Supply Chain Transparency

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January 2018

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Contents

The Problem Defined

An increasing area of concern within modern day supply chains is the necessity for significant supply chain transparency. Increasing transparency is a concern for many companies because it allows firms to identify areas of inefficiency, permit the sharing of knowledge, and understand the exact location of an item, whether it is moving upstream or downstream. At Company x (the participating company of this student research project), having a transparent supply chain is crucial for the company and its customers. Improving visibility within the supply chain not only provides a more detailed account of transactional activities but improves safety and pinpoints areas of inefficiency. The problem at hand poses the questions of which enabling technologies are available in order to advance this space and what current applications are available to make the necessary improvements.

The Potential Solutions

In order to increase upstream material and resource transparency in the healthcare industry at Company x, extensive research has been performed by examining industry leaders and the various platforms they utilize. These systems include blockchain, Amazon Web Services, and Oracle SCM Cloud. The benefits, implications, and applications of each of these three platforms is examined in order to provide information on the best solution for COMPANY X's supply chain.

The Impact

With $76.5 Billion in sales in 2017, Company x is a massive company that can extensively benefit from the implementation of supply chain transparency initiatives. Having a more visible supply chain highlights areas of inefficiencies and drives growth within the company, allowing for the development of a more sustainable supply chain. Due to the early nature of developments in supply chain transparency efforts, COMPANY X will be able to lead the industry through their innovative approaches to solving this issue.

Creating a clearer supply chain will increase upstream resource transparency and traceability. Due to increased consumer, company, and government demand for information about where products are coming from, COMPANY X must invest in the development of traceability efforts within their supply chain to not only remain profitable, but to further innovate.

Increasing supply chain transparency at Company x will increase consumer trust and build brand reputation. Tracking the supply chain will allow the company to further track its environmental footprint of their actions, protect against counterfeit goods, and ensure that suppliers are not shortcutting their manufacturing by using inferior alternatives to the approved source of materials (New, 2010). Focusing on improving upstream transparency will allow COMPANY X to pinpoint quality, safety, and reliability issues early on.

The Research

In order to analyze the benefits and implications of increasing supply chain transparency and traceability at Company x, extensive research has been conducted. By utilizing resources such as professors of procurement within the Smeal College of Business, representatives from leading companies, and research-based articles, conclusions and suggestions have been made.

Our research serves as a working document for Company x colleagues to draw upon as the research of supply chain transparency and traceability continue to grow.

Methods to Increase Supply Chain Transparency

The Importance of Transparency

Due to the rise of counterfeit goods, product recalls, and extensive safety requirements, supply chain transparency and traceability have become an increasing area of concern for consumers, companies, and governments alike. Transparency reveals areas within the supply network where inefficiencies, investment bottlenecks, and below-standard business practices are occurring. Decreasing the opacity of the supply chain improves product quality, reliability, and safety, which in turn improve company profits and trust among consumers.

More than ever, provenance has become a major concern for consumers. Products that are vague about their origin will likely not remain competitive in consumer markets due to the rising expectation of firms to be transparent about the origin of their products (New, 2016). The rise of counterfeit goods causes consumers to question the authenticity of products, therefore reaffirming the importance of creating a transparent supply chain. Revealing the origin of products will build consumer trust and brand reputation at the same time.

Eventually, complete transparency and traceability will be a mandate for any company's suppliers. Supply chains will begin to develop in a way that eliminates suppliers that do not provide data about provenance. Furthermore, constructing a transparent supply chain permits companies to meet demand for responsible practices regarding social and environmental standards (Ascent Global Logistics, 2017). Transparency within a supply chain consequently reduces risk as buyer-supplier relationships become clearer. Lastly, a more traceable supply chain increases the efficiency of firms as unnecessary middlemen can be cut out of the chain and more direct relationships can flourish.

In continuation, having a transparent supply chain directly impacts the traceability of goods both upstream and downstream, therefore connecting all points of the chain together. Transparency reveals how a supplier is performing, shows the path from supplier to consumer, reduces the risk of mislabeling, and improves the integrity of any supply chain. By having more information at hand through this clear supply chain, more effective audits can be performed. In a crisis such as a product recall, rapid traceability analysis can be done in order to find an effective solution in the most efficient way (*ChainPoint*, 2018).

Perhaps one of the most persuasive reasons for pharmaceutical companies to adopt supply chain traceability software is the creation of the Drug Supply Chain Security Act. Enacted by Congress in 2013, the Act requires an "electronic, interoperable system to identify and trace certain prescription drugs" (Wentworth, 2018). The DSCSA places pressures on US manufacturers to improve the transparency within their supply networks.

Solutions to Improve Transparency

In order to successfully improve transparency and traceability within the Company x supply chain, three potential solutions can be implemented. The benefits, concerns, and industry applications of Blockchain, Oracle SCM Cloud, and Amazon Web Services are discussed to serve as possible solutions for COMPANY X to solve the challenges at hand.

1. Blockchain

Blockchain is a shared, distributed ledger that facilitates the process of recording transactions and tracking assets in a business network. Traditionally, blockchain was utilized in bitcoin systems - a digital cryptocurrency launched in 2009 (Rosic, 2016). Only recently has blockchain started receiving attention in the field of business.

The primary difference between bitcoin and traditional currencies is that unlike traditional currencies, bitcoin is not controlled by a central monetary authority. These currencies are managed and confirmed by every participant who uses bitcoin.

Blockchain in the supply chain industry has emerged recently but the number of firms implementing the technology is rapidly increasing. For example, large corporations such as Walmart and Maersk recently started utilizing IBM blockchain in order to increase cost-efficiency and transparency in their supply chain systems (Rosic, 2016).

In the pharmaceutical industry, Merck has implemented blockchain by utilizing SAP Pharma Blockchain. The company believes that the implementation of blockchain in their supply chain will help them fight against counterfeit drugs in the pharmaceutical market (New America, 2018). The implementation of blockchain in pharma will provide solutions to better store and trace confidential patient health data (Shanley, 2017). In continuation, somewhat unique to the pharmaceutical industry is the fact that pharma products must cross multiple countries and jurisdictions where safety and security protection are

necessary. The employment of blockchain as a software to improve visibility in pharmaceutical supply chains has many benefits along with several noted areas of concern.

Benefits of Blockchain in the Supply Chain

The benefits available from implementing blockchain into any system revolve around the creation of a shared visibility ledger, smart contracts, and consensus. The creation of these three aspects provide key benefits of increased transparency and collaboration, decentralization, and immutability. All the benefits created through the implementation of blockchain processes link back to the creation of one crucial element: trust.

Shared Visibility Ledger

To begin, blockchain's creation of a shared visibility ledger prevents the redundancy of double entry. This ledger records all transactions across the business network and shares this information among all participants in the network. The ledger is a crucial aspect to the foundation of blockchain since this system operates on the premise of a shared platform. The shared visibility ledger permits all member companies to view what the other's supply chains are like, where the efficiencies and inefficiencies lie, and what improvements can be made. The shared ledger helps with the standardization of record keeping and transactions within the supply chain because it will show exactly when and where each transactional purchase occurred. Because the ledger is permissioned, participants will only be able to see transactions that they are authorized to view, which prevents confidentiality issues within the supply chain.

The shared ledger also reduces inefficiency, creates transparency within the supply chain network, and reduces fraud and misuse. Since transactions are recorded chronologically and are shared between multiple parties, participating companies reduce their individual data silos and in turn become more transparent. This increased collaboration allows information that is auditable by all companies to be shared (Taylor, 2017).

Smart Contracts

In continuation, another benefit available from the implementation of blockchain in a supply chain is the creation of smart contracts. A smart contract is the automatic creation of a contract within a blockchain (Troy, 2016). The contract creates a set of agreements and rules that are automatically executed within the transaction. These contracts are

created between the blockchain user and a regulator, the participant with overseeing transactions. Similarly, contracts are created with the blockchain developers, processing platforms, data sources, and the certificate authority. The creation of these smart contracts allows all transactions made through the blockchain to be done in an ethical and transparent manner.

The benefit with the creation of smart contracts is that the rules and penalties around an agreement are automatically enforced (Rosic, 2016). Paper-based reporting systems have become far too outdated to keep up with the ever-changing technological environment. The creation of an online, cloud-based contract would not only ease the relationship between contracting companies but would decrease the reliance on an outdated system of contracts. Smart contracts eliminate the need for forms to pass through multiple channels for approval. Tasks and payment are automated and are clearly accessible to all operating parties. Smart contracts guarantee specific outcomes and eliminate the need for litigation for disputes over contracts (Troy, 2016). The standardization of many smart contracts will eliminate the need for companies to create contracts from scratch.

Creation of Consensus

The third major benefit from implementing blockchain is the creation of consensus, which means that transactions can be verified and committed through consensus. The simplest definition of a blockchain is "a network of collaborating parties who share a decentralized database" (Taylor, 2017). So, the idea of consensus is naturally embedded in the foundation of what blockchain is. By having proof of stake, where validators hold a certain percent of the network's value, and using a multi-signature approach to transactions, the majority of validators must agree to a transaction before it occurs within the blockchain. This consensus ensures that proper transactions are occurring and that each action is approved by the respective company.

Because all companies that operate within the blockchain have their own copy of every transaction, there is complete transparency. After a transaction occurs, the data can never be augmented, therefore the accuracy of the information that is recorded will always be truthful. This further strengthens a supply network as upstream and downstream suppliers can build trust on the notion of consensus. At each transaction, the data is automatically encrypted, allowing no room for faulty registration of transactional activities.

Concerns Regarding Blockchain Application

Confidentiality

After significant research, there appears to be major points of weakness within the blockchain platform. To begin, confidentiality remains a major issue. Although some measures have been taken, including Microsoft's development of the Coco framework, security measures within the network remain a concern. In order to overcome these cybersecurity risks, Company x would have to invest heavily in updating their current company security measures. This includes increasing the power of the company networks, firewalls, and employee confidentiality measures. The accountability frameworks present within the blockchain network only provide security measures to a minimal extent. Advances in quantum computing provide algorithms that may prevent hackers from reaching certain amounts of information, but there is a major possibility that a breach in security could lead to the loss of massive amounts of confidential company information.

The complete transparency that blockchain technology gives is useful in many regards, however, there need to be limitations on the data access controls. Companies employing blockchain as a transparency measure must have controls on what information is being shared, yet still maintain transparency in the necessary areas. Currently, there are only some measures in place to control what information is transparent and what is not. However, these measures may not be flexible enough to meet the pressing demands of current complex supply chains.

Recent Development

Another major concern with the implementation of blockchain is its recent development. Although there are major and significant benefits with the use of blockchain, the newness of the cloud service provides major risks for any company who endeavors on using the system. After speaking with various industry experts, there is a consensus that IBM Blockchain is a major development in the realm of cloud system management. The significant amount of coordination that is required between participating companies within the blockchain is essential for the system to be successful. More centralized databases are easier for a multitude of companies to streamline their information into, but the blockchain system is brand new and requires massive amounts of integration.

Safety and Security

In continuation, another weakness of the blockchain platform is that companies must pick and choose what data they want to be protected. Essentially, companies must decide which data they do not mind gets 'hacked', and that is a very difficult decision to make. Having to worry about the safety of a company's confidential information is another burden that is not necessary to bear when there are several other systems on the market that can keep company information private and secure. The weak points for information collection within the IBM Blockchain still need to be addressed, and that is an issue that takes not only time, but investment on behalf of the operating company. Confidentiality within the blockchain system is still under major development, and it would be detrimental for a company such as COMPANY X to have private company information revealed in the nodes of the blockchain.

Scalability

Compared to other more established technologies, blockchain still lags in terms of scalability. Integrating transactions from smaller, far upstream suppliers may not be advantageous for some companies, while essential for others. For blockchain to be successful, the scale of adoption must span a large portion of various industries. If blockchain operates on a small scale, the information sharing that occurs between the nodes would not be very useful. The question of whether blockchain's performance will decrease when loads of companies join in on the process is another problem to consider. Experts worry that the more information that enters the system, the more bogged down the performance of the blockchain will become (Bloomberg, 2017).

Immutability

Another major concern with blockchain regards the immutability of the blockchain ledger. With the ledgers and transactional records within the blockchain system being permanent and unchangeable, complications may arise if a mistake occurs within the system as it is much more difficult to correct a mistake that was found within the blockchain system. The EU 'right to be forgotten' law makes the complete removal of information a necessity, and with blockchain, this may be near impossible (Bloomberg, 2017).

GOVERNMENT REGULATIONS AND LAWS

The establishment of blockchain as a traceability tool may lead to legal implications if companies record transactional information that is not correct. Because the blockchain model provides the opportunity to digitize governance models, disputes may arise between countries and areas with differing laws (Bauerle, 2017). Different regulations, maritime laws, and commercial codes govern the rights of possession in different countries and jurisdictions, and the sharing and transfer of information through the blockchain system may violate these codes (Casey, 2017).

Blockchain Application Examples

1. **Microsoft**

Microsoft Corporation (MSFT) embarked on the blockchain journey in November 2015, a year and a half after CEO Satya Nadella unveiled his vision to emerge as a preferred cloud platform in the "mobile-first, cloud-first, data-powered world." Microsoft's offering of "*Blockchain as a Service (BaaS)*" on Microsoft Azure was started to enable enterprise clients and developers have a single-click cloud-based blockchain developer environment. (Bajpai, 2018). Today, several companies have created and joined blockchain-related consortia. There was a proliferation of consortia in 2017, and they have become integral to today's R&D ecosystem. A consortium typically involves multiple large companies, software development startups, blockchain-oriented research and educational organizations, and even government agencies (Lannquist, 2018).

2. **Walmart**

Walmart Inc. is getting suppliers to put food on the blockchain to help reduce waste, better manage contamination cases and improve transparency. The retailer, which started running tests with IBM Corp.'s blockchain platform in 2016, is ready to use the technology on its live food business, according to Frank Yiannas, Vice President of Food Safety and Health (Bloomberg, 2018).

3. **Merck**

Part of what Merck's applied technology group is now exploring are those potential applications for the blockchain within the healthcare field. After the financial services sector, Kulatilaka said, healthcare could potentially be the second-biggest industry to adopt blockchain technology. But don't look for the industry to make any big moves over the next year. A "level of boldness" is needed to make sea changes in healthcare, as

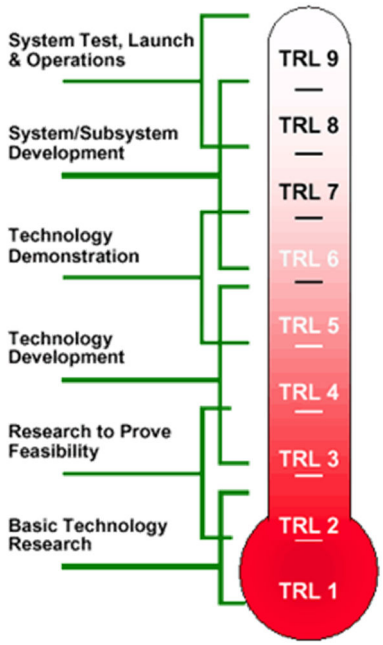
Kulatilaka pointed out, but blockchain technology will be implemented more and more over the next five years (MedCityNews, 2018).

4. **Visa**

Global credit card giant Visa has rolled out the first, pilot phase of its blockchain-based business-to-business payments service, B2B Connect. First announced last year, Visa plans to use the platform to ease cross-border payments by facilitating direct payments between institutions, cutting out the middleman the industry currently relies on. The platform - developed with the assistance of blockchain startup Chain - is also designed to ensure secure, yet transparent payments between enterprises (Visa.com, 2018).

Subjective Opinions on Blockchain Technology

IS BLOCKCHAIN TECHNOLOGY TOO NEW?



Upon our research, we discovered numerous benefits regarding blockchain technology. It all seems like blockchain is a revolutionary technology without any flaws, but the technology has only recently been implemented in companies. For example, Walmart implemented blockchain technology at the end of 2017, but only with a very selective number of suppliers, such as Dole.

While Walmart has been experiencing benefits from blockchain technology, especially on supply chain transparency, it is too early to determine whether blockchain technology is indeed the future of supply chain technology or not. We had an opportunity to attend a presentation from a former employee from IBM Blockchain. According to him, as blockchain technology is too new in the supply chain industry, there is not enough historical data regarding this technology nor is there diversity in applications. He also mentioned that with today's blockchain technology in supply chain, companies in a supply chain network are forced to share a great amount of information, which could deter some companies from joining in.

Similarly, Vicki Huff Eckert, Leader of Pricewaterhouse Cooper's US and Global New Ventures, shared her expertise on the subject. From her professional opinion after operating in the tech industry for over 25 years, Eckert believes that a company should not invest in blockchain at the current moment due to its ever-changing nature, volatility, and need for improvement. She emphasizes that if a company were to invest in blockchain now, they would have to bear the costs of issues within the system. Eckert recommends companies to wait a few more years until blockchain has become a more developed platform before companies invest in using it to improve their supply chains.

Our suggestion for COMPANY X is to wait until blockchain technology reaches a certain level of technological maturity until the company implements blockchain in its supply chain. The chart on the right is the commonly used Technology Readiness Level (TRL) scale developed by NASA. We believe that blockchain technology is somewhere between TRL 6 and 7 as the technology lacks number of tests and examples so far. We recommend that

COMPANY X should consider implementing blockchain when the technology reaches TRL 8 or TRL 9.

2. Oracle SCM Cloud

Oracle SCM cloud is a cloud-based inventory management system that provides several applications to solve various supply chain issues. Launched in 2015, the integrated cloud platform provides software solutions that meet customer requirements for increased security within their supply networks (Arora, 2015). After observing the developments of other integrated cloud platforms that Amazon and Microsoft were creating, Oracle decided to design a platform that is a modern suite for improving efficiency and company performance.

The Oracle SCM Cloud's goal is to be a reliable, high-performing, compatible, and secure cloud system that will manage a firm's supply chain. At the launch of the Cloud in October 2015, Larry Ellison, Oracle's Chief Technology Officer, emphasized that this product's top priority is to secure company information. He emphasizes the Supply Chain Cloud's ability to secure data in real time through a user-friendly system. Oracle has developed more than 45 Software-As-A-Service (SaaS) and Platform-As-A-Service (PaaS) systems that facilitate the improvement of supply chains around the world (Arora, 2015).

To increase global inventory visibility, improve flexibility of trade between internal partners, optimize the flow of goods, and reduce costs, Oracle has created twelve supply chain-specific clouds ("Inventory Management Cloud"). Although all the cloud options address the issues of supply chain transparency and traceability, there are three that are specifically designed to reduce the haziness of the supply network. These options include the Inventory Management Cloud, Order Management Cloud, and Supply Chain Collaboration and Visibility Cloud.

a. *Inventory Management Cloud*

Oracle SCM Inventory Management Cloud's main function is to comprehensively manage materials. The user of this platform can view comprehensive material flows, warehouse work, and product costs across the supply chain. The Inventory Management Cloud permits the management of global intercompany transactions while proactively managing inbound, on-hand, and outbound operations ("Inventory Management Cloud", 2018). Within this system, the flow of goods can be optimized, therefore reducing costs, inventory levels, and cycle times. The Inventory Management Cloud not only promotes transparency within the supply chain but provides a solution to create lean processes.

b. *Order Management Cloud*

Oracle's Order Management Cloud manages orders from all channels to get a single view of the customer throughout the network. The OMC views and manages the order to cash cycle and optimizes the sourcing and fulfillment of an order to be the most profitable. This system particularly aids with the improvement of supply chain transparency with its proactive monitoring, which constantly locates and supervises orders at risk. In order to optimize system-wide fulfillment activity, companies can implement the Order Management Cloud ("Order Management Cloud", 2018).

c. *Supply Chain Collaboration and Visibility Cloud*

The Supply Chain Collaboration and Visibility Cloud detects, analyzes and resolves disruptions within the enterprise as well as key trading partners. Oracle SCCVC improves the performance of a company's global value network by automating end-to-end processes in order to make the supply chain more efficient and responsive. This platform improves supplier collaboration by gaining contract commitments from suppliers and by unifying the administration of trading partners onto one platform. The SCCVC improves supply chain transparency by alerting partners of demand changes and supply problems (*Oracle Cloud*, 2018).

Benefits of Oracle SCM Cloud

Increased global inventory visibility

The various platforms available under the Oracle SCM Cloud provide solutions to improve supply chain efficiency, transparency, and traceability. Global inventory visibility is increased through the implementation of these systems as each provides its own tailored solution to address an issue within the supply chain. The supply chain becomes more transparent and efficient with the use of these platforms as the trading platforms become unified, inventory management becomes more visible, and alerts are given when changes or risks occur in upstream or downstream demand.

Maturity of Oracle System

The benefits of implementing the use of Oracle SCM Cloud provide a different solution to addressing the issue of supply chain traceability. Firstly, the established, well-developed nature of the Oracle database provides numerous advantages for Company x. Because the company already operates on other various Oracle platforms, there is more familiarity with the navigation of this system. Implementation of Oracle SCM Cloud to increase transparency efforts would be a smoother transition for those beginning to operate with this extension of the Oracle system. Similarly, the financial investment into the SCM Cloud would be significantly lower than the investment into a whole new system. Because COMPANY X would have the option to invest in whichever SCM Cloud platforms best fit their needs, the investment would be tailored to the needs of the company.

Choice of Platform

The Inventory Management Cloud provides comprehensive material management information, which is critical to the improvement of visibility in any supply chain. The Order Management Cloud similarly manages orders, but in a more streamlined viewpoint. The network of the supply chain is narrowed down to provide information on singular orders. The Supply Chain Collaboration and Visibility Cloud not only detects and analyzes disruptions within a supply chain but works to solve these areas of inefficiencies. Coupling the implementation of these systems with one another will provide a well-rounded solution to improving the transparency in the healthcare industry. Opposite of IBM Blockchain, these Oracle SCM Cloud solutions provide a singular view for the using company to analyze their respective supply chains. This singular view provides the

necessary confidentiality within the medical devices, pharmaceutical, and consumer segments of the COMPANY X supply chain.

Cloud at Customer Concept

Oracle has developed a unique "cloud at customer" concept that addresses the typical barriers present with cloud adoption. By adopting an Oracle SCM Cloud solution, a company receives all the benefits of using cloud computing with data being transmitted to the company's data center. Oracle then manages the day-to-day operations. The creation of several different Oracle systems allows the customer to choose which subscription platform is best for their company, which provides a more tailored solution to solving the issue of supply chain traceability. The Oracle SCM Cloud was designed with the customer in mind. With its robust use of visuals, social networking, and self-service features, the Oracle Cloud empowers employees to manage the supply chain of their company.

Concerns with Oracle SCM Cloud

Integration of Cloud Computing

As the development of cloud computing within the realm of supply chain has become a recent endeavor, there are still risks associated with the transition to cloud computing. According to a study of over 1,300 business leaders performed by Dynamic Markets, 81% of respondents believe that cloud applications must "be fully integrated with each other as well as with on-premises software in order to reap the full benefits of the cloud" (Hildebrand, 2018).

Problems with integration of cloud systems has remained the largest obstacle in the adoption of a completely cloud-based supply chain. In fact, 50% of companies abandoned cloud software as a service (SaaS) applications in the last three years due to integration issues (Hildebrand, 2018). For these cloud systems to be successfully integrated, companies must map data. However, the complexity of data mapping provides a major hurdle for any company to adopt a supply management system such as Oracle SCM Cloud. Data mapping is not only complex, by time-consuming and error prone. Data mapping leading to cloud computing is particularly difficult for companies that lack a unified integration system. However, the Oracle Integration Cloud System was created to help companies streamline and integrate their information.

Data Governance

As with blockchain technology, the data-governance integrity of cloud computing is an issue. A set of policies regarding information sharing and data transparency between companies must be clearly stated. How companies decide to integrate their cloud resources with each other and with other applications is a necessary discussion in order to understand what data is being transmitted or protected. Security within cloud computing will remain a top concern. The underlying platforms within these cloud computing systems must have their own security measures embedded in the underlying software. Then, companies must adapt their own security measures to ensure that their data is protected. These security measures extend beyond firewalls and passwords but require the training of employees to understand the importance of confidentiality with the shared data.

Applications of Oracle SCM Cloud

Hundreds of companies currently use the various platforms offered under the umbrella of Oracle SCM Cloud to improve their supply chains. Companies such as AT&T, adidas, Freddie Mac, Motorola, and Merck have adopted the cloud computing services of Oracle. The plethora of available platforms in the Oracle Cloud allows companies to choose the service that best fits their needs. Examples of companies employing Oracle Cloud solutions are outlined below.

1. **FarmaCorp**

FarmaCorp, Bolivia's leading pharmaceutical retail chain, uses Oracle's Warehouse Management System to reduce costs, increase lot visibility, and improve efficiency. This retailer carries pharmaceutical products, medical devices, and consumer goods, like Company x. Like the Inventory Management System, the Warehouse Management System improves the flow of inventory in the supply chain. The implementation of the WMS eliminates the IT backlog and allows FarmaCorp to effectively manage their inventory. FarmaCorp has developed a competitive advantage in their industry by applying the Oracle software ("Oracle Customer Success-FarmaCorp", 2017).

2. Dong-A ST

Located in South Korea, Dong-A ST is a leading global pharmaceutical company that focuses on developing prescription drugs, medical devices, and diagnostics. Through the implementation of the Oracle Cloud's Oracle Argus Safety, the company created a web-based pharmacovigilance system that not only improved visibility within the supply chain, but also increased the efficiency and reliability of crucial drug-safety information. Through this Cloud, Dong-A ST can quickly share regulatory reports with its international trading partners to ensure that their supply chain is meeting global compliance standards. Oracle Argus Safety analyzes complex pharmaceutical safety data through its multidimensional analysis features ("Oracle Customer Success- Dong-A ST, 2018).

3. Amazon Web Services

Amazon Web Services (AWS) is the largest web-based cloud service provider worldwide. Founded in 2006, it is used by many corporates throughout the world including industry leading firms such as GE, Kellogg, Adobe and many more. COMPANY X is also utilizing more than 120 AWS applications, but mostly on R&D. The following are benefits from COMPANY X's implementation of AWS and some benchmarks.

Amazon markets AWS to subscribers as a way of obtaining large scale computing capacity more quickly and cheaply than building an actual physical server farm. All services are billed based on usage, but each service measures usage in varying ways. As of 2017, AWS owns a dominant 34% of all cloud (IaaS, PaaS) while the next three competitors- Microsoft, Google, and IBM- have 11%, 8%, 6% respectively, according to Synergy Group.

AWS Database Products

There are various types of databases available for enterprises to use from different applications. For instance, Amazon Aurora, a database service used by industry leading customers such as Dow Jones, Verizon and even the United Nations, provides a quick-responding, high performance database that is also secure and reliable at a very low cost.

Another advantage of AWS is that the AWS Database has migrating tools that can stream data from all major databases such as MySQL, Oracle, and SAP. This allows customers to enjoy great visuality throughout the network with minimal cost and effort.

AWS Management Tools

Amazon offers several different management tools for all instances, from resource inventory management to creating standardized products. One application that we suggest COMPANY X is AWS Config. This tool allows customers to make continuous record and configuration to AWS resources and gives notifications to designated individuals.

British Gas, the largest UK energy and home service company, is one of the major customers of AWS Config. They use AWS Config to collect end-to-end data in real-time throughout their complicated network and make adjustments.

Benefits of AWS

Existing Commitment from Company X

COMPANY X is already one of the main customers of AWS. The IT division of global enterprise turned to AWS when it decided to move to cloud strategy. Currently, COMPANY X is utilizing 120 applications based on AWS Cloud including intensive/complex data modeling and the number is expected to triple by the end of this year.

According to the keynote from COMPANY X's CTO, COMPANY X utilize Amazon WorkSpace in order to provide various functionalities, from e-mail server to inventory management. With that said, if COMPANY X implements AWS as part of its supply chain strategy, the cost and effort needed for initiation will be minimal. In fact, integration between different departments throughout the same platform database could also bring better productivity to the whole company.

Industry Leading Service Provider

Without a doubt, AWS is the industry leader in the cloud computing industry with 47.1% market share in 2017 by revenue. This large market share allows developers to work under the AWS platform to develop new applications and continuously improve services. Another advantage of AWS is that on top of available applications by AWS, each customer can

develop their own application if necessary. This will allow COMPANY X to deploy its own developers to create applications to meet their specific needs. AWS is also one of the safest data management companies in the industry. As one of the most well-established service providers on the market, AWS provides secure data management to its customers.

Concerns with AWS

Due to the recent development of AWS, not many concerns have yet been detailed. However, it has been noted that the support fees associated with Amazon Web Services are an issue for many users. AWS support fees vary on a sliding scale tied to monthly usage, so support costs can grow quickly if you are a very heavy user. Also, AWS has had a significant history of outage since its creation. Both Azure and AWS strive for greater than 99.95% service availability, with each provider giving credit back to customers if uptime drops below that figure, but while both services have been reliable, each have experienced periodic outages that affected popular services like Netflix, Office 365, and more.

Applications of AWS

1. *General Electric*: GE Integrated AWS application in their manufacturing process
2. *Nisa*: A small company develops and provides supply chain applications based on AWS
3. *TraceLink*: Develops and provides application focused on track-and-trace network based on AWS

Company x Progress

Palm Oil Traceability

Due to the fact that the sourcing of palm oil derivatives may be associated with unacceptable deforestation practices, Company x has directed their efforts into increasing the transparency of the palm oil supply chain. In 2014, COMPANY X began working with The Forest Trust, an NGO committed to creating a more transparent supply chain. Gaining transparency within this supply chain, COMPANY X can pinpoint suppliers who do not comply with their standards for the sustainable sourcing of palm oil. This increase in transparency has allowed COMPANY X to realize areas of improvement and the company has begun to partner with various NGOs, including IDO, Solidaridad, and Wild Asia, and industry coalitions such as the Roundtable for Sustainable Palm Oil to help improve the palm oil industry (Frank, 2016).

Company x has been dedicated to using its voice within the industry in order to advocate for change, whether that change be increase supply chain transparency or sustainable business practices. By ensuring that their suppliers have robust sourcing criteria, COMPANY X fosters the creation of sustainable buyer-supplier relationships and a transparent supply network. Continual monitoring of the palm oil supply chain, among other supply chains, will not only improve COMPANY X, but the industry (*"Company x",* TFT Transparency Hub).

Closing Remarks

In conclusion, there are several various platforms available that can aid in the development of a more transparent and traceable supply chain. After significant research, there are three rising technologies that are enabling this transformative approach to manage the supply chain. Blockchain, Oracle SCM Cloud, and Amazon Web Services are all cloud-based platforms that provide various solutions to address the pressing needs of modern and complex supply chains. Each option has its own set of benefits and limitations, but all provide insight into a less opaque supply chain. In the end, all three options increase the efficiency of any supply chain, build trust with customers, and increase company profits as the traceability and transparency of goods are heightened.

In order to solve the issue of supply chain transparency at Company x, it is recommended that the company explore adding onto their already existing Oracle database through Oracle SCM Cloud applications or to further develop their platforms on Amazon Web Services. The volatility and young age of blockchain technologies makes it too risky of an endeavor for COMPANY X to invest in at the current moment. All in all, there are several marketplace solutions that when combined can create a powerful system that improves supply chain transparency, traceability, and efficiency.

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