EXTERNAL LOGISTICS SIMULATION + AI – TEACHING MATERIAL

The teaching material includes an integrated module: a **2-hour lecture and a 2-hour practical session** introducing applications of artificial intelligence in external logistics. It addresses key supply chain challenges – from transport planning and route optimization to delay prediction and supplier selection – demonstrating how AI transforms logistics from reactive to predictive and resilient. By combining theory with practical case studies, the module develops skills in machine learning, generative AI, and multi-criteria analysis in real-world logistics contexts.

During the lecture, students will learn the fundamentals of AI applications in external logistics and its impact on transport planning, fleet management, route optimization, and document processing. The theoretical part covers data-driven decision-making, real-time route recalculation, delay prediction, and the shift from reactive to predictive and resilient logistics. The lecture also addresses AI use in connected vehicles, smart infrastructure, enterprise systems, autonomous decision support, and control towers. Emphasis is placed on predictive maintenance, risk detection, service reliability, and alignment with sustainability goals – such as reduced fuel use, lower costs, better vehicle utilization, and decreased emissions – highlighting AI as a key driver of long-term transformation in logistics.

The practical session consists of five exercises in logistics and artificial intelligence. In the first, students build a predictive model of delivery delay risk in e-commerce using the DataCo Supply Chain dataset, covering the full proces – from data preparation and elimination of data leakage to interpreting results and evaluating a GBM model. The second exercise, based on the Multimetal case, focuses on using generative AI (ChatGPT) to analyze delivery delay factors – from identification and verification to qualitative and quantitative assessment using statistical methods (Pearson, Spearman). In the third, students act as analysts at TechParts Europe and select the best microcontroller supplier, combining Excel analysis with AI tools (Gemini, Claude, Microsoft Copilot). The fourth exercise introduces machine learning in logistics – students apply linear and logistic regression as well as the KNN algorithm using transport data based on Eurostat and IRU statistics. In the fifth, students work with a real dataset in Orange Data Mining – preparing data, building and comparing models, evaluating them with AUC, accuracy, and F1 metrics, and critically assessing their performance and data limitations.

During the course, students will acquire practical skills in using artificial intelligence tools to solve real-world logistics problems. They will learn how to build and evaluate machine learning models for predicting delivery delays, work with large datasets, and identify modeling pitfalls such as data leakage. They will also develop the ability to use generative AI (e.g., ChatGPT) for structured business analysis and factor evaluation, combining its outputs with statistical methods. In addition, students will practice multi-criteria supplier selection by integrating Excel-based analysis with AI assistants. The classes will help them understand how AI supports data-driven decision-making in external logistics.

Acknowledgements

The project is co-financed by the governments of the Czech Republic, Hungary, Poland, and Slovakia through Visegrad Grants from the International Visegrad Fund. The mission of the Fund is to advance ideas for sustainable regional cooperation in Central Europe.

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Visegrad Fund