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Mobile Blockchain in Digital Supply Chain

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***Abstract*—Mobile device users are estimated to reach 4 billion in 2018 and 6 billions users in 2023. These mobile devices have changed how individuals and organizations carry out their activities. Increasing smartphone efficiency is changing how companies collaborate with their suppliers and distributors. Blockchain technology, which was first created for Bitcoin, is generating disruption in other industries. Even if the long-term forecasts for Bitcoin and the economy remain uncertain, it is increasingly evident that Blockchain technology can cause enormous disruption. However, because it poses a threat to the existing order of the modern world's prominent organizations, institutions, and power structures, its potential may never be fully realized. This article will introduce you to Blockchain technology and its potential use in the logistics and supply chain. If maintained on the Blockchain, data about supply chains and logistics can be sent across the network in a reliable, secure, and auditable manner. In some supply chain implementations, Blockchain is being replaced by distributed ledger technology, which offers several benefits. This article discusses the possible use of blockchain technology and mobile devices in the supply chain and logistics industry**

Keywords— Blockchain, Distributed Ledger, Mobile Device, Supply Chain, and Digital Supply Chain

I. INTRODUCTION

Ecommerce business owners must prioritize mobile marketing as mobile commerce grows. Let's examine the newest mobile user data to determine how many individuals have smartphones. Smartphone users are rising annually. Smartphone users will reach 6.6 billion in 2022, a 4.9 percent annual rise. It is also 2.9 billion, or 79%, more smartphone users than in 2016, six years earlier. From 2016 to 2022, global smartphone users expanded by 10.4% year, with the highest rise in 2017. Smartphone users increased 20.9 percent that year. Most mobile phones are smartphones. Smartphones make up 76.9% of mobile devices, according to recent figures.

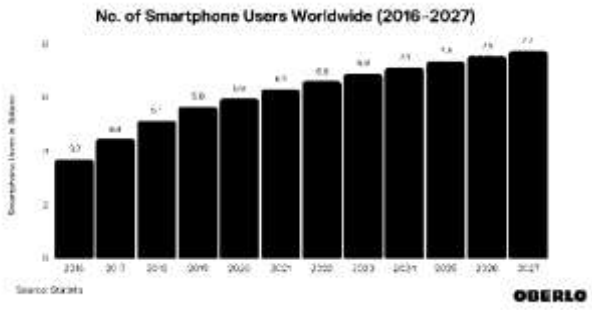


Figure. 1. Mobile/Smartphone Users Prediction Worldwide. Source [1]

Smartphone users are expected to reach 6.8 billion by 2023. With a projected worldwide population of slightly over eight billion by 2023, smartphone penetration will be 85 percent. Thus, over eight in ten people will have smartphones [2].

Digitalization is involved in almost all aspects of any organization [3], and SCM is no exception. Industrial internet is enabling the manufacturing to become much smarter and more agile. Augmented Reality means increase labor productivity and in transportation and logistics improvement invisibility along with emerging new service models including drones. Tomorrows leaders know that to capitalize on this wealth of data, their supply chains need to become digital, smart, and connected. The real question is how fast and efficiently the supply chain is adapting to the era of digitalization, hyper connection and personalized products

available anywhere, anytime. The term "digital supply chain" is a relatively new concept that was first introduced in the industrial world and getting its popularity in the academic area every passing month [4].

Blockchain is Bitcoin's most significant technological contribution. Even if the future of Bitcoin and a significant section of the economy is undetermined, it is apparent that the Blockchain can improve several economic aspects. Even if the concept of Blockchain is developing, this is the case. Given that it is a disruptive technology capable of bringing down many of the modern world's large hierarchical organizations, institutions, and power systems, its potential may not be used entirely[5]. Logistics and supply chain operations may benefit from blockchain technology. Various technologies, like radio frequency identification (RFID), telematics, barcodes, two-dimensional codes, sensors, and the Internet of Things (IoT), are used to track items as they move through the supply chain [6] .

Until recently, the data were only available within an institution (such as a company) or to a restricted number of trusted partners; thus, their full potential was not noticeable. This is because the data was only recently accessible. Each participant in the supply chain maintains their information system. However, these information systems connect only seldom [7]. A lack of trust in one another when transferring information has been the key barrier. Blockchain technology allows sharing of information regarding logistics and supply chains across supplier networks to be safe, secure, and verifiable. As a result of these capabilities and the development of Blockchain, supply chain applications are becoming increasingly efficient. The supply chain management sector thinks that global pilot projects would provide benefits.

Its qualities, current usage, and future goals have been provided so that academics and businesses may apply them efficiently in their digital supply chain operations. The Blockchain: What is Its Purpose? What parts of the supply chain utilize Blockchain, and what are the most significant benefits of this technology? How many supply chain apps have been developed utilizing blockchain technology?.

II. LITERATURE REVIEW

A. What is Blockchain Technology?

At its most basic, you can think of blockchain technology as a decentralized database. It is a distributed system of recording information that cannot be hacked, changed or tampered with. Blockchain technology removes the need for a central supervising authority, or server, as it is essentially a digital ledger of transactions distributed across a network of computer systems [8].

Before a new block of data is added to the chain, all the independent network nodes participate equally in a verification process that ultimately guarantees the data's integrity and security . The technology basically imposes transparency, as every single transaction or data interaction is automatically visible to everyone on the blockchain network and attached with a timestamp.
Wondering how this technology can help developers make better mobile apps? Let's proceed with a showcase of the key benefits of blockchain technology for mobile app development.

B. Theorizing about how Blockchain could affect SCM

Theorization of the logistics discipline can benefit from borrowing theories from other areas [9], and builds upon the theoretical framework initially suggested by [10][11], which compares and combines four popular theories that are widely used in social science and economic research. [12], supply chain management "actively (and collectively) manages supply chain operations and relationships to maximize customer value and generate a sustainable competitive advantage."

Essential supply chain functions include creation, procurement, production, shipping, demand management, coordination, and final assembly. Logistics is the most crucial component of supply chain management [9].
Positive economics considers all institutions involved in distributing commodities and services as networks. These networks have several supply network members and connections. Therefore, "supply networks" (also known as "supply chain networks" or "distribution networks") is a better term for more complex temporal structures that emphasize the number, position, nature of relationships, activities, business goals, capacity, information services, and technology base of its participants [13]. "supply networks" focus on the activities, aims, information services, and technology underpinning of its members. Figure 2. demonstrates industrial dispersion.

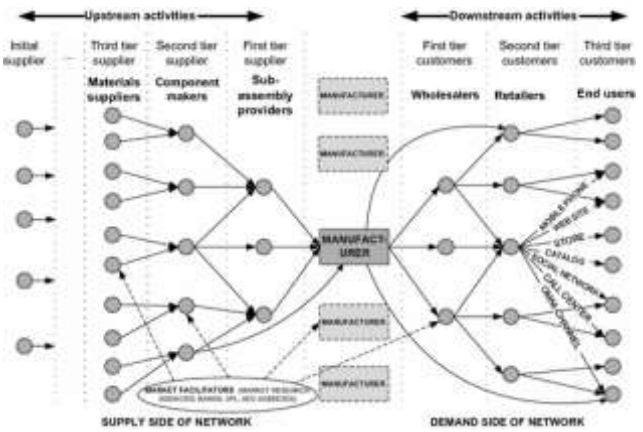


Figure 2. Supply network around manufacturer.
Source Revised according to [12]

The supply and demand networks of manufacturers (or distributive networks). The supply side consists of the direct and indirect suppliers of firm. Demand refers to every supply chain member participating in product delivery [14].

The demand and supply tiers illustrate the supply chain stages. The location of the supplier network influences the supply and demand tiers. The network's supply side handles upstream operations, and the demand side handles downstream operations [15]. They facilitate the movement of goods, information, services, money, expertise, and energy within the supply network.
Figure 1 illustrates how retailers and other members interact with consumers. Numerous retailers presently sell via

multiple or all channels. Channel commerce offers a consistent, user-friendly consumer experience across all distribution channels (tablets, smartphones, social networks, kiosks, storefronts, catalogs, contact centers, etc.) [16]. Customers desire to buy any goods, at any time, from any location, and via several channels simultaneously. They want to buy items via many channels simultaneously (e.g., examining the offer on a personal computer, trying out at a store, paying over a mobile device to avoid waiting in line at the cash desk, assessing the shopping experience through social networks after the goods were delivered home) [17]. The requirements of customers have not changed, but ICT may reconfigure the supply chain to accommodate them. The supplier network provides visibility and traceability to customers. Customers desire exact product origin and distribution chain details from businesses. There are multiple definitions exist in the industrial world for the DSC concept. In our view, DSC can be defined as follows [4]:. "An intelligent best-fit technological system that is based on the capability of massive data disposal".

C. Combining Blockchain with Mobile Technology

Blockchain technology was first well-known as a way to make sure that all cryptocurrencies worked well. Now, it is seen as a database that can be used by almost any mobile app [18]. The blockchain is a decentralized ledger that keeps track of transactions between different parties and shares that information with everyone who has a stake in the system. This makes the system very clear and improves app security because fraudulent transactions can't be made and transactions can't be changed without the stakeholders knowing.

This technology can be used to connect many different areas. Blockchain protocols not only make it easier to do digital transactions by giving us new ways to do them, but they also work well with peer-to-peer transactions in mobile apps [19]. So, blockchain makes it possible to keep permanent records of any kind of transaction, based on what the mobile app needs.

Existing business models can be greatly changed by blockchain applications that offer instant solutions at lower costs. By using new methods, the blockchain protocols can make digital transactions in business processes easier to use. Blockchain can automate the processes that used to be done by hand and took a lot of time.

Even if cryptocurrencies lose the race, blockchain will be around for a long time because it is based on strong encryption. This technology will stay popular in the coming years because it is supported by many large financial institutions, real estate groups, healthcare organizations, and other industries that need to track transactions securely.

III. RESEARCH METHIDOLOGY

Research Design will drives IT artifact development and practice in this research [20]. Iteratively designing and evaluating IT artifacts should be relevant to the subject of interest and founded on the preceding knowledge base. We used knowledge of blockchain technology, best practices of real-world blockchain implementations, and blockchain-related IT documents to establish a framework for evaluating blockchain implementations. We used DSR approach for information systems research [20] to improve our artifact: issue identification, objective definition, design and development, demonstration, assessment, and communication (Figure 3).

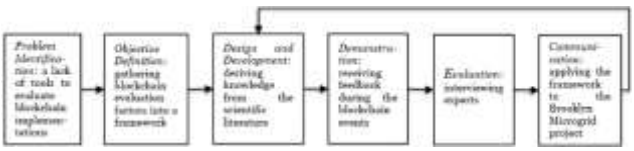


Figure 3. Methodology of Developing a Framework for Mobile Blockchain Implementations.
Adopted from [20]

This method described the duration and approach to the blockchain solution design and implementation depend on the specifics and scale of operations the solution should cover. Below are described typical steps take to implement a blockchain.

Problem Identification. The blockchain area is early in development and lacks tools to evaluate blockchain implementations. Thus, many blockchain implementations fail [19].

Objective Definition. We casually questioned experts whether our framework may be useful. To develop solution goals, the writers often visited blockchain events.

Design/Development. Using data, we iterated our solution. Data Collection. "blockchain," "distributed ledger," "framework," "taxonomy," and "topology". We found 51 papers from conferences and academic journals about how blockchains are used.

Demonstration. We presented the framework at scientific conferences, consortiums, and other blockchain-friendly events.

Evaluation. Because our findings include several blockchain topics, we sought specialists in computer science, finance, and social sciences. Face-to-face, Skype, and phone interviews averaged 74 minutes. Interviewees averaged eight years of employment and three blockchain projects. Interview guide utilized. After discussing blockchain implementation assessment elements with interviewees, we demonstrated the first iterations of the framework. The interviewees discussed the suggested blockchain assessment parameters and their interconnectedness using the framework. Interviews and fresh literature informed our framework revision. Thus, we called or emailed the same experts for comments on the latest versions. All experts gave comments.

Communication. We demonstrated the framework's applicability on a random blockchain implementation to the knowledge base. Randomization provides a framework abstraction that should assess any blockchain implementation.

A. Research Model

Figure 4. describes how to make mobile blockchain application based on the conditions of the user, also in this figures describes how ICT may enhance supply chains management involves several approaches by typically gather, analyze, integrate, and disseminate data.

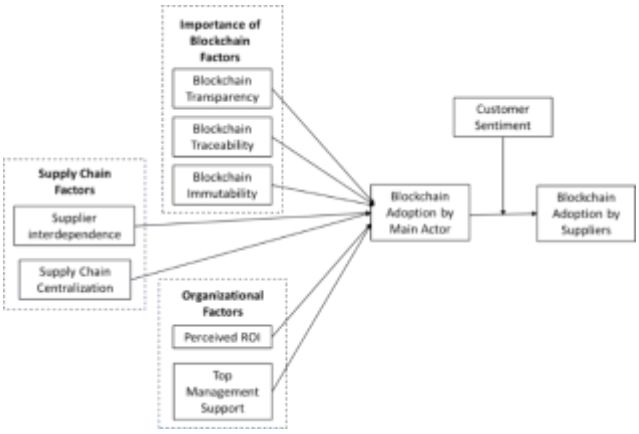


Figure. 4. Research Design

B. Digital Integration in Supply Chain

Blockchain is expected to accelerate the dynamics of industry 4.0 and encourage the application of secure digital technology for all forms of data. In a supply chain system, for example, transactions and the identity of goods sent by suppliers to manufacturers will be recorded in a block.

Here are some examples of using blockchain:

1. Community Services record the population's identity, process demographic data for the population census, and monitor transportation conditions and the community's track record in driving vehicles [21].

2. Live Science and Healthcare record patient data (including types of treatment and drugs consumed), which can be forwarded to doctors and hospitals, and social institutions (according to patient permission) to monitor the patient's condition in real-time [22]. Then the patient data population (whose name is withheld) can be processed by the company or health institution to determine the community's character and the disease they are suffering from.

3. Manufacturing and automotive, monitoring and recording the use of spare parts, how long/far the vehicle has been used, what maintenance has been done and what maintenance has been missed, and vehicle usage behavior. The benefit is to monitor the life cycle of a vehicle [23].

4. Energy efficiency, i.e., a machine or equipment is no longer in use; the machine will automatically stop and record and monitor its energy consumption [24] .
   In global trade, the role of blockchain is increasingly fundamental when all parties can transact securely; there is no fraud and tax evasion because all information, including prices and costs, is recorded since the first product was produced [25].

5. According to the World Trade Organization (WTO) in 2018, blockchain can reduce various barriers and increase efficiency in the world trade supply chain process, increase world GDP by 5% and increase world trade volume by 15% [26].

In addition to efficiency, all parties involved in the supply chain can build trust in trading because the data is valid and avoid manipulation.

IV. RESULT

A. System Design

Figure 5 shows how data including the original data source, batch numbers, manufacturing and processing data, expiry dates, storage temperatures, and shipping details are digitally connected to actual products as they transit from source to destination. Figure 5 shows that smart contract-executed product may be tracked. Data in a new block is permanent on the blockchain. Farms, transport firms, packaging companies, warehouses, and retailers build a consensus on transaction data. Each verified block is added to a chain of transactions, creating a permanent record of the process. The computerized record verifies each product received at the shop and helps merchants control product shelf life in individual locations.

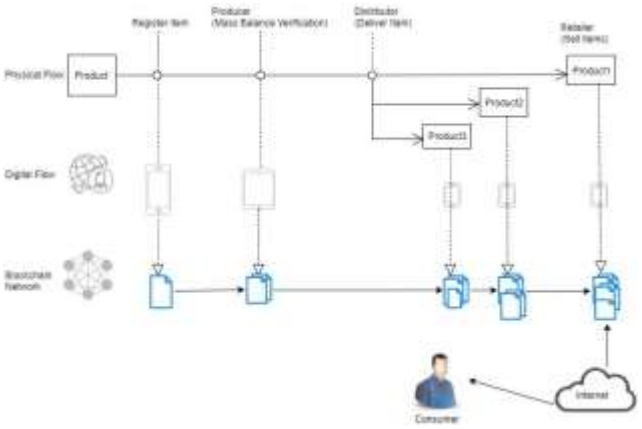


Figure 5. Mobile Blockchain Smart-Contract Architechture.
Source. Authors

Due to the fast rise of internet technology, several new traceability solutions have been implemented in supply chains. Blockchain technology can improve product traceability, but it won't fix everything. Leveraging it does not guarantee accurate data entry. Humans may enter data depending on automation. The immutable ledger records data corrections.

B. System Components

System support involves numerous related components. The system model is briefly described as follows:

- Blockchain. Virtual Machines operate the network (VM). The blockchain requires a network of associated parties and miners to verify transactions [27].
- Contract. Smart contracts never experience outage, fraud, censorship, or intermediary meddling [28]. Ether is required to install smart contracts (Fig. 6) or perform operations.
- Peer-Discovery. Transactions need network nodes to connect. Bootstrap nodes keep a list of all network nodes in the node discovery protocol [29].
- Server. It connects blockchain users to front-end users.
- Database. Each participant maintains, calculates, and updates new entries into a blockchain database.
- The nodes work together to reach the same conclusions, giving built-in security.
- Device. Users utilize gadgets to engage with, check data status, and more.

```
contract Trace{
        struct trace {
            bool consumed;
            bool used;
            bool created;
            uint id;
            uint producedBy;
            uint consumedBy;
        }
        struct activity{
            bool created;
            string name;
            uint id;
        }
        mapping(uint => trace) lookup;
        mapping(uint => activity) activityLookup;

        uint orders;
        function trace(){

            orders = 0;
        }
        event ActivityCreated(uint orders, uint activityId, string description,
            uint consumedtraceId, uint producetraceId);
        event traceCreated(uint orders, uint traceId);
}
```

Figure 6. Smart Contract Sourcecode

Algorithm 1: AddUser
Input: addNewUser
Output: bool
1 if msg.sender not the owner of the contract then throw;
end
else
2 if addNewUser exist then
3 return false;
else
authorizeUsers[addNewUser] = true;
4 return false;
5 End

Algorithm 2: CreateItem
Input: item[Id], producedBy[id], consumedBy[id], productDescription, enum ItemNames, timestamp(date)
Output: Added items with timestamp captured
1 if msg.sender not the owner of the contract then
throw;
else
2 mapping CreateItem to (id) and add it to Index
variable collection of data
return true;

The contract consists of three functions, Adduser (Algorithm 1), createItem (Algorithm2), and searchItem (Aglorithm 3).

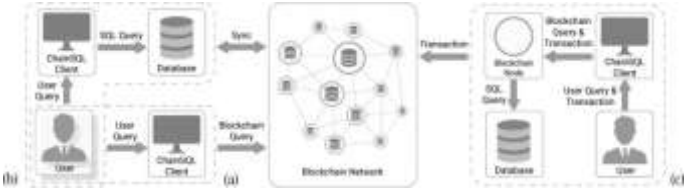
- Contract owners can only use AddUser. His account address will authenticate users when they use the contract function.
- CreateItem: Only contract owners may add things mentioned in the algorithm, such as products. The first parameter is to verify the owner address if it exists, reject if not, and the final argument is to add data to the blockchain utilizing mapping to seek for a particular item and obtain relevant information.

Algorithm 3: SearchItem
Input: itemId
Output: searchResult
if msg.sender not the owner of the contract then
throw;
else
1 searchResult ⇐ Index[itemId] ;
2 get Index[itemId] array's length len;
for uint i=0; i¡ itemId; i++ do
return itemId;
3 return searchResult;

- SearchItem searches stored things. The first parameter confirmed user validity address, looped all records using Ids produced in the second method, and returned the searched results.

This paper also represents the start of a decentralized supply chain system linked to mobile devices. The suggested method lets users know a product's origins by distributing data updates to the network. The network's digital ownership provides consumers confidence to trust producers' digital goods.
Decentralized supply chains need database architecture. CHAINSQL [30] is an open-source blockchain-database system. It provides tamper-resistant consistent multi-active databases.

ChainSQL is the first system to combine blockchain tamper-resistance and distributed database query speed. ChainSQL's business usecases in finance and supply chain demonstrate its value, suggesting intriguing future applications. System implementation considerations are also underway. ChainSQL supports large data analytics and complicated indexes for query optimization.



Fig, 7. ChainSQL Access Mechanism. Source. [30]

The use of blockchain technology in logistics and supply chains or networks (Fig. 8) is advantageous for the following two reasons:

1. Information may be shared in real-time in a secure, verifiable, and dependable manner using blockchain technology. As a result, they are made available to all supply network participants (depending on the Blockchain),

2. Smart contracts are computer programs that function on the Blockchain, allowing transactions to be automatically verified and performed when specific conditions are met.

Supply chain management and logistics are developing as a result of the key benefits offered by blockchain technology. Tracking where products come from and how they move through the supply network, predicting demand, reducing the risk of counterfeiting and fraud, providing everyone with open access to information about supply chains, reducing the impact on the environment, and automating transactions with smart contracts are some of the most important applications of blockchain technology in logistics and supply chain management. In supply chain management, blockchain technology is frequently employed to reduce the likelihood of fraud, track where items originate and depart from, and predict client demand.

C. Traceability and Visibility Enhancement

Mobile Blockchain and RFID are frequently used to trace a product's origin and supply chain. Traceability and visibility are prerequisites for any excellent logistics services. If a company can tell consumers where, who, how, and where a product was created, it has an advantage over its competitors. Traceability decreases the likelihood of food poisoning, disease, and other forms of contamination. All supply network members have access to the same data on activity and product placement [31].

Only members of the supply grid can authenticate this information, which is trustworthy and safe. IBM and other significant firms embrace blockchain technology. Cargill, an American agribusiness, is researching how it can let customers trace their Thanksgiving turkey. By scanning a QR code or RFID tag on the primary package, consumers may have access to the product's vital information on its origin, processing, temperature, and quality

D. Improved Demand and Forecasting

Successful supply chain management needs coordination and integration of demand management. Demand management helps stakeholders in the supply chain to forecast and plan for demand. It modifies supply and demand to maximize supply chain profits. Demand management coordinates activities to forecast demand, modify demand, and produce supply [32][33]. Typically, demand management entails forecasting, planning, and influencing demand and supply.

Blockchain's security and transparency provide long-term data transfer for demand management in supply networks. If supply chains cannot connect, competitors may obtain access to critical information or alter the content. Demand is estimated by supply chain players based on client orders. These are referred to as "derived requirements" since they demand substantial safety inventory upstream in the supply chain.

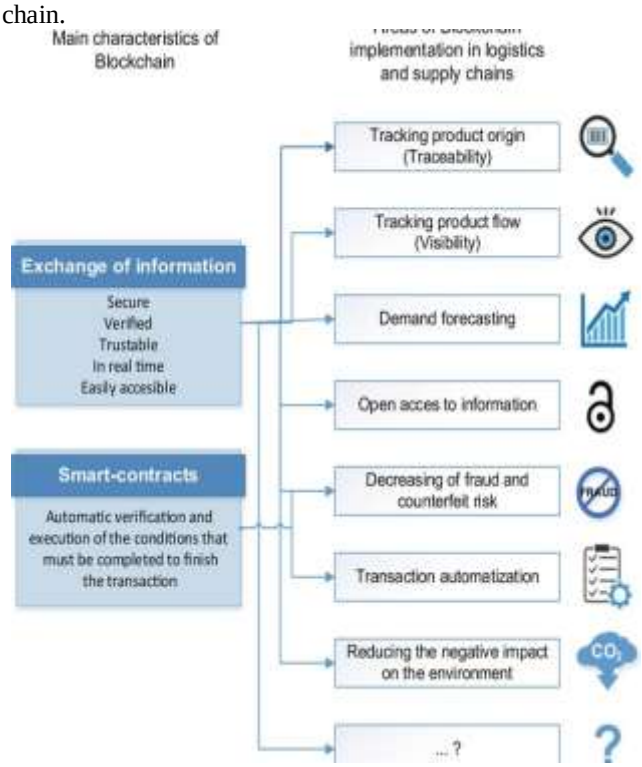


Figure 8. Blockchain Technology Implementation on Digital Supply Chain. Source. Authors

This causes the supply chain to have excess inventory, which raises costs, impedes commodity movement, and necessitates ineffective management. Collaborative demand management prevents whiplash effects and optimizes supply chain inventory levels. Each supply chain link—often two or three connected members operating at various levels—must produce a single demand estimate based on client preferences. The only independent demand of supply chains is the consumer's product demand time and place [34]). Only the final consumer, whether B2B or retail, produces actual product demand. Participants upstream should base their demand on this independent demand to prevent safety stockpiles at each echelon. This method of forecasting demand needs supply chain participants to communicate their requirements. The absence of trust in modern supply networks is the greatest obstacle to knowledge exchange. As the most secure technology (since2008 Bitcoin's Blockchain has never "crashed," "froze," or been hacked), Blockchain efficiently resolves supply network coordination and integration issues. The Blockchain has the most significant computing capacity. You may save money if the independent demand data is accurate, current, and not shared with your rivals. If the Blockchain approves, stakeholders in the supply chain may access independent demand data (no one else may remove or edit records). The distributed ledger technology blockchain [33] promotes global transparency and trust. Blockchain alters the nature of trust. The entire system trusts this network. [35]. Since

everyone can verify the chain, they may utilize the identical database without trusting one another. Since they lack confidence, supply networks may facilitate information and commerce. Even this new concept of trust is not accepted. The development of organizational and association trustworthiness approaches [36].Consumers may join the supply chain by installing an app based on the Blockchain. This gives clients the ability to manage their orders. Customer input in real-time may improve projections and retail and industrial operations.

E. Open Access

The data on a blockchain may be viewed by anybody or only a select few members of the distributed ledger. Open communication within the supply chain may save paperwork, avoid direct touch, and educate customers and consumers. Open access streamlines supply and logistics networks. Maersk and IBM have collaborated on digital methods to enhance container management and international trade [6]. Since June 2016, they have collaborated with Microsoft, DuPont, Dow Chemical, Tetra Pak, Port Houston, Rotterdam Port Community System Portbase, and others to deliver container shipping data on Blockchain [37]. Insurance companies, banks, and supply chain partners decrease the costs of goods-travel insurance. In January 2018, they announced their intention to develop an open blockchain-based global trade digitization platform [44] with a secure repository and safe transactions for the global shipping industry. Maersk was expected to bring Kenya-Rotterdam flowers. Two hundred related business transactions resulted in waste, wasted flowers, and inaccuracy. They study shipments from California and Columbia. Expenses for shipping containers and paperwork may be equivalent [38]]. Integrating all supply chain stakeholders into the blockchain application and building a digital document pipeline made all documents and activity public to all parties.

They also indicated who made or transferred the products, where, and when they were manufactured or transferred. This expedites the transmission of information and products along the supply chain, reduces local and international direct interaction, eliminates errors, delays, and other waste, and eliminates waste. Spreading information avoids fraud and delays. With accurate and real-time cargo location data, ports, terminals, ocean carriers, and intermodal transportation might help better plan, organize, and monitor the supply chain. Marine Transport International believes Blockchain technology might save $300 in labor and administration costs each trip [22]. Annually, seventy million freight containers are shipped [35]. By 2017, IBM and Maersk expected to collect data from 10 million shipping containers. Blockchain technology might streamline container transportation and port links [39] . Rotterdam and Antwerp, the two largest ports in Europe, are optimistic about Blockchain [38]. Several modes of transportation will employ Blockchain to transmit fleet management data via telematics securely.

Supply chain innovations in British Columbia may aid businesses and individuals in reducing their environmental effects. Lifecycle data may facilitate the recycling, (re)manufacturing, and leasing of existing products, while open access and fewer online interactions and transactions minimize paper documentation [26]. Lastly, businesses that positively impact the environment may be rewarded or penalized for their carbon dioxide emissions. Enhanced understanding or more significant carbon fees might accomplish this. Buyers may have more faith in the item if a product's data is public and verifiable via Blockchain.

F. Complete Data Transparency

End-to-End Supply Chain Enabled by Blockchain. Illustration Of Dry Aged Beef in Figure 9, The supply chain for dry-aged beef exemplifies Blockchain's potential "End-to-End Blockchain-Enabled Supply Chain". To address consumers' increasing demand for local, organic, and traceable commodities, retailers may supply product information via an app. Customers may compare the beef's supply chain journey to their expectations by scanning a QR code with their smartphone. The blockchain database contains historical and real-time data on the beef product, including origin (feed or breeding), timing (age length, transit time, best-before date), location (farm and beef across the supply chain), and extra information (recipes and wine suggestions). Offering recipes and wine recommendations can help retailers increase sales [40].

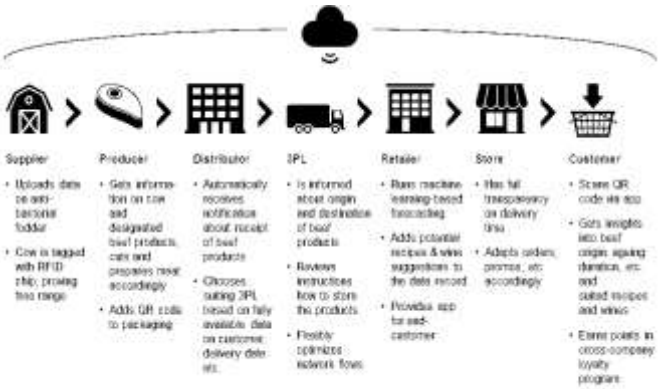


Figure. 9. Examples End-to-End Supply Chain Enabled by Blockchain. Source [40]

Blockchain can be applied in supply networks outside of retail. Spare-parts data may be stored on a blockchain during their entire lifecycle, including remanufacturing. Logistics use cases include entirely digital freight documentation, digital verification of goods ownership, and automated customs clearance. In develop blockchain mobile applications, for monitoring and administration, including customs, to increase transparency, idle time, and cost.

G. Blockchain is the backbone of the digitalization of the supply chain.

Blockchain is the foundation of digital supply chains, providing advantages over conventional IT

infrastructure and analytics. Several parties may be connected to a blockchain without experiencing data loss. Blockchain is autonomous from adjacent and legacy systems, allowing for rapid implementation. Data in a block is immutable, and distributed storage prevents cyberattacks. Every participant in the chain has access to all information. Players can safeguard company data by defining access permissions. Retailers may restrict consumer access to beef product data rather than data from upstream in the supply chain. Predictions based on machine learning rely on massive, dependable data. A shared database reduces administrative costs and increases productivity.

H. Critical Success Factors for Integration

Integration of Blockchain into supply chains in three phases has the highest probability of success (see "Phase Integration of Blockchain into Supply Chains"). Start with an internal blockchain to familiarize yourself with the technology and assure data integrity and accessibility. Connect logistics providers and direct suppliers to the Blockchain for data sharing. Add all supply chain actors, including customers, to the distributed ledger. Blockchain enhances user experience, efficiency, and value while reducing expenses.

I. Phase Integration Of Blockchain Into The Digital Supply Chain

Three-Step Method: a three-step approach to gradually integrate blockchain into supply chains is most likely to be successful “Stepwise Blockchain Integration into the Supply Chain”. To start, a company-internal blockchain should be set up, giving the organization time to get accustomed to the technology, while insuring data availability and consistency. Next, extend the blockchain to adjacent players, such as third-party logistics and direct suppliers, fostering data exchange. Finally, integrate all players along the supply chain, including the end customers, to the blockchain [40].

At its full potential, blockchain improves the customer experience, drives value end-to-end, and roots out inefficiencies, thereby lowering costs.

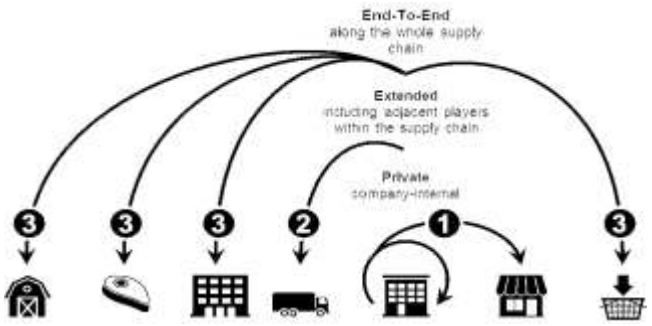


Figure. 10. Integration Phase. [40]

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V. DISCUSSION

For companies in building a digital supply chain using mobile devices:

A. Understand what digitization can and cannot do

Automating the process of procurement of goods, ordering, making invoices, and payments will be the company's first step in increasing the efficiency of the process, but not all processes can run automatically. The process of making invoices is not enough just to create electronic documents. To increase accuracy and reduce double-checking, companies need to combine automation with rules-based processes to ensure that e-invoices are validated.

B. Revolutionizing the process

The use of mobile devices in managing supply chains will make companies change their business processes to be more collaborative, fast and transparent. Supply chain management is not a process that is run in silos, but involves many parties both inside and outside the company. Therefore we need a common platform that connects various parties and the entire supply chain process. In addition, the platform must also provide collaboration media both for departments within the company or for third parties.

C. Utilizing Data

The use of digital media allows companies to be able to utilize stored data into useful information and assist in decision making. For example, a company can see the performance of its partners such as suppliers or distributors to determine whether to continue working with these parties or not. Another example is that companies can combine purchase data in real time as well as previous purchase data to predict the amount of inventory that must be purchased, so that the product will always be available.

D. Benefits of digital supply chain for companies:

Supply chain networks are becoming more connected, scalable and fast. Companies that change their traditional supply chain strategy to digital are able to improve customer relationships and also have better financial performance.

Improve decision making for each party in the supply chain network through pre-stored data.

Improve the company's ability to meet customer needs, with the ability to access demand data in real time, on time delivery at minimal costs, as well as a controlled procurement process.

VI. CONCLUSION

Leveraging disruptive technology and building a digital supply chain means removing the barriers that we have experienced in traditional supply chains and requiring us to focus on integrated services that can drive value in the company. From the implementation of the digital supply chain, we as people who run the business can better understand and monitor the supply chain flow from end to end, making it easier for us to make improvements that will affect our relationships with suppliers, distributors and customers. In the end, the digital supply chain also not only creates supply chain efficiency, but also creates a more resilient supply chain flow, especially when faced with a crisis.

Blockchain technology can drastically transform the information and financial flows that support material movements despite its limits and possible risks. It enhances exchanges based on trust in the supply chain, optimizing the material flow (by reducing costs and making consumers happy). The development of new consensus algorithms is crucial to the growth of the technology.

As well as typical of a decentralized system, the model reduces administrative costs and gets rid of the complicated administrative procedures. For future work, this design needs to be developed further as it is connected to IoT systems in order to improve the reliability of the supply chain system.

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