

# *Models for Sustainable Urban Development in the EU (Good Practices and Challenges for New Member States of the EU)*

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**Abstract**— The focus of the study is on sustainable urban development in the context of the European Union (EU), examining best practices and challenges related to the adaptation of successful models in the new member states of the EU. The analysis is based on the example of three leading European cities – Barcelona, Amsterdam and Copenhagen, which are known for their innovative approaches to resource management, transport, energy efficiency and social integration. The aim is to identify innovations and sustainable solutions in resource management, transport, energy efficiency and social integration. The leading thesis is that sustainable urban development in the new member states can be accelerated through strategic governance, smart technology integration and active citizen participation, supported by effective public-private partnerships and innovative financial models. The methodology used is process and strategic benchmarking, which allows for a systematic comparison of different approaches and identification of opportunities for their implementation in newer EU Member States. The results show that the successful practices in the cities examined can be adapted to the specific contexts of the new member states, provided that there is effective interaction between local government, business and civil society. The research highlights the importance of sustainable policies and management strategies that contribute to long-term socio-economic and environmental goals.

**Keywords**— *smart cities, sustainable development, smart technologies, circular economy, urban mobility, Public-Private Partnerships*

## I. INTRODUCTION

Sustainable urban development is a key priority in European Union policies, as part of global efforts to deal with climate change, improve quality of life and manage resources efficiently. Smart cities that combine innovation,

sustainable technologies and smart governance have established themselves as a strategic model for the development of urban areas. Examples such as Barcelona, Amsterdam and Copenhagen provide successful practices in the integration of innovative solutions that combine social, economic and environmental aspects, and offer opportunities to accelerate sustainable development in other European cities

Despite the progress made in infrastructure and economic modernization, some of the major cities in the new EU member states – Bulgaria, Romania and Croatia – still lag behind in some key aspects of sustainable urban development compared to more developed Western European regions. Large cities in these countries face serious challenges in areas such as transport sustainability, energy efficiency and social integration. To catch up, it is essential to prioritize actions to integrate innovation, develop intelligent transport systems and deploy technologies to accelerate the transition to sustainable governance. A strategic focus on public-private partnerships and the active involvement of citizens in decision-making processes could make a decisive difference in closing these gaps.

Achieving sustainable development in these cities requires an in-depth analysis of leading examples and the identification of strategic priorities that can accelerate the transition to smart governance. The aim of this study is to analyse best practices in sustainable urban development through a comparative analysis of Barcelona, Amsterdam and Copenhagen using the benchmarking method. This study focuses on the key tools and solutions implemented in these cities to serve as a benchmark for the formulation of development priorities for large cities in the new EU member states.

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Expected outcomes of the study include:

- Identification of successful practices and solutions to be applied in the context of smart cities;
- Analysis of the main challenges faced by cities in the new Member States;
- Formulation of strategic planning recommendations to facilitate the transformation towards sustainable development.

The relevance of the topic arises from the need to narrow the development gap between old and new EU Member States, as well as the growing need for integrated solutions to address urban and environmental challenges. This study aims, on the one hand, to identify good practices and, on the other, to propose practical guidelines for their adaptation in the context of the new Member States.

## II. MATERIALS AND METHODS

### A. Theoretical framework of the issue

Sustainable urban development is an integrated concept that combines social, economic and environmental aspects to ensure balanced and long-term development of urban areas. The foundations of this concept are laid in the report *Our Common Future*, where sustainability is defined as development that meets the needs of the present without compromising the opportunities of future generations [1]-[4].

This concept has subsequently been developed by authors such as J. Sachs, who highlights the importance of global SDGs [5]. And furthermore by D. Meadows and J. Randers, who emphasize a systems approach to urban planning and management [6].

Smart cities extend the concept of sustainable development through the integration of information and communication technologies (ICTs) that optimize resource use, improve quality of life and reduce environmental footprint. J. Morelli, L. Greenwood, K. Lockwood, and C. Portillo research how smart technologies can support sustainability [7], [8].

A. Caragliu, C. Del Bo и P. Nijkamp proposes an analytical framework for smart cities based on 6 key aspects: economics, mobility, environment, human, quality of life and governance [9], [10]. Whereas N. Komninos, H. Schaffers, P. Tsarhopoulos and R. Hollands emphasize the importance of innovation and intelligent systems in urban development [11]-[16].

The benchmarking method, widely used in strategic management, is a proven approach for identifying and adapting best practices. R. Camp и I. Bruno define benchmarking as the process of systematically comparing results and processes to identify opportunities for improvement [17]-[19]. M. Spendolini adds that the success of benchmarking depends on the ability to adapt leading practices to the specific local circumstances [20].

Within the framework of sustainable urban development, benchmarking is applied to analyse innovative solutions successfully implemented in global leaders such as Barcelona, Amsterdam and Copenhagen.

Barcelona establishes itself as a leader in the integrated management of urban services through smart technologies and green platforms [21]. Amsterdam has demonstrated success stories in sustainable mobility and the circular economy, combining innovation in transport and waste management. Copenhagen, on the other hand, stands out for its carbon-neutral development strategy and innovations in urban planning that promote the balanced use of resources [22].

At the same time, large cities in the new EU Member States face a number of challenges that hinder the implementation of sustainable and smart approaches. Lack of effective institutional coordination and limited financial mechanisms to stimulate innovation are identified. Gaps in digital connectivity and outdated infrastructure also present major obstacles.

The theoretical review shows that the success of sustainable urban development depends on the integration of leading practices and their adaptation to the local conditions.

The research, using the benchmarking method (Fig. 1), focuses on the analysis of best practices applied in Barcelona, Amsterdam and Copenhagen with the idea of proposing priority directions for the development of cities in the new EU Member States.

### B. Methodology of the research

This study applies an integrative approach combining both quantitative and qualitative methods of analysis, with an emphasis on process-oriented and strategic benchmarking. This methodological approach allows a systematic comparison of sustainable and smart practices implemented in three leading European cities – Barcelona, Amsterdam and Copenhagen. Process-oriented benchmarking focuses on a detailed overview of the management practices and operations that lead to sustainable urban development, while strategic benchmarking analyses the long-term goals and vision of these cities in terms of sustainable management.

The analysis focuses on key indicators related to resource management, the transport system, energy efficiency, digitalization and citizen participation, aiming to compare results and, on this basis, to extract useful strategies and approaches that can be adapted to the context of other cities.

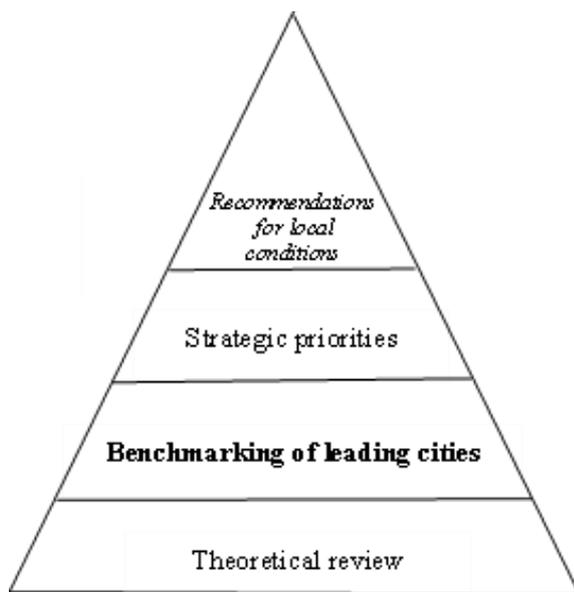


Fig. 1. Logic scheme and survey tools. (Source: authors' own research).

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The data used in the study was taken from secondary sources including academic publications, official reports, strategic plans and statistical sources. For the cities of Barcelona, Amsterdam and Copenhagen, examples were used from well-established international initiatives that demonstrate innovative approaches to sustainable development.

The qualitative component of the study aims to identify successful approaches and innovative solutions in the cities surveyed, while the quantitative analysis is applied to compare three main sets of indicators. Using these methodological approaches provides a systematic and objective analysis that contributes to the formulation of practical guidelines and policies to accelerate sustainable development in European cities.

### III. RESULTS AND DISCUSSION

#### A. Empirical Research

The study is based on the benchmarking method, following its methodological procedure for systematic comparison and analysis of best practices. The approach allows to identify leading innovative solutions and to adapt successful models applied in the cities under consideration – Barcelona, Amsterdam and Copenhagen. By comparing key indicators related to sustainable urban development, the study aims to provide conclusions and recommendations that can serve as a basis for strategic planning and development.

The analysis is structured around three main groups of indicators that are essential for assessing sustainability: environmental sustainability, social sustainability and quality of life, economic sustainability and innovation. They illustrate the key dimensions of sustainable development and allow for a comprehensive assessment of progress and challenges in the context of the cities surveyed.

For the purpose of the study and in view of the benchmarking analysis, three main groups of sustainable urban development criteria were identified, each including specific sub-criteria and indicators (Table 1).

Due to the limited length of the publication, the specific results obtained by the evaluation method will not be presented here. Instead, attention will be focused on the general guidelines and main conclusions that can be drawn from the analysis of sustainable urban development in the European cities under review – Amsterdam, Barcelona and Copenhagen. The study aims to identify the main characteristics of successful practices and excellence in the field of environmental, social and economic sustainability, in order to provide valuable results, insights and recommendations for other cities in the process of transformation.

On the basis of the comparison made, the significant integration of sustainable development in the strategies and policies of the leading cities is noticeable. In Copenhagen, for example, environmental sustainability is underpinned by ambitious carbon neutrality targets, with around 50% of the city's energy currently coming from renewable sources, and the aim to increase this to 70% by 2030. In Barcelona, the focus on green urban spaces and energy efficient buildings has shown significant progress, with 40% of buildings in the city center already reported to have been renovated to achieve better energy efficiency.

In the social area, we report that the cities under review are actively working to improve quality of life through access to high quality public services, safety and a healthy urban environment. Amsterdam, for example, is actively integrating smart technologies to support city management, with 60% of its residents now using mobile apps to access services and information. The city also encourages citizen participation through digital connectivity platforms that provide feedback and citizen involvement in decision-making. At the same time, Barcelona places special emphasis on social integration and cultural diversity, creating a sense of community and belonging through public initiatives that cover around 30% of the population.

Economic sustainability, on the other hand, is characterized by a strong focus on innovation, high-tech industries and cooperation between the scientific and business communities.

In Amsterdam, the success of the start-up ecosystem and the focus on the circular economy demonstrate a skillful approach to attracting investment and building a sustainable economic structure.

TABLE 1 GROUPS OF CRITERIA AND INDICATORS FOR SUSTAINABLE URBAN DEVELOPMENT

Environmental sustainability	Social sustainability and quality of life	Economic sustainability and innovation
1. Carbon dioxide emissions (tone/capita/year)	1. Access to public services (percentage of population)	1. Share of green economy (percentage of GDP)
2. Energy efficiency of buildings (kWh/sqm/year)	2. Equality and social inclusion (Gini index)	2. Investment in innovation (percentage of GDP)
3. Share of renewable energy sources (% of total energy consumption)	3. Healthy urban environment (number of parks/thousand people)	3. Support for start-ups (number of start-ups per year)
4. Waste management (percentage of waste recycled)	4. Conditions for cultural activities (number of cultural events per year/1000 inhabitants)	4. Share of high-tech companies (% of all companies)
5. Air quality (PM2.5 concentration in µg/m <sup>3</sup> )	5. Level of education (number of graduates per 1000 inhabitants)	5. Research expenditure (percentage of GDP)
6. Water resources management (percentage of reused water)	6. Transport connectivity (length of public transport/sq km)	6. Employment rates (% of working age population)
7. Urban green infrastructure (percentage of green space/urban area)	7. Sustainable urban planning (density index)	7. Share of sustainable tourism (percentage of tourism revenue)
8. Sustainability of urban mobility (percentage of electric vehicles)	8. Safety (number of crimes/1000 inhabitants per year)	8. Sustainability of the digital economy (number of IT companies per 10 000 inhabitants)
9. Green space (m <sup>2</sup> of green space per inhabitant)	9. Quality of life indicators (subjective satisfaction index)	9. Number of patents (number of patents per 1000 inhabitants per year)
10. Sustainable land use management (percentage of agricultural land)	10. Accessibility for people with disabilities (number of adapted public facilities)	10. Attractiveness for foreign investment (euro per capita/year)
11. Biodiversity (number of species/100 km <sup>2</sup> )	11. Indices of subjective well-being (work-life balance)	11. Number of public-private partnerships (number of projects/year)
12. Sustainable transport (number of cycle lanes/100 km <sup>2</sup> )	12. Promotion of citizen participation (number of public consultations per year)	12. Financial incentives for innovation (EUR/year/company)
13. Redevelopment of industrial zones (number of zones converted/year)	13. Promotion of healthy lifestyles (percentage of physically active people)	13. Competitiveness of local enterprises (% revenue growth per year)

Environmental sustainability	Social sustainability and quality of life	Economic sustainability and innovation
14. Pollution control (number of inspections per year)	14. Improvement of educational infrastructure (number of schools upgraded)	14. Export potential (exports in euro per capita per year)
15. Environmental areas (percentage of protected areas)	15. Promotion of volunteering (percentage of people participating in volunteering initiatives)	15. Participation in international networks (number of partnerships per year)
16. Climate impact (% reduction in CO2 emissions over 10 years)	16. Youth development programs (number of programs per year)	16. Sustainable funding (percentage of sustainable projects of total funding)
17. Sustainable urban technologies (number of technologies deployed per year)	17. Social housing affordability (number of dwellings per 1000 inhabitants)	17. Scientific and business cooperation (number of joint projects)
18. Eco-labelling (number of certified products/services)	18. Cultural diversity indices (number of cultural events for ethnic groups)	18. Sustainable supply chains (number of chains in place)
19. Resource efficiency (percentage of recycled materials used)	19. Sustainable well-being indicators (sustainable well-being index)	19. Economic sustainability of cities (% GDP per capita growth)
20. Climate change vulnerability assessment (vulnerability index)	20. Resilience of social systems (% of population covered by social protection)	20. Number of green initiatives (number of initiatives per year)

In 2024, start-ups in Amsterdam attracted investments worth around €2 billion, with sustainable technology and healthcare among the key areas for development. Copenhagen is another impressive example with innovation in energy efficiency and leadership in developing green technologies that are even being exported to the international market, with the value of green technologies expected to reach €4,5 billion by 2025.

These observations underline the importance of a holistic approach to urban planning where the three main pillars of sustainability - ecology, society and economy - are interlinked and complementary. While environmental initiatives set the long-term direction for conservation, social policies provide the immediate impact on human well-being, and economic measures provide the resources to sustain and expand these efforts. The next section will provide a more in-depth analysis of best practices that demonstrate outstanding results in the area of sustainable urban development. Examples will be specifically selected to illustrate innovative approaches and solutions that can serve as models for adaptation in other urban contexts.

**B. Strategic Approaches to Sustainable Urban Development**

The comparative analysis of Barcelona, Amsterdam and Copenhagen clearly shows how leading European cities are implementing sustainable urban development and highlights the significant differences in their progress. These cities have built solid foundations for a sustainable future by integrating smart technologies and renewable energy into their urban infrastructure. On the one hand, they are investing in innovation and, on the other hand, they are actively promoting social integration and mobility, making them pioneers in sustainable development at a global level. At the same time, many large cities in the new EU Member States are facing challenges related to delayed innovation, insufficient financial resources and congested infrastructure.

As it is illustrated in Table 2, Barcelona has demonstrated impressive success in adapting smart technologies and energy efficiency, actively implementing solutions that reduce carbon emissions and lead to a cleaner and more sustainable urban environment. Amsterdam, on the other hand, exemplifies innovation in the circular economy by actively promoting recycling and waste reduction. The city is a leader in electric mobility and is creating sustainable economic models that can be adopted by other European cities. Copenhagen also provides clear examples of sustainable resource management, focusing on reducing carbon emissions and integrating sustainable technologies into the urban environment.

Many Eastern European cities still face serious challenges affecting their ability to adapt to a rapidly changing urban environment.

TABLE 2 BEST PRACTICES IN SUSTAINABLE URBAN DEVELOPMENT

<b>Environmental sustainability</b>	<b>Social sustainability</b>	<b>Economic sustainability and innovation</b>
Barcelona Integrating renewable energy and energy efficiency	Barcelona Opportunities for citizen participation in sustainable city management	Barcelona Integration of smart technologies in urban infrastructure, with a focus on sustainable construction and transport
Amsterdam Promoting electric mobility and reducing waste	Amsterdam Strategies for social integration and inclusive public spaces	Amsterdam Supporting innovation in electric mobility and the circular economy
Copenhagen Carbon neutrality and emissions reduction strategy	Copenhagen Investment in health and social services that meet the needs of all citizens	Copenhagen Supporting start-ups with a focus on green technologies and sustainable innovation

Lack of sufficient investment in modern transport and environmental solutions, as well as difficulties in innovating, make it difficult to accelerate the introduction

of sustainable solutions in urban infrastructure. Despite the difficulties, these Eastern European cities have great potential for progress and any small effort towards sustainable development can bring significant benefits to the quality of life of citizens.

Comparative studies of Barcelona, Amsterdam and Copenhagen show that these cities are innovating in their urban environment and actively demonstrating how sustainable development can be achieved by integrating different areas of society and the economy.

Barcelona stands out as an example of energy efficiency and sustainable urban planning, where renewable energy and smart technologies create a dynamic and environmentally friendly urban environment. Strategies to reduce carbon emissions, as well as innovations in transport, show how modern technologies can change urban governance towards a sustainable future.

Amsterdam, for its part, has not only innovated in the circular economy and electric mobility, but has also established itself as an example of social sustainability by actively involving citizens in decision-making processes and creating inclusive public spaces. Strategies such as encouraging recycling and reducing waste reduce the City’s environmental footprint and also offer economic and social benefits to all its residents. This combination of environmental, social and economic innovation makes Amsterdam one of the leaders in sustainable urban development.

Copenhagen demonstrates how sustainable resource management can be linked to innovation in the industrial sector and entrepreneurship. The city is steadily reducing carbon emissions while investing in social and health initiatives that improve the quality of life for all its residents. Copenhagen is a successful example of how a carbon neutral strategy can be embedded not only in energy policies but also in the economic and social development of the city.

These three examples of sustainable urban development show how integrating different aspects of sustainability – from eco-innovation to social integration and economic efficiency – can lead to significant achievements in creating smart and sustainable cities. They lay the foundations for the future of cities and show how the achievements of leading European cities can be applied and adapted in other contexts.

Recommendations to promote sustainable development of large cities in the new EU Member States. The existing lag of large cities in the new EU Member States in the context of sustainable urban development can be overcome by adopting innovative approaches and strategically applying successful practices from leading European cities such as Barcelona, Amsterdam and Copenhagen. In order to catch up with these leaders, concrete strategies need to be developed that include integrating advanced technologies, stimulating innovation, social responsibility and citizen engagement.

In Fig. 2, we present several key tools and approaches that can help large cities in the new Member States achieve sustainable development and close the gap with leading examples in Europe. The proposed measures will be analysed sequentially by their defining characteristics: tools (T), approach (A), objective (O).

a) Establishing innovation hubs and initiating public-private partnerships – innovation hubs and techno parks to support start-ups in sustainable development (T); leveraging local universities, research institutes and private investors to encourage collaboration to develop innovations in clean technology, energy efficiency and sustainable building practices (A) [23]; supporting the rapid deployment of new technologies and practices that will accelerate the development of urban infrastructure and increase the competitiveness of the economy (O).

b) Implementing smart and environmentally friendly transport solutions – expansion of low-carbon public transport networks and promotion of electric vehicles (T); constructing “green” transportation corridors and expand bike lanes. Incorporate Intelligent Transport Systems (ITS) to manage traffic and reduce congestion (A); reducing carbon dioxide emissions and improve urban mobility while reducing energy costs and increasing the efficiency of the transport network (O).

c) Supporting the circular economy and sustainable resource management – stimulating recycling and waste reduction through circular business models and technologies (T); encouraging enterprises to adopt resource reuse models through initiatives such as separate waste collection and the promotion of green entrepreneurial practices (A); reducing waste and better manage resources with a focus on renewable energy and energy efficiency in production processes (O).

d) Strengthening civic engagement and social integration – introduction of public forums, public councils and platforms for participation in urban policies (T); using digital platforms to interact with citizens and involve them in decision-making processes, encouraging socially responsible projects that improve the quality of life of vulnerable groups (A); improving social integration, promoting active citizenship and ensuring equal access to basic public services such as health and education (O).

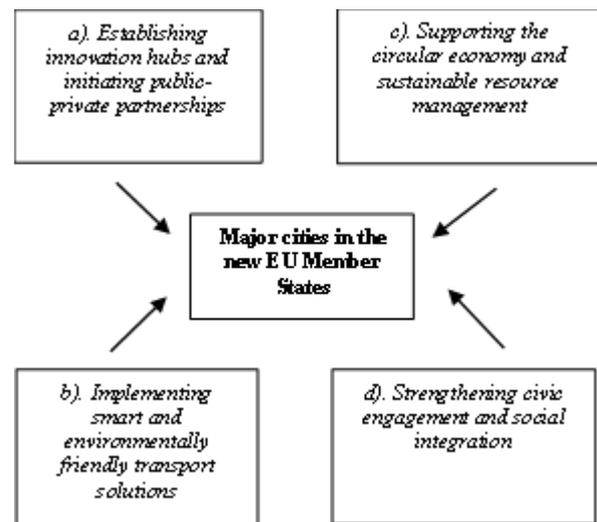


Fig. 2. Tools and approaches for urban development. (Source: authors' own research).

By following these recommendations and adopting innovations that have already proven effective in other European cities, major cities in the new EU Member States have the opportunity to accelerate the transition to sustainable development. These steps will position them not only as leaders in sustainable development, but also as innovation hubs that attract new investment and create jobs leading to a higher quality of life for their citizens.

#### IV. CONCLUSIONS

Large cities in the new EU Member States have the potential to catch up with the leaders in sustainable urban development if they integrate strategic innovations and best practices, such as the following:

*First* - Invest in innovation and technology for sustainable development to accelerate the transition to smart and green cities.

*Second* - Stimulate public-private partnerships that will enable effective implementation of innovation and build infrastructure for sustainable development.

*Third* - Active citizen participation and social responsibility to strengthen public ownership and achieve a better quality of life for all.

Overall, with a focus on innovation and engaging all stakeholders, the new members could create sustainable and competitive cities.

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