Blockchain Solutions:
Practical B2B Supply Chain Applications

There has been a significant amount of hype around cryptocurrencies and blockchain in the last five years, with business to business (B2B) blockchain applications slowly starting to gain traction in leading-edge organizations.

Although blockchain is the underlying technology for cryptocurrencies, the technology can be separated from a cryptocurrency, such as Bitcoin or Ethereum, and used in a B2B environment where a high degree of visibility and/or security is essential. Significant opportunities exist for companies that strive to understand the capabilities of blockchain technology and creatively apply the technology as a solution to business transactions. Successful organizations will benefit from a reduction in overall costs of processing, monitoring, validating and executing transactions between a buyer and seller of products — and in other areas across the entire supply chain. Understanding the capabilities of the underlying technology is imperative to ensuring that the value and benefits clearly outweigh the costs and risks of implementation.

Business-to-Business Blockchain Benefits

Blockchain technology has the capability to optimize business processes that are manual, paper-based and dependent on human interaction — and that often lead to mistakes or are left undone altogether. Blockchain technology delivers solutions to business problems previously thought unsolvable due to lack of transparency, security and trust in the ecosystem.

The four primary problems that blockchain technology tackles are commonplace across industries:

1. Provenance — Blockchain technology was designed to be immutable, which allows for the ability to track or trace the origination of a product to the beginning of a process in seconds. With 100% traceable and guaranteed origin data on products, transparent and real-time tracking throughout the waypoints of the supply chain, and cryptographically secured digital records in compliance with agreed-upon business rules, blockchain delivers a real-world solution to an age-old, time-consuming process.

2. Real-Time Visibility — With internet of things (IoT) sensors and scanning capabilities, blockchain can be integrated to collect transaction data in real-time, providing complete visibility and traceability to the location and time of the event. For example, certain businesses incur excess costs because there is no practical way to collect information when a container is full or empty, or when a container enters a new jurisdiction via a cross-border transaction. Blockchain offers the ability to solve the last-mile problem by connecting offline resources, such as a container or a package, with online capabilities using IoT devices. The interface between the offline world and its digital representation allows multiple parties in the supply chain to permanently record transactions that are not easily accessible today and provide a seamless and transparent experience for the customer.

3. Encryption with Immutability — Blockchain can authenticate participants and transactions with streamlined processes across large networks involving various partners, in a high security environment that cannot be modified after the transaction is recorded. In other words, blockchain allows for a secure, "single source of truth" that is recorded

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and verified in close to real time. This also nearly eliminates cybersecurity risks with blockchain encryption, because there is no central authority that can be hacked, and decentralized authentication is performed through public-key cryptography combined with possession of individual private keys by the participants.

4. Transaction Transparency — Blockchain offers participants 100% transparency for all transactions, including supporting documentation, with no risk of manipulation or tampering. The information in the blockchain can be relied on by all users without concern for fraud, errors or transmission of inaccurate information.

Regardless of the benefits, evaluating blockchain as a solution requires laser focus on the specific business problem. The decision process and follow-on business case need to carefully weigh the benefits of highly secure access to immutable transactions against operational concerns about the authentication of the product's origin as well as transaction integrity.

One of Many Solutions Explained: Smart Contracts

Transparent tracking of a product through the supply chain to its destination, real-time visibility to the product location, and availability of relevant documents for the user at any time are critical considerations in developing the business case for a blockchain solution. If these considerations are fundamental to the success of the blockchain solution, then depending on the current costs of managing the supply chain and the risks associated with failure, smart contracts using blockchain technology may be an appropriate solution.

Smart contracts have the advantage of using blockchain technology but can be used in more isolated and focused situations that don't require full peer-to-peer management. Different from traditional paper contracts, a smart contract is not simply an online contract. A smart contract takes the form of computer code using distributed ledger technology and executes itself upon receipt of electronic data inputs. With a smart contract, the key enhancement is self-execution through the combination of its ability to react to

online data triggers and the access of the smart contract to the value itself. A smart contract supplements the actual implementation of a traditional contract between two parties engaging in an arm's length transaction and contains the promise that a computation happens in an agreed-upon manner. Smart contracts allow the performance of credible transactions without third parties.

A very simple example of a smart contract is downloading Apple iTunes music. In this example, the buyer selects a song, purchases the song, agrees to the non-negotiable terms and conditions from Apple, and is constrained to using the song on a limited number of devices. The software will disable the song if the buyer attempts to use the music on more than the pre-determined number of devices. A more complex smart contract would involve a car loan and the car itself. A smart contract would disable the car if the debtor missed payment. If all payments were received in a timely manner, then the vehicle title would be issued to the debtor and ownership transferred automatically upon receipt of the final payment. There would be no human intervention unless required. Applied to a larger business scenario, any asset that requires periodic payments to the owner/creditor could be disabled by the creditor if payment were not received. The actual contract is written in a traditional manner, agreed to and signed by the parties, but enforced with a smart contract that ensures timely payment by the debtor to the creditor.

Smart contracts solve the problem of automatic enforcement of contract rules without human intervention in a secure and immutable environment, thereby reducing transaction costs while achieving the same objectives of traditional contract enforcement. In order to implement a smart contract, a company needs to:

— first ensure that the terms of a contract are defined without any ambiguity, which also requires data-driven transactional discrete criteria and

— second, have easily measurable and objective criteria for contract fulfillment.

The smart contract is a key facet of blockchain and will enable quick and efficient enforcement of agreements, especially across global transactions.

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Evaluation Framework for Blockchain and Smart Contracts

The consideration of blockchain for specific business issues can initially use a two-dimensional framework to evaluate the fit: the need for origin verification and the need for real-time visibility. Since encryption, immutability and transaction transparency are always part of the solution, the decision process can be simplified — if the need for provenance and visibility is low, then blockchain will not likely be of great benefit.

But if the supply chain process requires provenance validation or real-time visibility, blockchain may offer measurable advantages. Ultimately the cost-savings related to the data generated must exceed the costs of implementation.
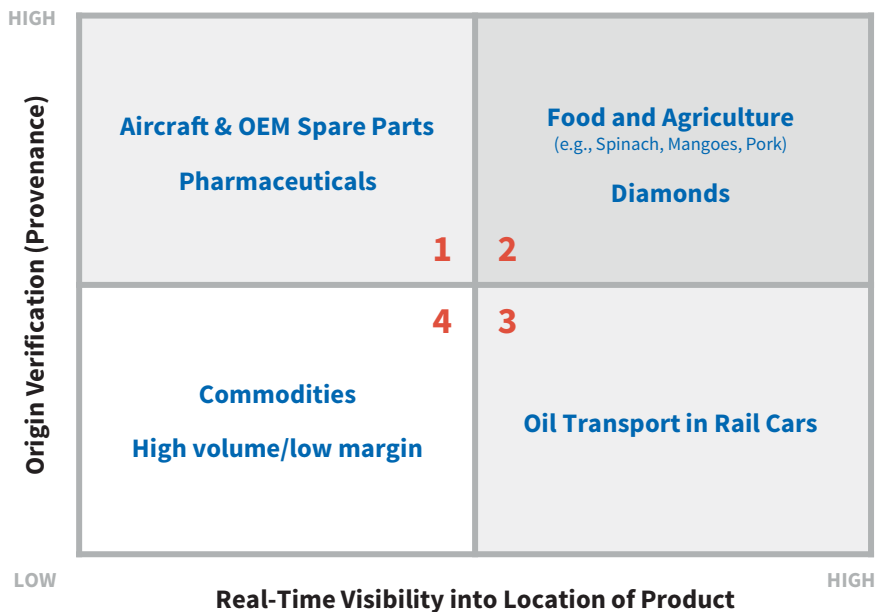
Quadrant 1: In this scenario, the need to know the origin of the product is highly critical to the ownership transfer and end-user application. For example, airline parts are typically used four times in their life cycle before being decommissioned, making the validity of their quality documents critical to the purchaser without a need for real-time visibility. To attest to OEM, blockchain can be used for the immutability of records related to production date and prior ownership, avoiding any question of forged documentation. The situation is similar for pharmaceuticals, especially because of the possibility that counterfeit drugs in the supply chain can cause significant harm or even death.

Quadrant 2: Blockchain can offer substantial benefits when provenance of the product is critical to the end user and there is significant value associated with real-time visibility of the product location. For example, being able to pinpoint the source of food contamination can improve public safety by limiting exposure to tainted products, and for farmers and retailers, it could decrease the costs and risks associated with overly broad product recalls. As a case in point, in 2018, E. coli contamination of Romaine lettuce caused an outbreak of bacterial infections across 36 U.S. states and several Canadian provinces that resulted in five deaths and an estimated $350 million of economic losses across the industry.

Another example of blockchain applicability is with the diamond trade. The Kimberley Process Certification Scheme to prevent trade in conflict diamonds has 55 participants which account for 98% of the global trade in diamonds, but the process is flawed due to its manual nature and fraught with non-compliance. Everledger is implementing a blockchain solution for tracking diamonds, which will create an immutable record and eliminate conflict diamonds from the global supply chain.

Quadrant 3: In certain situations, real-time visibility is a concern but provenance is not. For example, consider the situation in which a company is shipping railroad cars of oil from Canada to the Gulf of Mexico.

Exhibit 1 - Blockchain Evaluation Framework (with examples)

HIGH

Origin Verification (Provenance)

Aircraft & OEM Spare Parts

Pharmaceuticals

1 | **2**

Food and Agriculture
(e.g., Spinach, Mangoes, Pork)

Diamonds

4 | **3**

Commodities

High volume/low margin

Oil Transport in Rail Cars

LOW

Real-Time Visibility into Location of Product

HIGH

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Hydrocarbon chemistry is tested upon delivery — prior to refining — so the origin verification is not critical to the transfer of product. Visibility is a concern, however, because insurance costs are much higher when the rail car is full than when the car is empty. Insurance costs can be dramatically reduced when empty rail cars are moving from the Gulf back to Canada, and offloading the oil can be impacted by the price based on when the offloading is recorded, so time is an expensive variable in this case. Without using blockchain and IoT devices on the rail cars, tracking the status of thousands of assets across multiple railways is practically impossible, and can end up costing thousands of dollars — if not millions — more in fees. Only with blockchain can the insurance problem be solved.

Quadrant 4: If provenance of a product and real-time visibility are not required, then blockchain will not be a supply-chain solution. Careful consideration of each business issue is critical to understanding the business case, the problem to solve, and the resources to be expended in developing, implementing and maintaining the solution.

Conclusion

In our experience with implementing blockchain projects with clients, projects can fail when they are overly ambitious and focused on the technology solution rather than the problem being resolved. To be successful, companies should continue to examine the overall goal of solving the problem at hand. Zoom out during the evaluation process and determine if the business case exists and the problem is being solved. Projects with costs in excess of the benefits are quickly terminated once the sponsors understand the economics.

We recommend the following key steps in evaluating whether distributed ledger technology will be an optimal solution for your needs:

1. Define the problem. Use the framework of evaluating the need for provenance or real-time visibility for the first analysis. Recognize that immutability and transparency will be part of the solution and therefore should be important to solving the business problem.

2. Determine the current costs. Understand the costs incurred in the current environment to deliver products though the supply-chain network. Evaluate and quantify the costs that would be eliminated if a blockchain solution were implemented.

3. Define the technology solution. The technology solution can be complex. Picking a technology and a business partner with experience will be critical to success.

4. Determine the cost and timeline to implementation. Once the technology solution is defined, identify the design, testing, implementation and maintenance costs. These additional parameters will be the primary determinant of a business case, assuming the benefits identified in step #2 are significantly in excess of the implementation costs. Evaluate the need for a pilot program or proof of concept before attempting an enterprise rollout.

5. Check the boxes and engage stakeholders. Keep internal stakeholders and executive sponsors informed, engaged and involved with key background information and decisions. Move forward once all the boxes are checked and stakeholders are convinced of the value proposition.

Blockchain is not a solution looking for a problem. According to Gartner, by 2023, 30 percent of manufacturing companies with more than $5 billion in revenue will have implemented projects leveraging blockchain. As companies develop a better understanding of blockchain's capabilities and benefits, we expect the pace of supply-chain solutions using blockchain technology to increase dramatically, yielding new, innovative solutions to optimize the supply chain as a whole.

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