BLOCKCHAIN AND 5G-ENABLED INTERNET OF THINGS (IOT) WILL REDEFINE SUPPLY CHAINS AND TRADE FINANCE

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Emerging technologies can introduce greater efficiency and new capabilities to supply chains and trade finance. Josias Dewey, Robert Hill and Rebecca Plasencia of Holland & Knight LLP explore some of the most promising uses of blockchain, IoT and 5G technology as well as some obstacles for implementation.

Today's global economy depends on a myriad of complex relationships among numerous participants, many of whom are critical to supply chains around the world. These supply chains are responsible for the incredible growth in the global economy over the last several decades. This global flow of commodities and finished goods depends on trade finance to allow participants to address payment and delivery issues and provide needed liquidity. Approximately 80 to 90 percent of global trade is reliant on trade finance, which is estimated to be worth nearly ten trillion dollars a year. Yet, many of the world's supply chains and trade finance solutions are still based on several-hundred-year-old processes and legal doctrines. Given these legacy practices, there are opportunities for greater efficiencies and new capabilities within the global supply chain. We will discuss several opportunities for improvement made possible by leveraging (1) blockchain and distributed ledger technology, (2) the Internet of Things (IoT), and (3) 5G technology. But the transition from paper documents, such as letters of credit and bills of lading, to digital smart contracts must first overcome several challenges. A significant investment will be required in order to implement many of the most promising solutions, some of which will require cooperation among numerous nations, shippers and manufacturers, among other market participants. We believe the potential improvements are significant enough to justify the investment.

Existing Supply Chains and Trade Finance

Currently, the movement of goods and commodities across the globe is driven by processes that have remained static over many decades and, in some cases, centuries. Supply chains developed around the need to move away from barter-driven trade to one based on units of account and stores of value, such as gold, which allowed for the acquisition of goods for money. These advances led to the rise of marketplaces around the world. Ocean shipping made it possible to move large quantities of goods and commodities from one port to another far more efficiently.

Since then, many advances in our supply chains have focused on addressing certain fundamental issues that arise out of transactions not involving the contemporaneous exchange of bartered goods or exchanges for money.

While a superior approach in terms of economic efficiency, "chicken and egg" situations continue to exist, such as sellers not wanting to ship goods for delivery before the purchaser has paid; and, likewise, buyers do not want to pay for goods that they have not received. Trade finance has evolved, in large part, to address issues like this through the use of financial intermediaries, such as a bank who issues a merchant letter of credit. While several emerging technologies have the potential to improve global trade, this article focuses on the two technologies that will likely achieve some of the most radical improvement—blockchain and 5G-Internet of Things ("IoT"). In isolation, either technology implemented by itself is capable of incrementally improving the industry; but, when taken together, they may significantly improve and alter existing processes.

Blockchain Technology

A blockchain is often described as a decentralized peer-to-peer network that maintains a public (or in some cases, private) ledger of transactions. For this reason, blockchain technology is also called "distributed ledger technology" (or just "DLT"). A computer science degree is not required to understand the fundamentals of how a blockchain works. The key concept is the existence of a replicated ledger, which can be thought of as a database or Excel spreadsheet. Because a ledger can store all kinds of information, blockchains can be used in many different contexts. Blockchains that primarily facilitate the transfer of cryptocurrencies, such as bitcoin, maintain a database that records how every virtual bitcoin is spent—but one can track any digital data object.

These ledgers are considered decentralized because transactions are often stored on several thousand computers connected to a common network overlaying the Internet. Each node contains a complete history of every transaction completed on a block-

chain beginning with the first transaction that was processed into the first block on that blockchain. This network of nodes is connected via the Internet, but in a completely decentralized manner (i.e., there is no single server to which all the nodes are connected). These computers all operate on a common software platform, which is often referred to as a "protocol". In short, blockchains are networks of computers, all running a common software application that must come to agreement before making any change to the network's ledger.

5G/IoT

5G refers to the next generation of wireless technology that will replace today's 4G LTE standard. The formal standard defining 5G will be promulgated by the 3rd Generation Partnership Project, more commonly referred to as 3GPP, an international collaboration that unites multiple telecommunications standard development organizations. 3GPP structures its standards as "Releases." The forthcoming Release 15 will be the first set of 5G standards. 3GPP plans to roll out the earliest minimal set of 5G standards in late 2018, with future iterations following after that.

Although 5G is not yet standardized, major development programs are well underway, with some companies making efforts to roll out pre-standardization 5G offerings for some applications. With the precipitous decrease in time between wireless network generations, there is a widespread belief in the industry that development cycles must be accelerated to meet anticipated future market demands. In the current pre-standardization phase, the term 5G encompasses a variety of technologies that will likely be used in next generation networking. One of the most important of these technologies is the so-called "new radio," massive multiple input multiple output ("MIMO") antennae that are expected to play an important role in achieving wireless network capabilities that far surpass the current 4G LTE technology. 5G is also likely to utilize "small cells" in some areas, which will allow denser and more effective network infrastructure than conventional base-station deployment alone.

The aggregate effect of 5G technology will be to allow wireless networks with far greater capability to support bandwidth-intensive content, large scale sensor arrays, and low-latency remote control applications than existing wireless networks. Some of these applications will be improved versions of existing commercial products and services. For example, mobile devices will have access to higher quality streaming video and better-augmented reality products that overlay additional data over real-time digital camera images.

Many of the most exciting applications will not directly interface with humans at all. Specifically, 5G will enable machine-to-machine communications over wireless networks on a far larger scale than any previous technology. This is a key aspect of a 5G-powered IoT, wherein huge numbers of man-made objects are interconnected via sophisticated wireless networks. This will allow great improvements in areas like real-time monitoring of supply chains, real-time control of electrical grids, connected (and eventually autonomous) vehicles, and smart agriculture, among many others. Furthermore, the 5G IoT will mean that ever more companies will need to consider wireless issues that were not previously central to their businesses. These dynamics will create challenges and opportunities for both traditional telecommunications companies and for companies that the 5G wave sweeps into the wireless world.

After the original submission of this article, 3GPP completed the specification for the "non-standalone" 5G New Radio on an accelerated basis, an important step in 5G standardization. As of this writing, the "standalone" 5G specification—which will use next generation core architecture—is expected to be finished in June 2018 as part of 3GPP Release 15.

Impact of Blockchain and 5G/IoT on Supply Chains and Trade Finance
The promise of secure, real-time data about goods in transit requires bandwidth having capacity that doesn't exist with our current infrastructure. 5G-enabled IoT is intended to greatly increase this capacity. Without this upgrade to our telecommunication infrastructure, the development

and adoption of some blockchain solutions involving logistics will be limited to pilots and other deployments at reduced scale. Blockchain technology is particularly well-suited to respond to both the challenges and opportunities of a 5G-enabled IoT. Therefore, it is very likely that each technology will spur greater adoption of the other.

More specifically, blockchain can serve as both a way to log data in a form highly resistant to tampering and a tool to fight the introduction of malicious IoT devices into our networks. Threats to the network are exacerbated by the production of millions of inexpensive networked devices having little-to-no native security features. The proliferation of these devices has led to large-scale DDoS attacks on large swaths of the Internet. These shortcomings also pose a threat to the safety of our homes (e.g., Nest) and vehicles (e.g., autonomous vehicles), both of which are becoming more dependent on embedded, network devices for normal operations. Keeping this network of devices secure is also important to ensuring privacy rights are respected and sensitive information kept out of the hands of bad actors. By registering an IoT device on a blockchain, other devices on the network will know with a high degree of confidence that a device is what it says it is, without having to rely on a centralized server which might be more easily compromised in some circumstances. Multiple start-ups are working towards blockchain-based solutions to 5G IoT. In this way, blockchain approaches can make the 5G IoT better.

With a secure 5G/IoT network, supply chains can leverage the integrity of a blockchain's logs (or ledger), which, when properly implemented, are nearly impossible to alter. Without this integrity, otherwise valuable data collected about goods in transit or the vehicles transporting them would be the subject of much more skepticism about their accuracy. This also has implications for those providing trade finance, who in many cases must be able to determine with relative certainty whether certain conditions have been satisfied. For example, a letter of credit should only be honored if presented with a draft that con-

firms the bill of lading or other applicable document of title has been negotiated to the purchaser. Under current practices, this is accomplished by the physical presentment of wet-ink documents. These manual processes and controls can be a cumbersome and fragmented process for lenders, sellers and buyers, which can lead to falsified documents and other fraud, require redundant reconciliation, sale of counterfeit goods and a general inability to keep private-deal terms confidential. Once the legal and business logic of trade finance transactions are reduced to code and embedded in self-implementing digital contracts (known as "smart contracts"), the delivery of a digital bill of lading can automatically transfer to the buyer upon a ship reaching port; and the seller automatically receives the purchase price without the need for physical presentment.

There are other significant benefits, including integrity and providence matters. For the consumer, there is certainty that the product is what it says it is, whether dealing with luxury goods or non-GMO food products. For example, Walmart has engaged in a pilot program to ensure the safety of produce sent to the U.S. from a foreign producer. It is for these reasons and many others, that so much investment has been spent in supply chain and trade finance. The benefits gained by the number of parties involved in the supply chain far exceeds the potential cost to implement.

The use of blockchain technology, enhanced with the power of 5G, will serve not only to save companies millions of dollars in operating costs, but also in potential legal fees arising from disputes that could have been avoided had smart contracts been used. Take, for example, the typical supply-chain process. A smart contract prototype can streamline the supply-chain process and allow for the automatic payment of goods upon receipt and eliminate the need of having to deal with accounts receivables, waiting a 30-day period for payment of goods received, and paying for billing department personnel to track down distributors with outstanding invoices.

But the supply chain often involves much more than simply paying for goods

received. Manufacturers have contractual relationships with their distributors that encompass a myriad of issues, including assignment of a particular territory, purchase volume requirements, and volume incentive rebates. A volume incentive rebate is a rebate provided by the manufacturer to a distributor that sells a certain volume of a particular product. But disputes can easily arise with respect to whether the conditions precedent to earning the rebate were met, potentially resulting in the expenditure of substantial litigation fees and costs.

A blockchain-based smart contract could eliminate disputes regarding whether a distributor is entitled to a volume incentive rebate. Beyond having to sell a certain volume of a particular product, a volume incentive rebate often requires that the product be sold in a particular territory. With the use of blockchain technology coupled with the power of 5G, a shipment can be tracked so that both the manufacturer and the distributor instantly know exactly where they stand with respect to a volume incentive rebate. For example, a tracking device on a shipment of 100,000 units of a particular phone model would allow information to be uploaded immediately onto the blockchain to show that the shipment was received in the distributor's holding warehouse, which would trigger automatic payment by the distributor to the manufacturer. The shipment is tracked further to show to what areas the distributor is selling the units. As the information is immediately loaded onto the blockchain, both the manufacturer and the distributor can see in real time how many units of a particular model have been sold in a particular territory to determine whether the conditions precedent to earning a volume incentive rebate have been met. If the volume incentive rebate is conditioned upon proof that all 100,000 units are sold within a particular territory, and the information uploaded onto the blockchain from the tracking device shows that 20,000 phones were actually sold outside the designated territory, then both parties know that the conditions have not been met and the rebate has not been earned. Because this information

could be uploaded onto the blockchain immediately, it would be extremely difficult for a distributor to attempt to alter these records after the fact in an attempt to defraud the manufacturer. If the information uploaded onto the blockchain shows that the distributor satisfied all the conditions precedent, the rebate would be issued automatically to the distributor, without the need for the distributor to follow up with the manufacturer for payment.

Should litigation still arise, the parties would have immediate access to the information that was recorded on the blockchain to determine whether a distributor's claim that it is entitled to a rebate is legitimate and/or whether any defenses (such as the failure to meet certain preconditions) are available to the manufacturer. Hundreds of thousands of dollars in litigation costs, including the astronomical costs of electronic discovery retrieval and production, could be avoided entirely because the information has been recorded on the blockchain, eliminating the need to go back through each parties' electronically stored information and old records to try to prove or disprove whether the units were all sold within the designated territory.

Challenges and Obstacles
But for all the promise of blockchain in this context, there are still obstacles that must be overcome before all the world's trade is completed on distributed ledgers. Payment rails for the distributed systems currently under investigation are still not perfect. More specifically, unlike Bitcoin and Ethereum, most enterprise blockchain systems lack a native virtual currency. While one can be easily added, there would also need to be agreement on standards and foreign exchange adjustments. As such, it is more likely that payments made will be triggered by electronic messages from the distributed ledger that instruct traditional fiat accounts to initiate an outbound payment (e.g., messaging with SWIFT codes). There is also a lack of uniformity in existing distributed ledger protocols and, as of today, no interoperability exists. That means different ledgers can't currently communicate with each

other, but there is hope. Development teams are actively developing interfaces to achieve interoperability across ledgers. Furthermore, given the rather nascent nature of the technology, many companies prefer to overlay their distributed systems atop their legacy system to maintain a level of redundancy (i.e., "keeping the training wheels on").

Possibly the greatest challenge, however, is addressing these and other issues within the context of dozens of nations, government agencies and industry participants across shipping, manufacturing and finance—just to name a few. This level of collaboration is difficult to achieve and does not evolve quickly. It will take time before many of these systems are deployed. More discrete projects with modest goals may be available for commercial deployment on a larger scale within as little as two to three years. More ambitious projects will take longer, but the value proposition is too great to be abandoned.

Companies likely to be impacted by these changes should consider those impacts on their future competitiveness and market share. For some, failing to make an investment in these efforts will make it more difficult to compete against those actively engaged with the technology since the start. Attempting to replicate their efforts within a short period of time will likely prove challenging for many companies—deployment is not as simple as unwrapping a standard software application. For those interested in being early adopters, the possibilities presented by blockchain and 5G-enabled IoT present unique opportunities. The accelerating pace of development, however, means the window of opportunity will not remain open indefinitely. **TSL**

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