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THE POTENTIAL OF BIG DATA SOLUTION APPLICATION IN LOGISTICS

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Abstract. Big Data, which appeared as a result of changes in the structure of generated data and the development of new technologies, is attracting more and more attention from both scientists and business practitioners. A lot of companies are adopting Big Data analytics for all-round business development and gaining additional competitive advantages. At the same time, it is known that Big Data analytics is a global trend that is changing the approach to managing organisations. However, despite the importance of this technology to competition, small and medium-sized companies have not shown much interest in such technologies. The aim of the paper is to analyze advantages resulting from its application in different areas of logistics such as supply chain or inventory optimization and to identify the prospects Big Data analytics using in small and medium-sized transport and logistics companies. In the process of research work, there were applied theoretical research methods, such as case method, source research, statistical analysis, synthesis and comparison. The practical part of this study contains an analysis of the best practices for using Big Data analytics in logistics, as well as the conclusions formulated on the basis of this analysis. The relevance of this work is due to the global growth in the volume of data in the world, the development of new technologies and the growing interest in this issue from the scientific community. Taking into account the fact that the development of Big Data analytics is seen as the basis of the company's competitive advantages, ignoring these technologies by small and medium-sized logistics companies can, in theory, lead to their complete withdrawal from the market.

Keywords: Big Data, logistics, optimization, business, supply chain, economy efficiency, technology, analytics, global trend, tools, business development.

Introduction

Today's “Digital universe” is changing and expanding at a rate that doubles the amount of data every two years (Jeske et al., 2014). In addition to this exponential growth in the volume of information, its qualitative characteristics also change significantly.

First, the types of data themselves are expanding due to the emergence of new devices capable of accumulating and transmitting information: smartphones, RFID (Radio-frequency identification) webcams and web sensors have firmly entered our life. Essentially, all of these devices are a huge number of autonomous data sources that continuously generate streams of data without human intervention.

Second, the vast majority of newly generated data comes from CCTV (Closed-circuit television) camera images, blog entries, forums, discussions, and e-commerce directories. This data is unstructured, chaotic and not always reliable. All these trends have led to the emergence of a fundamentally new direction – Big Data processing technologies. In the broad sense of the word, this is a set of approaches, tools and methods for processing both structured and unstructured data of huge volumes of information arrays of various types in the context of its continuous growth and actualization (Manyika et al., 2011).

It is believed that these technologies are most effectively implemented in logistics. Today, logistics providers manage the mass flow of goods, and in the process of this management, in turn, huge datasets are created. And the larger the logistics operation, the higher the requirements for efficient data operation. However, the amount of data that is generated in the world is growing exponentially, and the current IT tools are becoming insufficient, which gives rise

to problems in this area. To solve potential problems, the concept of Big Data was born a few years ago, which allows you to efficiently accumulate, store, analyze and manage the amount of data that significantly exceeds the functionality of traditional systems.

Working with Big Data today is part of the development of the company and life in general, and also has a solid scientific approach, despite the continuous study these days. In academic area, researchers have given a new concept as Big Data in this practice, which also has been a new trend of application in the field of transport & logistics (Tiwari et al., 2018).

The aim of the paper is to analyze advantages resulting from its application in different areas of logistics such as supply chain or inventory optimization and to identify the prospects Big Data analytics using in small and medium-sized transport and logistics companies.

This is understood by logistics companies themselves, as shown by the survey "Logistics Trends and Strategies" conducted by BVL International (Handfield et al., 2013), according to the results of which 60% of respondents said they plan to invest in Big Data analytics during the next five years.

Today, pioneers and innovators in the implementation of Big Data technologies are global and transnational companies that contribute to the dissemination of the achievements of scientific and technological progress in this area (UNECE/HLG, 2014). That is why the study of their experience in this area is of undoubted interest.

1. Related works

The ability to conduct high performance analyses is one of the biggest advantages resulting from the application of Big Data in contemporary organisations and particularly in the logistics domain. T. Davenport mentions new data utilization and value-related opportunities such as: "cost savings, decision changes, and product and service improvements, and also notes that by adding Big Data, decisions of different types can be enhanced. Big Data can support many business applications, but organizations must develop a prospecting plan". There are several ways Big Data can be used to enhance a business, such as:

- **Saving money by leveraging Big Data technologies.** For example, Citi uses free open source software (Hadoop) and inexpensive commodity servers to support big data analytics.
- **Making routine business decisions faster.** Caesars uses real-time interventions to provide gamblers with coupons that increase customer retention. UPS uses Big Data to support real-time routing, which has saved the company around 85 million gallons of fuel.
- **Supporting new types of decisions.** United Healthcare has started analyzing call center conversations to identify signs of customer dissatisfaction that might lead to attrition. Schneider uses sensors in its trucks to indicate when and where refueling should occur, as well as to predict hazardous driving behaviors.
- **Developing new products and services.** One of the most exciting applications for Big Data is new product development. Examples include the Nest thermostat and Monsanto's predictive planting service which is based on weather data analysis (Davenport, 2010).

As companies consider how to prospect for Big Data projects, they may wonder whether to first analyze their data or evaluate their customer needs. As Professor Davenport says "Organizations must understand the business context, as well as their information assets".

These solutions will boost business efficiency and competitiveness (Kott et al., 2015) and generate huge benefits for customers (Chen et al., 2014). Big Data used in enterprise business activities can contribute to the transformation of logistics business processes in the distribution field, for example, by quantifying optimum inventory levels and improving supply chain activities, as well as in other areas such as sourcing, product development, production, marketing, sales and human resources (Schmarzo, 2013). In the form of small logistics enterprises, it also affects local economies (Wiśniewska-Sałek & Nowakowska-Grunt, 2014). The results of the Accenture company survey show the results obtained by companies through the application of Big Data which are shown in Figure 1 which include improvement in customer service, quicker and more effective response time to supply chain issues, improvement in supply chain efficiency, greater alignment in the supply chain, optimization of inventory more efficient decision-making process. Big Data is having an impact on organizations' reaction time to supply chain issues (41%), increased

supply chain efficiency of 10% or greater (36%), and greater integration across the supply chain (36%). This research found that companies are achieving significant results using Big Data analytics to improve supply chain performance and gain greater contextual intelligence.

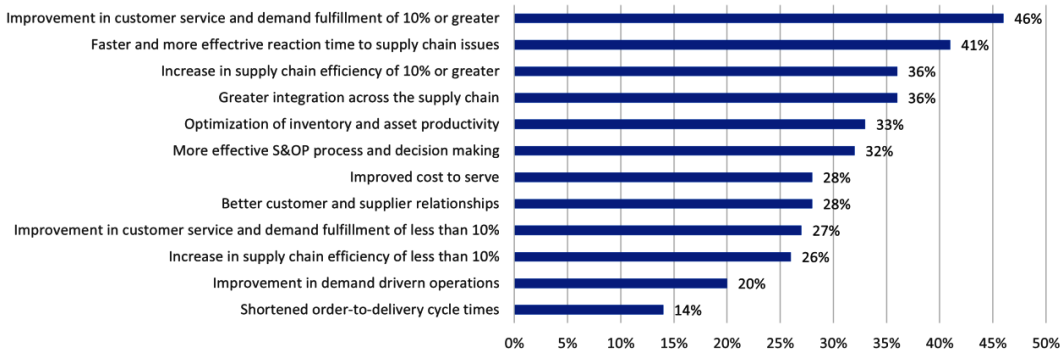

Figure 1. Big Data advantages (Accenture, 2014)

L. Columbus notes that "Big Data is revolutionizing how supplier networks form, grow, proliferate into new markets and mature over time. Transactions are not the only aim, based on the insights gained from Big Data analytics, building knowledge-sharing networks (Columbus, 2016). He also argues that "Big Data and advanced analytics are being applied at a rapid pace in optimization tools, demand forecasting, integrated business planning and supplier partnership and risk analytics" and highlights the fact that" 64% of supply chain managers consider Big Data analytics to be a disruptive and important technology, laying the groundwork for long-term change while 5% of chain managers voted for irrelevant position of this type of analytics. Below given Figure 2 is shown other indexes of technologies for supply chain.

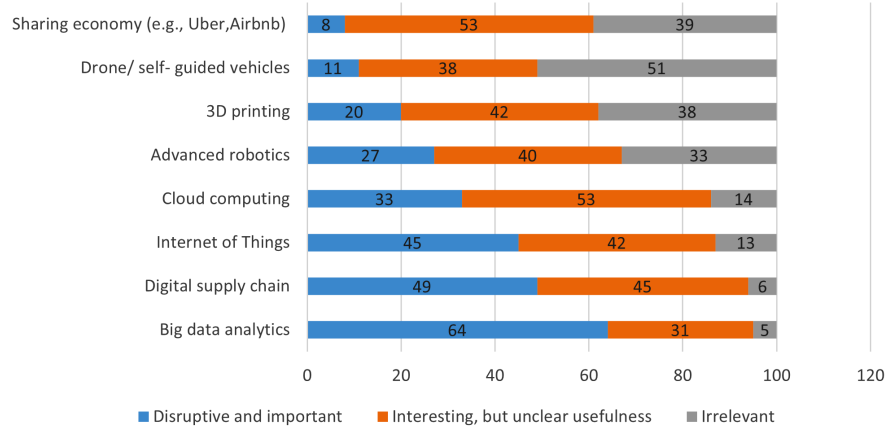

Figure 2. Disruptive technologies for supply chain (SCM World, 2015)

The analysts of the McKinsey company say that Big Data is used in "inventory management in the supply chain areas where additional details offered by advanced analytics mining multiple datasets can continue to improve the inventory management of retailers together with an automated bar code system. The authors argue that "inventory management enables stock forecasting to be enhanced by integrating several datasets such as sales records, weather forecasts and seasonal sales cycles" (Manyika et al., 2011). This approach enables transport optimization through the use of GPS-enabled Big Data Telematics and route optimization to improve fleet and distribution management" in distribution and logistics optimization (Manyika et al., 2011). They also note that "transport analytics by optimizing fuel efficiency, preventive maintenance, driver behavior, and vehicle routing can improve productivity". Finally, in order to inform supplier negotiations, Big Data can be used where retailers can evaluate consumer desires and purchasing behavior in order to inform their supplier negotiations. "A primary competitive advantage for logistics providers is

optimum resource utilization. Big Data techniques boost planning efficiency and the level of detail achieved, allowing logistics providers (Grondys et al., 2014) to precisely balance demand and resources available, and logistics providers can protect customer operations with Big Data tools and techniques by conducting predictive analytics on a global scale" (Kuckelhaus et al., 2013).

2. Methodology

In the process of research work, theoretical research methods were applied, such as source research, statistical analysis, synthesis and comparison. Given approaches help us to find best solution for the main aim of improving efficiency using Big Data tools. Moreover, these types of methodologies meet all expectations of the main Big Data integration and using in logistics enterprise cases.

Analysis of the literature revealed a number of possible ways to use Big Data analytics in logistics companies. It was found that the main areas of application could be optimization of routes during transportation, optimization of a vehicle repair plan, reducing the cost of storing goods awaiting delivery, as well as forecasting the demand for transportation services through predictive analytics methods. To solve this problem, it was decided to use the **case method.** In turn, the case method is not based on previous literature, but uses actual examples from real life as a basis, which avoids the problem of lack of data.

It was also decided that the study will be carried out on the basis of an analysis of several cases, since the goal is to determine how to use certain technologies in a specific type of business in order to identify existing patterns.

After the choice of the case method as a research method is justified and its main characteristics are determined, it is necessary to develop a **research methodology**. The methodology proposed by R. Yin is taken as a basis.

The **research methodology** was as follows:

1. Statement of a research question;
2. Selection of relevant cases;
3. Analysis of each case separately;
4. Cross-case analysis;
5. Formulation of preliminary results;
6. Comparison of preliminary results with the studied literature on the subject;
7. Formulation of the final conclusions of the study (Yin, 2014).

The research question stage was described earlier in this chapter and is formulated as "**How the players in the logistics market are using Big Data analytics at the moment".**

Having described the methodology, below is a description of the analyzed best practices of Big Data analytics in logistics.

3. Examples of implementing Big Data analytics in logistics

As part of the preparation of the work, 10 different examples of the use of Big Data analytics in logistics were collected and studied.

3.1. UPS

A prime example of the use of Big Data analytics in the logistics business is United Parcel Service, better known as UPS (Lekoudis et al., 2005). UPS processes more than 40 million requests to locate their order every day, owns more than 100,000 vehicles worldwide, and transports 2.7 million units of cargo per day, according to the company's official website. Datafloq estimates the company stores over 16 Petabytes of data, which is the equivalent of 16 million Gigabytes. The company uses this data for completely different purposes.

One of the applications of Big Data analytics is to reduce environmental impact. UPS tracks more than 200 metrics for each vehicle, including engine status, mileage, average speed and number of stops. This data is used to reduce the amount of greenhouse gases emitted. The collected data is also used to track the driving behavior of drivers. If the system sees that the driving style deviates from the norm, the driver is sent for additional training.

UPS uses Big Data analytics to optimize its business. The company determined that left turns are ineffective as they force the vehicle into oncoming lanes, which slows down its speed. The company banned its drivers from unnecessarily turning left, which allowed for faster delivery despite the simultaneous increase in route distance. Another example of optimization is tracking the condition of a company's vehicles. Using sensors located in vehicles, the company can track their need for service, which allows it to reduce the cost of maintaining its fleet by reducing the number of emergency and major repairs.

One of the most striking examples of the use of Big Data analytics at UPS is the ORION project, or On-Road Integrated Optimization and Navigation, on which the company spends about $ 1 billion annually. The basis of the project is a mathematical algorithm that is used in real time to optimize the route of the vehicle. The system is capable of generating 10 thousand different route options per minute. The system also allows the development of new driving practices to improve driver efficiency.

In addition to optimizing and caring for the environment, UPS is using Big Data to develop new services for its customers. This is how the My Choice service was created, giving customers the ability to change the time and place of order delivery.

3.2. DHL

DHL is another successful example of Big Data analytics in logistics. Like UPS, DHL uses Big Data analytics to optimize shipping routes in real time. In addition, the system also monitors situations when the client notes that he will not be able to accept the parcel at the previously specified place and at the specified time in order to avoid aimless travel. In addition, the company also monitors the condition of its cars for problems to plan repairs, and also records the amount of exhaust gases emitted by cars (Singh et al., 2006).

DHL is also using Big Data analytics to predict shipping needs over the next 48 hours. This allows the company to properly allocate its resources, which increases their utilization, as well as increase customer satisfaction, avoiding unexpected peaks in demand in certain areas.

For the B2C (Business-to-Consumer) segment, the company has developed the DHL MyWays application. The service allows its members to pick up orders along the way and deliver orders to places that lie along their route. This service allows the company to significantly reduce the costs of the last mile, which it considers the most expensive in the route, using the natural movement of citizens around the city. The company uses Big Data analytics to track the position of couriers and cargo and correlate them, showing the courier exactly the cargo and delivery locations that lie along its route.

Another product of the company for the B2B segment is the DHL Geovista service. The service allows users to forecast sales in potential new markets as well as track the level of competition in existing markets. All this allows companies to effectively change their business model based on the information received.

3.3. FedEx

FedEx was founded in 1971 in Memphis, USA. The company's revenue for 2016 was $ 50 billion (Li et al., 2006). The company is known for its commitment to implementing modern technologies to make informed decisions, as well as to improve business efficiency.

The company is actively investing in technologies for automating warehouse operations, introducing smart trucks to optimize routes and reduce fuel consumption, as well as in the development of new software products, including for its customers. The company also introduced modern pricing and processing systems for large volumes of orders from online retailers. The second point allows the company to establish effective relationships with online stores, establishing interaction with which the company considers one of its most important priorities.

One of the examples of Big Data analytics implementation in a company is the SenseAware project. This is a product that allows you to track in real time the location and status of the order, as well as indicators such as humidity, temperature, atmospheric pressure and illumination of the place where the package is located. This product is used both by the company itself and is offered for sale to everyone.

FedEx also uses sophisticated mathematical models powered by Big Data to predict consumer responses to a company's tariff changes or new product and service introductions.

3.4. Walmart

Walmart is one of the most successful retailers in the world. According to official figures, the company makes $ 36 million daily from its 4,300 stores located in the United States. Walmart collects 2.5 Petabytes of unstructured customer data every day (Singh et al., 2018). The company is estimated to have information on 145 million US citizens. To date, the company has learned to use the collected data to optimize inventory at the level of one store in the chain, depending on the information about consumers in the area of its location. The company also currently has 10 active sites localized for different regions of the world. The company analyzes about 100 million keywords every day to correctly determine their meaning.

Walmart actively collects data about its consumers and their shopping habits in order to offer them exactly what they need. To do this, the company uses various technologies to analyze social networks and websites. She currently uses Hadoop technology to collect various information for 10 of her sites and aggregate into a single database. In addition to Hadoop technology, the company has also implemented MapReduce and NoSQl technologies, as well as developed its own data processing technologies. To effectively use the collected data, the company created a department called Walmart Labs, which is also developing new software. However, in addition to it, the company has also created the open platform Thorax and Lumbar, which enable developers to create programs for Big Data analytics.

The company also developed the Get on the Shelf platform, which allows anyone to offer their product to a large audience. Site visitors vote for their favorite products and the most popular ones go to Walmart stores.

3.5. Amazon

The company was founded in 1994 by entrepreneur Jeff Bezos in Seattle (Lincoln IV, 2018). The company has a market capitalization of $ 430 billion today. The company's total revenue for 2016 was $ 135 billion, and the company's operating income for the same period was $ 4.1 billion. Notably, 75% of this operating profit comes from the AWS (Amazon Web Services) cloud computing and new software division.

The company uses all these data to optimize its activities, since, despite its significant capitalization, the company is experiencing problems with profitability, therefore, the company focuses a lot on reducing costs.

Amazon uses its order data to locate its warehouses as close as possible to the largest points of consumption. The company also uses forecasting technologies to anticipate orders from its customers and send goods to the correct warehouse before making a purchase. All this allows the company to reduce transportation costs by 10–40%.

The company has also implemented a Big Data analytics-based personnel appraisal system called the Anytime Feedback Tool. It allows an employee to rate one another and then rates each employee based on the collected data.

The effectiveness of the recommendations is enhanced by the company's price proposals. Amazon keeps track of stock availability, competitor prices for similar products, which products are currently most popular, and their customers' wishlists and order history to boost their sales. The price of an item in an Amazon online store usually changes every 10 minutes.

As mentioned, in addition to its core business, Amazon uses Big Data analytics as part of the AWS division. The company has developed a software solution, Amazon Elastic MapReduce, which allows you to analyze and manage large amounts of data. In the same way Amazon company applied what is called "Antizipatory Shipping" aiming to optimize the delivery time by relying on various sources such as the purchase and search history, notepads or wish lists and the time the mouse pointer stays on certain offers. consequently therefore, that help Amazon company to deliver goods to a delivery warehouse that customers in this region have not yet warehouse ordered (Berthold, 2019).

3.6. Cargomatics

Cargomatics was founded in the USA in 2013. The company represents a business model like Uber. Venture capital investments totaled $ 12 million over four rounds of investments. The company's revenue for 2016 was $ 5 million. The company employs 40 people (Hofmann & Osterwalder, 2017).

The company does not have its own trucks. The main asset of the company is an internet platform that brings together shippers and truck owners. Unlike traditional logistics companies, Big Data analytics at Cargomatics is the

backbone of the business model on which all of the company's services are built. Big Data analytics are essential for the company to track carriers' trucks in real time and to improve platform performance.

3.7. Convoy

The company was founded in 2015 in the USA. Like Cargomatics, the company is a representative of a new business model in which the main asset of the company is not vehicles, but an online platform where shippers place orders, which are then distributed among carriers registered on the platform. The company employs 16 people.

As in the case of Cargomatics, for Convoy Big Data analytics is an integral part of the business model, therefore the company uses various Big Data analytics such as tracking and predictive analytics.

3.8. MAN

MAN is part of the Volkswagen Truck Bus Group. The main product of the company is freight transport (Samal, 2019). The company has developed an open platform RIO, which unites all aspects of the transport process: shippers, carriers, dispatchers, drivers and consumers.

RIO is an open platform, on the basis of which third-party developers, along with the developers of MAN, can create various software products.

At the moment, the platform has the following functionality. First, the platform directly transmits to the driver the actual requests for cargo transportation. Secondly, the Truck Share application has been created on the platform, which is an aggregator of the vehicle fleet and allows drivers to exchange cars. Third, RIO uses the Loadfox app to allow part-load truck drivers to pick up additional orders along the way. In addition, the platform allows tracking the technical characteristics of trucks.

3.9. General Electrics

Since 2012, General Electrics has been introducing modern sensors into its turbines, trains and engines of various types. The data collected from these sensors is subsequently used by both the company's customers and General Electrics itself. Customers get the opportunity to use data to both reduce their costs and improve the quality of customer services, while avoiding the costs of collecting Big Data and implementing technologies for their analytics. At the same time, General Electrics receives data on the quality of its products, which allows the company to identify potential development opportunities for its products (Ngoie, 2014).

3.10. Fleet Risk Advisors Inc.

The company has developed a software product that collects data on the driver's work schedule, travel speed, route distance, travel time and about the driver, including his driving habits. Further, all this information is used to assess the likelihood of a particular driver participating in a road accident. This technology allows companies to avoid road accidents involving their warriors, thereby reducing costs and increasing the reliability of transportation.

Table 1 presents generalized data on the given cases and technologies that are used in them. Table 1. Brief description of the analyzed use cases of Big Data analytics in logistics

No.	Company	Issues	Technologies
1	**UPS**	Reduced emissions, vehicle health monitoring	Vehicle and cargo tracking, data analysisfrom sensors/ detectors
		Reduced delivery time	Real-time route optimization
		Driver training	Data analytics from sensors and vehicle tracking
		Improving customer service	Analyzing customer data from a company application
2	**DHL**	Reduced emissions, vehicle health monitoring	Vehicle and cargo tracking, data analysisfrom sensors/ detectors
		Reduced delivery time	Real-time route optimization
		Demand forecasting	Predictive analytics
		Creation of new products	Analysis of historical order data, analysis ofcustomer data

End of Table 1

No.	Company	Issues	Technologies
3	**FedEx**	Reduced emissions, vehicle health monitoring	Vehicle and cargo tracking, data analysisfrom sensors/ detectors
		Reduced delivery time	Real-time route optimization
		Creation of new products	Analysis of historical order data, analysis ofcustomer data, vehicle and cargo tracking
		New product development and pricing	Predictive analytics, econometric modeling
4	**Walmart**	Demand forecasting	Analysis of data from social networks and the Internet
5	**Amazon**	Logistic network design	Descriptive analytics
		Demand forecasting	Predictive analytics
		Improving customer service	Sharing data analytics from sensors andsensors and vehicle tracking
6	**Cargomatics**	Vehicle management	Vehicle tracking
		Demand forecasting	Predictive analytics
		Improving customer service	Historical data analysis
7	**Convoy**	Vehicle management	Vehicle tracking
		Demand forecasting	Predictive analytics
		Improving customer service	Historical data analysis
8	**MAN**	Creating a new business model	Descriptive analytics
9	**General Electrics**	Creation of new products	Data analysis from sensors/detectors
		Creation of new services for clients	
10	**Fleet Risk AdvisoryInc.**	Vehicle management	Vehicle tracking

4. Cross-sectional analysis of Big Data analytics use cases

After describing the found examples of the use of Big Data analytics in logistics and analyzing each of them separately, an analysis of all selected cases was carried out. Based on the analysis, four groups of cases were identified that have common characteristics. The groupings were based on the type of company that implemented the Big Data technology and whether the company was directly or indirectly associated with the logistics industry. ***The first group includes large logistics companies that have implemented Big Data analytics technologies. These*** include UPS, DHL, FedEx. All these companies have a traditional business model, when the company generates the main income by providing transportation services for various goods. All of these companies have gradually introduced Big Data analytics. In all of the examples reviewed, however, companies did not limit their implementation of Big Data analytics to one functional area, such as demand forecasting or freight transportation. On the contrary, these companies are using Big Data analytics to drive their business forward. Big Data analytics in these examples were used to optimize the shipping process and shorten delivery times; reduction of carbon dioxide emissions and control over the condition of vehicles; improvement of customer services by providing more detailed information about the cargo and analysis of customer needs; as well as the creation of new software products based on the company's own developments, which were subsequently offered to other players in the logistics market.

The second group includes young companies using a new business model, in which the Internet platform becomes the main asset of the company, and value is created due to the ease of transactions on the platform, as well as the number and variety of platform participants. This group includes Cargomatics, Convoy and MAN. Moreover, this group can also be divided into two subgroups.

The third group includes technology companies that develop software for analyzing Big Data for logistics. Such companies included Fleet Risk Advisory Inc., General Electrics, MAN. Despite the fact that General Electrics and MAN are not technology companies, their interaction with direct players in the logistics market is no different from how the described technology companies interact with them. All of these companies develop highly specialized software that uses only one Big Data analytics method. The clients of such companies are organisations that cannot

independently develop such technologies, or are afraid to take risks associated with their development. However, it should be noted that these companies are not aimed specifically at the logistics market. It would be more correct to say that potential clients of such companies are organisations that have their own vehicles, regardless of the field of activity. Also, none of the companies currently offers a comprehensive logistics solution that would include various solutions in the field of Big Data analytics. An exception is MAN, which has attempted to develop such a solution collectively by creating an open online platform.

The fourth group can be called "Other". It included Amazon and Walmart. All these examples relate to the field of application of Big Data analytics in logistics and are of great interest, however, according to none of the criteria, they can not be attributed to one of the three main groups.

5. Final conclusions of the analysis of examples of the use of Big Data analytics in logistics

Based on the cross-sectional analysis of the cases, a number of conclusions were made, which were correlated with the studied scientific literature on the subject, in order to compare the direction of scientific research on Big Data analytics in logistics and the application of such technologies by practitioners.

The first result of the study was the compilation of a rating of the popularity of Big Data analytics technologies in logistics based on the studied company cases. In total, 26 ways of using Big Data analytics in logistics were identified, of which 15 unique ones can be distinguished. Next, an analysis of all Big Data analytics technologies used in logistics was carried out, after which indicators of the frequency of use of such technologies were derived. Indicator values have been rounded to the nearest whole number. The calculation results are presented below:

- Vehicle tracking – 23% (6 mentions of 26);
- Predictive analytics – 19% (5 mentions out of 26);
- Analysis of data from sensors and detectors – 15% (4 mentions of 26);
- Descriptive analytics – 12% (3 mentions out of 26);
- Sharing data analytics from sensors and sensors and vehicle tracking – 8% (2 mentions out of 26).

As can be seen from the above list, the most popular are vehicle tracking technologies, predictive analytics and data analytics from sensors and sensors installed in vehicles.

Further, a number of conclusions were drawn based on the study of the first selected group of companies. First, as the analysis has shown, such companies use Big Data analytics not only in logistics as such. Despite the fact that logistics is their main field of activity, the companies also have marketing and strategy departments, whose activities have a significant impact on the company's overall position in the market.

Another conclusion follows from this. Big Data technologies are used by Big Data for the full and comprehensive development of the company. Such technologies allow top management to make more informed and, as a result, high-quality decisions, provided, of course, their ability to correctly comprehend new data. However, this question is not related to the research goal of this work and therefore is taken as a fixed premise. Thus, it can be argued that Big Data analytics technologies are becoming a strategic tool for the company. Again, this thesis is supported by research from consulting companies and analytical agencies in this area, which noted that Big Data analysts are changing the way they approach company management.

Companies that develop and sell Big Data analytics technologies allow conventional companies to avoid the costs of developing such technologies, purchasing and maintaining the necessary equipment, as well as finding the necessary specialists and paying them salaries. However, in this case, there are also limitations. Today, there is no company that would offer a comprehensive solution for Big Data analytics in logistics. Thus, a business cannot use the full range of such technologies. The number of partner companies will grow in proportion to the number of technologies used by the companies. This, in turn, will lead to an increase in the complexity of managing such technologies. Also, the company will not be able to achieve synergy between such technologies. Typically, data obtained from one technology is used in another, which allows you to increase the depth of data analysis. However, when using technologies from different companies, this becomes much more difficult, since the compatibility of programs from different developers becomes a necessary condition, which is rare on the market.

Conclusions

Big Data analytics is one of the key trends in the management of companies around the world. Many companies are starting to implement such technologies to improve the quality of their decisions. In addition, the interest of the scientific community in this topic is growing. However, Big Data analytics remains, in the minds of most, the prerogative of large companies. The problem of Big Data analytics in small and medium-sized businesses is practically not covered. The same is true for the logistics sector. As part of this research work, an analysis of the possibilities and limitations of the use of Big Data analytics in logistics companies was carried out.

In order to determine how in world practice such technologies are applied in logistics, an analysis of various cases selected for research was carried out. Based on the analysis, three groups of cases were identified:

– cases of large logistics companies,
– cases of platform companies with an innovative business model, and
– cases of companies developing solutions for Big Data analytics in logistics.

In addition, the analysis of the cases showed that the most popular technologies are vehicle tracking, data analysis from sensors and detectors installed in a vehicle, the combination of these technologies, as well as predictive demand analytics technologies.

Currently, the concept of running a logistics business is at the stage of rethinking. This paper explored how Big Data analytics can be used to help companies achieve a competitive advantage. However, when combined with machine learning and engineering breakthroughs, Big Data has the potential to transform the way a logistics business is run.

If now the logistics business is mainly focused on optimizing its activities, and the market is represented by large players who own large vehicle fleets, which have many exclusive contracts with shippers, then in the future the situation may change dramatically. Logistics services will be provided on Internet platforms, where cargo owners and vehicle owners will be represented. If now companies are focusing directly on the delivery process, then in the future, due to the automation of transportation, this need will disappear, and companies will focus their efforts on answering questions about where to do business and what kind of cargo to transport, which are aspects of a business strategy. In such conditions, the logistics market can potentially become more attractive for small and medium-sized logistics companies. Companies will be able to purchase vehicles and register them on platforms, extracting revenue from them, without the need to compete in prices and service levels with other logistics providers, since these parameters will be set by the platform itself.

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DIDŽIŲJŲ DUOMENŲ TYRIMO TAIKYMO GALIMYBĖ LOGISTIKOJE

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Santrauka. Didieji duomenys, atsiradę pasikeitus sugeneruotų duomenų struktūrai ir kuriant naujas technologijas, sulaukia vis daugiau mokslininkų ir verslo praktikų dėmesio. Daugelis įmonių taiko „Big Data" analizę visapusiškai verslo plėtrai ir įgyja papildomų konkurencinių pranašumų. Tuo pat metu žinoma, kad „Big Data" analizė yra pasaulinė tendencija, kuri keičia požiūrį į organizacijų valdymą. Tačiau, nepaisant šios technologijos svarbos konkurencijai, mažos ir vidutinės įmonės nerodė didelio susidomėjimo tokia technologija. Darbo tikslas – išanalizuoti pranašumus, atsirandančius dėl jos taikymo įvairiose logistikos srityse, pvz., tiekimo grandinės ar atsargų optimizavimo, ir nustatyti perspektyvas, susijusias su „Big Data" analitika naudojant mažas ir vidutines transporto ir logistikos įmones. Tyrimo metu buvo taikomi teoriniai tyrimo metodai, tokie kaip atvejo metodas, šaltinio tyrimas, statistinė analizė, sintezė ir palyginimas. Praktinėje šio tyrimo dalyje pateikiama „Big Data" analitikos naudojimo logistikoje geriausios praktikos analizė, taip pat šios analizės pagrindu suformuluotos išvados. Šio darbo aktualumą lemia pasaulinis duomenų apimties augimas, naujų technologijų plėtra ir didėjantis mokslo bendruomenės susidomėjimas šiuo klausimu. Atsižvelgiant į tai, kad „Big Data" analizės kūrimas laikomas įmonės konkurencinių pranašumų pagrindu, mažų ir vidutinių logistikos kompanijų ignoruojamos šios technologijos teoriškai gali lemti visišką jų pasitraukimą iš rinkos.

Reikšminiai žodžiai: didieji duomenys, logistika, optimizavimas, verslas, tiekimo grandinė, ekonomiškumas, technologijos, analizė, pasaulinė tendencija, įrankiai, verslo plėtra.