



Blockchain in Supply Chain



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Abstract

Today's supply chain has become very complicated, with lot of effort involved at each stage of the process - right from raw material (mining / farming / production / assembly) to the final consumption / disposal stage. Given this complexity, there is lack of visibility which often leads to inefficiencies, wastages, delays, and sometimes even exploitation, creating an unsustainable business environment. Many of these issues can be solved by blockchain technology, which creates and stores an immutable transaction or a registry tag, that moves with product across the supply chain.

This aids in creating visibility and helps the upstream / downstream players to understand the product journey across the supply chain. Customers can track the delivery schedule as well as authenticity of the end products and can exactly identify when it will reach them. Similarly, production plants can identify the path of raw material flow and schedule operations accordingly, thereby reducing wastage, and improve the operational efficiency of the assets.

Also, as companies continue to invest in R&D to develop new products / technologies and drive innovation, they need to safeguard their investments to remain at the top. Here again blockchain technology could be leveraged as this would help keep track of patents and maintain their intellectual property rights. However, blockchain is still few years away from complete maturity, and needs to find space in existing technology landscape with government / regulatory acceptance needed in certain applications.



Complexity in Global Supply Chains

Times have changed in the globalized world and businesses have started operating from multiple countries, serving people across the globe. In olden days, companies used to source and manufacture in domestic areas for selling in international markets. But now, each part of what gets assembled in the product, comes from different geographies, for selling many a times in an altogether different market.

Supply chain, a key driver for business has become complex with sourcing happening at one end of the spectrum, manufacturing happening at the other end and the end products being delivered across the globe. All this results in the product being exchanged between multiple entities before reaching its destination. According to Reuters, Maersk found that a shipment of refrigerated goods from

East Africa to Europe can go through nearly 30 people and organizations, including more than 200 different communications among them. The network of suppliers, manufacturers and partners are finding ways to reduce costs, increase profitability, improve production efficiency, and all these while maintaining quality in the ever-changing business landscape.

The challenge in supply chain stems from the fact that it is a key pivot that connects suppliers, manufacturers, retailers, partners and consumers with the product. Add to this, the pressures of competitive pricing strategies, ever-changing customer preferences, and associated complexities for different market segments, companies are striving to find ways to optimize the supply chain process to remain competitive.

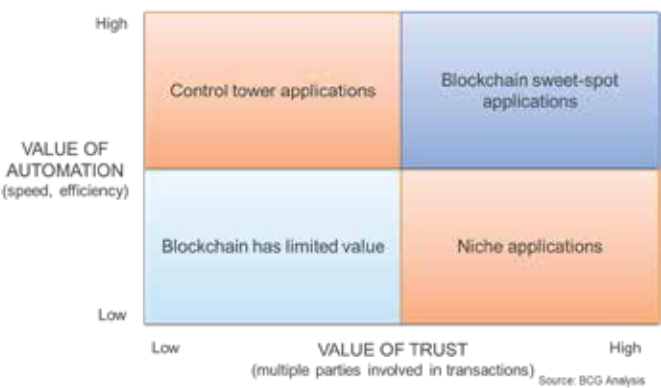
Need for Supply Chain Visibility

Visibility across end-to-end supply chain is the goal for many organizations, as it helps drive certain key functions of the supply chain like demand-supply synchronization, optimization of fulfillment channels etc. (Few more benefits are mentioned in the figure below)



End-to-end transparency though, has been poor till now. In one survey of CPOs, it was found that only 6% of them have full visibility of their entire supply chain; 65% said they have limited visibility beyond their tier 1 suppliers. This lack of visibility is not just because of the global complex landscape, but also due to wrong systems in place.

Organizations traditionally have looked at 'Digital Control Tower' for gaining visibility across the extended landscape. This worked well where transactions were carried out manually, and complete trust was prevalent among various participants in the chain. These control towers are lacking though, in the digital age, where automated and fluid networks are common, and automating trust and control is necessary. They can be replaced by blockchain technology which can automate the system (with smart contracts), and manifest trust by design.



Blockchain vs. Control Tower

About Blockchain

Foundation of blockchain was established in 2009, when pseudonymous developer(s) Satoshi Nakamoto introduced Bitcoin, with a 9-page whitepaper, offering a currency that used no paper or metal but only few lines of code. Underlying technology powering this virtual currency gained prominence with the rise of Bitcoin, which at some point in 2017 had market capitalization more than giants like GE, P&G, and Walmart. With rise in its popularity, it is called by many as 'Second Generation of Internet' and 'Internet of Value'. Gartner estimates that by 2025, the business value added by blockchain will grow over \$170 billion, and then exceed \$3.1 trillion by 2030.

Even though there is no consensus amongst organizations for blockchain definition, there are some features which form the

foundation of this technology and make it suitable for some unique opportunities.

Blockchain at its core is a decentralized distributed ledger, where transactions (which can be exchange of material, currencies, assets, securities, identities, or any other record) are time stamped and added into a block, which are linked and secured using cryptography. This is supplemented by innovations like 'smart contracts' on top, which are computer programs that execute certain tasks on meeting a pre-defined condition, thereby automating the process and removing middlemen in certain cases.

Public and Private Blockchain

When blockchain got decoupled from Bitcoin, there came into existence two separate categories of it, 'Public Blockchain' and 'Private Blockchain'.

Public Blockchain

Public blockchain is a more traditional form of blockchain in which anyone can join the network and carry out transactions. Given the open nature of such a blockchain, it has stringent protocols for transaction validation, which by design compel all participants to act in a legitimate way. One example for such protocol is 'Proof of Work' (PoW) adopted by Bitcoin. PoW, by design needs 'miners' to validate transaction and they consume tremendous computing power as the network grows, making it difficult to maintain speed with scale. All this is needed to secure the open public network, as trust between participants cannot be guaranteed.

Private Blockchain

In contrast to Public blockchain, Private blockchains allow only approved participants to be added in the network and they carry out transactions based on the predefined privileges. For supply chain, these participants can be various nodes in the chain like supplier, manufacturer, logistics provider, distributor, customer etc. As there exists partial trust among these entities, there is no need to have high energy consuming protocol like PoW for validating transactions, and it can be carried out using simple one's like 'proof of stake', 'proof of elapsed time', 'simplified byzantine fault tolerance', or even simple voting-based or lottery-based system.

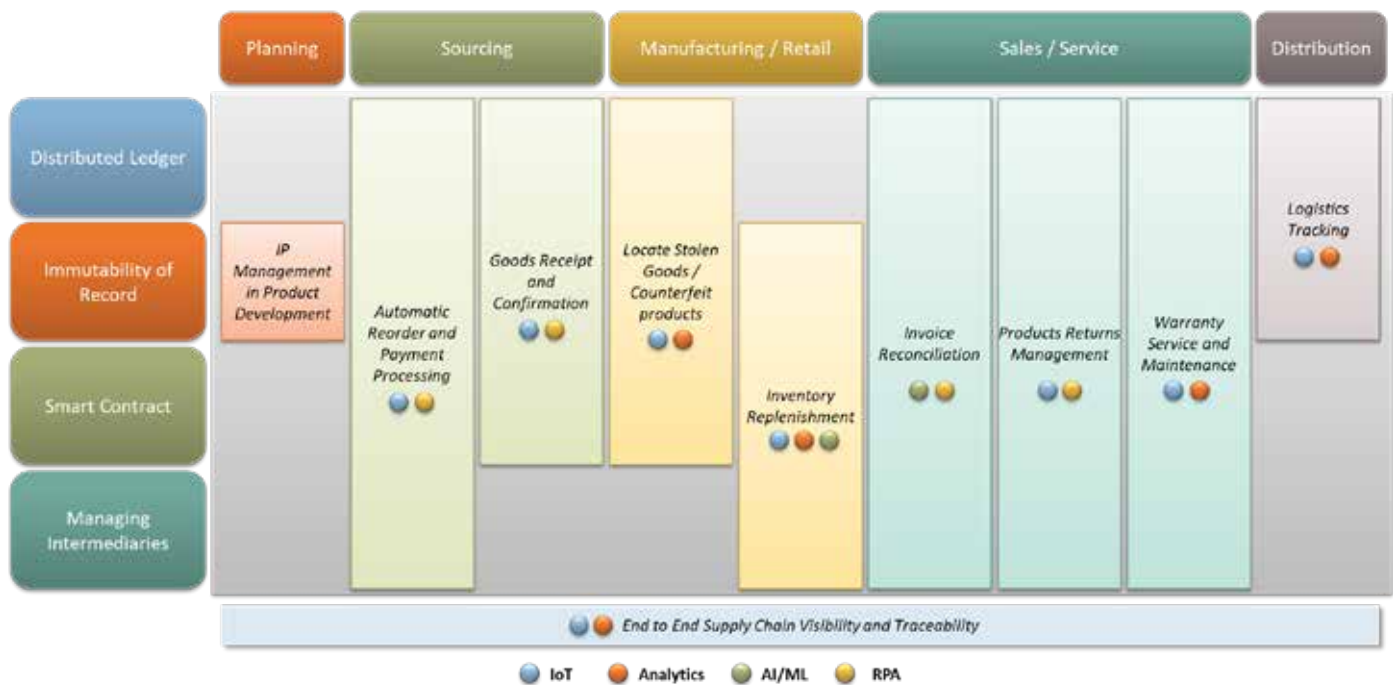
Blockchain Applications across Supply Chain

One of the most difficult questions organizations face is to justify the business case for blockchain, given that there is negligible evidence to suggest that blockchain has been integrated with existing processes and system landscape by any organization. To answer this, organizations need to define the problems they intend to address using blockchain and see how the business benefits can be realized, not just for a specific function, but across their value chain. They need to assess several parameters like cost of quality, delays, product recalls, counterfeit goods market, litigation cost etc. to justify the business case. As difficult as computing the ROI is, considering the nascent stage of the technology, it makes the

decision process easier for an organization to move from a pilot phase to a full-fledged implementation and hence, realize the desired outcome, instead of making it just another piece of the technology puzzle.

Few use cases for blockchain, which make use of core tenets of blockchain, are listed in the figure below. These can be enhanced further by coupling it with other technologies like IoT, Analytics, AI/ML etc.





Use Cases across Supply Chain

Blockchain Adoption Approach

Blockchain adoption needs business and technology stakeholders aligned with the expectation and outcomes, to ensure success. It must start with 'why blockchain?', and why the problem cannot be solved by any other matured technologies. A quick checklist that helps identify if blockchain is the right choice for a given case is as follows:

- 1 Are multiple stakeholders / partners involved in the process?
- 2 Do stakeholders / partners have trust issues?
- 3 Is information / data change a serious concern?
- 4 Are there multi point data reconciliation process?
- 5 Is there a possibility of fraudulent transaction?
- 6 Are there manual verification processes?
- 7 Is process latency an issue?

Checklist for Blockchain adoption

Blockchain usually complements existing applications and this technology replacing some of the applications in entirety, may or may not happen. It should always be followed by a proper change management initiative to guide end users on how the future systems will interact and work.

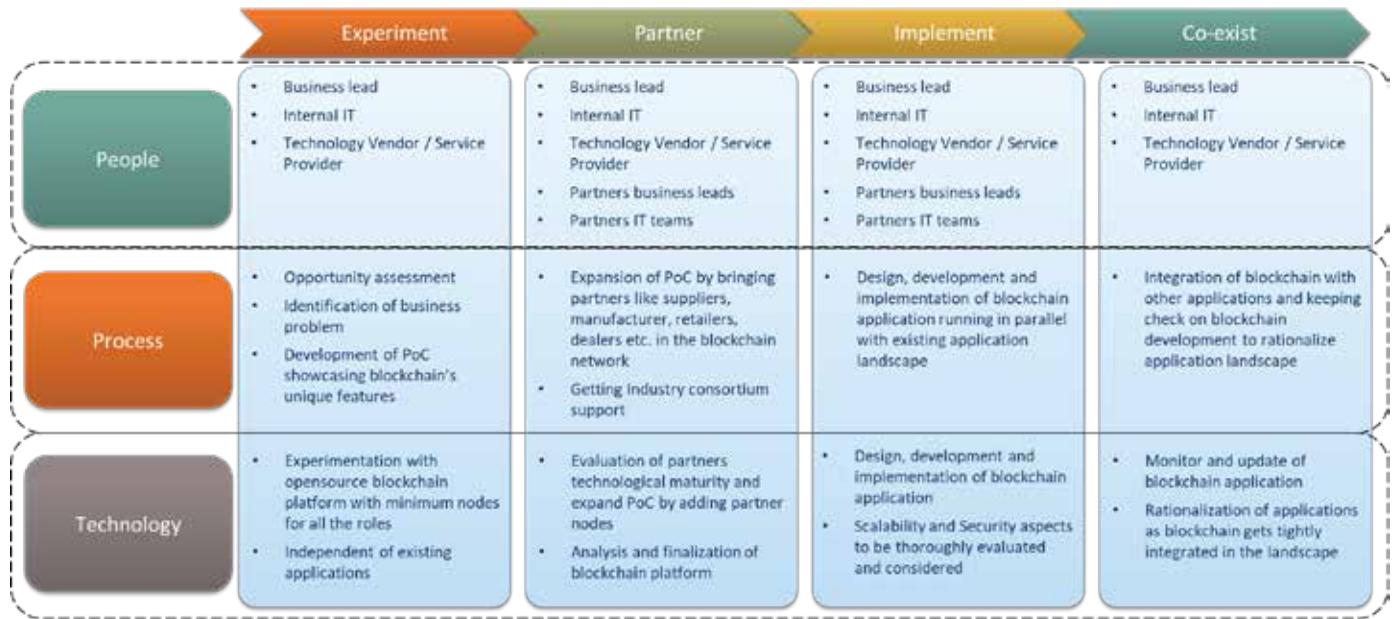
It is preferable to start with a pilot project or a proof of concept (in a small area), show how the technology works and then move on to further developments. The approach should start with business

strategy and vision and define the goals that are expected to be achieved through the initiative. Business and IT should work together to deep dive into functional requirements that are envisaged as part of the project. A program roadmap must be laid out and this will outline the way the project is run, till the end state is reached.



Technology roadmap definition will help in evaluation and platform selection in sync with the architectural design. Interfaces, if any, that need to be developed from the existing applications should be looked in detail. Scalability and Security aspects become a key as that explains the viability of the PoC developing into a full-fledged initiative for realizing business benefits in future. Finally, end user experience and usability will have to be considered accommodating ease of operation and frequency of usage.

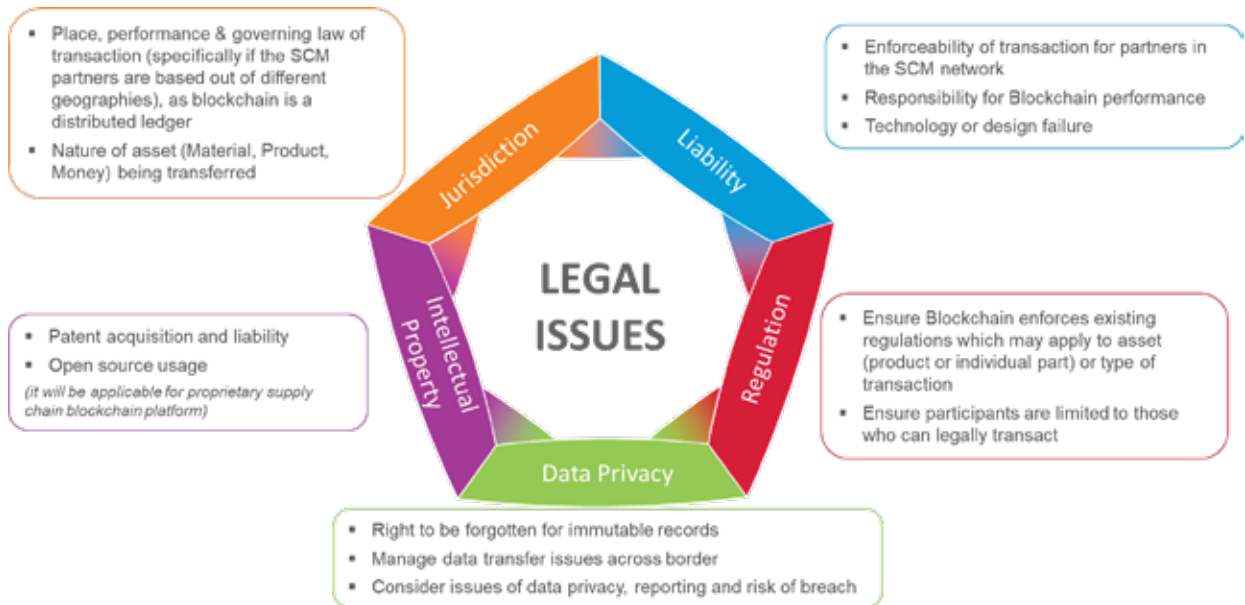
Hexaware's 'EPIC Framework' for blockchain adoption helps organization through all the stages of lifecycle, right from use case identification, business case validation, PoC development to complete product development and implementation.



Hexaware's EPIC Framework for Blockchain Adoption

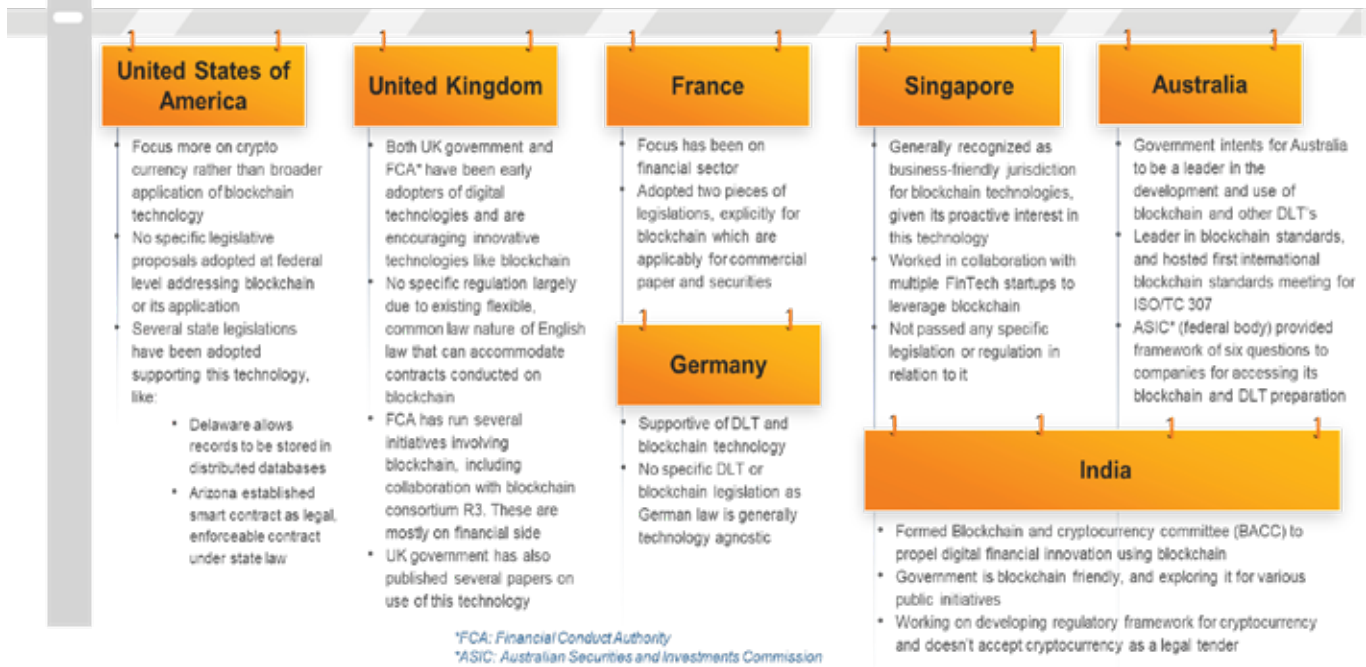
Regulatory and Legal issues

Whenever a new technology comes into existence, there are talks of regulatory aspects that need to be adhered to. The below illustration depicts some of the issues that need to be investigated when going for a blockchain implementation:



Blockchain legal issues

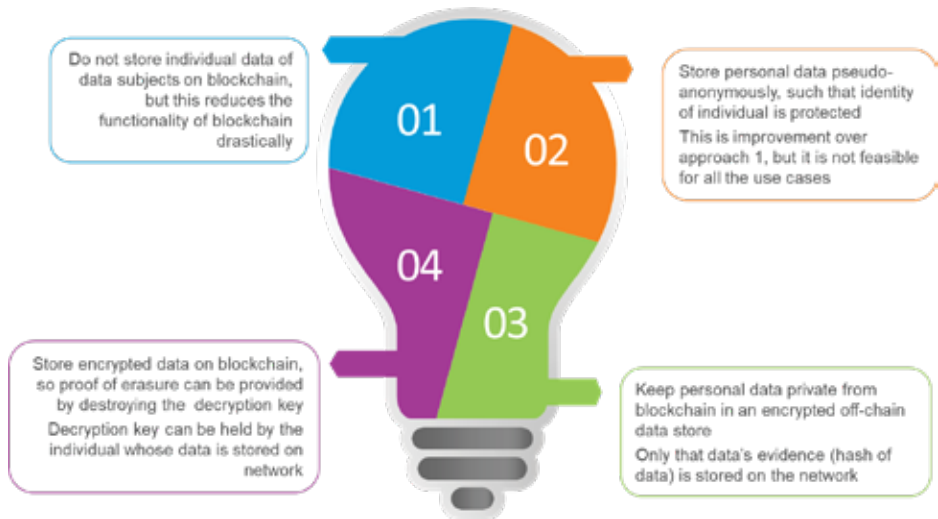
Even though the market for blockchain in supply chain is growing at a tremendous pace (As per IndustryARC report it is expected to reach \$424.24 million by 2023, with North America expected to dominate the market with \$131.65 million in annual revenues), the acceptance across the globe is not consistent. The below table provides a summary of blockchain acceptance as a technology for some of the key markets.



Blockchain and GDPR

Global Data Protection Regulation (GDPR) came into effect in EU, from May 25, 2018, providing their citizens and residents more rights and control over their personal data. This not only impacts the organizations operating out of EU but will also affect organizations which hold data related to EU citizens or residents. Non-compliance penalties are also heavy (higher of 4% of world-wide turnover or 20 million euros), which make it necessary for all systems implemented, including blockchain, to be compliant with it.

One of the fundamental principles of GDPR is 'Right to be Forgotten' which empowers EU citizens to ask for deletion of their record from any recording system. Blockchain being an immutable and append only record, it becomes challenging to accommodate this request depending on the architecture in place. Few workarounds though which are commonly implemented till the time blockchain is properly accommodated in GDPR are as follows:



Accommodating GDPR's Right to Erasure in Blockchain

Conclusion

Blockchain technology has the potential to disrupt and could be an answer to some of the problems faced by supply chain. The technology is in nascent stage and is still evolving as we have discussed earlier. The key is to get started with initiatives on a smaller scale and once the ecosystem develops further, the bigger transformations avenues can be looked at. The crux of blockchain lies in provenance, immutability, trust, transparency and understanding these key tenets will help in leveraging the technology in the digital supply chain journey. Big projects and full-time implementations may take a few more years but the technology as such looks promising for adoption by organizations.

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Hexaware services customers in over two dozen languages, from every major time zone and every major regulatory zone. Our goal is to be the first IT services company in the world to have a 50% digital workforce.

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