

## **ANALYSIS OF THE BIG DATA CONCEPT AND ITS USE FOR LOGISTICS PROCESSES**

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**Abstract:** This article deals with Big Data analysis and subsequently the application itself for logistics. Today, it is possible to consider various opportunities to improve Big Data analysis and its logistics applications. The research is conducted by examining monitoring strategies based on, for example, technologies and relationships to financial performance. This article contains the attributes of big data, their effective forms of implementation, and the implementation methods themselves. Big data is a benefit to the industry, and nowadays it is inconceivable that a business should not work with a large amount of data it needs to collect, analyze, and transform into useful data to become more competitive.

**Keywords:** *Big Data, Analysis, Logistics processes, Cloud, Logistics 4.0.*

### **1. INTRODUCTION**

Some people believe that Big Data is just a big fad that will go away if they ignore it for long enough. It won't! The hype around Big Data and the name may disappear (which wouldn't be a great loss), but the phenomenon will stay and only gather momentum. What we call Big Data today will simply become the new normal in a few years 'time when all businesses and government organizations use large volumes of data to improve what they do and how they do it. Share how Big Data is used today, across lots of different industries, among big and small companies, to deliver real value [1].

Big Data provides an overview of how companies and organizations across all different industries are using Big Data to deliver value in diverse areas. covered areas including how retailers (both traditional bricks 'n' mortar companies as well as online ones) use Big Data to predict trends and consumer behaviors, how governments are using Big Data to foil terrorist plots, and even how a tiny family butcher or a zoo uses Big Data to improve performance, as well as the use of Big Data in cities, telecoms, sports, gambling, fashion, manufacturing, research, motor racing, video gaming and everything in between. Instead of putting their heads in the sand or getting lost in this startling new world of Big Data, the companies I have featured here have figured out smart ways to use data in order to deliver strategic value [2].

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## 2. BIG DATA USABILITY ANALYSIS

The combination of state-of-the-art technologies such as Web 2.0, which integrates with Industry 4.0 and the Internet of Things, has provided an opportunity for the industry to pay attention to. Finally, it is necessary to actively work with Big Data and its analysis [3]. Big data has become essential due to the rapid increase in information that needs to be processed. Big data occurs in various forms of connection to devices such as sensors, networking, transactional applications, web media, and more [4].

Using Big data technology, a data environment with a large amount of information was created. Although sensors, for example, have greatly simplified data acquisition and collection, they must also be properly processed to provide useful data and be used correctly. In the Big data sector, the information is contained in such an amount that it is almost impossible for ordinary software to identify, process, and use the information. Therefore, more advanced software is used that can identify hidden patterns, unknown correlations, market trends, and other useful business information [6].

Big Data has therefore gained popularity around the world, mainly due to increased performance and the use of new knowledge. Enormous amounts of information today are collectivized from several sources (enterprise resource planning (ERP), orders and logistics, information channels and social media, product lifecycle management, and data and information sources cooperating with technologies such as GPS, and RFID, smartphones, and many others) [6] [7].

According to research by Beroe, Inc., one of the leading providers of procurement information, the global business information market is expected to reach \$ 30.9 billion by 2022. Indispensable factors include analysis of Big Data, demand for data as a service, and demand for data [8].

### 2.1. Big Data trends

Big data is currently a priority source, whether public or private companies and healthcare institutions in the fight against the COVID-19 pandemic. Thanks to the advanced development of the cloud system, organizations of various sizes can analyze the volume of business data in real-time and make the necessary changes to business processes as needed (Fig. 1, 2) [9].

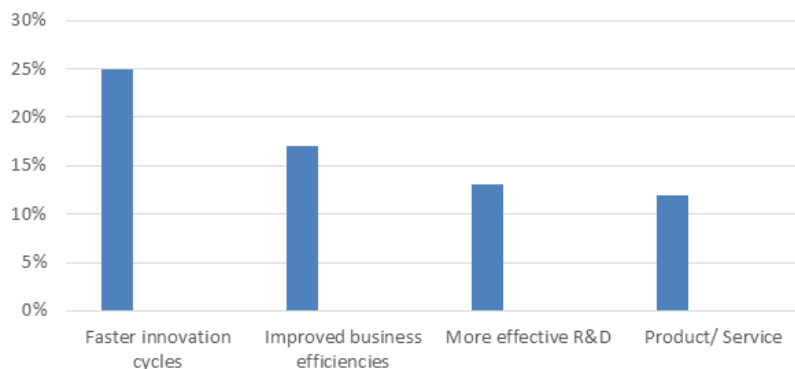


Figure 1. Top benefits that drive the use of data analytics, source: Chicago Analytics Group 2019 [9]

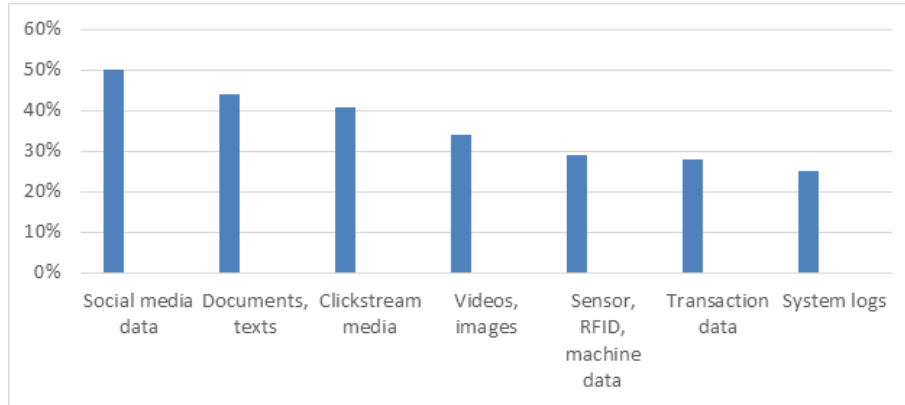


Figure 2. Areas where companies plan to increase their big data analysis investment, source: BI survey 2019 [10]

### 3. BIG DATA DEVELOPMENT FORECAST

#### 3.1. New enterprise data repository

While technology development is still advancing and industry and logistics are coming together from a wealth of data, this does not mean that centralized data centers and Cloud Computing technology are at the forefront of development, the exact opposite is true.

However, the evolution of connectivity of devices such as passenger cars to autonomous cars is encountering increasingly advanced uses (not only in heavy industry, manufacturing, or Industry 4.0 and other areas where Industrial Internet of Things technology is enormous, but it deals with the financial sphere to computer games). Another achievement of science and technology is the 5G network and everything it will allow in the future [11].

Nevertheless, the cloud is ready to modulate the core of the network, which will allow the collectivization of all market and development information. There is still room for public cloud growth. Figure 3 shows the increase in data for each year.

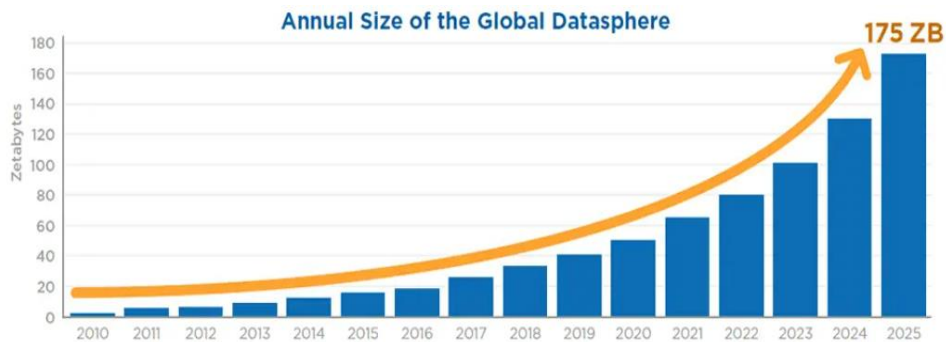


Figure 3. Annual Size of the Global Datasphere, source: IDC Datasphere

According to Seagate and IDC, the cloud is a new core. As part of the concept of digitizing the global portfolio, they found that by 2025, 49% of the data stored on a global scale could

be in a public cloud data center. This is because companies continue to push the cloud to increase data processing needs and extensive logistics [12].

#### 4. BIG DATA TRANSFORMING LOGISTICS

Logistics has undergone significant development thanks to Big Data and is gradually beginning to process supply chain information, to make better strategic and tactical decisions to improve business profitability, increase savings and improve customer relationships.

According to Gartner, Big Data is correction data when we consider data in large volume, high speed, and great variety (Fig. 4). Big data brings positive results even if it is necessary to introduce new and profitable processing methods to improve ideas, decision-making activities, and automation of production processes [14].



Figure 4. Use of big Data in logistics – source: Solstice [7]

Logistics, like other areas, performs corporate intelligence and data retrieval tasks to streamline processes, reduce costs and increase service levels. These goals can only be achieved through proper analysis and data collection.

Benefits of using Big Data in logistics:

- **Optimization:** improved service levels, times, resource utilization, and real-time predictive data coverage,
- **Commercialization:** access to valuable data that the marketing intelligence department analyzes and uses ahead of time,
- **Integration:** today's logistics solutions can be seamlessly adapted to most of the production and distribution processes. This results in updated information about the market, region, and customer operations. The big data lists this data to prevent and resolve interruptions,
- **Interconnection:** the potential of big data lies in strengthening the transmission and distribution network by analyzing information from the flow of goods, throughout the process, from receipt to delivery of the order,
- **Automation:** big data is used to automatically collect information from vehicles via routes, weather data, and traffic levels [11].

Specialized logistics companies help clients make better decisions using formal systems for processing and analysis of current and historical information of the company (stocks, routes, partners, etc.).

#### 4.1. Logistics 4.0

There has been a rapid improvement in logistics in the last 2 years. In 2022, these changes will move forward. The concept of digitization and sustainability has and will have a significant impact on the way work in logistics takes place in the future. The preview summarizes the biggest trends for 2022 [8].

For some time now, the entire logistics has been moving to Logistics 4.0. The designation is derived from the Fourth Industrial Revolution. Logistics 4.0 as a new era of logistics is based on digitization, more involvement of automation, and, finally, the interconnection of devices across companies. The goal of Logistics is to simplify processes, increase efficiency and stabilize global supply chains. It is in these times of pandemics that it is necessary to identify threats in the supply chain and eliminate them immediately.

Logistics 4.0 is associated with various issues that will have a key impact on the future of logistics (Big Data, machine use and automation, and networking). Digitization is already noticeable in the field of transport, autonomous driving on the one hand represents road safety, on the other hand, it also benefits the fluidity of road traffic [11].

Data is a crucial factor for logistics and is becoming more and more important as the volume of data increases. With ever new software and smarter hardware, more and more data can be collected and exchanged with each other. Based on the respective data, the logistics companies involved can conclude the past and provide forecasts for the future.

The aim of deploying Big Data and intelligent networking of market participants is to stabilize the entire supply chain and anticipate and avoid potential failures or disruptions or develop alternative plans to still meet the specified schedules. The data can also be used to optimize transport routes to improve their efficiency (Fig. 5) [8].

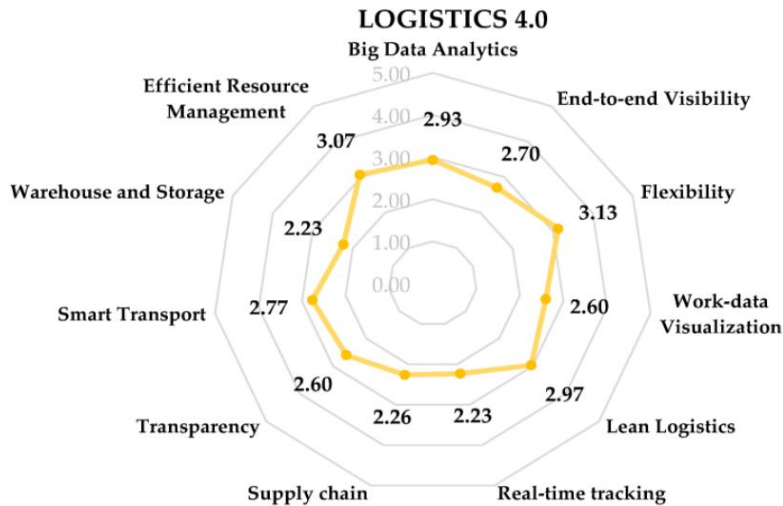


Figure 5. The maturity level of Logistics 4.0 – source: MDPI [13]

## 5. CONCLUSIONS

This article shows that even in times of pandemics, the logistics process is much more used. Therefore, it is necessary to keep up with technical developments. Data analysis of logistics processes brings many benefits for companies. At the same time, the areas in which big data analysis is needed have expanded. Logistics companies are forced to process huge amounts of big data. Procurement of data centers that can process large amounts of data can be financially burdensome for a business, but the financial return on investment is guaranteed to show.

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## REFERENCES

- [1] *Data Age 2025: the datasphere and data-readiness from edge to core*. Retrieved from <https://www.i-scoop.eu/big-data-action-value-context/data-age-2025-datasphere/>
- [2] *The Digitization of the World From Edge to Core*. Retrieved from <https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf>
- [3] Pati, S. (2021) *Top 10 big data analytics trends and predictions for 2022*. Retrieved from <https://www.analyticsinsight.net/top-10-big-data-analytics-trends-and-predictions-for-2022/>

- (accessed: September 21, 2021)
- [4] *Big data and analytics: definitions, value, trends and applications*. Retrieved from <https://www.i-scoop.eu/big-data-action-value-context/>
  - [5] *Big Data is transforming logistics*. Retrieved from <https://blog.solistica.com/en/big-data-is-transforming-logistics> (accessed: July 22, 2019)
  - [6] Jay, A.: *11 Big Data Trends for 2022/2023: Current Predictions You Should Know*. Retrieved from <https://financesonline.com/big-data-trends/>
  - [7] *Logistics Trends 2022: The Future of Logistics Is Digital and Sustainable*. Retrieved from <https://dhl-freight-connections.com/en/trends/logistics-trends-2022-the-future-of-logistics-is-digital-and-sustainable/>
  - [8] Çınar, Z. M., Zeeshan, Q. & Korhan, O. (2021). A Framework for Industry 4.0 Readiness and Maturity of Smart Manufacturing Enterprises: A Case Study. *Sustainability* **13**, 6659. <https://doi.org/10.3390/su13126659>
  - [9] Gregor, T., Krajcovic, M. & Wiecek, D. (2017). Smart Connected Logistics. *Procedia Engineering*, **192**, 265-270. Transcom 2017, 12th International Scientific Conference of Young Scientists on Sustainable, Modern and Safe Transport. High Tatras, Grand Hotel Bellevue, Slovakia. 31. 05-02. 06. 2017. <https://doi.org/10.1016/j.proeng.2017.06.046>
  - [10] Fusko, M., Rakyta, M., Krajcovic, M., Dulina, L., Gaso, M. & Grznar, P. (2018). Basics of Designing Maintenance Processes in Industry 4.0. *MM Science Journal*. March 2018, 2252-2259. [https://doi.org/10.17973/MMSJ.2018\\_03\\_2017104](https://doi.org/10.17973/MMSJ.2018_03_2017104)
  - [11] Gregor, M., Hodon, R., Biňasová, V., Dulina, L. & Gašo, M. (2018). Design of Simulation-Emulation Logistics System. *MM Science Journal*. October 2018, 2498-2502. [https://doi.org/10.17973/MMSJ.2018\\_10\\_201878](https://doi.org/10.17973/MMSJ.2018_10_201878)
  - [12] Marr, B. (2016). *Big Data in Practice*, Wiley, United Kingdom, <https://doi.org/10.1002/9781119278825>
  - [13] Bahga, A. & Madiseti, V. (2019). *Big Data Analytics: A Hands-On Approach*, Book Website: [www.hands-on-books-series.com](http://www.hands-on-books-series.com)
  - [14] Patnaik, S. (ed.) (2020). *New Paradigm Of Industry 4.0: Internet Of Things, Big Data & Cyber Physical Systems*, Springer, <https://doi.org/10.1007/978-3-030-25778-1>