

ORACLE® | Deloitte.

JANUARY 2019

Enhancing Supply Chains with the Transparency and Security of Distributed Ledger Technology

Value Driven Supply Chain powered by Blockchain and IoT





Overview

As the digital revolution takes shape, leading organizations will need to maintain competitive advantage through a focus on speed to market and the ability to rapidly navigate changing business environments. Ultimately, competitive advantage will come from an organization's ability to optimize and drive value from its supply chain using technology. Moving a product from supplier to customer requires a cross organization chain of extensive coordination between human and mechanical inputs. Global Supply chains are the subject of continued innovation to improve end-to-end visibility, product tracking, fraud, regulatory compliance, delivery speed, and settlements. The ability to capture, translate and interpret data through a cycle of physical inputs to digital analysis driving physical results has the potential to deliver tremendous value to the extended enterprise.

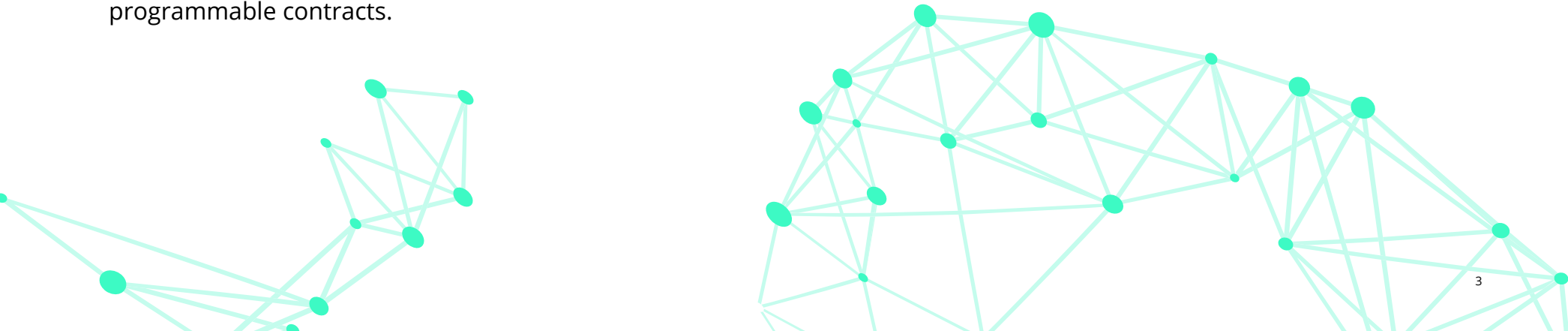
This point of view combines Oracle's product vision and Deloitte's digital supply chain industry knowledge to showcase how Blockchain and IoT technologies can help companies innovate with agile, trusted, and transparent supply chains. It will address key supply chain challenges in traceability, compliance, flexibility, and stakeholder management across multiple industries. Fortune 2000 decision makers will come away with an increased understanding of how Blockchain and IoT can drive sustainable next generation value into their supply chain.

Impact on Enterprise

The concept of blockchain was introduced in 2008 via Bitcoin by the pseudonym Satoshi Nakamoto. The underlying technology of Bitcoin (the blockchain) eventually took a success trajectory of its own; mainly because it gives us an elegant technology solution for a class of historically challenging business problems. Blockchains as we know today, espouse three foundation elements – validated tamper-resistant record of entries, value transfer, and programmable contracts.

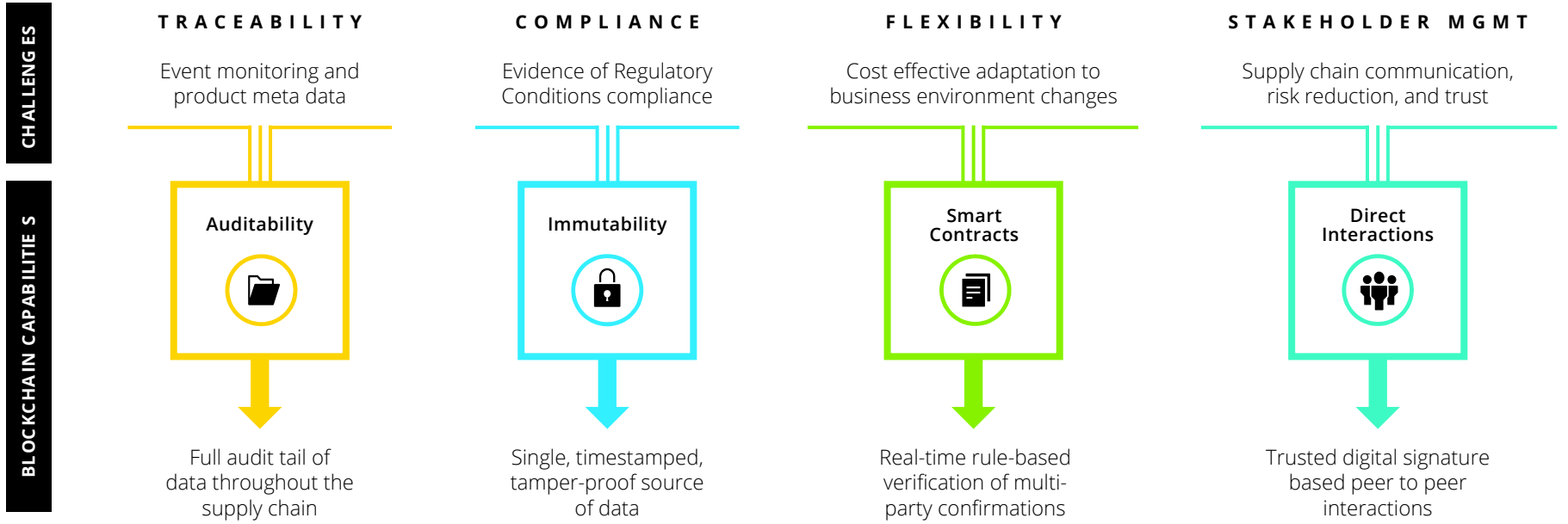
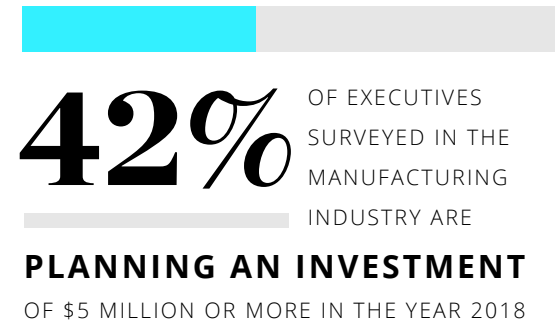
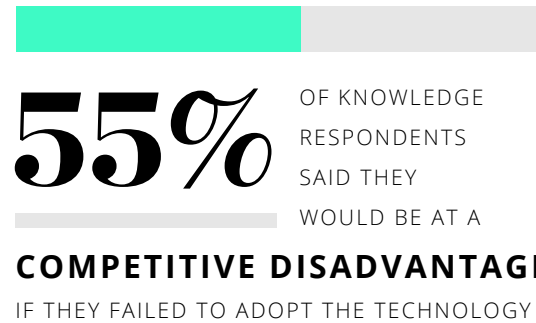
Internet of Things (IoT) is the technology that enables tracking and monitoring of connected devices and exchange data. Together, Blockchain and IoT provide an always ON and secured supply chain platform that can help organizations to have end-to-end transparency, better accountability and one source-of-truth among various participants in the supply chain. For instance, IoT can be used to track and monitor, when an incident of interest happens – like a spike in truck temperature during a cold chain shipment. This incident is etched into the blockchain so all parties that are impacted will have visibility into the incident and have access to reliable, validated information from the blockchain ledger.

Many other kinds of supply chain challenges can be resolved or mitigated by leveraging Blockchain and IoT together. For instance, in the pharmaceutical industry, according to the World Health Organization, it is estimated that up to \$200 billion worth of counterfeit pharmaceutical products are sold globally every year and 50% of these drugs are purchased online.¹ Counterfeiting usually enters or breaks the supply chain close to the manufacturing source. Blockchain and IoT enable a closed loop chain that makes counterfeiting attempts much harder to accomplish. In the automotive industry, cars are now high tech devices in motion. The rise of the disruptive technologies and complex sourcing networks make the existing auto production tracking method inadequate to maintain the product provenance tracking. A single component recall will take months if not years, and cost millions of dollars. A Blockchain and IoT enabled product provenance tracking solution will bring transparency, visibility, and accuracy into this complex supply chain.



IMPACT ON ENTERPRISE

Deloitte's 2017 Blockchain Survey² of 308 senior executives at firms with \$500M+ in revenue provides a clear indication of the trend:



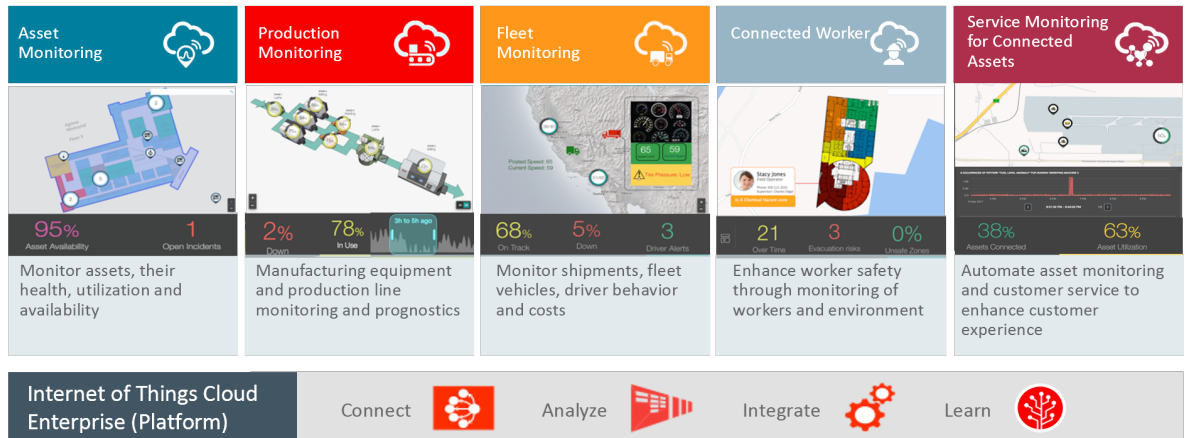
Oracle Technology

Oracle IoT Cloud

Oracle Internet of Things Applications enable enterprises to securely connect devices, analyze real-time and historical data, and integrate to back-end applications. Companies can extend their supply chain, enterprise resource planning and customer experience applications to the physical world, there by driving automation powered by intelligent predictive algorithms and digital twins.

Oracle offers five IoT SaaS applications (see picture below) that help customers to meet their business functional outcomes in simple steps. These SaaS applications have built-in predictive models and 'auto machine learning' that do not need customers to have hard-to-find data scientists. These IoT apps can easily be integrated into other business applications to optimize workflows. In addition, customers could also choose IoT PaaS when they have bespoke needs and capabilities for their use cases.

By choosing the right set of products customers can track and monitor various aspects of the supply chains end to end.



Oracle Blockchain Cloud Service

Oracle Blockchain Cloud Service (BCS) is a distributed ledger cloud platform to provision blockchain networks, join other organizations, and deploy & run smart contracts to update and query the ledger. This enterprise-grade blockchain solution enables you to:

Deliver Business Results

With the ability to rapidly onboard and easily scale global network participants, your operations run continually with resilience, high availability, and autonomous recoverability. Secure access in a permissioned blockchain is protected by Oracle Identity Cloud Service with behavioral authentication, single sign-on, and key management services.

Drive Innovation

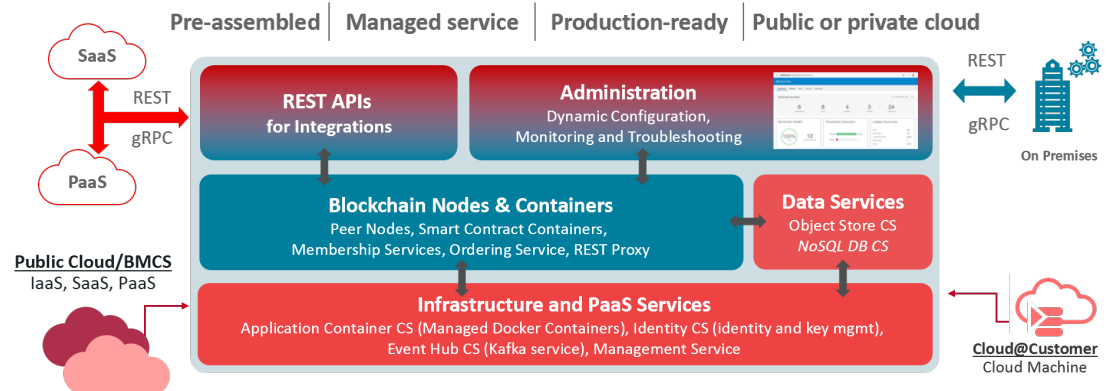
For Oracle ERP Cloud, Oracle Supply Chain Management Cloud (SCM), and other applications running in Oracle Cloud and on premises. Extend your enterprise boundaries by enabling new business models and revenue streams from untapped markets with blockchain-verified identity and offerings. Speed up existing business processes with trusted, real-time information sharing across existing Oracle ERP Cloud, Oracle SCM Cloud, NetSuite SuiteCloud Platform, and custom blockchain application integrations.

Reduce Risk, Complexity, and Increase Efficiency

by securely automating cross-organization transactions and providing reliable sharing of information—both inside and outside the enterprise boundary. As a result, your organization simplifies compliance and audits, while reducing transaction costs and security and privacy risks. A pre-assembled, managed cloud platform also enables you to simplify operational complexity, dynamically change network configurations, and rapidly identify and resolve issues with real-time monitoring dashboards.

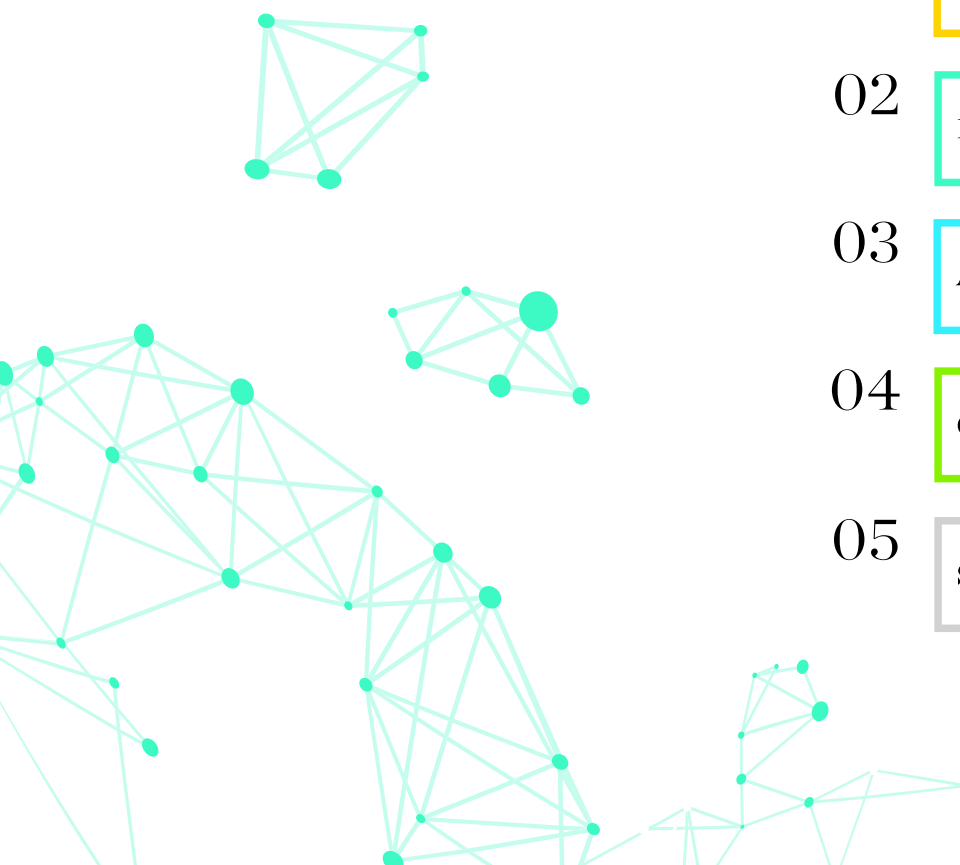
Accelerate Time to Market

With a REST API-driven platform and rich integration options in Oracle Cloud Platform. Start developing blockchain applications within minutes without complex setup and provisioning. Leverage API-driven development for cloud and on-premises applications using REST API and API management service to easily invoke blockchain services directly, or with integration accelerators from Oracle Cloud.



Supply Chain Use Cases

Early investment in Blockchain technology can provide innovative organizations with competitive advantage. Fast movers will likely realize the value of addressing these challenges more quickly and comprehensively than their competition. To accomplish these results, organizations need to understand Blockchain & IoT capabilities, choose the appropriate starting point for their industry, and prove out the value with an applicable and functional use case. Oracle and Deloitte have come together to identify five core use case categories for executives to consider as they decide where to apply Blockchain.

- 
- 01 Tracking**
All manner of product tracking throughout the supply chain including origin and custody of parts and assemblies (product provenance tracking) as well as location based journey positioning (product journey tracking)
 - 02 Digital Paper**
Digitization of supply chain documentation and online auto-verification including purchase order execution, bill of lading, custom declarations, and customer acceptance
 - 03 Auto-Verification**
Rule based monitoring and exception handling of product quality attributes like country of origin, temperature, quantity, and weight or volume
 - 04 Contract Performance**
Settlement or reverse logistics based on certification results, delivery performance, in-transit incidents, and invoice matching exceptions
 - 05 Settlement Automation**
Direct peer to peer payments for goods and services rendered without bank or clearing house intermediaries

USE CASES

These use cases are applicable across the supply chain with benefits that differ by industry and organization based on the level of focus and compliance required to complete the cycle. During each stage of the end-to-end supply chain there is opportunity to weave in Blockchain capability.

I TRACKING: IoT technology makes the real-time accurately capture of your entire supply chain information a reality. The following are three major types of product tracking:

Component/product provenance tracking:

Companies have been making substantial supply chain investments over the years to streamline business processes, minimize risk, and boost customer loyalty. However, the simple question of “where did this come from?” is still a difficult question to answer in most companies. From Takata airbag recall, to romaine lettuce recalls, having the visibility to re-trace the path of an item across complex global supply chain is a vexing problem. Peoples' lives, corporate revenues and reputation are at stake when inadvertent delays creep up in these situations. By leveraging IoT and blockchain, companies can have a technology solution that provides deeper insights and quicker incident detection and resolution capabilities.

Another key aspect of provenance tracking is that of transparency. Companies now have an opportunity to offer deeper transparency to customers and build brand loyalty. For example, let's take the example of a parent looking to buy a food product at a grocery store. By bringing mobile, IoT and blockchain technologies together, it is now possible to offer an interactive experience for the parent with the product for him/her to get richer information about the product, ingredients, allergens, its origins and other information that would help them make the buying decision with confidence. In this scenario, blockchain helps to provide the provenance information, IoT helps to track various aspects of the product, and mobile offers on-the-spot interactive experiences for the user. In addition to the above, the same solution can also be leveraged to simplify legal and regulatory compliance that many industries have to comply with.

Product journey tracking:

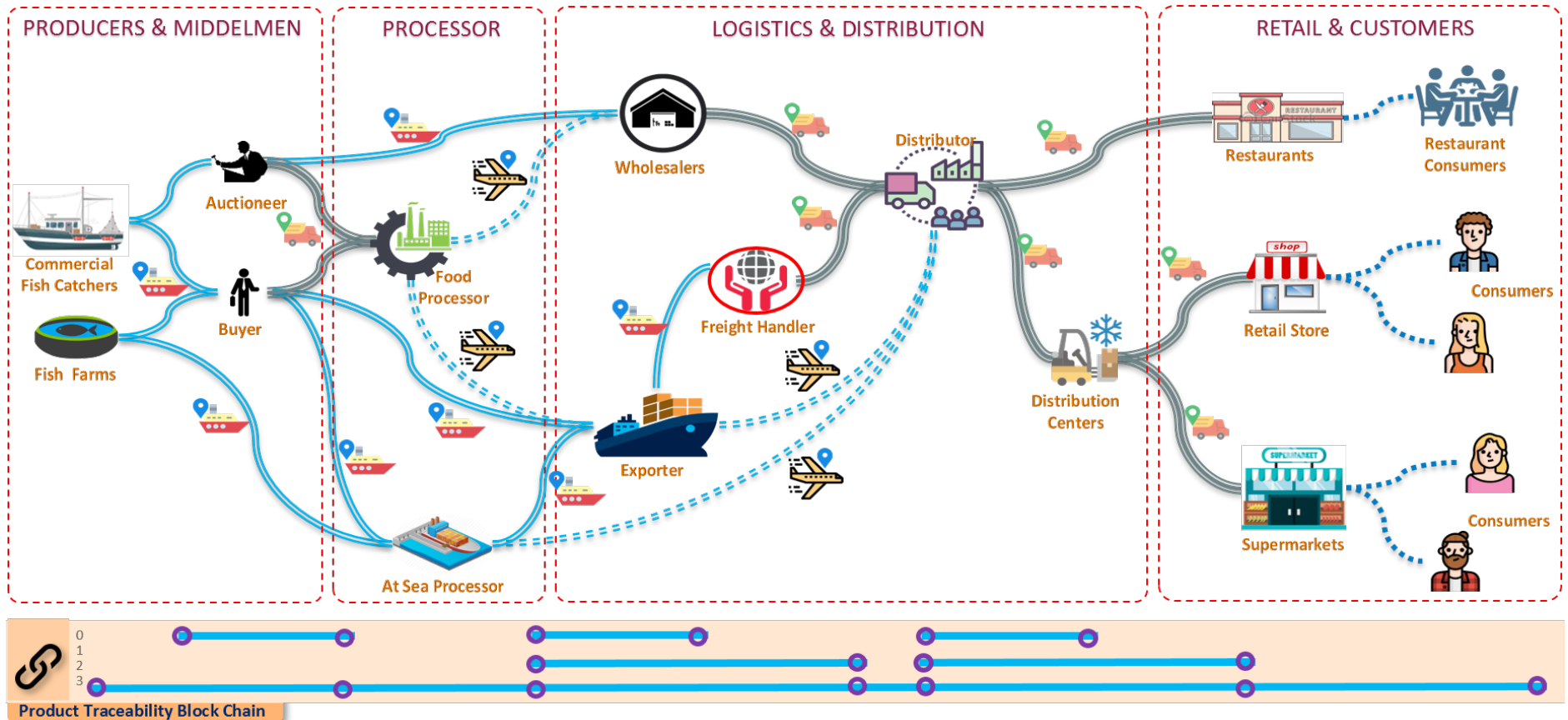
As products go through complex logistics across the globe, several risk factors are introduced. When sensitive products like medicines, wine, fruits are shipped, delays with logistics can cause degradation of the product. Some products are very prone to counterfeiting, and imitation products get injected into the supply chains, despite the best efforts of today. With IoT, products can be tracked with much more granularity than ever all throughout their product journey, and blockchain is leveraged as a mechanism to document and share validated non-repudiable information about any incident that might of be interest to the stake holders of the supply chain.

Change of ownership and custody tracking:

Suppliers, manufacturers, banks, insurers, freight forwarders, 3PLs and other players play critical roles in moving goods across the supply chain. With IoT and blockchain, many aspects of the ownership and custody tracking aspects can be automated or simplified. As IoT tracks, the smart contracts on blockchain help to automate the tracking and transfer of value in the ecosystem.

USE CASES / TRACKING

The following end to end product traceability use case demonstrates the potential use and value of Blockchain and IoT technologies:



USE CASES

2 **DIGITAL PAPER:** Paper-work related complications frequently cause delays, losses and business risk for companies. This problem is exacerbated when the products are time-sensitive- such as dairy, medicines and meat. Companies are increasingly considering IoT and blockchain as a way to mitigate this risk, as they can be enabling components to digitize the paperwork and automate the validation/verification process. With this automation the risk of falsified paper documents or manual errors creeping into the documents can be minimized.

4 **CONTRACT PERFORMANCE:** One of the key challenges in the supply chain world is to measure the performance, both internally and externally for your partners. The challenge lies in the lack of visibility (the performance data). IoT and Blockchain technologies will capture the vast amount of supply chain data, which can be mined and translated into pre-defined Key Performance Indicators (KPIs). The supply chain transparency will help organizations to easily measure and manage their supplier contracts. Suppliers can be incentivized for better performance, and lower performers can get precise feedback on opportunities to improve. With smart contracts, payments and other processes can be automated and simplified based on the performance characteristics recorded in the blockchain.

3 **AUTO-CERTIFICATION:** Modern manufacturing machines offer granular data about production quality metrics, deviations, and exceptions. As manufacturing automation increases, quality verification and certification processes are getting automated as well. Secondly, as products' time-to-market shrinks there is a need for partners to share information reliably, and efficiently. Blockchains can help in this regard. Their ability to provide common, shared, tamper-resistant information helps with partners having the right kind of visibility of quality and production metrics that might impact their business KPIs. Blockchains like Oracle BCS offer confidentiality and privacy features that enable partners to safely and securely share only the pertinent information.

5 **SETTLEMENT AUTOMATION:** One of the key benefits from Blockchain technology is to enable direct peer to peer payment for goods and services rendered without bank or clearing house intermediaries. Payment and Invoice across the borders will benefit the most given the long processing time and high costs of the clearing process. It will also reduce the currency exchange risk due to the near real time settlement. We anticipate that this model of leveraging blockchains for payments will unleash further innovations in trade finance, business lending, payment mechanics and more.

Blockchain and IoT technologies can bring safety, transparency, automation, and operational efficiency to supply chains. They supplement and extend the core enterprise platforms such as ERP and SCM to unlock bigger values from today's complex and changing supply chains. When coupled with other emerging technologies, such as Robotic Processing Automation (RPA), it can generate even more value.



Adoption Approach

Many organizations are often overwhelmed with the amount of technologies that are available and by the pace of change. Forward leaning teams are keen to innovate, but defining how, when and what to start with can be a challenge. At Deloitte, our experienced Blockchain and IoT professionals focus on helping clients to embark on an innovative journey, by adopting the value driven approach - thinking big, starting small and scaling fast.

ADOPTION APPROACH



THINK BIG

Identifying the use case that can resolve a critical business issue is the key to a successful emerging technology deployment. The value driven approach for innovation needs to be enforced throughout the journey.

- Socialization & Education: Getting internal buy-in for the potential use of Blockchain and IoT technologies starts with the socialization and education of internal stakeholders around what these technologies are, and more importantly, the potential benefits/impacts on their business operations. Creating a community interest and excitement is a nice start to the journey.
- Ideation: Broaden the tent during the ideation phase. Include business and innovation leaders to help explore the positive impacts Blockchain and IoT can have on the business.
- Use Case Design: Focus on the value outcome. Review existing business strategy and priorities, and identify the use cases that attack the most critical business issues or strategy.

START SMALL

In order to quickly prove the value of the solution, and not lose focus on the journey, we recommend starting with a small Proof of Concept (POC) pilot project. This approach aims to achieve quick wins that help build familiarity and buy-in around the value Blockchain and IoT can provide the business.

We advise clients to limit the initial number of participants for the POC to a select group of trusted vendor partners. All vendor partners need to endorse the use case plan; there should also be firm commitments made around the selected technology; i.e. Oracle Blockchain and IoT, the success criteria for the POC, and a defined adoption approach.

SCALE FAST

Implementation: After the initial POC concludes and participants' reach an agreement to move forward, we encourage clients to capture the first mover advantage and scale the solution quickly. By leveraging an agile methodology, organizations should rapidly progress the prioritized use cases through iterative cycles. The enterprise should also simultaneously develop go-to-market and roll-out strategies for other partners/geographies and institutionalize the operating model by incorporating the lessons learnt from the POC. The goal is to expedite the deployment process for a commercial-scale product.

It is critical for both internal and external stakeholders to ensure the solution adheres to legal, statutory, regulatory, tax and other compliance requirements during the implementation planning process.

ADOPTION APPROACH

Blockchain and IoT belong to a digital ecosystem which exceeds the boundaries of an organization, enabling co-operation between multiple parties. Conventional enterprise architecture adoption approaches may not always be effective for such ecosystems due to their dynamic nature; and the adoption success lies in being able to manage it well. To harvest the benefits of the innovative technologies, we help organizations work towards establishing a robust risk management strategy, governance and controls framework to ensure appropriate management of risks.

While innovation is accelerating, these technologies are still emerging and our vast experience in blockchain and IoT solutioning and implementations aids us to assist clients in keeping the following considerations in mind:

SYSTEM ARCHITECTURE

- Figuring out the right blockchain architecture for the use case may be challenging. Deloitte & Oracle can help clients to arrive at the well suited technical architecture; keeping in mind the business, functional and technical requirements.
- Deciding on the IoT device sensors, vendors, communication architecture and security paradigms to implement at each point of the IoT architecture are key areas of focus during a client's decision making and implementation.

SOLUTION STANDARDS AND PROCESSES

- Like every technology implementation, it is important to set up the right standards and practices for design, development, testing, and reviews. A leading practice from blockchain implementations is to have code review/audits of the chaincode completed for all areas of the business that are impacted, including: legal, finance and engineering teams.

SECURITY

- All parties on the blockchain need to reach an agreement on how network security is handled; and establish common rules for the permissioned blockchain. Controlling access and ensuring security across the network is critical to achieving the benefits of blockchain.
- IoT security aspects are critical and should be designed and set up to ensure data is secure to prevent malware and incorrect data ingestion into the system.
- Unlike other technologies, this is a shared process between all participants. Organizations should pay close attention to legal, regulatory and even cultural impacts.

Bottom Line

The Blockchain and IoT technologies will digitize the next generation supply chain. The result - a transparent, instant, secure and agile supply chain that will increase efficiency, quality and speed. These technologies will also serve as core differentiators for organizations that strive to keep pace with increasingly complex supply networks and customer expectations.

To learn more about the Oracle Blockchain Platform, visit oracle.com/blockchain or connect with Deloitte at deloitte.com/oracle.

Authors

JOHN LIU



John Liu is Chief Innovation Officer in Deloitte Consulting's Oracle practice. He helps organizations transform their business and grow in the digital era by leveraging emerging technologies. He tweets at @johnliu88, and is based in Los Angeles.

ANANT KADIYALA



Anant Kadiyala is director of blockchain and IoT industry solutions at Oracle. He tweets at @akadiyala, and is based in the San Francisco Bay Area.

PETE CANNISTRACI



Pete Cannistraci is a leader in Deloitte Consulting's Oracle practice. He assists manufacturing companies in defining and executing their digital supply chain transformations using Oracle Cloud. He is also responsible for Deloitte's Oracle Cloud Business Case Strategy and delivering it to clients who want to better articulate the value of their technology investments.



CONTRIBUTORS

- Vidya Arun
- Shagun Goyal
- Anant Parnami
- Jithendra Brahmavar
- Sankar Prabakaran
- Amit Dubey
- Pooja Bhaumik

REFERENCES

1. *Fiona Clark, "Rise in online pharmacies sees counterfeit drugs go global," The Lancet, October, 2015*
2. *Niamh O'Connell; Danielle Andrzejewski; Darshini Dalal; Kai Gindner, "When two chains combine: Supply chain meets Blockchain," Deloitte Consulting LLP, November, 2017*

This publication contains general information only, and none of the member firms of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collective, the "Deloitte Network") is, by means of this publication, rendering professional advice or services. Before making any decision or taking any action that may affect your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

As used in this document, "Deloitte" means Deloitte Consulting LLP, a subsidiary of Deloitte LLP. Please see www.deloitte.com/us/about for a detailed description of the legal structure of Deloitte USA LLP, Deloitte LLP and their respective subsidiaries. Certain services may not be available to attest clients under the rules and regulations of public accounting.

Copyright © 2018 Deloitte Development LLC. All rights reserved. Member of Deloitte Touche Tohmatsu Limited