How Blockchain Can Transform the Supply Chain

Supply chain has become complicated. Some would say cumbersome. It takes days to make a payment between a manufacturer and a supplier, or a customer and a vendor. Contracts must be handled by lawyers and bankers, which means extra cost and delay. Products and parts are often hard to trace back to suppliers, making defects difficult to eliminate. Whether for industrial equipment, consumer goods, food products, or digital offerings, supply chains have headaches a-plenty.

Friction in supply chain is a big problem. There are too many go-betweens. There is too much to-ing and fro-ing. The rise in uncertainty stops supply chains from working well. Suppliers, providers and clients must deal via central third-party entities, instead of directly with each other. What should be simple transactions turn into lengthy procedures with many steps.

Blockchain could be the answer to many of these issues. This recent technology is what drives bitcoin and other so-called cryptocurrencies. However, it goes much further than a hackproof way of holding and exchanging money. Blockchain can be used for any kind of exchange, agreements or tracking. In a supply chain, it can apply to anything from self-executing supply contracts to automated cold chain management.

**A Blockchain Primer for Supply Chain**

What is blockchain? Here’s a simple explanation. A blockchain is a distributed, digital ledger. The ledger records transactions in a series of blocks. It exists in multiple copies spread over multiple computers, which are also called nodes. The ledger is secure because each new block of transactions is linked back to previous blocks in a way that makes tampering practically impossible. As it is decentralised, it does not depend on any single entity (like a bank) for safekeeping. The nodes connected to the blockchain network get updated versions of the ledger as new transactions are made. The multiple copies of the ledger are the “truth” about every transaction made so far in the blockchain. Trying to falsify the ledger would mean having to falsify the copies at precisely the same moment. The chances of being able to do this in blockchain networks of any useful size are negligible.

That’s all a bit abstract. Let’s look closer at the real-life example of bitcoin. It is important to recognise bitcoin as just one way of using blockchain. However, it also happens to be one of the best-known examples. Bitcoin is a recently invented currency that is separate from any state-controlled currency. Entirely digital, it exists thanks to the distributed ledger of transactions on computers across the world. You can buy bitcoin from bitcoin exchanges. You can then use bitcoin over the Internet to make and receive payments. Each payment transaction is added to the ledger, which can be consulted by anyone at any time. Details like the amount, time and date of each payment are visible, although your personal identity is not. Bitcoin holders therefore usually do not know each other. To deal with this anonymity, bitcoin uses another distributed mechanism called mining to add blocks of transactions to the ledger in a secure, tamperproof way.

Now, let’s compare with supply chain. The same key features of blockchain being used by bitcoin map onto the basic needs for reliability and integrity for a supply chain.

Consensus

All the entities in the chain agree that each transaction is valid. For bitcoin, that means a transfer of an amount of bitcoin. For supply chain, it could be payment, warehousing, transport or delivery.

Provenance

The entities in the chain know where each asset came from. They also know who owned it before and at what time. For bitcoin, the asset is money. For supply chain, assets can be anything from iron ore and wheat to money, machines and copyrights.

Immutability

No entity can tamper with an entry in the distributed ledger. Bitcoin transactions cannot be erased. Only a new bitcoin transaction can reverse the effect of a previous one. Similarly, supply chain payments cannot be falsified. Neither can records of inventory, warehousing conditions, delivery times and dates, and so on.

Finality

The copies of the shared ledger all hold the same version of the truth. What works for the bitcoin network also works for any other blockchain network, supply chain included.

Beyond Bitcoin to Business Blockchain

Bitcoin is a useful way of getting to grips with the blockchain concept. It is also just one (special) example. Blockchain for supply chain uses the same four basic principles. However, there can be significant differences in the way these principles are applied. First, bitcoin uses “mining” as the way to update and extend the ledger. Mining takes large amounts of computer power. It also involves many mining teams over the Internet, each competing to be the one to add the next block to the ledger. Blockchain for business and specifically for supply chain is not obliged to use mining. There are other options for securely updating a business blockchain. Second, the applications for blockchain in supply chain are far more diverse than making or receiving payments. A large part of this diversity comes from the use of smart contracts.

A smart contract is a software program that uses blockchain to carry out the contract. The program is stored on the blockchain. The smart contract will therefore function exactly as it has been programmed. No fraud or other interference is possible. A smart contract can take input from a ledger and trigger an event. For example, if a payment has been received, the smart contract can trigger a delivery. Or if a condition has not been respected (for example, timely delivery or proper storage), the smart contract can trigger a penalty or another action. Third-party go-betweens are not necessary. Manual checking of conditions and events can be avoided. Costs and time can be saved with a software program that runs automatically, using information guaranteed by the blockchain to be correct.

Applications of Blockchain in Supply Chain

The following examples are now in use or can be implemented today using existing technology.

Automotive supplier payments

Blockchain allows the transfer of funds anywhere in the world. Traditional banking methods are not needed. Transfer is direct between payer and payee. It is also secure and rapid – in minutes, compared to days for automated clearing house payments, for example. Bitcoin transfers specifically also offer lower fees. Australian vehicle manufacturer Tomcar uses bitcoin to pay suppliers. Currently, three partners in Israel and Taiwan accept this. Tomcar’s supplier agreements use standard terms. The advantage is in the cost savings. On the other hand, the firm is careful to avoid hanging onto too much bitcoin. While bitcoin is international by nature, some national governments see it as a way for companies to make an investment. Companies with bitcoin holdings may therefore be taxed accordingly.

Meat traceability

Product status at each stage of production can be recorded using blockchain. The records are permanent and inalterable. They also allow the tracing of each product to its source. Global retailer Walmart uses blockchain to track sales of pork meat in China. Its system lets the company see where each piece of meat comes from, its processing and storage, and sell-by date. In the event of product recall, the company can also see which batches are concerned and who bought them.

Electric power microgrids

This example shows how entities of any size can use blockchain. In other words, blockchain is not just for the big players. Smart contracts are being used for redistributing excess power from solar panels. The Transactive Grid is an application running on blockchain to monitor and redistribute energy in a neighbourhood microgrid. The program automates the buying and selling of green energy to save costs and pollution. The technology for running the program is the Ethereum platform, designed for building smart contracts of any kind.

RFID-driven contract bids and execution

RFID tags are commonly used in supply chain to store information about products. The tags can be read easily and automatically, then processed by IT systems. So, the logic goes, why not use them for smart contracts for logistics? The practical setup could be as follows. RFID tags for cartons or pallets store information on delivery location and date. Logistics partners run applications to look for these tags and bid for delivery contract. The partner offering optimal price and service gets the business. A smart contract then tracks status and final delivery performance.

Cold chain monitoring

Food and pharmaceutical products often need special storage. Also, enterprises also see the value in sharing warehouses and distribution centres, instead of each one paying for its own. Sensors on sensitive products can record temperature, humidity, vibration, and other items of interest. These readings can then be stored on blockchain. They are permanent and tamperproof. If a storage condition deviates from what has been agreed, each member of the blockchain will see it. A smart contract can trigger an action to correct the situation. Depending on the size of the deviation, this action may be to simply adjust the storage. However, it could also extend to changing “use-by” dates, declaring products unfit, or applying penalties.

**Blockchain and Internet of Things**

Other ambitious ideas come from using blockchain and IoT. One suggestion is for smart contracts to manage rentals of driverless cars. A smart contract could check for rental payments. If payment has not been made or simply at the end of the rental contract, the smart contract could lock the car and tell it to drive itself back to the renter.

**Challenges to Be Met**

Blockchain has its challenges too. Enterprises that want to harness blockchain power for their supply chain will need to watch out for the following.

Ecosystem still in progress

**The first telephone was useless until the second one arrived. In time the phone spread all** over the world and now we can’t do without it. The situation is similar for blockchain and companies that want to do business with specific partners. Those partners will need to buy into blockchain as well. For example, Tomcar mentioned above only uses bitcoin payments for about 2% of the parts it buys. However, niche uses of blockchain are on the rise. It may be just a matter of time until businesses “join the dots” for widespread acceptance.

**Currency volatility**

Bitcoin is an easy way to start using blockchain. The problem is that bitcoin exchange rates with other currencies can change rapidly. Payment terms must be short enough or flexible enough to be able to cash in bitcoin and recover the value expected. Bitcoin and other cryptocurrencies (Ether for example for the Ethereum platform) are also volatile in another sense. If you lose the digital key (passcode) to your cryptocurrency reserve, there is no other way of getting it back.

**Technology and knowhow**

Blockchain programming takes a mix of software skills. It also helps to understand economies and businesses, especially your business. You may have to train staff or hire new people with these skills. You could also outsource your blockchain development to a third party. The best choice for you will depend on your current situation and future aspirations.

**Mindset**

Blockchain was started by people who wanted to decentralise applications and operations. They wanted to make dependency on centralised entities like banks optional instead of obligatory. This is a new way of thinking. Don’t be surprised if it takes you or your colleagues a little time to shed your mental shackles and get into the swing of the blockchain movement.

**Conclusion**

Blockchain can transform supply chains, industries and ecosystems. Interestingly, even organisations like banks, who would seem to be losing out, can see opportunities to use blockchain to streamline their own business. In-depth transformation of supply chains will not happen overnight. However, supply chains can already start using blockchain for small portions of their operations. Smart contracts can help eliminate costly delays and waste currently due to manual handling of paperwork. From there, the door is then open to smarter, faster, more secure supply chain from one end to the other.