A Study of Blockchain and Iot for Improving Supply Chain Process

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ABSTRACT

When operating in today's highly competitive business market, the ultimate objective of every company is long-term survival. As can be observed nowadays, the majority of businesses are driven by the needs of their customers. They mostly rely on a mix of pull and push systems to complete their tasks. The supply chain is a crucial aspect of the operations of manufacturing organisations as well as other industries. Keeping this in mind, it is discovered that the supply chain is subjected to a large number of hazards. A number of issues confronting a conventional supply chain are discussed in this study. These include inventory theft, information theft, smuggling and piracy, and entrusting data to a third-party vendor. In order to protect both data and goods, there is a strong feeling of need for data protection and monitoring. In this article, we will describe the actions that must be taken in order to use Blockchain technology. This article will discuss how Blockchain, when used in conjunction with an IoT platform, can enable a real-time and secure supply chain in the future. The productivity, efficiency, and profitability of the supply chain may all be increased as a result of these efforts.

Keywords: Supply chain, Blockchain of Things (BIoT), Security, Blockchain, Internet of Things (IoT).

I. INTRODUCTION

As supply chains develop more powerful, incorporate a more noteworthy number of partners, and rely upon a more noteworthy number of outside counterparties, it is essential to comprehend how they work. With the ascent of blockchain innovation, it has turned into a plausible choice for unravelling the entirety of the information, reports, and correspondence communications that exist inside the production network organization. There will be a tremendous volume of information/data divided among various stages in a production network in any production network. The Internet of Things (IoT) and blockchain might be utilized in production network to oversee a lot of information while likewise guaranteeing its security. Security, efficiency, effectiveness, and productivity of the inventory network will be in every way upgraded because of this drive.

The Internet of Things (IoT) alludes to the reconciliation of connected gadgets with the end goal of information gathering and level headed independent direction. The shortfall of intrinsic defensive

instruments, then again, leaves the Internet of Things defenseless against security and protection gambles. With its Safety by Design highlight, blockchain may support the mitigation of significant security prerequisites in the Internet of Things. A significant number of the qualities of blockchain innovation [1], like unchanging nature, receptiveness, recognizability, information encryption, and hierarchical adaptability, might be utilized to tackle a portion of the compositional inadequacies of the Internet of Things. The Internet of Things (IoT) would make it achievable to screen the specialized condition of the hardware as well as the wellbeing and security of the representatives. It might likewise be utilized to impart additional directions to all gatherings engaged with the production network, as well as to increment perceivability while on the way.

Regardless of whether both blockchain innovation and Internet of Things arrangements are serious areas of strength for exceptionally, may benefit extraordinarily from the blend of these refined advancements, which is alluded to as Blockchain of Things (BIoT) [2]. The report consolidates the numerous security worries that the production network is stood up to with because of the enormous volumes of information and exceptionally tremendous intricacy. Data is frequently disconnected, challenging to recover, introduced incomprehensibly, or hard to assess, in addition to other things. Taking into account the possibility of encouraging development in any sector may threaten. The uplifting news, then again, is that even the most fundamental executions of blockchain innovation can possibly essentially expand creation, effectiveness, and productivity. This exploration delineates the consistent reconciliation of blockchain innovation with Internet of Things (IoT) into the conventional production network organization and makes sense of how different security difficulties might be tended to.

II. LITERATURE REVIEW

As indicated by Lei Xu and partners [3], the current endeavors of blockchain innovation are centered around transport information. The creators propose a connecting framework that takes utilization of another worldview for managing computerized personalities. The review uncovers significant marine transportation challenges that could bring about incorrect data being given. A computerized personality structure and a total plan are proposed based on the discoveries, and these structures and plans might be incorporated with marine production network the executives' frameworks that utilization Blockchain innovation to diminish the disjointedness of data. Furthermore, it recommends a framework that guides in the reconciliation of the physical and digital universes, as well as the counteraction of freight misfortunes and the decrease of the heap of really taking a look at freight.

As indicated by Vishal Naidu, et al. [4], a critical technique for the computerization and decentralization of production network the executives' exercises has been created. The recommended framework will change the entire production network tree into a framework in which every substance is viewed as a part of the framework. In contrast with current production network the executives' frameworks, the framework viable is more proficient and worthwhile to clients. They had the option to limit botch rates at different levels of the production network and improve client support on a major scale because of utilizing this technique, as indicated by the creators. It would consider an exhaustive retracement and crossing of the production network tree, which would help with the identification of inconsistencies across different tree levels. This framework guarantees that ongoing production network the executives' frameworks are a successful and cutthroat option for the frameworks being used today.

Among the production network issues tended to by Mitsuaki Nakasumi [5] are Double Marginalization and Information Asymmetry, among others. Blockchain-based answers for these and different issues are researched. This study looks at the meaning of laying out a successful production network in any case. As per the discoveries of the examination, information is one of the main instruments for makers in supply fastens to further develop it. It is expressed in the paper that, because of the tremendous measure of information created and traded that is expected for the creation exercises, it is basic to distinguish the most significant information and focus just on the "essential exchange" that will bring about future changes at the production network level. The creator analysed motivating force gives that emerge with regards to extreme gamble irregular characteristics, for example, the risk of running out of limit. As a result of the lop-sidedness, the effect of limit risk is more serious for the decentralized production network than it is for the in an upward direction coordinated production network in the decentralized production network. To settle the issue of twofold underestimation, the creator proposes a blockchain-based answer for the issue examined here.

Lai Jieyu is a Chinese writer. In this paper, [6] researches and investigations the administration of the coordinated operations production network for cross-line web based business by means of the utilization of block chain innovation. Following a prologue to the "decentralization" of the blockchain and its essential significance, this article offers three novel utilizations of the blockchain in the space of coordinated operations, cash development, and data stream. The article shows that web-based business in China has taken critical steps as of late, especially across borders. It trusts that the execution of blockchain innovation will introduce another period of development for China's cross-line coordinated operations production network.

Chan Hyeok Lee and associates [7] talk about the block chain Internet of Things biological system. At the point when data is placed into the block chain, it is feasible for that data to be spilled by means of an interaction known as verification of work. The information may possibly be compromised by means of the utilization of a location search. Subsequently, the specialists used a procedure known as information no verification to protect their discoveries. In this review, the creators exhibit information security by means of the utilization of brilliant agreements and zero information verification. An outsider can modify or get the Internet of Things information that is kept in a blockchain. The brilliant meter is submitted in request to record the gadget's power utilization and result measurements. Brilliant meters are defenseless against security imperfections, which raises specific protection issues. As a result of brilliant agreements and zero information, the review guarantees that information might be kept more secure yet exchanges can in any case be finished effectively.

Mohamed Awwad and associates [6] feature how the utilization of blockchain innovation could work on the effectiveness of production network the executives. Blockchain is a decentralized, digitalized, and openly available report of all bitcoin exchanges that is kept up with by a disseminated organization of PCs. This might be utilized to neutralize the offer of fake items as well as to protect brand names. Industry areas like web-based business, food appropriation, and stockroom dissemination all need more straightforward and proficient stockpile chains. Because of the way that this innovation starts with the client's interest and finishes with the client's conveyance, it might further develop straightforwardness, risk decrease, adaptability, and speed, all of which benefit the purchaser. With regards to Internet of Things (IoT), the article covers the early reception

of block innovation, with specific spotlight on how much blockchain innovation has been utilized for the motivations behind approval, straightforwardness, and recognizability in different areas.
This exploration will analyze how customary production network activities might be protected by the organization of Internet of Things (IoT) and Blockchain innovation, which can additionally aid the goal of safety challenges in conventional stockpile chains.

III. SUPPLY CHAIN PROCESSES

The current endeavors of blockchain innovation, as indicated by Lei Xu and partners [3,] are centered around information move. Involving an original structure for overseeing computerized personalities, the creators propose a connecting framework that sounds carried out, really. The review uncovers significant marine transportation challenges that could bring about erroneous data being given. A computerized distinguishing proof structure and a total plan are proposed based on the discoveries, and these structures and plans might be incorporated with marine production network the executives' frameworks based on Blockchain innovation to diminish the disjointedness of data. Likewise included is a proposition for a framework that will support the reconciliation of the physical and virtual universes, the counteraction of freight misfortunes, as well as the decrease of the heap related with freight investigation.
A fundamental procedure for the computerization and decentralization of production network the executives' exercises is introduced by Vishal Naidu and associates [4]. By carrying out the recommended framework, the entire production network would be changed into a framework wherein every substance is a part of the framework. As a substitute for current production network the executives' frameworks, the recommended approach is both proficient and valuable. They had the option to cut botch rates at different levels of the production network and improve client support on a wide scale because of utilizing this innovation. A full retracement and crossing of the production network tree would be conceivable, aiding the identification of inconsistencies across different tree levels. With this framework, existing production network the executives' frameworks might be supplanted with a compelling and cutthroat other option.
Among the production network issues tended to by Mitsuaki Nakasumi [5] are Double Marginalization and Information Asymmetry, among others. Blockchain-based arrangements are being researched to address these issues. The need of fostering a compelling production network is tended to in this review. As per the discoveries of the exploration, information is quite possibly the most fundamental instrument that anyone could hope to find to makers in supply chains for the improvement of their items. It is expressed in the paper that, because of the tremendous measure of information produced and traded that is expected for assembling exercises, it is basic to distinguish the most significant information and to focus just on the "essential exchange" that will bring about future changes at the production network level. The creator analysed motivating force gives that emerge with regards to serious gamble irregular characteristics, for example, the risk of running out of assets. In the decentralized production network, the effect of limit risk is more serious than it is in the in an upward direction coordinated production network, attributable to the lop-sidedness. As an answer for the issue of twofold underestimation, the creator recommends that a blockchain-based methodology be utilized.
Mr. Lai Jieyu (otherwise called Lai Jieyu) is a Chinese legislator and financial specialist. [6] researches and investigations the administration of the coordinated operations production network for worldwide web-based business with the utilization of block chain innovation. In this article, in

the wake of giving an outline of the blockchain's "decentralization" it offers three novel utilizations of the blockchain in the space of coordinated operations, cash development, and data stream. Web based business has made critical advancement in China, as per the distribution, and has spread quickly the nation over. It reaches the resolution that the execution of blockchain innovation will introduce another period of development for China's cross-line coordinated operations production network.

On the block chain Internet of Things, Chan Hyeok Lee and associates [7] talk about the circumstance. A technique known as confirmation of work might permit information to be spilled from the block chain after it has been transferred. By doing a location search, it is feasible to get the data you are searching for. Subsequently, to safeguard this, the specialists used a procedure known as information zero proof. Brilliant agreements and zero information confirmation are utilized to portray information assurance in this article. An outsider can modify or get the Internet of Things information that is put away in a blockchain framework. To record the gadget's power utilization and result, a brilliant meter is introduced. There are significant protection issues with brilliant meters as a result of safety imperfections. The creators presume that using brilliant agreements and zero information, information might be kept secure while exchanges can in any case be finished.

Production network the executives might be made more compelling by utilizing blockchain innovation, as indicated by Mohamed Awwad and partners [6]. block Chain (articulated "block") is a decentralized, digitalized, and straightforwardly open record of all bitcoin exchanges. To battle fake items and safeguard marks, this may be used. Among the web-based business organizations that need more noteworthy straightforwardness and effectiveness is food appropriation, which incorporates stockroom dissemination. Because of the way that this innovation starts with the client's interest and finishes with the client's conveyance, straightforwardness, risk decrease, adaptability, and speed may be in every way gotten to the next level. In particular, the review tends to the early reception of block innovation with the Internet of Things, with a specific spotlight on the level of organization of blockchain innovation for the motivations behind approval, straightforwardness, and recognizability in different areas. Theoretical:

As per this examination, the Internet of Things (IoT) and Blockchain innovation, which might additionally help tackle security challenges in the customary production network, can be utilized to safeguard conventional production network capacities after they have been carried out.

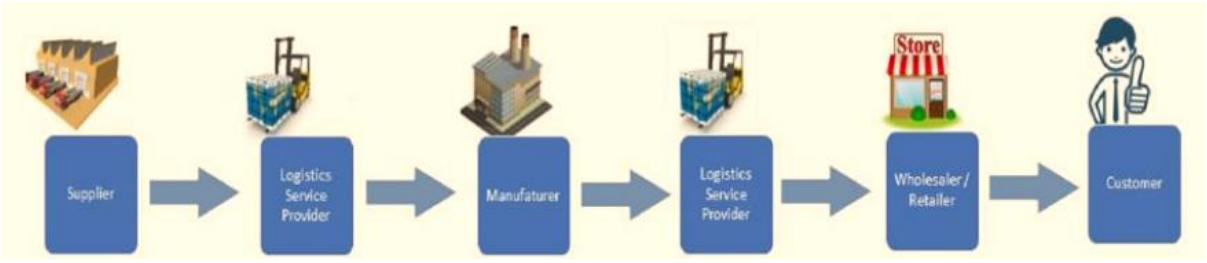

Figure 1: Supply Chain Flow

The following are some of the issues that current supply chains are dealing with [7]:

- The absence of transparency from one end to the other results in a broad variety of concerns, including theft, violation of codes of behaviour, and other violations.

- Lack of flexibility to adapt to unexpected changes in demand and in the control of operational costs: demand is constantly changing as a result of the influence of globalisation. As a consequence, operational expenses are raised in an indirect manner as a result of this.
- Many of the activities involved in supply chain management are often performed by hand, which makes them time-consuming to complete.
- Efficiencies in supply chain risk management: A system that is inefficient in supply chain risk management will be unable to foresee hazards and will therefore be unable to react to the situation.
- Lack of sophisticated technology: Modern supply chain management lacks the new technology necessary to address the challenge that has arisen as a result of the fast changes brought about by globalisation.
- It was unable to monitor the system in real time and to keep track of the items' movements and locations inside the storage facility. It was also impossible to track shipping requests and payment processing.

A. Supply Chain with IoT

From the provider to the end client, a standard production network model might be portrayed as an organization of connections between all people, organizations, and exercises engaged with the business interaction. For businesses like retail, assembling, coordinated factors, and web-based business, keeping up with command over supply chains is a basic part of their tasks. Be that as it may, production network the executives might turn out to be more convoluted because of rising purchaser interest, changing business sector elements, and unexpected postponements, among different variables. Moreover, a significant number of the exercises engaged with production network the executives are frequently performed the hard way, which makes them tedious to finish. Corporate leaders are searching for strategies to work on the productivity, reconciliation, and viability of their inventory network the executives' activities.

In spite of the fact that there are different issues with conventional production network procedures, as displayed in the previous segment, the production network is confronted with an expansive assortment of obstructions subsequently. Models include: no continuous observing of the framework, no checking of item development or area inside the storage space, no observing of transportation solicitations or instalment handling, and different issues that are exceptionally refined. The Internet of Things (IoT) will give an answer for these issues.

B. Role of Internet of Things in Supply Chain

The Internet of Things (IoT) is an assortment of genuinely connected gadgets that are equipped for observing, recording, sending, and trading information. Gadgets connected to the Internet of Things (IoT) are frequently associated with arranged PCs by information or Wi-Fi organizations. It is the Internet of Things (IoT) gadgets that utilization innovation to evaluate numerous attributes of their general surroundings. These perspectives incorporate area; temperature; stickiness; light level; versatility; taking care of capacities; speed of tasks and exercises; and a few other ecological boundaries. IoT merchandise are accessible in an expansive scope of different designs, including RFID processors, cell phones, and convenient sensors, among others.

Using GPS and an assortment of different innovations, Internet of Things (IoT) frameworks can screen, validate, and affirm things and shipments across the production network. The capacity states of hardware may likewise be observed by means of the utilization of Internet of Things gadgets,

which can assist with improving quality control across the production network. The Internet of Things (IoT) is definitely not a solitary innovation; rather, an assortment of advancements will cooperate to construct insightfulness. Other mechanical progressions incorporate correspondences innovation, data innovation, electronic sensor and actuator innovation, as well as forthcoming advancements in PC and scientific procedures.

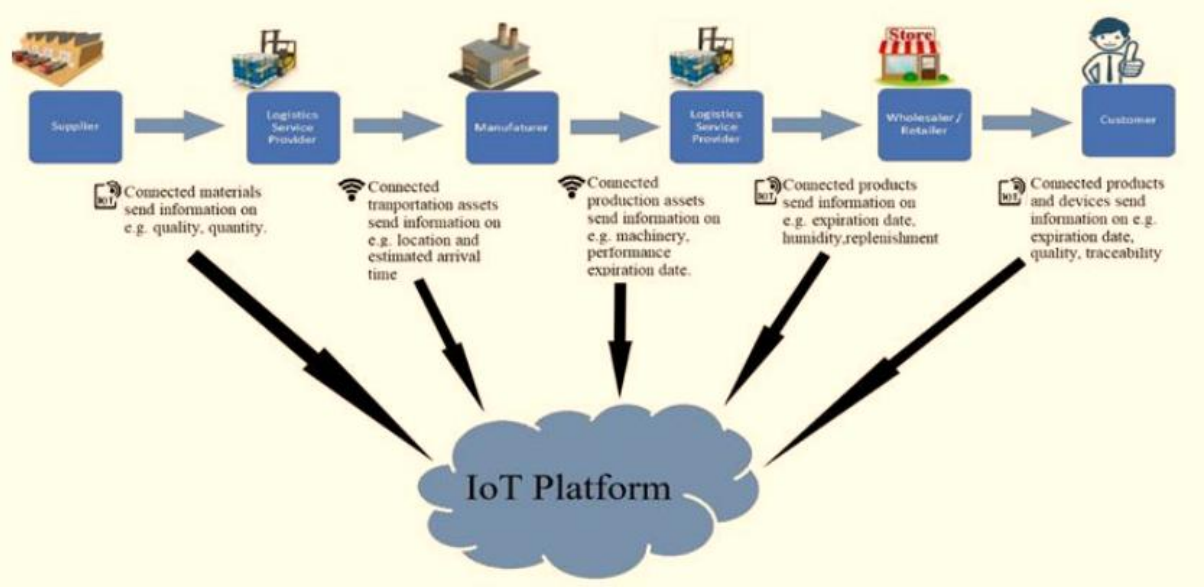

Figure 2: Supply Chain with IoT Platform

Some of the benefits the supply chain can reap by the implementation of IoT are8 :

- Data Acquisition - Internet of Things sensors may be installed in a range of goods to gather information on how each customer interacts with them. These technologies enable the analysis of the patterns of usage of diverse customer demographics, and the information gathered may be utilised to help designers create new products.
- Businesses may agree on the threshold value of commodities needing certain temperature or humidity conditions, such as food products, by collaborating on a product monitoring system (see Figure 1). If the threshold limit is surpassed, IoT sensors in the warehouse may send out an alert to the people who need to know.
- Aspects of product lifecycle management include material lifecycle management, which is also one of the most important supply chain management techniques. Various parties, including suppliers, producers, business-to-business partners, mega-stockists, wholesalers, and retailers, are involved in the flow of products as they increase. In order to handle challenges such as under- and over-stocking, Internet of Things sensors may be utilised to monitor commodities across multiple supply chain systems. The Internet of Things (IoT) technology may also aid in the identification of providers who are geologically fit for the company.
- Inventory Management - Businesses may install Internet of Things sensors in their inventory to get real-time notifications on the status of their goods. Businesses will be able to analyse demand for various items based on information received by IoT sensors thanks to the Internet of Things.

- Logistics - The supply chain is made up of a variety of fleet components, including as containers, ships, and trucks, that are used to transport goods and consignments to their destinations. Companies will have more control over their delivery trucks as a result of the real-time tracking of vehicles that will be enabled by connecting these components to the Internet of Things.

IV. SUPPLY CHAIN WITH BLOCKCHAIN

An organization's conventional production network has been displayed in the exploration, as well as how Internet of Things innovation might be utilized to make it speedier and more proficient. It has been seen that as the utilization of the Internet of Things develops, the gamble of its maltreatment develops also. These risks, then again, may be diminished by consolidating blockchain innovation into its general plan.

All discussions between Internet of Things gadgets are saved in the cloud utilizing blockchain innovation, which is an exhaustive information storehouse. This gives your prompt admittance to the entirety of the item's significant data. Along these lines, both the organization and the client might profit from blockchain and Internet of Things innovation to screen the full item life cycle across the whole production network, setting aside time and cash.

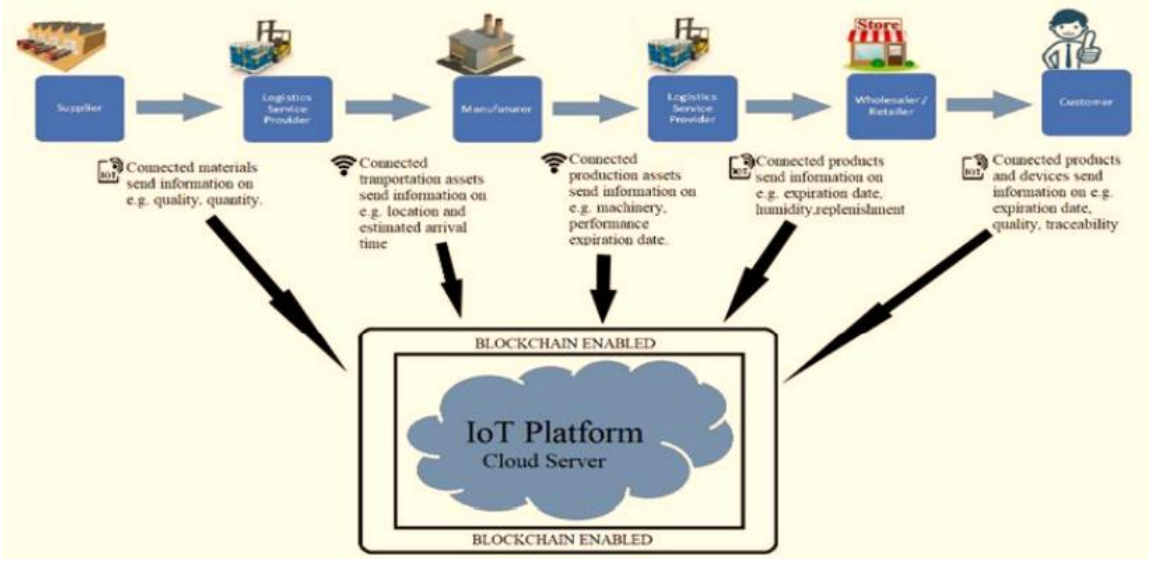

Figure 3: Supply Chain with IoT Enabled Blockchain

It goes about as an association between the genuine and computerized universes by giving dependable data about the merchandise and materials utilized in a production network, which is fundamental in the assembling business. There is more straightforward admittance to data when the Internet of Things (IoT) and Blockchain are utilized in the Supply Chain. This associates both the physical and data streams and makes the production network safer, trustworthy, straightforward and financially savvy.

A. Implementation of Blockchain–

- STEP 1

Set up a private blockchain network - Ethereum might be utilized to make a private blockchain network that is open just to the individuals who have consent. It is a disseminated PC network that

is based on the blockchain innovation. To lay out an Ethereum block chain, every association should initially set up a superior execution registering unit, known as an Ethereum hub, on its own PC organization. Ethereum hubs might be made utilizing applications that are accessible on an assortment of stages, for example, Go Ethereum or the 'geth' order line interface.

- STEP 2

Utilizing Smart Contracts, you might make more convoluted exchanges on Ethereum's blockchain. A piece of programming works with the trading of cash, merchandise, properties, offers, or whatever else of worth. At the point when every one of the requirements are finished, the brilliant agreement is a PC program that works independently and without human intercession. Which works unequivocally as planned, without really any opportunity of interference, restriction, debasement, or obstruction from outside parties.

Brilliant Contracts are like traditional intranet frameworks in that they have a brought together storehouse and a concentrated data set containing every one of the information on the production network processes that the association handles; notwithstanding, rather than having a solitary location drifting data set for all hubs, Smart Contracts have a solitary location drifting data set that fills in as a contact point for the whole organization. Different programming languages, including JavaScript and C++, might be utilized to make brilliant agreements. For these programming dialects, there are online compilers accessible, which might be utilized to make brilliant agreements, also. The agreement might be distributed on a particular organization of the Ethereum block chain, in the event that such organization exists.

- STEP 3

Make a Distributed Application - A Distributed Application is a product application that is created to gather or transferring information from or into a drifting Smart Contract Ledger, which is currently during the time spent being constructed. This Smart Contract record is for the most part housed on distributed storage stages, and it is equipped for running on a few PCs simultaneously. This disseminated blockchain application might be created in a direct way by first producing a website page in HTML/CSS and afterward utilizing an API called Web3Js, which fills in as the connection point to the Ethereum block chain.

B. Advantage of using Blockchain enabled IoT in Supply chain:

Notwithstanding the various issues related with the conventional appropriation chain structure, there is significant interest in whether and how blockchains can assist with getting the dissemination chain industry, given the intricacy and absence of responsibility that at present exists in our ongoing stockpile chains.

- Laborers taking stock from dissemination focuses, specifically, keeps on being a critical wellspring of worry for production network supervisors and leaders. As a result of the sheer volume of products that travel through these offices, monitoring everything is troublesome. Subsequently, it is frequently convoluted to take activities. It involves work force inside the association teaming up with others outside the organization, for example, drivers, to ship taken things from the dissemination community to a place where they might be sold.
- Data Theft - As production network innovation and information stockpiling frameworks shift to the cloud, cloud information security is turning out to be more significant. Powerlessness to successfully control cloud access will bring about significant IT risks, including, or surprisingly more terrible, conceding clients an unreasonable measure of

privileges, most authorities on the matter would agree. This will make the cloud information accessible to anyone with any interest at all in approaching it. The utilization of blockchain innovation may likewise assist with mitigating this danger. It is feasible to do this by including vigorous authorizations and access control. In this methodology, admittance to cloud-based data might be confined and safeguarded. The data or information might be scrambled and saved, and the entrance keys can be randomized and promptly traded between the gatherings without the should be worried about hacking or other security breaks.

- Outsider Vendor Confidence - Cloud specialist organizations pay a lot of cash to ensure that their sites, as well as their notorieties, are secure. It is for this equivalent explanation that they are dependent on their method for resource. A few organizations are as yet hesitant to commit delicate data to outsider workers for hire, which is justifiable. The utilization of a cloud stage that doesn't put a high need on security expands the risk. Additionally fundamental is that main associations with earlier aptitude in taking care of delicate applications be recruited, as well as that they pass severe security checks. Furthermore, such firms have far more noteworthy standards and more security layers than the organizations whose information they are facilitating. Giving information to an outsider is exceptionally hazardous. Numerous organizations, be that as it may, who can't commit the fundamental assets to safeguard their own information, rely upon outsider workers for hire to do as such. At the point when information is moved or when information is gotten to through an outsider merchant, the level of safety could become compromised. By safeguarding the best level of safety, blockchain may help with the smooth progression of data in this present circumstance. The data is conveyed in pieces because of this technique. These blocks are scrambled, making the framework exceptionally protected.

V. CONCLUSION

Obviously, the production network is gone up against with critical difficulties, which will just fill in significance later on. The reconciliation of blockchain and Internet of Things advancements could help with the decrease of dangers in the production network. Consolidation of a block fasten innovation will assist with ensuring that the data is genuine. This will assist with staying away from any possible misrepresentation while likewise guaranteeing that the data is given in a helpful and safe design. Interestingly, by giving dependable data about production network materials and items, the Internet of Things (IoT) can possibly act as a connection between the physical and computerized universes. Subsequently, consolidating these two will bring about a safer option for the whole wellbeing of the production network.

REFERENCES

[1]. Panarello, A., Tapas, N., Merlino, G., Longo, F., &Puliafito, A. (2018). Blockchain and iot integration: A systematic survey. Sensors, 18(8), 2575.

[2]. Lerner, S. (n.d.). Enterprise Mobility Exchange. 5 Revolutionary Advantages of Combining Blockchain With Internet of Things | Enterprise Mobility Exchange. Retrieved from http://www.enterprisemobilityexchange.com/emecollaboration-tools/news/5-revolutionary-advantagesof-combining-blockchain-with-internet-of-things

[3]. Lei Xu, Lin Chen, ZhiminGao, and Yanling Chang, EleftheriosIakovou and Weidong Shi “Binding the Physical and Cyber Worlds: A Blockchain Approach for Cargo Supply Chain

Security Enhancement", 2018 IEEE International Symposium on Technologies for Homeland Security (HST)

[4]. Vishal Naidu, KumaresanMudliar, and AbhishekNaik, Prof PrasenjitBhavathankar ". A Fully Observable Supply Chain Management System Using Block Chain and IOT", 2018 3rd International Conference for Convergence in Technology (I2CT)

[5]. Mitsuaki Nakasumi "Information Sharing for Supply Chain Management based on Block Chain Technology", 2017 IEEE 19th Conference on Business Informatics

[6]. Lai Jieyu "Research on Cross-border E-commerce Logistics Supply under Block Chain", 2019 International Conference on Computer Network, Electronic and Automation (ICCNEA)

[7]. SatyabrataAich, SabyasachiChakraborty, Mangal Sain, Hye-in Lee, Hee-Cheol Kim "A Review on Benefits of IoT Integrated Blockchain based Supply Chain Management Implementations across Different Sectors with Case Study", International Conference on Advanced Communications Technology (ICACT)

[8]. Joshi, N. (n.d.). Application development | Big data| IoT | Digital Business | Cloud. IoT in supply chain management | Artificial Intelligence |. Retrieved from http://www.allerin.com/blog/building-smarter-supplychains-with-iot.

[9]. Wainstein, L. (n.d.). The Network Effect - Beyond Supply Chains. 7 Supply Chain Security Concerns to Address in 2019 - The Network Effect. Retrieved from http://supplychainbeyond.com/7-supply-chainsecurity-concerns-to-address-in-2019/

[10]. Chan Hyeok Lee, Ki-Hyung "Implementation of IoT System using BlockChain with Authentication and Data Protection", 2018 International Conference on Information Networking (ICOIN)

[11]. Mohamed Awwad, Sohit Reddy Kalluru, VarunKazhanaAirpulli, MadhubalaSantoshZambre, AniketMarathe and Prasham Jain "Blockchain Technology for Efficient Management of Supply Chain", Proceedings of the International Conference on Industrial

[12]. MarwaChamekh, Mohamed Hamdi, Sadok El Asmi, and Tai-Hoon Kim "Secured Distributed IoT Based Supply Chain Architecture", 2018 IEEE 27th International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises

[13]. AbderahmanRejeb, John G. Keogh, and Horst Treiblmaier "Leveraging the Internet of Things and Blockchain Technology in Supply Chain Management", Future Internet, Vol.11, No. 7, pp. 1- 22.

[14]. AmalAlahmadi, Xiaodong Lin "Towards Secure and Fair IIoT-Enabled Supply Chain Management via Blockchain-based Smart Contracts", ICC 2019 - 2019 IEEE International Conference on Communications (ICC)

[15]. PavanManjunath, RajashreeSoman,andDr.PritamGajkumar Shah "IoT and Block Chain driven Intelligent Transportation System", 2018 Second International Conference on Green Computing and Internet of Things (ICGCIoT)

[16]. Engineering and Operations Management Washington DC, USA, 2018