Blockchain Technology and its application in Retail

Kanishk Verma (Author)
Mumbai, India

Abstract: *In the late 1990s e-commerce revolution had struck the retail market and the retailers who had then migrated from their traditional systems to e-commerce know the potential of disruptive revolutionizing technologies. Given its wide range of potential applications and required changes at infrastructure level, blockchain being a shared ledger where all financial transactions are recorded, eliminating the errors that can occur when each member participating in a transaction maintains its own data set for the transaction acts as the perfect lubricant and catalyst between trusted as well as untrusted entities in a business*

Keyword: *Blockchain, Bitcoin, Cryptocurrency, Retail, Hash, Loyalty, Hash, Transparency*

I.   Introduction

Satoshi Nakamoto back in 2008 proposed a system for electronic transactions without relying on trust. It is nothing but peer-to-peer networking coupled with proof of public history of transactions that in turn becomes computationally impractical for an attacker to change and this system was implemented only a year later through Bitcoin. The underlying technology which decentralizes transactional data for sharing across a large network of untrusted participants is coined as Blockchain. Although this technology is mainly adopted in digital currency but it is also a promising technology for other wide areas. From healthcare industry to finance industry or throughout retail, blockchain technology has emerged to be the next big thing. This research paper serves to provide a simplified detail on blockchain and also serves to introduce its various applications and emphasizes on its application for Retail industry.

Blockchain is a way of digitally recording data and transactions. It acts as a distributed database of records or a public ledger of digital events or transactions that have been shared among participating parties across a large network of untrusted participants. Requirement of a third party verification is eliminated, thus disrupting any sector that leverages it traditionally. Each transaction in the public ledger is supposed to be verified by consensus of the majority of participants in the system. Once entered information will never be erased as it is immutable.

Even in its nascence, blockchain being a shared ledger where all financial transactions are recorded, eliminating the errors that can occur when each member participating in a transaction maintains its own data set for the transaction. Within the blockchain network aggregated data on transactions that have occurred are listed in blocks including timestamped blocks, act as data structure of blockchain. Blockchain technology itself is non-controversial and has worked flawlessly over the years and is being successfully applied to both financial and non-financial applications.

As a part of this paper to understand how retail organizations view blockchain, we conducted a survey of many retail professionals and the findings have been shared and explained in subsequent sections.

II.   What Is Blockchain ?

Before getting ahead of ourselves, we must understand what does the term blockchain exactly mean? Standard chartered defines blockchain as the technology behind Bitcoin and other cryptocurrencies as a distributed ledger database for recording transactions, more commonly defined as blocks. [1]

A tight coupling of three principals' i.e. Cryptography keys, distributed network with a shared ledger and record keeping & security together define a blockchain technology.

A. ***Cryptography keys:*** *To create a secure a digital identity reference. Combination of these public and private keys is a dexterous form of consent, forming unique digital signature*
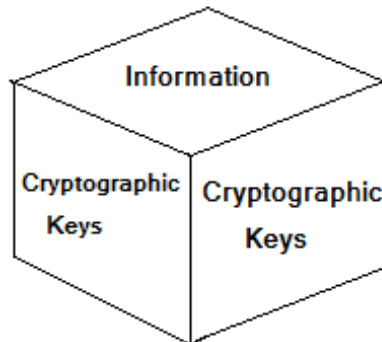
A digramatic representation of a block composed of
cryptogrpahic keys and other information
Fig.1

B. P2P network: The understanding of a distributed network can be done by "if a tree falls in the forest" experiment. [6] If cameras are setup in the forest to record the falling of a tree, we can obtain an analogy of the entire process of tree falling. Similarly, the distributed network acts as set of cameras, validating the entire movement of blocks in a chain.
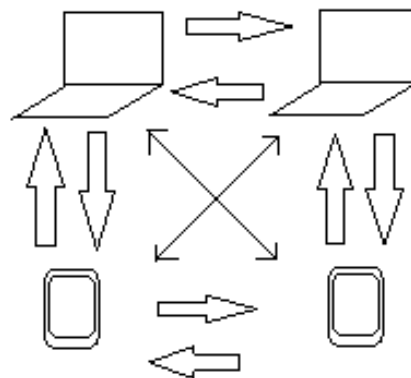
A P2P distributed network
Fig. 2

a. **Protocol:** A protocol enacts as a platform for the communication of a cryptographic block consisting of timestamp, digital signature and relevant information
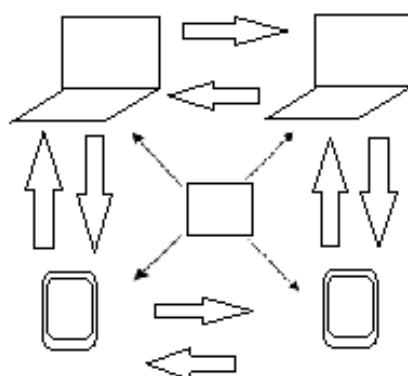
A distributed network of a block
Fig. 3

The entire blockchain technology is a mere replica of these tightly coupled three principals.

To understand blockchain better, we developed a basic blockchain wherein a block will store information like "NAME" and "Timestamp", which is encrypted using SHA256 encryption and this information is passed onto another block where the previous hashed value is hashed with current details, thus forming a blockchain. We have made use of Python programming language for this purpose. Below is a snippet, which consists of the code for storing information in the distributed ledger i.e. a block and a snippet illustrating the output for the same

```python
class Block:
    def __init__(self, index, timestamp, data, previous_hash):
        self.index = index
        self.timestamp = timestamp
        self.data = "Kanishk"
        self.previous_hash = previous_hash
        self.hash = self.hash_block()

    def hash_block(self):
        sha = hasher.sha256()
        sha.update("%s%s%s%s" % (self.index, self.timestamp, self.data, self
            .previous_hash))
        return sha.hexdigest()

    def __str__(self):
        return "Block <%s>: %s" % (self.hash, self.data)
```

Programming code for a sample blockchain

Fig. 4

```
Block #9 has been added to the blockchain!
Hash: 81a18fb08a42d65cf72bc09d5446632a73056638b5c990f69a9b5a3b4148a5ee

Block #10 has been added to the blockchain!
Hash: 873bbe429f0810d7a58a6602fe227e1058b218e83333d08d17f37f71958ccb40

Block #11 has been added to the blockchain!
Hash: 6f91a0fdde285d2e81ed68f22d815dfc116a57ac21031899bd93ce650b20948b

Block #12 has been added to the blockchain!
Hash: d4c888cd73df36dc105871cdb6cdad4493c3afe9e09b60211a93d892973b9832

Block #13 has been added to the blockchain!
Hash: f9a4db4909565cf37a83991e379128348ccb64c5a761fc704299bae71230a1f6
```

Output of program

Fig. 5

III.   Survey

To understand how retail organizations view blockchain, we conducted an online survey of 108 retail professionals between November 2017 and early January 2018. 53% of the respondents represented a division of the retail firm and the rest represented the entire firm. Respondents employ following divisions as functional areas: 38% in IT, 41% in Supply Chain Management, 29% in Data management, 26% in Finance and Logistics and HR, and 18% in Customer Service, 15% in marketing, compliance and procurement.

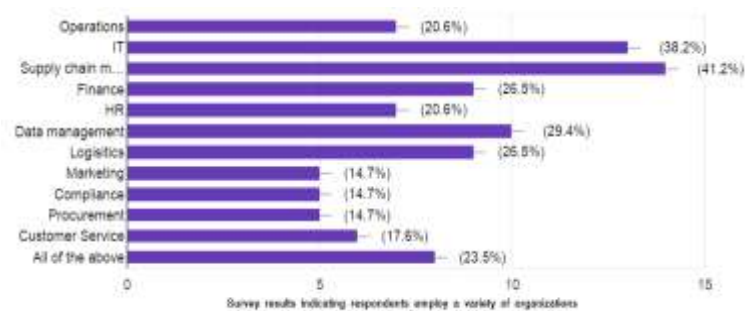Survey results indicating respondents employ a variety of organizations

Fig. 6

The main purpose for the survey was to understand the flexibility of Indian retail professionals to adapt blockchain technology as a platform for their business as usual activities.

Currently, all of the retail professionals in scope maintain a customer repository in form of a database and 85% use a delivery tracking system to enable smooth logistics tracking. For securing digital payments, only 15% have their own firewall for payment protection, rest all rely on firewall provided by banking partners.

On having frequent purchasing behavioral patterns of the customers presented in form of reports, majority of the respondents rated the idea 8 on 10

Survey response
Fig. 7
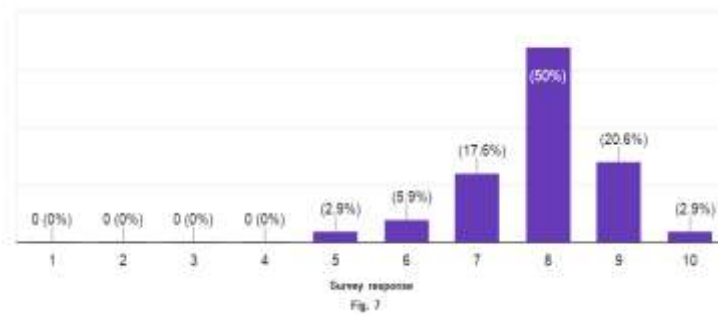
Each respondent was from a different retail industry segment. Majority of the retail professionals in scope were from Convenience stores or discount retail

Survey Response
Fig. 8
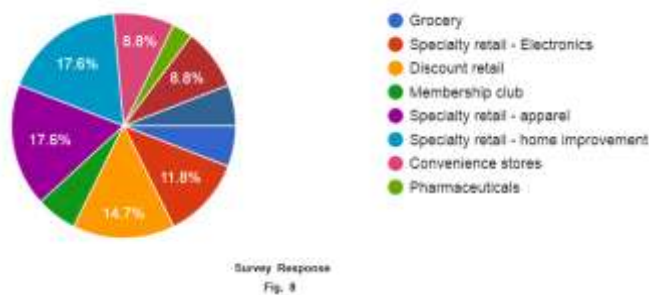
IV. Blockchain's Retail Potential

In the late 1990s e-commerce revolution had struck the retail market and the retailers who had then migrated from their traditional systems to e-commerce know the potential of disruptive revolutionizing technologies. Given its wide range of potential applications and required changes at infrastructure level, blockchain will change the way of retail market.

Customer serves the key role player in any retail domain and its trust is hard earned and easily lost. In an era where more and more transactions are happening on the internet, blockchain is a new headway. While blockchain is not going to revolutionize retail tomorrow, there are enough changes in the coming years that through meticulous innovation and appropriate investment can change the way retail is done now.

Further in the paper, it can be so viewed that adoption of blockchain technology by retailers can contribute a lot to assist the retailers in improving their existing business processes which in turn will lead to growth of their businesses. Following are a few key points under which this headway can be achieved.

4.1 Revolutionizing Supply Chain Management

During our survey, it so emerged that the fashion apparel industry retailers with their growing complex supply chain and knowledge unit management systems and shorter product life cycles, sales forecasting has become increasingly difficult. A blockchain solution, one where single source of truth systems coupled with smart contracts enable automatic execution of orders and payments, serves best to resolve the problems by accurate sales forecasting among many others.

For other wings of retail industry, shipment tracking and product/order recall are more of an integral part of current existing SCM systems. The SCM systems employed by many of the retailers does not facilitate immediate exact tracking for each stakeholder in the supply chain as they employ their own SCM for such a purpose. To revolutionize SCM in retail a blockchain can be used to store data about the shipment at every stage. It can include information like location, timestamp, check-in time, shipment handling personnel details, temperature, condition of package etc. Such a block of information can be accessed and added by each stakeholder in the supply chain. Thus providing accurate and concrete transparent information of the package. So in-case of product recall, such an accurate record will help retrieve and identify the point of failure and help Supply Chain Managing Retailers to run their businesses more efficiently.

4.2 Reduction in counterfeit goods

For designers of luxury consumable goods, deterioration of brand value by counterfeit goods can cause decline in value of the luxury commodity and hence cause the manufacturers and retailers to incur huge losses. Blockchain acts a verifiable and the only viable solution for such a cause.

The proliferation of forgeries can be avoided by enabling a blockchain digital ledger record to store all details of each product including the ones that are counterfeited. Hence, in such cases when the end-customer receives the package of goods or commodities scan a code that is permanently etched into the product in order to access all of the information stored in the blockchain's digital ledger record. Retailers prone to counterfeiting of goods and services can use such blockchain to renew their lost trust with their customers.

4.3 Revolutionizing tracking systems of provenance

In an agrarian nation such as India, farmers and retailers involved in supplying organic farmed goods to customers, the existing tracking systems are somewhat non-existent. The current supply chain is so horrendous that neither the end customer nor the source i.e. farmer are aware of the source of a product nor the justification for the high price incurred on a product.

Existing supermarket chains such as Organic India, Godrej's Nature Basket. Hyper City, Food Bazaar, Spencers and many others are currently facing a great hurdle in building strong confident relations with their consumers. As the consumers are growing suspicious that organic labels such as these are just a marketing tool and strategy to charge higher prices. Supermarket chains all across the nation can deploy a blockchain solution to raise this confidence by letting their customers to track the journey of a product from the farm to the store. This in turn can create an atmosphere of trust amongst all consumers.

4.4 Ever-changing Customer Profile

Significant changes in the psychographic profile of the consumers are an outcome of the changes in a country's economic, social, legal and political and most importantly the technological changes. The customers purchasing habits are never static, it may seem to the consumers that tracking their purchasing behavior may be an easy job but as published in a few research studies by a think tank Project Guru it doesn't seem so. A major hurdle encountered by marketers today is managing and maintaining such complex and vast data.

Marketers serving many retailers can employ a blockchain solution. Advanced data warehousing systems can be developed for the retailers using blockchain technology as the records stored and accessed across the distributed ledger are immutable. This data then can be used to forcecast the specific demands from a particular locality and suggest and store adequate stocks beforehand enhancing their just-in-time inventory facility. In today's ecommerce world, where same hour/day delivery are being employed by all retailers, data generated is enormous and to contain and being able to retrieve the same data along-with having developed algorithms which predict the next purchase of a customer, blockchain serves the best platform. The distributed ledger system across its computing network is already the next big thing.

V.   Implementation

The internet's commercial coming of age is instructive. The technological spectrum has advanced to new heights since ecommerce in 1990s. Early bird retailers who switched to ecommerce are the only ones with-standing the ripple effect of technology. Blockchain technology being the next big thing, retailers need to move quickly to gain experience so that they can understand the usage and various techniques to employ blockchain in multiple divisions of their organization.

During the survey, all of the respondents seemed ecstatic to take the blockchain leap but only a few of them were employing blockchain technology in the next year or so.

Out of all the respondents, a whopping majority were in the current phase of employing blockchain technology (as seen above)
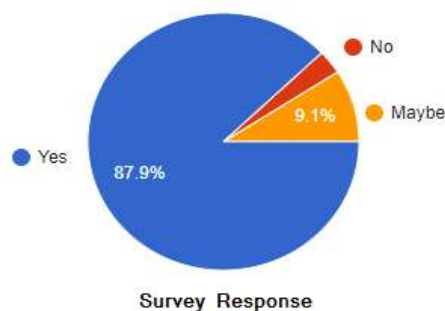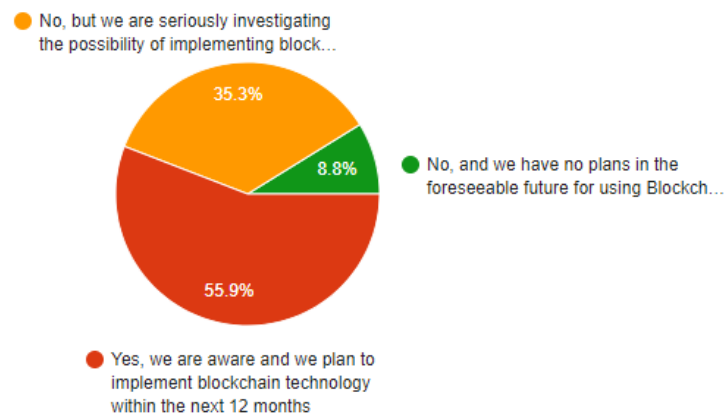

Survey Response

Fig 9

Survey Response
Fig. 10

But only 55% of the respondents were keen to employ blockchain technology throughout the organization or in a particular division.

To implement the blockchain technology in organizations, retailers need to develop strategies and make certain considerations such as

1. Set clear goals: Retailers need to assess whether blockchain technology is well suited for business issues
2. Flexibility: In its nascent stage, retailers need to stay flexible to adapt the changes and developments in blockchain technology.
3. Understanding real world potential: Retailers need to adapt and understand blockchain technology's real word potential and its large scale implementations.
4. Setting up cross-functional teams: The initiative should have all stake holders throughout the organisation set up cross-functional teams to address business specific problems and opportunities.
5. Selecting both permissioned and permission-less platforms: In order to have a custom tailored blockchain as per the business requirements, retailers need to select platforms as per each use case.

VI.   Figures

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VII.   Conclusion

Features of blockchain technology and its benefits have been limited to financial applications such as bitcoin and other cryptocurrencies. Still in its nascent stages, this technology is still evolving with lot of scope for different businesses. Just like in 1990s ecommerce which disrupted the traditional way of doing businesses for retailers, adapting to blockchain technology will change the way of doing business in the world. Improved transparency, better loyalty tracking system, better delivery tracking systems coupled with increased and efficient supply chain management are just a few of the many benefits this key technology aims to serve. Retailers in order to stand out from all the rest of their competitors need to adapt this disruptive technology, else their technique of doing business will be a thing of the past.

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