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Retraction

Retracted: Internet of Things-Based Smart and Connected Supply Chain: A Review

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. M. Abdul Zahra, Ilhan GARIP, Y. S. Almashhadani, and B. T, "Internet of Things-Based Smart and Connected Supply Chain: A Review," *International Journal of Antennas and Propagation*, vol. 2022, Article ID 8182813, 5 pages, 2022.

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Review Article

Internet of Things-Based Smart and Connected Supply Chain: A Review

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In the era of the Internet of Things (IoT) and the Industrial Internet of Things (IIoT), elements along the supply chain can be connected to one another to offer tracking capabilities. The information obtained from an always connected and working supply chain is then incorporated into the simulations of the virtual world (digital twin). This allows for an instantaneous simulation of the environment at any point in time and better, more optimized, and quicker decisions are made based on the results. This translates into more performance and a stronger competitive advantage. This paper will examine the main concepts surrounding the supply chain from the perspective of digitalization. In this paper, we will take a closer look at the main concepts related to the supply chain in light of digitalization.

1. Introduction

A supply chain is a sequence of steps that involve the procurement, planning, logistical planning, manufacturing, and distribution of a product. A supply chain network's main goal is to satisfy the needs of its customers, so the customer is a crucial part of the supply chain network [1]. A change in one link will affect the others because the processes are interconnected. The processes exchange information continually and the links change constantly. The configuration of the supply chain must be customised to the idiosyncrasies of each firm and industry, so there is no one universal supply chain model. It has been stated that there is no universal supply chain, but every supply chain should be structured around two fundamental principles [2]. A comprehensive analysis must include all processes or components involved. Information is an important factor in enabling success. In order to align all integrating parties, all information needs to be generated and processed. In recent years, all supply chain processes have undergone unprecedented changes due to the development of technology and innovation, primarily in manufacturing under the umbrella of the Internet of Things (IoT) which takes advantage of other innovations like cloud, digital twins, smart factories, and artificial intelligence [3]. The benefits of proper implementation of digitalization across the supply chain are evident: cost optimization, process flexibility, improved forecasting accuracy, improved customer satisfaction, etc. These challenges are forcing companies to carefully manage the implementation of digital enablers so as to maintain their competitive advantage [4]. However, to take advantage of digitization's opportunities, one has to consider the investment needed. In order to meet the challenges of current technological advancements, a significant investment of money and resources is needed. To determine whether an organization is mature enough to integrate cutting-edge technology into its intelligent and connected supply chain, it is necessary to produce previous exhaustive studies on each of the integrating elements of the intelligent and connected supply chain and to examine, in turn, how the company operates as a whole. It is imperative that procedures and processes are changed, competent people are recruited to make the changes and the organization is structured so that continuous improvement can occur. After all, the driving force behind the digitization of the supply chain and its evolution to a system of intelligent and connected links is a continuous improvement [5]. The novelty associated with IoT stems from its potential for widespread application as technical barriers associated with automated surveillance have been gradually eroding, drastically decreasing the associated costs in its wake. The Internet of Things (IoT) envisions an ecosystem where smart and interconnected objects can sense surrounding changes, communicate with each other, process information, and take active roles in decision making. Optimizing supply chain performance is a primary concern of manufacturing and logistics organizations.

2. Objectives

It was created in response to a set of objectives established for its development, which can be summarized as follows: a review of the main supply chain concepts from the perspective of digitalization. The goal of this study is to identify the relationship between the various concepts within the digitalization of the supply chain.

3. Methodology

An analysis of the bibliography has been conducted based on the following terms to prepare the text:

3.1. Supply Chain. A supply chain is the network of all the individuals, organizations, resources, activities, and technology involved in the creation and sale of a product. A supply chain encompasses everything from the delivery of source materials from the supplier to the manufacturer to its eventual delivery to the end user.

3.2. Cloud. "The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world.

3.3. Digitization of Industry. Digitalization is changing how products are designed, produced, used, and maintained as well as transforming the operations, processes, and energy footprint of factories and supply chains.

3.4. Digital Twin. A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning, and reasoning to help decision-making, see IBM Digital Twin Exchange.

3.5. Industry 4.0. Industry 4.0 is revolutionizing the way companies manufacture, improve, and distribute their products. Manufacturers are integrating new technologies, including Internet of Things (IoT), cloud computing and analytics, and AI and machine learning into their production facilities and throughout their operations.

3.6. Internet of Things (IoT). The term IoT, or Internet of Things, refers to the collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves.

3.7. Smart Manufacturing. Smart manufacturing is the notion of orchestrating physical and digital processes within factories and across other supply chain functions to optimize current and future supply and demand requirements.

The search for relevant articles to the concepts stated above has been conducted mainly in the Scopus database. Previously published articles on smart and connected supply chains have been reviewed and this article identifies connections and interrelationships among the different agents involved in the process in order to compile in one document the state of the art of the literature pertaining to this topic [6].

4. Conceptual Structure of Industry 4.0

4.1. Internet of Things (IoT). It refers to the extension of Internet technology through the use of the Internet of Things. It was coined by the Massachusetts Institute of Technology (MIT). Networking involves connecting devices of different types to a network and allowing them to exchange information, communicate, interact, and be able to be monitored and managed remotely. The Internet of Things (IoT) is a revolutionary technological development that allows the connection of "smart" devices over the Internet to create a virtually identical digital version of any industry, as well as the ability to predict behavior before it takes place in the real world. One area where IoT can be particularly revolutionary is production. In real-time, data can be collected from sensors embedded in all elements on the factory floor, providing highly accurate process monitoring and facilitating predictive maintenance [7]. It is possible to make the company's production process more flexible to adapt to changes in the market or to manage inventories better. The Internet of Things is already in place in the first phase, both in industry and in homes, with the aid of numerous devices that have sensors and actuators; however, there are still additional challenges to overcome within the hyper-connected paradigm.

4.1.1. Privacy and Security. It is no coincidence that the very feature that makes the IoT so compelling, hyper-connectedness, is also its most lawful aspect. To prevent cyberattacks and fraudulent use of information, it will be necessary to develop security systems and privacy protocols that are more robust [8].

4.1.2. Standardisation and Interoperability. The proliferation of IoT-associated devices depends on the availability of a set of models and standards.

4.1.3. Big Data. The definition of big data is the data that contain greater variety, arriving in increasing volumes and with more velocity. This is also known as the three Vs. Put simply, big data is larger, more complex data sets, especially from new data sources. In addition to managing the continuous streaming of data from countless connected devices, it will also be necessary to consider where, how, and what will be done with this data, as well as how the sheer volume of data can be analyzed and turned into useful information.

4.1.4. Technology. Consideration of energy and environmental constraints is primarily needed for the incorporation of necessary elements.

An overview of IoT challenges in the supply chain can be made by looking at the following, which would be exhaustive, but a more detailed list could look like this:

(1) Difficulty in achieving predictions. It is not easy to determine exactly how and where IoT can be used, so the consequences of its applications are unpredictable.
(2) Lack of strategy and planning scenario. Many companies lack a defined IoT strategy and do not know how to use the information generated to control the supply chain.
(3) Scalability and interoperability. They are hampered by the need to customise IoT-related solutions.
(4) Financial issues. Investment should be valued on the basis of return on investment.
(5) New business models. The highly connected digital world will change the business models currently employed.
(6) Shared responsibility. The responsibility of each actor for the possible errors that arise in a context where information barriers are intended to be removed should be established.
(7) Legal framework. Robust legislation on legitimacy, transparency, and accountability needs to be put in place.

The Internet of Things is not just about technology but plays a major role in its development. There will be a need for companies to be careful in selecting their hardware since the accuracy of the data will be determined solely by the sensors they use and to follow strict maintenance and validation processes since industrial environments are conducive to deteriorate technology [9]. A new role, the "data scientist," will be needed to contextualize and interpret them in order to distinguish which data are potential information and how to treat them to make them useful.

4.1.5. Supply Chain. As it is known today, the modern supply chain must transform within the wave of globalization to become a demand-responsive network that can respond swiftly to market requirements to sustain competitive advantage [10]. In today's supply chain, the use of electronic document interchange (EDI), enterprise resource planning, RFID, and e-commerce have become a part of everyday life, but because these technologies have grown so mainstream, they no longer make a difference and are not enough to capture the demand patterns and buying behaviors that put such pressure on the supply chain. Generally, supply chain integration entails the management of processes on all three organizational levels (strategic, tactical, and operational) in collaboration with each other. This integration allows for the most efficient and effective flow of information, products, and funds in order to maximise customer satisfaction at the lowest possible price and with the fastest turnaround time [11]. The supply chain can be enhanced through digitization through the IoT, which functions as flow facilitation in the previous paragraph.

(1) Information management enhances decision-making.
(2) Inventory management has improved. The elimination of inventory counting, as well as the optimization of warehouse capacity, is easily achieved by providing a real-time view of the components of inventory.
(3) Optimization of logistics. Applications such as route optimization and better last-mile delivery can be developed using real-time data capture.
(4) Managing supply chains in real-time. The information should be shared seamlessly from suppliers to customers to eliminate the whiplash effect.
(5) Logistics visibility. Information about transportation (location and incidents) can be made available to all actors in the supply chain, reducing costs, for example, by avoiding or minimising customer rejections.
(6) Predictive maintenance. It would be possible to create more effective predictive maintenance plans throughout the supply chain based on the data generated.
(7) The current rigidity of the system decreases costs by increasing customer satisfaction, increasing sales, and reducing risks.

4.1.6. Cloud. This paradigm was developed as a result of combining clustering and peer-to-peer technologies, as well as M2M, to create the cloud computing model, which is one of the two principal enablers of Industry 4.0. Industry 4.0 is revolutionizing the way companies manufacture, improve, and distribute their products. Manufacturers are integrating new technologies, including Internet of Things (IoT), cloud computing, and analytics, and AI and machine learning into their production facilities and throughout their operations. The cloud computing paradigm has been developed, thanks to a number of previous technologies such as clustering, peer-to-peer, and grid computing, and it is revealed as one of the two main enablers of Industry 4.0, alongside M2M [12]. The cloud plays a role in making supply chain elements interconnected because objects are smarter when they communicate. Because of the sharing of information in the cloud, there is no need for smart objects to be physically close, meaning regular elements can benefit from smart objects resources whether or not they are nearby [13]. In order to determine which resources to use, local or remote resources are selected based on the application and system capabilities (for example, storage size, sensing and/or processing capabilities, and the location of the required resources). It is recommended to use short-range communication technologies if the objects that need to communicate are located close to each other while Edge or Cloud technologies are necessary if the elements cannot directly exchange information [14]. The main reasons for cloud application problems within the supply chain are as follows:

(1) Lack of investment in IT.
(2) Lack of IT experience.
(3) Insufficient human resources to operate in the IT field.
(4) Difficulty in developing new IT components and integrating them with the existing ones.
(5) Creating secure systems in the cloud. This concern hinders the projected growth of the paradigm.

4.1.7. Digital Twin. The creation of digital twins aims not only to create simulations of products and processes, but also to simulate operations throughout the supply chain. As a result, we can now see 3D simulations of products, material behavior, and production processes. This simulation process is aimed at using real-time data collection to update the model using which actions will be taken in the virtual world and for greater control and better decision-making process about actions that will be implemented in reality. At the University of Michigan, Grieves was the first to introduce the concept of the digital model, and the usual method of describing digital twins is by analyzing models that describe physical machines [15]. Although, for the purpose of simulating the behavior of physical objects in the digital world, it is necessary to create high-fidelity digital models of the physical objects that include the geometrical and mechanical parts, as well as the electronic and software. In order to achieve cyber-physical integration of production, the digital twin provides an effective method. As a result, so-called smart manufacturing can generate more reasonable and accurate production planning. A digital twin of a production plant can be created using an array of IT environments within companies, ranging from shop-floor management systems to industrial automation systems or enterprise resource planning systems, and digital twins can be utilized for the start-up and continuation of projects. When a supply chain is being designed, a digital twin (DT) should be created, which can be updated after implementation by allowing for data collection parameters based on the assessment of the supply chain's behavior.

4.1.8. Industry 4.0. Introducing digital transformation is the process through which organizations use digital technologies (such as cloud computing, 3D printing, IoT, and big data analytics) to improve their products, change the way they interact with customers, suppliers and partners, and to change the way they compete on the global stage [16]. The formation of an integrated system of suppliers, producers, and customers is implied by this concept. According to the German government, Industry 4.0 is the part of an approach to improving industrial processes, from production to distribution, using internet-based technologies. It was introduced as part of its industry-wide strategic technology action plan for 2020 [8]. In addition, other countries took similar initiatives, including the Industrial Internet in the United States, as well as Internet+ in China. As shared by all these initiatives, the new paradigms of IoT, cyber-physical systems (CPS), crowdsensing, crowdsourcing, and cloud computing enable normal environments to become smart environments. In contrast to traditional embedded systems, Industry 4.0 technologies facilitate communication and cooperation between system members, significantly enhancing the overall intelligence of the process. In Industry 4.0, data capture is carried out automatically through the digitization of processes as well as an increasingly diverse range of application domains. A few examples are listed below, but these are by no means exhaustive.

(i) Quality control
(ii) Supply chain management
(iii) Product monitoring
(iv) Workplace safety
(v) Use of assets

One of the main drivers of Industry 4.0 are IoT devices, but it is worth mentioning that Industry 4.0 also includes intelligent bridges between CRM, SCM, and ERP systems, social networks, and other sources of information to create a system of information, management, and control never seen before. In this sense, I4.0 provides the best of both worlds: the advantages of customised products and the advantages of large-scale production. Furthermore, it is possible to improve the production of goods and services by using the material, productive, and human resources from cooperation networks with partners with unused capacity [11].

4.1.9. Smart Manufacturing. A smart manufacturing or digital manufacturing process is one that uses simulation, 3D visualization, analysis, and other processes to simultaneously define product definitions and define manufacturing processes [9]. This shift from classical manufacturing to smart manufacturing is being enabled by advancements in the technology behind it, such as the Internet of Things, big data, cloud computing, and artificial intelligence and all their applications. However, this process of data transformation is being hindered by widespread issues related to the massive amounts of data, such as the proliferation of multimodal data, the size of the feature space, and multicollinearity in the measurements. An intelligent facility should create intelligence within production in order to improve the productivity of the organization as a whole. Sensors are in charge of collecting various kinds of data throughout the enterprise, including data about production lines, machines, processes, work activity, and environmental conditions [12]. This production intelligence is based on deep learning, which is aimed at enabling the installation, through its data collection, to learn automatically, identify patterns, and make decisions based on the data it collects.

5. Conclusion

The R&D is an integral part of any IoT project and expanding it may be the first step toward project success. By utilizing R&D, your business can optimize costs, reduce risks, and minimize time to market for various IoT applications.

As a result of the creation of this document, we have drawn the following conclusions:

(1) The concept of Industry 4.0 combines IoT, smart factories, the cloud, and digital twins.

(2) In the current state of Industry 4.0, the greatest obstacle is the need to develop security around the exposed systems created by hyperconnection.

(3) An Industry 4.0 smart, connected supply chain will utilize the hyper-connectedness of all the elements and actors to the fullest extent possible.

(4) In order to exploit synergies, all actors in the supply chain need to be on the same level of development in terms of Industry 4.0.

(5) In order to succeed in the 4.0 supply chain, large corporations will have to take the lead in developing I4.0 standards that help their partners.

Data Availability

The data used to support the findings of this study are included in the article.

Disclosure

The study was performed as a part of the Employment of Institutions.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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