Using Big Data Analytics to Improve Logistics Processes and Forecast Demand

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Abstract

This study is relevant due to the increasing necessity to enhance the efficiency of logistics operations amidst rapid digitalization and globalization of markets. Our research aims to investigate the application of Big Data analytics in optimizing logistics processes and demand forecasting. The study employed diverse methodologies such as literature review, systematic terminology development, surveys, and graphical and tabular data visualization techniques. It underscores that Big Data analytics in supply chains involves leveraging various tools, processing systems, and algorithms to analyze voluminous data effectively. Traditionally, supply chain management (SCM) systems rely on ERP and other separate systems for data storage. However, the advent of analytics enables data integration, fostering more efficient decision-making processes. Big Data is profoundly impacting every facet of the supply chain. During the planning phase, integrated data across the network enhances demand prediction through statistical models. The results revealed that many Ukrainian logistics firms have begun adopting Big Data analytics. Specifically, they are leveraging it to optimize delivery routes, manage inventory based on demand forecasts, and evaluate warehouse operations' efficiency. This initiative contributes to cost savings in transportation, enhances forecasting accuracy by 10-15%, and reduces delivery times by a similar margin. However, the study underscores the challenges associated with managing large datasets and emphasizes the critical need for well-trained staff to effectively handle these analytics. Despite these challenges, most companies recognize Big Data analytics as pivotal in their logistics management strategies, enabling more efficient resolution of complex problems.

The article concludes that domestic companies possess substantial potential to enhance their logistics processes through the adoption of Big Data analytics but must first address existing challenges. To achieve successful implementation, continuous improvement of technological and organizational processes is essential, alongside ensuring high-quality data collection and analysis. These findings hold practical significance as they provide Ukrainian logistics companies with insights into the benefits and challenges of leveraging Big Data analytics. This

understanding will facilitate the development of effective strategies to bolster competitiveness and streamline logistics operations.

Keywords: Supply Chain Optimisation, Machine Learning Algorithms, Inventory Management, Logistics Improvement, Data Analysis, Information Technology In Logistics, Analytical Modelling, Demand Forecasting.

Introduction

The adoption of Big Data analytics to enhance logistics processes and forecast demand is increasingly pivotal in business strategies across all sectors of the economy. With vast volumes of real-time data available, companies can derive valuable insights to efficiently manage supply chains, optimize transportation of goods, and minimize costs. Big Data analytics also facilitates the prediction of demand fluctuations, thereby preventing warehouse overcrowding and optimizing inventory levels, which is crucial in dynamic market conditions.The study focusses the importance of leveraging Big Data for enhancing logistics operations and demand forecasting. Key challenges include the capability to process, analyze, and interpret substantial volumes of both structured and unstructured data in real-time. Additionally, ensuring data security and seamless integration with current logistics management systems presents another significant hurdle.

The study aims to explore the potential of utilizing Big Data analytics to enhance logistics processes and predict demand in today's business landscape. It's notable that extensive research already exists on the application of Big Data analytics for optimizing logistics operations and demand forecasting. For instance, Raman, Patwa, Niranjan, Ranjan, Moorthy, and Mehta (2018) conducted a study focusing on the analysis of Big Data and its impact on supply chains. They conducted a survey involving employees from multinational corporations across diverse global regions including the United States, the Middle East, Europe, Asia, and Australia. The research aimed to investigate how Big Data could improve existing supply chain practices by identifying opportunities, adding value, and achieving operational excellence.

Structural equation modeling (SEM) was employed for statistical analysis of the gathered data. The findings demonstrated that key factors such as demand management, supplier evaluation, Internet of Things (IoT), analytics, and data science significantly influence supply chain operations. These factors contribute to achieving operational excellence, reducing costs, enhancing customer satisfaction, improving visibility, and minimizing communication gaps between demand management and supply chain management (SCM).

Furthermore, the study emphasized that integrating Big Data technologies can lead to substantial added value and financial benefits for companies, potentially establishing a new benchmark within the industry.

Jeble, Dubey, Childe, Papadopoulos, Roubaud, and Prakash (2018) formulated a theoretical framework to explain the influence of big data and predictive analytics (BDPA) on sustainable business development within organizations. They applied resource-based view logic and contingency theory to construct their theoretical model. The authors utilized partial least squares structural equation modeling (PLS-SEM) to empirically validate their framework.

In another study, Fosso Wamba, Gunasekaran, Papadopoulos, and Ngai (2018) explored the potential of big data and analytics (BDA) to enhance logistics and supply chain management (SCM). They argue that BDA represents a significant opportunity for both academic research and practical management, challenging the perception that it is merely a passing trend. The authors highlight BDA's capability to generate new theories, thereby expanding the current understanding of predictive analytics.

Meanwhile, Brinch, Stentoft, Jensen, and Rajkumar (2018) focused on the application of big data in SCM. They initially assessed supply chain practitioners' awareness of BD usage through the Delphi technique. Furthermore, they categorized BD applications within the SCOR process framework, using questionnaire data to explore its various SCM applications in depth. The study also examined how implementing BD across supply chain stages can provide competitive advantages to companies, suggesting numerous directions for future research in logistics and SCM literature.

All these studies have explored the application of Big Data and its effects on supply chain management. However, their emphasis has been primarily on the broader aspects of employing Big Data in logistics processes and supply chain management. In our article, we intend to delve deeper by not only examining logistics processes but also concentrating on demand forecasting to offer a more comprehensive understanding of the potential of Big Data in SCM.

Methodology

During the study, we employed a diverse array of approaches and methods to conduct a thorough analysis of the influence of big data on supply chain management. Our approach encompassed both qualitative and quantitative methods, enabling us to develop a nuanced understanding of how big data can enhance demand forecasting and optimize logistics processes. To achieve these objectives, the following methods were utilized:

- Monographic analysis of literature sources. This method is crucial in scientific research because it enables a thorough examination of existing knowledge and the establishment of a theoretical framework for subsequent empirical studies. This approach facilitated a deeper understanding of the impact of big data on supply chain management, while also pinpointing critical areas for further investigation, such as demand forecasting and logistics process enhancement;

- A systematic approach to terminology development. This method aimed to clarify terminology associated with big data and supply chain management. Employing a systematic approach ensured consistency and clarity in terminology usage, enhancing the accuracy of analysis and interpretation of results. This, in turn, provided deeper insights into the relationships among various aspects of big data in demand forecasting and logistics process improvement.

- Survey. In our study, we employed an email survey method to gather data from logistics executives. The questionnaire consisted of six key questions designed to investigate the application of Big Data analytics in their logistics operations. The responses collected were analyzed to assess demand patterns and pinpoint practical challenges associated with the implementation of Big Data solutions in logistics. This methodology enabled us to gain insights into the current practices regarding big data usage in the industry and its influence on optimizing logistics processes.

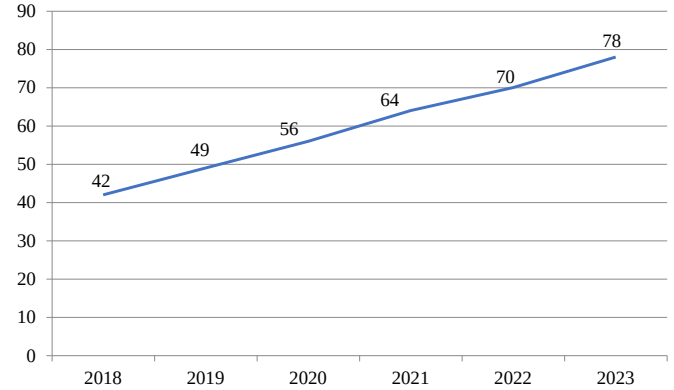
- Graphical and tabular methods of data visualisation. These methodologies enabled us to systematically present and analyze the results. The graphical approach visually illustrated the data dynamics, enhancing our comprehension of the relationships between the variables. Meanwhile, the tabular method organized the data in a clear and understandable format.

Results

The modern world generates vast volumes of data daily, driven by advancements in sensor technologies, Internet networks, and mobile devices. This influx includes both structured and unstructured data, necessitating efficient processing and analysis. Specialized technologies and machine learning algorithms are employed for this purpose, automating data processing and accelerating analysis. This capability empowers companies to extract valuable insights, make informed management decisions, optimize business processes, and uncover new market opportunities.

Statistics indicate a notable rise in the global Big Data market capacity in recent years (Figure 1). This surge is propelled by the escalating volume of data generated through modern technologies like sensors, the Internet, and mobile devices. Companies and organizations are actively leveraging this data to enhance their services, optimize business operations, analyze markets, and inform management decisions.

Figure 1. Fluctuations in the global Big Data market capacity from 2018 to 2023 (in USD billion)



Source: compiled from (Statista, 2024)

According to Forbes, in 2018, the world generated approximately 2.5 exabytes (2.5 billion gigabytes) of data from personalized sources such as Internet of Things (IoT) devices, sensors, social media, websites, emails, and other sources. This volume of personalized data continues to grow annually as both individuals and businesses generate new datasets in the digital realm (Marr, 2018). The year 2020 witnessed a significant surge in data creation and replication, surpassing expectations due to the widespread adoption of remote work and online education prompted by the COVID-19 pandemic (Taylor, 2022).

The global big data market is projected to grow significantly by the first quarter of 2027, reaching USD 103 billion, more than double its potential capacity in 2018. This growth underscores the continuous increase in internet data volume and its growing value.

Today, Big Data is widely utilized across various industries to achieve diverse objectives. In the public transport sector, it analyzes user behavior and evaluates service quality (Mikalef, 2019; Kolodiichuk et al., 2023). In education, it enhances educational efficiency, identifies learning strengths and weaknesses, and improves teaching methods (Taylor, 2023). In healthcare, it analyzes medical records, diagnostic images, and other health data to identify health trends and enhance diagnosis and treatment. In marketing, Big Data examines consumer behaviors, preferences, and purchasing patterns to boost marketing campaign effectiveness and customize offers.

In regional management, Big Data provides comprehensive insights into regional development dynamics, identifying trends, patterns, and areas needing attention. This informs models for evaluating regional development management effectiveness, defining criteria and metrics for assessing success (Kuczabski et al., 2023; Mikalef et al., 2019). In agriculture, Big Data enhances crop yields and production efficiency (Welch &Widita, 2019). Overall, digital tools are profoundly influencing various domains, shaping the contemporary landscape of digital society (Martynenko et al., 2023).

Logistics plays a pivotal role in Ukraine's economy by effectively managing the movement of goods from suppliers to consumers (Zrybnieva et al., 2023). It tackles complex challenges such as optimizing supply chains, cutting costs, enhancing service levels, and implementing innovative logistics solutions (Zomchak&Starchevska, 2023). A robust logistics system boosts enterprise productivity and competitiveness by reducing delivery times, maximizing transport efficiency, minimizing warehouse inventories, and preventing production delays. This positively influences product quality, customer satisfaction, and overall profitability (Ding et al., 2023).

The shift towards digitalization and e-commerce is prompting a reevaluation of logistics as a critical tool for supply chain management. This presents opportunities to streamline workflows and identify necessary changes for implementation. Today, conditions are ideal for digital transformation in supply chains, enabling the adoption of new technologies to optimize operations and enhance supply chain management efficiency (Kustrich, 2023).

In developed countries, a robust logistics network is crucial for achieving quality implementation and enhancing international competitiveness. It offers numerous advantages in developing commodity markets, optimizing logistics costs, and effectively conducting strategic business activities amidst globalization (Sapiński &Pochopień, 2023).

Logistics encompasses the entirety of supply chain management, spanning from raw material procurement to product transportation and final distribution. The integration of advanced technologies such as artificial intelligence, data analytics, the Internet of Things (IoT), and automated systems into logistics and supply planning processes has the potential to significantly reduce operational costs while enhancing functional productivity and system efficiency. However, practical application demonstrates that these benefits are achievable only through comprehensive digital transformation within business entities. Automation of production and logistics processes is essential for minimizing errors and delays, thereby improving the efficacy of predictive analytics within the logistics domain (Petrenko et al., 2024).

Big data analytics in supply chains involves utilizing diverse tools, processing systems, and algorithms to interpret vast quantities of data. Traditionally, supply chain

management (SCM) systems relied on ERP and isolated systems for data storage. However, the integration of analytics facilitates data consolidation and enhances decision-making effectiveness. Big data profoundly impacts all facets of the supply chain, particularly in planning, where integrated data networks improve demand forecasting accuracy through statistical models. For instance, leveraging communication and inventory management systems ensures optimal product availability, considering historical, current data, macroeconomic indicators, industry trends, and competitor insights (Petryk, 2020).

In essence, Big Data comprises technologies and methodologies designed to analyze and process extensive volumes of structured and unstructured data that conventional methods cannot handle effectively (Johnson, 2019).

Big Data technologies are instrumental in addressing several critical tasks, including:

- marketing and sales growth. Data analytics facilitates comprehension of consumer behavior, customization of marketing campaigns, and optimization of advertising expenditures;
- forecasting the market situation. The utilization of Big Data enables the analysis of market trends, prediction of demand, and forecasting of shifts in consumer demand;
- effective customer segmentation. Detailed data analysis facilitates the identification of distinct customer segments based on their needs and behaviour;
- improving products and services. Harnessing big data enables the collection of customer feedback, its analysis, and the enhancement of products and services;
- making more informed management and operational decisions based on Big Data analysis. Data analytics aids in addressing strategic and tactical challenges through objective data analysis;
- Increase in labour productivity. Process optimization through data analysis enhances the efficiency of workflow and resource utilization;
- efficient logistics. Leveraging Big Data enables optimization of supply chains, facilitates delivery planning, and enhances inventory management through precise forecasting;
- monitoring the condition of fixed assets.Data analytics aids in monitoring investment assets and their valuation, empowering informed decision-making in financial management;
- optimisation of the investment portfolio. Data analysis facilitates the assessment of risks and returns associated with different investment opportunities, enhancing the efficiency of managing investment portfolios (Shkyrta& Lazar, 2019).

The concept of BDA (Big Data Analytics) involves applying advanced data analysis methods, including statistical techniques, predictive analytics, and other methodologies, to process large volumes of diverse data. Its primary objective is to uncover hidden patterns, relationships, and trends within this data to derive valuable business insights. BDA aims to maximize business benefits, enhance productivity, and explore new markets and opportunities (Pawar &Paluri, 2022).

Johnson (2019) outlines that the concept of Big Data encompasses four primary dimensions, often referred to as the "4Vs" (Table 1).

Table 1. Key characteristics of the Big Data concept

No.	Characteristics	Description
1.	Volume	Big Data encompasses vast volumes of data generated and collected, often exceeding the capabilities of conventional databases
2.	Variety	Big Data encompasses diverse data sources and formats, including structured (e.g., database tables), semi-structured (e.g., XML files), and unstructured data (e.g., texts, images, audio, video)
3.	Velocity	Big Data is characterized by the velocity of data collection and processing, accommodatinglargestreams of dataarriving at highspeeds, such as from IoTsensors or socialmediasources
4.	Value	The potential value of Big Data lies in its capacity to uncover new insights, identify patterns, forecast trends, and enhance decision-making processes across various domains

Source: (Johnson, 2019)

The BDA concept facilitates not only data analysis but also forecasting and strategic decision-making. These methods enable companies to gain deeper insights into their customers, their needs, and their behaviors (Tiwari et al., 2018).

Therefore, big data analysis aimed at enhancing management decision efficiency is increasingly pivotal for generating top-line value. This approach considers the interests of the company producing the product or service, as well as those of its partners, customers, government entities, and non-profit organizations. Big Data analytics not only optimizes internal processes and boosts productivity but also fosters effective collaboration with other ecosystem stakeholders, thereby creating significant value for all involved (Semenog, 2020).

A focus on value creation through big data analysis allows companies to achieve competitive advantage through several critical mechanisms:

- creating new value pools. Big data analysis facilitates the identification of emerging opportunities and market needs, fostering the development of new products, services, and potentially new markets. This capability drives revenue growth and expands the company's product portfolio;

- development of new business models. Data analytics facilitates the development of adaptive and innovative business models. This encompasses creating ecosystems, partnerships, and collaborative initiatives with other companies, which can enhance operational efficiency and unlock new market opportunities;

- personalisation and enhancement of user experience. Data analytics enables enhanced personalization of products and services, thereby boosting customer satisfaction and fostering loyalty. By comprehending the specific needs of users, companies can tailor offerings to align with individual preferences and usage contexts.

Additionally, data analytics supports strategic decision-making by providing companies with the insights needed to make informed choices regarding business development, process optimization, and enhancements to products and services. This capability enhances organizational agility, enabling prompt responses to shifts in market conditions (O'Halloran & D'Souza, 2020).

Big Data, used to organize, store, and analyze unstructured information, underscores that many companies, despite acknowledging the importance of digital technologies in supply chains, still have limited digitalization in logistics. Most organizations rely on traditional communication channels like email, phone, and social media for interactions with carriers. While global leaders such as Michelin, Knauf, Nestle, Beiersdorf, and others recognize the significance of Big Data analytics for creating organized, transparent workflows, they are actively adopting digital technologies to make informed management decisions.

We believe that harnessing Big Data analytics to optimize logistics processes can significantly enhance business efficiency and effectiveness. Key aspects that underscore this importance include:

1. Demand forecasting.Big data analysis enables more precise forecasting of demand for goods and services. This capability empowers logistics departments within enterprises to strategically plan inventory levels, optimize delivery routes, and manage overall transportation volumes effectively. This approach helps minimize costs and mitigate risks associated with supply chain operations.
2. Route optimisation.Big data analysis facilitates the development of optimal delivery routes by considering factors such as traffic conditions, weather forecasts, road maintenance schedules, and more. This approach significantly reduces delivery times and transportation costs.
3. Inventory management. Big data enables the analysis of demand patterns and inventory usage to maintain optimal stock levels in warehouses. This strategy mitigates shortages and prevents excess inventory, thereby optimizing the company's capital expenditure.
4. Process efficiency analysis.By processing large volumes of data, weaknesses in logistics processes can be identified promptly, allowing for timely responses to improve efficiency and reduce costs.
5. Risk forecasting and management. Big data aids in

identifying potential risks, such as delivery delays, vehicle malfunctions, or unexpected changes in the production process, enabling the development of proactive risk management strategies.

6. Increase customer satisfaction.With more precise inventory and delivery management through big data analytics, businesses can enhance customer service by guaranteeing timely and accurate delivery of goods.

Implementing Big Data analytics in logistics not only reduces costs and enhances process efficiency but also provides companies with a competitive edge in the current market landscape. We conducted a survey among large and medium-sized Ukrainian logistics companies to assess the utilization of Big Data analytics in improving logistics processes and forecasting demand. The survey involved sending personalized email invitations to logistics executives containing six questions related to Big Data analytics. Participants were provided with a questionnaire link via email for their responses. Notably, 37 companies participated in the survey. Table 2 presents a summary of the survey results.

Table 2: The survey results

No.	Question	Answers	% in the total structure of respondents
1.	How does your company use Big Data analytics to optimise logistics processes?	We use it to optimise delivery routes	70%
		Inventory management based on demand forecasting	65%
		Analysing the efficiency of warehouse operations	50%
		Other aspects (security, tracking, insurance)	35%
2.	Is Big Data used to forecast demand for your products or services? What methods are used for this purpose?	Yes, we use	80%
		Methods: historical data analysis, machine learning, consumption analytics	70%
		No, they are not used	20%
3.	What specific benefits do you see in applying Big Data analytics to your logistics activities?	Reduced transport costs	75%
		Improving the accuracy of demand forecasting	70%
		Reduced delivery time	65%
		Improving customer service	60%
4.	What challenges or obstacles do you face when integrating Big Data analytics into your company's logistics processes?	The complexity of processing large amounts of data	55%
		Insufficient staff qualifications for data analysis	40%
		Challenges in collecting quality data	30%
		Other technical or organisational challenges	25%
5.	What specific results or improvements have you achieved through the use of Big Data analytics in logistics?	Reduce costs by 15-20%	60%
		Increase in forecasting accuracy by 10-15%	50%
		Reduce delivery time by 10-15%	45%
		Increase in customer satisfaction by 10-15%	40%
6.	Is Big Data analytics perceived as an important factor in your logistics management strategy? Why?	How it helps to solve complex problems more efficiently	85%
		No, it is not yet a significant part of the strategy	15%

Source: compiled based on survey results

Based on this survey, we have drawn the following conclusions:

1. A majority of domestic companies are already leveraging Big Data to optimize logistics processes and forecast demand.
2. The most frequently reported benefits of using Big Data in this context include cost reduction, enhanced forecasting accuracy, and decreased delivery times.
3. Key challenges identified include the complexity of data processing and the shortage of qualified personnel.
4. Most companies view Big Data analytics as crucial for their logistics management strategies due to its potential to enhance efficiency and competitiveness.

These findings underscore the significant potential of Big Data analytics in improving logistics processes and strategically managing companies' logistics operations.

However, it is noteworthy that many companies face challenges in effectively processing and utilizing large volumes of data, often accumulating information without leveraging it systematically. Challenges associated with implementing Big Data in logistics and supply chains encompass several critical aspects:

- Low level of digitalisation. Many companies depend on conventional communication channels like email, telephone, or social media to engage with carriers and other participants in the supply chain. This reliance can hinder effective management and diminish operational efficiency.

- Insufficient data processing and analysis.Many companies gather substantial amounts of data but lack systems or processes to analyze and leverage it effectively. This oversight can result in missed opportunities for optimizing processes and utilizing valuable information.

- Lack of data centralisation. Companies frequently store data in disparate systems and formats, complicating integration and hindering analytical operations. This fragmentation can impede obtaining a comprehensive view of their logistics processes and collaborations with partners (Smyrnova, 2018).Furthermore, the collection and analysis of large volumes of data raise concerns regarding data privacy and security (Storozhyk, 2024).

Discussion

This article underscores the critical role of Big Data analytics in optimizing logistics processes and forecasting demand within companies. The survey conducted herein reveals that this technology can substantially reduce transportation costs, enhance demand forecasting accuracy, and shorten delivery times. These findings align with scholarly perspectives, which affirm that integrating Big Data analytics into logistics can significantly elevate business efficiency and elevate customer service standards.

It is important to note that the survey targeted Ukrainian companies, many of which are still in the early stages of adopting Big Data analytics. Conversely, international logistics firms have embraced this technology for an extended period, refining their approaches to process optimization and demand forecasting over time. While these firms likely encountered initial challenges, they have since developed effective strategies to overcome them. Notably, they often boast highly skilled data analytics teams that leverage Big Data to its fullest potential.

Moreover, foreign companies tend to employ integrated data collection and processing systems, streamlining analysis and decision-making processes. Their current challenges often revolve around enhancing and scaling existing technologies rather than initial implementation hurdles. This observation is supported by researchers like O'Halloran & D'Souza (2020), who emphasize that international firms prioritize efficiency and competitiveness through continuous improvement of analytical tools.

A comparative analysis of our findings with existing literature suggests that Ukrainian companies stand to gain significantly from adopting best practices observed in foreign counterparts. This includes bolstering staff training in data analytics and embracing advanced technologies in logistics operations. Therefore, to enhance operational efficiency, Ukrainian firms should not only continue implementing Big Data analytics but also actively learn and adapt from international benchmarks and experiences.

Conclusions

The integration of Big Data analytics in logistics significantly enhances company efficiency and competitiveness through the optimization of logistics processes and demand forecasting.

Based on a survey of large and medium-sized logistics firms, the majority have already adopted Big Data to optimize delivery routes, manage inventory based on demand forecasts, and analyze warehouse operations efficiency. This implementation has led to notable benefits such as a 10-15% improvement in forecasting accuracy and a corresponding reduction in transportation costs and delivery times.

However, several challenges hinder the full exploitation of Big Data's potential. These include the complexities associated with processing large datasets and the shortage of skilled personnel adept in data analysis. Despite these challenges, most companies recognize Big Data analytics as pivotal in their logistics strategies, enabling them to efficiently address intricate operational issues.

To maximize the efficacy of Big Data analytics implementation, continuous enhancement of technological and organizational processes is essential. Additionally, ensuring rigorous standards in data collection and analysis is imperative for achieving optimal outcomes.

References

- Brinch, M., Stentoft, J., Jensen, J. K., &Rajkumar, C. (2018). Practitionersunderstanding of bigdata and its applications in supply chainmanagement. *International Journal of Logistics Management*, *29*(2), 555–574. https://doi.org/10.1108/ijlm-05-2017-0115
- Ding, L., Wang, T., &Chan, P. W. (2023). Forward and reverselogistics for circulareconomy in construction: A systematic literature review. *Journal of CleanerProduction*, *388*, 135981. https://doi.org/10.1016/ j.jclepro.2023.135981
- FossoWamba, S., Gunasekaran, A., Papadopoulos, T., &Ngai, E. (2018). Bigdataanalytics in logistics and supply chainmanagement. *International Journal of Logistics Management*, *29*(2), 478–484. https://doi.org/10.1108/ijlm-02-2018-0026
- Jeble, S., Dubey, R., Childe, S. J., Papadopoulos, T., Roubaud, D., &Prakash, A. (2018). Impact of bigdata and predictiveanalyticscapability on supply chain sustainability. *International Journal of Logistics Management*, *29*(2), 513–538. https://doi.org/10.1108/ijlm-05-2017-0134
- Johnson, S. (2019, August 21). How muchdata is produced every day 2021? *The Next Tech*. https://www.the-next-tech.com/blockchain-technology/how-much-data-is-produced-every-day-2019/
- Kolodiichuk, V., Cherevko, H., &Popivniak, R. (2023). Quality assessment of transit potential of the transport–logisticssystem of Ukraine. *Global Business Review*, *24*(1), 171–184. https://doi.org/10.1177/0972150920907008
- Kuczabski, A., Aleinikova, O., Poberezhets, H., Tolchieva, H., Saienko, V., &Skomorovskyi, A. (2023). The analysis of the effectiveness of regional development management. *International Journal for Quality Research*, *17*(3), 695–706. https://doi.org/10.24874/ijqr17.03-05
- Kustrich, L.O. (2023). Innovations in the field of logistics management. *State and regions. Series: Economy and entrepreneurship*, *3*(129), 639-68. https://lib.udau.edu.ua/handle/123456789/9958
- Marr, B. (2018, May 21). *How muchdata do wecreate every day? The mind-blowingstatseveryoneshouldread*. Forbes. https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/
- Martynenko, M., Losheniuk , O., Demchenko, H., &Osypenko , N. (2023). Developing and implementing digital marketing strategies of the future: toward improving productquality and competitiveness. *Futurity Economics&Law*, *3*(1), 63–84. https://doi.org/10.57125/FEL.2023.03.25.07
- Mikalef, P., Boura, M., Lekakos, G., &Krogstie, J. (2019). Bigdataanalytics and firmperformance: Findings from a mixed-methodapproach. *Journal of Business Research*, *98*, 261–276. https://doi.org/10.1016/j.jbusres.2019.01.044

- O'Halloran, D., D'Souza, F. (2020, July 29). *Data is the new gold. This is how it canbenefiteveryone – while harming no one*. World Economic Forum. https://www.weforum.org/agenda/2020/07/new-paradigm-business-data-digital-economy-benefits-privacy-digitalization/
- Pawar, P. V., &Paluri, R. A. (2022). Bigdataanalytics in logistics and supply chainmanagement: A review of literature. *Vision The Journal of Business Perspective*, 097226292210916. https://doi.org/10.1177/09722629221091655
- Pawar, P. V., &Paluri, R. A. (2022). Big Data Analytics in Logistics and Supply Chain Management: A Review of Literature.*Vision*. https://doi.org/10.1177/09722629221091655
- Petrenko, O., Medvedev E., Popova Yu. (2024). Planning of logistics systems using artificial intelligence. *Economy and Society*, 59. https://doi.org/10.32782/2524-0072/2024-59-61
- Petryk, I. (2020). Prospects for using Big data in supply chain management. *Scientific Notes of Lviv University of Business and Law*, *24*, 34-38. https://nzlubp.org.ua/index.php/journal/article/view/235.
- Raman, S., Patwa, N., Niranjan, I., Ranjan, U., Moorthy, K., &Mehta, A. (2018). Impact of bigdata on supply chainmanagement. *International Journal of Logistics Research and Applications*, *21*(6), 579–596. https://doi.org/10.1080/13675567.2018.1459523
- Sapiński, A., &Pochopień, J. (2023). Logistics Innovations and Their Impact on the Development of TransportationInfrastructure in Europe: Future Prospects. *Futurity of Social Sciences*, *1*(2), 4–17. https://doi.org/10.57125/FS.2023.06.20.01
- Semenog, A. Yu. (2020). Digital technologies in the conditions of the formation of a digital economy. *Scientific notes of the National University "Ostroh Academy". "Economics" series*, *19*(47), 20-28. http://nbuv.gov.ua/UJRN/Nznuoa_2020_19_5
- Shkyrta, I., Lazar, V. (2019). Bigdata technology: Essence, businessopportunities. *Scientific Bulletin of Mukachevo State University. Series "Economics," 2(12)*, 51–56. https://doi.org/10.31339/2313-8114-2019-2(12)-51-56
- Smyrnova, N. (2018). Digitalization as a main direction of logistics innovative development.
- *Socio-economic research bulletin*, *4*(68), 169?180. http://vsed.oneu.edu.ua/collections/2018/68/pdf/169-180.pdf
- Statista (2024). https://www.statista.com/
- Storozhyk, M. (2024). Philosophy of future: analyticaloverview of interaction between education, science, and artificial intelligence in the context of contemporary challenges. *Futurity Philosophy*, *3*(1), 23–47. https://doi.org/10.57125/FP.2024.03.30.02
- Taylor, P. (2023). Big data - statistics & facts. Statista. Retrieved June 20, 2024, from https://www.statista.com/topics/1464/bigdata/
- Taylor, P. (2022). Data growthworldwide 2010-2025. Statista. Retrieved June 20, 2024, from https://www.statista.com/statistics/871513/worldwide-datacreated/.
- Tiwari, S., Wee, H. M., &Daryanto, Y. (2018). Bigdataanalytics in supply chainmanagement between 2010 and 2016: Insights to industries. *Computers&IndustrialEngineering*, *115*, 319–330. https://doi.org/10.1016/j.cie.2017.11.017
- Welch, T. F., &Widita, A. (2019). Bigdata in publictransportation: a review of sources and methods. *Transport Reviews*, *39*(6), 795–818. https://doi.org/10.1080/01441647.2019.1616849
- Zomchak, L., &Starchevska, I. (2023). Macroeconomicdeterminants of economic development and growth in Ukraine: Logisticregression analysis. In *LectureNotes on Data Engineering and Communications Technologies* (pp. 358–368). Cham: Springer Nature Switzerland.
- Zrybnieva, I., Pichugina, J., Sigaieva, T., Saienko, V., &Korolkov, V. (2023). Benchmarking in the logistics management system of Ukrainian enterprises. *Amazonia Investiga*, 12(66), 206-224. https://doi.org/10.34069/AI/2023.66.06.20