Research Article

Enabling Trust Using Technology in Pharmaceutical Supply Chain

¹Dr.S.K.Manivannan*, ²M.Valliammal
¹Researcher, School of Management, SRM Institute of Science & Technology , Kattankulathur, Chennai, India.
²Faculty, Department of Management Studies, SRM Institute of Science & Technology, Vadapalani, Chennai, India.
*Corresponding author's E-mail: manivannan.srmmba@gmail.com

ABSTRACT

Importance of trust in the pharmaceutical supply chain cannot be over emphasized given the level of complexities involved in the number of stages, players and volume of trade. In this article we are exploring use of a new technology tool, namely 'Block chain' to enable trust through trusted record creation and management. The study is exploratory using Systems thinking methodology based. We find that though there are some legal issues that need to be addressed, the technology can be adopted by Indian Pharmaceutical to conduct their supply chain activities with trust and competence.

Keywords: Supply Chain, Block chain, trust

INTRODUCTION

The Indian Pharmaceutical industry is in a state of high growth with increasing complex relationships with its stakeholders. The industry is estimated to grow in to a Rs. 22 lakh crores by the turn of 2020 with over 25000 companies and 11,000 brands [1, 2]. Even with the continuous regulations for the pricing of medicines by the government of India through the National Pharmaceutical Pricing Authority, the increase in the cost of drugs is still seen to have a big effect on the access to medical care in India, even more so in the rural parts[3].

The picture gets even more complex with allegations of product quality issues, incidents of altering of drug labels have led to even big brands like Glaxo Smithkline recalling with heavy losses [4]. Previous research indicates the tune of product returns in pharmaceutical industry to be a minimum of 1.5% to 15% depending upon the brand in Indian market [5]. The same study also identifies various issues in the return of unusable stock which happens to be at the fag end of the expiry period while at the same time many part of the country experiences lack of quality drugs. Given the magnitude and impact of this phenomenon, this study proposes to explore using one of the latest information technology product namely Blockchain technology to aid the Indian drug industry supply chain to function more efficiently especially for the reverse supply chain.

Block chain

The blockchain technology was first proposed in 2008 through a research paper [6]. Though block chain has many applications the technology shot in to prominence with the alternative monetary promise through Bitcoins. However we need to keep in mind the basic premise of block chain as concept that enables the decentralized and immutable storage of verified transaction data. The technology ensures that the verity of data is kept intact by distributed information which self-regulates and self-checks the authenticity of entries. Thus block chain creates transparency – since every member of the network has access to the same data, providing a single point of truth[7].

Block chain, is a Distributed Ledger Technology which is a distributed, shared, encrypted database that serves as an irreversible and incorruptible repository of information. The blocks in the block chain are present in chronological order. The nodes have an automatically downloaded copy of the block chain when a new transaction enters the network. All the data about all transactions ever executed in the particular network is recorded in the blockchain[9]. Once the information was entered, it could never be deleted or changed. Block chain acts as both the network and database, secure and integrated. Block chain is able to build the transactions based on rules which are defined mathematically and enforced automatically.

Thus block chain can enact both immediate and long-term simple as well as complicated financial transactions. It could be used for transactions of different types of assets, business, currency or financial contracts. Further it can also act as a registry and inventory system for recording, tracking, monitoring, and transacting of all assets.

Reverse Logistics Issues in Indian Pharma-Industry

The inventory management in the pharmaceutical supply chain is majorly push based, and hence the inventory levels tend to be very high at the retail level. Hence the product return and redistribution management at the downstream level can reduce the production and benefit the hitherto unserved population. Further counterfeiting of drugs is also crippling the industry. World Health Organization estimates counterfeit drug sales to range between $35 and 40 billion per year (8%-10% of total

sales) [10]. The use of modern information technology will go a long way in addressing these issues.

METHODOLOGY

The methodology of this study is based on the Systems Thinking methodology[11]. Experts from the drug industry and the information technology industry were gathered and a brainstorming session captured various ideas for further exploration and the solution model was also similarly developed considering the supply chain system as a whole.

Technical Concepts of Block chain for Supply Chain

It is important to consider the technical concepts of block chain to understand the outcome of the various models with respect to legal, security, performance and privacy. Many different technologies based on Block chain were developed for various problems. Hence different business needs will have different solution technologies.

Broadly speaking block chain is a digital platform keeping the entire history of all transactions between users across the network both tamper proof and hack-proof. It is also a database to provide transactions in digital currency such as Bitcoin and Ethereum networks. Entire transactions created between users or agents are checked by cryptographic algorithms, grouped into blocks which are added to Block chain. No single party can change the information in blocks since they are chained to each other. Also every node in the network has its own copy of Blockchain, which are synchronized with other nodes using a peer-to-peer protocol. Thus the technology does not need a central authority for trust and consequently leads to confidence of participants in the integrity of any single transaction[12]. Block chain enables to process different transactions and securely reach consensus without third party intervention.

At one end we have public block chains, for example the Bitcoin system, where everyone can use the distributed ledgers, to communicate with any individuals. Here everyone can read from or write to such ledgers, making them appealing for many participants to participate in transactions. At the other side we have the option of private block chains, where the counter-parties to transactions want to keep all information about the transaction private, for example exchange of medical records or the shipment of goods. These are also known as Permissioned Block chains which can be appropriate and relevant for a commercial application. The usage of private Block chains gives the ability to determine the availability of any participant in the network to keep its information private. In thes networks new participants can access only by invitation by existing players in the system.

One of the implementation of block chain originally promoted by IBM and currently open sourced is the Hyperledger technology, currently supported by Linux foundation. The Hyperledger technology permits many

different uses of Block chain, therefore it allows the creation of distinct levels of permission. Due to the ability to encrypt the transaction, participants can conceal their identity, transaction patterns and terms of confidential contracts from third parties[9].

Problems with Pharmaceutical Supply Chains

A pharmaceutical supply chain consists of various links from the product process involving research, manufacturing and distribution of the drugs. With the globalization, a supply chain can have hundreds of stages and many physical locations for each of the above process stages. Such a complexity results in the difficulty of tracking events in the supply chains and investigating of incidents. Since the information is lost in each stage of the supply chain, the events in the later stages of a chain will present more difficulty in obtaining of information on it[13].

Buyers and sellers need a reliable system for verifying and validating the true value of a product or service purchased. A lack of transparency in supply chains implies that what we pay for a service or a product is often a wrong reflection of the true cost of production for same. In the Indian pharmaceutical supply chain, as the tracking of inventory status after manufacturing is neither complete nor fool-proof for majority of the supplies, if one of the players in the supply chain engages in counterfeiting of drugs, modification of expiry dates etc., investigation becomes very hard and often no one is held accountable[5].

In view of these kinds of scenarios, trust becomes very important in supply chains as the person in the link expects another party to execute something important to the person who entrusts to the other. For example in a transaction when one person was paid to provide a goods or service, the payer expects the other party to perform a particular action, supply of goods or service. Thus between players trust levels will be a central part of supply chain relationships[14]. Extending it further, the exchanges of records of such a transaction also have been trusted, which earn trust by the two interlinking concepts of reliability and authenticity. Reliability in records is defined as how trustworthy a record is based on two aspects namely, the levels of controls on its creation, the completeness and the competence of the record's author[15].

ANALYSIS AND DISCUSSION

Now that we know trust is important, technology provides a solution for creation and dissemination of trusted records. Block chain guarantees trust in a system using mathematics, code and decentralized verification of transactions. Block chain can solve the issue of multiparty contention without having to involve a human intervener. Parties that have different sets of interests will probably avoid contention as untrusted systems and processes are replaced by block chain implementations since they are

self-administered, self-executing and free of manual administrator.

Even in the absence of a central authority to control and correct the system, block chain can create a trusted decentralized system, which has a way of managing ownership information. Disputes (and hence distrust) occurs due to differing interests and claims about ownership of assets. These disputes, in the current world, are solved by a third party, typically banks or clearing houses. For example in a trade for shares, the stock exchange clearing house acts as the intermediary for any dispute settling with their own rules for trade. However increasingly we see a distrust for these third parties like banks in the current economic scenario[16,17]. However with blockchains, such dependence and trust to a third-party is not needed any more since the ownership authentication information does not reside with individuals or centralized institutions, but distributed across the population. Thus, the role of central authority is replaced by peer communities as peer-to-peer networks, and so no single entity will have the capability to unilaterally taking action, to safeguard or damage the trust that is part of these transactions. By democratizing information, organizations cannot unilaterally break the rules of the system, which increases the trustability of the system itself [16].

In view of these advantages, the block chain technology has the potential to fix some of the current problems with supply chains today. We can create a block chain implementation that registers all transactions of goods which includes the parties involved, date, price, location, state and quality of the product and other supply chain management information.

As the Block chains implementation is publicly available, it will be possible to track all the steps in the supply chain of every product. With such a block chain based supply chain, everyone can potentially trace a product back to the raw materials used to produce it. It will be nearly impossible for an attacker or "hacker" to take ownership of the block chain and the data stored there to manipulate it to their own advantage as it is immutable and cryptographically secured. Besides being immediately visible to all actors, every actor will also be getting a record containing a full auditable history of all the transactions of value ever conducted on the block chain implementation, making verification universally available to all players in the network.

Thus block chain technology suits transaction of value in a secure, open, peer-to-peer and auditable process. Comparatively the paper-based or electronic systems using just double entry accounting system for movement of assets and maintaining trust by recording and managing transactions is very inefficient as compared to the capabilities of block chain technology.

In the normal pharmaceutical supply chain these are normally brokers and middlemen who are paid a fee and

trusted to manage or process a transaction. However in the block chain implementation which has the potential to provide automatic block chain-based smart contract systems, will receives higher level of trust than these brokers and middlemen. The brokers and middlemen might lose their competitive advantage of trust to a block chain implementation which is more trusted and is efficient.

CONCLUSION

To address information integrity and transparency issues, block chain technology can be used to build open, secure and trusted supply chain management systems in the pharmaceutical industry assuming that the infrastructure for processing and recording transactions is secure and properly managed. The infrastructure should be based on open security standards such as Secure Internet communication standards and well audited internal systems of the participants to avoid pilfering of information at the source.

However since the technology is new, the standards for acceptance of such Supply Chain contracts to be accepted by banking and financial industry for financial implications such as working capital loans and other financial needs to be taken in to account. While the government is still looking at regulations of crypto-currencies such as Bitcoins, the enormous potential of block chain for business needs to be properly documented and needed legal and judicialry framework for recognition of trustworthiness of this new form of asset transactions needs to be separately recognized, codified and communicated to public by governments.

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