Article

Role of Analytics in Supply Chain Management Industry in Lithuania: Big Data Analytics & AI

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Abstract

Supply chain managers face a variety of obstacles when preparing for the future, as change is bound to happen. The increase in the importance of "big data" and also the use of "analytics" to analyze this data are two significant changes in the past few years. The analysis of big data is extremely important because it has the potential to yield significant value, and it is essential for companies to make use of the wide range of information sources by carrying out a comprehensive and accurate examination.

Goal: The purpose of this article is to showcase the constantly changing nature of supply chain management practices, predict the future impact of big data and analytics in SCM, emphasize the potential benefits of these trends, and offer guidance to leaders in the field of SCM.

Approach/technique/procedure: It is emphasized how crucial it is to derive value from the vast quantity of data accessible in the field of supply chain management. Definition of "big data" and analytics, with explanation of how they affect SCM applications.

Outcomes: Instances demonstrate how the supply chain management domain can be influenced by these recent trends and advancements. These examples have effectively adopted, utilized, and put into practice analytics that rely on large volumes of data. The existence of big data is undeniable, and utilizing analytics to derive valuable insights from this information has the power to create a significant influence. In summary, it can be stated that... It is important for supply chain managers to closely monitor these 2 trends because effectively incorporating "big data" analytics are able to keep them updated on advancements and alterations, ultimately enhancing their competitiveness.

Keywords

Data Analysis, Data Security, Supply Chain and Financial Outcomes, Logistics Industry

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1. Introduction

In this opening section, we will provide an overview of the topic at hand. The field of logistics and supply chain management (SCM) is a living and dynamic entity (Eccles 1954: p. 15) extremely energetic and constantly changing. In the past 50 years this has been particularly apparent. The field of distribution has evolved from its original definition in the early 1960s to encompass the entire organization, according to Stock (2013). 23). Instead of placing emphasis on finding ways to decrease expenses and improve service quality as mentioned by Christopher in 1998, the new priority is to guarantee a service that is consistent, dependable, and economically efficient.

Developments inside business source preparation, components require preparing, efficient client reply, buyer connection managing, listing managing, commuter routes management methods, just-in-time, factory management systems, complete quality management, collaborative preparation, forecasting as well as replenishment, among others, are due to innovative developments. 23). The progress made in these advancements was greatly dependent on the integration of information technology (IT) and computers, which was made possible by the fast technological advancements and also the enhanced computing capabilities. Furthermore, supply chain experts have grown to be more dedicated to handling unpredictability and potential hazards in the supply chain as a result of diverse external occurrences and elements, such as acts of nature. Tomasini and Van Wassenhove (2009) also stated that these flows resulted in humanitarian aid and the management of disasters. According to McKinnon et al., the concept of green logistics emerged as a result of focusing on sustainable development and dealing with environmental issues. 2010).

Certain advancements have brought advantages to supply chains, while others have imposed extra challenges on them. While the logistics and supply chain industry has developed extensively, professionals in this field recognize that they have to anticipate and adapt to future changes. They understand that various factors like emerging challenges, issues, and situations will demand their attention and thoughtful response.

One significant development observed in recent years impacting companies across all industries is the recognition of the importance of shifting towards precise insights backed by data. Make sure that decision making is done in an efficient manner. The advancement of information technology, faster computing systems, and the widespread use of personal electronics have propelled the world into the era of "big data". The power of data can enable businesses to succeed, but only with adequate and thorough analysis, known as "analytics" of the vast amounts of data available. Davenport and Harris (2007: 37) state that this has had noteworthy effects or possible consequences in different sectors, such as supply chain management and logistics. 9). The purpose of this article is to bring attention to and analyze different ideas related to these advancements, demonstrate how they are able to affect the field of supply chain management, and provide examples of their successful adoption, utilization, and implementation.

The objective of this article is to educate supply chain managers about the modifications and also offer a summary, explanation, and conversation on the different ideas and patterns related to "big data" and analytics. The objective of the presentation is to showcase how advancements in supply chain management (SCM) can have potential effects, making use of different examples. It also aims to demonstrate how businesses have gained a competitive edge by utilizing these advancements. The article consists of several parts. In the following section, a concise overview of relevant literature is presented, demonstrating an increasing acknowledgment of the significance of utilizing big data analysis to derive value in the field of supply chain management. The third section talks about big data, what it is and whether supply chain professionals should be paying attention to it. The fourth section of the book

concentrates on the examination of information, known as analytics or business analytics. The objective of this article is to provide a clear explanation of the term and explore its potential in enhancing decision-making and overall competitiveness of businesses through the utilization of big data. There are still people who doubt whether this is truly something different (Ittmann 2013). The fifth part focuses on the analysis of supply chain, specifically known as supply chain analytics. Section six focuses on how big data and analytics could potentially influence supply chain management. This part focuses on particular aspects of supply chain management which could be influenced and explains in what manner, including real - life cases and illustrations. Lastly, some closing remarks and suggestions are made.

2. Literature Review and Hypothesis Development

In the year 2013, the term "stock" refers to the ownership shares of a particular company that are bought and sold on the stock market. After reflecting on previous advancements in supply chain management (SCM), the report shifts its focus towards the future and highlights several significant "developments which will influence the direction of this field. Some of the identified elements include the ongoing progress in technology as well as the increasing significance of "big data" and data analytics in supply chain management. Technological advancements like advanced software, wireless methods, and smart phones have already had an impact on supply chain management (SCM). These advancements have resulted in smaller, more affordable, and more portable devices. This technology has the capability to not just expedite decision-making but also facilitate faster analysis of extensive data sets. Decide on the most appropriate plan of action based on the given situation. In the year 2013, the term "stock" refers to the ownership shares of a particular company that are bought and sold on the stock market. (2014) as stating that...) 2006: According to the information provided, it was suggested that the rate of knowledge doubling would increase to every eleven hours by the year 2010. In order to stay abreast of the growing range of data sources, it is essential to enhance the efficiency of "big data" analytics, which involves analyzing data. The companies that have adopted business analytics believe their performance has improved. In conclusion, according to Stock (2013), There are a lot of potential applications for big data analytics, (25).

In 2013, a survey was conducted by Deloitte and MHI to gather insights from supply chain executives regarding the advancements that fuel supply chains. The goal was to gather input from executives relating to upcoming supply chain trends with the potential to significantly influence future supply chains. According to a survey carried out by Deloitte & MHI in 2014, the most important strategic goals for supply chain executives were found to be supply chain analytics and multichannel fulfilment. 2). Expanding on the concept of supply chain analytics, the survey revealed that the following factors fall under this category:

Methods and tools that make use of information gathered from various sources, both within and outside an organization, to offer valuable insights that could assist supply chains in minimizing expenses and potential hazards, while also improving operational flexibility and the quality of services provided. 2) However, based on the responses of the executives who were surveyed, it was found that the supply chain department was not as effective as other departments in taking advantage of the benefits provided by analytics.

Cooke (2013: According to 11), among the top three trends to keep an eye on in supply chain management is the increasing adoption of "big data" analytics. By examining vast quantities of data

sourced from a variety of databases, supply chain managers are able to enhance the efficiency of their supply chain operations. There are various applications in the supply chain where this analysis can be utilized, as illustrated by the provided examples. In a 2013 editorial, Fawcett and Waller stated In line with 77), "big data" is not simply a trendy term; it entails thorough examination of data as well as the increasing merging of applications, tools, and resources that greatly affect the SCM field. This presents both a substantial obstacle along with a chance for advancement. Their focus is on conducting research in fields like information science, predictive analytics, along with big data related to supply chain management. Furthermore, they place significant emphasis on the necessity of developing skills in this emerging field, particularly focusing on big data. This has the capability to completely transform the dynamics of supply chain operations.

The significance of "big data" in SCM resulted in the commissioning of an analysis task by the Council for Supply Chain Management Consultants. Large data: Richey et al.'s very first analysis was printed. It's fairly recently printed an article (2014), concentrating on inside level selection interviews with source chain supervisors to recognize their perspectives on the idea of great information. What exactly are the advantages as well as complications related to great details evaluation? This particular analysis desired to determine greatest methods within using large details to improve SCM efficiency. All those interviews had been done within this specific from start. Though the analysis found specific outcomes, the people interviewed don't presently possess a single viewpoint about the significance of serious details as well as its implications for source chain managing within the approaching yrs.

Big data with appropriate analytics has proven to be a massive asset in various environments. Lewis (2003) provides an early and extensively discussed instance of a baseball team that utilized analytical and evidence-driven information on player performance to transform from being underestimated to becoming a highly competitive team. President Baraka Obama achieved significant successes in both the 2008 and 2012 US presidential elections as a result of the extensive utilization of "big data" analytics throughout both campaign periods (Samuelson 2009, 2013). Samuelson (2014) explores another recent illustration in the field of politics.

The use of big data in marketing is proving to be highly effective in creating marketing opportunities and influencing customer management (Svilar, Kanioura and Chakraborty 2013). To put it differently, the age range being referred to is between 22 and 25. The quantity of books being written about this topic is growing, along with the number of ways and fields in which it is being applied. The following books have been published in the past few years: Baesens (2014), Dietrich et al. (2014), Sathi (2012), and Siegel (2013) all wrote about the same topic. Watson and colleagues. The focus of (2012) is the use of big data along with analytics in the design of supply chain networks.

The literature review strongly suggests that there is a strong desire for the organizational function of supply chain management to adjust and develop in order to incorporate "big data" analytics. The application of analytics using "big data" has already shown significant advantages across various fields. At present, the world is experiencing and enjoying the era of "big data" and numerous individuals have acknowledged the immense value that comes with analyzing data. Many supply chain experts strongly believe that these trends possess great potential, and they are suggesting that the supply chain community should pay attention to them to be able to improve performance and competitiveness. Richey and colleagues The mentioned developments in (2014) still evoke caution and doubt among supply chain managers, leading to conservative and skeptical mindsets. The purpose of this report is to provide industry professionals with information about the concepts of "big data" and analytics. It also aims to help organizations adapt quickly to be able to achieve significant results through the use of "big impact through big data" (Court 2015). The article achieves this by showcasing various effective case studies that are currently being implemented.
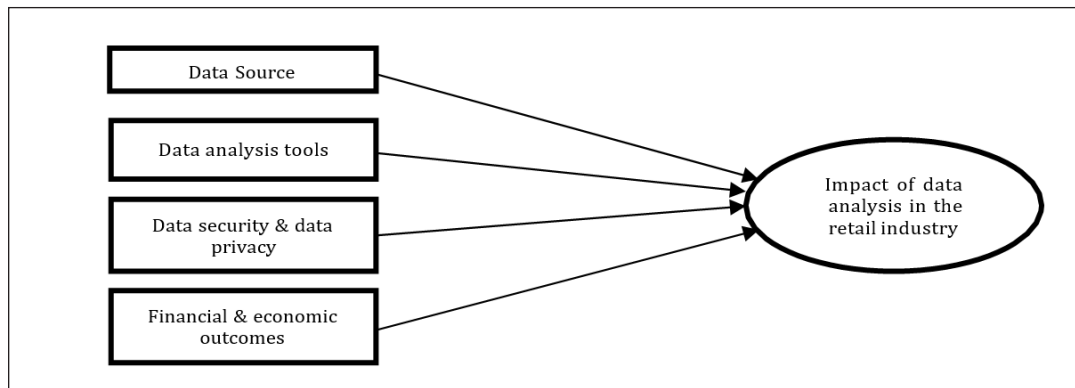
Figure 1. Analysis framework

3. Research Methodology

The strategy of the study focuses on variables identified through the literature review. The research was designed to understand the relationship, both direct and indirect, between dependent as well independent variables

3.1. Data collection

After the soil analysis was done from the review of literature, we obtained secondary information, which resulted in four independent variables. A survey was then developed in order to gather key information from people working at medium-sized and large retail organizations around the world. The questionnaire was tested in private interviews conducted with 20 respondents, as well as selected professionals working for medium and large retailers. After the interviews were completed, the questions were revised based on their responses. The final questionnaire was then sent.

A questionnaire was used to conduct the survey, which took into account both quantitative and qualitative aspects. Previous surveys were distributed among those who are familiar with the information-analysis and list-business. The purpose of this research was explained in a concise manner at the beginning of the survey, assuring the respondents that the collected data would be kept confidential. Each section contained questions designed to gather information about the variables. Three to five questions for each variable were created using a Likert-scale of five points to evaluate the use and adoption of information analysis in enterprise decision making. The majority of literature used to support each question was ISI Journals. A large number of people were emailed the final online survey through their personal contacts. The respondents were people who are involved in the retail industry, especially Supermarkets and Department Stores. A total of 284 replies were received but due to the lack of information, only 238 could be evaluated. In addition to Likert-scale items that were required, there was also a list of suggested additional items such as comments.

3.2. Analysis of data

Supply chain analytics refers to a collection of methods and technologies used to gather and analyze data from various sources, both external and internal, in order to gain valuable insights. These insights are aimed at assisting supply chains in cutting down expenses and risks, as well as enhancing flexibility and the quality of services provided. 2). Davenport and colleagues. (2010: 81) Give a summary of the supply chain procedures that could gain advantages from analytics in order to deal with the specific analytic challenges talked about in Table 1. Table 2 shows the examples presented.

The possibilities for supply chain analytics are being expanded as a result of the convergence of several forces. These items are: (1) The supply chain data is being enhanced; (2) data storage costs have decreased; (3) processing power has become faster and continuously expanding; (4) connectivity is now possible anytime and anywhere because of widespread availability of mobile data; (5) improved tools have made analysis easier. Additional advancements consist of (4) utilizing specific visualization methods and tools to effectively display vast amounts of data (MHI and Deloitte 2014: 3) as well as (4) making use of predictive analytics for advanced analytics (MHI 2014:). 4). In a lot of companies, the supply chain department is not yet as advanced as the commercial side in utilizing analytics, though this is quickly changing. 2).

Instances and real-life situations where analytics have been employed and put into action within supply chains. The transportation and supply chain management industry are in a prime position to make the most of technological advancements and the simultaneous growth of big data analysis with business analytics. Companies that handle their own supply chains, as well as those who delegate the task to third party logistics providers, are responsible for effectively handling a large volume of shipments, merchandise, as well as goods every day. Concurrently, they also generate extensive sets of data. According to Watson et al., countless shipments are monitored on a daily basis as they travel from their starting point to their final destination. This tracking process includes gathering details like the contents, weight, dimensions, current location, and the route taken for every individual shipment. These shipments are tracked across numerous networks. 2012). The value that must be capitalized on lies in the data tracking and the big data it provides, as it has the potential to be immensely valuable. Although this analysis and utilization of resources have not been fully explored, an increasing number of companies are adopting these advancements and witnessing improvements in their operational efficiency, effectiveness, and customer satisfaction.

Further discussion of this subject will involve the inclusion of instances and analyses that showcase the advancements achieved or the possible advantages of utilizing analytics. The purpose is not to extensively address every aspect of the supply chain, but rather to offer a glimpse into the potential and accomplishments in various areas, while briefly mentioning a couple of specific initiatives implemented by current companies. Predictive analytics in the retail industry and ensuring compliance with vendors' requirements. If vendors want to meet the anticipated service standards, it is crucial for vendors and retailers to work together and collaborate effectively. Predictive analytics plays a crucial role in the retailer/vendor partnership by not merely looking at the complete retail supply chain procedure but also guaranteeing adherence to vendor requirements.

In the past, there have been various examples of supply chain management (SCM) implementations. The product's quality, the order's performance, and the utilization of assets at the present time. Potential changes in crop output, malfunctions in machinery, and obstacles that impede progress: Forecasting demand, planning capacity, and exploring alternative sources

What occurred? What's presently occurring? What will occur in the future?

Insight (Reporting) (Alerts) (Extrapolation) What caused the incident and What should be the next reaction? What is the most effective move or outcome?

Examples of supply chain management (SCM) encompass various activities such as overseeing processes, monitoring quality, identifying bottlenecks, optimizing routing, ensuring seamless order flow, implementing proactive maintenance, and effectively managing yields. Optimisation of products, routing, and scheduling.

4. Supply Chain Management, Scm

(Krupnik 2013) According to Krupnik (2013), vendors and retailers can derive advantages from this situation in the subsequent manners.

- improved visibility for upcoming orders and predictions of demand
- ability to predict and monitor items with low in-stock levels in advance
- greatly decrease the negative effects caused by delayed and unfinished deliveries
- assess the potential risk of multiple scenarios occurring simultaneously.
- evaluate the possible combined risk posed by various scenarios.' analyze the potential danger of multiple scenarios happening in combination.

Retailers are able to make use of their ability to forecast the profitability of special quantity deals to figure out the best inventory levels for promotions and the most suitable shipping times. Furthermore, they are able to utilize these tools to propose pricing and allocation strategies even when they do not have access to past data.

Storey, Chen, and Chiang (2012: Business intelligence and analytics are viewed by 1165 as a crucial research and study area for dealing with data - related issues within companies. The progress made in e-commerce and web technology in recent years, as demonstrated in section 3's introduction and McAfee and Brynjolfsson's 2012 research, can serve as a clear example of this. 61). One of the best examples of this is Amazon, where millions of customers spend many hours looking at their website and analyzing every single click. Amazon's capabilities now extend beyond suggesting customer preferences and include efficiently monitoring inventory levels at their multiple distribution centers. They achieve this by analyzing product sales data and its direct influence on inventory levels in those centers. Amazon has recently revealed its approach to predictive shipping, which involves examining consumer data and using an advanced analytics system to enhance fulfillment strategies.

Predictive analytics offer retailers much more than just a report on sales; instead, they offer a holistic view of the future along with a tool to discover trends that can be tailored to create highly personalized customer engagement strategies. Predictive analytics makes use of statistical modeling and data mining techniques to analyze both past and present data for the purpose of generating much more precise predictions, whereas descriptive analytics focuses on assessing and understanding events that have already occurred. Loyalty cards exemplify the utilization of big data and analytics, offering significant implications for various aspects such as product selections, inventory management, and market insights. If customers use loyalty cards when making purchases at a retail store, the store is able to examine the data from these transactions to gather information about the specific items that are being bought, the preferences of loyalty card users, the quantities of purchases, and so on. This information can then be used to make decisions regarding product selection, the amount of inventory needed at different times during the month or year, the quantities to order, the timing of orders, the profitability of certain products,

and how often customers should be approached with promotions or offers. in order to make improved choices about where to locate, etc. The examination of large amounts of data gathered in this way can greatly steer marketing efforts.

The state of being able to be seen or noticed. Having a comprehensive view of product movement across the supply chain is essential for effective tracking. According to a recent report by Gartner Research in 2013, almost all companies currently lack the capability to achieve complete visibility across their supply chain, and this situation is unlikely to change in the foreseeable future. Advanced analytics, which include both prescriptive and predictive techniques, are allowing for immediate transparency through the entire supply chain. This transparency enables the ability to forecast, plan for demand, source materials, restock inventory, manage production, transport goods, and distribute products. Furthermore, these advanced analytics are also enhancing the accuracy of forecasting. 2). Companies will have the ability to enhance their visibility, which will allow them to accurately analyze supply chain information, make real-time decisions, and utilize advanced analytics to resolve issues proactively.

Salesforce is utilizing analytics to enhance the efficiency of their supply chain. According to Dietrich et al., Salesforce, a multinational company operating in 170 countries, recognized the significance of analytics and chose to make use of it in order to enhance the optimization of their supply chain. 2014). Many different solutions have been implemented. Four instances are briefly explained to demonstrate the diversity of issues addressed through several analytics tools.

This system places a higher emphasis on addressing Quality issues at a quicker pace compared to conventional statistical process control. Additionally, it detects Quality problems at an earlier stage than statistical process control. The utilization of the big data analytics solution is implemented in a number of areas, which includes suppliers, internal operations at Salesforce, and with products in the industry. By examining a vast quantity of data gathered from various points within the supply chain, we were able to diminish the need for redoing tasks, enhance efficiency, provide superior quality, as well as ultimately enhance customer contentment. The result was a significant reduction in cost.

Maintaining accurate inventory levels becomes a difficult task when dealing with multiple business partners, thus making the utilization of an Salesforce purchase analysis tool a challenging endeavor. This tool offers more than just visibility into supply and demand. It also helps manage distribution channels effectively and ensures the delivery of the appropriate product to satisfy customer demand, all while reducing inventory levels. The next best step is to enhance resource optimization in order to generate revenue by utilizing this tool that employs advanced analytics. Social media-based supply chain monitoring is a cutting-edge approach that leverages social listening to gather relevant and up-to-date information from various social channels. This method proves highly valuable in identifying potential disruptions, such as natural disasters, that could impact the supply chain. This is another way of getting information about products. There are already numerous possibilities and potential ways to utilize this.

5. Big Data Analytics

In the United States of America, supply chain Analytics firm End - to - End analytics offers clients with big data analysis, data visualization, and consulting services. open and complete interaction with clients; Kessinger and Pieper (2013) argue that having improved insight and comprehension of problems is also a benefit. (20 -22) Here are some of the examples of their work:

- Reality check for forecasting: The sheer volume of product level forecasts causes it to be impractical and impossible to manually review tens of thousands of them. The automated system

evaluates the likelihood of any forecast being fulfilled based on historical demand trends, identifying the most suspicious forecasts and lowering overall forecast error by 5 % - 10 % right away.

- Pricing concerns encompass aspects such as determining prices, implementing prices, and maximizing price effectiveness. The passage illustrates a scenario in which a sophisticated method of dividing a market into segments was created using eleven different factors to enhance the process of determining prices. As a result, the company experienced significantly improved profit margins.
- Collaboratively, they have worked with clients to enhance various aspects of supply chain planning, including long term volume planning, supplier scheduling, vehicle distribution to sellers, and inventory optimization strategies for automotive accessory wheels.

6. Conclusion

In summary, to conclude, ultimately, in conclusion, in brief, all in all. If we look around the world and observe information and mobile technology advancements, we can be certain that we are in the age of "big data." In with the advancement of computer technology, the capability to analyze data has vastly improved, enabling a more targeted, rapid, and extensive analysis compared to previous times. To stay competitive, organizations must possess the ability to swiftly adapt to market changes and comprehend the influential factors at work. It is crucial to properly utilize tools and methodologies for this purpose. This article aims to give a look at recent advancements that demonstrate how businesses in various industries are striving to transition from relying on intuition to utilizing precise, data-based analysis in order to make informed and successful business decisions. In order for supply chain and logistics managers to stay efficient, effective, and competitive, these changes are essential.

The utilization of big data can be beneficial for businesses in a number of ways, including predicting sales quantities, streamlining work timetables, and meeting customer preferences. The article presents additional in depth examples. It is crucial for SCM and logistics decision makers to recognize that with the transformation of organizations through data and analytics, there will be increased demands on management in the evolving landscape. In order for an organization to accomplish the goals detailed in this document, it is imperative to implement a variety of measures and initiatives. Some of these aspects include but are not limited to working across different departments, capturing data accurately, maintaining data accuracy, managing data effectively, using appropriate tools and strategies for analyzing data, and having the necessary human resources capabilities to accomplish all of these tasks.

In spite of the significance of all these matters, none of them have been acknowledged or even tackled in this article. At the moment, a lot of organizations are facing a shortage of effective leadership, which is hindering their ability to respond rapidly and effectively to these transformations and establish the necessary management frameworks and positions (Brown, Willmott and Court 2013). 78). Nevertheless, supply chain managers must remain vigilant as shifts are happening and cannot be avoided. This article aimed to inform supply chain managers about two significant trends that could change and impact the SCM sector in significant ways. The meaning and examination of "big data" were encompassed, alongside the elucidation of the term analytics in its present comprehension. Several instances are provided where the utilization of analytics in "big data" applications has proven to be successful. These examples highlight the benefits obtained from embracing data-driven decision-making approaches.

Change is always difficult, regardless of the setting. Nevertheless, this article has a clear and concise way of describing changes in a dynamic environment. Several examples demonstrate the impact of these changes on supply chains in areas where they have been put into practice. Big data is a reality and

Analytics are able to have a significant impact by leveraging data to unlock the maximum potential. Supply chain managers should acknowledge the significance of making decisions based on data. Organizations can only maintain competitiveness and enhance supply chain performance by following this approach

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References

1. Ghobadi F., Rohani M. "Cost Sensitive Modeling of Credit Card Fraud using Neural Network strategy", 2016 Signal Processing and Intelligent Systems, International Conference of pp. 1–5. IEEE.
2. Hutter T., Haeussler S., Missbauer H., 2018. Successful implementation of an order release mechanism based on workload control: a case study of a make-to-stock manufacturer. *International Journal of Production Research*, *56*, pp. 1565–1580.
3. Ji W., Wanga L., 2017. Big data analytics-based fault prediction for shop floor scheduling. Journal of Manufacturing Systems, *Volume 43*, pp. 187–194.
4. Ketokivi M., Choi T., 2014. Renaissance of case research as a scientific method. *Journal of Operations Management*, *32*, pp. 232–240.
5. Kumar A., Shankar R., Choudhary A., Thakur L. S., 2016. A big data mapreduce framework for fault diagnosis in cloud- based manufacturing. *International Journal of Production Research*, *54*, pp. 7060–7073
6. Lindström J., Larsson H., Jonsson M., Lejon E., 2017. Towards intelligent and sustainable production: combining and integrating online predictive maintenance and continuous quality control. Procedia CIRP of The 50th CIRP Conference on Manufacturing Systems, *Issue 63*, pp. 443–448.
7. Ramaswamy V., Gouillart F.J. The Power of Co- creation: Build it with them to Boost Growth, Productivity, and Profits, Simon and Schuster, Noida.
8. Rao A. M., rothstein m. A. How analytics is driving the supply chain innovation in north america., *business & IT*, 2022
9. SCHULTE R. "Application integration scenario: how the war is being won", in Gartner Group, Application Integration – Making E-Business Work, Gartner Group, London.
10. SEUFERT A., Schiefer J. "Enhanced business intelligence- supporting business processes with real-time business analytics", Proceedings of the 16th International Workshop on Database and Expert System Applications-DEXA'05, available at: www.ieee.org.
11. Tao F, Qi Q, Liu A, Kusiak A. Data-driven smart manufacturing. *Int J Ind Manuf Syst Eng* 2018;*48*:157–69. https://doi.org/10.1016/j.jmsy.2018.01.006.
12. Zhang J. Multi-source remote sensing data fusion: status and trends. *Int J Image Data Fusion 2010*;1. https://doi.org/10.1080/19479830903561035
13. Zhang Y, Ren S, Liu Y, Si S. A big data analytics architecture for cleaner manufacturing and maintenance processes of complex products. *J Clean Prod 2017*;142. https://doi.org/10.1016/j.jclepro.2016.07.123.
14. Zhang Z , et al.. Pathologist-level interpretable whole-slide cancer diagnosis with deep learning. *Nat Mach Intell 2019*;1. https://doi.org/10.1038/s42256-019-0052-1.
15. Zhong RY, Newman ST, Huang GQ, Lan S. Big Data for supply chain management in the service and manufacturing sectors: challenges, opportunities, and future perspectives. *Comput Ind Eng 2016*;101. https://doi.org/10.1016/j.cie.2016.07.013.
16. Zhu K, Li G, Zhang Y. Big data oriented smart tool condition monitoring system. *IEEE Trans Ind Inform* 2019;*16*:1. https://doi.org/10.1109/tii.2019.2957107