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APPLICATION OF BLOCKCHAIN TECHNOLOGY IN THE SUPPLY CHAIN MANAGEMENT PROCESS: CASE STUDIES

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Abstract
*With the development of technology, new approaches have been used in industry, agriculture and services sector. The remaining sectors in technological factors remain behind in competition. Within the 7*R *of logistics, each area is disadvantaged. In order to turn these negative conditions into a positive situation in all three sectors, the futuristic approaches should be closely monitored by all sector and corporate managers.*
In this study, we focus on the use of blockchain technology, which is a relatively new concept and used in limited areas, in the supply chain management process. In the first part, both the supply chain and the blockchain technology are conceptually expressed and introduced. In the last section, examples are included and evaluations are expressed. The study is in the form of case studies and observations review.

Keywords: *Supply Chain, Blockchain, Supply Chain Management, Tekno Logistics.*

1. Supply Chain Management and Blockchain
In this section, basic concepts are briefly mentioned. When Supply Chain Management is considered as a process, how blockchain technology will contribute to this process and what kind of interactions are explained in the next section.

1.1 Definitions of Supply Chain Management
Supply Chain is defined by the Council of Supply Chain Management Professionals (CSCMP) as;
Supply Chain Management is responsible for the planning and management of resources, including procurement of resources, the transformation of these resources into products and all logistics management activities, as well as the cooperation with suppliers, intermediaries, third-party service providers and finally channel partners involved in this process. and coordination process[1]
From the main source of supply chain management, side sources, ie side suppliers, and ultimately end-user groups, there are at least three studies. What is important is the management of the flow between stages. Three-way flow (source to end-user, inverse and bidirectional) flowing material and money in the opposite one another, document, feedback, work orders, etc. The information is bi-directional. Supply chain management is a set of functions of controlling money and goods flow using process management knowledge.

1.2 The Process of Supply Chain Management
Supply Chain Management encompasses all actions ranging from strategic-level actions of firms involved in the effective integration of suppliers, producers and distribution centers into tactical and operational-level actions. [2]

Quality-oriented enterprises depend on their understanding of supply chain management processes and their ability to design these processes accurately and rationally. Supply chain management is a process-oriented strategy and targets high quality at low cost.
Therefore, the processes that constitute the supply chain management have a critical importance for business success. [3]

Supply Chain Management processes are considered as eight processes defined by the members of the Global Supply Chain Forum. [4]

- Customer relations management
- Customer Service Management
- Demand Management
- Order Processing
- Production Flow Management
- Supplier Relationship Management
- Product Development and Commercialization
- Returns Management

1.3 Blockchain Technology

Blockchain, also called Blockchain technology, is an encrypted filing system that essentially ensures that the data block in a network environment is monitored, validated and permanently recorded by all users who have been granted access to that network, and stored permanently in a decentralized non-invariant distributed database. [8]

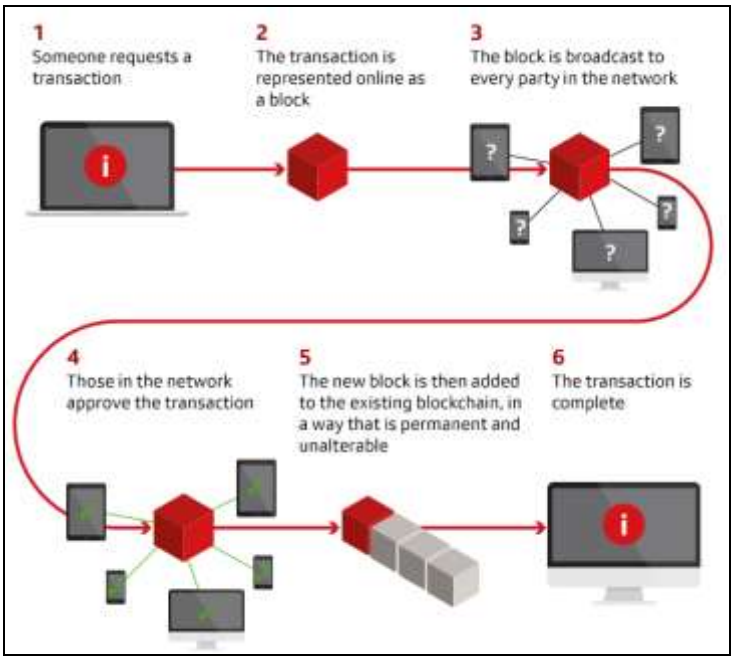

Figure 1: Blockchain Process
Source: Crosby, 2016

2. The Relations Between Blockchain and Supply Chain Management

Income Outside of the finance field, the block-chain studies have started to be experimentally in the recent past and the related studies continue to be concentrated day by day. Block chain applications are not only in financial fields

but also in supply chain, energy, food and agriculture. Thanks to the traceability, transparency and reliability features of Blockchain's main backbone, efforts to ensure integration and transformation with other fields of work continue under the leadership of globally renowned firms.
The supply chain is in the forefront among many activities to be transformed by Blockchain. The use of Internet-of-Things (IoT) applications tends to affect supply chain management (SCM). Thanks to the Internet of Things (IoT), radio frequency identification (RFID) tags, sensors, barcodes, GPS tags and chips, the location of products, packages and shipping containers is traceable at every step. This technology enables advanced, real-time tracking of products from their initial output. [5]
To use Blockchain Technology, facilitates the effective and hence effective measurement of revenue and performance through the supply chain processes that play a key role. When the input tracking data is processed in the registry of a blockchain, they cannot be modified. Other suppliers in the chain can track shipments, deliveries and progress. In this way, the trust between the suppliers is established through the block chain. By eliminating intermediaries, efficiency can be increased and costs can be reduced. Individual suppliers can perform their own checks and balances in real time [6].
New technologies offer promising opportunities for improvement across the supply chain. The use of a block chain in the supply chain has the potential to improve the transparency and traceability of the supply chain and reduce administrative costs [9]

Measurement of supply chain management performance is usually defined fort he sake of followings:

- Cost
- Speed
- Reliability
- Risk reduction
- Sustainability
- Flexibility [7].

All these performance metrics provide significant benefits in the qualitative transformations of the processes of the above-mentioned supply chain management processes..

2.1. Case studies of Supply Chain Processes

System interaction and transformation of Blockchain and supply chain management processes will be explained with the observed case studies. At the end of the relevant sampling, the correlation between the supply chain performance measures and the supply chain processes will be scheduled.

2.1.1 Blockchain Application at Maersk & IBM

The Danish freight forwarder, Maersk, is the world's largest container carrier, accounting for 18% to 20% of the market [10] Maersk is a high profile example of a company that successfully tests block chain applications in international logistics. Maersk uses this method for the GPS positions, temperatures and other data of the containers it transports all over the world.
Maersk has been looking for a better solution for tracking the speed of the loading and unloading operations, as well as the tracking of ships and hence transported containers.

In 2014, they began to evaluate the situation with the delivery of fresh fruits and roses from East Africa to Europe. [11] Containers were loaded to the ship in a very short period of time, but the documents needed to move the ship were exposed to waiting days. For this designated container, close to 30 people, such as customs, tax officials and health checkers, have been requested and approved. [10]
In this process, the products in the container could be damaged. Transport fee up to customs and so on. document costs were incurred. Fraud is a common situation in the global supply chain system. In this process, tricks on the container billets can be made illegally copied and criminal objects can be placed in the container.
IBM and Maersk, in September 2016, created a concept (POC) document following a flower-loaded container from Kenya's Mombasa port to the Netherlands / Rotterdam. The cost of shipping in the POC was $ 2,000 and the

documentation was calculated as approximately $ 300 (15% of the cargo value) [10] and the POC was considered a success. Maersk and IBM followed the system to track Anans loaded containers from Colombia and mandarin oranges from California [12].

Then in February 2017, a pilot project started with Schneider Electric's empty containers in France Lyon. Then the factory was filled with empty container goods and sent to Rotterdam. In Rotterdam, the container was loaded onto a Maersk Line ship and moved to Newark Harbor in the USA. The number of agencies involved in the pilot is an idea of the complexity of international transport. Institutions include the Dutch Customs Administration, the US Department of Internal Security Science and Technology, and the US Customs and Border Protection. [10]

Figure 2: Shipping Flow

Source: Maersk Application, web saite.

Shipping Information Line
It provides end-to-end supply chain visibility of all actors involved in global shipping in order to change ship events in real time in a safe and seamless way.

Paperless Trade
It digitizes and automates document filing for the import and export of goods by ensuring end-users secure, documented and stamped documents across national and organizational boundaries.

Currently, IBM and Maersk have announced that they launched a joint venture in January 2018 with the use of block chain technology to launch more efficient and safe methods for carrying out global trade.

2.1.2 Modum Case

The Swiss entrepreneurship firm Modum collaborated with the University of Zurich to design a system for the safe distribution of pharmacochemical drugs. To ensure availability, most drugs should be transported under full temperature, humidity and light conditions. The sensors associated with the mode continuously measure these conditions on the drugs being transported. In the current system, cargoes include multiple handling and many paperwork, which can also be changed. [13]

In the EU, with a recent regulatory change known as the Good Delivery Practice for Medicinal Products for Human Use (GDP 2013 / C 343/01), companies must report any deviations in temperature or other conditions in the affected recipients as well as in the dispensers. Today, the only way to comply with the new regulations is to use Refrigerated Trucks, which is an important part of the cold chain distribution. These trucks are usually four to eight times more expensive than normal logistics services. However, 60% of the 200 million-year shipment in the EU does not include temperature-sensitive products. In this case, $ 3 billion a year is spent for unnecessary cooling [14].

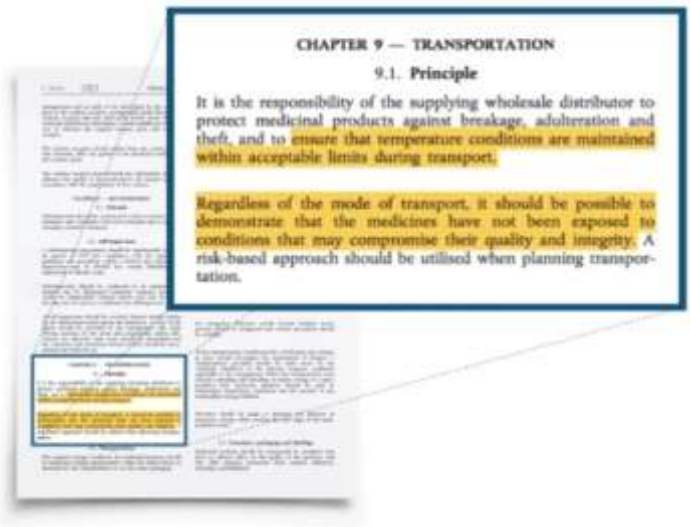

Figure 3: The Documents of the Transportation Principles for Medicine

Source: European Commission For The Best Practice (GDP 2013 / C 343/01)

As reported, the drugs have three temperature categories that need to be stored: cold (-20 ° C), cool (2 ° - ° C) and room temperature (15 ° ilaç25 ° C). My mode is focused on the transportation of the so-called room temperature. Medical supplies that do not require cooling are monitored by a Modum sensor to monitor the temperatures of the drugs. This means that the cold chain truck is not necessary. When the drug reaches the target, the data is transferred to the Ethereum block chain. [14]
Compares the smart contract with the legal requirements. If all the necessary conditions are met, the product is put on the market. If the temperature and other monitored conditions deviate significantly from the legal requirements, a deviation is reported to the sender and the receiver. Modum first pilot project was held in June 2016 [14]

2.1.3 Intel's Marine Supply Chain Tracking Application

In April 2017, Intel released a public demo explaining how the marine supply chain could be monitored using the open source Sawtooth code base. In order to ensure that all subsidiaries comply with food storage requirements, the ürün Ocean to Table du project aims to increase the accuracy and accuracy of marine traceability. [15]
The data of four trading transactions started to be tracked via https://provenance.sawtooth.me/# . In this process, IoT telemetric information and temperature information of the portion of the sea products to the marketer were related to the system. [15]
Like marine products in this case, IoT sensors can be added to telemetry parameters such as location, temperature, humidity, regional motion, product shock, etc., for monitoring of any nutrients delivered to another person for supply. The end-user can access a complete record of information so that the system can ensure that the information is accurate and complete.

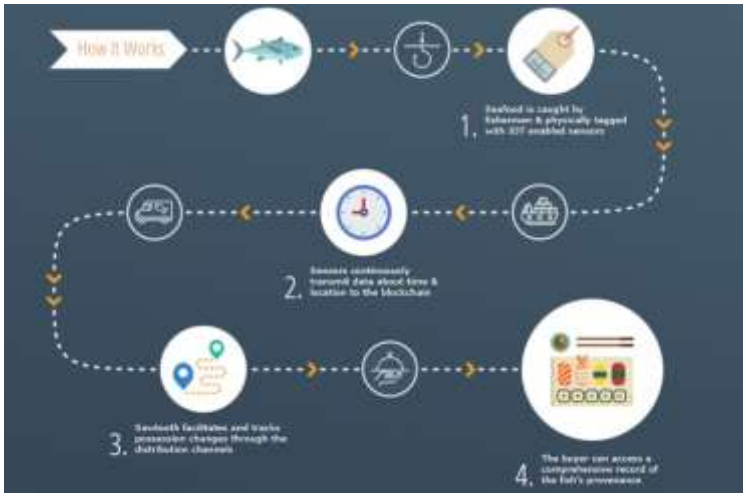

Figure 4: Intel's Marine Supply Chain Transaction

2.2. Roles of Blockchain in Reaching Various Strategic Supply Chain Goals

In supply chain management, there are several mechanisms to reduce costs in block chain applications. However, the transport / courier system carrying documents such as classical paper-based processes and air courier costs can be left out of the chain.[5] As a result of paper-free studies and related special digital contracts, the speed within the system is higher than the traditional supply chain.

As in the case of Maersk, Blockchain shows that all documents for shipping containers can be fully digitized and containers can be traced. The Modum example clearly shows us that it is possible to allocate the right amount of resources in order to perform shipping and other activities in the blockchain. [5]

In Intel's work on seafood, transparency reveals confidence across the supply chain. Automation in the chain saves time and operating costs. As a result, sellers and consumers know what they buy and what they pay for.

Another important issue in the applications of block chain is to verify sustainability. As a remarkable development, consumers are increasingly concerned about the source of food and beverages. Blockchain can relieve consumers' concerns about the source of food and beverages by making indicators of sustainability more measurable and more meaningful. [5]

Finally, using the block chain, a higher degree of flexibility can be achieved in the supply chain. Flexibility can be defined as the ability of the supply chain to varying competition for timely and cost-effective supply of products and services. [16]

3. Conclusion

It is observed that the cases of Blockchain Technology are important applications in the new period and era. This technology, which is pioneered by the financial sector, has already been able to move into practice in very few areas. The practices carried out in successful areas in the finance sector have been a light of hope for other sectors.

A supply chain management has been defined as a process that lasts up to the end user in the use of raw materials in nature. In this process, it is seen that some logistic groups adopt the blockchain logic as a different network. Cost, traceability, and in particular safety factors make it possible to increase blockchain utilization across the sector. As can be seen from the examples given, it has been observed that the basic principles of block chain logistics will be used not only in transporting institutions but also in all stages of agriculture industry and service sector.

In order to avoid the competitive advantage of the new generation of technologies and competition, the advantages of blockchain technology are worth not to be kept waiting. In this respect, it is necessary to measure the efficiency and effectiveness of the service sector in the establishment of blockchain applications, how to use human resources, and how to manage trained operators with regard to blockchain

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