

## **THE POSSIBILITIES OF BIG DATA SOLUTIONS APPLICATION IN LOGISTICS**

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### **ABSTRACT**

Nowadays big data solutions are widely applied in different types of organizations. Such solutions bring multiple advantages in business activity of contemporary enterprises and especially in logistics area. The aim of the paper is to present the notion of big data solutions and advantages resulting from its application in different areas of logistics such as supply chain or inventory optimization. The paper also presents review of selected practical examples and case studies regarding big data application in logistics area.

### **1. THE NOTION OF BIG DATA**

Big data “embraces multiple methods, techniques and tools enabling conduct of different business analyses for the purpose of enterprises management. It may be deployed at strategic, tactical and operational level of management in different branches of companies” [5]. The crucial is the fact that data for the purpose of analyses may be structured, semi-structured or unstructured. Berman provides Big Data definition where this solution is defined by the three V’s: volume of data; variety of data e.g. database records, documents, images; velocity meaning data changeability. [2] F. Ohlhorst adds fourth element to this definition which is veracity – “where purity of the information is critical for its value” [19]. Gartner group provides the following definition “Big data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making” [12]. It is also worth presenting the definition of big data provided by K. Pries and R. Dunnigan where they perceive it as “the proliferation of data, both structured and unstructured, as the result of exponential growth in the capabilities of computer processing power, data storage capacity, the use of computers to mediate transactions and social interactions, and the density of sensors, all at a decreasing cost” [20].

Technologies such as big data transform perception of nowadays analytics. Huge amounts of data allow for preparation of different analyses for the purpose of organization's management. [6] Big data requires application of parallel data processing and resignation from classical scheme of data storage. [23] F. Ohlhorst distinguishes basic components of big data solutions such as: data mining methods and techniques, business intelligence systems, statistical applications such e.g. predictive and regression analyses, data modelling. [19] As far as the source of data for analyses are concerned B. Baesens distinguishes “transactional data consisting

of structured, low-level, detailed information capturing the key characteristics of a customer transaction usually stored in massive online transaction processing (OLTP) relational databases; unstructured data embedded in text documents (e.g., emails, webpages, claim forms) or multimedia content; qualitative, expert-based data” [1]. The source of data for analyses may also include: social networking and media, mobile devices such as smartphones and tablets, internet transactions, network devices and sensors. [12] Y. Kuksina presented “a survey of senior market participants with the objective of understanding recent trends in big data and analytics in electronic trading which was published by the Global Trading journal” [15]. The results showing decision making support as a key business driver for using Big Data technology may be related to other industries and especially logistics.

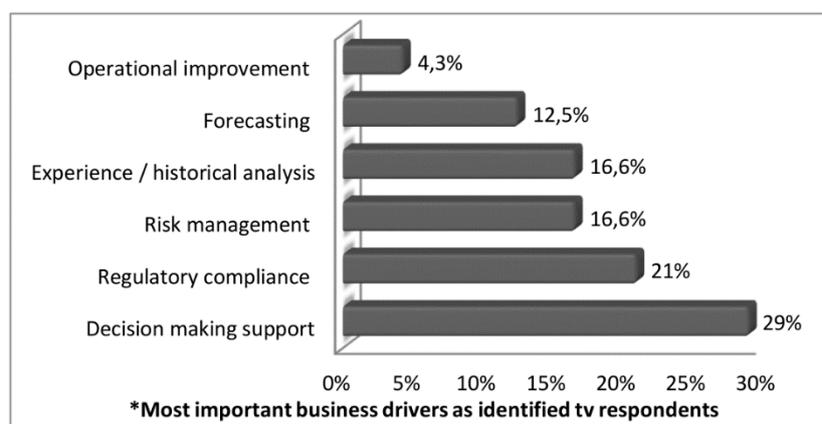


Fig.1

Key business drivers for using Big Data technology, [15].

As far as the technological platform for big data analyses is concerned it is worth mentioning such solutions as Hadoop platform “that facilitates the distributed processing of huge datasets through collections of product servers and is developed with scalable capabilities from a sole server to thousands of machines” [18]. Hadoop distributed file systems (HDFS) “attempts to enable the storage of large files, and does this by distributing the data among a pool of data nodes. MapReduce which can be used to develop applications to read, analyze, transform, and share massive amounts of data for parallel distributed computation involving massive datasets ranging from hundreds of terabytes to petabytes” [16]. Cloudera which “provides support for Hadoop in order to ensure enterprise-grade performance, data-access control, security and reliability” [18].

## 2. BENEFITS RESULTING FROM BIG DATA APPLICATION IN LOGISTICS

One of the greatest benefits resulting from big data application in contemporary organizations and especially in logistics domain is its ability to conduct high performance analyses. T. Davenport mentions new opportunities from data utilization and connected with value such as: “cost reductions, decision

improvements, and improvements in products and services and also states that decisions of various types can be improved by adding big data” [9]. Such solutions can improve the productivity and competitiveness [13] of enterprises and create huge benefits for consumers. [4] Big data applied in business activity of enterprises can contribute to transformation of business processes in logistics in the distribution area in e.g. quantifying optimal inventory levels and optimization of supply chain activities, and also in other areas such as procurement, product development, manufacturing, marketing, sales, and human resources. [22] It also influencing on local economies in context of small logistic businesses. [24] The findings of the survey conducted by Accenture company show the results achieved by the companies thanks to big data application and they are shown in the figure 1 and include improvement in customer service, faster and more effective reaction time to supply chain issues, increase in supply chain efficiency, greater integration across the supply chain, optimization of inventory, more effective process of decision making, better customer and supplier relationships, improvement in demand driven operations and so on.

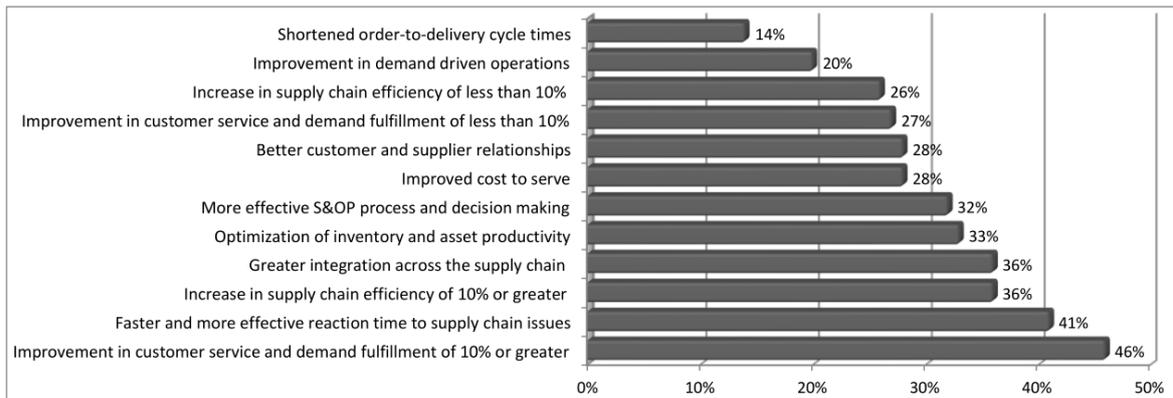


Fig. 2  
Big data advantages, [3]

L. Columbus states that “big data is revolutionizing how supplier networks form, grow, proliferate into new markets and mature over time. Transactions aren’t the only goal, creating knowledge-sharing networks is based on the insights gained from big data analytics” [7]. He also claims that “big data and advanced analytics are being integrated into optimization tools, demand forecasting, integrated business planning and supplier collaboration and risk analytics at a quickening pace” [7] and underlines the fact that “64% of supply chain executives consider big data analytics a disruptive and important technology, setting the foundation for long-term change management in their organizations” [7]. McKinsey company’s analysts claim that in the supply chain areas big data is used in “inventory management where additional detail offered by advanced analytics mining multiple datasets, big data can continue to improve retailers’ inventory management together with automated bar code system. The authors claim that “inventory management allows for improvement of stock forecasting by combining multiple datasets such as sales histories, weather predictions, and seasonal sales cycles” [17]. In distribution and logistics

optimization such solution “allows for optimizing transportation by using GPS-enabled big data telematics and route optimization to improve fleet and distribution management” [17]. They further state that “transport analytics can improve productivity by optimizing fuel efficiency, preventive maintenance, driver behaviour, and vehicle routing. Finally big data can be applied in informing supplier negotiations where retailers can analyze customer preferences and buying behaviour to inform their negotiations with suppliers” [17]. “Optimal utilization of resources is a key competitive advantage for logistics providers. Big Data techniques improve the reliability of planning and the level of detail achieved, enabling logistics providers [11] to perfectly match demand and available resources and with Big Data tools and techniques, logistics providers can secure customer operations by performing predictive analytics on a global scale” [14].

### **3. REVIEW OF PRACTICAL EXAMPLES AND CASE STUDIES**

One of the companies which uses IBM big data solutions is FleetRisk Advisors a business unit of Omnitrack located in the USA. The company utilizes “IBM PureData™ System for Analytics, powered by Netezza® technology which is a specialized platform for accelerated analytical processing. This enabled FleetRisk Advisors to transform its business and build a cloud-based, software-as-a-service (SaaS) platform capable of supporting three times as many clients as ever before. FleetRisk Advisors is a “specialized provider of advanced analytics solutions for the fleet management and logistics industries. It offers a range of services that help clients identify, predict and address issues before they affect the business focusing specifically on the areas of driver safety and fatigue, retention and recruiting, and workers’ compensation” [21]. The source data is constituted by telematics data and complex data models analyze the data and assess each driver for key risk factors such as miles driven, sleep opportunities and pay levels, compared to company averages. The authors of this case study further claim that “with its new analytics architecture in place, FleetRisk Advisors has the capacity to support a 300 percent increase in its client base” [21].

Another company applying big data technologies is Schneider National, one of North America’s largest truckload, logistics and intermodal services providers. The mentioned company has been using analytical optimization for several decades. They utilize “sensors for its trucks, trailers and intermodal containers which monitor location, driving behaviours, fuel levels and whether a trailer/container is loaded or empty” [8]. The author of the report states that thanks to deployment of “big data and more traditional data types the quality of the optimized decisions it makes with the sensor data is improving substantially, and the company’s use of prescriptive analytics is changing job roles and relationships. The company is introducing new sensors e.g. driving sensors all the time which may constitute the source of data for different types of analyses. Schneider is piloting a process where the sensor data, along with other factors, goes into a model that predicts which drivers may be at greater risk of a safety incident. [8]

The other company using big data solutions is DHL which processes real time information and DHL vehicles transport parcels rely on “dynamic routing system,

which recalculates the routes depending on the current order and traffic situation” [14]. The authors of cited case study state that “each driver receives instant driving direction updates from the on-board navigation system, guiding them to the next best point of delivery” [14]. Reduction of mileage “allows among other things for costs reduction. Due to MyWays software solutions last mile delivery is optimized as well. The solution implemented in DHL enables correlation of external data with internal network data which results in creation of Big Data Prediction Model that significantly increases operational capacity planning. Big data bring many benefits e.g. the resilience of entire supply chain is improved as well as emergency costs are reduced, proper service levels are maintained. DHL Geovista is an online geo marketing tool enabling analyses of business potential and it provides realistic sales forecast and local competitor analysis based on a scientific model and contributes to significant increase of data quality for planning purposes” [14].

## **SUMMARY**

Contemporary big data analytical methods, techniques and tools allow for performance of sophisticated analyses on the basis of different source data. Processed data may be indispensable for supporting decision making, improvement of business processes and supply chain in logistics. Big data solution might contribute to gaining competitive advantage of the organization which implemented it in its business activity and minimisation of risk in logistics and facilitation of logistics networks creation.

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