INNOVATIVE APPROACHES TO IMPROVING WASTE MANAGEMENT AND REDUCING ECOLOGICAL FOOTPRINT

Mirela Laura Cârpaciu[1], Andreea Ardelean[2*]
[1)] *Automatic Data Processing, Bucharest, Romania*
[2)] *University of Bucharest, Bucharest, Romania*

Abstract
This study analyses historical plastic waste data to identify generation and recycling patterns and to support more effective public policy formulation. It aims to enhance waste management practices and mitigate the ecological footprint through a comprehensive analysis of plastic waste characteristics and trends. With the use of pre-processed dataset, exploratory data analysis (EDA) in Python, linear regression, K-Means clustering, and ARIMA models for temporal forecasting were applied. Results indicate that waste volumes explain approximately 90% of the variation in an aggregated indicator, highlighting a system oriented towards large and concentrated flows. Clustering identified four distinct waste profiles, with a pronounced geographical dimension (including an extremely large volume cluster almost exclusively associated with Uganda), suggesting the need for differentiated strategies across countries. ARIMA models, though limited by short time series, demonstrated the potential for anticipating future trends, occasionally outperforming a seasonal naive benchmark. The study's main contribution lies in integrating a complete analytical chain—from preprocessing and EDA to predictive modelling and segmentation—offering a practical framework for prioritizing interventions in plastic waste management and informing public policies targeting both large and dispersed, underutilized flows.

Keywords
Waste management, ecological footprint, plastic waste, data analysis, sustainability, Python

JEL Classification
Q50, Q51, Q53, Q58, O10, O20, C10, C80

[*] Corresponding author, **Andreea Ardelean** – andreea.ardelean@faa.unibuc.ro