The Importance of Data-Driven Strategic Decision-Making in Logistics

Bogdan Dumitrășconiu[1], Mirela Octavia Sîrbu[2] and Cristinel Vasiliu[3]
[1)] *PROVA NOV, Bucharest, Romania.*
[2)3)] *Bucharest University of Economic Studies, Bucharest, Romania.*
E-mail: bogdand@prova-nov.ro; E-mail: mirela.sirbu@com.ase.ro
E-mail: cristi_vasiliu@yahoo.com

Please cite this paper as:
Dumitrășconiu, B., Sîrbu, M.O. and Vasiliu, C., 2024. The Importance of Data-Driven Strategic Decision-Making in Logistics. In: R. Pamfilie, V. Dinu, C. Vasiliu, D. Pleșea, L. Tăchiciu eds. 2024. *10th BASIQ International Conference on New Trends in Sustainable Business and Consumption.* Almeria, Spain, 6-8 June 2024. Bucharest: Editura ASE, pp. 488-494
DOI: 10.24818/BASIQ/2024/10/075

Abstract

Purpose/objectives: This research examines the crucial role of data-driven strategic decision-making within the logistics sector. It aims to explore how logistics activities can leverage data to optimize resource allocation, improve operational efficiency, and achieve long-term competitive advantage.

Design/methodology: The research is based on literature review and analysis related to data-driven decision-making in logistics. It incorporates theoretical considerations and a practical application to illustrate the usage of data analytics in strategic decision-making processes within logistics operations.

Findings: The research identifies a strong correlation between the effective use of data-driven insights and enhanced logistical performance. It reveals that data-driven decision-making enables proactive planning, demand forecasting, inventory optimization, and identification of cost-saving opportunities throughout the supply chain.

Originality/value: This paper contributes to the existing body of knowledge by emphasizing the significance of data-driven decision-making specifically in logistics activities. It sheds light on the transformative impact of data analytics on strategic decision-making processes and underscores the value of data-driven insights in driving operational excellence It offers a valuable framework for decision-makers on how to effectively integrate data-driven practices into their logistics operations.

Possible Practical Implications: The study's findings can guide logistics companies in developing a data-centric approach. This empowers them to make informed, timely decisions that enhance overall efficiency, drive cost-savings, and ultimately improve customer satisfaction.

Keywords

Data-driven decisions, logistics, strategic decision-making, optimization, data analytics.

DOI: 10.24818/BASIQ/2024/10/075

Introduction

In the rapidly evolving landscape of logistics and supply chain management, the advent of data analytics has heralded a new era of strategic decision-making. The ability to harness vast amounts of data for insightful analysis has become a pivotal factor in optimizing logistics operations, enhancing efficiency, and securing a competitive edge in the market. This paper delves into the critical role of data-driven strategic decision-making within the logistics sector, aiming to underscore how leveraging data analytics can significantly improve resource allocation, operational efficiency, and long-term competitiveness.

Recent research underscores the growing importance of big data analytics in logistics and supply chain management, highlighting its potential to transform traditional logistics operations. For instance, studies by Bag et al., (2021) and Liu et al., (2022) emphasize the enhancement of information processing capabilities through big data analytics, enabling firms to achieve greater supply chain integration and sustainability. Furthermore, the work of Liu et al. (2022) explores the moderating role of data-driven decision culture in

bolstering green supply chain integration via big data analytics capability, illustrating the multifaceted benefits of a data-centric approach in logistics.

The critical challenge of predicting service completion times in last-mile delivery is considered pivotal for improving customer satisfaction and operational efficiency, as analyzed by the study of Pegado-Bardayo et al. (2023). A data driven solution is to use a combination of machine learning techniques and clustering techniques to predict the number of uncompleted services in last mile logistics. This prediction can help carriers increase their service levels without increasing the number of couriers and vehicles. The machine learning techniques are used to estimate the number of services that will remain uncompleted on a given route, while the clustering techniques are used to predict the routes to be followed by couriers and identify potentially uncompleted services as the last ones in each route.

The specific research problem addressed in this paper centers on the importance of data-driven strategic decision-making in logistics. It seeks to explore how logistics companies can effectively integrate data-driven practices into their operations to optimize resource allocation, improve operational efficiency, and achieve a sustainable competitive advantage.

The current paper is structured as follows: after the introduction, the next section provides a literature review on criteria chosen for research selection followed by research methodology considerations. For each criterion, key findings and contributions from recent research in the field of data analytics and its application in supply chain management and logistics are highlighted. Subsequently, it addresses a practical example that shows direct benefits of data-driven approach in getting business results. The results and discussion section strengthens the paper by elaborating on the key findings and their implications for logistics operations, followed by the conclusion, with the results of the analysis, demonstrating the correlation between data-driven decision-making and enhanced logistical performance.

1. Big Data Analytics in Supply Chain Management

The advent of big data analytics (BDAC) has revolutionized the landscape of logistics and supply chain management (SCM). The ability to process vast amounts of data and extract actionable insights has become a cornerstone for strategic decision-making within the logistics sector. BDAC encompasses both technical and managerial capabilities, enabling organizations to capture, consolidate, and analyze data to generate new insights for data-driven programming, decision-making, and operation (Bag et al., 2021).

A significant application of BDAC in SCM is its contribution to green supply chain integration (GSCI). GSCI is a process-oriented approach that emphasizes the strategic collaboration between firms and their supply chain partners to manage intra- and inter-organizational green practices, aiming to improve environmental performance (Liu et al., 2022). BDAC enhances GSCI by providing the necessary information processing capabilities, allowing firms to efficiently collaborate with partners to comply with environmental regulations and reduce uncertainties.

BDAC improves the information processing capabilities required for effective supply chain collaboration. Big data technical capability allows firms to gather and analyze data from suppliers regarding environmental criteria, design specifications, and cleaner technology. This capability is crucial for evaluating suppliers' green performance and managing partnerships (Bag et al., 2021; Liu et al., 2022). Similarly, big data managerial capability enables firms to establish data-driven strategic planning, integrating upstream suppliers' resources effectively and ensuring an efficient green collaboration relationship (Liu et al., 2022).

Data integration plays a mediating role in the relationship between BDAC and external partners. Firms with high levels of data integration can leverage BDAC to automatically analyze and utilize demand data from suppliers and customers, thereby facilitating integration with external partners to achieve strategic and operational goals This internal integration is essential for cross-functional collaboration and communication.

The culture within an organization, particularly a data-driven decision culture, significantly influences the effectiveness of BDAC. This culture reflects the extent to which all organizational members value data when making decisions. It enables firms to make more reasonable decisions based on data, ensuring higher internal synergy and rapid response, thus potentially substituting the effect of BDAC in the process of GSCI to some extent (Liu et al., 2022).

Bag et al. (2021) conducted a survey to investigate the impact of big data analytics capabilities (BDACs) on reverse logistics decisions and remanufacturing performance in South African manufacturing companies. The research team argued that firms possessing BDA capabilities can efficiently build reverse

logistics strategies for developing competence in remanufacturing operations. The survey analysis provided following practical implications:

- Managers should prioritize building robust BDAC capabilities.
- Emphasis on quality decision-making within reverse logistics processes is essential
- Managers need to focus on effectively measuring and evaluating performance

In summary, these strategic actions empower managers to navigate the complexities of logistics and drive operational excellence. The findings of this research provide logistics activities with a clear directive to develop a data-centric approach. By integrating BDAC into their operations, firms can make informed decisions that enhance efficiency, drive cost savings, and improve customer satisfaction.

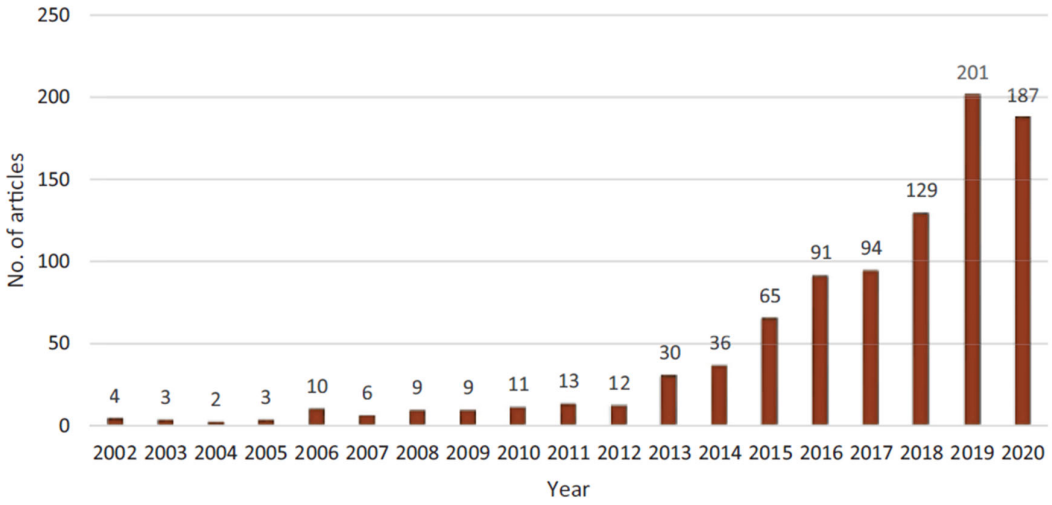

Figure no. 1. Year-wise publications on DDQM in SCs
Source: Agrawal et al., 2023, p.84

The conclusions and results mentioned are supported by increasing interest of the research community (Figure no. 1) to investigate and address BDAC in specific domain. Agrawal et al. (2022) provides a comprehensive examination of how (BDAC) capabilities can be systematically integrated into quality management within supply chains. The bibliometric study aimed to analyze the significant contributions made by authors, institutions, and countries in the data-driven quality management (DDQM) in supply chains (SCs) (Agrawal et al., 2023).

2. Optimization of Logistics Through Data-Driven Approaches

The availability of artificial intelligence (AI) and machine learning (ML) technologies has further propelled the ability to make strategic decisions based on data-driven insights. This subsection delves into the optimization of logistics through data-driven approaches, focusing on last-mile service completion prediction, cost strategies optimization, and planning of refined product primary logistics, according to Qiu et al. (2022).

The last mile of delivery is the most critical yet challenging part of the logistics chain, often characterized by unpredictability and high costs. A study by Pegado-Bardayo et al. (2023) introduces a data-driven decision support system that employs machine learning and clustering techniques to predict uncompleted services in last-mile logistics (Pegado-Bardayo et al., 2023). This approach not only enhances the accuracy of service completion predictions but also identifies potential cost-saving opportunities by optimizing courier routes. By predicting the number of services that will not be completed each day and identifying their location, logistics companies can adopt strategies to optimize their service level and enhance customer satisfaction. This methodology illustrates the power of data-driven insights in transforming the last-mile delivery process, making it more efficient and reliable.

Data-Driven decision-making and optimizing last mile delivery, together with other digitalization related subjects are specifically addressed by industry service providers. According to Boltrics (2023), a leader in logistics digitalization solutions, within “The top 10 logistics trends for 2024” article, the logistics industry

is undergoing a significant transformation, driven by the increasing value of data and the adoption of data analytics tools and platforms. These advancements are enabling logistics providers to gain deep insights into customer behavior, optimize supply chain operations, and proactively identify potential risks. The core of this transformation lies in the ability to seamlessly interpret vast datasets and extract actionable intelligence, thereby empowering logistics companies to make data-driven decisions (Boltrics, 2023).

Optimizing cost strategies in the logistics business is paramount for maintaining competitiveness and profitability. The research by Yaiprasert and Hidayanto (2024) explores the use of AI-powered ensemble machine learning to enhance cost strategies and maximize profits (Yaiprasert and Hidayanto, 2024). By simulating business threshold cost data, the study identifies optimal mitigation strategies that can significantly reduce operational costs. The ensemble ML methods employed in the study demonstrate the capacity to analyze complex relationships and patterns in cost data, providing valuable insights for strategic decision-making. This research underscores the importance of adopting AI and ML technologies in logistics to drive cost efficiencies and improve the bottom line.

AI-powered ensemble ML can accurately analyze large amounts of data related to transportation, labor, and packaging costs to identify patterns and relationships. Traditional cost optimization methods have limitations such as manual labor and static pricing models. These methods are often slow, inflexible, and unable to adapt to the dynamic nature of the logistics industry. AI-powered ensemble ML, on the other hand, offers a more efficient, flexible, and adaptable way to optimize cost strategies. AI-powered ensemble ML can analyze historical data, current trends, and external factors to predict demand fluctuations, enabling logistics carriers to proactively adjust their operations and minimize costs (Yaiprasert and Hidayanto, 2024).

The planning of refined product primary logistics involves the efficient transportation of goods from production facilities to distribution centers. Data-driven approaches play a crucial role in optimizing this process, enabling companies to forecast demand accurately, plan optimal routes, and manage inventory effectively. The integration of AI and ML technologies facilitates the analysis of historical data, current trends, and external factors, such as market dynamics and weather patterns, to make informed decisions. By leveraging data-driven insights, logistics companies can ensure timely delivery of products, minimize transportation costs, and reduce the risk of stockouts or overstocking.

The optimization of logistics through data-driven approaches presents a transformative opportunity for the logistics sector. By leveraging AI and ML technologies, companies can enhance last-mile service completion, optimize cost strategies, and improve the planning of refined product primary logistics. The studies reviewed in this subsection highlight the significant benefits of adopting data-driven decision-making processes, including improved operational efficiency, reduced costs, and enhanced customer satisfaction. As the logistics industry continues to evolve, the integration of data-driven practices will be crucial for companies seeking to maintain a competitive edge and achieve long-term success.

3. Research methodology

The paper focuses on reviewing and analyzing existing research related to data analytics and its application in logistics and supply chain management. The literature review was done utilizing two specific criteria for selecting relevant research:

- Big Data Analytics in Supply Chain Management
- Optimization of Logistics Through Data-Driven Approaches

The paper analyzes findings and contributions from recent research studies published by various authors on selected criteria. This analysis helps build the case for the importance of data-driven decision-making in logistics.

Industry perspectives are incorporated by referencing a report from Boltrics (2023) on logistics trends. This adds practical context to the research findings.

Overall, the paper utilizes a literature review methodology to gather and analyze existing knowledge on the topic, drawing strength from previously published research and industry reports.

4. Practical application: Occupancy rate, one of the most important KPIs in logistics

Following exposed theme, this is a practical application study of data-driven usage and decisions, supported article "Occupancy rate, one of the most important KPIs in logistics" from Boltrics (2018) (figure no 2).

Business Intelligence is predicted to significantly impact the logistics sector, with a focus on data understanding for optimizing business processes and client needs. Occupancy Rate, defined as the percentage of warehouse capacity used, it is a crucial KPI. An ideal occupancy rate is between 85 to 90%, balancing efficiency and space for unexpected orders.

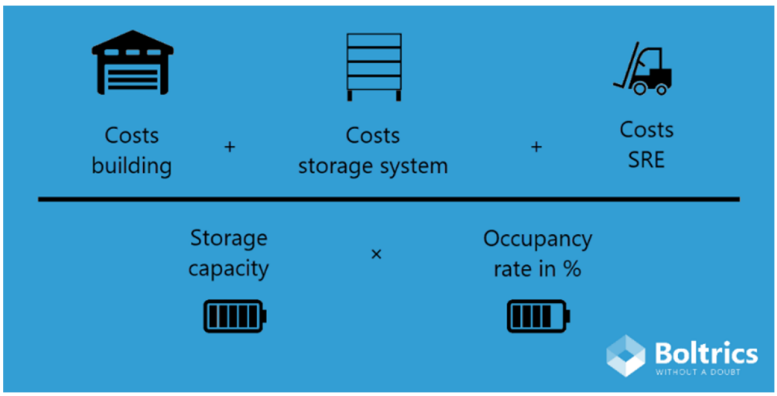

Figure no. 2. Calculating the costs of a pallet place
Source: Boltrics, 2018.

The cost of storage space varies, and the formula provided helps calculate the breakeven point for covering costs and determining productive occupancy rates. Investing in data analysis tools can enhance efficiency by providing insights into KPIs and enabling informed decision-making.

Understanding the occupancy rate provides a clear picture of your warehouse's efficiency. If you find a significant portion of your capacity is not being utilized, it might be an indication to strive for more tasks or consider cost reduction through automation. On the other hand, if you're frequently hitting your maximum capacity, congratulations! This might be a sign that it's time to consider expansion or reorganization of your warehouse. Data can further assist you in identifying seasonal trends, enabling you to plan accordingly. The more information you have, the more evidence-based your actions can be.

The business landscape is constantly evolving, demanding continuous adaptation. Companies that resist change risk falling behind. History is replete with examples of once-dominant firms that failed to adapt to new realities. To thrive in this dynamic environment, agility and a willingness to embrace change are essential. One key strategy is to leverage data analytics. By integrating data analysis into core processes, businesses can gain valuable insights to optimize efficiency and gain a competitive edge.

5. Results and discussion

The research convincingly demonstrates a positive correlation between leveraging data and achieving superior logistics performance. Yaiprasert and Hidayanto's (2024) study on AI-powered cost analysis exemplifies this. Their research showed how these techniques could identify optimal cost mitigation strategies, leading to significant reductions in operational expenditures. This reinforces the notion that data-driven decision-making isn't merely about marginal gains; it can unlock substantial cost savings and improve a company's bottom line.

The reviewed studies overwhelmingly support the notion that data-driven decision-making is not just beneficial, but transformative for logistics operations. For instance, Pegado-Bardayo et al. (2023) demonstrated how a data-driven approach using machine learning could predict uncompleted deliveries in last-mile logistics. This not only improved efficiency but also identified cost-saving opportunities through route optimization. These findings highlight the potential of data analytics to move beyond incremental improvements and fundamentally reshape how logistics companies operate.

However, the impact of data analytics goes beyond just cost optimization. It presents a paradigm shift for logistics operations. By integrating AI and machine learning, companies can automate repetitive tasks, predict disruptions in the supply chain before they occur, and optimize delivery routes in real-time – functionalities that were unimaginable just a decade ago. For instance, studies like Qiu et al. (2022) point

towards AI's potential in optimizing last-mile delivery, a traditionally complex and unpredictable aspect of logistics.

It's important to acknowledge that implementing data-driven practices isn't without its challenges. The cost of acquiring and maintaining data analytics tools can be significant, and fostering a data-centric culture within organizations requires a shift in mindset. Additionally, ensuring data security and privacy is paramount, requiring robust cybersecurity measures. Despite these challenges, the potential benefits of data-driven decision-making far outweigh the obstacles. By embracing a data-centric approach and addressing these challenges strategically, logistics companies can position themselves for long-term success in the ever-evolving landscape of the industry.

Conclusion

This research has demonstrably underscored the pivotal role of data-driven strategic decision-making in optimizing logistics operations. By harnessing the power of big data analytics (BDAC) and artificial intelligence (AI) technologies, logistics companies can achieve significant advancements in several key areas:

Enhanced Operational Efficiency: Data-driven insights empower logistics providers to optimize resource allocation, improve route planning, and streamline processes, leading to a more efficient and agile supply chain.

Reduced Costs: AI-powered cost analysis and optimization techniques enable companies to identify cost-saving opportunities, minimize operational expenditures, and achieve greater profitability.

Improved Customer Satisfaction: Utilizing data analytics for accurate demand forecasting and last-mile service completion prediction empowers logistics firms to deliver products more efficiently and reliably, ultimately enhancing customer satisfaction.

Sustainable Competitive Advantage: Integrating data-driven practices into core logistics operations allows companies to gain a significant edge over competitors by achieving superior operational performance and strategic agility.

In conclusion, the current logistics landscape is undergoing a transformative shift, driven by the increasing importance of data analytics and AI. By embracing a data-centric approach, logistics companies can unlock new levels of efficiency, cost optimization, and customer satisfaction, ultimately securing a sustainable competitive advantage in the marketplace.

This research offers valuable insights not only for academics but also for logistics practitioners. By implementing the findings and recommendations presented herein, logistics professionals can make informed decisions that drive operational excellence and propel their businesses towards long-term success.

Future research directions could explore the integration of data-driven decision-making with emerging technologies such as blockchain and the Internet of Things (IoT) to further revolutionize logistics operations and supply chain management. Additionally, investigating the ethical implications of data-driven practices within the logistics sector would be a valuable contribution to the ongoing discourse.

Acknowledgement(s)

„This paper was financed by The Bucharest University of Economic Studies”.

References

Agrawal, R., Wankhede, V.A., Kumar, A. and Luthra, S., 2023. A systematic and network-based analysis of data-driven quality management in supply chains and proposed future research directions. *The TQM Journal*, 35(1), pp.73–101. https://doi.org/10.1108/TQM-12-2020-0285.

Bag, S., Luthra, S., Mangla, S.K. and Kazancoglu, Y., 2021. Leveraging big data analytics capabilities in making reverse logistics decisions and improving remanufacturing performance. *The International Journal of Logistics Management*, 32(3), pp.742–765. https://doi.org/10.1108/IJLM-06-2020-0237.

Boltrics, 2018. *Occupancy rate, one of the most important KPIs in logistics*. Available at: <https://www.boltrics.com/en/2018/08/16/blog-occupancy-rate-one-of-the-most-important-kpis-in-logistics/> [Accessed 12 March 2024].

Boltrics, 2023. *The top 10 logistics trends for 2024*. Available at: <https://www.boltrics.com/en/2023/12/28/blog-the-top-10-logistics-trends-for-2024/> [Accessed 10 February 2024].

Liu, Y., Fang, W., Feng, T. and Gao, N., 2022. Bolstering green supply chain integration via big data analytics capability: the moderating role of data-driven decision culture. *Industrial Management & Data Systems*, 122(11), pp.2558–2582. https://doi.org/10.1108/IMDS-11-2021-0696.

Pegado-Bardayo, A., Lorenzo-Espejo, A., Muñuzuri, J. and Aparicio-Ruiz, P., 2023. A data-driven decision support system for service completion prediction in last mile logistics. *Transportation Research Part A: Policy and Practice*, 176, p.103817. https://doi.org/10.1016/j.tra.2023.103817.

Qiu, R., Liang, Y., Liao, Q., Wei, X., Zhang, H., Jiao, Y. and Zhang, H., 2022. A model-experience-driven method for the planning of refined product primary logistics. *Chemical Engineering Science*, 254, p.117607. https://doi.org/10.1016/j.ces.2022.117607.

Yaiprasert, C. and Hidayanto, A.N., 2024. AI-powered ensemble machine learning to optimize cost strategies in logistics business. *International Journal of Information Management Data Insights*, 4(1), p.100209. https://doi.org/10.1016/j.jjimei.2023.100209.