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A Detailed Study of Blockchain: Changing the World

Shweta Singh[*], Anjali Sharma[*], Dr. Prateek Jain[**]

**Department of Computer Science and Engineering,*
Manav Rachna International Institute of Research and Studies (MRIIRS), Faridabad, India.
***Department of Computer Science, Accendere Knowledge Management Services*

Abstract

We are moving towards digitalization and the most common term which comes to everyone's mind while talking about the same is," currency". To support this, we have 'Bitcoins', Bitcoin is a type of digital currency that can be exchanged on the Blockchain, the shared ledger technology. Bitcoins are, in essence, electricity converted into long strings of code that have money value. Bitcoin is a form of digital currency, created and held electronically. Blockchain is a shared ledger technology which is used to transfer bitcoins. It is also finding its application in various other domains such as e-voting system, government, health care etc. The security of transactions has become such a major concern these days. The blockchain network comes with full-fledged security features and hence are being welcomed everywhere. With security other special characteristics of blockchain have also been briefed in our work. It is known to us very well that any invention has to go through a lot of challenges; same is the case with blockchains. We have briefed some of the challenges that the implementation of blockchain technology is facing. In this paper we have discussed the concepts of current blockchain technology, its features application and challenges.

Keywords: Shared-ledger, bitcoin, blockchain

INTRODUCTION

He idea of Bitcoin was conceptualized by ***Satoshi Nakamoto***, an anonymous figure. In May 2008, he shared a white paper about Bitcoin. He did not disclose who he was. He outlined how the currency would work. The first major blockchain innovation was bitcoin, a digital currency experiment. The second innovation was called blockchain, which was made keeping in mind that the technology that operated the Bitcoin should be separated from the currency and used for all kinds of other inter organizational cooperation. Almost every major financial institution in the world is doing blockchain research at the moment, and 15% of banks are expected to be using blockchain in 2017. The third innovation was called the "smart contract," embodied in a second-generation blockchain system called ethereum, which built little computer programs directly into blockchain that allowed financial instruments, like loans or bonds, to be represented, rather than only the cash-like tokens of the bitcoin. The fourth major innovation, the current cutting edge of blockchain thinking, is called "proof of stake." Current generation blockchains are secured by "proof of work," in which the group with the largest total computing power makes the decisions. These groups are called "miners" and operate vast data centers to provide this security, in exchange for crypto currency payments. The new systems do away with these data centers, replacing them with complex financial instruments, for a similar or even higher degree of security. The fifth major innovation on the horizon is called blockchain scaling. A scaled blockchain accelerates the process, without sacrificing security, by finding out how many computers are necessary to validate each transaction and dividing up the work efficiently. To manage this without compromising the legendary security and robustness of blockchain is a difficult problem, but not an intractable one. A scaled blockchain is expected to be fast enough to power the internet of things and go head-to-head with the major payment middlemen (VISA and SWIFT) of the banking world. Bitcoin is a type of digital currency that can be exchanged on the Blockchain, the shared ledger technology. Bitcoins are, in essence, electricity converted into long strings of code that have money value. Bitcoin is a form of digital currency, created and held electronically. No one controls it. Bitcoins aren't printed, like the normal currency in fact they're produced by people, and increasingly businesses, running computers, using software that solves mathematical problems. Without having any physical existence Bitcoins are of very high value in terms of money and each the day value in physical currency of Bitcoin changes. It's most important characteristic, and the thing that makes it different to conventional money, is that it is decentralized. No single institution controls the bitcoin network. This gives many people relief because it means that a large bank can't control their money. Bitcoins in many parts of the world have become a mode of payment for example in countries like Argentina it is used to pay for Uber. It is created as a reward for the process known as mining. Blockchains shift some control over daily interactions with technology away from central elites, redistributing it among users. In doing so, they make systems more transparent and more democratic. The governments and industry giants are investing heavily in blockchain research and development to enhance their services.

Figure 1. Bitcoin

After understanding about Bitcoin the question comes in our mind, “how this digital currency is shared?” The answer to same is Blockchain. A shared ledger allowing any participant in the business network to see THE system of records. In layman language it is a technology that transfers bit coin. Blockhain technology was used by the global network of computers which used it to collectively manage the database that records Bitcoin transactions. That is why the Bitcoin is managed by its network, and not any one by central authority. And now to understand it in better way, The traditional way of sharing of documents involves the Microsoft word document. Documents is made and send to other parties and asked for revision if required. The document is then again received back and again revised until we are satisfied . both the parties have their own view of document and they can access the same at the same time , this is an example of shared technology between two parties. Blockchain is also a shared ledger technology but the sharing is between all the people on network. Without the consent of all the people on the network changes cannot bt made on the document. And the most critical area where we use the blockchain is transactions as here the records of transactions is not stored between with one or two people but with the network as a whole.

Figure 2. The Fig. shows how nodes are linked in a blockchain

WORKING OF BLOCKCHAIN NETWORK

The step to step explanation to the working of Blockchain is explained below

- Let’s start with the person who requests a transaction say it is A. Let A has to send some digital currency to B.
- The requested transaction is represented online as a block.
- A verified transaction can involve crypto-currency, contacts, records, or other information.

  Crypto currency: It is the currency that which has no physical form, it only has the network existence and it cannot be exchanged for any other item such as platinum. No central bank has control over this currency and also the network is completely decentralized.
- This block is now broadcast to every party in the network.
- Those in the party look for the validity of the transaction.
- Once verified, the block is then added to the chain which provides an incredible and transparent record of transaction. And which is also permanent and unalterable.
- The digital currency moves from A to B. Transaction is complete.

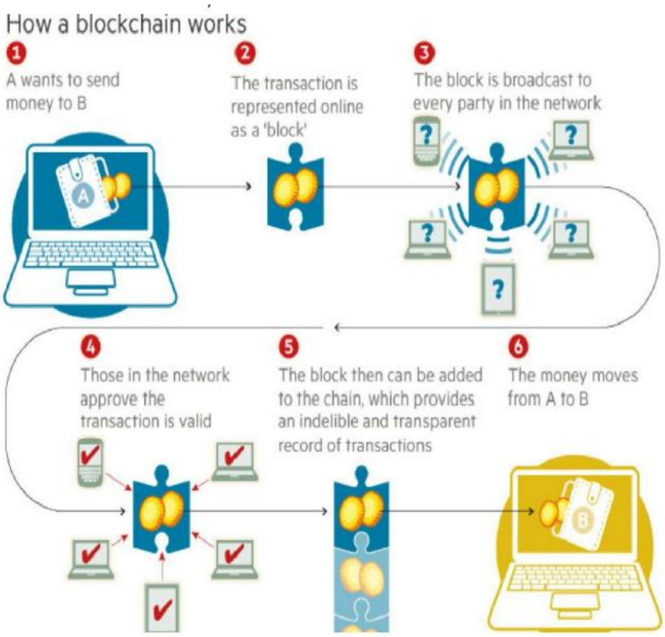
How a blockchain works
1
A wants to send money to B
2
The transaction is represented online as a 'block'
3
The block is broadcast to every party in the network
4
Those in the network approve the transaction is valid
5
The block then can be added to the chain, which provides an indelible and transparent record of transactions
6
The money moves from A to B

Figure 3: Working of Blockchain

SPECIAL CHARACTERISTICS OF BLOCKCHAIN

SECURITY

The first decision that is made while establishment of a Blockchain is too see the architecture of the system. Blockchains have consensus on their ledger by this property the all the nodes have information and if any node makes changes in it, then it is informed to all the other nodes. In private blockchain we can control who is allowed to operate a node as well as how those nodes are connected with each other. The nodes which has more connections will receive the information faster. For a node to be considered active it should have certain number of connections. A node that transmits incorrect information or restricts the transmission of information is identified easily in this network.

As mentioned above, the choice of infrastructure is tied to the service plan selected. The IBM Blockchain Platform Enterprise and Enterprise plus plans leverage industry-leading security through LinuxOne Emperor to ensure that all code and data are encrypted at all times, tampered virtual machines (VM's) will not start, and no admin or privileged access occurs. Code is executed within IBM Secured Services Containers (SSCs) which protect the security of the ledger.

- SSC's ensure:
  - Tenants are isolated from each other
  - Protection from insider attacks or compromised
- Credentials by removing privileged access
  - Data encryption keys are private and data is inaccessible
- Even to IBM under court order
  - Trusted Boot loading for tamper proof code execution
- The IBM Blockchain Platform meets the highest FIPS 140-2 Level 4 standard for hardware security modules (HSM). Additionally, the IBM Blockchain Platform's "Always-on" design supports network updates while operational and even has optimized performance on the world's fastest Linux compute.
- Each of these features is backed by IBM's deep Hyper Ledger Fabric expertise with 24x7x365 coverage for technical blockchain support baked directly into the console. Specific tools and capabilities were included to make network operation easier.
- These include:
  - Dashboards for monitoring and managing the resources
- On the network
  - Lifecycle Management for seamless upgrades of the full
- Code stack without pausing the network.
  - 24/7 Technical Support integrated into the portal
  - Hardened security stack with no privileged access,
- Malware and tamper resistance, 100% disk encryption and HSM key protection.

➢ **Durability and robustness:** Blockchain technology is fully robust. Blocks of information are stored on the blockchain that are identical across the blockchain network, the blockchain cannot be controlled by any single authority and hence it has no single point reason of failure. Bitcoin was invented in 2008. And since that time, the Bitcoin blockchain has no report of failure. The internet has proven to be durable for almost 30 years. It's a track record that works well for blockchain technology as it continues to be developed with each passing day.

➢ **Transparent and incorruptible:** The blockchain fulfills the state of consensus. The property of consensus works on the idea that if any change is to be made on the on the blockchain transaction then before doing it we need to take the permission of all the individual nodes without them we cannot do the same. Due to this property our blockchain network achieves the feature of transparency. The transparency is the property of the whole blockchain network. Also the blockchain network to a large extent eradicates the chances of corrupting of data. Now this can be understood as: In the normal mode of transaction which involves banks as central authority, there is one person who is responsible for a particular piece of information so it is very easy for him to corrupt the data as he requires since he is not accountable to anyone. But in the blockchain network if one wishes to change a piece of information then this change will be reflected in the system of each and every node, and there are at least 100 -200 nodes so it is practically impossible for the data to be corrupted.

➢ **Security:** We have seen the feature of consensus. Now for the security of the network the same concept can be applied. This can be understood as: If someone wishes to hack all the information about a bank. Then a skilled person can do it without much difficulty as the number of system to be hacked is only "one". But the case of blockchain is different if one wishes to hack this network of nodes then he will have to hack all the networks, hacking only one particular system will not work for him. Hence blockchain technology comes with full proof consent of security.

➢ **Increased Capacity:** in normal transactions involving banks we have few centralized servers which controls all the operations but in case of blockchain we have thousands of systems working together. This results in the processing of transactions with very speed and in limited periods of time.

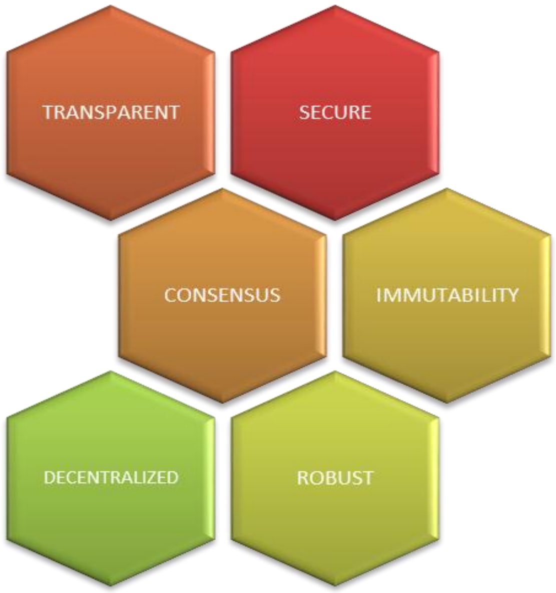

Figure 4. Characteristics of blockchain

- **Faster Settlement:** In the traditional mode of transactions involving banks the process of settlement takes a lot of time, from few days to a week as we have few centralized systems which does the following work... Blockchain technology can actually settle the transactions in very less time or say instantly as the number of systems involved is quite more than the traditional system. This saves a lot of time and money of the financial industry.

- **The idea of decentralization:** The blockchain is a decentralized technology. Decentralization means that the control over all the processing is not with any single entity. A global network of computers uses the blockchain technology to jointly manage the database that records the Bitcoin transactions. That is, Bitcoin is managed by its network as a whole, and not by any one central authority

- **Remittances:** It is the action of sending money in payment or as a gift. Many families are spread all over the globe, and sending money overseas is inefficient and in many cases incredibly expensive. For example, if a girl is doing her graduation from USA while her family is in India. Now if the father wants to give her money on some special occasion like her birthday then he will firstly go to the bank fill and check and deposit it. The money will reach to her in 1 or two weeks. But through the technology of blockchain the money can be transferred instantly.

- **Exchange-rate risk protection:** If you're an institution transferring a large amount of money from one currency to another overseas, oftentimes, it can take banks 3–5 days for the transaction to complete which means that there is risk of the change in the exchange rate in that time period. Bitcoin again eliminates this as it is transferred overseas in real time so you won't be susceptible to exchange rate risk. e.g. If someone from India sends an amount of Rs. 50,000 to someone living in USA then due to exchange rate the actual amount transferred might be around Rs. 30,000. Bitcoin eliminates such type of issues.

- **Inflation protection:** Another major use case for bitcoin is inflation protection. Countries that have experienced high inflation and volatile currency swings, like Argentina, suffer from the ebbs and flows of their currency, and there are many cases in which currency fluctuations happen so dramatically that one can lose a substantial amount of their worth in a matter of days, weeks and months.

- **New currency:** Others are using it as currency as some major retailers are accepting it as a payment. In today's world of digital era, the technology will surely and surely gain heights as everyone is moving towards become digitalized and bitcoin is a very magnificent way to do the same.

- **Immutability of the data:** Once we decide to agree on a transaction is cannot be changed. Following the previous transactions, another transactions can be done but the there is no way to hide the original transactions. With this comes the idea of **provenance of assets** according to which for any assets we have information about where the asset it, who is the owner of the asset and the life history of the asset owner.

- **Consensus:** The property of consensus works on the idea that if any change is to be made on the on the blockchain transaction then before doing it we need to take the permission of all the individual nodes without them we cannot do the same

BENEFITS OF BLOCKCHAIN TO THE SOCIETY:

- If someone hears of the blockchain for the first time, then it may seem complicated or complex in nature but in reality the idea behind blockchain is quite simple. It is kind of database having penetration distribution and is used all over the word through millions of devices. Now the database or say the information can be on anything from scientific discoveries to needs like money, or even votes. It ensures trust and also integrity between the strangers and also vanishes the chances of cheating or betrayal. In this technology faith and trust is established through the Mass relationship or say cooperation, and also the most important of all "smart code" which out numbers the powerful bodies such as banks, governments or the enterprises of technology.
- The main reason for so much of curiosity and awareness or say interest which is generated in the blockchain technology is because everyone is fed of the betrayals and also aware of the curses that banks

can cause to them. Hence they are hoping that blockchain technology will bring a significant change in the financial service industries, by lowering the cost of transactions and also the complexity and this will make the banks improve upon their transparency and regulations.

- It is known by now that the blockchains are transparent, provides a decentralized medium and a platform of recording lists of the transactions that take place each and every day or more precisely seconds. The most common example of this technology is Bitcoin. Since Bitcoin creates faster, cheaper public records on blockchain based transactions of currency other ways have result in to create the new currency which can also be used for the non-financial transactions like casting of votes and which comes with a lot of features and aims.

- When it is required or necessary to know about the ownership histories and background data, Blockchains perfectly suit these kinds of jobs as it can manage the supply chains to provide authenticity and correctness that a certain commodity has been ethically and properly sourced or a product has been made from where it has to be made. Also it can simply resolve the problem of music or video piracy. Blockchain also provide opportunities in the field of public services such as the health and welfare payments or the self-executing contracts for the companies that run themselves without any interference from human.

- Blockchains are a boon in resolving the problem of music and video piracy and hence enabling digital media to be legitimately brought, inherited and sold. they can also be used in public services such as health and welfare payments Blockchain distributes the daily interactions with technology to the users, which was previously with the central bodies. By this, they make the system more transparent and hence democratic. The government and business men who are implementing this technology are doing it to enhance their services.

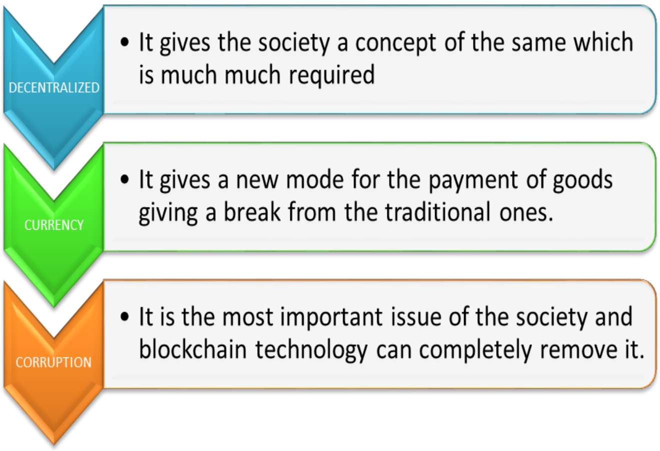
DECENTRALIZED
• It gives the society a concept of the same which is much much required
CURRENCY
• It gives a new mode for the payment of goods giving a break from the traditional ones.
CORRUPTION
• It is the most important issue of the society and blockchain technology can completely remove it.

Figure 5. Impacts of blockchain on society

APPLICATION AREAS OF BLOCKCHAIN

- **Currency:** Currency is one of the major applications of blockchain. It was mainly designed for bitcoins i.e. online currency. By this means it can be treated as the international currency. Till now many researches have been done to make a wide use of blockchain but there hardly any applications of it in which bitcoins is not included. Bitcoins have a great role in developing the technology of blockchain. Here is a conclusion of how blockchain applications for currencies work and some of their implications. However, since there are already several accessible guides and discussion pieces on this topic, the focus will be on how Bitcoin's dominance of the blockchain field could affect wider development of the technology and other applications of distributed ledgers.

- **Patents: protecting innovators while incentivizing innovation:** owners have been facilitated by the right to exploit innovations for specific periods by their patents. It was to motivate the innovators by the patent system for a making progress against their competitors. It is necessary for the patent to make a proper balance of the protection of innovators against the protection of compactor's, if not protected then the risk for free riding competition will be an obstacle in investment for new innovations. And if competitors are not protected then they would be deterred from investing in the improvements and cost savings and would be pushed away from involving in industry and breaking the original innovator's monopoly. Hashing and Proof of existence are the two features of the blockchain which make it relevant to the patent system. Hashing is also known as digital finger print in which a document is transformed into a fixed length code. Every single hash is unique and even a minor difference in it would lead to a radically different hash. Only repeating the hashing process on an identical copy of the original document will produce the same hash. Crucially, it is impossible to regenerate a document from its hash. The proof of existence is the second one. It is the recording of the procedure of blockchain technology that how could it change our lives. While this procedure a record is created that this hash existed at a given time. This record is available for anyone to view as part of transparency but no one can interpret the contents of hash. However, owners of the original document can prove that the document existed at the time the transaction was made by repeating the hashing process on a cloned copy of their original document by using the same hashing algorithm. This shows publically recording without revealing the content publically. This process can be used by the investors to protect their work by recording a hash of their patent.

- **E-voting System:** Even after this advancement in technology elections are conducted offline. This technology has given very promising results in this voting system as no one can alter the votes as well as it is cheap than conducting polls offline .It has been seen as a many means of increasing engagement and turnout, and even reconnecting links between citizens and political institutions, claims that should be read with some skepticism, e-voting could be done in many ways : using the internet or a dedicated, isolated network; requiring voters to attend a polling station or allowing unsupervised voting; it can also be done using any gadgets that we use on everyday purpose like mobile phones ,laptops etc. . Now we still are in dilemma whether to continue trusting central authorities to manage elections or to use blockchain technology to distribute an open voting record amongst the citizens. The blockchain is transparent and distributed among users which I can be used to logging and verifying. Usually, votes are recorded, managed, counted and checked manually. Blockchain-enabled e-voting (BEV) would empower voters to do these tasks themselves by allowing them to hold a copy of the voting record. The historic record cannot be changed, because other voters would see that the record differs from theirs. An illegitimate vote cannot be added, because other voters would be able to see that it is not compatible with the rules (perhaps because it was already counted or is not associated with a valid voter record). BEV would shift power and trust away from central actors, such as electoral authorities.

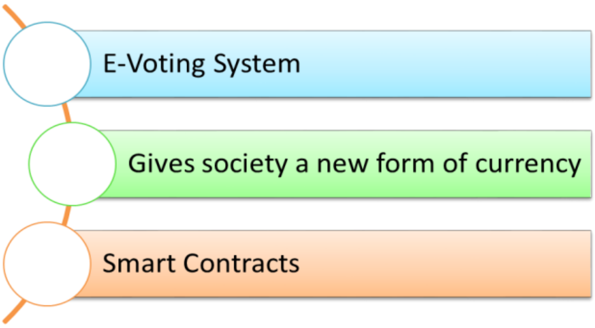

Figure 6. Applications of Blockchain

- **Network Operations:** The IBM Blockchain Platform enables founders to initiate, invite, and configure a network with a simple user interface. Initiating a network creates 3 ordering peers, and two certificate authorities. This provides a founder with a ready to use foundation for creating their business network. Founders can then invite additional participants to the network using any number of peers. Participants will receive email notifications of their invite so that they can easily join the network. The Network Operations user interface also enables a founder to configure core network components such as identity verification and channel creation. This helps to ensure that only permissioned users access the network, and confidential transactions are enabled via channels.

- **Operational Monitoring:** Users require the ability to monitor the activity on a network as it grows in terms of transactions and participants. The IBM Blockchain Platform provides both a Network Traffic Dashboard and Network Health Monitor. These dashboards enable proactive adjustment to network operations and clearly define resource consumption within the network.

- **Blockchain states**: Rethinking about the public services in the context of opening up data, services and decisions in the public sector through digital media and technologies, a new generation of open, transparent, collaborative and accountable e-Government services are under development. Recently a report has been published which outlines how blockchain-based technologies could provide new tools to reduce fraud, avoid errors, boost productivity, cut operational costs, support compliance and force accountability in many public services. Potential applications of the same include tax collection, identity management, distribution of benefits, local (or national) digital currencies, property and land registry and any kind of government record. The same technology also opens the doors for the non-state actors to provide state-like services, from notary services to global citizenship and identity. Data used by public institutions is often internally fragmented and opaque to other actors, notably citizens, businesses and watchdogs. Blockchain technology could allow records to be created and verified with a greater level of speed, security and transparency. Record keeping is the most immediate application of the blockchain technology in public administrations. The combination of time-stamping with digital signatures on an accessible ledger is expected to deliver benefits for all users, enabling them to conduct transactions and create the records and store them.

- **Smart contracts**: As compared to the traditional ledger the blockchain ledgers surely present several interesting and novel features. It not just records the time and a detail of transactions but beyond that it also plays a more active and potentially autonomous role in the implementation and management of transactions. Blockchains also have the feature of automatic execution of transaction with response to certain conditions being met, providing a ‘guarantee of execution’. Based upon this self-executing smart contract are being developed rapidly. Smart contracts can be defined as a ‘computerized transaction protocol that executes the terms of a contract’. In simple terms it means that, the terms of an agreement between two or more parties are programmed into set of instructions or say code that are stored on blockchain that are stored on the blockchain. When certain conditions described in the code made are met, the required actions that are defined in the code are automatically executed.

CHALLENGES TO BLOCKCHAIN

- **Regulations**: We all are aware of the fact that when it comes about technology innovation the regulatory authority often lags. Day by day new products and services are coming up based on the blockchain transactions but sadly we have no regulations on how transactions should be written. Transparency is the most important feature of blockchain but the highly regulated industries may need to develop new regs for blockchain. Similarly there are many special characteristics which may need to be altered based on various situations. So for this we need properly regulations governing the blockchain

- **Standards**: As with regulations, we currently lack one common set of standards for writing transactions on a blockchain. In fact, there are three open source consortium organizations, each with its own standards and code. Part of this evolution is complicated by the wide variety of usages for blockchain and the most appropriate form standards will need to take in addressing these use cases. The regulations that evolve to regulate this environment will help drive the adoption of standards and may well drive these consortiums together.

- **Need More Validation**: Another obstacle to adoption is executives' fear that the technology has not been tested enough in pilots and POCs. Ultimately, what are blockchain's limitations? Early POCs validate its scalability, but what are its limitations for handling a large volume of enterprise transactions and data? Different applications will face different scalability issues as adoption increases. And how much time and computing power will be necessary to process a huge number of transactions?

- **Culture:** From ages we have a certain way or say tradition of doing transactions. The blockchain technology takes us away from the traditional way of doing things. It is a major shift from centralized network to the decentralized one and not all the institutions can accept the concept of decentralization. Blockchain is more of the business process change and less of the technology implementation.

REGULATION &STANDARD
COST &EFFICIENCY
SECURITY & PRIVACY
VALIDATION & ORGANIZATION

Figure 7. Challenges to implementation of blockchain

- **Cost and efficiency:** We have various types of blockchain and each of them comes with different speeds and effectiveness with which the transactions can be done. Out of many types, those which give high amount of speed and effectiveness are quite costly. So in order to give the best of service to the people and also aid maximum benefits from the blockchain technology one has to go for the best blockchain which is quite costly.

- **Security and privacy:** The bitcoin transactions are tied to the "wallets" instead of the individuals. Applications of the blockchain require that the transactions and contracts should be linked to known identities. This raises a serious question about the privacy and security of the data that is stored and accessible on the blockchain. Till now no one has every managed to break the architecture of a blockchain**.** But still, it is not easy to get over the taught, "technology has its own advantages and 'disadvantages'. This is the reason why some of the institutions are finding it difficult to shift to this technology

- **Organization: The** blockchain creates most value for organizations when they work together on areas of shared pain or shared opportunity – especially problems particular to each industry sector. The problem with many current approaches, though, is that they remain stove-piped: organizations are developing their own blockchains and applications to run on top of them. In any one industry sector, many different chains are therefore being developed by many different organizations to many different standards. This defeats the purpose of distributed ledgers, fails to harness network effects and can be less efficient than current approaches.

CONCLUSION

After having a look about the working mechanism and features of Blockchains, it can be analyzed that this technology can surely prove to be a boon for the society. Their recommendable features are consensus, security, transparency, etc. Due to consensus, blockchains are very secure. Security is the major concern these days and blockchain guarantees it to the full extent. To hack a blockchain network one has to hack thousands of computers which are interlinked and it is practically impossible to do it. The features of blockchain also has many benefits for the society. Since blockchain is transparent hence the it can help the society to get rid of many curses such as corruption. Due to the property of transparency no single party can make changes in the transaction history as if it attempted to do so, then it will be reflected on all the systems of the blockchain. It can also be used in those situations where it is required to determine the ownership histories etc. with such remarkable features this technology also faces many challenges such as there is no government rule or regulation about the use of this technology, no standards are set, highly cost of the network and also the major reason, ‘culture’. If these challenges will be overcome in the future then the technology will surely evict a lot of evils from the society and take us to a new era of digitalization.

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