USING BIG DATA AND AI TO FORECAST DEMAND FOR POSTAL AND LOGISTICS SERVICES IN TURBULENT CONDITIONS

YAREMA Oleg
PhD in Economics, Associate Professor,
Associate Professor of the Department of Digital Economics and Business Analytics
Ivan Franko National University of Lviv
ORCID ID: https://orcid.org/0000-0003-3736-4820

HRYNDA Tetiana
Student of Master's degree
Ivan Franko National University of Lviv
ORCID ID: https://orcid.org/0009-0003-7540-3808

Abstract. *The article explores the possibilities of using Big Data and artificial intelligence technologies to forecast demand for postal and logistics services in Ukraine in conditions of increased turbulence caused by military operations, instability of market processes, and dynamic changes in demand. Key data sources are considered, as well as methods for their processing and analysis to build more accurate and adaptive predictive models. The study paid particular attention to the analysis of modern data mining tools, in particular clustering using the DBSCAN method and time series forecasting using Long Short-Term Memory (LSTM), which are currently the most effective for time series forecasting. A comparative analysis of traditional forecasting methods and models built using artificial intelligence and Big Data technologies was conducted to identify the forecasting method with the lowest percentage of forecast error. The study is based on an analysis of modern scientific publications on the topics of Big Data, machine learning, and logistics.*

Keywords: *Big Data, artificial intelligence, demand forecasting, postal and logistics services, LSTM, DBSCAN, time series, clustering, machine learning, logistics, forecasting.*

Logistics development is taking place in an environment of increasing market instability and complexity. Traditional approaches to forecasting in turbulent conditions are not always able to consider all the factors that affect the demand for postal and logistics services. Therefore, intelligent forecasting systems based on big data and artificial intelligence are becoming particularly relevant. Big Data technologies allow you to collect and process large amounts of information from various sources in real time. Artificial intelligence algorithms make it possible to detect hidden patterns and build adaptive demand forecasting models, which significantly increases the efficiency of management decisions in logistics companies.

The application of Big Data technologies and artificial intelligence fundamentally transforms approaches to demand forecasting in logistics services, enabling a shift from static models to dynamic, adaptive decision-support systems. The use of methods such as DBSCAN clustering for identifying data structures and anomalies, and LSTM modeling for deep time-series analysis, provides significantly higher forecasting accuracy, particularly under

conditions of instability and abrupt market fluctuations. The comparative analysis of traditional statistical methods and AI-based models confirmed that machine-learning approaches demonstrate lower forecasting errors and possess the ability to adapt to atypical demand spikes. This is especially important for the Ukrainian postal and logistics market, which operates under the influence of wartime risks, shifts in transportation flows, and irregular consumer activity. The obtained results indicate that integrating AI algorithms into TMS and WMS platforms, CRM systems, and analytical modules will enable enterprises to enhance planning efficiency, optimize warehouse and transportation resources, and minimize the risks of capacity overload. This forms the basis for creating more resilient, predictable, and efficient logistics processes, which is critically important in a highly turbulent environment.

Reference

1. Інформаційні системи в управлінні Новою Поштою. *LP-Sklad*, 2023. URL: https://lp-sklad.biz/blog/informaczijni-systemy-v-upravlinni-novoyu-poshtoyu/

2. A study of deep learning-based algorithms for supply chain logistics demand forecasting. *Learning-Gate Journal*, 2025. DOI: https://doi.org/10.55214/25768484.v9i3.5650

3. AI-driven big data analytics: the next big thing in supply chain management. *DHL Global*, 2023. URL: https://www.dhl.com/global-en/delivered/innovation/big-data-analytics-in-supply-chain-management.html

4. Comparative Analysis of Traditional and AI-based Demand Forecasting Models. *ResearchGate*, 2024. URL: https://www.researchgate.net/publication/388443834

5. DBSCAN Clustering in ML – Density based clustering. *GeeksforGeeks*, 2023. URL: https://www.geeksforgeeks.org/machine-learning/dbscan-clustering-in-ml-density-based-clustering/

6. Hofmann E., Rutschmann E. Big data analytics and demand forecasting in supply chains: a conceptual analysis. *The International Journal of Logistics Management*, 2018, 29(2), 739–766. URL: https://www.sciencedirect.com/org/science/article/abs/pii/S0957409318000688

7. Kagalwala H., Venkatesh G. Predictive Analytics in Supply Chain Management: The Role of AI and Machine Learning in Demand Forecasting. *ACR Journal*, 2025. URL: https://acr-journal.com/article/predictive-analytics-in-supply-chain-management-the-role-of-ai-and-machine-learning-in-demand-forecasting-886/

8. Mitra A., Sutradhar S. Comparative Study of Demand Forecasting Models for Retail Chain. *International Journal of Retail & Distribution*, 2022. URL: https://pmc.ncbi.nlm.nih.gov/articles/PMC9514716/

9. What is LSTM – Long Short Term Memory? *GeeksforGeeks*, 2023. URL: https://www.geeksforgeeks.org/deep-learning/deep-learning-introduction-to-long-short-term-memory/

10. Zamani E. D., Fosso Wamba S., Kala Kamdjoug J. Artificial intelligence and big data analytics for supply chain resilience: a systematic literature review. *Annals of Operations Research*, 2023. URL: https://www.researchgate.net/publication/363319307