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The Role of Big Data in the Holistic Development of the Logistics Sector: Challenges, Benefits, and Potential Applications

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Abstract

Internet of Things and Logistics are constantly integrating deeply after the explosion of the 4.0th science and technology revolution. The scale and network of logistics coverage for economic activities can expand comprehensively thanks to pioneering technologies such as big data analytics and cloud computing. In the future, big data will drastically transform modes of transportation and supply chains. In the context of big data and fierce competition, the logistics industry needs to seize the opportunity to improve capacity, operational efficiency and optimize resource use. The focus of this review is to highlight the role of big data in the transformation and resilience of the logistics industry to the new opportunities and achievements of the fourth industrial revolution. Moreover, the challenges and opportunities for the 4th generation logistics are also focused on assessing through recently published literature that is directly related to the topic of Big Data and Logistics. Finally, the current status and prospects of applying Big Data to develop, modernize and optimize for the logistics sector are discussed before conclusions and recommendations are presented.

Keywords: *Internet of things, logistics, big data, economic development, industry 4.0.*

Introduction

With the society is growing up, this had followed fields in society development. Firstly, is the social sector, next is the education system, finally are the economic realm in science and economic system. For this development to become long-term and sustainable, new solutions are needed to find. These solutions cooperate to make the advantages in the competitive marketplace, from this to enhance the standards of economic and social and high quality of life guarantee. The revolution named 4.0 is coming, it is led by the development rapidly of technology (Bogoviz 2019). The Internet of Things (IoT), Cloud Storage, Big Data, or

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Artificial Intelligence are new technologies, and they are encouraged to use in industrial processes. These applications on purpose to digitalize and optimize industrial procedures (Hermann, Pentek, and Otto 2016)(Lu 2017). But, only about 48% of producing factories said that they are willing to change in technology when they received support from developers despite the notions of Industry 4.0 analyzed and put out (Baur and Wee 2015). The creation of conditions to apply 4.0 technologies in the industrial environment is faced many barriers, these difficulties are alleged due to gaps (Baur and Wee 2015). Data are created increasing sharply with unprecedentedly large scale, this led to the data source in the global dizzy increase, and this increase is due to the advancement of information technology. With a huge amount of data, it will bring both opportunities and challenges. Opportunities bring new values and new discovering, but the challenges will pose important problems about data management and analysis. These things were born a new conception and it is called Big Data. From change in retail sales has made all of the logistics industry must change (Fernie and Sparks 2018)**.** Before the appearance of e-commerce, based on logistics providers, the development of Logistics was separated into three main phases (Z. Han et al. 2015). When The First Industrial Revolution has occurred, the industrial manufacturing company was mass born and these began to produce goods. This entails the demands related to the storage and transportation of their goods. The channels of distribution beginning were built between buyer and seller base on the isolation of production and circulation. After that, the process of economic globalization forcefully promoted, the division of the working class in society more and more obvious. This was the main reason for the release of the professional third-party logistics corporation. And with the born of these Logistics companies, the outsourcing of logistics became popular because it helped manufacturer companies cutting down costs and growing up efficiently (Fernie and Sparks 2018)(Barreto, Amaral, and Pereira 2017). But when e-commerce was developed successfully, the function of logistics has From change in retail sales has made all of the Logistics industry must change (Fernie and Sparks 2018). Before the appearance of e-commerce, base on logistics providers, the development of Logistics was separated into three main phases (Hoang Phuong, Minh Tuan, and Minh Tuan 2019). But when e-commerce was developed successfully, the function of logistics has once again changed. Now, logistics not only is connecting bridge between manufacturer and seller, but also it is a tool of the producer to direct approach with retailer and consumers. A new marketplace has been coined and developing rapidly base on Internet networks, businesses that sell products through e-commerce can promptly gain a new competitive advantage (Fang et al. 2018). An example of the connecting between producer and end consumers is express

delivery companies. The rapid development of this company base on connection network transport and warehouse system in many places and these companies are believed that symbols of the connectivity between the manufacturers and the end customer (Hoang Phuong Nguyen 2019) (Kawa 2017).

These trends such as Industry 4.0, Big Data, Smart Data, and Data Analytics are appearing more and more, it arises everywhere. That the data arise more and more, this made the initial advantages quickly turn into the disadvantages: Data was much provided, but the amount of data supply adverse pieces of information more than the amount of potential data for factories. Information logistics is a major direct relatedly to this issue in this context: Summarize, the goal of Information logistics is providing the right data, right format, right place at right time (Altendorfer-Kaiser 2017). The provision of useful data is very important and necessary in manufacturing.

Big data logistics can be understood as modeling. This model is shown throughout the analysis of the (urban) transport systems and the distribution systems. The data for this analysis is created by GPS, mobile phone, and transactional data on company activities, the data from the above sources are combined with human activities (e.g. social media, public transport). All of these have created huge data sets. The variation from “product-related” services to “information-related” services is a fundamental shift in the logistic industry. The changes start at smart computing and the innovations in technologies, this is changing daily demands and requirements. With resource aggregation easily and capacity sharing exactly, all of these are done by enhanced following the real-time tracking of means of transportation.

Big data analytics is understood that terminology used to depict large-scale data collection in terms of aspects acquisition, storage, management, and analysis in which traditional tools are not capable of doing (Y. Wang et al. 2017). High data volume, rapid data stream (velocity), manifold data, and low-value density are features of big data. For example, in a day, Facebook can put more than 500 terabytes of new data into the databases of this website; about 1 terabyte of new deal data per day are created by the New York Stock Exchange; Over 10 terabytes of data are created by a single jet engine in 30 min of flight time. Instead of grasping a large amount of information, big data technology specialized in the handling of meaningful data to notice the ‘added value in each data. This is the strategic meaning of big data technology (Y. Wang et al. 2017). In fact scenarios, by using various machine learning algorithms, with full information, a computer can create an application model for implementation of " smart things" (Kataria and Mittal 2014). In the future, all faces of life such as conduction, translation, face recognition, e-commerce will performance base on big

data and machine learning. It is called artificial intelligence (AI). Internet and the logistics industry continued to integrate deeply after the science and technology revolution recent. In the next five to ten years, the technologies like big data analytics, cloud computing, IoT will develop and become the next age of information technologies. At that time, logistics networks will change with full coverage and comprehensive expansion (Aliresearch 2017). The digitization in logistics will be sharply improved, the new method of division of labor including crowdsourcing, crowdfunding and sharing will be usually used. With AI technology evolve, the service economy and traditional economy will integrate deeply. All of these will promise to make a significant change in the logistics industry. So that, in the hereafter, big data will sharply transform more than business formats. It promises to change lives and orienting the trajectory of economic and social development. And as a necessity, it will have more positive impacts on the logistics industry**.** (Manyika et al. 2011) (Yan et al. 2019).

In this age of big data, in the logistics industry, a lot of data need to handle in a day, especially the whole logistics. These include many different works like transportation, warehousing, distribution, packaging, and several other links (Xue, Weipeng, and Yingying 2015)**.** A complete information stream is created by a link. And it will be a data disaster and a huge waste of resources if the logistics companies cannot deal thoroughly with this data problem as soon as possible. The logistics industry is applied big data technology, this problem is being researched by a huge number of domestic and foreign researchers. The adaption of companies with the change and cope with the fierce market competition have great meaning for each company. Besides that, making the strategic decisions of the logistics industry, operational management, brand management, customer service, service renovation, etc. is affected significantly by this problem. This helps factories optimize resource allocation in the logistics industry, speed up the upgrade process and industry of Logistics transformation, to meet the requirements of the era of information (Jun 2014)**.** In the context of big data, in the market competition, the logistics industry needs to catch the opportunity in order to improve the possibility, improve efficiency, use resources of data, etc.

In this work, assessments of the influence of Big data on the development trend of the logistics industry are presented. Furthermore, the advantages and disadvantages that cloud computing and Big Data analytics bring to the transport and logistics industry are discussed before analyzing the potential and effective applications of Big data in the logistics industry. Finally, prospects and conclusions on the prominent role and applications of Big data in revitalizing the logistics industry were given.

Fundamental Big Data and Logistics

Big Data

The logistics sectors are one of the ideal industries that benefit from the methodological advances and analytical capabilities of Big Data technology. With the growing up digitization of these fields, and with the massive stream of goods and individuals. The transport and logistics companies need to continuously create huge and wide data sets while managing these flows. The information such as location, content, size, heft, origin, destination, and much other communication are being collected throughout the transport networks and the global delivery by millions of shipments are transported every day. Creating valuable sets of Big Data has opened new ways for businesses basing on new opportunities for operational efficiency, the experience of the customer, and a new business model.

Big data is known as an all-around term for any set of data collection - architecture or un architecture - that are so huge and too many multiple variables for conventional data processing systems to handle steadily. Therefore, "Big Data is defined as too huge datasets for traditional data-processing systems, from the above information, this needs to require new technologies" by Provost and Fawcett. Big Data is often shown as machine data because it is often created by machines. IBM described Big Data about the scalability according to four aspects: (1) volume, (2) velocity, (3) variety, (4) veracity, and it is shown in **Figure 1**. The final "V" pillar is created by the combination of four core ingredients of big data called value. The organizations can collect greater value information through more profound insights from outstanding data analysis (Altendorfer-Kaiser 2017).

This definition is widely disseminated because it focuses on emphasizes the meaning and necessity of Big Data including the discovery of large hidden values from the huge data set, multiple types, and generate rapidly. Hassanien et al. (Hassanien et al. 2015) have coined the 5Vs model by adding Veracity as the main characteristic of Big Data. Beyer and Laney (2012) (Beyer and Laney 2012) have defined Big Data in more detail, Big Data is information assets with high-volume, high-velocity, and/or high-variety, it requires new forms of treatment that it allows for enhanced decision-making, detailed information discovery, and optimize the process. Therefore, a data set is considered as Big Data when it has functions like data collection, storage, allocation, management, analysis and visualize data through the current technologies (Gopal and Chintala 2020).

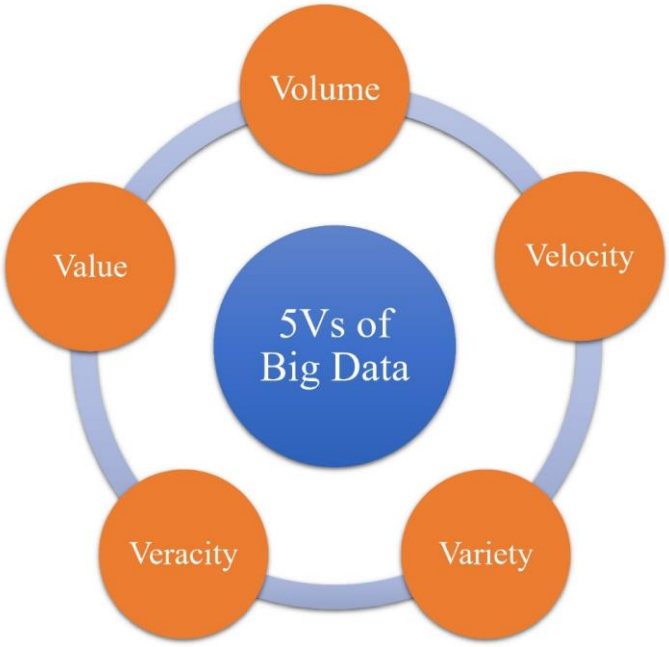

Figure 1. The 5Vs of Big Data (Hassanien et al. 2015)

In 2014, Singh and Reddy have a discussion about many of the different platforms available for analyzing data effectively (Singh and Reddy 2015). In discussion, they conferred about the different armature platforms for big data and they had a detailed description of the software framework in the task support. The features of Big Data were highlighted in 2013 by Sagiroglu, Ankara, Turkey, and Sinanc (Sagiroglu and Sinanc 2013)**.** The organizations or companies have received useful pieces of information by them to understand the importance of Big Data. Furthermore, the problems about content, range, forms, methods, advantages, and challenges as well as privacy concerns on it also mentioned. In 2014, Han Hu, Yonggang, Tat-Seng, and Xuelong have discussed a literature survey and system guide for big data analytics platforms, supply, and the overall picture for non-specialist readers (Hu et al. 2014). The challenges, the definition of Big Data was shown by Ghosh (Ghosh 2016). Next, a systematic measurement to divide big data systems into four consecutive modules was presented by them. These modules were called data generation, data acquisition, data storage, and data analytics. The variation in the computing model and the programming paradigm for Big Data problems and applications have been mentioned since 2015 by Trifunovic et al. (Trifunovic et al. 2015).

The applications and emerging studies relating to Big Data developed the business intelligence and analytical frameworks (BI&A) (Chen, Chiang, & Storey, 2012) (H. Chen, Chiang, and Storey 2012). Together with 4 main analysis systems including Text Analytics, Web Analytics, Network Analytics, and Mobile Analytics, in the study component of the

proposed framework, BDA become a fifth analysis technology, and these are determined as one of five main platform technologies, BDA used as a term, and these are emerging fields for analytics study (H. Chen, Chiang, and Storey 2012). Data acquisition and generation have been focused on by companies, so it has increased rapidly, and it became the realm prominent in recent times (Alexander, Hoisie, and Szalay 2011), usually emanating from the following data sources. According to the calculation, about 2.5 quintillion bytes of data have been created every day, this is a challenge for organizations to face. That is how to collect and manage a huge of data, and more than that is how to pick out meaningful value from it (Bakshi 2012). It is a fact that the significance and potential value of BDA are needed to understand by companies, so as to guarantee intelligence from this went up to the level of data, a benefit in business can translate by it (Gobble 2013)(McAfee et al. 2012). Notwithstanding, many companies have wrestled before they realize the potential value of BDA. Following the global survey of 720 firms worldwide, when asked, up to 64% of companies answered that they intended to invest in BDA projects during 12-24 months. However, less than 8% of these companies had really deployed a solution so far (Kart, Heudecker, and Buytendijk 2013). According to a recent survey, the target of most BDA plans is determined plainly and relate to the analysis of location data (70%) or freeform text (64%), so as to elevate the customer experience, cut down costs, rationalize existing process and more focused marketing activities, a considerable number of companies were still uncertain whether their ROI index (return on investment) would be going up or down**.** (Kart and Heudecker 2015) (Hopkins and Hawking 2018).

The Latest Generation of Logistics

The changes of social, industrial, and technological were brought the changes of history and Logistics is a field that changes with history in **Figure 2**. The fourth industrial revolution and scientific and technological achievements of the 21st century have brought a result called Logistics 4.0. New ways of data exchange, vertical and horizontal integration of chain of value and new business models were allowed by the development of ICT (Information and Communication Technologies). In 2011, The term Logistics 4.0 has appeared for the first time and the appearance of this term like a reaction and support to industry 4.0. Nowadays, the terms in the Logistics 4.0 field appear more and more such as Procurement 4.0, Supply Chain 4.0, Marketing 4.0, Distribution 4.0, Inventory Management 4.0, Warehousing 4.0, Order Management 4.0, etc., The requests in the logistics field in the industry 4.0 is being supposed meet the requirements for the development of Industry revolution 4.0. Industry 4.0 processes should be provided by Logistics 4.0 right from the start such as handling market

requirements, production planning until supply the smart product to end customers. Digitize logistics operations and processes - Digital applications in logistics are considered the solution. The activities like Cooperation, Connection, Adaptation, Integration, Autonomy, Comprehension are considered features of digitizing the logistics systems (Desfiandi, A., et.al., 2019). The latest ICT, software systems, and the Internet are platforms of Logistics 4.0, these above together provide the following: Logistic management, Realization of goods flows, and Realize information flows (Oleśków-Szłapka and Stachowiak 2018). The planning, performance, and controlling are all of the processes of Logistics management. All of the activities that allowing the movement of goods flows from the source of base materials to the supply of the product to the final consumer are the reality of goods flows. Information flows are believed that is very necessary to carry out the flow of goods and logistics management (Radivojević and Milosavljević 2019)(C. Chen, Tabssum, and Nguyen 2019).

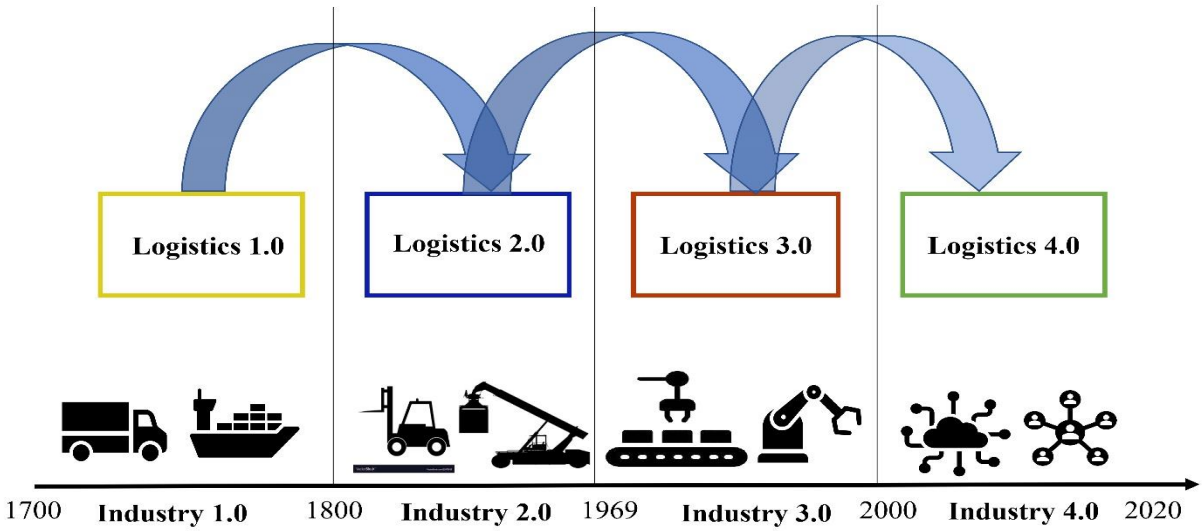

Figure 2. The development of Logistics

Because its ingredients allow intelligent management of processes, Logistics 4.0 is known as smart logistics. Automatic Identification, Connectivity and Integration, Automatic Data Collection, Real-Time Location, Data Processing and Analysis, and Business Services are the main part of Logistics 4.0 (K. Wang 2016). Automatic identification of all objects and those involved in logistical processes, the ability to locate them and collect data in real-time, allow quality management, planning, and optimization (Hoang Phuong Nguyen et al. 2020). Processing and analyzing data create new learning, the provisos for intelligent management, and new working services. The most important technologies are presented in **Figure 3** despite there are many technologies mentioned (Radivojević and Milosavljević 2019).

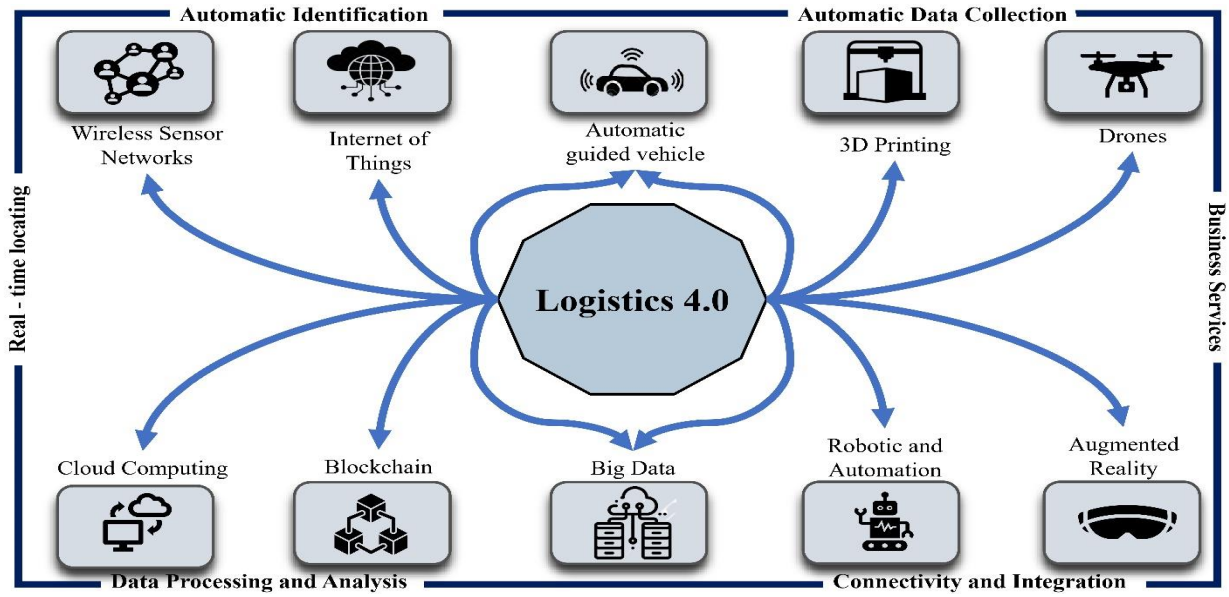

Figure 3. Ingredients and technologies of Logistics 4.0 (Radivojević and Milosavljević 2019)

Difficulties and Advantages for the Logistics İndustry in Big Data Application

The use of Big Data techniques will bring large advantages in dynamic transformation. However, it poses many challenges including difficulty in collecting, storage, searching, data extraction, analysis, and visualization of data. In order to harness the power of Big Data, many challenges must be overcome. One of the biggest challenges in computer architecture. Following Moore's law by Chen and Zhang (C. L. P. Chen and Zhang 2014), after every 18 months, the efficiency of the Central Processing Unit (CPU) is doubled. Although the disc rotation speed has improved a bit, the performance of the CD driver is doubled at the same rate. Besides, the amount of information also increases exponentially. Real-time values exploring from Big Data are limited by this. Another important challenge concern Big Data analytics comprises data inconsistency and ability of extension, timeliness, and data privacy. Therefore, data must be properly constructed and some preprocessing techniques, such as data cleaning, integration of data, exchange data, and date reduction should be applied to reduce noise so as to fix inconsistencies. The data collection and data storage is changed extremely by Big Data, including data storage appliance, data storage architecture, data access structure. The accessibility of Big Data is put in the highest position in the knowledge discovery process. Whereby, in order to fully or partially break the limitations of computer architecture, big data needs to be accessed efficiently. Commonly used architectures to storage including Direct-attached storage (DAS), network-attached storage (NAS), and storage area network (SAN). However, these drawbacks and limitations are expressed very clearly in large-scale distributed systems. A popular way to improving the performances of computationally intensive data is optimization data. Data duplication, parallel migration,

distribution, and access parallelism are included in this. Network bandwidth capacity is a sticking point in the cloud and distributed systems when the volume of data is large. Data security is another problem of cloud storage. Periodically detect and retrieve data, data promise assurance, complementary value, reuse, and maintaining are the main target of data curation. This includes authentication, storage, management, preservation, accession, and representation (Gopal and Chintala 2020).

In logistics systems, supply chain management, consumer management, after-sales support, and advertisement are necessary elemental in a comprehensive analytical framework by Kambatla et al. (Kambatla et al. 2014)**.** A large amount of multimodal data includes customer transactions, in-store video feed, inventory management, advertisement, consumer relationship, customer preferences and sentiments, sales management substruction, and financial data among others. Efficiency is improved by the comprehensive implementation of RFID for inventory tracking, links to the database of the supplier, integration with customer preferences, and an integrated financial system. The mining of RFID-enabled production data to support production logistics decision-making is facilitated by the Big Data approach by Zhong et al. (Zhong et al. 2015). Almost all datasets are comparatively well structured and integrated into these applications. Privacy and security problems will be easier to handle because the infrastructure and the data analysis are all done in the same security domain. Because the evolution of analysis will lead to capable of scaling large amounts of multimodal data and this is the main bottleneck in this area (Gopal and Chintala 2020).

The probability that the data contains valuable information and secret information will increase due to increasing data volume. Therefore, cybercriminals will easily steal information stored for Big Data analysis purposes by Kshetri (Kshetri 2014)**.** Besides, the value can be created by the availability of personal data. An equally important issue is determining relevance in huge volumes of data and the use of Big Data analytics to create value from relevant data. Using such data, through quality differentiation and differential pricing, the different groups can provide different products. The techniques that are not Big Data only allow to determine variables with much lower correlation than Big Data analytics. Such variables are the basis for designing services and setting prices. Association of structured and unstructured data for different sources, hidden connections between unrelated external data can be disclosed. Protect intellectual property rights, protect personal privacy, trade secret and financial information are all security issues that need to be protected by Chen and Zhang (C. L. P. Chen and Zhang 2014). Almost at developing and developed countries established Data protection laws. Due to extremely huge amounts of Big Data and tough

security workloads, so data security problems are harder to solve especially Big Data-related applications (Gopal and Chintala 2020).

Thanks to the application of new technologies in transport chains, all forms of logistics operations have been significantly improved such as supply chain management, express delivery, e-commerce, reverse logistics, freight logistics, maritime, air, and land logistics. Digital changes in transportation and logistics are leaded by new technologies and these are the things creating an ever-growing dataset. One of the most popular trends in the logistics and transport industry is IoT, which takes the most of high communication technologies such as Machine to Machine Communication (M2M) to connect almost any object to the Internet (Kckelhaus 2016)(Hoang Phuong Nguyen 2020)**.** IoT can be used for vehicle-to-vehicle communication and many Intelligent Transportation System applications, especially with the increasing use of sensors, Global Positioning System (GPS), Radio Frequency Identification (RFID), and WIFI, giving transports and objects more and more connectivity. Therefore, a substantial source of huge datasets is transport and logistics. In fact, management capabilities and resources are faced with a big challenge, that is all of these data. However, this can be a huge opportunity to gain from the untapped potential of these data such as create useful new business models, improve customer experience as well as efficient operation, etc (Borgi, Zoghlami, and Abed 2017).

A huge of data related to the haulage chain can be made use of by Data-driven transport and logistics companies, pick-up, and delivery to expand previously established services and create new information assets and therefore new business models. The valuable data source and rich information for offering to new customers are established by a distributed fleet of vehicles continuously moving across geographical ranges and equipped with cellular connectivity, any kind of cameras, or sensors. The large vehicles to transport can be exploited in many cases if an environmental intelligence system is used. The valuable data such as density of traffic, noise, pollution, temperature, and humidity are provided to real-estate developers, the agencies of the environment, and the government for city planning and environmental controlling activities by logistics service providers (Borgi, Zoghlami, and Abed 2017).

The collection of detailed information about customers is an important aspect of Big Data analytics in the logistics industry. The data taken from distribution and transport networks can be helped logistics service companies good management customer relationships and understanding the demand of the customer. The logistics providers and transport companies can make comprehensive computing of customer satisfaction and minimize the loss of

customers after a period of time by combining multiple data sources into one to gain insights across the entire customer base (Coussement, Lessmann, and Verstraeten 2017)(Borgi, Zoghlami, and Abed 2017).

An important factor in terms of Big Data analytics is collect detailed information about customers. Data pulled from the distribution network carries value that will have special implications for customer relationship management and analysis. The demand of consumers can be understood through the application of Big Data techniques. The consolidation of multiple data sources expands allows comprehensive assessment of customer satisfaction by the Big Data analytics method. The logistics providers need to consolidate multiple data sources to be able to gain a panoramic view across the entire customer base. To be able to have a panoramic view about the customer interactions and operational performance, ensure the satisfaction of both receiver and sender then Big Data analysis is necessary. The aggregation of information from as many points of tangency as possible will help the logistics and transport companies getting accurate results from customer feedback reviews. From analytical perspectives of management business components and different types of stakeholders can analyze open study issues in logistics systems and supply chain management, inside, prediction, inventory management, transportation management, human resources of the transportation industry are main business functions by Robak et al.(Robak, Franczyk, and Robak 2014). The issues such as delivery time forecasting, response promptly to customer experience, real-time planning for availability, inventory management, customer and provider relationship management can use Big Data to solve. Data not only as normal information but also as a strategic property, using Big Data for analyzing data will help the companies and organization in supply chain management recognized the economic value in data through revenue-generating activities by Rozados and Tjahjono (Rozados and Tjahjono 2014) (Gopal and Chintala 2020).

The Revival of Logistics with Big Data Technology Support

Thanks to the application of new technologies in logistics and transport chains, all of logistics operation form were significantly improved, that can include activities such as Supply chain management, express delivery, e-commerce, reverse logistics, freight logistics, maritime, air, and land logistics. Digital transformations in transportation and logistics are being led by these new technologies that have created an ever-growing dataset. One of the most popular trends in the logistics and transport industry is IoT, these trends make the most of high-communication technologies like Machine-to-Machine (M2M) communication to connect almost any object with the Internet (Kckelhaus 2016)**.** With the increasing of sensors system,

Global Positioning Systems (GPS), Radio Frequency Identification (RFID) and WIFI will help things easier connection, such as the communication of vehicles -to-vehicles can use IoT and many more Intelligent Transport Systems applications or at the car park, avalanche area or traffic approach in the shape of ITS infrastructure have implemented many immobile sensor nodes (Zhao and Fan 2018). Huge Datasets is having a significant source of information that is transport and logistic. However, management capabilities and resources will be faced with a challenge these are large of data. Though the untapped potentials of these data can become great opportunities for constructing helpful new business models, ameliorating customer experience, and operational efficiency can also be achieved (Borgi, Zoghlami, and Abed 2017).

When shippers, logistics providers, and carriers jointly manage logistics operations will create a huge of data in the global logistics field, according to the Council of Supply Chain Management Professionals (Stroh 2002)**,** For Logistics planning, the big data originating from RFID tags, mobile equipment and EDI transactions (Swaminathan 2012) are needed to exploit information. This involves delivering products from the point of supply (i.e. manufacturing facility or warehouse) to the point of demand (i.e. retail points) through intermediate storage nodes (e.g. central distribution center). Network flow issues where each arc deputizes a mode of transport with a given capacity and duration can formulate logistics planning issues (Dong and Chen 2005)(Jharkharia and Shankar 2007)(Grewal, Sareen, and Gill 2008)**.** From sources in transportation networks such as transport costs, forecast of supplier's factory availability, demand prediction at demand points, and networkability have created Logistics data (Najafi, Eshghi, and Dullaert 2013)**.** Predictive analytics tools are needed for designing the supply chain in logistics operations, making it agile in the context of disruption of supply and demand uncertainty (G. Wang et al. 2016).

In logistics planning, the routing optimization both of fleet and equipment are very important things. The vehicle routing issue tries to optimize the order of accessed nodes in a route, for example, for a parcel delivery vehicle, for return vehicle collection, or both (Drexl 2013)(Özdamar and Demir 2012)**.** Static and dynamic optimization is methods that are applied to solve such problems(Lisowski 2018). The consideration of the distance between the pair of nodes optimally, estimated traffic, left turns, and other bindings are set on the ways, such as delivery and pickup time casement (Vidal et al. 2013). Many factors complicate transportation planning and operation distribution in the global logistics network such as too many vehicles, vehicle capacities, limited delivery time, or delivery time is extended (Li, Tian, and Leung 2010)**.** For optimization of the routing of commodity, trucks,

as well as fleets that use analytics methodologies and techniques, are needed (Novoa and Storer 2009)(Minis and Tatarakis 2011). This is intended to balance transportation costs and profit margins and watching out for maintenance and safety (G. Wang et al. 2016).

Achieving final Intelligent manufacturing has been awakened the combination between Cloud Manufacturing and the Internet of Things. A large of data will create by the IoT technologies like radio frequency identification (RFID) that is developed in manufacturing sites (H P Nguyen 2020). Such data are intricate, abstract, and variable so it very makes it difficult to use fully the data that carries loads of useful information and knowledge. Big data on RFID-enabled store logistics from Cloud Manufacturing has presented a visualization approach by this paper (Visualization of RFID). Basing on production logic and time series, the RFID raw data are recreated by an innovative RFID-Cuboid model. Several contributions are highlighted. Firstly, the traditional industry needs to be upgraded and converted which is a possible way for application the integration between IoT and Cloud Manufacturing. Secondly, For the data must be interpreted, by using production logic and time stamps, the RFID-Cuboid model has been proposed. Thirdly, for helping the end customer can easier their daily operations, the visualization method has been suggested in a practical report. These cases bring lessons and deep meaning in the implementation of Big Data analytics in the industrial sector and deploy IoT-enabled Cloud Manufacturing (H.-P. Nguyen, Liu, and Zio 2020).

For ensuring competitiveness for sustainable growth, the application of business intelligence (BI) with the purpose make the right decision is needed. The collection and analysis of big data become necessary when information and communication technology develops rapidly. This led to a significant increase in academic research on big data and big data analytics (BDA). However, because many companies do not understand and use concepts in an integrated way, that leads to this research unrelating to BI (H P Nguyen 2020). Therefore, twofold (Jin and Kim 2018) is the main purpose of this research. Firstly, documentation on BI, big data, and BDA is needed to consider to be able to see that are not dispart methods but an integrated decision help system. Secondly, through a study about sorting and logistics handling of a typical courier business, we know how to use big data and BDA in practice combined with BI of companies. Company's cost-effectiveness in regard to data generation data analysis/simulation and results from the practical application is focused on by ours. By using big data through effective BI, our findings could enable companies to attend effective management without sinking in additional infrastructure. The indirect experience could be

provided to them, so to increase competitiveness, decreasing trial and error is needed to maintain (H.-P. Nguyen, Baraldi, and Zio 2021).

The issues about the planning and operation of a container port are attracting research interest, and there is a great deal of literature relating to the subject. In spite of this field had a lot of progress, however, the problems related to the loading transport and the operation of the dump have not been completely resolved (Deja et al. 2017). With the introduction of Industry 4.0 allowing technologies, many improvements for efficient management of operational processes are expected by the maritime industry. Due to the multimodal and complex nature of seaports, it becomes the key point in the maritime logistics chain (Hoang Phuong Nguyen 2020). Consequently, to improve their operations, the coordination of communication between the parties involved in the seaport is very important. Currently, the main support system for seaports such as Electronic Data Interchange (EDI) and Port Community Systems (PCS) shown weakness in the timely, accurate, efficient, and secure exchange of information, this causes high operating costs, administration of low resource, and low performance. For these reasons, Industrial Data Space (IDS) reference architecture model to allow a secure data communication space and motivate a multimodal transport terminal was based on the contribution presents about Seaport Data Space (SDS). In order to take part in the SDS and share the data, each party relating to the seaport has to implement the IDS connector. So as to manage the huge data shared in SDS and extract useful information to ameliorate decision making, an integrated Big Data architecture on top of SDS. By allowing port and container terminal authorities to share their data with a shipping company, it has evaluated the architecture. As a result, by using the functions of the Big Data architecture, it has developed several Key Performance Indicators (KPIs). In order to allow easy interpretation of results for vessel operational planning base on these KPIs has shown in the dashboard. By reducing transaction costs, improve information quality, and demonstrate efficiency, the SDS environment improved the communication between stakeholders (Sarabia-Jacome et al. 2020).

Global seaports are believed to have a key influence on the world economy. The global container traffic has increased an average of 10% every year since 1990. Equally, the major logistical and technical issues around the world are caused by the increase sharply in ship sizes. From the above facts, Big Data as well as the new digital technologies will bring great advantages for maritime logistics and ocean shipping companies. Besides many positive things of digitizing in maritime logistics in terms of efficiency, safety, and energy-saving, there also will have some risks (e.g. data abuse, cybercrime). Founded on a systematic

literature review, the state of digitalization in navigation logistics is provided in this article, the existing problem areas and the potential for improvement are also discussed. The results demonstrate that is essential to know how to catch the growth potential to get the exploitation advantage. However, the study is still in the early stages and lacks theory and experiment as well as a lack of explanatory approaches to proper recommendations for action and refactoring. (Fruth and Teuteberg 2017).

Recently, in order to design and deploy Big Data middleware to help IDS, the developers issued the Boost 4.0 project. The space between IDS architecture and Big Data management is the main target of the project (Boost40, n.d.)**.** The project intends to publish at the end of 2021. Moreover, the current documents for the maritime industry will be offered a few Big Data architectures (Vouros et al. 2018)(H. Wang et al. 2015)**.** Lambda processor architecture was the main approach used by these architectures, with scalability, efficiency, and high availability are proven effective by it (Marz and Warren 2013)**.** Requirements of IoT for Big Data management or the use of the circle of life of Big Data model for their designs were not considered by these architectures. The design of Big Data architecture for IoT has been considered and a variety of recommendations (ITU-T Study Group 20 2014)(International Telecommunication Union 2021) has been released by The International Telecommunication Union (ITU). Furthermore, Demchenko et al (Demchenko, De Laat, and Membrey 2014)proposed the Big Data life-cycle model (BDLM), the model supplies essential advantages for data reusability at any stage of the lifecycle and reduces large amounts of data at an early stage. Big Data architecture is considered the platform to extract relevant information from distributed data to improve port operations. (Sarabia-Jacome et al. 2020).

The current status of big data analytics (BDA) at levels of organization and supply chain management (SCM) levels in Brazilian factories has been recognized by this paper (Queiroz and Telles 2018). Specifically, exploring the perception of BDA in Brazilian enterprises and proposing a framework to analyze the maturity of enterprises in implementing BDA projects in the logistics/SCM field was focused on by it. 1000 companies did a survey on SCM levels through answering questionnaires. After the survey was received 272 questionnaires including 155 questionnaires was answered properly, representing a 15.5% response rate. This paper identified the knowledge of Brazilian businesses about BDA, the difficulties and barriers to the application of the BDA project, and the connection between supply chain levels and the knowledge of BDA. The BDA projects in SCM offered a framework to apply. External values of the study are not announced due to limitations, the limitations are derived from the generalization of the results even in the Brazilian, which derived from the sampling

conducted. The understanding in the field of study should be improved in future studies and how Big Data impacts supply chains or networks in new world regions, such as Latin America. The detailed information for practitioners to develop activities related to big data and SCM are provided by Queiroz and Telles (Queiroz and Telles 2018) and the functional and coherent guidelines through the triangulation framework of BDA-SCM as a complementary tool in implementing BDA projects in the SCM context (Queiroz and Telles 2018).

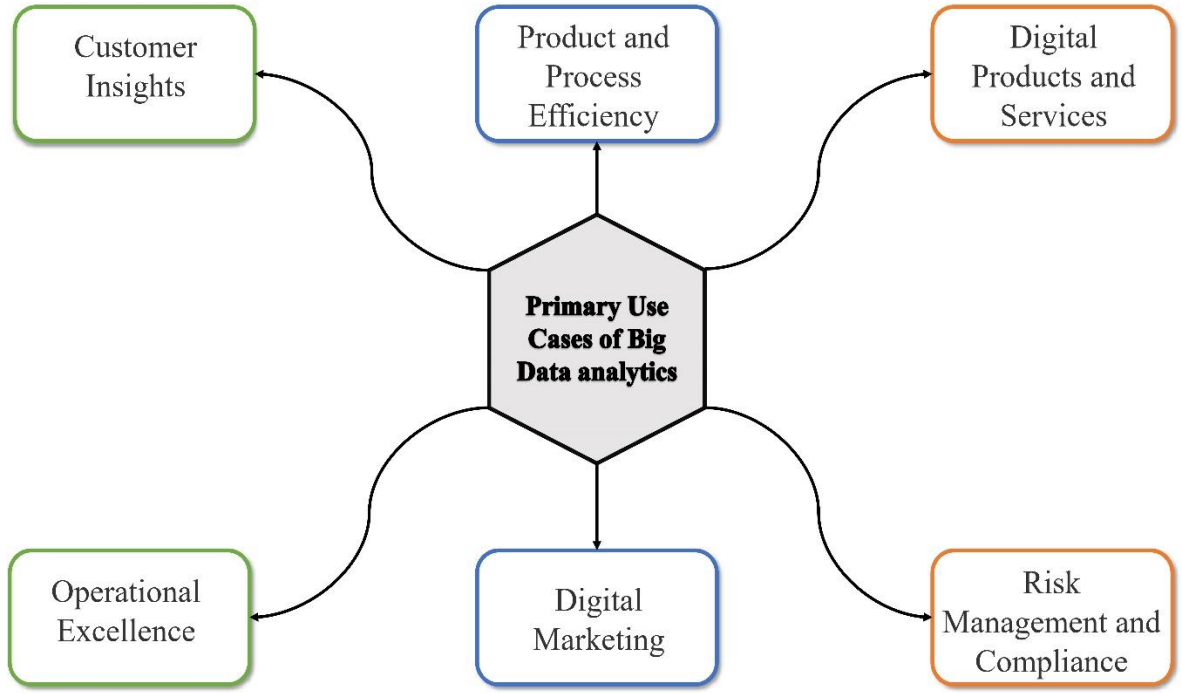

Figure 4. Primary Use Cases of Big Data analytics (S.-W. Kim 2017)

The main target of big data analytics has been divided into six categories; the big data values model have illustrated in **Figure 4** (S.-W. Kim 2017). The information such as detailed information customer, goods process efficiency, digital product services, excellent operation, and digital marketing are included by the model. The key examples of the use of big data by foreign and domestic companies by reinterpreting much of the main targets of big data analytics into customer relationship management, internal process improvement, improve efficiency, and create new value positions are all considered by it. Big data is considered technology to extract value from data and analysis results. A huge file of structured or unstructured data that exceeds the capabilities of management of existing database tools is included by it. Many fact cases used big data technologies to solve logistics problems. Amazon example, they have applied big data technology for the management of inventory systems and predictive delivery services. By using big data, consumers changing purchasing

patterns in real-time have been predicted by them and in inventory policies, they reflected this. This network has effectively managed the quantity of inventory, optimized efficiency, cut down costs, and made a profit by using big data technology. The information such as the list of previous customer orders and interesting goods in the shopping cart were analyzed by it. Even when the customer is about purchase uncertainty, by delivery prediction from a store near the customer's address, the customers will always receive the product as soon as possible by the demand information flow. All of the clothes of the ZARA brand are all tagged Radio-Frequency Identification (RFID). Status of goods, products frequently used by customers, and preferences of consumers are identified by RFID tags. By the Social Network Service (SNS) and online shop, the information is sent to the data center and after that, the information's hobbies of customers are extracted. Finally, the data center will analyze various data and improve them to create new products. In order to cut down unnecessary inventory, ZARA associated with the Massachusetts Institute of Technology (MIT) does this. By developing a big data-driven inventory distribution system that helped them achieve this, where inventory and turnover data from stores around the world are analyzed in real-time. The information such as analyze product demand prediction, store sales trends, and determine the correlation between the number of goods and cargo volume are dissected by ZARA that the purpose of making the right decision. The finding out the policy of not using the repository based on correct decision making with big data (S.-W. Kim 2017)(S. S. Kim 2019)(Choi 2017). In 2011, the Supply Chain & Logistics “Cello” solution of Samsung SDS was developed, the establishment of Information Technology (IT) systems and consulting through extensive project experience in the field of integrated logistics is the secret of the project. (Jeong 2019).

The existing distribution methods adopted by Chinese e-commerce companies are analyzed in this paper (E-commerce-logistic). Based on experimental analysis of the E-shopping mall at JD.com (Jing-Dong), the new features, new challenges, and new odds of big data of E-commerce businesses will be compared and investigated by this paper. In order to investigate of distribution selection mode of e-commerce enterprises, the Analytic Hierarchy Process (AHP) method and entropy value is used, to verify the model, the Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) method is also used. Management insights are brought by this study by Han et al. (M. Han and Wang 2017), it is very useful for e-commerce logistics distribution practitioners (E-commerce-logistic).

The support of big data systems expanded by the cloud to empower modern logistics services through promoting synergies between 3/4PL (third/fourth party logistics) in order to form sustainable or highly integrated logistics supply chain services. However, big data

applications may be limited in providing efficient logistics services without addressing the quality and degree of accuracy of the data. Defines an architectural framework and related research and development program for a cloud application to develop and implement a Big Data Logistics Business Platform (BDLBP) for management of supply chain network services is the main results of the study by Paper et al. (Paper et al. 2015). Providing powerful decision help for the logistics network and related parties through embedded capabilities in BDLBP. Real-time operational capacity planning and route optimization basing on the activity research paper and expand the scope of dynamic and uncertain situations are two of the three strategies and operability. The third capability, big data analytics in the cloud will support the planning of strategic logistics networks is currently being studied, and this approach purpose to cover this capability is supported.

The new trend in applications of transport and logistics is adopting Big Data technologies. The rapid emergence of new notions and thereby opening the way for new prospects in the future is being led by Information Technologies (IT), Data Science, Robotics, and Artificial intelligence (AI) with a rapid growth rate. Moreover, the 4.0 industrial revolution is considered a future project that fully integrates IT, Internet of Things, and Artificial Intelligence technologies in producing, that is leading to the new concepts such as Smart Manufactory (self-learning and self-regulating production systems and processes) and Smart Technology (fully automated computer-aided system controlling the entire working process). (Zhang, Cheng, and Boutaba 2010).

These new capabilities operate and manage processes independently and autonomously are allowing full development of autonomous decision processes in the logistics and transportation field, called Smart Logistics. The key trend in Smart Logistics is the birth of new intelligent vehicles and self-driving cars model in transport infrastructure basing on Big Data and IoT (Lewis 2010)**,** this also brings more automatical and flexible logistics solutions. For example, a self-driving truck that can change the future of shipping was designed and introduced by Mercedes, which is the “Future Truck 2025” (Mell 2009) prototype.

Logistics providers improve service quality and process efficiency by anticipating and anticipating demand in advance of inquiries and orders, resulting in shorter delivery times base on predictive analytics big data, and predictive logistics. The planning of a smart city uses predictive algorithms to match logistical resource availability to demand. Base on analyzing customer buying behavior, thereby allowing same-day or one-hour delivery services are detected by Anticipatory Shipping, that allows logistics provider moving product to new distribution centers closer to where potential customers. For example, Amazon has

developed an Anticipatory Shipping application, which was granted a patent in 2013 for coming up with a method and system to deliver the intended package (Assunção et al. 2015).

Prospects and Conclusion

The world is going through the fourth industrial revolution. After the third industrial revolution, characterized by computers and global internet connectivity, the fourth industrial revolution is the revolution of digital transformation, digital technology, and artificial intelligence. Following the inevitable trend, the modern economy has been transitioning to a digital economy and smart production when digital technology and artificial intelligence crept into all areas of the economy and business activities. Big Data and data science are the technical foundations of this smart economy. Based on the reviews and discussions in this article, we have found some core values of Big data for the logistics industry as follows:

One of the main drivers of Big Data collection and analysis for companies these days is cost reduction. Real-time information and comparison with historical data play a very important role. Easy access to data in the supply chain can help businesses set benchmarks, optimize regulation, and find opportunities to reduce costs. Collected data can provide a company with a complete picture of its current supply chain to help make more relevant strategic decisions, this can help build a more cost-effective supply chain.

Second, Big data can help businesses increase customer satisfaction significantly. Indeed, it provides enough information for supervisors to choose the most ideal shipping methods, use the best carriers, reduce the possibility of damage and minimize delays. All of that leads to improved service. In short, by giving customers access to real-time data, companies and customers alike can quickly see what's going on in transit. That will help with problem-solving efforts.

Finally, on the issue of traceability, it is a heavy operation in terms of data processing. By leveraging Big Data, companies can improve the system's traceability performance, as well as reduce the time to perform work related to accessing, integrating, and managing the database of products that have been marked "revoked" or "repaired".

Thus, the significant impacts of Big Data on the logistics industry can be demonstrated through applications including blockchain technology, digitization of the logistics industry, develop outsourced logistics services (3PL) and E-logistics, home delivery service, big data analytics to make purchasing decisions, integrated Chatbots and Cobots, and improve logistics services 4.0. Therefore, Big Data is playing a key role in optimizing, improving productivity, and reducing costs for logistics activities. Big data has become a standard for collecting and analyzing huge amounts of information to increase the revenue of businesses.

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