

Blockchain Technology and Global Supply Chains

Global production and supply chain management are, by design, complex and geographically disjointed, especially in a multinational corporation's network of global supply chains. Each supply chain involves multiple companies, multiple links in the chain, and lots of resource ties between these entities and links. Given such a dynamic and multifaceted setup, the nature of globalization with trade barriers, varied policies worldwide, diverse cultural and environmental issues, and people from business and nonbusiness functions make it difficult to have a good handle on information that flows in global supply chains. It also makes it difficult to manage risk, security, and value-added aspects of the chain. Every company wants just-in-time information at its disposal, but not every organization in a global supply chain is willing or able to supply such information easily.

Meanwhile, many supply chain executives and corporate strategists make a compelling case that information flows in global supply chains are perhaps more critical than even the flow of products, component parts, and raw materials. Timing in production relies on information flows. In particular, traceability is becoming an urgent requirement and a fundamental differentiator in many supply chains (e.g., agri-food sector, pharmaceutical and medical products, high-value goods). Lack of information transparency in these chains prevents organizations and customers from verifying and validating the true value of the product, component part, or even raw materials. The cost involved in managing chain intermediaries, their reliability, and performance further complicate traceability in the chain. In fact, both strategic and operational issues arise from these risks and lack of transparency.

To solve some of these supply chain issues, nearly all of the world's leading companies use sophisticated enterprise resource planning (ERP) and supply chain software. Some of the systems include connected manufacturing equipment to digital shipping notices and RFID scanning. Most multinational corporations track the earliest origins of a shipment, often all the way to the recycling bin, if needed. However, even with such tracking, most large companies have only limited information on where all their shipment is at any given moment in the global supply chain even after investing heavily in their digital infrastructure. One of the core reasons for this limited information is that even as supply chains are becoming more efficient, corporations often do not have an up-to-date technology infrastructure to manage the chains. Then again, even if possible, not every organization in a global supply chain is willing or able to supply such information easily.

Enter blockchain technology! Blockchain technology refers to a distributed electronic ledger that has the capacity to record a variety of transaction types, such as those that occur within a supply chain. The ledger is distributed across a peer-to-peer network; it is duplicated and stored on multiple independent servers within a decentralized peer-to-peer network. This distributed ledger can provide complete transparency to transacting parties. While any of the computers connected to the network can make changes to the ledger, they can only do so by following the rules set out in the blockchain's underlying consensus protocol (a predetermined mathematical algorithm) that requires the majority of other computers on the network to agree to a given change in the ledger. Once a consensus has been established in accordance with the algorithm's encoded rules, all the computers on the network update their copies of the ledger simultaneously. Changes cannot be made to the distributed ledger without a consensus and cannot be made (or altered) retroactively without agreement as defined in the consensus protocol. Any attempt to do so will be automatically rejected by the network. The term "blockchain" is

derived from the fact that transactions are bundled together into "blocks" of data that are then "chained" together by encrypted "locks." These "locks" are a product of the consensus protocol and encryption is used to inhibit fraud. The goal is to produce a ledger that contains an immutable shared record of the truth that cannot be manipulated in real time or in retrospect. The key point here is that the integrity of the ledger is guaranteed by mathematical rules, cryptography, and its decentralized nature

Another important aspect of a blockchain system is what are known as *smart contracts*. Smart contracts are automated mathematical rules stored in a blockchain. These rules state that an event (e.g., transaction) cannot take place until certain prespecified actions have occurred and have been accepted by the network (e.g., a payment will not proceed until X and Y have occurred). For example, a company and its supplier could write a smart contract that would trigger the automatic release of payments to the supplier once a certain set of conditions encoded in the contract are met, such as the good(s) being delivered on time, in good condition, and from factories that have been verified by third parties as having met predetermined standards with regard to employees' working conditions and environmental standards (this also allows a final consumer to be assured that a product was ethically sourced and/or produced without the firm having to incur the costs of intermediaries such as certification agencies). The same smart contract might also be used to verify to the supplier that the purchaser has sufficient funds on hand to pay for the goods, triggering production and/or shipment. In this way, payment terms are automated and based on pre-coded triggers in the smart contract to build a trust-like relationship between transacting entities.

Within supply chains, the core logic of blockchains means that no piece of inventory (e.g., raw material, work-in-process, component parts, finished goods) can exist in the same place twice. If a product is moved from finished goods to in-transit, the transaction status will be updated for everyone, everywhere, within minutes, with full traceability back to the point of origin. Such traceability is important for a number of reasons. For example, if a company wants to negotiate procurement deals based on total volume that the company and its subsidiaries and partners buy, a blockchain-based solution can facilitate the calculations of the exact volume discount based on total purchasing. And in a trusting and transparent way, the companies involved can mathematically prove that the calculation is correct because of the blockchain technology. Plus, the calculations can be done while preserving the privacy of each company's individual volumes.

Through blockchains, companies gain a live, real-time digital ledger of all transactions and supply chain movements for all participants in their supply chain network. While seemingly simplistic as a concept, the real-time feature involving a company and companies in that company's network would not have been a simplistic feature to implement without blockchains, given transparency, trust, ability, and willingness problems. But with blockchain technology, companies can negotiate sourcing discounts based on the total number of purchases they do - purchases done on their behalf by others, purchases done by business partners, and purchases made by everyone else in the supply chain network. With a constantly refreshed digital ledger that incorporates data from all relevant partners, a company can see the total volume regardless of who directed the purchase activity without each user having to share its operational data with others. The efficiencies are real as well. Without blockchain's "distributed ledger technology," companies would enlist lots of people to audit their orders to try to capture as much of these volume benefits as possible, but would seldom be successful in capturing all aspects of the supply chain network.

Despite the many positives of blockchain technology, everything is not as optimistic as what the blockchain appears to be, not yet at least. Investment, infrastructure, and implementation are concerns, especially on a worldwide scale. In a Deloitte survey reported in The Wall Street Journal, a majority of organizations see a compelling case for the use of blockchain technology, but only one-third of the business executives who participated in the study said that their companies had initiated implementation of the technology. One issue is that large companies have legacy concerns with their current technology. Fitting blockchain technology into existing systems around the globe is difficult, costly, and not as efficient as possible to reap the short-term, immediate advantages that blockchain technology offers companies. Plus, worldwide, not all companies have the same opportunities to invest in blockchain (due to costs, software compatibility, infrastructure, etc.), which means companies in any given supply chain network may still not reap all the advantages expected by implementing blockchain technology.

Case Discussion Questions

1. Why might lack of transparency in a supply chain might be a problem for a company?
2. What are the potential benefits associated with using blockchain technology to account for the flow of goods through a globally dispersed supply chain?
3. How might blockchain technology be used to increase the "ethical sourcing" of products in a globally dispersed supply chain?

1. the supply chain cannot work together as well and they might not be able to coordinate the different steps of the supply chain in the most effective manner --> leads to longer production times, less efficiency and higher costs; if changes happen the other companies might not understand why, but with transparency they'll understand it and adapt to it; they can better find out where the supply/distribution chain can be optimized (if everybody plays with open cards)

2. easier following the production and incoming orders, as well as ranking them from urgent to not as urgent; establish control on your supply chain (u know what everybody is doing); the supply chain can act as one entity when ordering products (because they can track how many each of them orders) --> company knows what and how much their supply chain needs

3. production company might be able to better control where the suppliers source from --> it gets harder to source from unhuman sources (dictatorships, horrible working conditions, etc); companies may be able to better compare production/price between two options and then might decide to move production to a country with politically stable country with a positive development in regards to human rights