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Transport Policy of European Union Member States in the Period 2008-2023

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Kamila Bednarz-Okrzyńska[1]

Abstract:

Purpose: *The European Union's transport policy focuses on ensuring sustainable, safe, and efficient mobility, in line with the objectives of the European Green Deal, which aims for climate neutrality by 2050. This article aims to assess the changes in the transport policies of individual EU countries between 2008 and 2023.*
Design/Methodology/Approach: *The study was conducted using 10 selected variables that describe the outcomes of transport policies in 27 EU countries. Methods from multidimensional comparative analysis were employed.*
Findings: *Over the past 15 years, EU countries have made significant progress in implementing more environmentally friendly and socially-oriented solutions in both passenger and freight transport. This progress has led to a significant reduction in road accident fatalities and a decrease in transport-related pollution.*
Practical Implications: *Evaluating the factors that shape the preferred developmental direction of EU countries' transport systems can help identify priority areas that should be considered in making various socio-economic decisions in the field of EU transport policy.*
Originality/Value: *The article demonstrates the potential of using multidimensional comparative analysis methods to assess the importance of factors influencing the development of transport systems in individual EU countries and to offer a synthetic evaluation of their transport policies.*

Keywords: *EU transport policy, multidimensional comparative analysis, sustainable mobility.*

JEL codes: *C38, R42.*

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[1]*Ph.D., University of Szczecin, Institute of Spatial Management and Socio-Economic Geography, Poland, e-mail: kamila.bednarz-okrzynska@usz.edu.pl;*

1. Introduction

The EU's transport policy is a key component of its overarching strategies aimed at ensuring sustainable, safe, and efficient mobility for citizens and goods. Its primary objectives include enhancing the interoperability of transport systems, reducing greenhouse gas emissions, and promoting new technologies and mobility solutions. These efforts are aligned with the objectives of the European Green Deal (EGD), which aims to achieve climate neutrality by 2050 (Haines and Scheelbeek, 2020).

The EGD sets a target to reduce transport emissions by 90% by 2050, with initiatives including investments in alternative fuels, electric vehicles, and the modernization of public transport fleets (Monti, 2022; Tsakalidis *et al.*, 2020), along with a new emissions standard for cars aimed at reducing average CO2 emissions by 37.5% from 2021 to 2030 (Haas and Sander, 2020).

A major focus within EU transport policy is the development and modernization of the Trans-European Transport Network (TEN-T), which seeks to better integrate the transport infrastructure of member states. The European Commission, in its TEN-T progress reports, emphasizes the need for investments in rail, waterborne, and coastal transport, as well as sustainable urban transportation systems (Bottcher, 2006; Stephenson, 2010). The EU also places a strong emphasis on advancing zero-emission and low-emission transportation options. This includes regulations on emission standards for new vehicles, as well as recommendations for promoting electromobility and innovative alternative fuels.

According to reports from the European Environment Agency (EEA), transport still accounts for a significant share of CO2 emissions, necessitating further measures to limit its environmental impact (Aparicio, 2017). These efforts are supported by research and development initiatives within programs such as Horizon Europe, which promote modern technologies, intelligent transport systems, and logistics digitization.

The Sustainable and Smart Mobility Strategy, published in 2020, outlines the EU's pathway to creating a greener, digital, and resilient mobility system (Communication, 2020).

As part of its transport policy, the EU also advances road safety initiatives, such as Vision Zero, aiming to reduce road fatalities to zero by 2050. The EU's strategies and actions in the field of transport are grounded in a wide range of reports, analyses, and consultations with member states, social partners, and other stakeholders to ensure coherence and effectiveness ("EU Road Safety," 2022). EU countries face the challenge of balancing environmental protection, enhanced quality of life, and economic growth, making transport transformation a complex and long-term pursuit.

2. Literature Review

One of the EU's priority areas is infrastructure development. In an integrated European Union, transport should play a key role in economic development and consumer service provision. However, despite being emphasized in the initial treaties, this role was not fully acknowledged during the first 30 years of the EU's existence. Despite past failures in EU transport policy over many years, the Single European Market elevated transport to a central position in European policies and later made it a core element of sustainability policies (Alias *et al*., 2019).

From 2021 to 2027, more than €116 billion in EU structural funds is planned to support transport and ICT infrastructure. For investments to promote regional development and reduce regional disparities, they must be effectively allocated (Mačiulytė-Šniukienė *et al*., 2022). Modern transport infrastructure is a driving force behind the economic development of regions and EU member states. The development of various types of infrastructure (transport, information and communication technologies (ICT), energy, water, and sewage systems) contributes to economic growth, though government quality also influences infrastructure-related growth effects (Butkus *et al*., 2023; Mačiulytė-Šniukienė and Butkus, 2022).

Research has shown that the strength of the relationship between transport infrastructure and transport efficiency varies across countries (Gnap *et al*., 2019), and EU countries differ in the degree to which they implement technologies aimed at mitigating the negative environmental impact of transport. The legal aspects of decarbonization policies in the transport sectors of EU member states are also being examined.

Key policies under consideration include promoting increased vehicle load through shared usage, congestion charges, bicycle and pedestrian zones, bans on fossil-fuel vehicles in cities, and emission reduction standards (Kiryk, 2022). The issue of innovative energy technologies in road transport is of growing importance (Kraciuk *et al*., 2022). Empirical studies show a positive impact on economic growth for every mode of transport, except for inland waterways.

Moreover, CO2 emissions from all modes of transport, along with other specific air pollutants, negatively affect per capita GDP (Gherghina *et al*., 2018). The link between transport infrastructure and economic outcomes in EU-28 countries has been demonstrated (Cigu *et al*., 2018) as well as the impact of the development potential of the transport and logistics sector on the competitiveness of EU countries (Oriekhova, 2021).

The European Union has adopted a strategy aimed at developing and harmonizing the transport network in every member state to achieve a uniform EU-level network (Dobre *et al*., 2022). To bridge the gap with Western European countries, funding was allocated for former socialist bloc states to build and modernize roads

(Wornalkiewicz *et al*., 2021), while the consolidation of a common EU transport policy directly depends on the level of integration of member states, though it increasingly extends beyond the EU's borders. At the same time, a decline or slowdown in the development of a common EU transport policy has been observed in the face of various crises and conflicts (Moszczyńska, 2022).

Based on EU strategic documents, reports, and roadmaps, ten topics have been identified as playing a key role in transport-related research (Esztergár-Kiss, 2023)

3. Research Methodology

The ranking of regions from "best" to "worst" is based on values that describe individual regions (synthetic variable or synthetic development measure), derived from a function that aggregates the information contained in the selected diagnostic variables. In this type of research, it is essential to consider the significant impact of the choice of diagnostic variables (Czyżycki, 2018a), the chosen weighting system for these variables (Czyżycki, 2018b), the importance of the normalization formula (Czyżycki, 2012), and the aggregation formula (Czyżycki, 2019) on the obtained ranking results.

To align with the objective of this study, the following indicators were chosen to describe regional development: Freight and mail on board (Tonne per thousand inhabitants - X1), Passengers carried (Passenger per thousand inhabitants - X2), Freight and mail air transport over national territory (tonne-km per inhabitant - X3), Passenger air transport over national territory (passenger-km per inhabitant - X4), Share of new zero-emission vehicles in all new vehicles (Percentage - X5), Passenger cars (Car per thousand inhabitants - X6), Length of motorways (Kilometre per hundred km² - X7), Road traffic deaths (per hundred thousand inhabitants - X8), Average CO_2 emissions per km from new passenger cars (Grams per kilometre - X9), Persons killed in road accidents (Per million inhabitants - X10).

To determine changes in the transport policy, data describing these variables were collected for all 27 current EU countries (Eurostat) for both 2008 and 2023. For variables X3, X4, X7, X8, and X10, due to a lack of data for 2023, their 2022 values were used.

To ensure the comparability of variables, the zero-unitarization method (Kukuła, 2000), was employed, which normalizes variables within the [0,1] range using:

- for stimulants (X1-X7), the formula::

$$z_{ij} = \frac{x_{ij} - \min\limits_{i} x_{ij}}{\max\limits_{i} x_{ij} - \min\limits_{i} x_{ij}} \quad (1)$$

- for destimulants (X8-X10), the formula:

$$z_{ij} = \frac{\max\limits_{i} x_{ij} - x_{ij}}{\max\limits_{i} x_{ij} - \min\limits_{i} x_{ij}} \tag{2}$$

Weights for individual diagnostic variables (wj) were determined using the CRITIC (Criteria Importance through Inter-criteria Correlation) method (Diakoulaki *et al*., 1995), which requires the normalization of variables according to formulas (1) and (2), followed by the calculation of the standard deviation σj for each normalized variable and the linear correlation coefficients rij between all variables. The individual weights are then determined based on the following formula:

$$w_j = \frac{C_j}{\sum_{k=1}^{n} C_k} \tag{3}$$

where

$$C_j = \sigma_j \cdot \sum_{k=1}^{m} (1 - r_{ik}) \tag{4}$$

The resulting weights meet two basic assumptions related to the weights of diagnostic variables, namely positivity ($w_j > 0$) and summability to unity $\sum_{j=1}^{m} w_j = 1$).

To assess the level of regional development, the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method (Hwang and Yoon, 1981) based on Euclidean distance, is applied, with object rankings created based on the Ci values calculated using the formula:

$$C_i = \frac{d_i^-}{d_i^+ + d_i^-}, \tag{5}$$

where:

$$d_i^+ = \sqrt{\sum_{j=1}^{m} w_j \left(z_{ij} - z_0^+\right)^2}$$

$$d_i^- = \sqrt{\sum_{j=1}^{m} w_j \left(z_{ij} - z_0^-\right)^2} \tag{6}$$

$$z_0^+ = \begin{cases} \max\limits_{i} z_{ij} & for\ stimulant \\ \min\limits_{i} z_{ij} & for\ destimulants \end{cases} \tag{7}$$

$$z_0^- = \begin{cases} \min\limits_i z_{ij} & for\ stimulant \\ \max\limits_i z_{ij} & for\ destimulants \end{cases}$$

To determine the significance of changes in transport policy outcomes among EU member states, rankings were created based on data from 2008 and 2023 using the above formulas. The Kendall tau (τ) coefficient (*Encyklopedia of Measurement and Statistics*, 2007) was used to assess the alignment of these rankings. This coefficient ranges from -1 to 1, with 1 indicating full agreement, 0 indicating no agreement, and -1 indicating complete opposition. To test the hypothesis of ranking alignment, the Kendall tau significance test was employed, with the test statistic defined as:

$$Z_\tau = \frac{\tau}{\sqrt{\frac{2(2n+5)}{9n(n-1)}}} \tag{8}$$

for n>10, it follows an asymptotic normal distribution (Abdi, 2007).

4. Results

Based on the conducted research, it can be observed that over the analyzed 15-year period, the significance of the selected diagnostic variables describing the transport systems of individual European Union countries has practically not changed. Only in the case of the variable describing the number of cars per 1,000 inhabitants (X6), there is a noticeable increase of more than 50% in its significance, while for the variables describing average CO2 emissions per km from new passenger cars (X9) and persons killed in road accidents per million inhabitants (X10), there is approximately a ten percent decrease in their significance (Table 1).

However, there have been significant changes in the ranking positions of individual countries regarding transport policy performance. Italy showed the most substantial positive change, moving from 25th place in the EU in 2008 to 8th place in 2023.

Positive changes were also observed for Portugal (rising from 26th to 12th place), Lithuania (rising from 24th to 13th), and the Czech Republic (rising from 21st to 11th). Conversely, the worst performance among EU countries was observed in Ireland (dropping from 9th to 25th place) and Sweden (dropping from 13th to 27th place) (Figure 1).

Changes in rankings were mainly due to fluctuations in the values of individual diagnostic variables over the years 2008-2023. In the case of freight and mail on board, the entire EU recorded an average decrease of almost 15 tonnes per thousand inhabitants, with the largest increase noted in Belgium (20.6) and the largest decline in Luxembourg (401.9).

Regarding passengers carried, there was an average increase of over 1,322 passengers per thousand inhabitants during the analyzed period, with the maximum increase of 6,789 passengers per thousand inhabitants in Malta and the largest decrease of 231 passengers per thousand inhabitants in Sweden.

The variable describing freight and mail air transport over national territory showed the greatest increase in Lithuania (79.7 tonne-km per inhabitant), while it decreased in Finland (8.3 tonne-km per inhabitant).

In the case of passenger air transport over national territory, the largest increase occurred in Hungary (2,579.2 passenger-km per inhabitant), while the largest decline was in Spain (522.2 passenger-km per inhabitant).

At the EU-wide level, there was an average increase in the share of new zero-emission vehicles among all new vehicles (13.9%), passenger cars (97.1 cars per thousand inhabitants), and the length of motorways (2.0 kilometers per hundred km²).

Meanwhile, over the years 2008-2023, there was a decrease in the average values of indicators such as road traffic deaths (4.7 per hundred thousand inhabitants), average CO2 emissions per km from new passenger cars (48.7 grams per kilometer), and persons killed in road accidents (46.5 per million inhabitants). Detailed statistics on the changes in the examined variables are presented in Table 2.

Table 1. *Weight values defining the importance of selected variables in the development of the transport system of individual EU countries*.

	X1	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*	*X9*	*X10*
2008	0.0765	0.0939	0.1213	0.1213	0.1115	0.0785	0.0988	0.0892	0.1191	0.0898
2023	0.0734	0.0927	0.1244	0.1218	0.1042	0.1184	0.0972	0.0823	0.1050	0.0808

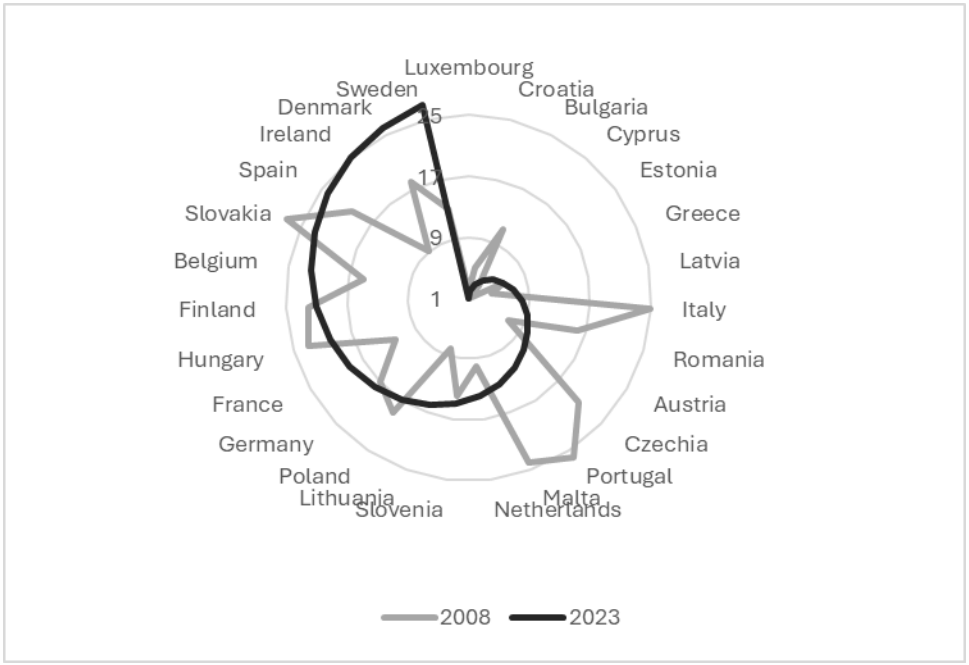
Source: *Own analysis based on Eurostat.*

Table 2. *Selected statistics describing changes in variables related to the effects of transport policy from 2008 to 2023.*

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
max	20.6 (BE)	6789.2 (MT)	79.7 (LV)	2579.2 (HR)	38.5 (SE)	228 (RO)	9.0 (SK)	2.7 (MT)	-12.8 (SK)	28 (MT)
min	-401.8 (LU)	-231.1 (SE)	-8.3 (FI)	-522.2 (EE)	2.6 (HR)	-13 (LV)	0 (LV. MT)	-11.4 (LT)	-112.9 (SE)	-112 (LT)
average	-14.8	1322.1	9.7	455.5	13.9	97.1	2.0	-4.7	-48.7	-46.5
median	1.3	816.0	4.9	305.2	8.9	92.0	1.4	-4.3	-48.1	-44.0
St.Dev	76.6	1510.6	17.9	712.2	10.7	66.0	2.2	3.0	23.4	29.9

Source: *Own analysis based on Eurostat.*

Figure 1. *Ranking of European Union countries by transport policy performance in 2008 and 2023*



Source: *Own elaboration.*

5. Discussion and Conclusion

In response to climate change, EU countries strive to reduce greenhouse gas emissions in line with the goals of the European Green Deal. Transforming the transport sector is crucial, as it accounts for a significant share of carbon dioxide emissions in the EU. Consequently, actions are being taken to promote the use of electric and hybrid vehicles and alternative fuels (e.g., hydrogen and biofuels). Many countries are introducing financial incentives for drivers, such as subsidies for purchasing low-emission vehicles or tax breaks.

Member states are also heavily investing in the development of public transport, enhancing its accessibility, quality, and energy efficiency. New metro lines, urban railways, and tram systems are being established, while existing systems are modernized. Active mobility, including cycling, scooters, and walking, is gaining significance—particularly in the context of reducing car traffic in cities and creating low-emission zones.

A key goal of EU policy is to eliminate road fatalities entirely by 2050. As part of this initiative, member states are implementing strategies to improve road safety

through infrastructure modernization, better signage, speed reduction systems, and other engineering measures.

The transformation of the transport sector—including the shift to electric vehicles, the construction of charging infrastructure, railway development, and road modernization—is highly costly. It requires significant financial resources, both from state budgets and private investments.

For many countries, finding the necessary funds to implement these changes in the short and long term poses a particular challenge. Efforts to reduce emissions in the transport sector must be balanced with economic and social needs. For numerous countries, especially those reliant on combustion-engine vehicles, the transformation may impact employment, costs for businesses, and economic competitiveness.

Transport transformation often encounters social resistance, including opposition to the implementation of low-emission zones in cities, changes in parking policies, the high cost of new vehicles, and the necessity of adapting mobility habits.

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+p%C5%82atnego+parkowania%2C+wprowadzenie+stref+dla+rower%C3%B3w+i+pieszych+oraz+zakaz+wjazdu+pojazd%C3%B3w+benzynowych%2Fdiesel+do+miast.&q=polityka+transportowq+poszczeg%C3%B3lnych+pa%C5%84stw+UE&pro=on&lang=pl&year_min=2018.

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