • Latency due to processing through intermediary? • Does the intermediary exist due to lack of trust?	**Yes –** agents & intermediaries are appointed at high fees to manage and administer the process.

Transparency	• Are multiple participants involved? • Does increase in transparency into the transaction help the participants?	**Yes** – consortium members seek transparency customer's rating, loan administering, etc. while customers seek transparency in underwriting.
Information Storage	• Is the same information being stored in multiple locations? • Is data consistency an issue?	**Yes** – customer information has to be gathered from multiple sources for underwriting. Each member also stores a copy of the customer details
Manual Processing	• Does the process involve manual operations? • Is the cost of Reconciliation high?	**Yes** – the entire lifecycle is very paper intensive with customer details, negotiated terms and conditions among members, etc
Trust	• Is there trust among participants? • Do multiple participants have the right to modify transactions? • Is there a risk of fraudulent transactions?	**Yes** – multiple participants are involved in the transactions including agents, customers, consortium members, etc. who may not be well known to each other, causing a lack of trust.
Documentation	• Is the documentation paper-based? • Is there a large number of documents / reports required to be generated?	**Yes** – There are multiple documentations required at consortium formation, as well as payment with a lot of validations for bills, items of purchase, etc. This is not due to regulatory reporting requirement.
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	**Yes** – the turnaround time can be reduced and risk lowered if payment settlements become real time.

Current Pain Points	***How Blockchain Can Help***
Time-consuming process: Selection of members based on financial soundness and industry expertise, evaluation of borrower's financial background and then negotiation of term and conditions is a tedious and time consuming process for the Lead Arranger.	**Faster syndicate formation**: Automated selection criteria for syndicate formation in programmable smart contracts.
Intermediary Fees: Agents and intermediaries have to be appointed at high fees to manage and administer the process	**Technology integration:** Automated due diligence and analysis of information for loan underwriting through Blockchain, reducing TAT.
Manual Processing: The technology systems are obsolete and processes are manual and paper intensive, taking a long time as well as increasing the cost of operations.	**Digitization of documents**: Agreements, contracts, terms and condition documents, etc. are digitized on the BlockChain and validations and checks are automated.
Duplication of effort: The lack of technology integration for due diligence and underwriting causes referencing of different applications and sources during the process. Document duplication also leads to risk of fraud.	**Document immutability:** Immutability feature of the Blockchain eliminates need for multiple copies of the same documents being held.
Delayed settlement cycles: Delayed settlement cycles for payments lock up capital and increase default risk.	**Reduced settlement periods:** Blockchain can facilitate near real-time loan funding and payment settlements with activities executed via smart contracts.

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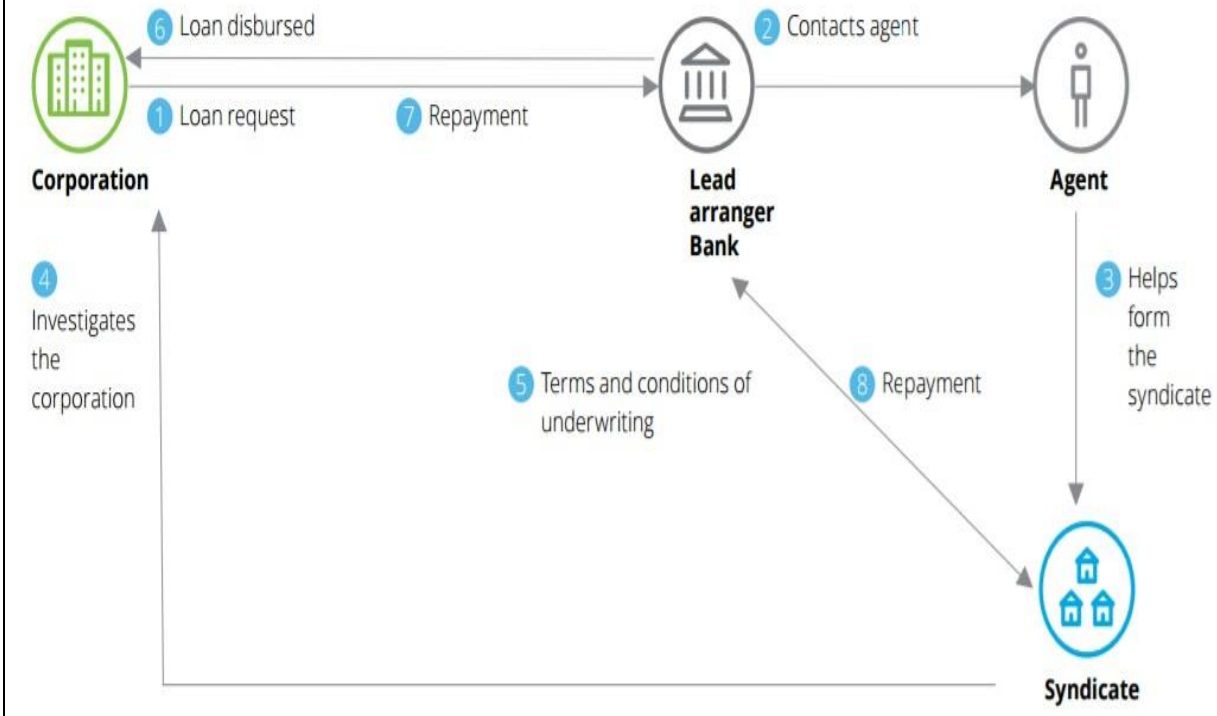
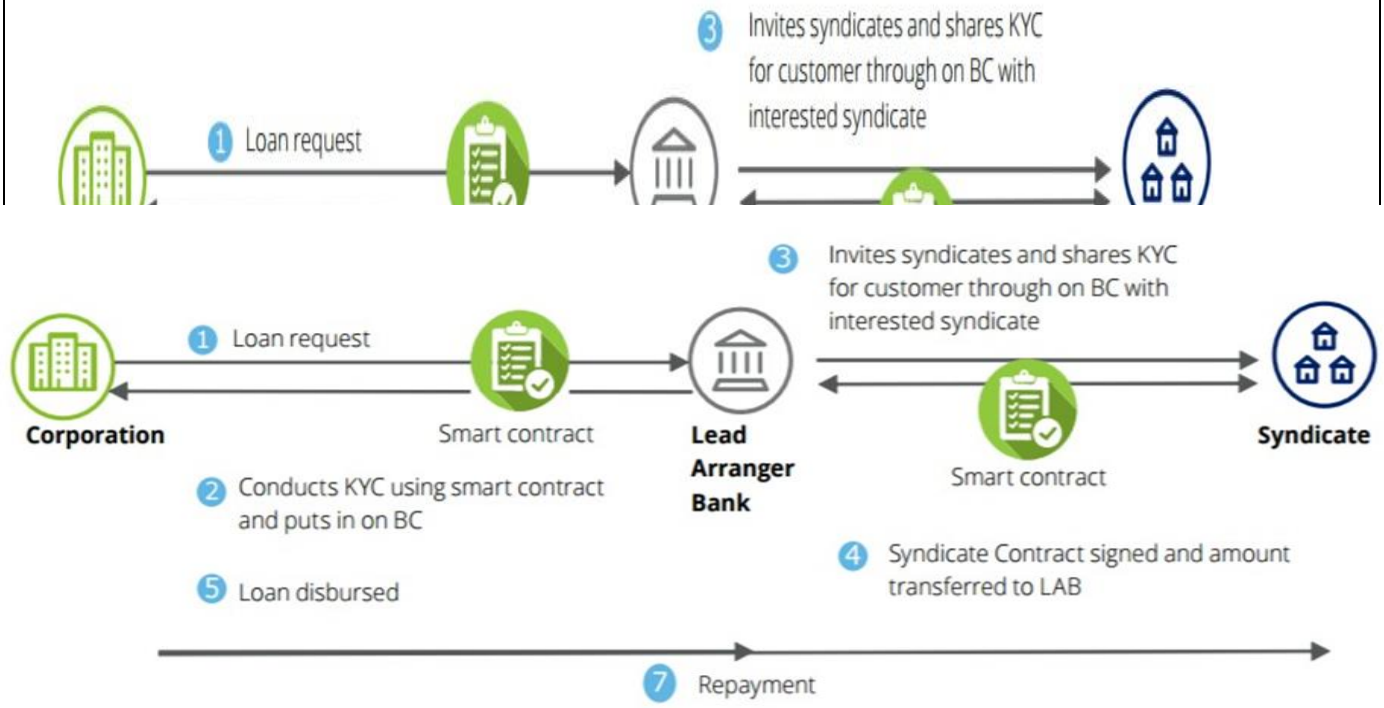

6 Loan disbursed
1 Loan request
7 Repayment
2 Contacts agent
Corporation
Lead arranger Bank
Agent
4 Investigates the corporation
5 Terms and conditions of underwriting
8 Repayment
3 Helps form the syndicate
Syndicate

TO BE


3 Invites syndicates and shares KYC for customer through on BC with interested syndicate
1 Loan request
Corporation
Smart contract
Lead Arranger Bank
Smart contract
Syndicate
2 Conducts KYC using smart contract and puts in on BC
4 Syndicate Contract signed and amount transferred to LAB
5 Loan disbursed
7 Repayment

7.2 Payments

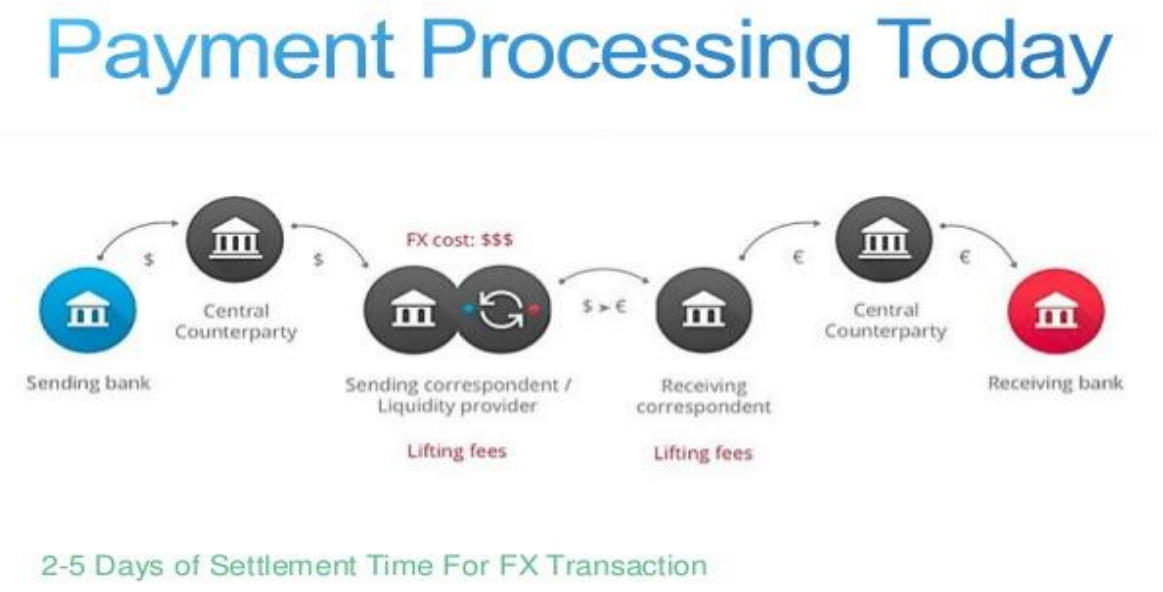
The Indian banking sector has been growing successfully, innovating and trying to adopt and implement electronic payments to enhance the banking system. Though the Indian payment systems have always been dominated by paper-based transactions, e-payments are not far behind. Ever since the introduction of e-payments in India, the banking sector has witnessed growth like never before.

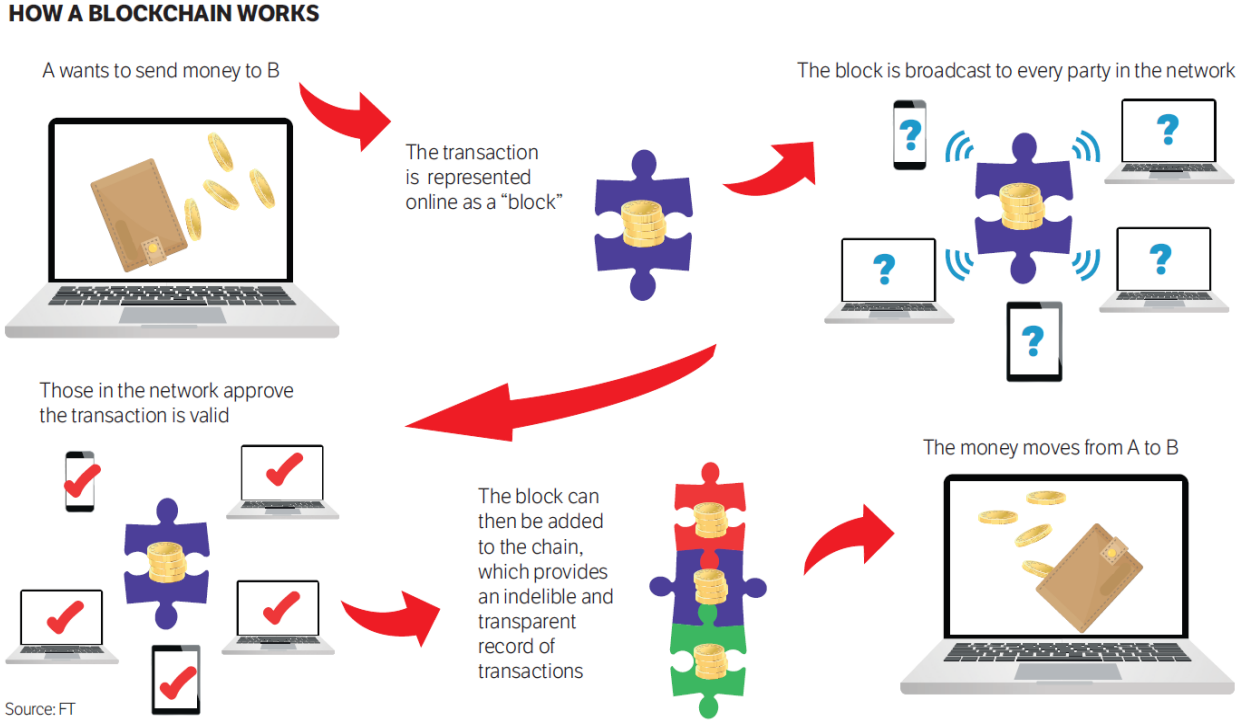
Looking at the nature of today's payment processing services, it makes it difficult to follow the movements of money. Even with current Know Your Customer rules, it can be challenging to link the name on a bank account to an identifiable person or company – though new "beneficial ownership" rules may make it easier in the U.S. In some countries, secrecy rules prevents banks from revealing financial information about their customers to foreign regulators.

We have examined this landscape using our assessment framework and find a near-perfect candidate for adoption of a Blockchain based solution.

Factor	***Assessment Framework***	***Payments Fit***
Intermediary	• High fees for intermediary? • Latency due to processing through intermediary? • Does the intermediary exist due to lack of trust?	**Yes –** intermediaries such as correspondents, counter-parties increases latency.
Transparency	• Are multiple participants involved? • Does increase in transparency into the transaction help the participants?	**Yes** – applicant, beneficiary, bank, correspondents, etc. are involved in the transaction. Higher transparency would increase trust in the system, and speed up the process.
Information Storage	• Is the same information being stored in multiple locations? • Is data consistency an issue?	**Yes** – common information is stored across the participants such as banks, correspondents, counter-parties.
Manual Processing	• Does the process involve manual operations? • Is the cost of Reconciliation high?	**Yes** – it is required throughout the lifecycle of the process. Manual processing is performed by the correspondents and banks.
Trust	• Is there trust among participants? • Do multiple participants have the right to modify transactions? • Is there a risk of fraudulent transactions?	**Yes** – multiple participants are involved in the transactions and make changes/ issue instructions. Since these may be unknown to each other, there is a lack of trust and possibility of fraudulent activities.
Documentation	• Is the documentation paper-based? • Is there a large number of documents / reports required to be generated?	**No** – Large number of documents are required to be generated.
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	**Yes** – it will help in providing enhanced customer experience, and reduce the exposure risk of banks.

Current Pain Points	*How Blockchain Can Help*
Manual documentation	**Automated documentation**
Time-consuming process	**Real time settlement of transaction**
Lack of mechanism to track throughout the process	**Real time-tracking of transaction**
Potential of fraud	**Fraud proof**



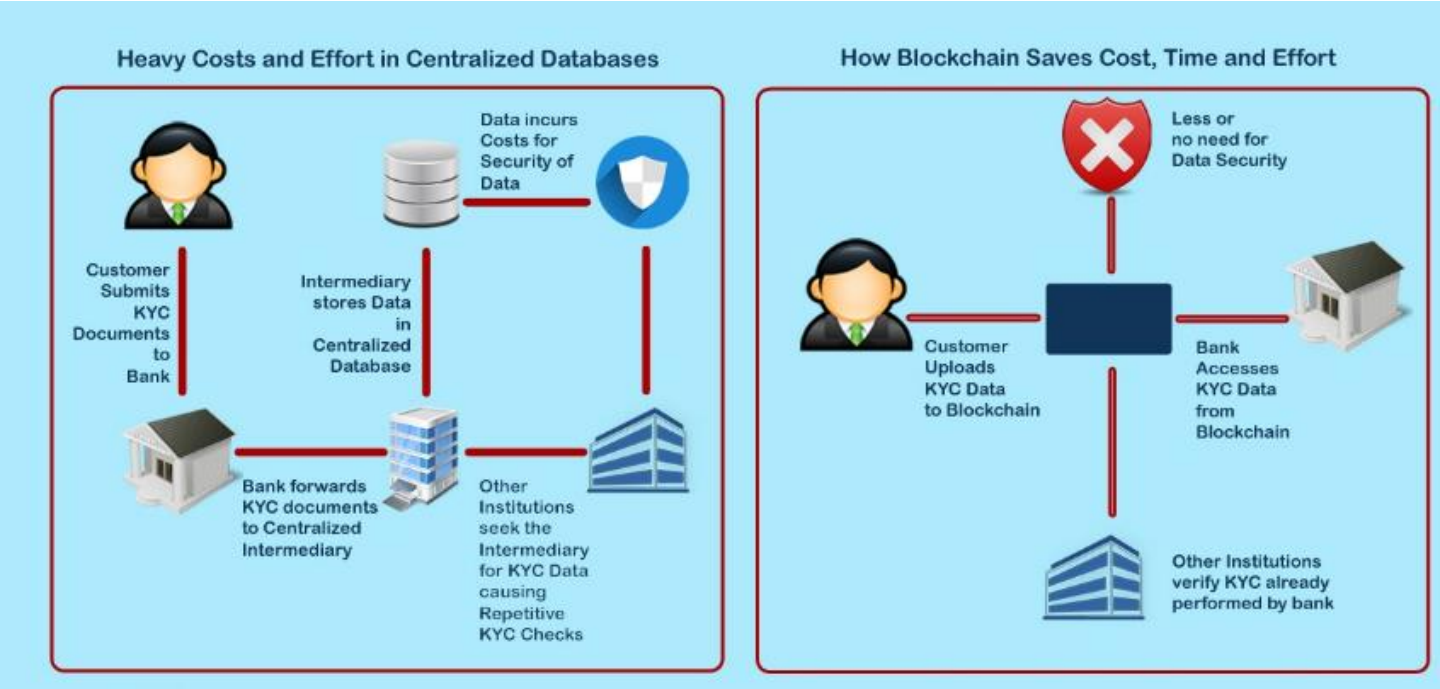


7.3 KYC

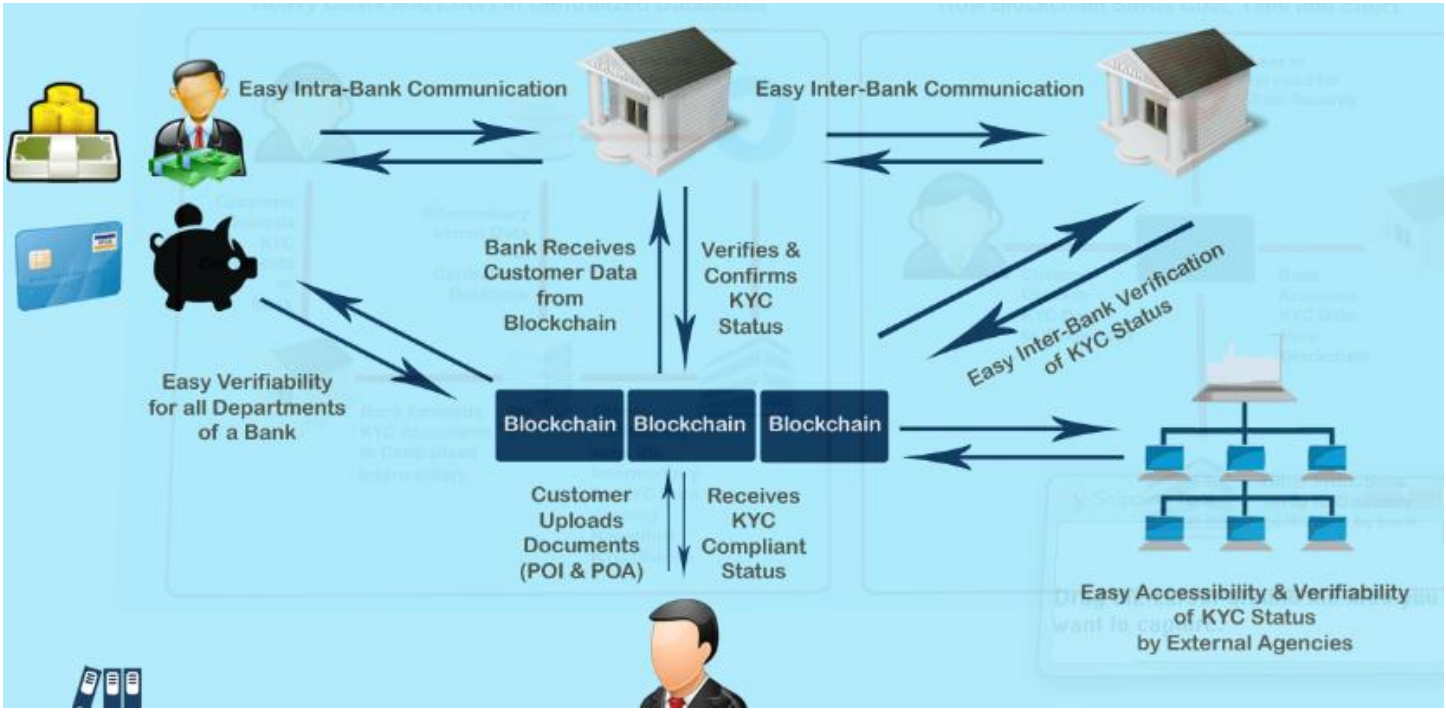
KYC processes are generally repetitive, inconsistent, and duplicated, leading to high administrative overheads and costs. Currently KYC documents are: i) Collected and stored internally, using a document management system or internal database ii) Shared with multiple external agencies for validation on an individual basis iii) Updated by banks in their internal repository upon successful validation and reported to central agencies. However, initiatives by private entities such as The Society for Worldwide Interbank Financial Telecommunication (SWIFT), banking consortiums, and government bodies have led to an upsurge in the number of KYC registries. These registries act as centralized repositories that store all documents and information related to KYC compliance, whereas the central registry stores digitized data tagged to a unique identification number for each customer. Every bank and financial institution has to perform the KYC process individually and upload the validated information and documents to the central registry. By using the unique ID, banks can access the stored data to perform due diligence whenever customers request for a new service within the same banking relationship or from another bank.

Factor	***Assessment Framework***	***Payments Fit***
Intermediary	• High fees for intermediary? • Latency due to processing through intermediary? • Does the intermediary exist due to lack of trust?	**NO –** intermediaries as such are not present.
Transparency	• Are multiple participants involved? • Does increase in transparency into the transaction help the participants?	**Yes** – applicant, company, bank, government, etc. are involved in the transaction. Higher transparency would increase trust in the system, and speed up the process.
Information Storage	• Is the same information being stored in multiple locations? • Is data consistency an issue?	**Yes** – common information is stored across the participants such as banks, companies, government.
Manual Processing	• Does the process involve manual operations? • Is the cost of Reconciliation high?	**Yes** – it is required while verifying the documents. Manual processing is performed by everyone who accepts KYC.
Trust	• Is there trust among participants? • Do multiple participants have the right to modify transactions? • Is there a risk of fraudulent transactions?	**Yes** – multiple participants are involved in the transactions and make changes/ issue instructions. Since these may be unknown to each other, there is a lack of trust and possibility of fraudulent activities.
Documentation	• Is the documentation paper-based? • Is there a large number of documents / reports required to be generated?	**Yes** – The applicant statements are all paper-based. This is not due to regulatory reporting requirements.
Time Sensitivity	• Will the transactions benefit from being real-time or synchronous?	**Yes** – it will help in providing enhanced customer experience, and reduce the exposure risk of banks.

Current Pain Points	***How Blockchain Can Help***
Data integration	**Intra-bank applications**
Expensive technology	**Inter-bank applications**
Evolving regulation	**Centralized blockchain-based KYC**
Fragmented approach	**Fraud proof**



KYC – using Blockchain Technology



8. NEW CONCERNS RELATED TO IMPLEMENTATION OF BLOCK CHAIN

8.1 Integration concern

Blockchain applications offer solutions that require significant changes or complete replacement of existing systems. In order to make the switch, financial institutions must strategize the transition.

8.2 Control, Security, and Privacy

While private or permission blockchain and strong encryption exist, there are still cyber security concerns that need to be addressed before the general public will entrust their personal data to a blockchain solution.

(i) *Ledger Level Security:* Membership to the blockchain needs to be restricted to participants who have been subject to required scrutiny. Typically, members will be institutions who have real world legal credentials and are unlikely to disengage (as opposed to retail users who can withdraw from participation).

(ii) *Network Level Security:* Blockchain systems typically consist of multiple subcomponents in addition to the blockchain software – these may include conventional "shadow" databases, messaging, and other services. It is recommended that communication between components of different nodes is made secure from a networking stand point. The network must be resistant to many different attack vectors, both external and internal to the network.

(iii) *Transaction Level Security:* Transaction level security is critical for financial institutions. Transaction accuracy and immutability is what drives the firm's books and records. Relevant details of transactions must be encrypted using PKI concepts so that transaction details are not compromised to unintended parties.

(iv) *Contract Security:* Smart contracts (also called self-executing contracts, blockchain contracts, or digital contracts) are simply computer programs that act as agreements where the terms of the agreement can be pre-programmed with the ability to self-execute and self-enforce. Smart contracts are written using programming languages such as C++, JavaScript, Java, Go, Python, etc. As with any computer program, there is a possibility that the creator of the contract program intentionally or otherwise creates a flawed program which can introduce vulnerabilities for the assets controlled by the contract

8.3 Uncertain regulatory status

If the government regulation status remains unsettled, blockchain will face a hurdle in widespread adoption by financial institutions

8.4 Nascent/ Experimental Stage

While most of the banks have started experimenting or developing proofs-of- concept around blockchain, there it ill are not any major breakthroughs in blockchain applications in the real sense.

8.5 Cultural adoption

Blockchain represents a complete shift to a decentralized network which requires the buy-in of its users and operators.

8.6 Initial Cost

Blockchain offers tremendous savings in transaction costs and time but the high initial capital costs could be a deterrent, which is a major concern for banks.

9. CONCLUSION

Although the potential of Blockchain is widely claimed to be at par with early commercial Internet, banking firms needs to understand the key features of the technology and how it can solve the current business issues as on one hand, internet enabled exchange of data while on other, the Blockchain can involve exchange of value. Banks need to identify opportunities, determine feasibility and impact, and test proof of concepts.

However, the questions around regulations will have to be resolved through focused discussions with competent regulatory authorities and incorporation of their thought-process. . They concluded that regulators should engage, intervene at early stage and shape the innovation. This will allow them to understand the technology, assess the risk, and enable the tailor made solutions to their specific obstacles.

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