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Quantification of Sustainable Urban Development: An Analysis of SDG 11 in the European Union Countries

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Abstract:

Purpose: *This article presents a synthetic indicator assessing the implementation of SDG 11 – Sustainable Cities and Communities – in EU member states. The proposed measure enables quantitative comparisons, identification of spatial disparities, and supports strategic planning in the context of the 2030 Agenda.*
Design/Methodology/Approach: *Hellwig's method was employed to conduct a multidimensional comparative analysis. The indicator was constructed based on diagnostic variables including the share of public transport in passenger traffic, housing deprivation, exposure to noise, road traffic fatalities, premature deaths caused by air pollution (PM2.5), and perceived exposure to crime or vandalism. The analysis covered the years 2013, 2020, and 2023, allowing the identification of long-term changes as well as the assessment of disruptions related to the COVID-19 pandemic.*
Findings: *The synthetic indicator made it possible to rank EU member states in terms of SDG 11 performance. In 2023, the highest scores were achieved by Ireland, Denmark, and Sweden, while the lowest were recorded in Bulgaria, Greece, Romania, Latvia, and Portugal. The results reflect the combined effect of the analysed variables and reveal significant differences in the level of sustainable urban development across Europe.*
Practical implications: *The indicator serves as a tool for policymakers, urban planners, and EU institutions, enabling the monitoring of progress towards the 2030 Agenda, supporting decisions on resource allocation, and identifying priority areas for intervention. It can also be used to evaluate the effectiveness of EU policies.*
Originality value: *The article proposes an empirical, measurable, and integrated approach to assessing sustainable urban development. The synthetic indicator allows for international quantitative comparisons, deepens the analysis of spatial disparities, and enriches the methodology of urban policy research in the EU.*

Keywords: *Synthetic indicator, Hellwig's method, multivariate comparative analysis, SDG 11, sustainable cities, urban policy.*

JEL Codes: *C38, Q01, R11, R58, O52.*

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1. Introduction

Cities are key centers of contemporary development, serving as major hubs for economic, social, scientific, and cultural activities. Urban areas facilitate intensive processes of knowledge exchange, innovation, and services, which shape the pace of civilizational change. At the same time, rapid urbanization generates multifaceted challenges, including pressures on transport and public infrastructure, social inequalities, housing shortages, and risks to residents' health and safety.

In 2015, the United Nations adopted 17 Sustainable Development Goals (SDGs), establishing a global agenda for social, economic, and environmental development. Among these, SDG 11 – Sustainable Cities and Communities – holds particular significance for urban areas. Achieving this goal requires a comprehensive perspective on urban development processes, accounting for the complex interactions of social, environmental, infrastructural, and economic factors.

Assessing the implementation of SDG 11 is challenging due to the fragmentary nature of available statistical data. Analysis of individual indicators provides only partial information, making the development of a synthetic measure necessary to obtain a holistic understanding of urban development and enable cross-country comparisons.

The purpose of this article is to present a synthetic indicator assessing the implementation of SDG 11 – Sustainable Cities and Communities – in EU member states. The proposed measure enables quantitative comparisons, identification of spatial disparities, and supports strategic planning in the context of the 2030 Agenda. The analysis covers data from 2013, 2020, and 2023, allowing the evaluation of long-term trends and the assessment of significant disruptions, including the impact of the 2020 health crisis, on urban development and resilience.

The indicator is constructed using Hellwig's linear ordering method, complemented by procedures for selecting diagnostic variables, temporal comparative analysis, and country classification through clustering techniques. This approach not only facilitates the assessment of the current level of SDG 11 implementation but also enables the identification of developmental trajectories, typologies of member states, and areas requiring priority support.

2. Literature Review

Research on sustainable cities and communities (SDG 11) has developed along several well-established lines. One important stream focuses on defining and classifying sustainable cities and smart sustainable cities, with particular attention to the integration of environmental, social, and economic dimensions.

Studies emphasize that the concepts of the "sustainable city" and the "smart city" are interconnected, and that the development of digital technologies and ICT can support the achievement of sustainable development goals while enhancing community engagement in co-creating innovative solutions (Almeida, Guimarães, and Amorim, 2024; Bokolo, 2023; Giles-Corti *et al.,* 2022).

Another area of research explores the use of advanced technologies in urban management. The integration of the Internet of Things, artificial intelligence, Edge AI, and blockchain is seen as a driver of smart urban systems, improving energy efficiency, mobility, and crisis management (Badidi, 2022; Khan *et al.,* 2023; Monteiro, Sousa, Coutinho-Rodrigues, and Natividade-Jesus, 2024).

A significant body of literature examines urban green infrastructure and multifunctional spaces that enhance climate resilience and improve residents' quality of life. Studies highlight the role of green roofs, facades, parks, and other green elements in combining environmental, recreational, and aesthetic functions within urban areas (Croce and Vettorato, 2021; Herath and Bai, 2024).

The development of renewable energy sources in urban environments constitutes another key research direction, particularly with regard to wind power and local energy generation. These studies emphasize the role of renewables in strengthening the resilience of energy systems and supporting the decarbonization of cities (Vallejo Díaz and Herrera Moya, 2024).

Sustainable mobility and pedestrian-friendly urban design represent further important areas of investigation. Scholars discuss the potential of light electric vehicles, bicycles, and scooters, as well as planning tools that enhance walkability, in line with the "15-minute city" concept (Aparicio, Arsenio, Santos, and Henriques, 2024; Abduljabbar, Liyanage, and Dia, 2021).

Research on policy, planning, and governance in sustainable cities forms a distinct yet related stream. Analyses address spatial planning strategies, urban infrastructure development, intelligent transport systems, and the application of data analytics, all of which contribute to urban resilience and energy transition (Monteiro, Sousa, Coutinho-Rodrigues, and Natividade-Jesus, 2024; Giles-Corti *et al.,* 2022; Hussain *et al.,* 2023).

Within this context, the literature emphasizes the importance of urban form, transport systems, and technologies supporting electric mobility and walkability for reducing energy consumption, lowering greenhouse gas emissions, and improving quality of life.

From these diverse strands, a holistic perspective on sustainable urban development is emerging. This approach combines environmental, social, and technological dimensions, enabling more effective planning of cities that are resilient to crises, energy-sustainable, and better equipped to address future challenges (Giles-Corti *et al.,* 2022; Hussain *et al.,* 2023; Herath and Bai, 2024).

Despite the growing body of research, a significant gap remains. There is a lack of comprehensive empirical assessments of urban policy effectiveness across the European Union that would capture their combined impact on different aspects of urban life. Existing studies often focus on individual indicators or specific countries, but systematic comparative approaches that integrate multiple components of sustainable development into a coherent, cross-country evaluation are still missing.

3. European Union Policies for Sustainable Urban Development

The European Union plays an active role in shaping the frameworks and directions for sustainable urban development, serving as a reference for national and local policies. It develops mechanisms that support effective action in social, economic, and environmental domains, while assisting cities in adapting to challenges related to urbanization, climate change, and digital transformation (Sustainable urban development).

One of the key strategic documents is the Urban Agenda for the European Union, initiated in 2016 through the Amsterdam Pact (EC, 2019). Its objectives are to support EU cities in implementing EU law, facilitate access to funding, and improve knowledge on urban functioning. The Agenda applies a multi-level governance principle, fostering close collaboration between the European Commission, Member States, local authorities, and civil society organizations. Its actions focus on priority areas, including air quality, housing, urban mobility, poverty, and digitalization, with solutions adapted to local contexts.

Another pillar of EU urban policy is the Sustainable and Smart Mobility Strategy (EC, 2020b), which outlines the transformation of transport systems in line with climate neutrality and digitalization. The strategy aims, among other goals, to increase the number of zero-emission vehicles, expand public transport, and achieve climate neutrality in at least 100 cities by 2030.

All EU actions in sustainable urban development are aligned with the broader European Green Deal (EC, 2020a), which seeks to make Europe the first climate-neutral continent by 2050. The Green Deal provides a framework for urban, energy,

and transport transformations and promotes resource-efficient solutions that enhance urban livability.

Funding for sustainable urban development primarily comes from the European Structural and Investment Funds. Key instruments include:

- The European Regional Development Fund (ERDF), supporting infrastructure, urban regeneration, and territorial cooperation;
- The Cohesion Fund, aimed at improving economic, social, and territorial cohesion;
- The European Social Fund (ESF), which supports employment, education, and social inclusion initiatives in urban areas.

Complementing these traditional funds are investment instruments, such as the European Fund for Strategic Investments (EFSI), which mobilizes private capital for strategically important projects, including urban infrastructure and energy transformation.

City-specific initiatives include the Urban Innovative Actions (UIA) program, supporting testing of new urban solutions, and URBACT, promoting knowledge exchange and networking among EU cities (EC, 2019). Horizontal programs, such as Horizon 2020 and LIFE, support research, innovation, and environmental actions, directly impacting urban quality of life.

Through the integration of structural funds, investment instruments, and thematic programs, the EU establishes a multi-level support system for cities, enabling the reduction of development disparities and the implementation of innovative solutions in mobility, environmental quality, and social inclusion. EU urban policy relies on the synergy of three main pillars: legal regulations, financial instruments, and expert knowledge.

Initiatives such as the Urban Agenda, the Sustainable and Smart Mobility Strategy, and the European Green Deal provide cities with tools to adapt to local needs and implement environmentally responsible and innovative solutions. Financial support from structural and investment funds, supplemented by horizontal programs and city-specific initiatives, forms a comprehensive system for improving urban livability, reducing territorial inequalities, and advancing climate neutrality.

Importantly, EU policy does not impose uniform solutions but creates frameworks for cooperation, knowledge exchange, and the adoption of best practices across diverse urban contexts, promoting responsibility and innovation in local community development.

When analysing EU policies on sustainable urban development, it is essential to consider variations among Member States, as reflected in indicators monitored by the

European Commission. Targets related to environmental quality, mobility, or living conditions are measured using indicators such as: the percentage of population connected to at least secondary wastewater treatment, the share of buses and trains in inland passenger transport, the severe housing deprivation rate, and the percentage of population exposed to household noise.

These indicators allow both assessment of national progress and identification of intra-EU disparities in infrastructure quality, sustainable transport availability, and socio-environmental conditions.

Consequently, studies examining cross-country differences in urban sustainability are crucial for evaluating the effectiveness of EU instruments and serve as a basis for designing more targeted actions within cohesion policy.

Despite the comprehensive frameworks and funding mechanisms, there remains a lack of systematic empirical studies assessing the effectiveness of urban policies across the European Union, particularly in terms of their combined impact on social, environmental, and economic dimensions.

4. Research Methodology

To evaluate sustainable urban development across EU Member States, the study applied the linear ordering method, enabling the conversion of complex phenomena into a single synthetic indicator (Balcerzak, 2015; Hellwig, 1981). This method enables an objective comparison of countries, taking into account environmental, social, and infrastructural aspects that shape the quality of life in cities.

In the first stage, data harmonization was carried out by transforming the variables to a common scale, which ensured their comparability (Bąk, 2018). For this purpose, a set of diagnostic variables was selected to reflect key dimensions of sustainable urban development, including:

- Share of buses and trains in inland passenger transport [%] – stimulant,
- Severe housing deprivation rate [%] – destimulant,
- Population living in households considering that they suffer from noise [%] – destimulant,
- Road traffic deaths, by type of roads [per 100,000 inhabitants] - destimulant,
- Premature deaths due to exposure to fine particulate matter (PM2.5) [per 100,000 inhabitants] - destimulant,
- Population reporting occurrence of crime, violence or vandalism in their area [%] – destimulant,

These indicators were based on statistical data monitored by the European Commission (Eurostat, 2025).

Based on the data, an observation matrix X was constructed, consisting of n rows (EU Member States) and m columns (diagnostic features) in the following equation (1):

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix}$$

From the preliminary list of indicators, a final set of diagnostic features with a sufficient level of differentiation was selected. Their variability was determined using the classical coefficient of variation, calculated on the basis of the standard deviation:

$$V_j = \frac{S_j}{\bar{x}_j} \tag{2}$$

where:
V_j – coefficient of variation of the *j*-th variable,
S_j – standard deviation of the *j*-th variable,
$\bar{x}_j$ – arithmetic mean of the *j*-th variable,

$$\bar{x}_j = \frac{\sum_{i=1}^{n} \mathrm{x_{ij}}}{n} \tag{3}$$

where:
x_{ij} – the values of variable *j* in country *i,*

The standard deviation of the variable was calculated according to the formula:

$$S_j = \sqrt{n^{-1} \sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2} \tag{4}$$

Variables for which the coefficient of variation did not exceed 10% were considered to lack sufficient diagnostic properties and could have been excluded from further analysis. However, in this study, all selected indicators met the differentiation criterion, and therefore none of them was omitted.

Subsequently, the diagnostic variables were normalized, transforming them to a common scale to ensure data comparability. The standardization method was applied, converting the original data matrix into a matrix of standardized features (Grabiński, Wydymus, Zeliaś, 1989), according to the formula:

$$Z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j} \tag{5}$$

Z_{ij} – standardization of the variable's value in a country.

Based on the final set of indicators after standardization, a pattern was established – an idealized state with the best possible values: (Z_01; Z_02;…,Z_0k):

– for a destimulant:

$$Z_{0j} = \min Z_{ij} \tag{6}$$

– for a stimulant:

$$Z_{0j} = \max Z_{ij} \tag{7}$$

Based on the final set of indicators after standardization, a pattern was established – an idealized state of development. Subsequently, using the linear ordering method based on the development pattern, the taxonomic distances of EU countries relative to this model reference object were determined using the Euclidean metric.

This made it possible to assess the degree of similarity or differences in achieving the sustainable development goals of cities. On this basis, a synthetic development index was calculated, which evaluates a country's position relative to the pattern while simultaneously considering environmental, social, and infrastructural aspects.

$$M_i = 1 - \frac{d_{i0}}{d_0} \ (I = 1, 2, \dots, n) \tag{8}$$

where:

$$d_{i0} = \sqrt{\sum_{j=1}^{m} (z_{ij} - z_{0j})^2} \ (i = 1, 2, \dots, n; j = 1, 2, \dots m) \tag{9}$$

where:

$$d_0 = \bar{d}_0 + 2S_0 \tag{10}$$

$$\bar{d}_0 = n^{-1} \sum_{i=1}^{n} d_{i0}$$

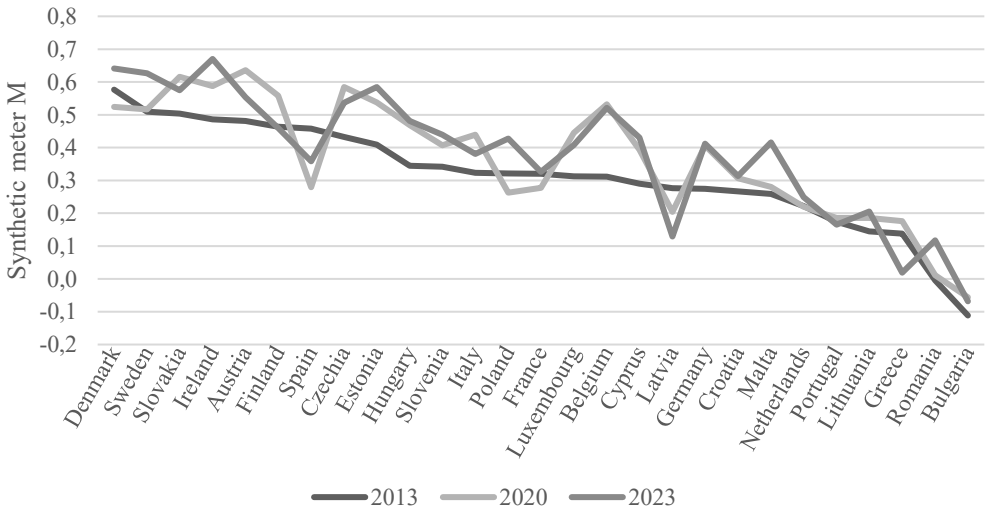
$$S_0 = \sqrt{n^{-1}\sum_{i=1}^{n}(d_{ij} - d_0)^2}$$

M_i – synthetic indicator
d_{i0} – Euclidean distance of each object from the constructed pattern
z_{0j} – normalized value of the pattern for variable *j*
$\bar{d}_0$ – arithmetic mean of the taxonomic distances
S_0 – standard deviations of the taxonomic distances

Based on the normalized data, a set of statistical characteristics of the diagnostic variables was developed, illustrating the spatial differentiation of the level of challenges related to achieving the sustainable development goals of cities in the European Union member states.

On this basis, countries characterized by extremely high or low levels of sustainable development in the social, environmental, and infrastructural dimensions were identified. The values of the synthetic indicator made it possible to rank the countries according to the degree of achievement of the cities' sustainable development goals – the results of this ranking are presented in Figure 1.

Figure 1. *Ranking of EU countries in terms of sustainable transport development in 2013, 2020, and 2023*



Source: *Authors' calculations.*

In the final stage of the study, EU member states were classified using the *k*-means method, based on the values of the synthetic indicator. The classification was first

based on the overall mean and then refined using partial means, which allowed the identification of groups of countries with similar levels of sustainable urban and community development:

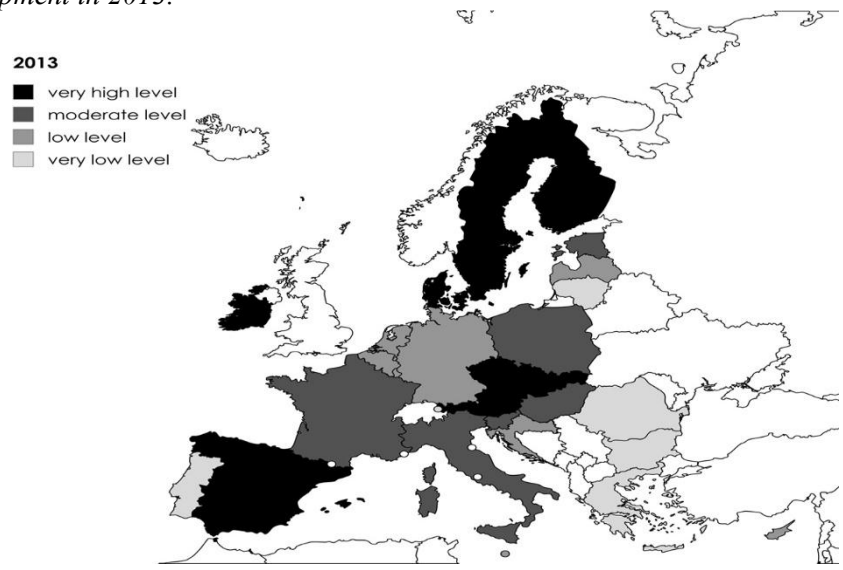
- Group I – very high level of sustainable urban and community development: $z_i \geq \bar{Z}_{1l}$
- Group II – high level of sustainable urban and community development: $\bar{Z}_1 < z_i \leq \bar{Z}_{1l}$
- Group III – moderate level of sustainable urban and community development: $\bar{Z}_{2l} < z_i \leq \bar{Z}_l$
- Group IV – very low level of sustainable urban and community development: $z_i \leq \bar{Z}_{2l}$

where:

$\bar{Z}_l$ – mean value of the development indicator
$\bar{Z}_{1l}$, $\bar{Z}_{2l}$ – intermediate means of the development indicator

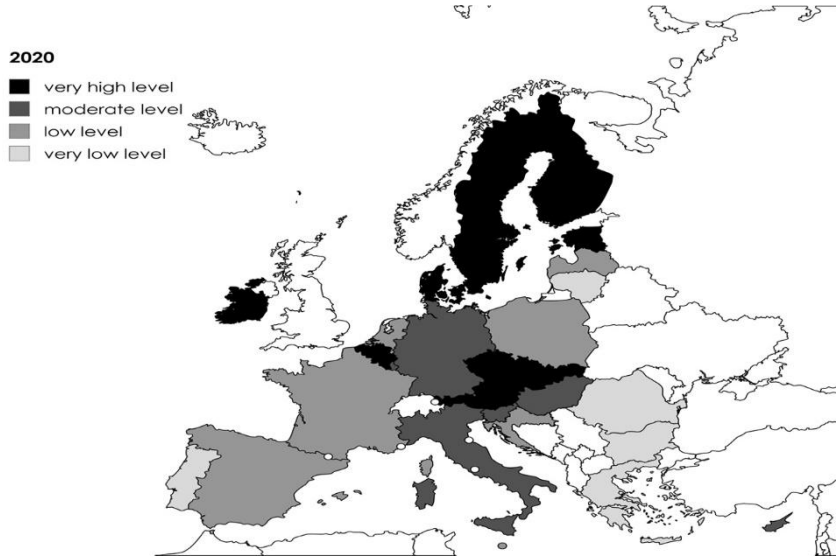
The variation among EU countries in terms of sustainable transport development, previously reflected in the four identified categories, is presented graphically (Figures 2, 3, and 4). This type of visualization not only facilitates the identification of leaders in sustainable urban and community development, as well as countries requiring intensified efforts in this area, but also allows for tracking the direction and dynamics of changes occurring in individual countries over time.

Figure 2. *Variation among EU countries in terms of sustainable urban and community development in 2013.*



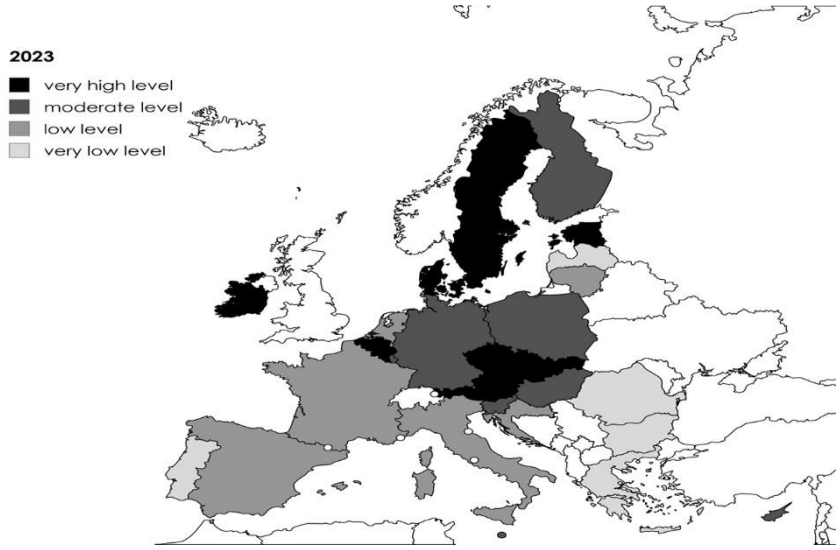
Source: *Author's calculations.*

Figure 3. *Variation among EU countries in terms of sustainable urban and community development in 2020*



Source: *Authors' calculations.*

Figure 4. *Variation among EU countries in terms of sustainable urban and community development in 2023*



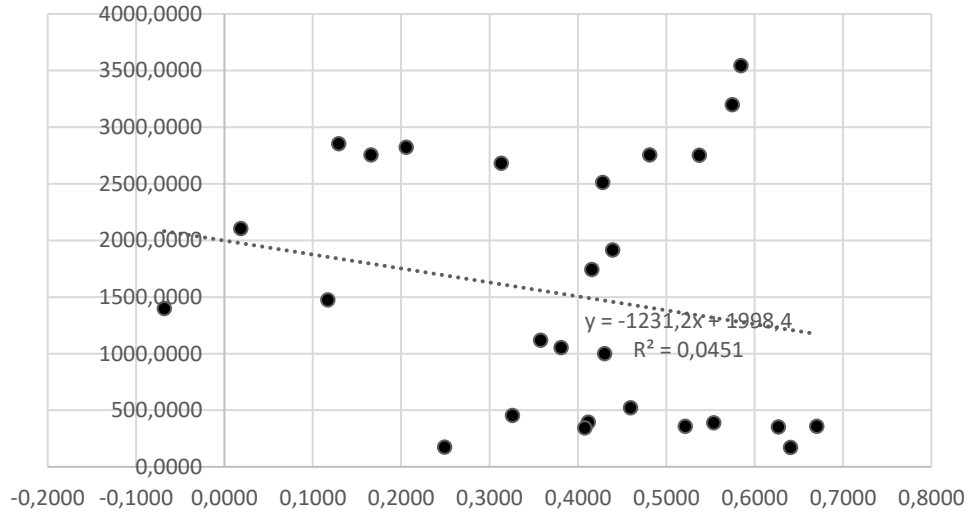
Source: *Authors' calculations.*

The obtained results enable an assessment of the scale of environmental and social pressures in cities and provide a basis for further analysis of potential relationships between these phenomena and the level of financial support from the European Structural and Investment Funds, including the European Regional Development Fund, the Cohesion Fund, and the European Social Fund.

In the next stage of the study, the relationships between the synthetic indicator of sustainable urban and community development and the amount of funding from the aforementioned funds were analysed. The aim was to determine the extent to which financial support translates into achieved outcomes.

To this end, Pearson correlation analysis and linear regression were applied, allowing for the identification of the direction and strength of the relationship between the variables and the estimation of the share of funds in explaining the variability of the synthetic indicator. The results of this analysis are presented in Figure 5.

Figure 5. *Relationship between per capita EU funding and the synthetic indicator of sustainable urban and community development in EU countries*



Source: *Authors' calculations.*

The conducted study allows for the identification of outlier cases in which the level of funding is not reflected in the values of the sustainable development indicator. It also facilitates the detection of non-linear relationships between funding and the level of urban development, and highlights areas where additional factors - such as institutional effectiveness and the coherence of national strategies - should be considered in further analyses of urban policies in EU countries.

5. Research Results and Discussion

The analysis of the synthetic indicator of sustainable urban and community development in EU countries from 2013 to 2023 reveals significant variation between countries and divergent trajectories over time. In some countries, a consistent increase is observed, while others experience fluctuations or stagnation, and in certain cases, a marked decline.

In 2013, Ireland belonged to the group of countries with a relatively high indicator (0.4866; fourth place), and by 2023 it had reached 0.6702 - the highest among all member states. Denmark and Sweden maintained a steady upward trend throughout the analysed period, consistently ranking among the top countries. Austria reached the highest value of the entire study in 2020 (0.6360); however, by 2023, its indicator had decreased to 0.5535.

Although it remained in the leader group, this case illustrates that even countries with a well-established position are susceptible to fluctuations if the pace of innovation implementation slows. Finland exhibited a similar dynamic—after rising to 0.5579 in 2020, its indicator fell to 0.4594 in 2023, returning to the level of a decade earlier.

In Central and Eastern Europe, Estonia stands out as a particularly notable case, increasing from 0.4088 in 2013 to 0.5843 in 2023, which allowed it to join the group of highest-performing countries in the region. Poland, despite a drop to 0.2624 in 2020, improved to 0.4280 in 2023. Hungary and Lithuania followed a similar growth trajectory.

Trends in Southern European countries were less favorable. Spain had an indicator of 0.4576 in 2013, which declined to 0.2795 in 2020 and partially recovered to 0.3579 in 2023, yet it did not return to its pre-decade level. Italy reached 0.4396 in 2020, decreasing to 0.3808 by 2023.

At the bottom of the ranking are Romania, Bulgaria, and Greece. Romania improved from a negative value in 2013 (–0.0048) to 0.1170 in 2023, but remains in the lowest category. Greece reached 0.1756 in 2020, but the indicator fell to nearly zero in 2023 (0.0185). Bulgaria remained at the lowest levels throughout the period (–0.0683 in 2023).

The year 2020 was particularly significant due to the COVID-19 pandemic. In many countries (e.g., Poland, France, Spain), indicators dropped sharply due to mobility restrictions, reduced infrastructure investment, and shifting social priorities. At the same time, in some countries (Austria, Estonia, Belgium), the crisis accelerated efforts in low-emission transport and the development of public spaces, enabling improvements in the indicators despite adverse conditions.

Differences between countries did not diminish over the studied period. In 2013, the gap between extreme values was 0.6914 points, while in 2023 it increased to 0.7385 points, indicating that disparities in urban policy implementation are widening despite indicator growth in some countries.

The relationship between per capita EU funding and the synthetic indicator of sustainable urban and community development is weak and negative ($r = –0.212$). Linear regression results confirm the absence of a strong correlation: the slope ($\beta \approx –0.00006$) indicates a minimal negative effect, and the coefficient of determination (R^2

≈ 0.045) shows that only 4.5% of the indicator's variability can be explained by funding levels. This implies that financial support alone is insufficient to drive improvement—national strategies, implementation quality, and institutional capacities play a decisive role. For example, Denmark achieves high indicator values with relatively modest support, in contrast to Estonia or Bulgaria, which receive larger funds but do not achieve commensurate results.

6. Conclusions, Proposals, Recommendations

The analysis of the synthetic indicator of sustainable urban and community development in EU countries from 2013 to 2023 highlights persistent differences in the pace of transformation and levels of advancement in urban policy implementation.

In some countries, clear progress is observed; however, many countries still lag significantly behind the leaders, and in certain cases, disparities in sustainability levels are widening. This indicates that urban transformation in the EU is uneven, and the ability of individual countries to adapt to socio-economic and environmental changes varies considerably.

The results of the analysis of the relationship between EU funding and the synthetic indicator confirm that financial factors play an important, yet indirect, role. Funding alone does not determine the effectiveness of urban policies—the key drivers of success are institutional quality, strategic consistency, and the capacity to respond flexibly to changing conditions, including crises such as the COVID-19 pandemic. Countries achieving the highest indicator values combine rational use of financial resources with the ability to channel them toward actions of long-term significance.

The findings suggest a need to strengthen strategic planning and urban management processes, particularly in countries below the average indicator values. Priority should be given to establishing robust mechanisms for monitoring and evaluating public policy outcomes, as well as enhancing institutional capacities for effective implementation. Targeted corrective actions are also necessary, including knowledge transfer, support for building administrative competencies, and the adoption of proven solutions in lower-performing countries.

Another area requiring intensified efforts is the inclusion of local communities in planning and decision-making processes. Citizen participation improves the alignment of interventions with local needs and enhances urban resilience to external shocks, including economic and environmental challenges.

In conclusion, achieving sustainable and lasting development of cities and communities in the EU cannot rely solely on increased funding. A comprehensive approach is essential, combining well-targeted investments with long-term planning, effective management, high-quality institutions, and active citizen engagement.

Only such an approach will allow not only the maintenance but also the systematic enhancement of sustainability levels across the European Union.

Table 1. *Key EU Programs and Initiatives Supporting Urban Development and Urban Policies, 2014–2027*

Program / Initiative	Implementation Period	Key Objectives / Scope	Policy / Implementation Tools	Funding Sources and Mechanisms	Type of Financial Instruments
European Structural and Investment Funds (ESI) (ERDF, Cohesion Fund, ESF, EAFRD, EMFF)	2014–2020, 2021–2027	Regional and urban development, employment, education, sustainable economy, fisheries, rural areas	National and regional operational programs, territorial cooperation	EU budget (approx. €351.8 billion for 2014–2020)	Grants, national co-financing
European Fund for Strategic Investments (EFSI)	2015–2020	Reducing the investment gap in the EU, financing strategic projects	Investment Plan for Europe (the "Juncker Plan")	€21 billion guarantee from EC and EIB, mobilization of private capital	Loan guarantees, loans
European Investment Project Portal	from 2016 (ongoing)	Promotion of urban and regional projects in the EU, accessibility for global investors	Central online platform (available in 24 EU languages)	Project financing via public and private investors	Matching investors with projects
Urban Innovative Actions (UIA)	2015–2020	Testing new urban solutions (mobility, energy, housing)	Project competitions for EU cities	Budget €371 million (ERDF)	Grants
URBACT III	2014–2020 (currently URBACT IV 2021–2027)	Knowledge exchange between cities, joint development of urban solutions	Cooperation networks, workshops, knowledge platforms	Budget €96.3 million (ERDF + participating countries)	Cooperation project grants

Horizon 2020	2014–2020	Research and innovation, including projects for sustainable cities	EU framework program, project competitions	Budget €80 billion (grants for research consortia)	Research grants
LIFE	2014–2020 (continuation in 2021–2027)	Environmental and climate protection in cities (energy, waste, air, noise)	LIFE project competitions	Budget €1.1 billion (environment) + €0.36 billion (climate)	Grants, co-financing

Source: *Author's calculations.*

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