

Block Chain Technology and Its Applications for Financial Inclusion

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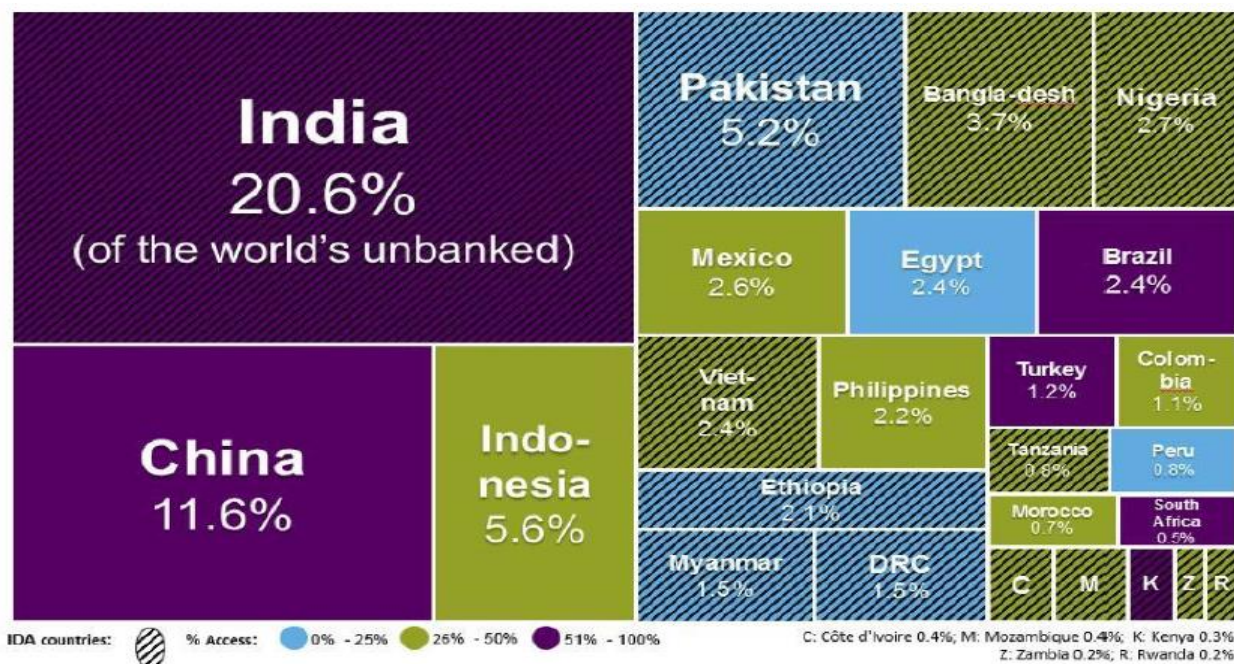
Abstract:-Blockchain and its underlying Distributed Ledger Technology is considered as the biggest innovation since the internet and is identified to have the potential to transform the banking and financial services. This paper provides a primer on blockchain technology and discusses the technology’s potential to accelerate financial inclusion in India. The main objective of this paper is to review the existing literature on the narratives on block chain in banking and financial services industry around the world and to identify its potential applications to accelerate financial inclusion in India.

Keywords:-Block Chain, Financial Inclusion, Mobile Banking, Distributed Ledger Technologies.

I. INTRODUCTION

In 2014, Global Findex report by World Bank estimated that about 3.5 billion people in the world are unbanked or underbanked. The World Bank identified this issue as one their priorities through the ‘Universal Financial Access (UFA) by 2020’ Initiative and India tops the list of 25 countries that are identified as a priority of the UFA. Below

graph (Figure1) shows the proportion of unbanked in the identified 25 countries. This shows that India is the second largest financially excluded country in the world with more than half of its population considered as unbanked or underbanked. At the same time, India is one of the fastest growing markets for mobile phones. According to TRAI’s monthly Indian Telecom subscription report in Feb 2017, total mobile subscriber base has reached 1100million. Thus for countries like India where more than half of the proportion of households are financially underserved, the banking brick and mortar network is not a feasible solution and leveraging technology and innovative products and services are the best solution. Government of India has recognised this opportunity as early as 2008 and has formulated a number of initiatives to target mobile banking services, yet the adoption of mobile banking is slow. This paper attempts to identify the limitations of the current programs and discusses if blockchain may help closing the gaps theoretically, by analysing the existing narratives of applications of blockchain implemented to accelerate financial inclusion around the world especially in countries Kenya and Philippines.



Source: World Bank Group

Fig. 1: Proportion of Unbanked Population Around the World

II. LITERATURE REVIEW

A. Overview of Distributed Ledger and Block Chain Technology

UK government Chief Scientific Adviser on a report “Distributed Ledger Technology: Beyond block chain”(2016) defines Distributed ledger Technology as an asset database that can be shared across a network of multiple sites, geographies or institutions. The report explains that all the participants within a trusted network have their own identical copy of the ledger. Any changes to the ledger are reflected in all copies in minutes, or in some cases, seconds. The assets which can be financial, legal or electronic stored in the ledger are secured cryptographically through the use of ‘keys’ and signatures to control who can do what within the shared ledger.

The main ideas of the Distributed Ledger technology are that a) the entries cannot be reversed or otherwise modified) these have the ability to grant granular permissions c) automated data synchronization d) privacy e)security and f) transparency so that it cannot be tampered. Its main disruptive attribute is that it is decentralized and therefore not dependent on a central controller or on someone who stores the data.

B. How A Block chain Works

ITU-T Focus Group Digital Financial Services on their report “Distributed Ledger Technologies and Financial Inclusion” (2017) explain how a block chain operates in detail as below:

A block chain is stored in fixed structures called ‘blocks,’ which consist of a header and the block chains content. The block header includes metadata, such as a unique block reference number, the time the block was created, and a link to the previous block. The block data ie the content of a block is usually a checked list of assets and instructions, such as transactions made, their amounts, and to whom they were made. The blocks are appended and stored one after the other in a continuous manner, but they can only be appended when the participant’s nodes in a distributed network reach a consensus. The transactions are verified independently by the nodes on the block chain and a consensus is reached. As shown in Figure 2, the chain is only appended, never allowed to be and hence DLTs are tamper evident.

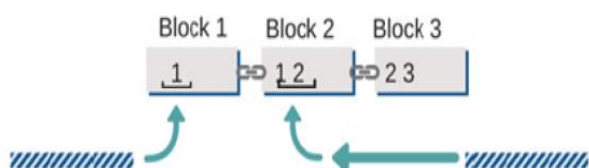


Figure 2: Source: ‘Distributed Ledger Technologies and Financial Inclusion’ –ITU - T Focus Group on Digital Financial Services

Mc Lean, S and Deane-Johns S on his paper “Demystifying Block chain and Distributed Ledger Technology – Hype or Hero?” (2016), explains that individual blocks are tied together by the timestamp. Each record is time stamped and provided with a unique cryptographic signature, thus ensuring the genuineness and integrity of the ledger.

Using the latest block, one can access all the previous blocks linked to it in the chain. Hence, a block chain database retains the complete history of all the assets and the transactions executed pertaining to the assets since the very first one.

This makes the data in a blockchain verifiable and auditable in the network

C. Key Constructs of Blockchain

Pani Baruri in is paper “Blockchain powered Financial Inclusion”(2016) explains the key constructs of Blockchain as below:

- *Distributed shared Ledger:*
A sequential record of transactions in a distributed ledger shared across a trusted business network.
- *Smart Contracts:*
Business logic can be embedded in the ledger and these can be triggered when certain conditions are met.
- *Network Consensus:*
All participants must agree to a network verified transaction by consensus. Only then the block can be appended.
- *Security:*
Cryptography is a central feature which maintains the authenticity and integrity of a block chain. The transactions in a block chain are secure, authenticated and verifiable.

D. Block Chain’s potential for FI:

One of the major challenges faced in India for adoption of mobile banking is the cost of remittances. The case of EKO which was successful in India for mobile banking adoption revealed that population that started using EKO for mobile banking discontinued the usage once remittances were charged a transaction fee. This clearly indicates that mobile banking adoption in India will be increased if the cost of transactions were nil to low.Pani Baruri in his paper “Blockchain powered Financial Inclusion”(2016) explains that block chain has the potential to reduce costs both in demand side and in supply side which would lead to overall cost reduction.

E. Cost Reduction- Demand Side

Pani Baruri describes in detail that storing transactions in one automatically shared, tamper-proof database could eliminate the need for complicated procedures and clearing

houses now used to make sure banks have their records in sync, saving time and money and reducing the risk of error. He mentions that without middlemen, payments and settlement can happen rapidly without any time delay so that people can access when they need it and also Iso costs would be reduced exponentially because a distributed ledger could support large amounts of small transactions (micro transactions).

F. Cost reduction- Supplyside

Article published in Sammantics website, “Blockchain and Financial Inclusion: From the Last Mile to the Last Meter” explains on how block chain will help cost reduction from supply side. It is mentioned that distributed ledgers support "smart transactions"ie. with smart contracts, transactions that include multiple assets, transactions that include multiple parties and transactions can be executed. The article explains that this will cause an explosion in tradable assets globally and allow the unbanked not only bank accounts but access to global capital markets by allowing for all types of value transfers and that it also allows for better property records in emerging markets, where these are essentially non-existent right now. The article points out that dispute settlement on all types of assets through contracts and legal services increasingly tied to code can be linked by a blockchain and hence trade will go up exponentially locally and over distances because of unbreakable escrow or programmatically designed smart contracts.

G. Success Stories of Blockchain Applications Around the World

a). Regalii

Regalii is a mobile bill pay platform that applies blockchain and facilitates bill payment anywhere in the world. This application enables payments for utilities and services like electricity, water, gas, mobile, health insurance in 10 countries. Regalii partners with the same Financial Institutions that remittance senders already know, trust and use. The Regalii platform tracks all the finances of a family member remotely and summarizes these financial matters into a SMS. Each week Regalii sender and recipient receive the SMS summarizing their family’s financial situation, ie, the bills that are due, how much is due, and when these are due. Also, they can choose to pay them with one simple click.

Whitepaper “Block chain and financial inclusion: The role blockchain technology can play in accelerating financial inclusion”(2017) published by Georgetown university, McDonough School of Business evaluates Coins.ph, Bitpesa and Unocoins elaborately on how they help in accelerating financial inclusion, as below:

b). Coins.ph

Launched in 2014 in the Philippines, Coins.ph is a mobile platform that uses blockchain to allow individuals to gain

access to financial services through their mobile phone. Coins.ph was established with the intent to serve the unbanked or underbanked. With an estimated half a million users, it is ranked one of the world’s best and well-versed applications of bitcoin and blockchain. The first product offered was for remittances as this was the first need identified by Coins.ph. Today, it is their largest service by volume and now Coins.ph is one of the most used financial apps in the Philippines, and it is the only non-bank in the top five list.

Philippines had the same problems as India, ie. More than half of the population didn’t have access to bank accounts. Even if they had, it was dormant or inactive. Banks could not reach the remainder of the population by traditional banking methods because the costs are higher than the revenues from them. Thus the unbanked resorts to costlier options to transfer money to conduct daily transactions. The Philippines ranked third as the largest recipient of remittances in 2015, receiving about USD\$30 billion a year and hence there is a huge need for cross border payments as well.

Coins.ph identified this opportunity to reach more Filipinos amid the growing penetration rate of smart phones provides an affordable bitcoin mobile wallet, allowing Filipinos who work abroad to send remittances more conveniently.

c). BitPesa

BitPesa is a pan-African platform that redefines how businesses make payments to and from Sub-Saharan Africa. The company initially focused on remittances, but focussed to payments and B2B Foreign Exchange (FX) services. The service facilitates business payments and trade between Africa and the rest of the world. It also allows people who bank with small local banks to send money to a local bank in Kenya, Nigeria, Tanzania, and Uganda without having to go through correspondent banks. This includes payments from popular mobile money services as well as delivery to a national or international bank account on the same day. BitPesa offers financial payment services with faster settlement times ie one day which took 9 days in the traditional system and at much lower cost than traditional banks. BitPesa’s fast settlement times allow the company to provide certainty on exchange rates. Clients need to have an existing bank account, mobile money service, or digital currency account. They then get a quote to transfer funds from their origin currency to their destination currency via the BitPesa platform. BitPesa receives funds in the origin currency and pays out in the destination currency.

d). Humaniq

Humaniq is a blockchain banking app building the next generation model for financial services. Launched in 2016, Humaniq aims to provide mobile finance to the 2 billion unbanked population through its mobile app that uses biometric authentication to replace traditional methods of ID and security. Humaniq has launched a new financial

inclusion app that opens up access to verified identities and cryptocurrency to all those shut out of the digital economy's opportunities.

The Humaniq 'Lite' version is aimed at the unbanked, people who are illiterates and this will be the focus of a pilot programme getting underway in Ghana, West Africa.

Lee Baer on Humaniq Blog describes that Bio-identification gives the undocumented an identity necessary to accessing financial services, an identity that one billion people in the world lack. It involves taking two photographs of a user and these should match and in order to eliminate fraud, the second one should show a particular emotion of the user. This is in order to prevent anybody using two matching photographs not of themselves. In addition, a further security measure is the validation of the user's phone number with an SMS.

He also explains that the wallet system in the app makes it possible to send and receive cryptocurrency. A user can review their balance in HMQ and the equivalent amount in local currency, determined by their location. The app shows a user's entire transaction history with complete details: the status of the transaction, the amount and the local currency equivalent. The app allows users to send and request funds either by selecting users from the contact book, scanning a QR code. It can even be done by entering a phone number for users who are not using Humaniq and these people will receive an SMS with a weblink where they can collect/send their payment.

Humaniq App Lite will be liberating people without access to documentation and banking. It also provides an open source full-stack and API that will be available for startups to build services on top of the core Humaniq technology. This makes it easy for Fintech partners to plug into the Humaniq network as well.

e). *BanQu*

Elena Mesropyan on her article "How the First-Ever Blockchain Platform Aims to Connect the World's Poor to the Global Economy" 2016 explains the functionalities of the app BanQu and how it helps to connect the poor to global economy.

The article explains that the BanQu network uses a proprietary method to create a mash-up of a 'selfie' and other key characteristics for people with no access to technology or banking and that this Economic Identity can be augmented by critical pieces of information such as land rights, voter registration, relationship based credit profiles and health records, etc.

The article discusses the uses cases focused on solutions in following areas a) Lifting status of refugees b) Destroying extreme poverty c) Empowering women (currently, ~50% of women globally are financially excluded) d) Food/medical/payroll distribution in conflict zones e) Increasing revenue streams for social enterprises via

diaspora capital participation and compliance-based remittance

The wide mobile phone adoption in African countries allows BanQu to create a personal digital profile consisting of various records of personal, financial and other activities. That profile is recognized and accepted by financial institutions as a legitimate identification information thus allowing people to access formal financial services.

BanQu embeds meaningful events in one's life into blockchain to empower the person and provides access to data that would allow that person to use this history as an identification information.

All pieces of information can be stored in the cloud and can further be used as a proof of identity. The idea and the solution BanQu was able to build is a life raft for refugees who are lost and excluded from legal and financial systems.

Ripple is a mobile application which uses blockchain to send money anywhere in the world in any currency instantly. Users simply need to load money to an active Ripple wallet through a payment gateway.

WorldRemit is a mobile application that provides an online service that lets people send money to friends and family in other countries, using a computer, smartphone or tablet

H. *Digital Identity*

Bryant Nielson on his article "Digital Identification on Blockchain" (2017), describes that the demands for authentication and identification are getting much elevated than even before and since blockchain has gained immense recognition worldwide, especially for making the financial transactions safer, the digital identification is the area where this technology seems to bring some great and advanced solutions.

He explains that each time a customer goes to the new bank for the services, he or she is KYC-vetted, even though one bank has verified them already, as a customer. This issue is multiplied at big banking institutions where the customer must be verified for KYC compliance again and again in various departments. He suggests that if the group of banks shares KYC blockchain, the institutions can cut their costs on KYC collection software. With the shared ledger system developed on the public key cryptography, banks can authenticate customer, and the certificates linked to that key, can authorize him or her for different functions

Estonia, a small country in the EU zone, has been operating universal national digital identity scheme using blockchain and has managed inclusion through the Estonia ID card and mobile ID for Estonian citizens. The Estonia ID card is a cryptographically secure digital identity card that allows the

people to access public services, financial services, medical and emergency services as well as to pay taxes online, e-vote, provide digital signatures, and travel within the EU without a passport.

III. ANALYSIS AND DISCUSSION OF LITERATURE

From the literature review done, a few of the potential applications of the blockchain narrowed down are:

A. Remittances

White paper “Blockchain and Financial Inclusion: The role blockchain technology can play in accelerating financial inclusion” published by McDonough School of business, Georgetown University explains in detail how Coins.ph and BitPesa use blockchain as below:

B. How Coins.PH Uses Blockchain

The whitepaper explains that Coins.ph used blockchain in a manner as how Skype or Whatsapp facilitates direct communication and that they are more responsive in their services and provide more efficient and affordable pricing due to the lack of dependence on banks. Unlike Telco mobile money networks, blockchain is an open network and hence funds can be sent to any country and be converted into almost any currency. Blockchain helps Coins.ph facilitate remittances from any country, as long as the sender is able to purchase digital currency. Opening a Coins.ph account is easier than opening a bank account. Users can just provide their phone number. And there are no minimum cash requirements or monthly fees. Also, when serving low-risk individuals, they can take advantage of reduced due diligence for those individuals. For example, for KYC purposes, users can take a “selfie” on their mobile holding a government I.D. and use it.

Blockchain provides advantages by reducing fixed costs that banks incur and removing the minimum capital requirements that banks need to comply with. Thus, Coins.ph avoids having to charge high fees and can charge a lower percentage than a usual remittance by banks. For example, people usually pay a fee of 7.5 percent per transaction, while Coins.ph users pay a fee of 1 to 3 percent. When a user transfers money within the app, there are no processing fees. A charge is deducted when users make a cash withdrawal within the established partnership. Furthermore, blockchain alleviates counterparty risk since transactions are settled instantaneously as there are no intermediaries. Since they use digital currency as their medium to conduct transactions, they cumulate demand to get the best forex rate and do not have to maintain multiple currency pairings. Users are not exposed to bitcoin price fluctuations since they convert or hold the funds in Philippine Pesos or any other currency instantaneously. This is important since the unbanked are risk averse and would not want to subject to bitcoin

fluctuations. They will receive the exact amount of local currency they hold.

The white paper explains that when Filipinos work abroad and send money to the Philippines, they lose an average of 7.5 percent of the remitted value to fees. This is roughly equivalent to losing one month of wages for every year they work. Thus, charging a fraction of the cost means a savings of up to 80 percent i.e., an amount returned to families to potentially improve their lives and the country.

C. How Bit Pesa Uses Blockchain

The Whitepaper explains that BitPesa uses blockchain for money transfer. It is mentioned that they receive funds in the original currency and transfer it to digital currency which is then transferred via the blockchain in almost real time to a digital wallet in the destination country. That digital currency can then be converted into local currency and paid out. Blockchain simplifies the money transfer process by reducing the number of intermediaries from five to three and the settlement time from approximately two to seven days to near real time. The transfer in and out of the digital currency happens in almost real time and hence reduces the risk of changes in the digital currency and keeps transfer amounts consistent from the origin to its destination thus helping in financial inclusion.

In the whitepaper a Study by Jack and Suri (2014) is quoted which examines the effects of mobile money's lower transaction costs and it explains that by lowering transaction costs, households were better able to manage risk and withstand economic shocks. In a 2016 study, researchers found that mobile money enabled women to move out of agriculture and into business. Lowering transaction costs encourages employment and could increase the disposable income of locals employed by foreign institutions. This also allows them to receive payments for services performed remotely.

The whitepaper points out that a large percentage of the payments BitPesa processes from the U.S. and Europe to Sub-Saharan Africa are to foreign social workers. The reduced cost will allow for increased funds to be spent on further development of these agencies and their work.

D. Digital and Economic Identity

The unbanked especially people in rural areas do not have access to traditional financial services because they lack verifiable ID or any identification at all. Michael Mainelli in an article “Blockchain will help us prove our identities in a digital world” in Harvard Business Review mentions that by using blockchain, individuals can receive a digital identity verified with biometrics which is securely stored and managed for transacting value nationally and internationally.

Pani Baruri in his paper “Blockchain Powered Financial Inclusion” describes that blockchain provides digital identity

to individuals with enhanced privacy, so that identity is restricted to devices as well as other individuals with access.

Kate in her article “Blockchain and Financial Inclusion for Citizens in Poverty” (2016) explains that Digital identities could be confirmed through distributed ledgers running on securely-encoded devices – or even through software on a mobile device – which would allow end-users to receive benefits directly, at reduced transaction costs to banks or local authorities. As a result, the citizens in poverty will become fully included in the financial system through point that is more reliable than a bank account.

By creating a digital identity using blockchain technology, citizens lacking proper access to the financial system would gain a higher independence and better chances for welfare. Credits.vision, OneName, ShoCard, BitNation are a few of the successful companies allowing to create a blockchain-powered digital identity.

E. Property Registers

Frederick Reese in article “Land registry: A big Blockchain case explored” explains how block chain can be used in land registry system. He explains that to understand the potential of a blockchain land registry system, one must first understand how property changes hands. In India, when a purchaser seeks to buy property today, he or she must find and secure the title and have the lawful owner sign it over.

He explains that for a large number of residential mortgage holders, flawed paperwork, forged signatures and defects in foreclosure and mortgage documents have marred proper documentation of property ownership. The resulting situation means that the property no longer has a 'good title' attached to it and hence is no longer legally sellable, leaving the prospective buyer in many cases with no remedies.

Frederick Reese suggests that Land registry blockchains seek to fix these problems. By using hashes to identify every real estate transaction (thus making it publicly available and searchable), proponents argue issues such as who is the legal owner of a property can be remedied.

Also, for most farmers, credit worthiness is determined by their lands and homes. Without a clear line of ownership, tools for financial mobility – such as seed loans for new businesses – cannot be obtained, leaving affected communities with few options for improving their fortunes.

Another important functionality of block chain registry is it would also address 'nuisance properties' and the possibility of land title fraud. It would be easier to locate nuisance properties, such as properties seized on tax liens, abandoned properties and properties without proper titles.

F. Smart Contracts

“Distributed Ledger Technologies and Financial

Inclusion”(2017), a paper published by ITU-T Focus Group on Digital Financial Services, explains that Smart contracts that are self-executing and embedded into a blockchain can enforce legal contracts containing multiple assets and enforcement or performance triggers. It is explained that a smart contract that provides insurance for crop failure whereby small farmers are automatically paid out by insurance companies based on externally-derived micro-climate pattern data linked to the smart contract that over a period, signals drought conditions.

Tess Johnson in his paper “Smart Contracts and Blockchain: What Happens if the Blockchain Breaks?” mentions that smart contracts can also help to provide economic identities for some of the vulnerable populations, such as refugees and internally displaced people. BanQu, for example, enables individuals to set up a personal digital identification profile and accumulate a transaction history on the BanQu blockchain, creating a footprint for the unbanked to participate in the global economy.

G. Block chain In India

India is the world's largest remittance recipient at US\$69 billion in 2015. As of December 2016, the global average cost of remittance was 7.4%. Meanwhile, financial institutions that use blockchain technology offer lower costs for cross-border payments, typically ranging between 1% and 3%.

In India, Unocoin enables individuals and businesses to buy, sell, store, use and accept bitcoin. The company provides a bitcoin wallet with a point-of-sales platform. It also partners with other blockchain business providers to increase the application of bitcoin in India and improve its processes.

ICICI bank has partnered with Stellar, a Open, non-profit payment platform to enable low-cost global money transfers to the Philippines and cross-border payments to and from India, Europe, Kenya, Ghana and Nigeria. This partnership will enable cross-border payments without traditional wire fees. ICICI is also planning to launch a blockchain backed mobile wallet application for its university and office campuses, which they will potentially roll out to their entire customer base.

IV. RESULTS AND DISCUSSION

The studies conducted in India and other developing and underdeveloped countries have been analysed and the potential application of blockchain in banking for financial inclusion in India are identified in areas such as remittances, property registry, smart contracts and clearances and settlements to accelerate financial inclusion. Also, the major benefits that are identified by the usage of block chain are as below:

A. Elimination of Intermediaries/ Third Parties

The basics of Block chain is that it is built within a trusted

network ie. It doesn't need any intermediaries and that the contractual promises can be automated without much human interventions. This eliminates the need for clearing houses and ensures that the bank records are always synchronised.

B. Reduction in Settlement Time

Currently Clearance and settlement time is between two to three days leading to liquidity risks, especially for the financially excluded population whose majority of transactions are micro transactions. This reduction in settlement time helps people to access their money as and when they need it. Blockchain between banks could authenticate the transactions in a trusted network and execute C&S faster and more efficiently.

C. Reduction in Cost

Blockchain can cut operational costs from supply side considerably and reach the unbanked and underbanked at the edge of wireless and not just bank accounts. Santander predicted that blockchain technologies could reduce banks' infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between \$15-20 billion per annum by 2022. By eliminating plastic cards and letting their customers transact exclusively through mobile phones, banks could reduce distribution costs and customer-service costs which again would help them reach out the unbanked population.

D. Digital Entity

Majority of the unbanked or unbaked population in India do not have access to traditional financial services because they lack verifiable ID or any identification at all. By using Blockchain can help them receive a digital identity verified with biometrics which is securely stored and managed for transacting value nationally and internationally.

V. CONCLUSION

Innovative products and solutions in banking are the only way to accelerate financial inclusion in India, given the challenges of providing financial access to rural population. Blockchain technology has a huge potential in accelerating financial inclusion. Blockchain can reduce the remittance costs and shorten settlement time which are the main hindrances in the adoption of mobile banking by rural population, considering the nature of their transactions (Large no. of transactions with a small amount). But, the usage of block chain technology is still at a nascent stage and it would require a collaborative effort from the government and the FIs for block chain to gain pace. With the collaborative effort, block chain technology would definitely be a game changer in financial inclusion.

VI. SCOPE AND LIMITATIONS

Firstly the conceptual paper discusses about the current scenario of block chain technology adoption around the

world especially in developing countries. It doesn't discuss the technical and regulatory aspects of blockchain technology. Secondly, being a conceptual paper, this study attempts to analyse studies conducted by other researchers where certain errors may have crept up owing to their limitations. Similar errors have been unknowingly borrowed in this paper since the entire conclusion has been based on those studies. Thirdly, this paper does not discuss the user friendliness of the technology and the demand side barriers in its adoption.

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