

Blockchain in Supply chain – Indian context

Introduction:

The ever-increasing globalization of supply chain, global uncertainty, emergence of new technologies and the development of Indian market creates a curiosity and the need to look into all these things together. Blockchain is undoubtedly one of the emerging technologies which is making a big impact in many industries such as finance and is already on its way to make a mark in the supply chain sector as well. India, being the developing country has its own internal issues as well as the external challenges in their booming supply chain market. This report presents the critical Indian supply chain issues, overview of blockchain technology and its benefits in supply chain management, insight into the current state of blockchain implementation and its adoption challenges in the context of Indian supply chain. The final portion concludes the future of blockchain for India's supply chain system based on some of the empirical evidence presented.

Limitations:

India being the vast diversified country with enormous population, there exists the large number of industries and the various types of businesses. However, this report has taken the consideration of only few industries such as garment industry, food industry to highlight some of the supply chain issues.

Supply chain issues in India:

Inventory problems: Inventory issues due to high lead time, poor visibility and certain manual textile processed are some of the critical issues faced by the garment supply chain sector. In India, garment organizations are usually found to overstock specific type of products which eventually leads to obsolescence and acts as a barrier for in-demand products (Kalyani, 2021). The over stocking of products will increase the holding costs for a company and that could affect the company's future investment plans. The buying of raw materials for apparel products used to happen one year in advance based on the forecast demand and this process of high lead time causes overstocking in the inventory. Lack of visibility of information flow only aggravates the improper inventory estimates. Certain processes such as visual color matching are being done manually which leads to 16 days of work-in-progress inventory and 30 days of raw material inventory (Kalyani, 2021). In the developed countries such as United Kingdom, the

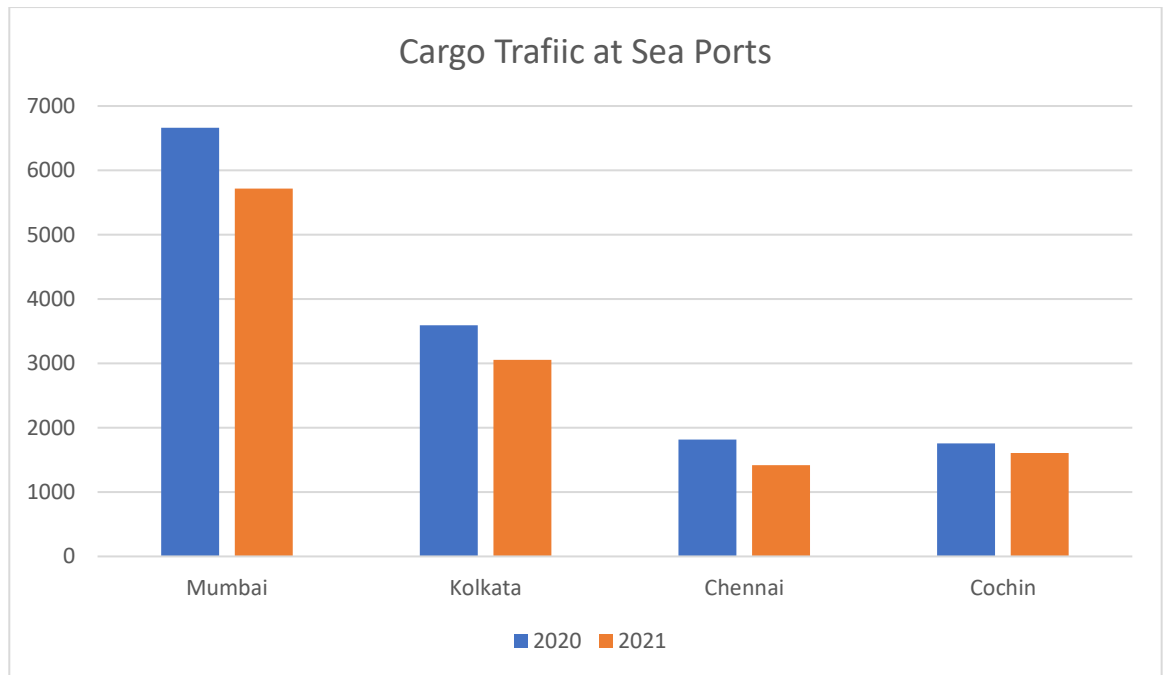
approach of just in time is being used to manage the inventories. But in India, due to many factors such as diverse festival seasons, climatic conditions, most companies are not able to implement the just in time concept. Considering the dynamic nature of customer choices on fashion and textile products, inventory optimization is a crucial thing to be implemented.

Logistical challenges: Despite having all the four modes of transport, the fragmented nature of logistics infrastructure makes it difficult to the supply chain process as it includes both organized and unorganized participants. The inclusion of many check-posts nowadays for documentation verification further worsen the process by slowing down the goods movement. Poor road conditions due to occasional excessive rainfall acts as one of the barriers in implementing the just in time concepts.

Trust Related Issues: Collaboration among the various supply partners is one of the key aspects in supply chain performance. The long-term partnership with the suppliers is a challenge in India majorly due to the lack of knowledge of garment manufacturers in executing it successfully (Kalyani, 2021).

Quality issues: The major issues in the food supply chain are being the quality control and the higher market price due to the involvement of multiple parties such as middlemen. The involvement of multiple third-party vendors in the supply chain has high chances to create a disruption in the flow and it will be difficult to trace back a product to its origin.

Issues due to Pandemic: The below chart presents the comparison of cargo traffic in terms of number of vessels at major sea ports of India during the financial year 2020 and 2021 to show the impact the pandemic has imposed on the country's maritime supply chain (Narasimha, Jena and Majhi, 2021). It is clearly evident that there has been a negative impact due to the decrease in the number of vessels at all the major ports.



Considering the ongoing growth of the country, the current supply chain issues are forecasted to get stronger as the population and demand are projected to grow higher. Hence, it is crucial as well as high time to apply technology into the Indian supply chain system to make it more efficient.

Blockchain - Overview:

Blockchain is a decentralized ledger system used to store the transaction details through a series of chained blocks. Each block contains a unique information about the previous block such as the hash number. The information in each block is available to every participant in the transaction process. Once the data has been stored and validated in the block, it is very complex or nearly impossible to change due to the linking of hash number of previous block.

The fast and secure transactions can be done with the help of smart contract system in blockchain. Smart contracts are set of programs written in the blockchain and it works based on certain predefined conditions. Once the conditions are met, the corresponding actions will be executed. Such actions could include releasing funds, sending notifications, etc. The concept of smart contracts helps to make the supply chain process work quickly.

Blockchain in Supply chain:

Blockchain being the decentralized ledger system brings lot of positives to the overall supply chain performance.

SC Resilience: The decentralized nature of blockchain removes the presence of a dominant member in the supply chain and thereby avoids the single point of failure. This eventually brings the control for each and every supply chain member over their data and so strengthens the overall supply chain resilience.

B2B Integration: The large supply chain systems are highly volatile to the disruption caused by the delay from any suppliers in it. For example, the car manufacturing requires huge number of products for the assembly from many suppliers, even a delay in anyone supply could eventually delay the manufacturing of the final product and results in huge financial loss. These can be avoided with better risk management which requires sharing of data from all the suppliers. With the data security blockchain offers, the risks associated with the suppliers can be managed in such a way that the business-to-business integration gets simplified ((Nick, Aljosja and Bhaskar 2019).

Traceability: In the case of centralized systems, the suppliers might hesitate to share about their relationships with other suppliers as they could think that their customers might bypass them and source directly (Nick, Aljosja and Bhaskar 2019). Hence, it is difficult to trace the product without proper data. Blockchain gives the parties in the supply chain the required privacy by unlinking the transaction to the sender or recipient thus allowing the traceability of a product only through product specific key.

Real-time Information: A container takes approximately 36 hours to physically get from Singapore to Jakarta, Indonesia. However, information and financial settlement can take up to seven days, this is primarily due to the fact that instead of having direct access to data and being able to verify automatically whether the actual transaction happened, as the buyer and seller have to rely on network of trusted third parties (Nick, Aljosja and Bhaskar 2019). Blockchain with its smart contracts approach, enable real time settlement of information flow through contractual conditions and helps to execute the transactions faster by completely digitizing all the required documents in the cycle.

Procurement Phase:

Blockchain helps to bring the digital trust to the procurement cycle. The feature of smart contracts is used to avoid the payment gap between delivery of a product, generation of invoice and the actual time of settlement (Kamble, Gunasekaran and Arha, 2019). This is accomplished by the integration of delivery and product as well as the integration of logistics partners and banks.

Logistics Phase:

The benefits of trace and track mostly gets reflected in the delivery cycle. In the large and wide supply chain systems the chances of discrepancies in the data flow and in the end quality of product are more (Kamble, Gunasekaran and Arha, 2019). The information flow of the product is achieved by integrating blockchain with other technologies such as Internet of things, RFID, etc. The sensors placed in the vehicles inputs the information about the product to the blockchain. Such data in the blockchain cannot be altered or forged and it can be queried anytime to analyze the lifecycle of the product.

Pandemic Period:

Blockchain will be of great useful to the food and pharmaceutical industries during the pandemic situations. The increase in the demand for food products has raised as public used to keep up their food stock. This increase in demand has caused the delay in supply chain and so the contamination of food. Blockchain with its traceability feature can help to track the temperature level of the products throughout the supply chain process.

To summarize, blockchain features can positively affects supply chain management at its every stage as well as during the uncertain periods.

Blockchain in SCM - India:

Current State:

Among the states, Kerala is leading in the adoption of blockchain to the supply chain process. The Kerala development and innovation strategic council (K-DISC) spearheads a blockchain application project in the food industry to enable smooth functioning of purchase and distribution of milk, vegetables and fish in the state (Indiametrics, 2022). Apart from this project, a dedicated academy for blockchain has been developed by Kerala government to prepare the professionals. The use of blockchain is

in the testing phase in the logistics industry. The government of India launched a project called electronic cargo tracking system (ECTS) to achieve secure documentation and GPS-based tracking of containers. The test run is being carried out in one of the container depots as of October 18, 2021 (Quartz India, 2021). The industries such as pharmaceutical are in their nascent stage as well in using blockchain in their supply chain. India has definitely realized the advantages of using blockchain in the SCM and has started to use or test it. However, it is important to mention that the country is clearly still in its inception phase of blockchain adoption. The progress of the ongoing projects may decide the future of blockchain in Indian supply chain management.

Adoption Challenges:

Blockchain Characteristics: Despite providing numerous benefits, blockchain has its own challenges when it comes to the implementation of it in Indian supply chain management. With respect to characteristics of the blockchain, immutable data is a definite barrier for its adoption though it provides the required security of data. Suppose if any wrong data has been entered into blockchain correcting such error requires the edit of all the blocks. Since each block contains the hash number of previous block, error correction will need a great deal of effort. Though blockchain provides secure data, privacy of data can be a challenge. Some sensitive information may be contained in the agricultural products such as production methods. Therefore, it is difficult to handle the balance between confidentiality and transparency (Chen, Liu, Yan, Hu and Shi, 2020).

Integration Difficulty: One of the challenges in adopting blockchain technology is the complexity of integration. In order to implement the blockchain concepts, the integration of all the required information from first tier supplier to the end receiver is required. In the case of food industry, the supply chain usually includes huge number of participants. For example, biscuits are made from a variety of ingredients, the production process of which involves several suppliers. Every involved supplier must record the production information, such as raw materials, using blockchain technology. Therefore, integrating these suppliers into a blockchain system can be a very difficult and costly task (Chen, Liu, Yan, Hu and Shi 2020). The same complexity applies to other few industries as well such as automobile and electronic industries where the number of suppliers is generally more. The requirement of unified data format adds to this integration challenge, as each and every manufacturer or supplier

produces data in their own formats, common data storing format will be required for blockchain implementation. So, every involved supplier will have to use digital systems to store the data. Some small-scale suppliers in India could be using pen and paper methods, so an initial high investment will be required from their end. To achieve the successful integration, co-operation of all the participants in the supply chain is mandatory which is obviously a critical challenge for to get implemented.

Investment Challenges: Blockchain is entirely a new concept for the global supply chain, recruiting the employees with requisite skills will be a challenge or the organizations will have to invest in training their human resources in blockchain. Apart from the training or recruitment investment, the cost of purchase of the required hardware and software needs to be incurred by the organizations. To obtain certain advantages of the blockchain such as traceability, blockchain needs to be integrated with other emerging technologies such as internet of things, etc. This raises the investment needed to use the blockchain technology. Overall, high initial investment is a crucial barrier to keep the focus away from the blockchain technology (Kumar Bharadwaj, Garg, Gajpal and Abd El-Latif, 2021).

Complexity of Technology: Since many people and organizations lack clarity in the technology, the understanding and the use of the blockchain will be challenging for the users. The defects due to algorithm in the blockchain may be difficult to resolve or more time consuming (Kumar Bharadwaj, Garg, Gajpal and Abd El-Latif, 2021).

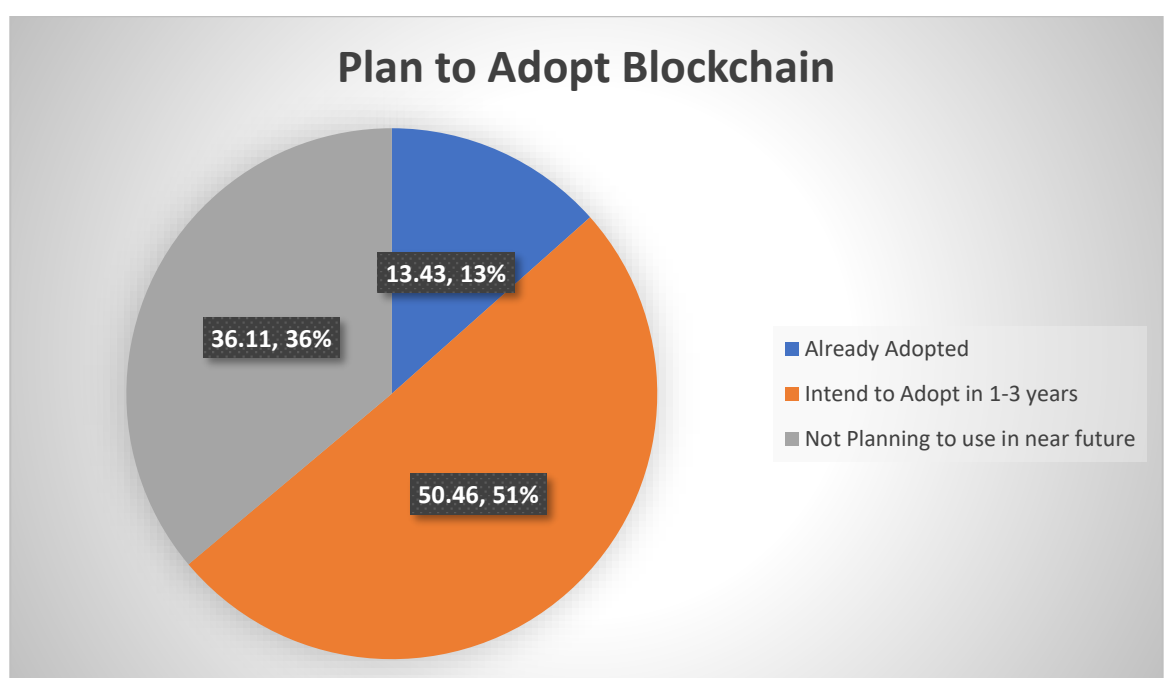
Lack of Regulations: A common blockchain related regulations need to be implemented in both inter and intra country wise so that it will be easy for both large and small suppliers to follow the common guidelines and hence clear procedures to share the data between them. The diverse nature in the global supply chain and the different demands from different countries for the regulations may bring the complexity in the implementation of global legislation and regulations (Chen, Liu, Yan, Hu and Shi 2020).

Infrastructure Challenges: Queiroz, M M and Fosso Wamba, S determined the adoption challenges of blockchain specific to Indian Supply chain management through the of survey of supply chain professionals. Factors such as Performance expectancy (PEXP), Social Influence (SINF), Facilitating conditions (FCON), Blockchain transparency (BTRAN) and Trust of supply chain stakeholders (SCTRU) are used to identify their influence on the individual behavioral intention and expectation. Among those five

factors, FCON and BTRAN acts as the barriers for the blockchain adoption. Facilitating conditions such as organizational and technical infrastructure acts as crucial challenge for the companies in India. India, being the developing country does not have the enough required infrastructure to support the new technologies all throughout the country though it may not be the case for long time. Blockchain transparency is about the exchange and visibility of information between organizations. BTRAN may not be a crucial barrier like FCON as it does not have significant negative influence on behavioral intention. The reason BTRAN is not supportive for adoption is mainly due to the lack of awareness of the professionals on the technology.

Challenges Specific to India: Among all the challenges, the specific ones related to Indian supply chain are decided based on the survey conducted with the small and medium enterprises in India. India, being the emerging country, it is crucial to consider the inputs from the small to medium enterprises as they are more in number. The initial investments, complexity of technology, government regulations are specific to the supply chain management of India. The challenges related to blockchain characteristics and its integration are more in general and applicable to all organizations around the globe.

The below pie chart presents the responses from the small and medium enterprises of India in adopting blockchain in their supply chains (Kumar Bharadwaj, Garg, Gajpal and Abd El-Latif, 2021).



Conclusion:

Though there are numerous problems in adopting to blockchain technology, companies from India are keen to bring the technology to streamline their supply chain process. This is evident from the fact that survey conducted with small and medium enterprises in India holds more than 63% for already adopted the blockchain technology and looking forward to use it in the near future. Since the government has started a pilot project of blockchain in logistics and the initiation of blockchain academy in the state of Kerala, the challenges such as complexity of technology and government regulations can be fixed over the time. Thus, blockchain is going to have some serious role to smoothen the Indian supply chain management with its unique advantages despite being in the nascent state of use currently.

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