

Blockchain adoption in supply chain networks in Asia

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Abstract:

Reports on how blockchain can impact industries. IN 2009, Toyota announced a recall of four million vehicles due to faulty gas pedals.¹ The recall cost an estimated US\$2 billion. The company had received pedals from many suppliers. It lacked mechanisms to track the suppliers that were responsible for the faulty pedals. There was, thus, no way to know which cars had the defective pedals. Similar problems are found in the food industry. Blockchain has the potential to provide solutions to problems such as mentioned above by addressing visibility and traceability challenges. Blockchain technology enables companies to record every event or transaction within a supply chain (SC) on a distributed ledger, which is shared among all participants, making it secure, immutable, and irrevocable. It makes it possible to deal with a crisis in a targeted way after such a crisis is discovered and provides distributed trust. Blockchain can facilitate handling and dealing with crisis situations such as product recalls due to faulty parts or security vulnerabilities. Blockchain's public availability means that it is possible to trace back every product to the origin of the raw materials, and transactions can be linked to identify users of vulnerable parts and devices. Also, blockchain can reduce the costs of a supply chain.

Keywords: blockchain | supply chain management | safety | industries | companies | management

Article:

In 2009, Toyota announced a recall of four million vehicles due to faulty gas pedals.¹ The recall cost an estimated US\$2 billion (<https://tinyurl.com/yc8uthj8>). The company had received pedals from many suppliers. It lacked mechanisms to track the suppliers that were responsible for the faulty pedals. There was, thus, no way to know which cars had the defective pedals.² Similar problems are found in the food industry.

Blockchain has the potential to provide solutions to problems such as mentioned above by addressing visibility and traceability challenges. Blockchain technology enables companies to record every event or transaction within a supply chain (SC) on a distributed ledger, which is shared among all participants, making it secure, immutable, and irrevocable.³ It makes it possible

to deal with a crisis in a targeted way after such a crisis is discovered and provides distributed trust. Blockchain can facilitate handling and dealing with crisis situations such as product recalls due to faulty parts or security vulnerabilities. Blockchain's public availability means that it is possible to trace back every product to the origin of the raw materials, and transactions can be linked to identify users of vulnerable parts and devices.⁴ Also, blockchain can reduce the costs of an SC.

Blockchain is decentralized and accessible to all participants and stakeholders, making it efficient. Therefore, blockchain can increase efficiency and transparency of SCs. Blockchain ledgers can also improve financial liquidity by including not only manufacturers, distributors, and buyers but financing parties as well. Once all parties agree on a set of transactions, they can release payments and invoices and deliver goods.

Regarding the investment costs, it is worth noting that various pieces of information can be tracked with RFID tags, sensors, and barcodes. These are already widely used across many SCs and provide relevant data. Blockchain deployment in SCs can, thus, be achieved with relatively low additional investment.

SOME BLOCKCHAIN PROJECTS IN SUPPLY CHAINS IN ASIA

Firms in many Asian economies have started to incorporate blockchain in SCs (see Table 1). Many high-profile projects are in China, where local and foreign companies have teamed up to develop blockchain-based SC solutions. This can be partly attributed to the Chinese government's initiatives to move to a higher technological gear. For instance, the Chinese President has called blockchain a "breakthrough" technology (<https://www.cnbc.com/2018/05/30/chinese-president-xi-jinping-calls-blockchain-a-breakthrough-technology.html>). More than 40% of Chinese startups that received government funding for breakthrough technologies in the first quarter of 2017 were blockchain related.⁵

IBM, Walmart, and Chinese e-commerce company JD.com were reported to be working together with Tsinghua University National Engineering Laboratory for E-Commerce Technologies to improve food tracking and safety in China. They announced a Blockchain Food Safety Alliance. The goal is to create a "standards-based method" to collect data about the origin, safety, and authenticity of the food. The system will provide real-time traceability throughout the SC (<https://tinyurl.com/ycfuldk>).

In this section, we give a brief summary of SC projects presented in Table 1.

Provenance

The British tech start-up Provenance conducted a pilot project in Indonesia to enable the traceability in the fishing industry. By using mobile phones, blockchain, and smart tagging, Provenance tracked fish caught by fishermen. The pilot successfully tracked fish in Indonesia for the first six months of 2016. Indonesian fisherman who participated in the pilot project sent simple text messages to register their catches. For each registered catch, a new blockchain-based digital asset is created. Each batch of fish that passed through an SC supply consisting of traders,

processors, brands, and supermarkets had a blockchain-based ID. The ID also provided audit information to prove that the fishes were caught in a legal and sustainable manner (<https://www.fastcompany.com/3063440/tracking-tuna-on-the-blockchain-to-prevent-slavery-and-overfishing>).

Table 1. Blockchain in the supply chain in Asian economies: Some examples.

Developer and/or user of blockchain solution in the SC	Explanations	Remarks
Accenture and digital ventures	Launched procure-to-pay (the process an organization uses to purchase raw materials needed to do business) solution for Thai businesses. The solution aims to facilitate purchasing processes, payments, and access to finance for SC partners (https://tinyurl.com/yarj8hrf).	Uses R3's Corda open-source platform. Some Thai businesses were reported integrating the solution into their operations (https://tinyurl.com/ybuzsmn).
Provenance	Conducted a pilot project in Indonesia to enable the traceability in the fishing industry.	Using mobile phones, blockchain, and smart tagging, it tracks fish caught by fishermen.
Toyota	Tracks auto parts in various countries, factories, and suppliers, and provides and shares information on a real-time basis among manufacturers, finance companies, insurers, service providers, regulators, and customers (https://tinyurl.com/y8u5crw9). IoT data from vehicle parts are integrated into a blockchain.	Is expected to reduce recall rates and fake products and increase consumer safety.
Alibaba	Worked with AusPost, Blackmores, and PwC to explore blockchain use to fight food fraud.	May 2018: two products, one from Australian companies Anchor and another from Blackmores, were part of a trial (https://tinyurl.com/y7r7mu9l). Each imported item is assigned a unique QR code. By scanning the code, consumers can see details about the product. August 2018: Alibaba's Ant Financial signed a strategic cooperation with the Wuchang municipality in China's Heilongjiang province to track the rice supply chain (https://tinyurl.com/ycn5gesl).
JD.com	Implemented blockchain in SC system and B2B e-commerce.	In 2017, the system went live with beef manufacturer Kerchin as its first supply-chain partner. The company announced plans to have more than ten brands of alcohol, food, tea, and pharmaceutical products on its blockchain (https://tinyurl.com/ydeyqu34).

The current sustainable tracking systems are largely based on papers and reports. A full quality control is a challenging task in the current system since seafood trades source from a large number of boats. There is also a lack of supervision. Blockchain can help consumers, regulators, and other participants to track the source of their food and take relevant actions. A commercial

launch of this technology can reduce unethical and illegal practices in the industry including slavery.

Alibaba

Alibaba teamed up with New Zealand's Fonterra and New Zealand Post and Australia's Blackmores and Australia Post to develop blockchain-based Food Trust Framework (<https://www.alizila.com/alibaba-ups-food-safety-via-blockchain/>). The goal is to develop a blockchain solution model that participants across the SC can use. Alibaba's international marketplace Tmall Global uses blockchain and product tagging with unique QR codes to track and monitor food products and make the information available to consumers. Each step in the SC is authenticated and verified.

Relevant data such as those related to production, transportation, customs, inspection, and transfer of ownership are secured with blockchain. The blockchain with these proofs is stored by the Alibaba. The copies of the records are also stored and validated by other participants (<https://smartereum.com/7630/how-alibaba-is-championing-the-application-of-blockchain-technology-in-china-and-beyond-thu-nov-08/>).

In April 2018, it announced a pilot program to track international shipments to China sold on its online marketplace T-Mall, supplied by Australian healthcare supply firm Blackmores and New Zealand dairy product maker Fonterra. As of May 2018, two products, i.e., one from Australian companies Anchor and another from Blackmores, were part of a trial.⁶ Each imported item is assigned a unique QR code. By scanning the code, consumers can see details about the product.⁷ Blockchain systems such as those of Alibaba provide detailed and complete records of the SC history of food products. Blockchain platform would track shipments in real time and improve security and transparency in food SCs.

Alibaba announced plans to implement blockchain also in domestic SCs. In August 2018, Alibaba's online payment affiliate Ant Financial signed a strategic cooperation with the Wuchang municipality in China's Heilongjiang province to track the rice SC (<https://tinyurl.com/ycn5gesl>). Tmall and Rookie Logistics are other partners in the project (<https://www.nasdaq.com/article/alibaba-baba-thinks-blockchain-will-change-the-world-cm1018125>). A major goal of the project is to stop counterfeit versions of the well-known Wuchang rice, which is known for high quality with limited production. The pervasiveness of counterfeit Wuchang rice has increased (<https://www.ncbi.nlm.nih.gov/pubmed/27400533>). Each bag of Wuchang rice sold on the Tmall platform will display a QR code with a unique identification number. Consumers can scan this code using a smartphone app before paying for the rice. The details provided include the specific field the rice came from, seeds, and fertilizers used to grow the rice, as well as information related to shipments (<https://www.ethnews.com/ant-financial-to-launch-blockchain-app-to-track-rice-quality>).

Walmart

In 2016, Walmart trial tested a blockchain-based solution to monitor pork products in China. In May 2017, Walmart successfully used blockchain to trace and validate pork products from a

farm owned by the Chinese meat producer Jinluo. The meat products were transported to a Walmart distribution center in Beijing.⁸ Walmart's blockchain system makes it possible to track and view details about products, farms, factories, batch number, storage temperature, and shipping instantly. These details help assess the authenticity of products and expiry dates. It can, thus, ensure that what the food consumers are eating is right and authentic.

A major benefit of the system such as this is that in case of a crisis related to food safety, Walmart can easily pinpoint the source. It then can engage in strategic removals of affected products. There is no need to recall the entire product line. It is also easy to trace where other products, such as fruits, meat, and vegetables from the same batch, have gone. In addition to blockchain's role in package authentication and tracking, Walmart has outlined its plans to incorporate the technology in authenticating a customer and a courier, measuring the temperatures containers and products, and comparing with acceptable thresholds and other purposes.⁹

JD.com

JD.com has implemented blockchain in its SC management system and B2B e-commerce. In 2017, the system went live with beef manufacturer Kerchin as its first supply-chain partner. The company announced plans to have more than ten brands of alcohol, food, tea, and pharmaceutical products on its blockchain (<https://tinyurl.com/y7jbvrcg>). In the beginning, blockchain-enabled product tracking focused on supermarkets in big Chinese cities such as Beijing, Shanghai, and Guangzhou (<https://tinyurl.com/y7tkdkq8>). As of August 2018, over 400 brands and 11 000 different stockkeeping units had blockchain-based tracking features.⁵

INITIAL FOCUS ON HIGH-VALUE PRODUCTS

Currently, the deployment of blockchain-based solutions is more justifiable and more realistic in high-value products than in cheaper products. The London-based blockchain company Everledger developed blockchain-based solutions that are used to verify provenance of products. It was first used for rough-cut diamonds. The system can be considered to be a digital expression of the Kimberley process. Similarly, Tracr was conceived by De Beers in 2017 as a comprehensive mine-to-customer traceability solution using blockchain for the entire diamond industry. The pilot project, involving a small group of industry participants, was launched in January 2018.

In March 2018, JD.com announced a plan to implement blockchain to track its meat SCs. Customers would be able to monitor their meat products. Initial focus would be on high-end beef from Australia (<https://tinyurl.com/y8kfyv75>). Likewise, in 2017, Thailand Post announced a plan to use blockchain in order to increase its ability to share information across all SC functions and touchpoints such as warehouse processes and delivery services. Its pilot project focused on tracking big-ticket items (<https://tinyurl.com/ydyne3mf>).

Over time blockchain implementation costs are likely to be reduced. This is likely to make blockchain-based solutions more affordable to smaller companies and accelerate its diffusion in SCs.

SUMMARY

The SC efficiency benefits from blockchain technology are significant, as it will improve business processes for all participants. The cases of JD.com and Thailand Post indicate that blockchain implementation in SCs currently is economically more justifiable for high-value products than for cheaper products. In particular, blockchain will improve efficiency gains from eliminating manual effort and paper processing; provide clear provenance that verifies the true origin of products; and establish chain-of-custody to that ensure goods were handled only by trustworthy partners.¹⁰ All these lead to a high level of consumer confidence.

The real-time tracking of products in an SC using blockchain solutions reduces the overall cost of moving items in an SC (<https://tinyurl.com/ycq294w6>). For example, when blockchain is applied to speed up administrative processes in SCs, the extra manual costs in the system are automatically reduced, while transactions remain secure. The benefits of speed and efficiency are especially evident in the international export process. Regulators can also be part of the SC network, which can lower the costs of regulatory compliance. Likewise, blockchain enables more effective response if contaminated food products are discovered, which are important cost-saving implications for retailers in situations involving a crisis.

More importantly, the elimination of middlemen and intermediaries reduces risks of frauds, product duplication, and saves money. Also, risk of losing products will be reduced with distributed trust and accurate record-keeping. Trust plays a very important role when it comes to compliance. The immutable nature of blockchain in the SC could establish necessary trust.

DISCLAIMER

The authors are completely responsible for the content in this article. The views expressed in this paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

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