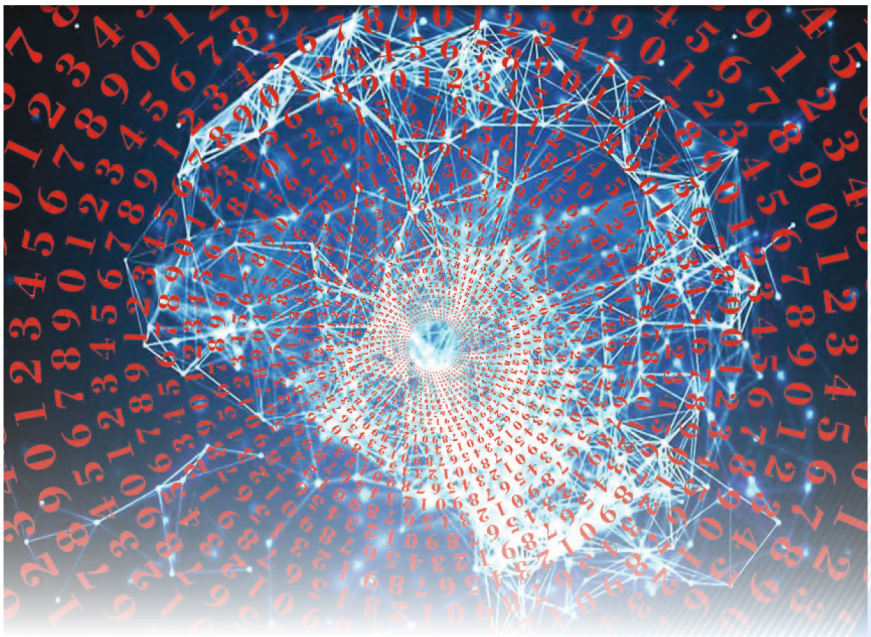
GUIDANCE NOTE ON BLOCKCHAIN TECHNOLOGY



THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

(Statutory body under an Act of Parliament)

GUIDANCE NOTE

ON

BLOCKCHAIN TECHNOLOGY

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA
(Statutory body under an Act of Parliament)

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Foreword
(Second Edition)

I am pleased to note that the Professional Development Committee is bringing out 2nd Edition of Guidance Note on Blockchain Technology. Blockchain Technology has gained a lot of attention in different types of industries including: financial servicesand e-commerce. Blockchain is changingthewaya person understandstrust and security in his daily routine activities. The objective of this publication isto provideunderstandingof the concept andits robust power as a technology which isbound to changesociety as theInternetdid. Further, this publication recognises how,Blockchain technologycan be leveraged in accounting and otherformsofdatamanagementsystems.

I thank CMA Biswarup Basu, Vice President of the Institute, CMA Vijender Sharma, Chairman and other members of Professional Development Committee and the PD Directorate of the Institute for their efforts and contribution in bringing out Guidance Note on Blockchain Technology.

I am sure this publication will prove to be very useful to members and other stakeholders who are interested in the basic understanding of the fundamentals of Blockchain Technology and how it can be leveraged in accounting and other forms of data management systems.

With Warm Regards,

CMA Balwinder Singh
9th January, 2020

CMA Vijender Sharma
Central Council Member
Chairman-Professional Development & Members' Facilities Committee

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Preface
(Second Edition)

I am happy to present the second edition of Guidance Note on Blockchain Technology to the members on behalf of the Professional Development Committee of the Institute. The intention of coming out with the second edition on Blockchain Technology is that Cost Accountant fraternity who are implementing blockchain will take pride of being consultants in studying the system, designing the requirement and add value to industries.

With the use of blockchain, it is expected that accounting practices may be enhanced thus reducing costs for maintaining and reconciling ledgers (book keeping). Professionals on these fields can now concentrate in making intellectual efforts in planning, strategy, analysis, valuation and many others instead of performance of mundane tasks which can be done by machines without any application of mind on the basis of pre-loaded data sets which are directed to trigger at certain events.

I am sure that Guidance Note will help the members to take better strategic business decisions and develop solutions to real-life situation and they will be benefitted in imparting their professional responsibilities successfully. I urge the members to give their suggestions on the Guidance Note so that it can be further improved in the time to come.

Thank you very much.

CMA Vijender Sharma
9th January, 2020
New Delhi

CMA Amit A. Apte
President

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Foreword

Blockchain is a digital ledger on which transactions are recorded chronologically, authenticated by all the persons involved and can be viewed by all who have access and appropriate permission. This, according to many technologists, is the future of internet and recording of business transactions. Blockchain provides solutions that are highly relevant in the digital industry and in others. Blockchain is changing the way people view trust and security in their daily life.

I am happy to note that the Professional Development & CPD Committee is coming out with the Guidance Note on Blockchain Technology in view of the growing trend and the pace in which Blockchain Technology is moving.

I hope that this publication will provide a basic understanding of the fundamentals of Blockchain Technology and how it can be leveraged in accounting and other forms of data management systems to our members and other stakeholders.

I congratulate CMA P. Raju Iyer, Chairman and other members of Professional Development & CPD Committee and the PD Directorate of the Institute for their efforts and contribution in developing the Guidance Note on the contemporary topic. I hope that PD & CPD Committee of the Institute will continue to bring out such valuable documents for the capacity building of its members in all professional areas.

With Warm Regards,

CMA Amit A. Apte
20th January, 2019

CMA P. Raju Iyer
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Preface

Blockchain Technology offers a means to automatically create a record of who has accessed information or records, and to set controls on permissions required to see information. Blockchain Technology model is built on few pre-requisites.

First one being chronological. All transactions arc chronologically created and linked.

Second, its immutable - Once a block is created, it can be altered at any particular time or by any method or by any chance. Any kind of alteration or hacking would alter earlier blocks and in turn entire chain would change.

Third, its shared. The technology requires all blocks to be shared to all the parties in the link.

Fourth, there is no need of a central server. All data is decentralized and nodes act as participating source of a block. This is called peer to peer network.

Fifth, its secure. Many blocks in the chain get private signatures attested (hash) and hence making the transaction more secure.

Cost Accountant fraternity may become advisors for industries trying to implement blockchain and take pride of being consultants in studying the system, designing the requirement and add value to industries.

In order to enhance the capacity building and to support members of the Institute, the Professional Development & CPD Committee has brought out Guidance Note on Blockchain Technology which will enable them to understand the everyday nitty-gritty to be a successful Blockchain professional.

I acknowledge the sincere efforts CMA Murali Mohan, who has developed this Guidance Note. I also thank Shri Satish Kumar S and Shri Dayanand K G for reviewing the Guidance Note and adding valuable suggestions.

I sincerely thank CMA Amit A. Apte, President of the Institute, CMA Sanjay Gupta, Immediate Past President of the Institute, CMA Balwinder Singh, Vice President of the Institute, other members of Professional Development & CPD Committee and the PD Directorate for their contribution in bringing out Guidance Note on Blockchain Technology.

1 am sure this guidance note will help readers to acquire basic knowledge of block chain - concept and design and will help to take better strategic business decisions and develop solutions to real-life situation.

CMA P. Raju Iyer
Chairman, Professional Development and CPD Committee

20th January, 2019
New Delhi

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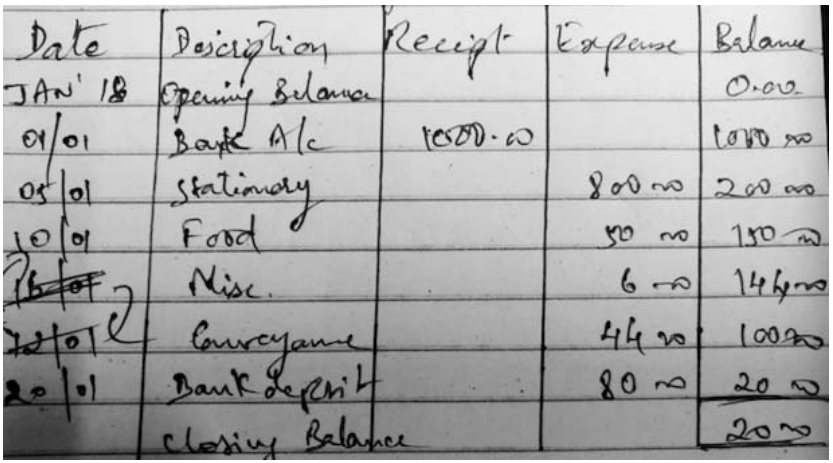
GUIDENCE NOTE ON BLOCKCHAIN TECHNOLOGY

HISTORY OF BLOCKCHAIN - TIME STAMPING

To comprehend the essential idea driving blockchain, we, as a whole ought to return to the time when there were no mobile phones or no computers. To maintain the decorum, all records were time stamped. A simple example is cash book. The manual cash book had date wise transactions in it and there was no chance of altering or amending the dates. Any corrections, strike-offs or any kind of date or data changes were considered ambiguous and a feeling of uncertainty and integrity (especially for auditors) would arise.



Date	Description	Receipt	Expense	Balance
JAN' 18	Opening Balance			0.00
01/01	Bank A/c	1000.00		1000 ∞
05/01	Stationary		800 ∞	200 ∞
10/01	Food		50 ∞	150 ∞
~~15/01~~	Misc.		6 ∞	144 ∞
18/01	Conveyance		44 ∞	100 ∞
20/01	Bank Deposit		80 ∞	20 ∞
	Closing Balance			20 ∞

After some kind of digitisation and computers slowly becoming invincible part of our life, manual registers started getting replaced with digital or computerised data. Type-written matters, Floppies etc. found its place. Now the question of "date stamping" emerged among digitally advanced technologists in early 90's and everyone had their own ideas of time stamping the data. Idea was to have "time stamping" intact without any possible or chance of manipulations. Programmers wanted to have their data chronologically arranged and unalterable. Few research papers and experiments were published.

Haber and Stornetta, in their research paper titled “How to Time-Stamp a Digital Document” gave a comprehensive solution to this requirement. The research paper was published in 1991. Abstract from their research paper read: ‘The prospect of a world in which all text, audio, picture, and video documents are in digital form on easily modifiable media raises the issue of how to certify when a document was created or last changed. The problem is to time-stamp the data, not the medium. We propose computationally practical procedures for digital time-stamping of such documents so that it is infeasible for a user either to back-date or to forward-date his document, even with the collusion of a time-stamping service. Our procedures maintain complete privacy of the documents themselves, and require no record-keeping by the time-stamping service’.

They further said: In many situations there is a need to certify the date a document was created or last modified. For example, in intellectual property matters, it is sometimes crucial to verify the date an inventor first put in writing a patentable idea, in order to establish its precedence over competing claims.

According to the research paper, a client sends a document to timestamp to a time stamping server (TSS) and the server would sign the document with the current timestamp. Also, the server would link the document to the previous document. The pointers pointed to specific data and not the location of the document. So, if the data changed, the pointer would become invalid. It ensured no one could tamper the data that had once passed through the server.

Two properties of time stamping digital documents were defined in the research paper.

1. one must find a way to time-stamp the data itself, without any reliance on the characteristics of the medium on which the data appears, so that it is impossible to change even one bit of the document without the change being apparent.

2. It should be impossible to stamp a document with a time and date different from the actual one.

To achieve this, they proposed a good plan of distributed network. Simple solution given by them in their words “Whenever someone has a document to be time-stamped, he or she transmits the document to a time-stamping service (TSS). The TSS service records the date and time the document was received and retains a copy of the document for safe-keeping. If the integrity of the

client's document is ever challenged, it can be compared to the copy stored by the TSS. If they are identical, this is evidence that the document has not been tampered with after the date contained in the TSS records. This procedure does in fact meet the central requirement for the time-stamping of a digital document.

To address 'the security' aspect, they explained the terms "Hash" and "Digital Signature" where Hash is a kind of mathematical formula so it remains unique whenever a document is created and Digital signature identifies the creator. To avoid intentional mischiefs, they proposed "linking" and "Distributed trust" which is considered the first necessity of Blockchain.

Satoshi Nakamoto - a pseudonym whose identity is still unknown gave a good shape and designed the present structure of blockchain technology in 2008. Though, their focus was on cryptocurrency, the technology they designed was/is termed blockchain technology and their success gave birth to the famous bitcoin.

BLOCKCHAIN – CONCEPT, DEFINITION AND UNDERSTANDING

To comprehend and appreciate the potential of blockchain, it is necessary to first understand few terminologies. First step of Blockchain as explained in the prior section history is time-stamping. To reiterate and summarise:

Time-stamping

This is the process of establishing authenticity of a record by having its time of creation as part of its unique ID [1]. This makes it impossible to change a section or the entire of the record without raising red flags.

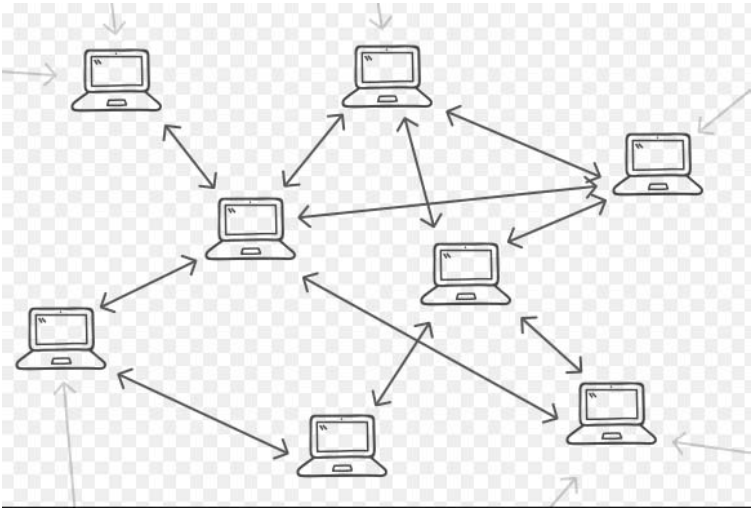
Other terminologies mentioned below are critical in understanding blockchain

Cryptography:

The use of secret codes to protect the credibility and privacy of data as well as communication channels. In layman's language, cryptography means secret codes. Dictionary defines it as "art of writing or solving codes". Many programs, protocols and systems encrypt and decrypt— cryptography— data as means of controlling access [2].

Node

The blockchain works on a peer-to-peer network of computers. The computers on this network are the ones known as nodes. The network is referred to as peer-to-peer because nodes do not require to go through a central server to communicate with one another. Any node can send a message directly to another. In the event the distance is significant, they rely on multi-hopping architecture to pass messages. This means one node can pick a message and pass it on to the next until the message reaches its destination [3]. User (Node) can login with his private key (like a password or DSC), a public key (like initial login to the system – as good as multi factor authenticator) or both.

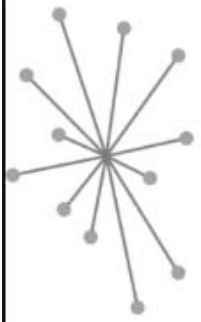


Distributed Ledger:

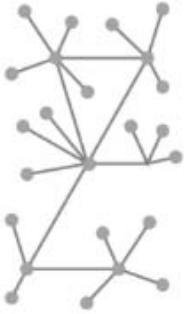
As name suggests this is a kind of ledger which is distributed across the network. This is a ledger whose copy each of the nodes on a peer-to-peer network possess. All users related to a transaction will / can have access of the transaction. The most important aspect of a distributed ledger is that all copies in a network synchronize in real-time without the help of a centralized authority.

When you transact through a bank, the record is made on a ledger that the bank maintains and has full control of. However, if the bank was to use a Distributed Ledger framework, the payer, the payee, the bank and any other stakeholder will all be nodes on a peer-to-peer network and each will have the copy of the ledger and all will take part in maintaining and updating it through consensus—rules implemented through a core software each node runs.

Centralized



Decentralized



Distributed Ledgers

- Users (●) are anonymous

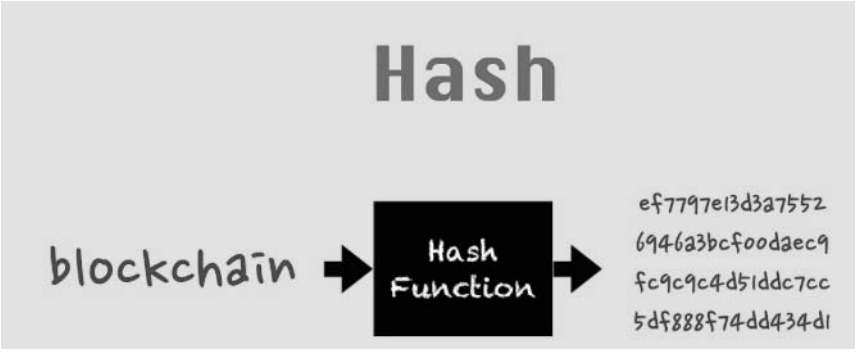
- Each user has a copy of the legder and partipates in confirming transactions independently

- Users (●) are not anonymous

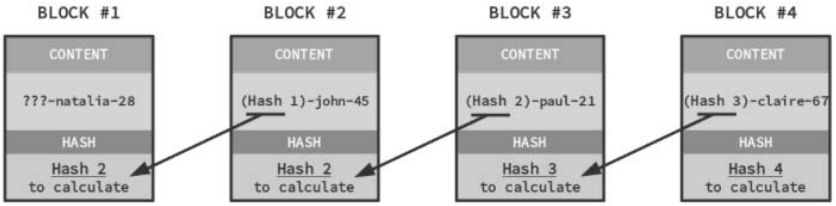
- Permision is required for users to have a copy of the legder and participate in confirming transactions

Hash

This is a state that is achieved by compressing any amount of data into a 64-character (or bit) alphanumeric unique code, which serves as its fingerprint. While a third party cannot see the original data, by looking at the hash, they can easily proof its authenticity [4].

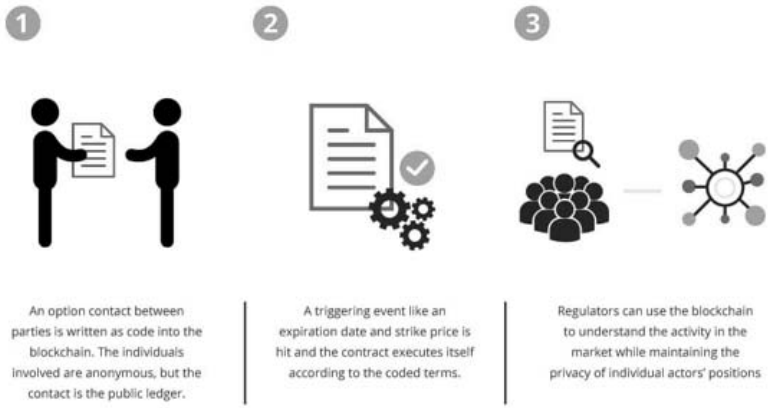


How does hash serve blockchain's architecture – is explained in the below diagram.



Smart Contracts:

A smart contract is a computer protocol intended to facilitate, verify, or enforce the negotiation or performance of a contract. In essence, it is a contract written in code whose performance is automated on the blockchain [5].



What is Blockchain ?

As mentioned above, blockchain is a distributed ledger on a peer-to-peer network. But how exactly is data recorded and organized on this ledger?

The first important aspect of the blockchain is that data is stored in chronological order. New transactions happening at the same time are put together by the peer-to-peer network (Nodes) into what is known as a block.

The block is then timestamped, hashed and joined to the previous block. The hash of the current block, which serves as its unique ID, includes an ID of the previous block.

This creates a Chain of blocks that are linked to one another through their unique Ids, hence blockchain. The first block on the blockchain is called the genesis block. Any event or addition to this initial transaction will be called another block.

Because of the fact the ID of one block is linked to the other blocks, tampering with one will require tampering with all the others.

But that is not even the hardest part. The hardest part is that you need to access every node that is on the network and change details in their copy of the blockchain. That is almost impossible to achieve.

Full cycle mentioned above is viewable by all the parties to the transaction – initial requestor, approver, funder, payer, signatory etc. – making the transaction a public or distributed document or distributed ledger. This mechanism is called Distributed Ledger Technology (DLT).

There can be additional requirements to this data set or set of blocks where smart contracts can be added for the next creator of block to check its authenticity. For e.g. a bill in an AP process becomes smart contract when it is in digital format. Confirmation of payment from vendor and accounting in our system makes transaction or the block closed.

Various definitions have been provided by various personalities on Blockchain, few of which are copied below for reference:

- Blockchain can be understood as a digital, immutable, distributed ledger that chronologically records transactions in near real time.

- A Blockchain is a kind of distributed data base and is one of the Distributed Ledger Technologies (DLT) where data is recorded, stored and sorted into blocks.

- The blockchain is a public ledger where millions of people are connected to that ledger.

- Blockchain is an enumerated list of records containing information. The individual enumerated records are called blocks and chained together using a cryptographic hash that is linked to previous block. Together these blocks are called as distributed ledger.

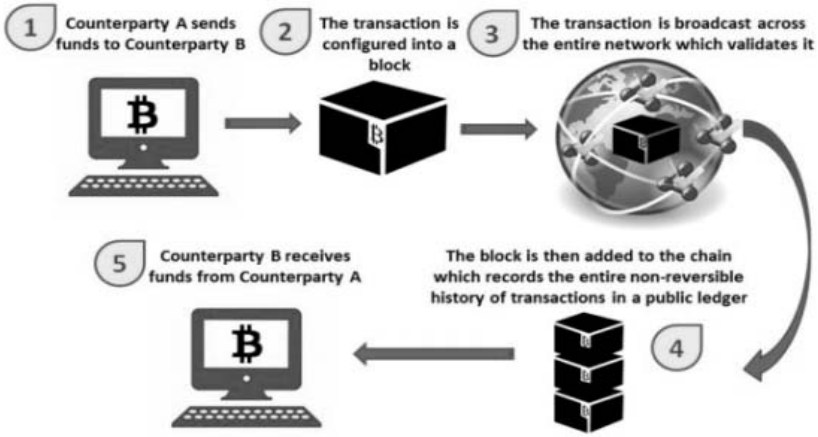
GUIDANCE NOTE ON BLOCKCHAIN TECHNOLOGY

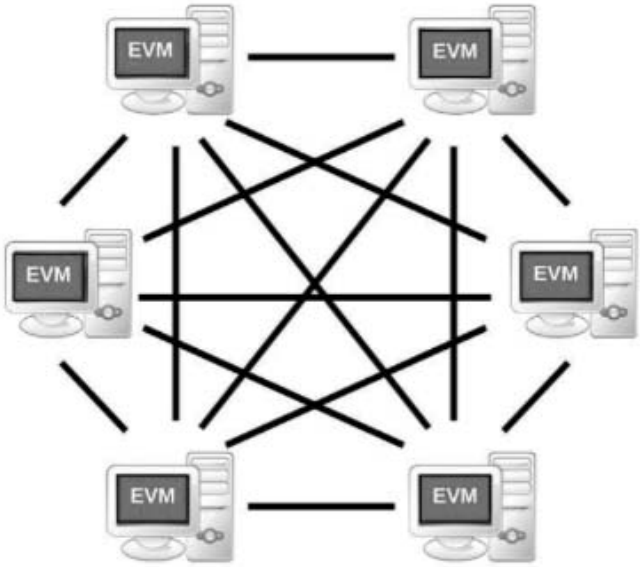
- Blockchain may be defined as an open, distributed database or public ledger that can record all transactions or digital events between two parties efficiently and in a verifiable and permanent way.

- Essentially Blockchain is a cryptographically enabled computing system with distributed ledgers maintained in and accessible from the computing device of each participating user.The blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value...Don & Alex Tapscott.

- Blockchain technology is like the internet in that it has a built-in robustness. By storing blocks of information that are identical across its network, the blockchain cannot:
  1. Be controlled by any single entity.
  2. Has no single point of failure..... blockgeeks

- A blockchain is a growing list of records, called blocks, which are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree root hash) ..... Wikipedia


1
Counterparty A sends funds to Counterparty B
2
The transaction is configured into a block
3
The transaction is broadcast across the entire network which validates it
4
The block is then added to the chain which records the entire non-reversible history of transactions in a public ledger
5
Counterparty B receives funds from Counterparty A


EVM
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PROPERTIES/FEATURES

The origin of the block or the first block or the first data created by a node is called genesis block and is the starting point of the Chain.

Unlike centralized databases, on the Blockchain, copies of data are stored in all participating nodes of the network.

The data stored in Blockchain are immutable which means blocks created once cannot be altered without having cascading effect on previous blocks.

Blockchain facilitates peer-to-peer transaction without involvement of any other third party. To do the transactions, one has to be in that particular Blockchain network. Another entity outside network cannot transact.

In essence, blockchain is like a giant spreadsheet on which assets can be registered and an accounting system for transacting them on a global scale.

With data on the blockchain accessible to the public, one might have concerns about privacy.

This is however taken care of in a much-nuanced way. Anonymity and privacy can be achieved on the blockchain. This is done through the use of public and private key combinations (cryptography). Any one loses his login credentials, then he/she cannot do any transactions. There is no way to recover the credentials.

When one requests for a transaction to be created on the blockchain, all the nodes will take part in verifying and confirming it. However, the nodes that are not directly part of the transaction can only confirm its authenticity and validity without having access to its details. This is possible through hash functions and blind digital signatures—first theorized by Professor David Chaum's 1983 paper 'Blind Signatures for Untraceable Payments.' [3]

The creator of a transaction can digitally sign access to it using public-private key cryptography. Through smart contracts, access to data on blockchain by others can even be limited by time, in addition to scope.

Near real time data: Another important property of blockchain is the near real-time reconciliation of data. This is possible because data is not silo-ed but open and inter linked. Furthermore, its validity and authenticity are verified and confirmed in real-time before synchronization happens across all nodes on a network. This also creates transparency and reduces potential for fraud.

Different block chains with different protocols

There are different protocols and different blockchains for different business objectives. Following are some of different blockchains already in use (majorly crypto currency related)

Bitcoin:

The underlying technology components are cryptographic hash function, digital signature, private-and-public key encryption, peer-to-peer (P2P) network, and proof of work (POW) consensus algorithm

Here the miner needs to solve a complex cryptographic puzzle to find it, and this essentially involves a large number-crunching operation done at high-speed. For this, the miner needs to try one number after another, which requires high computing power. Majority of the participating nodes must approve the transaction. Since this is a decentralized network, it isn't possible for anyone to capture majority of the computing power on the network, thus making the network very secure. Thus, while POW mining ensures high security of blockchain, it's also computing-power-intensive, and requires high amount of energy. It also requires high real estate, for hardware configuration and electricity. If the competition increases in the mining area, the earning of the miners may come down over the period of time

While the consensus mechanism requiring majority approval rules out foul play, it also creates scalability issues, since every node must load entire information on blockchain and participate in the transaction validation process. Bitcoin blockchain has recently implemented 'Segregated Witness' (SegWit) technology, which bypasses the limitation on block size, and separates signature information from the transaction data, to improve scalability of the network.

Ethereum:

Unlike Bitcoin, which was built for allowing crypto payment transactions over a decentralized network, Ethereum was designed with much larger objectives in mind. Ethereum provides a blockchain platform, using which, developers can launch their own blockchain projects, including their own cryptocurrencies. This is commonly called as '*Ethereum Virtual Machine*' (*EVM*), which has been used to launch over 1,000 DApps

Smart contracts make this possible. Smart contracts are pieces of code, which allows execution of legal functions, for e.g. taking control of an entity based on certain conditions, and transferring crypto tokens based on fulfilling required conditions. Smart contracts on the *Ethereum* platform are codes using *Ethereum*'s proprietary language Solidity, which is inspired by C++, Java, Python and JavaScript.

DApps are applications where the backend code runs on a decentralized blockchain, and comprises of smart contracts. The frontend code can be written in any language. To be considered as DApps, an app must meet the block chain principles.

Ripple Protocol:

Ripple protocol uses many of the features of Bitcoin or Ethereum, such as decentralized design, cryptographic hash functions, P2P network, and private-and-public key encryption.
However, Ripple was designed specifically to facilitate fast and cheap global transfer of money, which necessitates several unique features.

Users of Ripple can make payments to each other in either fiat currencies, or Ripple's native cryptocurrency XRP. The transactions are cryptographically signed, and the protocol enables real-time gross settlement, allowing fast global payments.

To achieve this, Ripple has designed the 'Ripple Protocol Consensus Algorithm' (RPCA), which uses a 'proof of correctness' concept.

Hyper ledger:

While public, permission-less blockchains have made it possible for many cryptocurrency projects to make a mark, wider adoption of blockchain is possible only when large enterprises adopt this technology. However, large enterprises have some specific requirements from blockchain technology, for e.g.:

- Only trusted entities should join the network, because enterprises can't have their proprietary information visible to everyone;
- Enterprises need blockchains with high scalability and transaction speed;
- Even among the trusted participants, access to information should be role-based.

A public, permission-less blockchain, such as Bitcoin, doesn't meet these requirements, because:

- These are fully open network, and anyone can join;
- Transaction validation uses computing power-intensive consensus algorithm, for e.g. POW, and it adversely impacts scalability and transaction speed;
- Every node can read entire information on the blockchain.

Hyperledger consortium was formed by the Linux foundation, and many other partners such as IBM, Intel, SAP, Cisco, Daimler, and American Express, to design and develop enterprise blockchains.

While Hyperledger has many flavors, however following are the few generic characteristics:

· It is a permissioned blockchain, only the entities explicitly trusted by the organization(s) can join it.

· Consensus mechanism here looks at the entire transaction flow, and nodes have different roles, with different tasks. The nodes here are differentiated based on whether they are clients, peers or orderers. A client creates and invokes transactions. Peers maintain the ledger, receive ordered updates from orderers, upon which they commit the transaction into the ledger. A specific type of peers, called endorsers, check whether the transactions meet necessary conditions (for e.g. required signatures) and endorse them.

-While this enterprise blockchain can be used in any industry, it's not suitable for cryptocurrencies

EXAMPLES/USE CASES

With all the above data, reader would have had fair idea of what Block chain technology is. The following describe use cases will help you understand more how the blockchain technology works:

Example:

Use Case 1: Let's consider online purchase as simple example.

When you purchase something from Amazon, Flipkart or similar online store, the blockchain can be deployed to help not only you, but all parties involved with the order to keep track of it. You, the online store, the delivery agent and every other person on the supply chain would be connected on blockchain to share data in realtime.

Meanwhile, the credibility of the data shared is guaranteed through its time stamping and the immutability of the blockchain. And that data could include such things as shipping progress, order details, payment received, package status, time it will reach different parties on the supply chain.

It could also include other nuanced forms of data such as the temperature of the container in which the Product is being shipped in. If someone on the supply chain tries to alter, say, the date of shipment, all the other components of the order will change and everyone will see this. And if something goes wrong and the condition of the Product is affected on transit, all stakeholders can in real-time pinpoint exactly where that happened and who exactly is responsible. Most importantly, no one gets to have the authority or power to change the data that till it reaches you or all the other stakeholders.

Use Case 2: Google sheets, Google docs, Microsoft online Excel, word are popular tools for collaboration when members of a team work on common projects from different locations. These tools, while they are very handy, are used through centralized servers, exposing private data to leaks and hack risks.

Now imagine having the same tools where the computers of team members connect directly without going through a server that Google or Microsoft maintains. All they have to do is to install client software on their desktop and they get to work on common spreadsheets and word documents.

This is possible with blockchain as it offers the ability of nodes on a peer-to-peer network to have copies of documents that synchronize in real-time without going through a central server. What's more, the technology provides the ability to make documents time-stamped and immutable.

Use Case 3: For the most part, if we want to send money, it passes through an intermediary such as a bank, a money remittance service or an agent. While this model is all we've known for ages, they present critical risks especially with the online environment. All these risks emanate from the fact that the intermediaries have to accumulate a lot of unsecured data on servers that can be hacked or compromised.

Blockchain offers a way to send money without going through an intermediary. In fact, this was its primary application through Bitcoin (or any crypto currency). The technology removes the need to accumulate data on servers and whatever data is used is obfuscated through cryptography, time stamping and elaborate consensus protocols.

The use cases of blockchain are numerous.

Others include health care where blockchain can help with having patient's history captured and shared by relevant stakeholders through public-private keys. The insurance sector can take benefit by having processes such as valuation, actuary work and claim handling digitized, automated and secured. Nearly every industry you look at there is a blockchain use case.

Let's do an exercise of building a blockchain - a simple one as below:

Let's do a run through a blockchain supported process for a trader who usually maintains just in time (JIT) methodology. A prospective client makes an inquiry to the marketing department about purchasing computers.

A negotiation on details like quantity, specification and price will follow. When there is an agreement on these details, the sales team will create a smart contract on the blockchain.
The moment this smart contract goes live, other stakeholders—both internal and external— will be automatically invited to be part of the transaction. These include the accounting department, the delivery agent, the customer support, the manufacturer and even the tax office.

The customer will make an order, which will be treated as a transaction on the blockchain. Other transactions will be the trader making a delivery and issuing invoices. The invoice will trigger payment from an escrow account linked to the smart contract.

The customer will issue a receipt and the transaction will end. All the stakeholders to the smart contract will receive real-time updates. It is even possible for any tax due to be automatically transmitted to the tax office. The accounts department will also get a breakdown of the costs involved and the profit collected. The books of account will automatically synchronize.

Since data or certain blocks are shared with respective customer and supplier, a need of Reconciliation becomes null as any change in any data of supplier or customer would hinder entire block. Clerical errors, if any, also cannot be modified leaving a clear cut picture of blocks being locked. All the above blocks are created by different nodes. Accessing of blocks by nodes can be by public or private key or a combination of both.

Supply chain management can be decentralised and moved into block chain technology to give more fair idea of the movement of materials.

Accounting can try with this technology where departments like reconciliation be laid off. AP and AR departments can take advantage of this technology and companies can see reduction in resources and manual work.

Auditors can take advantage by just looking at hash and certifying there are no changes or there are appropriate approvals for transactions.

BENEFITS OR ADVANTAGES OF BLOCKCHAIN TECHNOLOGY

No Central Authority.

Elimination of Intermediaries

Real time settlement

Reduction in operational or transaction costs

User controlled networks

Enhanced Security

Greater efficiency

Decreases Auditing costs

Traceability

Transparency

FUTURE OF BLOCKCHAIN TECHNOLOGY

Blockchain is already talk of town. If you are unaware of this technology, your survival in future may be at stake. You may not be surprised to see this technology getting into core and acquiring all software's in about 10 years.

As mentioned at few places, future of these industries might depend wholly on block chain technology.

Insurance

Healthcare

Supply Chain

Accounting

Auditing

Stock Exchange

Voting

Music - Streaming, IPR etc.

Property documents

Real estate

Banking Industry

Cross border P2P and B2B remittances

CHALLENGES / DRAWBACKS:

We all understand every new item - technology or otherwise - comes with its own initial limitations. There are always criticisms that follow anything. Blockchain technology also has its own de-merits. Though we see huge potential in blockchain technology, it is not without flaws. There are few who argue this technology can be disruptive and harmful. Below are few negative comments on this technology. Nonetheless, keeping the positives and its potential in picture, negatives of blockchain or its effect is minimalistic.

Few points on challenges or drawbacks are discussed here below:

Disruptive Technology: Blockchain is a very disruptive technology in itself. Disruption would literally mean scrapping the entire old system and getting into a new platform. Adopting it might mean scrapping entire systems and departments. This might mean a few professions and skills becoming obsolete.

Ideology: This is a completely new system and understanding it takes getting a brandnew approach. It is also true that the idea of new system has to be put in every stakeholder's mind, which might prove a difficult task.

Conceptualisation: A huge effort is required to conceptualise this technology. Management team has to support in designing the blockchain, and getting into a concrete shape might involve lot of steps and efforts.

Incorrect Programming languages and Skills: Organizations are already struggling to get the right talent in the market that can help implement the concept. This is because the technology requires mastering of new programming languages and coding skills.

Adoption: Adoption of change by employees, managers, and other staff might be a challenge as by human nature, people tend to resist changes. Changing the attitude of stake holders is always a difficult process.

Implementation: Having blockchain project working is turning out to be complicated and unpredictable. Even the most established blockchain like the Bitcoin and Ethereum blockchains have

to deal with bugs and broken code every now and then. Considering the value that is on these systems, this is always a serious threat.

Cost: Due to its nature of disruption, replacement cost can be huge. Design, concept, idea, implementation, time frame, network, programmers, training, hardware all adds to cost and the companies should be ready to adopt this. The transaction fee depends on the size of the smart contracts/attachments (block size). If the size is more the fees will be hefty. This is a problem with peer to peer network.

Time-frame: It takes time to go from the idea stage, programming, designing, trial and implementation. Going by projects that have successfully launched, it could take more than 2 years to have a live blockchain. And then many more years to fix and improve the code.

Training: Training all the staff and also other stake holders might be time consuming, cost requiring task.

Risks: Risks such as human error, incorrect permission tags, incorrect node set ups, incorrect designs, etc. can pop in and may be a threat for successful functioning of a blockchain project in the long term.

Cyber Security: For many reasons, blockchain networks have proven to be favorite targets for hackers. While no blockchain has been successfully hacked or manipulated, the companies and technology surrounding it have been. Security incidents have ranged from service disruptions to serious thefts of sensitive data, although the decentralised structure of blockchain networks makes them more resilient against network-wide attacks or tampering.

Loss of Login credentials: Even if any legitimate user loses/forgets his log in credentials, then he/she cannot do any transactions. As of now there is no way to recover the credentials.

To carry out the transactions one has to be in the particular network. That means anyone/entity outside that blockchain network, will not be able to do any transactions.

Quantity: In case of currency/trade blockchains (like bitcoin blockchain) the currencies availability has to be predefined well before block-chain initialization of the blockchain. That means once the block chain starts, you cannot change the amount of currency in the middle, while in production.

This will create the scarcity down the line or lose it value due to huge sell off due to some country central banks regulations or due to some speculations in any part of the world, where there is control over the government agencies

Resources: Transaction approval with puzzle solving requires high hardware and electrical resources. But this is concentrated with one or very few entities in any part if the globe. As of now mostly China (one country) maximum number puzzle solving high end server class machines with few entities. If the approval is with one entity who controls the verification is a risk. This may lead to monopoly and then to wrong approvals (technically possible).

In the smart contract based blockchains such as Ethereum, the transaction fee (gas) may also depend on the size of the smart contracts/attachments (block size). If the size is more, the fee will be hefty. This is a problem with peer to peer network.

Lack of supporting Infrastructure: The blockchain needs an already existing platform to operate. In particular, it requires a robust internet connectivity for nodes, reliable electricity source and resilient hardware pieces. These are not always available in every part of the globe. Since this requires high resources for transaction approvals (solving the puzzle), it requires high real estate - hardware configuration and electricity. If the competition increases in this area, the currency earning to them will come down over the period of time.

Tech savvy environment, Volatility, Complexity, Signature verification are a few others to name.

Looking at the potential of the blockchain, these drawbacks are not reason enough for any organization not to embrace the new technology.

IMPACT ON ACCOUNTING:

The blockchain can change accounting in a significant way.

It is safe to predict that International accounting bodies will soon feel the pressure to come up with frameworks, guidelines and Principles on the application of this technology.

Time and again, all new innovations, technological or otherwise, will have to pass thru finance or accounting in some way or other. Blockchain technology cannot be an exception. After digital world, accounting process did see vast changes by way of new softwares or technology entering into accounting and this gave many advantages. Controls were put to better place with the advancement of technology which brought efficiencies and other benefits.

The following are the ways by which technology will change accounting:

Automation of Reconciliation: Significant hit is expected to be on this department called reconciliation. Bigger companies have separate departments for recons and once the blockchain is adopted at large, necessity for reconciliation department and personnel working for recon will disappear. The technology offers capacity for real-time verification and confirmation of transaction. And more importantly, it allows for linking of records and real-time synchronization and reconciliation. This could mean scrapping of reconciliation department and personnel working in them changing their professional focus.

Also, inter-company transactions would have fewer errors and staff working on only inter-entity transactions would have time to spend on other value addition tasks. Similar situation would be on service providers who routinely do vendor or customer reconciliations. This however will bring an additional benefit of real-time balances.

Month close process: Month close or yearly close outs are tedious process now. Individuals will put in hours and even days to complete them. Blockchain technology would remove the greater part of the procedures involved since automation would complete majority of the month close exercises. All monotonous jobs that support closes can be automated. Books would constantly reveal progressing, live data and in this manner prerequisite for tackling close process would deny.

Paper less world: Due to its features of real-time data processing, transparency and immutability, the blockchain could move us into a paperless world. Most of the technology or softwares are

already following this concept of removing paper work. But developing nations like India still has lot to do on this front and blockchain could be the piece that will help us cross over.

Authenticity or Authorization: Blockchain would define permission for authentication and hence no document would move to next or payment level unless authenticated using private keys. This would leave a strong, almost zero error and no fraud situation.

Improve interface with Government: Blockchain would help governments a lot. Enormous tax evasion can be avoided by blockchain technology.

On the blockchain all stakeholders will always be on the same page—almost literally, this includes government agencies. There will be no need for one to report to another for the necessary steps to be taken.

At the moment the tax assessment process is a long and cumbersome process. Blockchain would help governments stop tax evasion. With smart contracts embedded into transactions via blockchain, tax calculations can become an easy and not only to management, but also to relevant government authorities.

Triple entry accounting system: In year 2005, Ian Grigg, came up with this new accounting concept which many of us would never think of - 'triple entry'. Blockchain is added to the to double entry system to create this new system. Every transaction would have an asset and liability and additionally 'receipt' becomes integral part which in turn gives need for authentication. This authentication will now be termed as triple accounting. In addition, entries from third parties are linked to the system through smart contracts on the blockchain.

AP or AR: We could gradually see reduction in AP or AR handling personnel as blockchain would eliminate few steps, like validation, and need to understand blockchain would become inevitable for accountants.

Due Diligence: Record checking, authenticating, validating and certifying are some of the most pressing data processing needs and consumes many man-hours. Blockchain can make these processes real time, significantly reducing the manual input required and the time required to complete.

Taxation: With proper smart contracts embedded into transactions via blockchain, tax calculations can become a easy ball game and not only management, but government authorities can also have information of tax payments or tax liabilities in their finger-tips.

Impact on Costing & CMAs:

Cost and management accountants (CMAs) should be interested in this new technology. That is because from the outset it cuts the cost of running businesses in many ways including those that come through auditing and assurance. Most importantly, however, is that the technology provides tools for tracking and recording costs in real-time.

It is important to point out though that the building of the blockchain capacity and the necessary tools relevant to cost and management accountants might have to be done by engineers and developers.

It is however upon cost and management accountant themselves to provide the correct designs and the needed continuous guidance for the right outcomes to be achieved. Institute might come up with its suggestions or FAQs on the treatment of cost involved for implementing blockchain technology.

Sections of costing - absorption, standard or any kind of method would have to be taken care during programming stage itself. Costing department might have to be given special privileges to access data for their analysis. FP&A would need more understanding of the technology and this would make everyone tech savvy.

Scope of CMAs might move to strategic decisions right from initial stage of programming to the end stage of implementation. It would be naive if CMAs don't step into technological shoes and understand few terminologies and be prepared for next industrial revolution 4.0.

While scope of the financial audits can drastically decrease, cost audits might become obsolete if the technology is successfully designed and implemented. Cost controls might automatically fall in line and categorisation of revenue or expense may be taken care in programming stage only and need to split them into appropriate heads can be automated leaving no error for leakage.

All these calls for CMAs to be well informed about the potentials and limitations of the technology. What a better place to start than reading this book— Blockchain Technology - Guidance Note for CMAs, by Murali Mohan.

GST ERA

As such GSTN can be termed as containing few properties of Blockchain - mainly shared or visible by all parties viz., supplier, customer and government. Once Blockchain finds its way and becomes more robust and more people start using it, GSTN can modify its structure and bring in blockchain to its conceptuality.

GSTN can use the concept of decentralising its whole network and help public get into blockchain mode which will not only help public but also government where everyone can track their transactions and also the related parties' transactions. Big players like Microsoft, IBM, SAP, Tally etc., can support government and get onto adoption of blockchain by nurturing its style of working.

Once banks join hands to be merged with GSTN, blockchain can easily peep in the blood of businesses and tax evasions will go to minimal level. A good project has to be drawn by GSTN by considering all parties - industrial associations, bigger firms, financial institutions etc. to make sure blockchain finds its easy way. A common, accessible and affordable blockchain has to be built in by government to monitor GST.

Conclusion:

With the pace, study on blockchain going on around the world, it could turn out to be the next internet. It could conquer telecommunications and even mobile devices will soon support and fall into its gambit. Accountants should make sure they are at the front with other professionals in understanding the basics of this technology. Institutes must start looking at options of building viable blockchains that meet the unique needs of the space.

Change is constant and moving with it is the only way to remain relevant in any business or profession. Blockchain is leaning towards being inevitable for accountants. It is therefore important that CMAs should understand it and get trained about it so that they are ready to spearhead its adoption.

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BLOCKCHAIN TECHNOLOGY THE POWER HOUSE FOR INDUSTRY 4.0 ERA

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Advancements in digital technologies in Industry 4.0 era have started bringin in quantum leaps in transformational impacts on systems and processes for value deliveries to business stakeholders. It has already shown potentials forenormousminimisation of value destructionsand surfeit of 'innoventive' value creations. Some of these technologies will cause shift to higher trajectory of quality and speed formultifaceted servicedeliveries by any government both at federal and county levels.

Blockchain is one of the most welcomed technologies of this new era. Digital scientists are categorisingit as a medium to high impact creating technology. But the present author's divination is that it has power of creatingground breakingtransformational impacts. Ithas immense potential to benefit people at the lower strata of society, more than what www has rendered in the immediate preceding era.

This paper has been written in sequel to the present author's first paper[1] on Blockchain, which was published in February 2018 issue of this journal. Objectivesare to

demystify myths and perceptions about Blockchain, take a brief account of its applications in solution building, humane dimensions, imperatives for digital scientists, and regulatory interventions that are necessary to achieve success in applications of this technology. The present author expects readers, if possible, to read his earlier paper for the benefits of continuity.

Research Methodology

Even after extensive research, one is hardlyable tohunt out hard facts andauthentic literatureson Blockchain as the technology has started evolving. However, news items, viewpoints of IT and legal professionals, blogs by academicians and opinion makers, etc. can be mined out from cyberspace. Any author on Blockchain, therefore, does not have options but to refer those.

The present author, however, has the benefit of interacting with many 'startupians', first generation entrepreneurs, digital scientists from world class MNCs, academicians, senior business professionals and opinion makers who are directly / indirectly associated with Blockchain applications. He has viewed their presentations, interacted in one-to-one meetings in events, e. g., National Blockchain Conference, Vizag, held in October 2017, World Block Chain Summits, in Dubai and Moscow held in October 2017 and April 2018 respectively. Desk-top researches had to be conducted to explore information and data points for his own inaugural keynote presentations, as the Chairpersonof those two summits and moderating three panel discussion sessions. This paper is being presented with researched out information and viewpoints gathered during interactions with those professionals.

Genesis of Blockchain

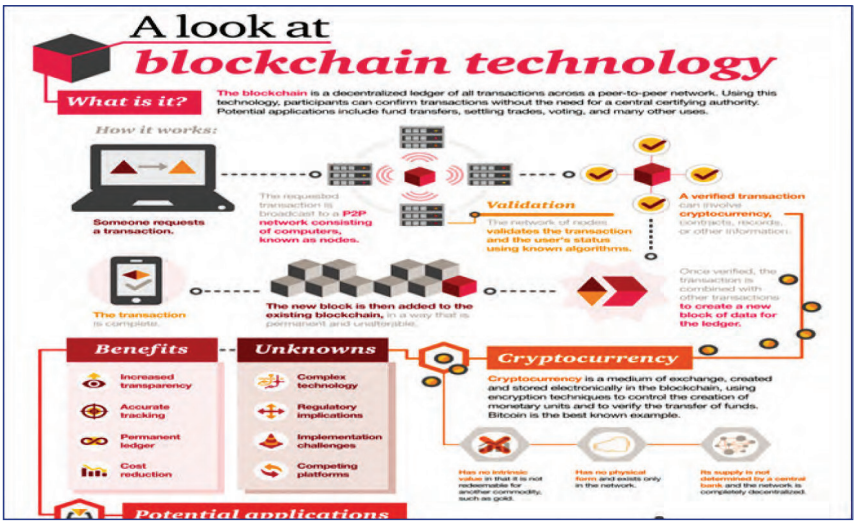
Ideation and the first use of this technology can be traced after the global financial crisis of 2008. In his article[2] Bernard Marr wrote that when "Satoshi Nakamoto, whose true identity is still unknown, released the whitepaper Bitcoin: A Peer to Peer Electronic Cash System in 2008 that described a 'purely peer-to-peer version of electronic cash' known as Bitcoin, blockchain technology made its public debut."Nakamoto'sseminal idea is based on a'chain of digital signatures'.There are differentviews whether Nakamoto was one person or the pseudo nameof a group of professionals who initiated Distributed Ledger Technology (DLT). In subsequent sections DLT and Blockchain has synonymously been used.

Tim Harvey[3] observed that, "..... However, a March Newsweek article raised the possibility that Nakamoto is a very real recluse living in Temple City, Calif. See "The Face Behind Bitcoin," (http://tinyurl.com/mhcq3ok) by Leah McGrath Goodman, Newsweek, March 6, 2014....."Objective of this paper is not to indulge into such controversies.

Keeping aside those, Bitcoin was thus born in 2009, followed by other crypto currencies (CCs). Bitcoin and CCsare being touted to be another asset class for investments and safe medium for conducting financial transactions.

Core of Blockchain

Essentially Blockchain is a cryptographically enabled computing system with distributed ledgers maintained in and accessible from the computing device of each participating user.Every usermust log into the platform from his / her device, called a Node in the whole chain, using both his / her private key and public key. Any user can viewearlier transactions by linking with the public keys of the initiating participants. He / she canalso initiate a fresh transaction or one linking withany previous transaction. No third-party authentication is required since every user accepts the terms and conductions of the 'Smart Contract' embedded in the platform. No usercandelete/ modify earlier transactionsof any user(s)in any manner and under any circumstances.



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Since every two-key sign-in and all transactions are cryptographed and simultaneously maintained in distributed ledgers of each Node, it is almost impossible to be hacked or infiltrated with a malware. The hacker must apply a superfast algorithmic tool, beating all developed so far, and use a computer with supersonic speed to decrypt those entries before hacking. Information privacyand safety will further be enhanced with implementation of 'General Data Protection Regulation' by the EU from May 25, 2018. In India, a similar Bill is in advanced stage of drafting by the Justice B. N. Shrikirshna Committee.

From around 2014 other digital scientists explored more and started developing private blockchains for alternative applications. Marr's3observed thatVitalikButerin, one of the co-founders of Ethereumand contributors to Bitcoin codebase, wanted to removethis technology's limitationof only dealing with a digital currency. He launched in 2015 the second public Blockchain called Ethereum, which could handle different types of transactions with the help of a built-in 'Smart Contract'. This version of Ethereum attracted attentions of multinational corporations likeMicrosoft, BBVA and UBS, because of its vastbusiness potentials,powerful ability to disrupt legacy systems and ushering in a new era.

Demystification of Blockchain vs. Cryptocurrency

Such a genesis of digital currencies, and because transactionsare conducted using a cryptography enabled DLT platform, this technology in common parlancehas become near cent percent synonymous to cryptocurrency. This perception is perhaps because a common man is yet to observe and experience widely used applications of this new technology. Readers will recall thatinternet was initially equal to email only till hundreds of other applications were developed. Let this be clear that Blockchain is not a crypto currency and a crypto currency is not equal to Blockchain.

A section of experts has attributed certain reported frauds concerningCCs to the failure of DTL. Many haveconcluded that Blockchain cannot prevent frauds like any other technology. Let this first be clearly understood that the meteoric rise and extreme volatilitiesin prices of Bitcoin and other CCsare not due to the underlying DLT but mainly due to interplay of factors, viz., demand, supply, human greedand many others influencing business and financial ecosystem.

Again, the reported frauds related to Bitcoin, etc. are not the frauds committed by infiltrating into the DLT. Human gluttony and ulterior motives have played their forceful roles like in any other cases of economic offences. Such frauds have mostly occurred in the course ofCCs being traded in exchanges operated byseparate entities. Most of the buyers and sellers do not directly accessthe underlying DLT platform from their respective Nodes.Their brokers in those exchanges do.

Readers will recall the newspaper item4 that US Justice Department has been reported to have started probe into suspected Bitcoin price manipulation. It will be worthwhile to quote a portion from the report – "Authorities worry that virtual currencies are susceptible to fraud for multiple reasons: scepticism, that all exchanges are actively pursuing cheaters, wild price swings that could make it easy to push valuations around and a lack of regulations like the ones that govern stocks and other assets."

Blockchain – The Power House of Industry 4.0

Solution architecture for dealing with business operations can be developed using an in-houseor external vendor's Blockchain dovetailing with digital transformation strategy. External DLT platforms are available based on opensource, permissioned, or hybrid arrangements. Readers may know more about eight such public Blockchains, viz, Ethereum, Hyperledger(Sawtooth Lake), Multichain, HydraChain, Open Chain, IBM Bluemix Blockchain, Chain, IOTA in the article of Shyam Purakayastha5. However, one must take due care before selection of the public DLT. Rohas Nagpal6 has written about 17 more platforms which are "purely peer-to-peer version of electronic cash."

At this stage readers are must be keen to know what all applications are possible using Blockchain. The present author hastried to compile the following illustrative list, which is in no way being claimed to be comprehensive, because every week and month a new use is being ideated, developed, tested, and / or put to pilot or full commercial use in some parts of the world.

Finance, Industry, Trade and Commerce	Government Service Functions and Others
1. Banking,Insurance, Credit history, FinTech	I. ***Government functions and services***
2. Cross border P2P and B2B remittances	1. Citizens identity management and Passport
3. Investments in capital assets, Derivatives	2. Public voting
4. P2P Lending, Crowd funding, Micro finance	3. Land registration, title deed and mortgage
5. eCommerce, Software Apps sale	4. Wills and inheritances
6. Health care	5. Underground water use management
7. End to end export-import business	6. Correction houses, orphanages
8. Multimodal supply chain	7. Gun safety management
9. Real estate listing and rental	8. Law enforcement and crime management
10. Sea and dry port management	***II. Others***
11. Security trading, stock exchange management	1. Music streaming

Finance, Industry, Trade and Commerce	Government Service Functions and Others
12. Contracts – Digital Rights, Wagers, Escrows	2. IPR of singers and musicians
13. Public transport and ride sharing	3. Donations and charity, old age home
14. Public car parking at airports	4. Protection of right to speak and write
15. Pollution control devices and carbon credit	5. Testimonials and credential documentation
16. Travel and leisure management	6. Cloud storage and cybersecurity
17. Warranty and maintenance services by OEMs	7. Education
18. IOT and Blockchain of Things	8. Human resource

The following information are relevant and useful to know in the context of Blockchain technology applications and implementations:

- Power of Blockchain is being further enhanced with simultaneous applications of Artificial Intelligence, Machine Learning, Deep Learning, Predictive Modelling and Internet of things. In near futureSwarm Computing and Human Brain-Computer Interface are expected to enhance the power of Blockchain.

- Existing and established entities can migratefrom legacy systems to DLTbased operations and accept payments through CC.The myth that Blockchain is for startups only has been invalidated by a European company called ParkinGo.

- There are several instances of service providers using Blockchainresorting to issue of their own CClike Helthureum for healthcare management. Some startups are also using and / or planning for Initial Coin Offering (ICO) of CCs as medium of raising funds for their projects, e. g., GladAge.

- As is evident form the above list DLT can encompass different streams of activities in one application. Therefore, very existence of embedded 'Smart Contracts' will transcend multitude of legislations withinand across sovereign boundaries when participants are from different countries, e. g. export-import transactions. This will cause legal disruptions.

- As per the findings of a recent survey of Gartner, worldwide 20.4 Bln. connected things will be in use by 2020, as against 8.4 Bln. in 2017, i. e., increase by 142%. But the centralised model that currently supports billions of smart devices connected to the IoT devices fails to address several critical risk issues. Technologists are trying to use IoT devices like tracking / tamper proofing seals, powered by Blockchain,to eliminate cyber-physical gap and create a transparent and responsible system for logistics management. This concept is being christened as 'Blockchain of Things'.

- Efforts are also on for ensuring omnichannel delivery with interoperability between more than one DLT platforms. These will add versatility, e. g., paymentsusing a digital currency, offered by a separate FinTech operator, while business operations are done in a different DLT. This will enhance user acceptances.

- International Decentralized Association of Cryptocurrency and Blockchain (IDACB), is working on basic principles of market legal regulation and synchronize law initiatives for various countries in Blockchain and CCs. Efforts are on to propose law initiatives for regulators based on best countries' practices. IDACB is said to already have memberships of about seventy-five countries.

- Some digital technologists are working for ushering in the requirements Industry 5.0 by cerebral designs of their Blockchain in such a flexible manner that each customer will have the option personalise his / her own needs and meet his / her unique requirements by using the platform the way they want.

Recent Developments

The following is an illustrative list of major recent developments. These will provide directional guiding lighttodigital scientists fortheir journey through roadless paths to the dreamdestinations of Industry 4.0.

- *"U.S. regulators are still looking into cryptocurrencies and initial coin offerings, but don't aim to suppress the industry, according to comments made during a panel*

at CoinDesk's Consensus 2018 conference in New York."[7]

- *"On May 16th, (2018) The European Parliament Committee on Research, Industry and Energy, passed a blockchain resolution, and included a section on initial coin offerings (ICOs). ... Greek S&D member Eva Kaili said that it was an important moment because this was the first time a big institution such as a Parliament was discussing the regulatory framework requirements for distributed ledger technologies and blockchain."*[8]

- *"J.P. Morgan Chase & Co. is experimenting with the way blockchain could help cut costs and facilitate smoother transactions within capital markets. ... The bank demonstrated a prototype of its blockchain-based platform for capital markets, called Dromaius, on May 16th at the Consensus 2018 conference...said Christine Moy, executive director and head of J.P. Morgan's Blockchain Center of Excellence."*[9]

- Emirates Real-estate Solutions, the technology arm of Dubai Land Development Authority, will develop five real estate related solutions using Blockchain, viz, Title deed management, Smart sales, Real estate listing portal, Rental platform and Mortgage platform.10The readers may be aware that the UAE Government has already taken multitude of ambitious initiatives for making Dubai as the happiest and smartest city of the world by 2020. Blockchain will play a pivotal role for achieving this target.

Recommendations

The present author would recommend for technologists,users, sovereign governments, regulators and all other stake holders associated with Blockchain to reflect upon the following comments and recommendations while dealing with DLT for solution building. He is of the view that consideration of these will further augment the power and resourcefulness of Blockchain.

1. Power of Mind: Time immemorial Indian mythology, particularly Bhagvad Gita, has taught us that "We are born into the world of nature, Our second birth is into the world of spirit. But he who with strong body serving mind, Gives up his power to worthy work." It is power of mind and spirit that will determine sustainable success in Industry 4.0 era. This comment can be corroborated by the famous quote of Albert Einstein who said that, "The true sign of intelligence is not knowledge, but imagination."

2. Application of '7WH Principle': In present market-driven globalised economyrisks and ever-changing dimensions of volatilities, uncertainties, complexities and ambiguities (VUCA) in the business ecosystem are day by day becoming more unpredictable. To withstand and combat thesefive foundations are required fora business ready solution. Those are Trust, Shared value proposition, Value experience, Ease of application, and Sustainability. IT professionals will be able to test whether any DLT based solution is really built on those five foundations and an antithesis of those risks by testing for the following '7WH Principle'based questions ideated by the present author:

- What are the latent needs and demands of business, society and humanity at large?
- Who are the service providers and target customers?
- When the solution is to be delivered, updated and upscaled?
- Where is the universe of customer located and for what value?
- Whose regulations are to be complied with and for what risk coverages?
- Whom should the user refer to in case of trouble?
- Whether any better solution is being offered by competitorsfor edge in competitiveadvantage?
- How to minimise risks of and value destructions by legacy systems, assess and track users' delight to ensure sustainability?

At every step of system development life cycle (SDLC) the system developers must apply the above questions to ensure sustainable effectiveness and desired ROI of their solution.

4. Humane Dimensions: Technology does not have morality, passion, emotion, ethics and value generation skills. Technologists have. Success of Blockchain will depend on those humane qualities of solution builders, leaving least scope for the user to deploy against humanity with an ulterior greedy motive. Blockchain will attain 'Darling of the Mass' status like 'Internet' if it is adopted and applied with the mindset of universal altruism. It should be grounded on the foundation of sustainable shared values. Blockchain technologists cannot become just another 'Technology-tribe'. They should be harbingers of shared developments

for inclusive happiness of mass. Blockchain should have its own ism irrespective of globalisation and protectionism.

5. Regulatory Need: www has transcended geographical boundaries, Blockchain will have to transcend sovereign / political boundaries for achieving its dream to be the 'Powerhouse of Industry 4.0' with ground-breaking successes. Humanity is one and the world is its home. Hence there is definite need of a global regulatory body for directional policy guidelines, defining international code of conduct, tracking and monitoring of applications, etc., which must be followed by all nations, besides own internal regulations. Institutions like UN or WTF can take this role. Objective will be to ensure that this powerful technology can also achieve, besides success for industry, trade and commerce;shared developments for inclusive happiness of all till the lowest strata of society across the world.

Blockchain and CMAs

CMAs will find enormous opportunities for participating in the process of developing market driven entity-specific business strategies, dovetailing the same with digital transformation strategies, providing consultations for risk-enabled performance management, etc. They can immensely contribute for articulatingdigitally transformed business requirements, participate in solution developmentusingBlockchain, AI, Machine Learning, Forensic Data Analytics, etc. testing them before use. They can define revised policies and lay down SOPsfor clients. They can also add values by conductingRAGE (Required, Available, Gap and Essential)Analysis before the said 7WH Principle is deployed and tested jointly with the digital scientists. All these willcontribute forensuring sustainable value creation for business entities and the society as a whole for inclusive happiness. MA

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BLOCKCHAIN: CONCEPT AND PRACTICAL APPLICATION

"The technology likely to have the greatest impact on the next few decades has arrived. And it's not social media. It's not big data. It's not robotics. It's not even AI. You'll be surprised to learn that it's the underlying technology of digital currencies like Bitcoin. It's called the blockchain."

—Don Tapscott

CMA Suraj Kumar Pradhan
Joint Director
Ministry of Finance
New Delhi

The controversial cryptocurrency Bitcoin suddenly caught the attention of the world when during the mid December 2017, its per US dollar exchange value came close to $20,000 from less than $1000 a year ago registering an astonishing growth of more than 20 times. However, its exchange value soon fell to less than $7000 within one and half month. Warren Buffet, the CEO of Berkshire Hathaway and world's 3rd richest man is very critical of cryptocurrencies and according to him Bitcoin and similar cryptocurrencies have no value. He even compared bitcoin with rat poison. The sceptics of Bitcoin compared it with "tulip mania", related to the Dutch financial craze for tulip bulbs in the 1630s. This article is however not related to the Bitcoin currency but about the technology behind it, the blockchain technology, which is slowly gaining acceptance among the technocrats. As per Mark Sigal, "The blockchain technology, as a mode of decentralization, has a potential to be next major disruptive technology following the mainframe, PC, Internet, and social networking/mobile phones to bring about paradigm shift in worldwide computing, with the potential to influence every sphere of human activity".

Growth of internet increased the horizon of the business by creation of virtual space and eliminating the need for place where buyer and seller can meet. This also created the need for transferring money through electronic payment. Traditionally, the electronic payment system is based on trusted third party model, wherein a trusted third party authorises the transactions between the payer and payee in exchange of transaction fees. This system becomes costlier when value of each transaction goes down due to relative increase in the fees per transaction.

To address this problem, Satoshi Nakamoto in his paper Bitcoin: A peer to peer Electronic Cash system proposed a electronic payment system, which was based on cryptographic proof instead of trust, where two willing parties to transacts directly with each other without the need for trusted third parties. This system was based on a peer to peer distributed timestamp server to generated computational proof of chronological order of transactions, which also addresses the double spending problem.

Objective

Blockchain is relatively new technology which was introduced just a decade back and there is still long way to go for its acceptance and adoption by masses. Even for the all pervasive internet, it took around 30 year for acceptance and adoption by the masses. Even if the blockchain technology is regarded as next major disruptive technology, still there is very little awareness about the technology. This article is an attempt to decipher the nuance of blockchain technology and interpret the technical aspects of blockchain technology in dummy's language. Throughout the course of the article attempt is made to keep the article crisp without comprising on the understanding of the subject. Bibliography is suggested for readers interested in in-depth knowledge about the subject.

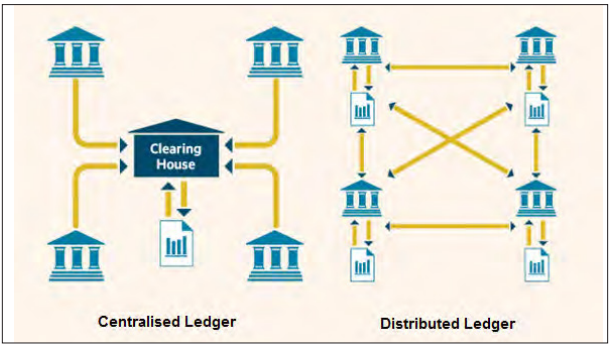
Introduction to the Blockchain Technology

In simple words blockchain can be described as chronological recording the transactions in form of blocks. For securing the transactions, cryptography is used. Each block is a cluster of transactions which are added to last block by reaching consensus about its authenticity among the users, which is then broadcasted to each users of the network for updating their database. Since the blockchain system is a chronologically arranged public ledger, recording all the transaction which is ever made, authenticated by distributed consensus method and shared among each of the participating users, it is very difficult to forge it. To understand the technology we have to understand its

features, which is enlisted below.

a) Distributed Ledger:

Under the traditional payment transfer mechanism, transfer of funds is routed through a trusted third party, banks for example, which authenticates the transaction. The transaction is then recorded and saved in a centralised server. User only receives copy of his transaction. Distributed ledger on the other hand, not only records the transactions, shares it with each of the participating parties. That means each user of the network is having the copies of all the transaction which is ever made in the system making it difficult for hacker to corrupt or hack the system, as he has to manipulate least 51 percent of users copy in the network to forge blockchain system.



(Source: www.ledgerfx.com)

b) Anonymity:

One of the important features of Blockchain technology is anonymity, which is achieved through creation of private key and public keys. Public key is utilised to create the address of the user which is broadcasted in the network for undertaking transactions and private key is used to authorise the transaction by the user. In Bitcoin blockchain system private key is an integer between one and about 1077. This private key is used to derive the public key which is an identifier of 26-35 alphanumeric characters. The public key is then hashed to arrive at address for the user. Blockchain ensures anonymity as transactions are broadcasted in network in form of address only i.e. when transactions are broadcasted in network, one can only able to see that one address has send money to another address and not the actual identity of the user. Anonymity is required only in public or permissionless blockchain, whereas in private or permissioned blockchain users or members are usually known and trusted.

(Source: https://blog.wetrust.io/why-do-i-need-a-public-and-private-key-on-the-blockchain-c2ea74a69e76)

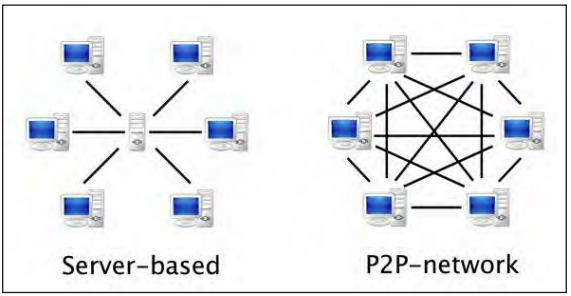
c) Cryptographic Hash function:

For making the blockchain system secure, hashing mechanism is used where input of any length is converted into output of fixed length. Under Bitcoin Blockchain, the transactions are taken as input and run through a hashing algorithm (Bitcoin uses SHA-256) which gives an output of a fixed length. In the case of SHA-256 (Secure Hashing Algorithm 256), no matter how big or small your input is, the output will always have a fixed 256-bits length i.e. expressed as a 64-bit number. This mechanism accommodates a fairly

large amount of input data (maximum possible size under 64 bit input is 2091752 terabytes). This function becomes critical when huge amount of data and transactions are dealt with where only hash is required to be remembered and tracked. Under hashing algorithm each input gives separate output and even a marginal change in input results in huge change in output. Therefore, only possible way to crack the hashing output is through "brute-force method" which means that you have to pick up a random input, hash it and then compare the output with the target hash and repeat until you find a match. The odds of this happening are astronomical. Under a 128-bit hash model possibility of finding such match is 2128 – 1 times which makes cracking of hash input in blockchain is practically unfeasible. Use of cryptographic hash function makes the blockchain system secure and reducing the possibility of forging it.

d) Network:

Blockchain uses a peer to peer networking model used by BitTorrent file sharing mechanism. It uses a flat topology with no hierarchical special server node. This means that all users consume services equally via consensus rules. As soon as transactions are broadcasted each user updates its copy of database containing the history of transactions. This model is different from client server model where data is stored in a central server and client needs to log in to the server to have access to requisite information. Traditional client server model is susceptible to data breaches due to singularity of data storage. Multiplicity of data storage makes it very difficult for a hacker to corrupt or modify the data. Such possibility arises only when a hacker is able to control at least 51 percent of users.



(Source: https://qph.fs.quoracdn.net/main-qimg-e22a0006a1277ad37aaa02360ef587ef7-c)

e) Distributed Consensus:

Blockchain is a decentralised peer-to-peer system having no central authority to monitor the fair happening of transactions. It therefore uses consensus mechanism for validation of transactions and resolution of disputes. There are four main methods of arriving at consensus in a blockchain system, these are: -

(i) The practical byzantine fault tolerance algorithm (PBFT): It is based on the potential solution to the Byzantine General's problem, where each user solves the problem, which is broadcasted to all users and consensus is determined based on the total decisions submitted by all users. Examples of Blockchains system which rely of PBFT consensus are Hyperledger, Stellar, and Ripple.

(ii) The proof-of-work algorithm (PoW): Bitcoin blockchain uses PoW method of reaching consensus where system uses 'hash function' to create conditions under which all participant are allowed to solve the equation but only a single participant is permitted to announce its conclusions which was independently verified by all other system participants. Hash function removes the possibility of arriving at the false.

(iii) The proof-of-stake algorithm (PoS): This method of reaching consensus is similar to PoW method except that participation in the consensus-building process is restricted to those parties having legitimate stake in the blockchain. Here hash function calculation is replaced with a simple digital signature which proves ownership of the stake. The network selects an individual to approve new messages based on their proportional stake in the network. Peercoin is the example which uses this consensus mechanism.

(iv) The delegated proof-of-stake algorithm (DPoS): The final method of establishing consensus is the most centralized, which works in the similar lines as the PoS

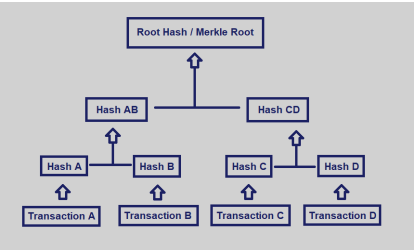
system, except that individuals choose an overarching entity to represent their portion of stake in the system. Bitshares is one company that employs a DPoS system.

f) Permission less:

There is a big difference in what blockchain system you need, depending on whether you allow anyone to write or only known and vetted participants can write. In this way blockchain systems can be categorised into either public or private blockchain. Public or permission less blockchains are ledger where anyone without any permission granted by another authority can read and write data. In the contrary in a private or permissioned blockchains network participants are known and trusted and writing of data by the chosen individual which is vetted as per their delegated authorities.

g) Storing of transactions:

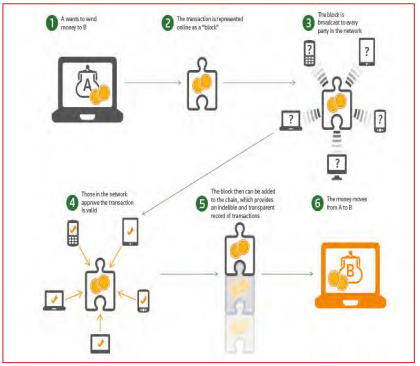
Under blockchain information are sequenced and stored in Merkle tree structure format, which summarizes all the transactions in a block by producing a digital fingerprint of the entire set of transactions, thereby enabling a user to verify whether or not a transaction is included in a block. The advantage of Merkle tree is instead of storing all the input, only hash function can be stored for verification of authenticity of transactions. Merkle trees are created by repeatedly hashing pairs of nodes until there is only one hash left (this hash is called the Root Hash, or the Merkle Root). They are constructed from the bottom up, from hashes of individual transactions (known as Transaction IDs).



Merkle Tree (Source: https://hackernoon.com/merkle-trees-181cb4bc30b4)

Understanding the blockchain process

The various features of blockchain are like the Jigsaw puzzle, where it is easier to solve it once all of its parts are collected and their functions are understood. The blockchain process starts when a transaction is initiated by a user. The user or the sender then uses his private key (digital signature can be used alternatively in the private or permissioned blockchain) to authenticate his identity. The content of transactions is then hashed to make it secure. After hashing the public key is added to the hash to send the transaction to the recipient. Recipient then validates the transaction by using his private key. This mode of transaction suffers with a inherent limitation especially in case of digital currency or transactions where some valuables are intended to transferred. Limitation in such transactions is recipient will never be sure whether sender has double spent the currency or the valuables. Sender may at the same time initiate the same transaction to the multiple recipients. To avoid such erroneous or fraudulent transactions consensus mechanism is used in the blockchain mechanism. Under which, transactions are broadcasted to in the network to arrive at consensus based on the respective blockchains pre determined on consensus mechanism for validation of transactions. Once validated it is added to the existing blockchain with time stamping ensuring that transactions are chronologically recorded. Beauty of the blockchain mechanism is that the recipient has to worry only about the double spending of previous transaction. The later and earlier transaction is automatically taken care of by the system itself. The blockchain system in respect of digital currency is dramatically shown below.



Blockchain System overview: (Source: https://blogs.thomsonreuters.com/answerson/wp-content/uploads/sites/3/2016/01/ infographic-how-blockchain-works.jpg)

Application of Blockchain Technology in various fields

Blockchain was created when first cryptocurrency Bitcoin

was introduced to the world by Satoshi Nakamoto in 2008. From the creation of first cryptocurrency to till today block chain is still evolving and as per Swan, 2015, blockchain 1.0 is currency, with applications related to cash, such as currency transfer, remittance, and digital payment systems. Blockchain 2.0 is contracts, the entire slate of economic, market, and financial applications using the blockchain that are more extensive than simple cash transactions, stocks, bonds, futures, loans, mortgages, titles, smart property, and smart contracts. Blockchain 3.0 is blockchain applications beyond currency, finance, and markets-particularly in the areas of government, health, science, literacy, culture, and art. Similarly as per Mark Sigal (2011), blockchain is one of the five disruptive technologies in the field of computing and today's connected world could usefully include blockchain technology as the economic overlay to what is increasingly becoming a seamlessly connected world of multi device computing that includes wearable computing, Internet-of-Things (IoT) sensors, smartphones, tablets, laptops, quantified self-tracking devices (i.e., Fitbit), smart home, smart car, and smart city.

The use of blockchain in various fields is unlimited. Out of which some are listed below:

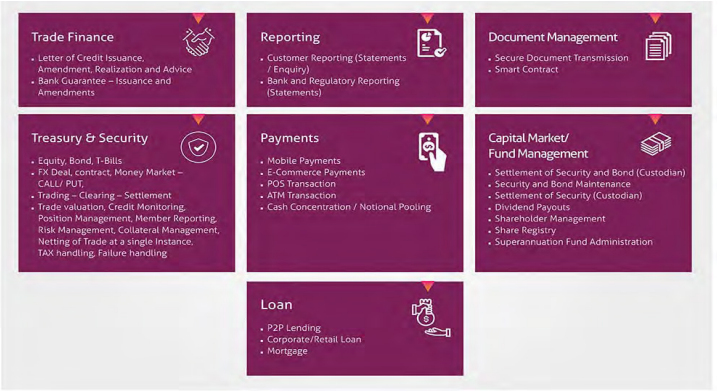
a) Cryptocurrency

Use of blockchain in cryptocurrency is well known. Blockchain originated from a Bitcoin cryptocurrency. The use of blockchain in cryptocurrency is already been explored to a large extent and as per website www.coinmarketcap.com more than 1500 types of cryptocurrencies are existing as of now. To ride on the revolution many of the central banks around the world started adopting blockchain technology to develope digital version of their own fiat currency to leverage the benefits of the underlying blockchain technology. Even Reserve Bank of India is looking at the possibility of introducing a 'central bank digital currency' which is tentatively named as 'Lakshmi' after the Hindu goddess of wealth.

b) Banking and Finance

As per the white paper "Applications of Blockchain Technology to Banking and Financial sector in India" published by Institute for Development and Research in Banking Technology in 2017, "Blockchain Technology has the potential to address certain limitations of the current processes by modernizing, streamlining and simplifying the traditional siloed design of the financial industry infrastructure with a shared fabric of common information. The advantages brought by Blockchain Technology can be broadly classified into cost savings, efficiency, and transparency". The modern financial system with a permission-based or private blockchain system can improve efficiencies by taking onboard all the beneficiaries to create a banking ecosystem to reap the mutual benefits in terms of moving cash and assets in real-time to settle market transactions.

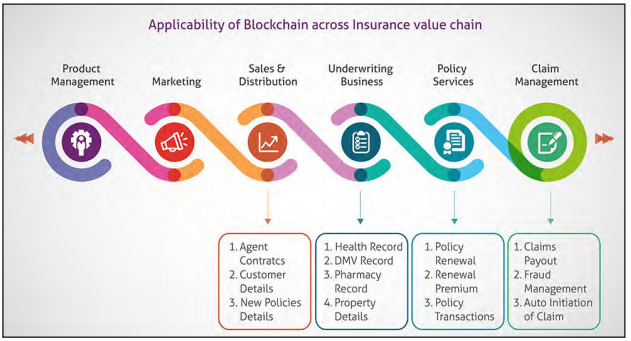
Use of Blockchain Technology in Banking and Finance



(Source: www.mindtree.com/blog/blockchain-banks-implementation-guide)

c) Insurance:

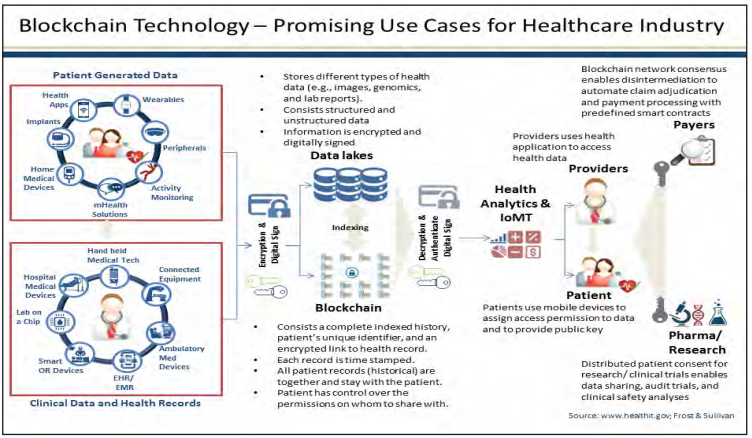
The use of blockchain technology has significant potential for entire insurance value chain. Certain insurance products can be automated through smart contracts, which will pay out against the insurable event without the policy holder having to a make a claim or the insurer having to administer the claim has significant attractions resulting in significantly lowering the cost of claims processing by reducing fraud opportunities. Blockchain has the potential to eliminate error, negligence and detect fraud by providing a decentralized digital repository to independently verify the authenticity of customers, policies and claims with a complete audit trail feature. This prevents duplicate transactions and provides a verifiable public record of all transactions.



(Source: http://umbertocallegari.com/blockchain-is-going-to-empower-or-disrupt-the-future-of-insurance)

d) Health Care:

The storage and sharing of health information presents an enormous challenge, including some important risks to privacy, and fantastic opportunities, including the potential to develop a practical understanding the health of unique individuals instead of generic humanity. Blockchain technology may revolutionize medical research and individual care by diving into this space and promising a new era of research and discovery propelled by analysis of aggregated longitudinal health information from individuals in the context of that from the population at large, and by a new ability for researchers to access data they need to gain new insights.



e) Digital Voting

This requires a geographically distributed network comprising of machines from both government and public infrastructure, which houses two distinctly separate blockchains, one for voter information such as who has voted and the other for vote information such as what has been voted. These blockchains are held completely separately to remove any threat to link votes for certain parties back to individual voters while maintaining the ability to track who has voted and how many votes are actually present. The blockchain containing information of who has registered to vote also allows service centres to ensure each voter in unique and as described by relevant authorities. Once registered voters are then allocated a vote after verification of their details has been completed.

Conclusion

Blockchain is regarded as one of the emerging technologies, which is still in evolving stage. The next wave of blockchain includes various innovation like hyperledger fabric, smart contracts etc., which addressed the earlier limitation of bitcoin blockchain. In the initial years of introduction of blockchain technology, it was mostly adopted by cryptocurrencies. The practical application of blockchain is limitless and researchers are still exploring the ways to fully exploit the potential of this technology. Looking at the pace of adoption of blockchain it seems that it will soon reach the critical mass, which will make the rate of adoption becomes self-sustaining and creates further growth. MA

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BLOCKCHAIN TECHNOLOGY –
AN EXPLORATORY STUDY ON ITS APPLICATIONS

"The blockchain will do to the financial system what the internet did to media"

Joi Ito, Neha Narula,and Robleh Ali - Harvard Business Review

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What is blockchain and how does it work? The blockchain is a public ledger where millions of people are connected to that ledger. For example, if we want to send money to someone what is the usual process? It passes through the intermediary called thebank or someone. But using blockchain we can send money directly to the concerned person. Here we may doubt that when transactions occur through an intermediary there is a great riskinvolved because someone can steal our data or something can happen, what if we can directly send the money to the concerned person? That is the advantage of blockchain since everyone isconnected to the block; a small change will affect the individual ledger of every person. So it is highly impossible to hack someone 's account and do data breach. If someone wants to do it then he has to hack millions of computers which are connected to the block simultaneously which is highly unlikely. It never allows manipulation, thedouble spending of money. Blockchain makes the changes instantaneously i.e it gives real-time data. It is tamper proof and brings transparency.

Review of Literature

(Sachchidanand Singh, 2016) In this paper,the author explains the importance of blockchain. He emphasized that it is a secure exchange digital currency, perform deals and transactions. And he says that each and every member in the block can have access to thelatest copy of encrypted ledgerwhere they can validate a new transaction. And the paper highlighted the need for the blockchain and how it is going to shape the future of banking, financial institutions and it can be adopted along with Internet of Things (IoT).

(Andersen, 2016) The author explains the potential of blockchain in accounting. He says that financial sector may undergo disruptive change. In his white paper, he explains the benefits of blockchain technology in specific to the accounting practices. Double entry process revolutionized the field of accounting and by using the blockchain technology we can create an interlocking system of accounting records instead of individuals. And he says this process is similar to verification done by a notary but in an electronic way.

(Jesse Yli-Huumo, 2016) In this paper,the author explains why there is attention to the blockchain technology. He says that because it central attributes which provide security, data integrity and anonymity without any intermediary in control of transactions are some of the reason he quoted for the attraction towards the technology. And in his study, his objective is to identify how many people focus on bitcoin and blockchain. At the end of the study, he found that nearly 80% focus on bitcoin and only rest on the technology part. He also says that many focusing on improving the limitations of the technology but many of the lack concrete evaluation for the solution provided.

Objectives of the Study

- To understand the blockchain technology
- To study the various applications of the blockchainin various fields
- To analyze the future blockchain applications

Major Blockchain Applications

I. Fair Value Accounting:

Blockchain technology is tamper proof and transparent. That is where the idea of using it in the fair market value of accounting emerged.The Digital Age poses a considerable challenge to stay relevant on thebalance sheet. Basically,the accounting is based on historical value of data. If someone wants to invest money in some company,he will analyze the company's annual report at the most or he will check for aquarterly report of the data which gives himit 's pastdata of 1 year or 3 months. So with this information, they can predict results to some extent only. If the investor has the real-time data about the company he can do it in a better way and may take wise investment decisions.

For example, if a company acquires another company or when it merges with another one, it usually affects the balance sheet at the end of the year. So an investor will know about the assets and liabilities of thecompany at the end of the year, but by using the blockchain technology the change will be immediate and instant. It will never give chance for the companies/firms to manipulate their data and cheat the investor, which brings transparency.

By using blockchain it removes all intermediaries as mentioned earlier. If blockchain technology is used in capital markets then intermediaries are not required. Basically, we need them to know about the companies' position and to analyze the market. When everything is going to be transparent why we need them for transactions.Buying and selling of securities can happen quickly and moreover, it reduces the cost of operations. It can also be used in mutual funds, treasury and securities andmanaging Funds etc..

Already blockchain technology has been incorporated intothe banking sector. Tech Giants Infosys and TCS are aggressive investors and innovators in this technology. Infosys has already incorporated this technology into their

The one thing that never changes is CHANGE itself...! We can see how the smartphone has changed our lifestyle. In the late 80's and 90's, we had to wait/stand in a queue for a long time for calling a person.Gradually the cellphone came into our hands and now the smartphone. The entire world has shrunk into our palm. Same is the case with the internet evolution, Facebook etc., and now blockchain technology is on its way. It not only changed the way we use the internet but also revolutionized global economy. Though it is in initial stage of development,the kind of growth since its inception is massive. The question WHAT IF has more power because many great innovations have a start on this question. Likewise, this article speaks about "What if blockchain technology is used in the fair market value of accounting?" and this article speaks about the various applications of blockchain technology.

banking product finnacle and 10 banks are using this in testing mode. And banks like ICICI, Axis Bank, Yes Bank etc have made agreements with some companies to implement it in their companies.

Also because of its wide range of safety, even RBI is considering to adopt this technology. The IDRBT an RBI institutepublished a white paper with the title "Applications of blockchain technology in banking and financial sectors in India". This technology certainly helps the managers in credit appraisal, risk management and improves the efficiency in managing NPAs at banks.

This technology maintains 3 types of ledgers: public, private, permissioned. It depends on the need ofan individual. It paves the way for a company to interact with the customer directly. If this technology had been innovated before one or two decades back, then probably the 2008 sub-prime crisis could have been avoided.Also same is the case with Satyam Computers Limited fraud with one of the most valued firms PwC made manipulation.

The daily change in balance sheet may not be possible in the initial stages. So the change can be once or twice a week. Certainly, this technology will emerge and adopted in various industries soon. Then the market performance or trading will be differentfrom then. Most importantly this technology will bring down the number of cases filed with the Insolvency & Bankruptcy code in the country in future and protects the lender's andinvestor 's interest in business and development.

II. Initial Coin Offering (ICO)

The most difficult task for any budding as well as an established entrepreneur is fundraising. They really need a good network and negotiation skills, further, they need the luck factor. Also, they have to conduct several business meetings, presentations to clinch the offer of a funding which is a very difficult and time-consuming activity. But now this concept of funding is slowly changing because of the new buzz/magic word ICO (Initial Coin Offering). What is this ICO? How is this going to be a game changer? Is it good or bad?.

Someone said, "If you are not ready to be rejected at least 50 times when you are raising funds, you shouldn't even try!". Probably this might get changed due to ICO. Just talk to any experienced entrepreneur and he/she will tell you that fundraising has the least fun and it is the least glamorous job. It is stressful, uncertain and depressing too. Normally people think/feel that fundraising for a company is easy because of the potential of the company which raised it. But the real scenario is quite different. Even top business giants like Facebook, Flipkart, Paytm, Ola etc., faced and are facing a similar situation, and when they are not able to raise funds they sell the firm.

When you attract an investor you need to give a certain

portion of company shares to him. When you raise funds in multiple rounds, at the end you don't have your own stocks in your company to sell. Then the only possible way to raise funds is going to primary markets i.e. IPO which is not an easy task for most of the companies. Because of this only few companies like Facebook Inc., went to IPO whereas companies like Instagram, Whatsapp sold their companies to Facebook after 3 rounds of fundraising. You have to face so many rejections while raising funds. It is not an easy task. And no one will accept your proposal at first take itself. Whatever is discovered today becomes outdated tomorrow. When there are several companies readily available in the markets,why should they invest in your company?. Your proposal may get accepted after 173 rejections also. There are a large number of startups which closed due to lack of funds. Thanks to ICO (Initial Currency Offering) as a solution to startup financing.

Assume that you are a CEO of astart-up which makesan app called XYZ. The app has really got the traction among the customers and it has gained a considerable market share over the past few months and now you want to stimulate your growth and recruit more workforce so you are eagerly planning to raise funds. The available options are VC (Venture Capitals) or IPO (Initial Public Offerings) or Angel financing or crowdfunding campaign like kick starter which is difficult to manage. The other emerging popular option now is ICO's (Initial Currency Offerings).

The ICOs are also tough but not like the other options, even a new set up startup can avail funds through ICOs,provided it provesits credibility to the world what it intends to doon a white paper. The white paper is something like a pitch deck in the form of a web page by putting all the details like how your business model is going to work, how the token allocation will be done, technical information about your project, the team member-details etc., This one paper should give a broad and clear picture of your vision and it should give a crystal clear information for the investor to takean informed decision. Unlike IPOs, in ICOs a token or a coin will be issued instead of securities. The greatest and significant advantage in ICO is owners stake is not diluted i.e. the investor who is willing to invest money can invest only in the particular project and not in the company. At the same time, each and every movement will be monitored by them and decisions will be taken by them.Whereas in the case of IPOs, the company CEO will take decisions.

The present trend of Investors is that of expecting high returns in a short span of time. Probably it is the main reason behind bitcoinpopularity and global reach in a much less time. Suppose, if you have invested $1 in bitcoin in early 2015 it would have fetched, you around $7420. Often these days investors are thrilled to see 8% returns on their investments, for such investors $7420 returns is a huge return in a short span of time. But it is not the only digital currency which has seen this tremendous growth, there are a few others and this ICO is also similar to them. During 2016-2017 many venture capital companies found it difficult to fund start-ups, thisICO arranged paymentof rent with coins by creating a DIY patented research tool. According to the Inc.com cypherium, rentberry, loci, trippki, rightmesh, experty, nau, coinlancer, fansunite, giftz are the top 10 companies which have already got ICOs or are going to get it in 2018. The ICOs have raised nearly $327 million through fundraising which is very high when compared to the usual venture capital. Also, anything which comes fastis not good.

Analysis:

If there is a top then definitely there will be a bottom also. In this connection, the negative effect is when the public starts investing money and if it does not fetch the expected return, it will be difficult for the good projects to get funds, and there is no regulator aswell. Since there is no regulator frauds are possible and if many projects look alike or do not reach the expected level then it is of no use. Though many central banks and regulators are studying the digital currencies, except theUSA, no other country has raised concerns regarding this. In the USAhas mentioned that it will be considered as security and nothing more than that.When we look at things happening across the world, it raises several questions in minds whether it will be another dotcom bubble.

This skepticism creeps because of a global financial crisis with every investment opportunity being labeled as economic bubble including the bitcoin. The important principle in investment is to wait patiently fora long time in order to reap good benefits. Similarly, we have to wait for another 10 years or more to see how the world is going to use the blockchainto support ICOs, digital currencies etc.. It isgoing to be the game changer of theworld economy.

III. Economic Inclusion and Entrepreneurship

Financial inclusion is a prerequisite for economic inclusion.

Applications:

i. Digital Asset Registries

Following digital currencies and money transfer, one

of the biggest blockchain applications in development is digital asset registries. The same distributed ledger technology provides the means to record and transmit digital goods over the Internet, while ensuring that these goods cannot be copied or multiplied

ii.Leapfrog Technology

One of the highest-impact applications of blockchains could be as a leapfrog technology for global financial inclusion. It does not make sense to build out brick-and-mortar bank branches to every last mile in a world of digital services. Instead, eWallet banking apps might be an effective means of reaching the two billion "unbanked" people in the world (PwC, 2016). Even without phone-based banking, low-cost debit cards might effectively service the unbanked (Rogoff, 2016).

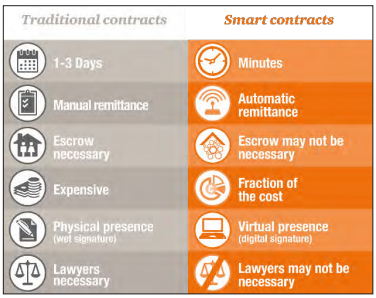
IV. Payment Channels and Peer Banking Services Following:

One of the most intriguing ideas being developed in the blockchain industry is payment channels. A payment channel is a financial contract executed over time in three steps:

i) One party opens up a payment channel with one or more parties and posts a pre-payment escrow balance on file,
ii) The party consumes against this credit over time, until
iii) The closing transaction in which aggregate activity is booked in one net transaction to close the contract.

V. Smart Contracts:

"A smart contract is a computer protocol intended to facilitate, verify, or enforce the negotiation or performance of a contract".



Simply put; a smart contract can facilitate the numerous touch points in a contract process, verify, and then enforce them.

Benefits:

- Instant Verification
- Authority
- Transparency
- Enhanced Privacy Structure

Conclusion

Block chain technology is not restricted to the above mentioned applications, it can also be used in a wide range of starting from electronic voting machine where we can have fair elections and it has been tested as trail in South Korea and they succeeded too. It can also help to reinvent the financial services system. Some of the financial companies started implementing use of this technology ina testing mode and many others are trying the ways to adopt to use it efficiently and many more applications. It can be adopted in each and every field. But as we know every coin has two sides likewise, it also has some disadvantages. But it can overcome with the rapid developments in technology. When internet came everyone was afraid how it is going to damages but now we are celebrating it. Now world has become like nothing can't be done without internet and many companies succeeded because of internet only likewise blockchain also will become in near future. MA

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BLOCKCHAIN TECHNOLOGY

WILL IT DISRUPT OR DISCIPLINE ACCOUNTANTS?

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Digital Technology or Disruptive Technology is the way of life today and so to say the future is towards digital world.The emergence of disruptive technologies viz., 3D Printing, Sensors, Bots, Robots, Internet of Things (IOT), Self-driving Vehicles, Simulation, Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), Big Data, Advanced Analytics, Drones, Blockchain etc., are dominating men and machines in every walk of human life. If you order any item online or over phone, it may soon be delivered by dronesreplacing the concept of door-delivery bydrone-delivery.

Disruptive Technology

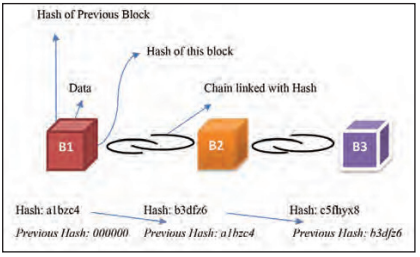
Disruptive Technology is one which displaces the entire existing technology or erodes the major part of use of existing technology. Digital photography disrupted the conventional film photography, pagers were completely disrupted by mobile phones and fixed or land-line phones were significantly replaced by mobile phones. Computers replaced typewriters and human-beings being replaced by robots are some of the examples of disruptive technology.

What is Blockchain?

A Blockchain is a kind of distributed database and is one of the Distributed Ledger Technologies (DLT) where data is recorded, stored and sorted into blocks. Unlike

centralized database, in Blockchain data is stored in various participating nodes. Blockchain is an enumerated list of records containing information. The individual enumerated records are called blocks and chained together using a cryptographic hash that is linked to previous block. Together these blocks are called as distributed ledger. The origin of the block is called genesis block and is the starting point of the chain. The data stored in Blockchain are immutable which means blocks created once cannot be altered without having cascading effect on previous blocks. Since it is distributed ledger technology, Blockchain facilitates peer-to-peer transaction without involvement any other third party. A Blockchain is a type of distributed ledger can contain financial or non-financial transactions replicated across the network on peer-to-peer network using cryptography.There is often a confusion between Blockchain and Bitcoin. Bitcoin is a type of unregulated digital currency know as cryptocurrency. Whereas, Blockchain is a distributed ledger technology that enables and maintains Bitcoin transaction ledger over peer-to-peer network without central authority.

Figure 1: Blockchain



B1 above is genesis block hence previous Hash is 000000, B2 isdependent on B1 and B3 on B2

What is a Hash?

Hash is a 64-character alphanumeric unique code assigned to a transaction. Typically, it works like a finger print of person making the transaction unique. Hashing ensures that original information cannot be seen by third party.

In a Blockchain, each block has a 'header' which contains technical information, reference to previous block, a digital finger-print (hash) of the data contained in the block and the contents of the block i.e., information about the transactions. Every time a participant of the network adds a transaction a new block is created. This is a key feature of Blockchain Technology making transactions more secure.

What is Distributed Ledger?

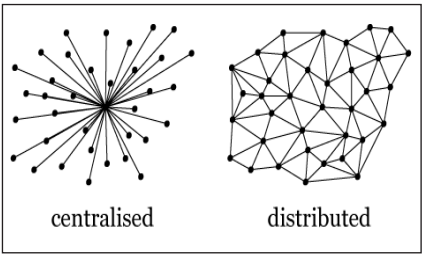
A distributed ledger is a database of assets or transactions that can be shared across multiple nodes in a network so that each participant has their own copy, with any change reflects in every copy almost simultaneously. Each transaction is recorded as a 'block' of data, and each new block has an encrypted copy of the previous block included within it. Blocks are then linked using cryptographic signatures to create a 'chain' of activity or transactions that are time-stamped, distributed and tamper-proof. In short, it creates an incorruptible ledger of information.

How is Distributed Ledger Technology Different?

Traditionally, ledgers are based on double entry book-keeping wherein for every debit there must be an equal credit. When a transaction is processed, one organization will record debit and the other records credit. Whereas in a centralized ledger a central authority maintains and appends the records to a single ledger and may choose to show a copy of that ledger to other market participants. Here the trust is placed on the third party who maintains the centralized ledger. For example, banks have total control over the customers' accounts as the banks maintain a centralized ledger at their end.

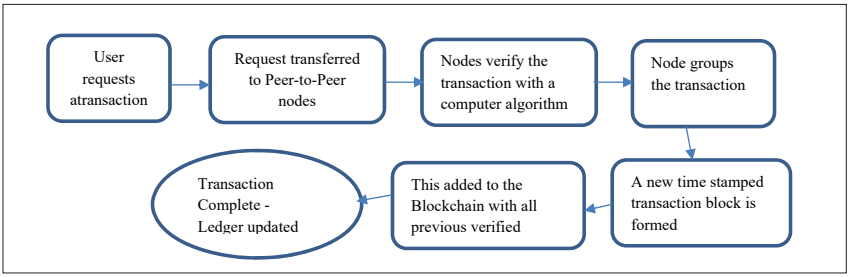
In case of distributed ledger, there is no centralized data storage or no centralized administrator. It is a database that can be shared across the network irrespective of geographical or any other constraint. Each participant connected to the network can have their own identical copy of ledger and any change reflects in all the copies of the ledger in minutes or seconds depending on the database. This ability to transact without the need of a trusted third party is the key feature of distributed ledger technology.

Figure 2: Centralized vs Distributed Ledger



How Does Blockchain Works?

Figure 3: How Blockchain works



Blockchain is a distributed ledger which can contain financial and / or non-financial information and is replicated across the network in near real-time basis over a peer-to-peer network. Every participant of the network owns the same copy of the ledger which gets updated whenever transaction is added. Transactions are highly secured and immutable. Uses cryptography and digital signature (time stamped) to prove identity, authenticity enforcing access rights.

There are three popular types of Blockchain.

a) Public Blockchain: In case of Public Blockchain anyone can transact on the network transactions are transparent but they are anonymous. Bitcoin and Ethereum are best examples of Public Blockchain. In case of Bitcoin and Ethereum transactions, participants of thesenetworks can see the transactions but the identity of the participant is anonymous.

b) Private Blockchain: In case of Public Blockchain the data is not available for public view. A private Blockchain network requires an invitation to join also a participant cannot read or write the Blockchain unless permission to do so. Private Blockchain is used by large enterprises with permissions defined between various stakeholders of the enterprise Blockchain. A bank can have its own Blockchain network for its private use with restricted access to its various stakeholders viz. employees, suppliers, customers, shareholders etc. In this case members are known but transactions are secret.

c) Consortium Blockchain: Consortium Blockchain is a hybrid model of public and private Blockchain in this case a group of companies or institutions can have their own Blockchain network to share the data among the consortium participants. A good example Consortium Blockchain can be CIBIL (Credit Information Bureau of India Limited). It is neither public nor private only a consortium of banks and financial institutions can access complete details of CIBIL network.

Blockchain Use Cases

Use of Blockchain Technology to Government

- Land records can be fully secured making it impossible to tamper
- Facilitates ease of credit availability to farmers from banks and prevents hacking of bank transactions
- Voter ID database can be strengthened so that a voter can vote from anywhere in the country and also avoids duplication in voting.

Use of Blockchain Technology to Industry

Use of Blockchain Technology while digitisation of healthcare industry brings transparency and significant change in public health. It also ensures genuineness of drugs and medicines, tracking expiry date of medicines etc.,

Use of Blockchain Technology while digitisation of education industry brings transparency in student records, faculty assessment, authenticity of certificates. This avoids requirements of attestation and verification of educational certificates.

Use of Blockchain Technology in oil and gasindustry ensures tracking of oil through the entire supply chain and facilitates immutable view of all events of assets life cycle. Smart contract based leases and termination results in reduction of legal costs.

Blockchain for Accounting and Auditing

Blockchain is an accounting technology, which deals with transfer of ownership of assets and maintaining ledger of accurate financial information. Use of Blockchain can increase the potential of accounting profession by reducing the cost of maintaining and reconciling ledgers. This may be a threat to accountants as automated reconciliations take away the work of accountants. But, Blockchain empowers the accountants that an asset exists with proven authenticity. However, the economic reality or economic value has to be validated by accountants.

Blockchain can improve India's current Trade Finance System. Blockchain Technology in identity management strengthensKnown Your Customer (KYC) verification process. Letters of Credit (LC) and Letters of Undertaking (LOU) can seamlessly be validated from end to end of the transaction cycle so that fake documents can be avoided.

Blockchain improves audit efficiency as auditors typically selects sample transactions and draws conclusion based on certain observations. However, use of Blockchain Technology facilitates time stamping feature observable on real-time basis. By using a hashcode, a unique 64-digit alpha-numeric signature is recorded corresponding to a single transaction. This hash code makes the transaction immutable (non-alterable) and establishes grater security. The same hash code appears at both the ends i.e., supplier and receiver.

Blockchain Technology can be potentially used in accounting and audit function. Blockchain ensures traceable audit trails, automated accounting and reconciliations, tracking of ownership of assets, authentication of transactions. Blockchain can be used as a source of verification for reported data. The days of sample based will soon be a history, as the auditors may soon use Blockchain Technology to test the entire population of transactions of a period under audit. This will extensively improve the level of assurance.

S.No.	Blockchain Features	Use in Accounting and Auditing
1.	Distributed Ledger	Since it is distributed ledger technology with no central authority it is almost impossible to hack all the nodes in the network. Provides highly secured environment
2.	Near Real-time updating	Transactions are recorded in near-real time basis at both the supplier and recipient end eliminates need for reconciliation.
3.	Digital and Time-Stamped (Hash)	All transactions are digitally time-stamped with a cryptographic hash, transactions are more reliable and authenticated.
4	Consensus	Transactions are updated only with the agreement between participants in the system and each block is linked to a specific participant.
5	Immutability	Data written to a Blockchain cannot be altered even by system administrator. This ensures greater data security and authenticity of recording

Case Study 1: Government of Andhra Pradesh- Bhoodhar Card

Andhra Pradesh has become the first State in India to adopt Blockchain Technology in Governance. Andhra Pradesh Government initiated the concept of Bhoodhar(Similar to Aadhar for People Bhoodhar is unique ID for lands) first of its kind in the country to secure land records using Blockchain Technology. This facilitates change of ownership of lands would be automatically recorded once the sale deed is registered. Lands based on the Unicode, are geo-tagged and the information automatically passes on to Revenue, Registrations, Survey, Municipal, Panchayat Raj and Forest Departments and are available instantly.

Case Study 2: Bajaj Electricals uses Blockchain to pay suppliers

The process cycle for bill discounting at Bajaj Electricals has come down from four to five days to almost real time after the implementation of Blockchain. Getting paid for materials supplied to Bajaj Electricals Ltd was a complex process for their vendors. It involves many steps including confirmation by Bajaj Electricals, making physical Bill

of Exchange by supplier, transportation documents and submission of invoice to Yes Bank for making payment. This was taking four to five days for getting payment credited to suppliers' account.

The company has explored a speedy and secure solution to replace manual bill discounting process using Blockchain Technology. In January, 2017 company went live on Blockchain based vendor financing developed by Yes Bank. This eliminated manual steps involved in the bill discounting process and entire transaction became almost paperless. Payment cycle came down to almost real time.

Epilogue

Blockchain Technology can bring revolution in the areas of banking, payments and money transfer, education and health, voting, trade finance, stock trading, real estate and insurance sectors. Digitization of accounting profession is still in its nascence stage compared to technical fields. Rather accounting profession is less disrupted than industrial technology! MA

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IMPACT OF BLOCKCHAIN TECHNOLOGY ON ACCOUNTANCY

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Paper currency is now outdated, digital interfaces are getting replaced by this new Blockchain Technology, which is considered as the most disruptive technology at present especially in the financial sector.

"Blockchain can be understood as a digital, immutable, distributed ledger that chronologically records transactions in near real time.

Blockchain which is also called as distributed ledger could help accountants gain clarity over the available financial resources and obligations of their organisations, and to utilise available resources, concentrate on planning and valuation, rather than recordkeeping. This technology has the potential to enrich the accounting profession by reducing the costs of maintaining and reconciling the accounting ledgers, and providing authenticity over the ownership and history of assets. Blockchain which was originally developed in 2009, to record crypto currency transactions has now evolved into a great number of applications such as financial markets, financial services, insurance, land registrations, voting, lease contracts and Government services.

Objectives of the Study

- To understand the accounting system
- History of accounting systems
- Triple entry accounting system, its working, advantages to accountants,

Scope of the Study

The scope of this paper is limited to bring the possibility of Triple entry accounting system if Blockchain Technology gets implemented in Accountancy. The paper is structured in two parts, first one deal with brief history of single entry and double entry accounting and Blockchain Technology promoting Triple entry accounting system and the second part deals with future of Accountancy and skills required by the accountants to meet the future challenges.

History of Accounting

Accounting is a system of recording and summarizing business and financial transactions. For as long as civilizations have been engaging in trade or organized systems of government, methods of record keeping, accounting, and accounting tools have been in use. Medieval Europe introduced monetary economy in the 13th century; merchants initiated recording multiple transactions by book keeping and for getting financed by banks.

Origen of Accountancy

An Italian mathematician and Franciscan monk Luca Bartolomes Pacioli, born in 1445 in Tuscany, is known as the father of accounting and bookkeeping, invented a system of record keeping that used a memorandum, journal, and ledger, He wrote *Summa de Arithmetica, Geometria, Proportioni et Proportionalita* ("The Collected Knowledge of Arithmetic, Geometry, Proportion, and Proportionality") in the year 1494.

Single Entry Accounting System

A single entry accounting system is normally maintained by small business units, only important aspects of transactions will be recorded. The basic accounts which are necessary will be prepared such as Cash A/c, Sundry debtor's a/c, Sundry creditors a/c the major account will be the cash book to record receipts and payments.

Assets and liabilities are usually not recorded in a single entry system; But to find out if the concern is making profits or losses, Statement of Profit/loss will be prepared; basically the difference between capital {ASSETS- LIABILITIES = CAPITAL (balancing figure)} of closing statement of affairs and capital {ASSETS- LIABILITIES =CAPITAL (balancing figure)} opening statement of affairs will be called as profit or loss. Statement of affairs is similar to Balance sheet except for the fact that capital will always be the missing figure.

Double Entry Accounting System

Double entry accounting is a system of recording where, each transaction with two aspects, one receiving/debit and another giving/credit. There is no limit on the number of accounts that may be used in a transaction, but the minimum is two accounts. Normally, accounts are prepared in T form, it means each account has two columns, left side is called debit and right side is credit and if any difference is there in the account, will be carried as balance. The following figure shows accounting cycle.

Transactions are recorded in journals and from journals, ledger accounts will be prepared the entire ledger balances will be entered in Trial balance and Final accounts will be prepared to know about the profitability and financial status of the concern. Entire process will be covered in a period of twelve months which is called as accounting period.

Fig: Double- Entry accounting system.

Issues with Double entry Accounting: (i) Double entry accounting system is time consuming, manual accounting system, is manipulations and errors prone. People can manipulate/alter the information.

(ii) Audit process will be very tedious and difficult as Double entry accounting system has numerous ledgers and financial statements, Audit proves to be very expensive.

Triple Entry Accounting System

Blockchain Technology based Triple Entry Accounting (Double-entry + Cryptography

Fig: Triple entry accounting system

Triple entry accounting system: It can be understood

that Triple entry system as an extension to the double entry system, in which technically, all accounting entries/ transactions are cryptographically checked and sealed, they occur simultaneously in the same distributed, public ledger, creating an interlocking and chained system of accounting records. In Triple entry accounting system, the transactions are recorded and distributed ,cryptographically sealed, manipulating /altering or destroying them to conceal any information will be practically impossible.

The term " Triple entry Accounting "was first used by Ian Grigg, financial cryptographer and described in his paper published in 2005 ,three years before the emergence of Bit coin and its underlying blockchain protocol.

A simplest explanation for triple entry:

Imagine, Company X buys goods worth Rs 100000 from Company Y, It means, as per double entry,

Company X	**Company Y**
Recording goods coming in and cash going out,	Recording goods going out and receiving cash,
Entry	Entry
Purchases /goods a/c _____Dr 100000	Bank a/c_____ Dr 100000
To Bank a/c 100000	To Sales a/c 100000

Now it will be, with Blockchain, each transaction will be recorded by the third party, and the third party is Blockchain, which verifies each transaction (Cryptographically) and a receipt will be issued.

Outcome:

Every transaction will be simultaneously recorded in the books of third party to be verified by the blockchain. As the transactions are entered in three places, it is called as Triple entry system.

Features of Blockchain Triple entry accounting system: Triple entry which is blockchain based accounting system has various features like, Smart contracts, Distributed ledger, double entry + cryptography, Tamper proof record, Validated and secured, and digitally signed agreements.

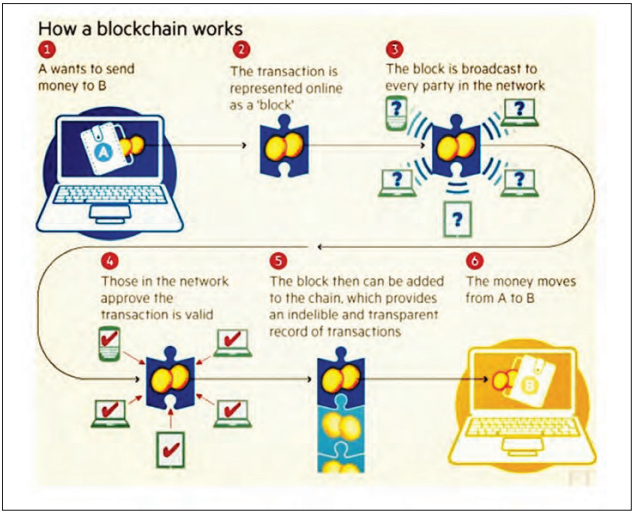
Working of Blockchain Technology:

An example showing the procedure that is required to be followed in Blockchain based Triple entry system.

1. Suppose, A wants to send money to B
2. The transaction is represented online as block,
3. The block will be broadcasted to every party in the network,
4. Those in the network approve, the transaction gets validated,
5. The block then can be added to the chain which provides an immutable and transparent record of transaction,

6. The money moves from A to B.

This can be well understood with the help of the following picture.



Source: Financial Times.

Advantages of triple entry accounting system for the Accountants:

➢ Quick access to information and Time saving,

➢ No possibility to commit any fraud,

➢ Immutable record hence no alterations are possible,

➢ Increased focus on client service,

➢ Technology driven, digital mobility opportunities,

➢ Talent management & succession planning

Future of accounting, opportunities for accountants' skills required to meet future challenges:

The emerging Blockchain technology is considered to be the most disrupting technology in Finance especially in Accounting and this technology provides the following opportunities to the accountants:

Accountants are experts in recording, book keeping, application of taxation and related rules, with the Blockchain Technology; they get opportunities to become Blockchain advisors and can join blockchain network.

Accountants can spend less time on identifying errors and mistakes and reconciliation works instead they can concentrate on areas like technical knowhow, advisory and related activities.

For all this accountants now must understand how this blockchain technology provides benefits to the organizations /Companies.

According to the Journal of Accountancy, the following truths, among others, are important to keep in mind regarding emerging blockchain technology:

➢ Blockchain is secure and cannot be hacked,

➢ Blockchain data can create new business opportunities,

➢ Educating yourself on blockchain will pay off.

Conclusion

A report by the World Economic Forum suggests that 10% of global GDP will be stored on blockchain-related technology by 2025. This implies that the way transactions are recorded and communicated will completely transform between at present and in the future. Implementation of this technology still requires time, the need for the hour for accountants is to acquire required skills and get updated with this new technology. MA

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GUIDENCE NOTE ON BLOCKCHAIN TECHNOLOGY

Blockchain technology has experienced exponential growth and innovation is driven by developers, start-ups and enterprise in all areas. The World Economic Forum has listed blockchain as one of the top ten emerging technologies of 2016. The meaning of the word Blockchain, according to Oxford Dictionary– 'A digital ledger in which transactions made in bitcoin or another cryptocurrency are recorded chronologically and publicly'. Blockchain technology forms the foundation for an internet-based peer-to-peer network that uses computer-powered cryptography to facilitate exchanges of value. Computers on the network(nodes), simultaneously verify and record transactions, allowing parties to complete transactions without the traditional trusted intermediary, such as a bank or credit card network. The obligation of ledger verification falls on the entire blockchain community as a whole. The digital ledger is almost impossible to manipulate records in a blockchain. However, Blockchain is different from Bitcoin. Bitcoin may be regarded as the entry point to understand the broader implications of Blockchain. In fact, Bitcoin is to blockchain as email is to the internet.

BLOCKCHAIN- A REVOLUTIONARY INNOVATION

"Blockchain is the most significant innovation in book keeping since double-entry accounting was introduced over 700 years ago. Traditional accounting required transactions to be recorded in two (or more) separate ledgers, depending upon the number of participants in the business network, and reconciled with each other. Blockchain means that there is only one common and indisputable ledger, which is agreed to by all parties."

-Juerg von Kaenel, Associate Director at IBM

Salient Features of Blockchain Technology

According to World Economic Forum, Block Chain has three main features: (i) veracity i.e. multiple copies (as opposed to a single copy) of the complete historical record of ledger entries are each verified by consensus. (ii) Transparency i.e it is a public record of activity that can be seen by all market participants.(iii) Disintermediation i.e. it operates using a peer-to-peer network, rather than requiring a specific central organisation. The salient features of Blockchain may be enumerated as follows:

1. Sharing of One Common Digital Ledger- Blockchain is a decentralized distributed ledger technology using cryptographic tools allowing the sharing of a digital ledger across a network of computers.

2. Transparency - Blockchain is a digital ledger which is fully public, continually updated by countless users. It is a list of continuous records in blocks(batches of transactions).

3. Reliability - The blocks are fully reliable and cannot be corrupted because the transactions cannot be altered retroactively.

4. Automatic System - It is also possible to program the Blockchain to record transactions automatically.

5. Measurability in Cryptocurrency - The monetary value of the transactions is usually measured in cryptocurrencies i.e. digital currencies

6. Disintermediation of the Ledger - It has the ability to transact without the need for any trusted central authority/ a third party intermediary.

7. Security and Privacy - Blockchain is secure as it cannot be hacked at all. It protects transactions and secures privacy.

8.Revolutionising Internal Record Keeping - Blockchain has the potential to change the way how records are kept and transactions are processed.

Review of Literature

The original concept of blockchain was published via a cryptography mailing list in November 2008 by someone under the alias Satoshi Nakamoto. The first commercial application built on blockchain technology emerged in 2009 as a digital cryptocurrency called Bitcoin, a peer-to-peer payment system enabling users to transact without trusted third parties. Literature review on Block chain accounting reveals that not many studies have been conducted in this area. However a few prominent studies have been discussed in this section.

Liebenau and Elaluf (2016) have discussed variety of applications of Blockchain within financial services. They have basically focussed on innovation around applications of the core protocol and on building a private and secure version of the blockchain. In another study by Brandon (2016) Blockchain accounting applications have been elaborated as "triple entry bookkeeping" as there are three entries that occur: the debit, the credit, and the

cryptographic signature of the transaction and three parties are there namely the buyer, the seller, and the blockchain network. Later Mori (2016) discussed the potential contribution of blockchain in financial transactions. The study observed that only 20% of the barriers to adoption are technology based, the other 80% being attributable to current business processes and business models.

Watson & Mishler (2017) explored this technology in many areas including stock trading, intellectual property, contracts, and accounting records. They observed its utility for accountants to manage ever-growing volume of transactions, prepare trial balance and financial reports, and analyze results in a timely manner. Similarly Broby and Paul (2017) also discussed the importance of Blockchain in financial settlements and in enhancing the reliability of financial statements. Brian(2017) regarded Blockchain as a technology to revolutionize economic sectors resulting in lower transaction costs and highlighted numerous advantages of this technology

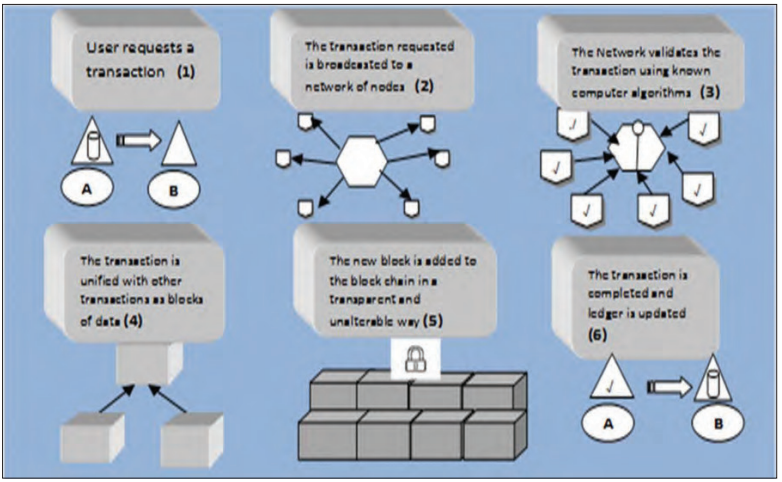
In another study by Iansiti and Lakhani (2017), Harvard Business School professors, in their paper entitled "The Truth About Blockchain," have termed blockchain as a foundational technology having potential to dramatically reduce the cost of transactions and reshape the economy. It could affect every agreement, process, task, and payment. Karajovic, Kim and Laskowski (2017) have performed a thorough analysis of the implications of blockchain technology in the accounting profession and its broader industry. In a recent study by Johnson (2018) he has defined and illustrated blockchain and its current and future use around the world. Blockchain provides technology services in a highly efficient and capable manner and has the potential to change the world for the better.

Blockchain Accounting: Transforming Accounting and Auditing

Under Blockchain Accounting, all transactions are recorded in a virtual block, and after some time, a new block is created, linked to all the previous blocks in the chain. The blocks are visible to both parties involved in the transaction. All of which makes it a system well-suited for storing and sharing accounts. Figure 1 illustrates the working mechanism of Block Chain Accounting.

Accounting, auditing and compliance are a massive cost for business globally. Blockchain accounting could help cut those costs. For example, a company can log off all transactions on an internal blockchain, and record these centrally. Likewise, external auditors could inspect a corporation's books in real time.

Fig. 1. Working Mechanism of Block Chain Accounting



Impact of Blockchain on Accounting

Technology trends are also reshaping accounting in virtually every way. The emergence of Blockchain technology is likely to transform the field of accounting ,by changing the way accountants work. Accounting has remained a highly respected profession serving the internal as well as external users by providing them the needed financial information. Blockchain is often viewed as accounting industry disruptor. The impact of Blockchain on accounting may be gauged from the following points:

Secure and Transparent Database- Blockchain in the field of accounting will provide very fantastic database to track data and goods as they move (physically or digitally) through supply chains and organizations. This will allow more rigorous analysis, conversation, and reporting process to take shape.

Full Authenticity of Parties/Transactions- It will take into account the accounts payable and receivable, with either intercompany transactions or client-customer transactions. It will verify the payment and the dates, ensuring full authenticity of transactions and will minimise counterparty risk and settlement time

Fiscal Accuracy, Speed and Reduced Fraud- It ensures fiscal accuracy, because when a transaction takes place in a blockchain ledger, it is not only updated in real time, but the transaction is closed instantly upon completion. It results in speedy reconciliations, preventing data manipulation and avoiding frauds.

Guaranteed Integrity and Security of Financial Data- As every transaction is recorded and verified, the integrity of financial records is guaranteed. Since all transactions are distributed and cryptographically sealed, manipulating, falsifying or destroying them would be practically impossible.

An End to Traditional Accounting Methods- Blockchain is poised to up-end traditional methods of invoicing, documentation, contracts, and payment processing across all industries, as it allows for real time recording of both sides of the transaction simultaneously in a shared ledger.

Accountant as Full Fledged Data Expert- It requires expert knowledge and mind.It will make accounting process faster and accurate. Consequently accountants will have more time for client interaction and creative thinking for development of accounting profession.

Technological advances are very much needed for the development of any nation. But at the same time, it is also very true that such developments may also threaten the basic premise of a few professions. Blockchain is a digital ledger on which transactions are recorded chronologically and can be viewed by all who have access. It allows for the transacting and securing of digital data resulting in efficiency in business transactions. It will revolutionize the financial world by radically reshaping finance, accounting and auditing professions by creating opportunities as well as challenges for these professionals. Finance executives should be made aware of the financial technology innovation, and predictions of the impact of Blockchain in the field of accounting and auditing. These professionals must treat the blockchain technology as transformative computing architecture capable of changing the entire accounting world. Accounting and auditing professionals must embrace automation because it's good for efficiency and efficiency is good for business. The present paper aims to provide an understandable definition of Blockchain and highlights the impact of Blockchain on Accounting and Auditing Profession.

Enhanced Organisational Efficiency and Effectiveness- Blockchain technology will reduce the lag time between when the information is requested and when it is provided, resulting in improved performance. It has the potential of preparing and providing the required information to the interested parties in virtually no time. It eliminates the need for book keepers and results in economies of scale.

Other Benefits- It will be very much useful in transfer pricing mechanism in cross-border transactions. It can also bring substantial efficiencies to tax collection and build critical inter-governmental trust relationships.

Blockchain has the potential to make a positive impact on business bottom line by significantly reducing the cost. It can promote privacy by providing more transparency and control with cryptographic keys. The technology also removes the problem of involving costly intermediaries by eliminating the intermediary. Since the ledger is distributed, it is less vulnerable to online attacks.

Impact of Blockchain on Auditing:

Auditing is a service critical to protecting shareholders and investors. Various scandals in the past have demonstrated that manipulation can adversely impact the integrity of the auditing process. Existing auditing practices may face conflict of interest, and may also be error-prone in a number of issues. The audit process has remained relatively unchanged for decades except the changes introduced because of IT orientation in the past. Blockchain challenges the basic premise of auditing. Blockchain technology addresses the human vulnerability issues in ledger entry reliability and trustworthiness by ensuring that all transactions are accurate, complete and unalterable. A blockchain solution could essentially allow for an automated third party verification by a distributed network to ensure that transactions are complete and accurate and unalterable. The impact of Blockchain on auditing has been enumerated under the following heads

1. ***New generation of audit services*** - Blockchain technology will give rise to a whole new generation of audit services. With access to real-time data, auditors can develop various mechanisms to streamline the audit activity. It may also be used by auditors in the area of cybersecurity and sustainability

2. ***Immutably Time-Stamped Verified Transaction***- Blockchain uses hash strings, and financial information is given a digital fingerprint which allows for an immutably time-stamped transaction that can be verified automatically with audit software.

3. ***Reduced time and cost of audit services***- Automation of auditing functions will significantly reduce the time and cost of audit services.

4. ***More Transparency***-It gives visibility to all transactions for approved users, and this may decrease auditors' work with sampling and validating transactions. Thus it will allow auditors more time to focus on controls and investigating anomalies.

5. ***Traceable Audit Trails***- Blockchain technology will result in traceable audit trails, automated audit processes, quick authentication of transactions, fast tracking of ownership of assets.

6. ***Redefining Role of Auditors***- It will change the way auditors work, whom they work with, where they do their jobs, and how they connect with clients and colleagues. For auditors to survive and thrive, they will need to learn these new developments.

With the implementation of Blockchain, large audit jobs with numerous staff members could be cut down to few individuals only for ensuring that the financial statements meet regulatory standards. However, the transaction recorded in a blockchain may be still be fraudulent , hence auditors would be needed but their nature of duties may be altered for betterment.

Conclusion

To conclude, it may be remarked that while the landscape for Blockchain technology is still in its infancy, its potential is transformational. Blockchain transaction tools offer the greatest opportunities for change in various accounting mechanisms, and creating a new platform to reshape the world of business and transform the accounting and auditing profession. Its potential disruption on the accounting industry cannot be overlooked. Various past developments such as the emergence of computers, ERP systems, and cloud computing have just changed the auditors' work instead of making them irrelevant. Auditors will need to develop a more data-centric approach and use it with a forward rather than historic perspective. In this way, the auditors will be able to provide very higher-valued service Firms who early adopt practices that account for these potential disruptions will be

better off in the long run. MA

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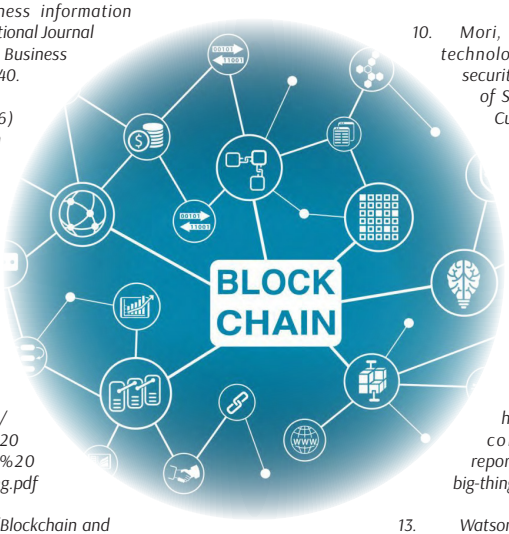

UNIVERSAL CONTEST OF PILOTING A REVOLUTION IN PRESENT ACCOUNTS AND AUDIT SYSTEMS

The spread of internet complemented with the rising speed of browsing over the last few years has led to exponential advancement of the digital world. Blockchain is set to be the next step on this evolution. Extensive research is being conducted worldwide in order to explore the prospects in revolution of technologies related to accounts and audit. It has even reached to the level of building a premise that Blockchain technology can bring tremendous improvement in terms of efficiency and reduction in consumption of time for the performance of services related to accounts and audit.

Further, it is also argumented by many researchers that this end to end technological change will help in real time data recording and auditing in the most effective manner. Where the auditors who are supposed to be saviours of various stakeholders and are expected to serve in a fiduciary relationship, might miss things due to limitations of human brain, these technologies are professed to give fair resolution to all the associated problems.

In contradictory, there is population who oppose such perceptions, raising ethical concerns and state that nothing can replace human intelligence as humans do not analyse the situation on the basis of set of only previous data present or pre-loaded instructions as an automated processes (i.e. create executable policies/ procedures on the basis of codes/ algorithms fed into the machine), rather their intellect deals emotionally as well.They consider various other factors too which exist around and are intangible in nature, yet most important for making right decisions,of which machine is incapable of determining, so as to avoid major issues to take place.

Moreover, the mixture of an artificial intelligence and necessary human intervention is believed tolead towardsa drastic movefrom present systems of bookkeeping, accounting and auditing to faster, smoother and effective methods of doing the same. The innovations in theblockchain technology can possibly shape shift it, in coming years.

Blockchain is considered as a development where the reliability of a ledger is no longer derived from central controller that maintains it, instead it is a derivative of a trust in the system that drives the recordkeeping. Moreover,

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the potential of self-executing smart contracts allows programmable ledger to fundamentally alter operations of all the contracts.

Constitution of a Blockchain

"A blockchain, is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block typically contains a cryptographic hash of the previous block, a timestamp and transaction data. By design, a blockchain is inherently resistant to modification of the data. It is 'an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way'. For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered without the alteration of all subsequent blocks, which requires collusion of the network majority."[1]

The blockchain has complete information about different user addresses and their balances right from the genesis block to the most recently completed block. The blockchain was designed so these transactions are immutable. The blocks are added through cryptography, ensuring that they remain meddle-proof where the data can be distributed, but not copied.[2]

Blockchain–Basis of Promising Systems for Accounting

With the use of blockchain, it is expected that accounting practices may be enhanced thus reducing costs for maintaining and reconciling ledgers (book keeping). Professionals on these fields can now concentrate in making intellectual efforts in planning, strategy, analysis, valuation and many others instead of performance of mundane tasks which can be done by machines without any application of mind on the basis of pre-loaded data sets which are directed to trigger at certain events.

"In terms of administrative procedures and approval processes, blockchain technologies could be employed to automate and distribute the execution log of a company's standard operating procedures or accounting procedures, thereby reducing inefficiencies caused by opacity, such as deficient knowledge or understanding of procedures, poor accountability, weak collaboration and distrust and centralized management bottlenecks."[3]

It is believed that distributed ledger technologies may help in maintenance of accounting records in such a manner that they produce the actual and fair results without any manipulations, reducing tax frauds. Thetechnology also claim to possess the potential of helping governments in collection of taxes and passing on the direct benefits/ subsidies/ grants/ aids/ supports/ scholarships etc.straight to the actual claimant, eliminating any kind of leakage.

In addition, smartsystemscan begenerated by feeding codes and algos on a blockchain where as and when an entry is posted, the artificial intelligence enables the accounting application of identifying the nature and classification of the entry or transaction as per the accounting standards of the related country and the same is immediately and automatically transferred to the next levels i.e. ledger, trial balance and financial statements on a real time basis. This will eliminate identification and posting of hundreds of entries by humans at later date which generally causes confusions and mistakes.Once adopted, such technologies shall simplify extraction of as-is financial statements showing the real balances and picture of an organization which can be derived at any point of time and date, facilitating calculation of exact and real value of the organization at a particular moment.

Furthermore, the system seems to bring revolutionary impact on working and operations of accounts and finance departments of the establishments, however, it needs alot of efforts, in terms of identification of numerous transactions which take place on a daily basis and basket of those need to be prepared and bifurcated based on current classification rules in accounting systems. These rules then need to be properly fed to the machines in the forms of instructions, for e.g. the moment sales take place, the related effects like collection of money or creation of a debtor is immediately generated and every relevant transaction along with the sales itself gets recorded at each and every statements where the effect of same must be documented and shown. However, the algos needs to be timely checked as and when there is amendments in rules or laws and instructions given to the machine need to be modified accordingly.

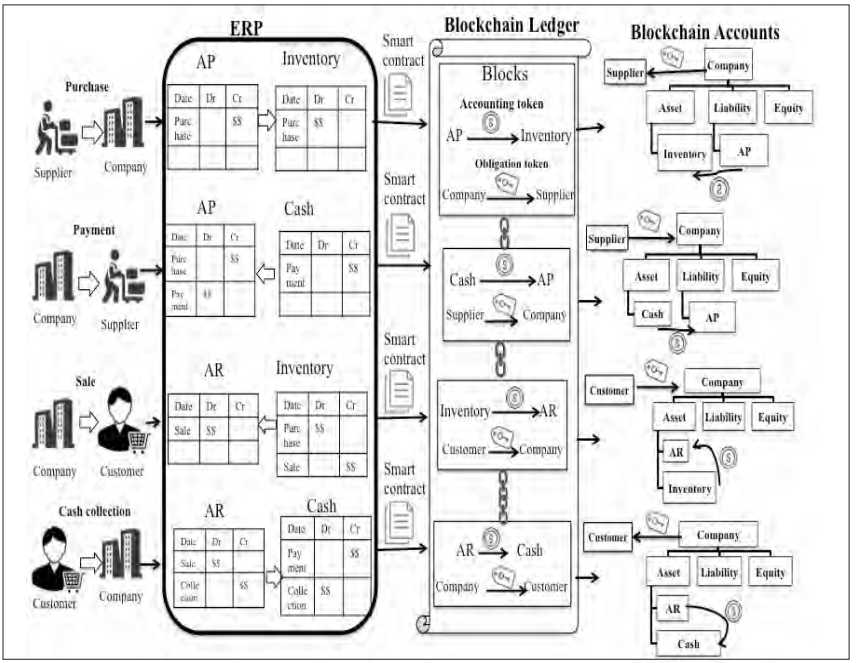
In this segment, research and developmentsection opens a plethora of opportunities to the accountants who are experts in record keeping, application of complex rules, business logic and settingof standards, in providing their valuable inputs and experiences so as to develop automated processes of accounting. Experience, guidance, advices and data available to them can help in developing a standardised and optimised financial system with the underlying technology of Blockchain. Although, this

seems to be a rigorous task but the continuous efforts, trial and error may help in constructing rules, regulations, instructions and standards into a digital language to be understood by the artificial technologies.

The challenge also lies in providing smooth transition from one end of operation to another and binding all the functions of an organisation under one technological platform. The dynamic nature of transactions recorded and recognised in the financial statements, make it more difficult. The technology also,shall seem to face the question of exactly and correctly identifying solutions to the problems where judgement or decision is required to be takenvery consciously,as the machine lacks the emotional quotient.Herculeantask of moving the already present records into the blockchain in a most effective manner so as to provide the auditors and regulators the access of data and records in order to check the transactions in real time and with certainty over the provenance of those transactions stands in front of scientists and researchers.

The impact assessment of various related aspects, suggestions of accountants, initiatives, concepts and propositions must be made in order to adopt the better, effective fast and efficient technology. Professionals in this fields must proactively participate in improvement and providing recommendations for the enhancement of system.Simultaneously, the extensive use and practice of the systems can lead to the production of desired results.

Figure 1 - A triple-entry accounting information system



Source :Dai et al. Toward Blockchain-Based Accounting and Assurance, Journal of Information Systems, Volume 31, Number 3, Fall 2017, pp. 5–21

The impact assessment of various related aspects, suggestions of accountants, initiatives, concepts and propositions must be made in order to adopt the better, effective, fast and efficient technology

Blockchain –Potential Foundation of Structures for effective AuditingSystems

"Operating in real-time is still a dream for financial services providers, even if they are introducing innovative digital platforms. However, we are not too far from making real-time financial auditing possible. While these[5] techniques will probably take some time to evolve and be adopted as industry standards, a move towards technology-enabled transparency and proof of solvency would indeed be a positive step forward."[6]

On the basis of accounted data available with the organisation i.e. invoice, shipping document, customer order, confirmation requests, bills of lading, letters of credit, receipts of transactions etc., an auditor at next level checks and verifies the reliability of same.They seek clarifications on vague transactions, if any and compare the same with the reporting standards applicable to particular industry and country.They also confirms occurrence of transactions, relevant information recorded, accuracy of the record, accounting period and the classification of such transactions.At complete satisfaction, in the end, theyexpress their opinion in the form of report on the accounts of an organisation.

Use of blockchaintechnology inauditing may help in instant verification of the uploaded records along with the substantiation of its exact amount. It may also assist in matching of accounted datafrom its inception or at the time of transaction when it was first incurred or generated and recorded at the journal, then, when it was next shifted to the ledger, trial balance and so on upto the finalisation of income statements.Due to the various in-built qualities of blockchain, verificationfrom the accounts recorded long back is also equally feasible.

It canmoreover benefitthe auditors in tracingandidentifying various mismanaged activities in just few seconds as the transactions are originally recorded then encrypted and timestamped, which later on can never be deleted, adjusted or modified. Fraud of financial statements made by organisations with mala-fide intentions by just rotating entries and then vanishing them at some level or later at some stages after few years will not be possible any more as they can completely be outlined that when they have been moved from one account to another.

If developed more, the technology can also help in verification of transactions of one organisation withanother. For e.g. if A and B are two different companies and A has sold the material to B while B has made payment against it, then blockchain may also help in identifying and approving the entries from the accounts of one another, if permitted by both of themby using the same technology for recording of transactions.

The technology can be extended to various other stakeholders in order to make it much user friendly that includes creditors, directors, employees, government (andits agencies), suppliers, unions, buyers etc.It canaid in detecting various non-compliances with respect to unauthorised deposits, loans to directors, related party transactions and others under the Companies Act, FEMA, ListingObligations etc.

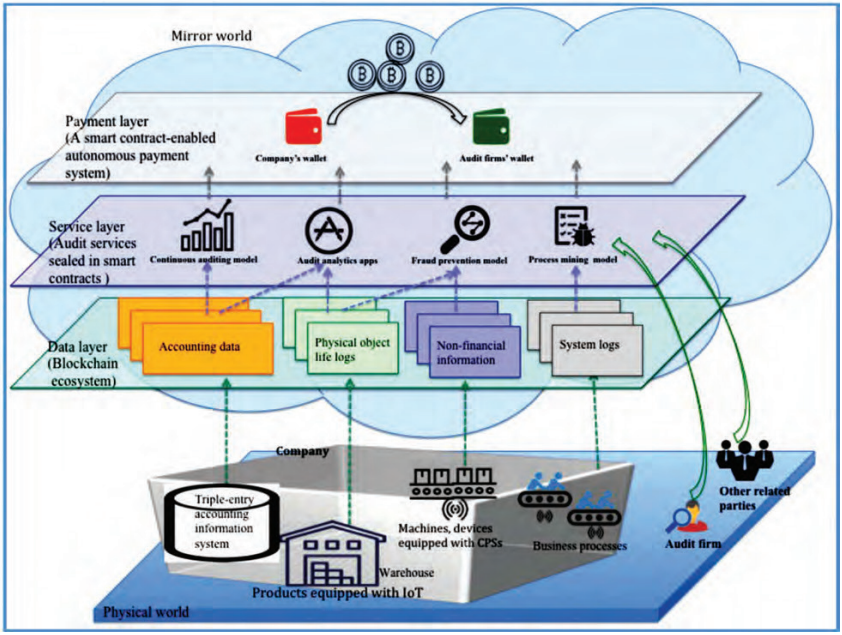
Blockchain also consist one of the very important features i.e. recording of the data at every block and verification of same since its inception each time which may be adjusted according to the willingness of management but comes with the inherent quality of verification sinceits introduction which makes it even more secure and trustworthy for the purposes of audit.

The challenge only lies in giving accurate commands to catch any kind of mismatch or non-compliance which also includes time to time checks and balances of fed instructions. The same could be done with the help of smart contracts. Further, the feature of location detection can add more value so as to examine where and when the transaction took placemaking it additionally relevant.

The technology which brings the distributed audit trail can also be given the customisable feature of embedding the accountability and responsibility on a particular employee making it pertinent to the auditors.The use of these technologies can help auditors in utilizing their

intellect and time in much more productive areas and activities including bringing simplicity to complex transactions, finding solutions for various unresolved issues, simplification of typical control mechanisms etc.which shall at the end help in adding value to the country and system.

Figure 2 - The vision of a blockchain-based audit assurance environment



Source :Dai et al. Toward Blockchain-Based Accounting and Assurance, Journal of Information Systems, Volume 31, Number 3, Fall 2017, pp. 5–21

Principles Underlying the Blockchain Technologysignifying it as a Forthcoming Champion

There are few principles which make the blockchain, a distributed ledger capable of performing and proving itself as one of the best platform for accounts and audit systems. Supported by its nature of transparency where the transactions are completely and fairly visible to all the relevant parties makes it potential technology for the current auditors to explore and utilise. The unique quality of the distributed ledger where the records are linked to each other forming a perfect unbreakable chain and wherethe transactions can't be deleted or modified in any case reduces the chances of manipulations with records to the extent of nil. Once the entry is made, it lasts there upto the perpetuity, fully verifiable.Feature of timestamping and cryptography makes it tamper proof and traceable.

The decentralised nature where there is no control of data in any central location and confirmation on the peer to peer basis leads to the production of fair and transparent results i.e. financial statements at the end of the period carrying exact and accurate profit or loss of an organisation.

The database consist of chain of traceable records since

its inception with the entire history, makes it easier for auditors to create checks and balances and track all the mismatches in a single go at comparatively lesser time. The technology comes up with the customisable features which can be performed at the ease and willingness of the management. The forks can be created if the feature needs to be added with the help of placing algorithms, standards, triggers, rules, regulations etc. so as to keep it adjustable to the size and requirements of an organisation, industry and the country in which it is operating.

Foreseeable Challenges

1. Wilful adoption of a change by the employees

Persuasion for adoption of a change by the society, resulted out of any innovation has always been a difficult task. Most of the people try to work in the pre-set and already organised platforms where they do not need to put any extra effort in learning and adopting something new. This phobia leads to slow embracing of better and fast technologies which can ultimately ease their business. This unfavourable attitude of employees towards accepting new technology and their lazy and lethargic attitude complemented by their unwillingness to upload the previous data and records onto the system followed by creation of codes based on the regular routine exercises of similar nature,manually performed by them and thencoding of national and international standards might be a difficult and challenging mission for any management.

2. Time taking process based on trial and error

The process to develop such a mechanism may take time and needs a lot of patience by each and every one. This may include many trials and errors in producing the effective results. Combining and joining one function of the organisation with another for e.g. accounts department, finance department, supply chain management, marketing, sales, corporate communication, legal and secretarial etc. to be linked with one another is another major task.

It is again followed by the challenge of creation of an end to end technology embedded procedures for linking of database of; one organization to another, with the government and other stakeholders. For e.g. the disclosure of financial statements is mandatory to be made to the exchanges before a particular date for listed companies at every quarter in the same prescribed format, which is a routine task, then,there can be created few algos instructing that once the financial statements are audited, the numbers from the statements can be converted into the format of disclosure as prescribed by the regulator,which can automatically be linked with the website of exchanges and gets uploaded on or before the cut-off date. Although the necessary human intervention is must in order to release an accurate information but at least the burden can be reduced uptoan extent of feeding of information in the prescribed format from the audited balance sheet.

Even if the aforementioned challenges are met on the front of development of such mechanisms and technology then there might be hurdles in obtaining permissions from various institutions for access of their data and information. Also, there can be disagreement in customization of applications amongst different organizations and bodies. Legal and ethical concerns may also be raised with respect to privacy and misuse of data and information. The sensitive data available on such open sources may lead to serious loss in terms of money, social security and also at various other fronts, protection of which is another challenge.

3. Faulty or fat finger algorithms- issues with respect to cybersecurity

Moreover, faulty or wrong fed algos whether intentional (with mala-fide intention) or unintentional (by mistake) may lead to serious disruption instead of being useful.Even after having an inherent quality of being secured, if in any case the data at such open source is manipulated by virus or malware attacks by cybercriminals or hackers, the situation may lead to huge loss of money, useful information and destruction of business. Thus strengthening of internal IT systems and protection of data by creating duplicate server at remote and unidentified location which should be effective enough to independently store and assimilate information is another predictablechallenge, which might bring costs to the organisation more than usual.

4. Development of user friendly approach with stakeholders and training of the existing staff

In this environment where machine is taking a lead, there is prevailing threat of loss of jobsof those who are engaged in a routine and monotonous task of similar nature. However, the same does not seem to be such a difficult and frightening event as those who are performing this kind of job may be trained and shifted to operate upcoming technologies who may also help in bringing some value addition to the system, organization and a country as a whole.

There must be although need to create awareness of such systems amongst the public, the stakeholders and the owners for immediate adoption of same. One of the best examples can be derived from MCA21, when

digitization of the same was hugely opposed by the professionals,contending that the digitization of physical activities shall lead to loss of jobs.

Instead since the year 2006, with the rise in economy; the roles of professionals, the tasks, practices and quality of work along with the remuneration has enormouslyenhanced, which has also impacted the governmentwhere related professionals are now providing inputs at the level of formation of several policies for the country and economy, which is considered as the value addition by the use of professional endeavours.

The digitization has rather simplified errands and given the professionals, ample opportunity to brainstorm and perform intellectual assignments,bringing importance to the profession and country instead of standing in a queue for an entire day, just for filing asingle document with the department.

Conclusion

As it is said that change is the only constant thing in this world and survival of the fittest applies everywhere, all those who are adaptable and embrace change in terms new technological environment full of functions related to artificial intelligence will be the ones who shall survive and thrive in such a cut throat competition.

Accountants and auditors are the one who may help in development of such an environment leading to reduction in financial crimes and making records of any organization, even more trustworthy bringing greater transparency and fairness.

Although, there seems to have many challenges in bringing it to perfection but that does not prohibit or abstain anyone from undertaking experiments which may ease our lives and routine works. The blockchain technology is promising and may be employed for at least giving a try for the purposes of accounting and auditing. MA

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Footnote

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[4]*Extracts from para 3, page 11, Report by Bretton Woods - The Promise of Bitcoin and the Block chain (2015)*

[5]*Blockchain is emphasized*

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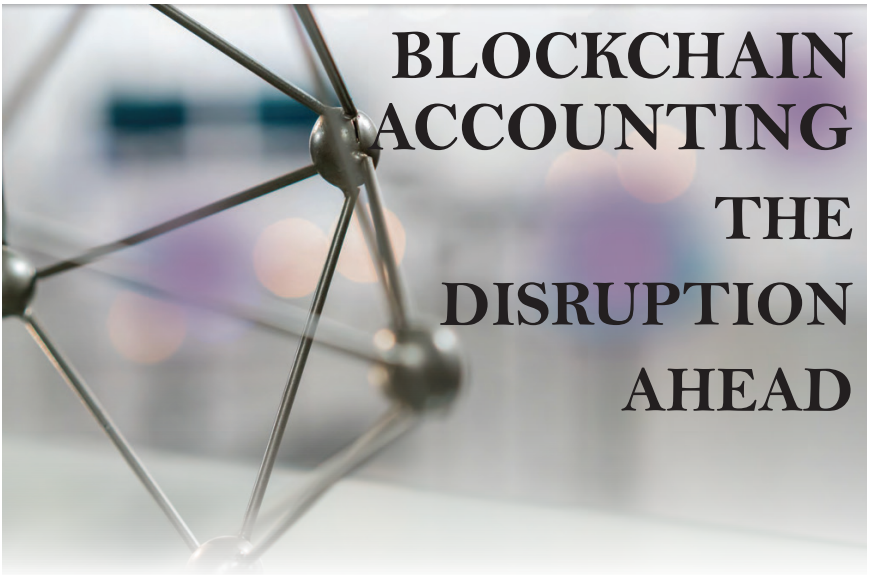

BLOCKCHAIN ACCOUNTING THE DISRUPTION AHEAD

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Technology often creates disruption. Over the time many industries have experienced such disruption, which has transformed the concerned industry in a big way. Fortunately or unfortunately, accounting, till date, has not experienced such technology driven disruption except the transition from manual accounting to computerized accounting process, a few decades ago. Even then, such transition never threatened the existence of accountants, but rather it was aimed to equip the then accountants with the knowledge of computer software to adopt themselves in a machine driven environment. However, recently there has been a significant development in the technological space that is threatening the very basic need of having an accountant, or at least a book-keeper, in an organization. Though the service of an accountant may not be outweighed completely (as an accountant often plays an important role in framing certain policies where certain degree of subjectivity is involved), this technology is capable to bring in such disruption in the field of accounting that it will get a complete transformation. This technology is none other than the blockchain technology which has already gained immense importance in various sectors, specially the financial sector.

The Origin of Blockchain Technology

The origin of blockchain dates back 1990s, when a technological solution was first offered to tackle the problem of time-stamping of easily modifiable digital assets ranging from multimedia files and text documents, in order to track their origin and any subsequent attempt to modify the same. The solution was explained by Haber and Stornetta (1991) in their article 'How to time stamp a digital document', in the Journal of Cryptology. In 1991, they first proposed computationally practical procedures for digital time-stamping of easily modifiable documents by creating cryptographically secured chain of blocks, so that it becomes impossible for a user, either to back-date or to forward-date his document. Their procedures claimed to maintain complete privacy of the documents themselves, and required no record-keeping by a third party time-stamping service. This concept of cryptographically secured chain of blocks laid the foundation of blockchain.

Blockchain, in its current form was conceptualized by Satoshi Nakamoto, a till date anonymous person (or a group), in his attempt to introduce Bitcoin, the digital crypto currency in 2009. Nakamoto used blockchain as the public transaction ledger for Bitcoin. Since then blockchain technology has matured a lot and has been experimented in various other platforms including recording of events, medical records, transaction processing etc.

Concept of Blockchain

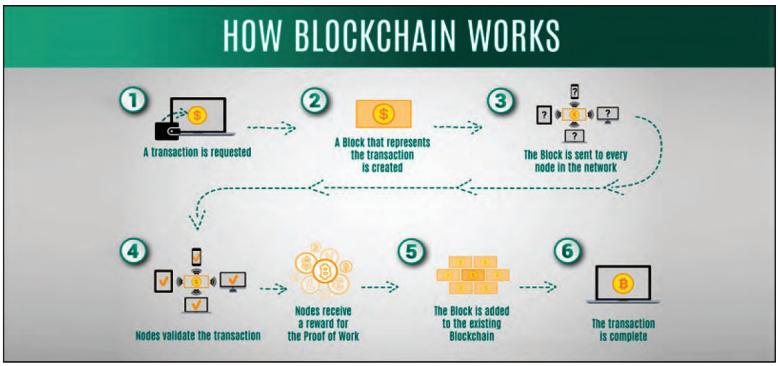
Blockchain may be defined as an open, distributed database or public ledger that can record all transactions or digital events between two parties efficiently and in a verifiable and permanent way. According to Swan (2015), blockchain is like a giant spreadsheet for registering all assets and an accounting system for transacting them on a global scale.

Modus operandi of Blockchain

Like the name suggests, a blockchain is a chain of blocks that contain information. It is a completely open and distributed ledger to record information with some interesting property- once any data is recorded in a blockchain it cannot be changed or tempered easily.

In a typical blockchain process, there are peer-to-peer nodes. When a transaction is requested, the request is send to these nodes. Nodes then verify the transactions with a computer algorithm. If majority of the nodes verifies the transaction, a new timestamped block is created and added to the blockchain of all previously verified blocks. This completes the transaction and the ledger is updated. Thus unlike a traditional transaction (say fund transfer through bank), where a central third party (the bank) records it and provides a copy of the same to the participants of the transaction, in a blockchain process, the same is done without the involvement of a central third party intermediary. This improves the security as data on a centralized server may be vulnerable to any cyber attack or loss due to other technical reason. In addition blockchain also saves cost by eliminating the need of a central authority as record keeping with them may be a costly affair at times.

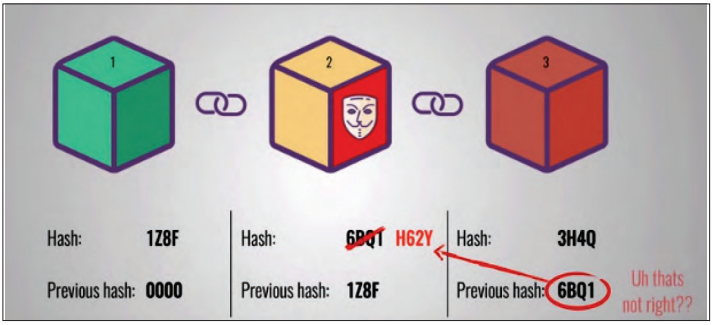
Figure 1: How blockchain works



Security Aspect of a Blockchain:

Blockchain is highly secured. In blockchain technology, each block contains data, a hash of its own and the hash of the previous block. Data in the block may vary depending upon the purpose. For example, in a Bitcoin transaction, the data will include the details of the sender, the receiver and the amount. Hash may be compared with fingerprints which are unique. Once the block is tempered its hash is changed and since the blocks are connected with each other by means of hash, all the following blocks become invalid as they will no longer contain the previous hash. Thus to temper with blocks effectively, a person will have to recalculate the hashes of all the blocks. This is further restricted by a mechanism called 'proof of work'. This mechanism slows down the creation of a block. In case of Bitcoin, it takes 10 minutes to create a proof of work. Thus when a block is changed, the person may need to generate the proof of work of all the following blocks. This makes the tempering process almost impossible. In addition to this, when a user joins the system he/she is given a full copy of the blockchain. Whenever a new block is added, it is sent to every nodes of the system. Each node, then, verifies the block to see whether it is tampered or not and eventually approve, if they are satisfied. In this way a consensus is achieved. Thus a fraud requires the acceptance of at least majority of the nodes to validate. This makes the fraud impossible to commit.

Figure 2: Blockchain is secured in terms of compatibility of has string



Blockchain –How Will It Transform Accounting?

1. Current State of Accounting Technology

From its inception, accounting has undergone many changes over the time. Changing business forms, depending upon the expansion needs of the business, has developed accounting procedures considerably. At the same time, overseas operations and cross border investments have necessitated convergence and/or harmonization of accounting practices across the nation. However, all the above developments were limited to changes in the procedures or practices only. Accounting, till date, has seen only limited changes due to technology except in the sphere of recording of transaction in digital mode.

Even then, digitalisation of the accounting system is still in its infancy compared to other industries. This is because, accounting requires exceptionally high level of regulatory compliance to ensure integrity. Entire system of accounting is required to be designed in a manner that fraud is impossible or at least difficult to commit. Unfortunately, today also it relies on mutual control mechanisms, checks and balances to achieve this objective. Though record keeping has been digitized, the entry in the computer system is still done manually and this leaves the scope for unintentional errors and planned frauds. Among other things there are systematic duplication of efforts, extensive documentations and periodical controls. Accounting is still manual to a great extent and far from being automated. As a result, there are frequent instances of compromising with the truth.

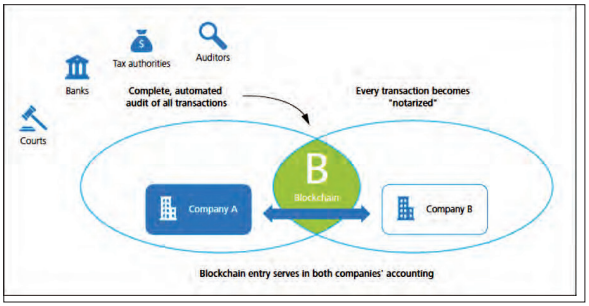
2. Blockchain and Distributed Ledger System to enhance the present state

Blockchain is expected to transform the present accounting system in a number of ways, though the ultimate benefit of the same may be available only after a considerable improvement in the technology and large scale adoption at various levels.

At the initial level, blockchain technology may help us to do away with central third party authorities like Stock Exchange, National Payment System, Property Registers etc. who keep records of transaction between two parties and issue verifiable receipts or copy of the records. These verifiable receipts or copy of the records are used in accounting to record the transactions in the books of accounts. Since blockchain is a peer-to-peer network, using it will no longer require the service of a central authority. Transactions will be recorded securely in blocks and corporations will not require maintaining the physical or digital records of the same. This will reduce the cases of falsifying records to commit frauds to almost zero as tempering the blockchain will not be easy at all.

In accounting, at the second level of the technology, it may take the form of a shared ledger, popularly known as World Wide Ledger (WWL). WWL mat be defined as an ultimate implementation of a searchable and verifiable blockchain accounting system where corporations will publish all their transactions and make them available for different regulators and stakeholders including shareholders. In this compete peer-to-peer system, all monetary transactions entered into by corporations will get verified and, if approved, will create a block. This will then added to the chain with a hash. The transactions will then be open to all who are registered and verified in the network. As a result, corporations will no longer require maintaining separate set of books for recordkeeping as the transactions same will remain saved in the blockchain and can be accessed at any time.

Figure 3: Blockchain Accounting implements Recording in a Shared Ledger



Finally, at the extreme level, blockchain may facilitate real time blockchain accounting. In this form, a software solution may enable transactions of currency, financial derivatives and other digital instruments between two or more interested parties, stores the transactions in cryptographically protected blocks, the integrity of which will be verified. Moreover, it may be further automated to make payments and settlements on maturity of the instruments and record those transactions also. Virtually at this level, accountants' role may be limited to only areas of judgement like inventory valuation, selecting the depreciation or provision policy etc. They will no longer be the book-keepers. However, as stated earlier, this will require the technology to evolve beyond the present level.

3. Benefits of Blockchain Accounting

Blockchain accounting, even in its simplest form, will offer a number of benefits. These are:

a) Reducing the cost of maintaining records: Application of blockchain accounting will significantly reduce the cost of maintaining physical or digital records of transactions. Records will now be maintained in form of blocks in the blockchain and anyone having the appropriate authority will be able to access the same at any time.

b) Authenticity of information: Physical and digital records are susceptible to unauthorized alterations. This eventually increases the chance of fraud. Due to its complex technology, tempering blocks, which contains the data, will be next to impossible. This will ensure authenticity of all information in the blocks.

c) Focus on value adding activities: Since blockchain

accounting will do away with the traditional record keeping, this will free up the resources engaged in it. These resources may be alternatively channelized to different value adding activities of the organization.

d) Reduction in frauds: Since records will be temper proof and even if they are altered, they will be easily traceable, the chance of fraud will come down drastically. Moreover, in its advanced form of real time blockchain accounting, the transactions will be recorded automatically. This will certainly eliminate the chance of errors in the recording process.

e) Eliminating the need for reconciliation: Since transactions will be recorded on real time basis and ledgers will be updated instantly, there will be no need for any reconciliation.

f) Real time reporting: In its extreme form, blockchain accounting will enable real time reporting. Any stakeholder registered on the network will be able to access the required information about a company. The regulators will be able to collect any information about the reporting entity on real time basis.

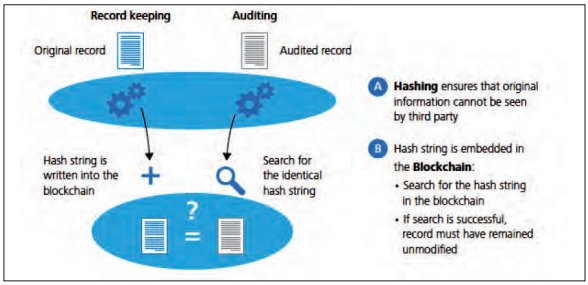
Blockchain Accounting Will Transform Auditing

Not only accounting, blockchain is also expected to transform the auditing profession in a big way. This is because, auditing is a process of attesting the accounts and hence any change in the process of maintaining accounts is bound to have significant implication in the procedure of auditing.

So far, in a computerized information system (CIS) environment, auditing is done in two ways- auditing around computers (known as Black-box approach) and auditing through computers (known as a White-box approach). Under the former approach, the auditor relies on the existing control in the user department and verifies the output with the input manually with the assistance of computers. In case of the latter, both compliance and substantive procedure is done through computers. This system of computer assisted or computer driven auditing is going to receive a complete transformation with the advent of blockchain accounting.

In blockchain accounting, there will be no trusted third party. Transactions of tangible or intangible fixed assets and of financial instruments will no longer be recorded by an intermediary, rather they will be recorded in blocks in the blockchain in a secured manner. Hence these transactions will no longer be backed by physical transaction receipts which are subjected to forgery very easily. The auditor will be assured enough about the authenticity of these transactions and ownership of the assets. In addition to this, companies will now record their transactions in a shared ledger. The entries will be cryptographically secured and hence falsifying or concealing them will be almost impossible. The transactions will be automatically verified in an electronic way. This standardization will allow the auditor to verify a large portion of company data automatically. The auditor will just need to search for the hash string in the blockchain that identifies the relevant block containing the transaction data. If the hash is not tempered, then it will exist on the blockchain. Thus existence of the hash string will assure that the record have been unmodified.

Figure 4: Auditor will search for Hash String to verify the transaction



This will save the cost and time of the auditors and the auditors will be able to concentrate more on the complex transactions, compliance or internal control related issues. This will certainly be value adding to a great extent.

Some Early Adopters of Blockchain Accounting

Considering its immense potential, some of the industry leaders have already attempted experimenting with blockchain in accounting. For example -

a) **IBM** has launched a secure cloud based platform for companies to test blockchain technology within their own supply chains to track high value items.

b) **Deloitte** established a blockchain development team called Rubix to develop client specific application using blockchain. PermaRec is one of such applications developed by this team, which a triple-entry accounting system that allows Deloitte to record transactions between their clients and quickly audit them.

c) Ethereum Foundation has developed **Balanc3**, an application solely focused on triple-entry accounting.

d) **Tierion** is a blockchain cloud service that allows companies to create digital time-stamped receipts.

Challenges in implementing blockchain accounting

Though blockchain accounting may offer a whole host of benefits and is capable of transforming accounting and auditing into newer levels of cost effectiveness, automation and highly dependable systems, there are certain challenges in implementing this technology.

a) Blockchain technology is highly depended on internet. Hence improper infrastructure can play the spoilsport. Also higher level of cyber security is a must.

b) Accounting and auditing are largely dependent on regulations. Thus to ensure the full benefits of blockchain accounting, appropriate regulations should also have to be enacted in this process. The process should be so enabled that any change in the regulation can be quickly adopted.

c) The second level of application of blockchain accounting i.e. WWL requires the large scale adoption of blockchain accounting by corporations. Unless the technology is adopted by many corporations, its effectiveness will be limited.

Conclusion

Blockchain is arguably the most discussed technology of this decade and there is every reason for that. As a sort of indestructible and incorruptible ledger, blockchain accounting offers to record data in a way which can be simultaneously accessible by auditors and regulators. This could potentially reduce the need for accountants to record transaction in separate locations with almost no way to consolidate and validate the same. Blockchain accounting is capable of providing a much more transparent and secured accounting framework to track transaction and assets. Hence traditional accounting is at the verge of a disruption which will redefine the role and need of accountants in an industry. Instead of record keepers, accountant will soon require to become interpreters and direct facilitators in decision making. MA

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