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Sustainable urban development of the Slovak Republic

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Abstract. The concept of sustainable development as part of the EU agenda emphasises the need for the sustainability and development of the economies of the EU Member States. The aim of the article is to evaluate the current state of selected activities defined as key to sustainable development, based on an analysis of the current state of selected cities in the Slovak Republic. The article will make recommendations based on its financial and economic analysis of selected transferred and original competencies of the cities of the Slovak Republic. Implementation these recommendations will ensure the future sustainability of development of the cities in the Slovak Republic. This article is part of the solution of Project VEGA no. 1/0837/21 "Spatial and Temporal Aspects of EU Cohesion Policy: Lessons Learned and Future Perspectives".

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1. Introduction

The significant increase in human activity in recent development stages has been inextricably linked to increased negative impacts on our planet. The result is that humanity is depriving future generations of suitable living conditions and constantly reducing the quality of the environment (Anand, Sen 2000). If development, as a natural consequence of human activity, is not tied with sustainability, environmental impacts will soon outweigh its benefits (Desha et al., 2010). Such an approach has been the subject of initiatives at the United Nations level (Agenda 2030, Local Agenda 21) and the European Union (Next Steps for a Sustainable European Future, The Charter of European Sustainable Cities and Towns Towards Sustainability). These steps have been followed by national strategies as well as strategies and initiatives at regional and local levels.

These trends are also reflected at the level of cities, which on the one hand provide a significant proportion of the population with opportunities for employment and for cultural and social activities, education, science and culture. On the other hand, cities are places of conflict between nature and civilisation that manifest a wide range of environmental, transport, economic, territorial and social problems. It is up to cities to approach this conflict of development and its impacts with the principles of sustainability in key activities. Cities should take responsibility for these issues at their level and start looking for ways – and taking steps – towards sustainable urban development. However, it depends greatly on the respective cities as to how they take the initiative and adopt strategic measures at their own level. This state of their activities is the subject of this analysis, evaluation and further recommendations. It has the ambition to contribute to the concept of promoting sustainable development in the conditions of cities of more than 50,000 inhabitants in the Slovak Republic. It is these cities that have the greatest potential for further development, including in connection with the growing trend in population migration to large cities. At the same time, these cities will primarily have to face the new challenges and problems associated with this trend and, on the other hand, will have to cope with the ever-increasing demand for quality, efficient and smart public services.

The topic of the article is the sustainable urban development of the Slovak Republic. When processing the article, attention is focused on the conditions of cities in the Slovak Republic with more than 50,000 inhabitants, specifically in the cities of Bratislava and Košice. The research part of the article focuses on applying a selected set of indicators of sustainable urban development in the surveyed cities. Emphasis is placed on determining the extent to which these indicators can be implemented and evaluated in the surveyed cities. This article has the benefit of a clear theoretical and practical explanation of the current state of sustainable urban development in local government in the Slovak Republic. Raising awareness of this situation allows the surveyed cities to better promote and evaluate the implementation of this concept, which is becoming a prerequisite for achieving competitiveness, efficiency, speed, availability and performance of local government in terms of the requirement to provide quality and smart public services. We consider this to be the current challenge for the public administration, and therefore also the local self-government we are researching. The elaboration of the issue of sustainable urban development in the environment of cities in the Slovak Republic with more than 50,000 inhabitants may be a future stimulus for the implementation of the recommended changes.

2. Sustainable Urban Development (LA21)

If a company wants to operate successfully in the market and withstand growing competition, it must introduce new technologies, respond to changes, and also use modern management methods (Výrostová, 2007). The same principle also applies now to cities, which are forced to introduce smart technologies and use modern management methods to be able to respond to constant change. One of the most fundamental challenges to sustainable urban development is the need to redirect economies along paths that are restorative rather than exploitative – that rely, for example, not on ever-growing consumption of material products, long-distance trade and replacement of local businesses by local branches of multinational corporations

(Stephen & Beatley, 2014). Local Agenda 21 is one of the tools through which the practical application of the principles of sustainable development at the local and regional level can be examined (Prizzia, 2007). It is implemented at a specific time and place and in a municipality or region. It is a process that, through improving governance, strategic planning, public involvement and the use of all the knowledge gained on sustainable development in individual areas, increases the quality of life in all its aspects and makes citizens more responsible for their lives and the lives of other beings in space and time (Rydin, 2012). According to the authors (Čepelová & Douša, 2018), Local Agenda 21 (LA 21) aims to increase: civic, environmental and cultural awareness and education; consultation; public involvement; support for partnership cooperation; and the use of indicators to monitor progress on the path to sustainable development. LA 21 is first mentioned in Chapter 28 of Agenda 21, a UN document adopted in June 1992 in Rio de Janeiro at the Conference on Environment and Development with the participation of 178 countries, including Slovakia (Huba et al., 2002). The Slovak Republic agreed to accede to the Rio Declaration and AGENDA 21 by the Resolution of the Government of the Slovak Republic No. 118 from 8th September 1992 on information on the course and results of the UN Conference on Environment and Development. The Government of the Slovak Republic therein instructed all ministers and heads of other central state administration bodies of the Slovak Republic to use the results of UNCED (United Nations Conference on the Environment and Development) and to incorporate them into the programmes of their ministries (Evans & Theobald, 2013).

The implementation and evaluation of the effectiveness of Agenda 21 is in the scope of the Government Council of the Slovak Republic for Sustainable Development. This council consists of, approximately, one third representatives of central state administration bodies focused on economic, social and environmental development, one third representatives of eight regional authorities and one third scientific and social life personalities from relevant organisations and citizens' associations with a strong focus on economic, social and environmental development (Ministry of the Environment SR 2020).

Local Agenda 21, as a process, leads to the improvement of quality of life and the environment in the municipality and supports cooperation between various interest groups in the municipality (citizens, local government representatives, local businesses, schools, churches, NGOs) (Morrisová et al., 2000). The application of LA 21 brings innovative and participatory elements to the development of all cities, municipalities and micro-regions. The partnership of the municipality with the third sector and other societal groups creates motivating conditions for the successful application of strategic documents. The greater the public participation, the greater the guarantee of the continuity of the LA 21 creative process, regardless of personnel changes in the elected self-government (Navarro-Espigares et al., 2018). With a well-managed LA 21 process, greater citizen satisfaction can be achieved in a relatively short time. Creating a common vision and finding real problems and ways to eliminate them will support the concentration of the creative forces of the local community, thus speeding up their solution (Lindner, 2019).

Citizens will gain a better relationship with the environment in which they live, and open discussion will help to understand different views and attitudes. Greater citizen participation and transparent decision-making will help prevent conflicts in the future (Xavier et al., 2019). Improving the quality of life and the environment will be achieved through good management of local self-government and gradual harmonisation of local programmes with sustainable development requirements. All this will contribute to a more efficient search for financial and other resources for the development of the municipality, city and micro-region and to their better use (Pozo-Llorente et al., 2019).

The analyses of the current situation showed that even in Slovakia there is a gradual involvement of local governments in the LA 21 programme, e.g. the Village Renewal Programme and the Healthy Cities project. There are 15 cities involved in the National Network of Healthy Cities of the Slovak Republic, namely: Košice, Banská Bystrica, Bratislava, Liptovský Mikuláš, Martin, Nitra, Prešov, Stará Ľubovňa, Trenčín, Trnava, Turčianske Teplice, Zvolen, Vranov nad Topľou, Levice and Spišská Nová Ves. In addition, the Association of Healthy Cities is established as a voluntary,

interest-based and non-profit association of local governments in the Slovak Republic, with the aim of supporting the health of the inhabitants of towns and municipalities. However, there is a lack of effective LA 21 support and constructive cross-sectoral cooperation at all levels, which, if provided, could lead to more effective progress. Most of the resolutions and planned tasks that were to support the LA 21 process remained only on paper, and their actual implementation is unsatisfactory. Financial and organisational support from the Slovak government is also very weak as compared to other European countries (e.g. the Czech Republic) – state subsidies are in practice provided only by the Ministry of Foreign Affairs of the Slovak Republic (examples are the Village Renewal Programme and the Green Project) (Kozová et al., 2003). The Smart Cities concept and LA21 have similar content and customs, but a different history. The first was created as a European industrial initiative from the environment of modern technologies, the second as an activity at the UN. Both meet in the city's strategy and its everyday practical implementation. When applying the Smart Cities and LA21 concepts, it is always necessary to avoid duplication, especially in the organisational structure. Therefore, if the city already implements LA21 as part of its strategy, there is no need to create a parallel structure and strategy for Smart Cities. If the city simultaneously fulfils the elements and approaches recommended by this methodology during the implementation of LA21, it may also, at its discretion and preference, also apply the Smart Cities concept (Ministry for Regional Development of the Czech Republic, 2019).

The current unfavourable situation of institutional security, uncoordinated work of individual ministries as well as ongoing ministries could be positively affected by strengthened local government competencies at the local and regional level, improved conditions for access to information, public participation and more effective implementation of the National Sustainable Development Strategy. In terms of support for LA21 programmes at the local level, there is also a special need for training of employees and elected municipal representatives. Already in 1994, ZMOS (The Association of Cities and Villages of Slovakia) established the Slovak Self-Government Education Foundation for educational purpose, but its activities were officially terminated in 2002. During its existence, this institution cooperated with a network of 11 regional training centres (RVCs), which covered the whole of Slovakia (Self-Government Education Association, 2021).

2.1. Indicators of Sustainable Urban Development

In connection with the development of municipalities, cities, and the quality of life of their inhabitants, there is a discussion in the Slovak Republic, but also in other developed and developing countries, about sustainable development at the local level. The modern city and its leaders, who influence the further direction of the city's development, need relevant information about the current state and trends in the development of key characteristics of the city (Navarro-Espigares et al., 2018).

Sustainable development indicators are used in political decision-making at all levels, including international ones, and to inform the lay and professional public. They constitute a set of comprehensive indicators that are: measurable, objective, credible, tailored to local conditions, reflective of issues of importance to quality of life, and enabling of citizen involvement in their compilation (Temenos & Lauermann, 2020).

Indicators are the result of processing and certain interpretations of primary or secondary (taken over, already processed) data that often make sense not in themselves, but in a broader context. Indicators can be created not only from data, but also by editing and processing existing indicators (Novák et al., 2016). The main criterion for selecting a suitable indicator is its usefulness for its users. In the case of sustainable development indicators for cities, the primary target group is comprised of the representatives of the municipalities' public administrations. We cannot forget other stakeholders and "major groups", who are primarily the public, such as local entrepreneurs, associations or civic associations (Fritz & Meinherz, 2020).

Managers of larger and smaller companies today work with the terms (and the content of the terms) "indicator", "benchmarking", "project

cycle evaluation" and "monitoring", but quite commonly these penetrate the public administration environment only slowly. Here too, however, the situation is slowly but surely changing for the better. The reason is clear: the use of these modern methods increases the efficiency and productivity of public administration and improves the quality of public administration or the quality of public services. This can have a positive effect on public customers, who are citizens (Masik et al., 2021).

The areas of sustainable urban development indicators are related to the second aspect of public service quality cited above, i.e. to the legitimate expectations of citizens that quality of life in their city (municipality) will increase. It is important to say that the cities have only limited competences to influence these indicators. Examples are air pollution from local heating plants (legislation is imperfect and enforceability is virtually zero), the availability of basic healthcare or the registered unemployment rate. In these examples, cities can create the conditions for improving the value of the indicator (for example, by making a favourable rent or creating a job using the European Social Fund), but in no case does it have a 100% impact on the development of the indicator. Pragmatic and fiscal reasons also need consideration. A city that is able to permanently improve the quality of life of its inhabitants will certainly not suffer from populational decline. Instead, the influx of new residents and companies will improve tax yield, thus allowing further investment in developing the municipality. Thus, working to improve indicator-based evaluations can have a positive, real-world impact (Fioretti et al., 2020).

In the scientific literature, the most common attempts are to describe and analyse processes in the city using quantitative and qualitative indicators. In some cases, the indicators are structured within a certain framework, e.g. Phillis et al. (2017) applied the SAFE model (sustainability assessment by fuzzy evaluation) to cities, where sustainability is a function of two factors – the state of the environment and human well-being, which together contain 46 variables. This produced a ranking of cities (Helsinki, Vienna and Stockholm in the first places) and the finding that the main problems of developed cities are greenhouse gas emissions and waste production, while in developing countries it is crime and poverty. In most attempts to implement indicators, however, the choice of indicators is subjective, and thus can be based on political priorities, customs, data availability, overall feasibility, etc. Furthermore, the selection can range in number from a few to many tens, and relationships between them may not be defined in any way. The most popular indicators include the European Common Indicators (ECI), which are attractive because they constitute a small number of indicators (the first five being mandatory "1–5" and the second five optional "6–10") with well-developed methodological sheets enabling benchmarking of many European cities. In the case of composite indicators and indices, the evaluation tends to be more complex – it is usually not based on a model of relationships between factors and variables, but only a statistical method is applied, and the result is then the selection of variables and their weighting, aggregation algorithm. Examples are the City Prosperity Index (CPI), the Sustainable Cities Index (SCI), the Cities in Motion Index (CiM), the Global Power City Index (GPCI), the Quality of Living (QoL), the Spatially Adjusted Liveability Index (SALI) and the Cities of Opportunity (CoO). None of these aggregates, however, have undergone major expansion or application, either in the decision-making process or as a communication tool. Below are some of the indicator sets used, which at the time of their creation had the ambition of describing the sustainability of cities, municipalities and regions (Čepelova & Dousa, 2018).

ISO 37120: Sustainable development of communities: Indicators for city services and quality of life. This standard establishes a methodology for the use of sets of indicators to manage and measure the performance of urban services and quality of life. The standard applies to all cities, municipalities or local governments that are interested in measuring their performance in a comparable and verifiable way, regardless of size and location. It consists of 17 thematic areas, which meet more than 90 indicators of sustainable development (ISO, 2018).

The European Common Indicators (ECI) are the best known and most widely used set of sustainable development indicators at the local level in the Czech Republic. The kit was developed in 2001 at the initiative of the European Commission and has been tested in several dozen European

cities. This set is in line with the official policy criteria of Agenda 21. In 2003, it was taken over by the newly established TIMUR initiative (Team Initiative for Local Sustainable Development) and began to be applied to the conditions of Czech cities. At present, the ECI set as a whole – or appropriate sub-indicators thereof – is or has been used by about 50 cities in the Czech Republic. The only signatory from Slovakia was the town of Púchov, but then Rimavská Sobota and Šaľa joined later in 2003. The set of ECI indicators consists of 10 indicators. They are: 1) Citizens' satisfaction with the local community, 2) The city's carbon footprint (local contribution to global climate change), 3) Mobility and local passenger transport, 4) Accessibility of public spaces and services, 5) Local air quality, 6) Children's routes to and from school, 7) Unemployment, 8) Noise pollution, 9) Sustainable land use, and 10) Ecological footprint of the city. Currently, ECI indicators are promoted and methodically supported only by the company CI2 (CI2, 2020).

Programme indicators (indicators of strategic or development plans of cities and municipalities) are applied in strategic (planning) documents, where they serve as a control tool for evaluating the effectiveness and success of planned measures (CI2, 2020).

Local specific indicators (indicators of the state of the municipality, quality of life indicators) are those that reflect specific events and the specific requirements of the municipality or region for which they are designed (so-called "Tailor-made" indicators). Site-specific indicators can complement indicator sets that other municipalities or cities use for comparison (e.g. ECI) (CI2, 2020).

In terms of the requirement for regular evaluation of the entire spectrum of sustainable development (hereinafter referred to as SD) of any locality, there is no suitable methodology available in the Slovak Republic that would facilitate assessment of these indicators not only by state administration bodies, but especially by local governments. At the same time, doubts have been raised as to whether a sufficiently wide range of data is available for this assessment and whether there are qualified experts for evaluating sustainable development at the level of local governments. The assessment of sustainable development is undoubtedly always a multidisciplinary matter, with requirements for a comprehensive assessment of all quality-of-life options in a locality, including an assessment of the wider environmental links that the community uses or that affect or may affect the local quality of life (Kološta & Bolcárová, 2015). From this point of view alone, this evaluation is clearly not only comprehensive but also very complicated. This issue requires not only the involvement of experts to evaluate the diverse range of activities that take place in a locality, but that also emphasises the involvement of the broader local public. For these reasons among others, the monitoring and evaluation of sustainable development at the local level in the whole of the Slovak Republic is still in its infancy and is being put into practice very slowly. The slow implementation of these steps is marked not only by the absence of the above aspects, but also by the lack of financial resources (Vargová, 2010).

The surveys resulted in a recommendation to periodically evaluate the development of the SD site based on regular and systematic monitoring of available local data over a longer time series, including community-preferred SD indicators.

3. Methods of research and data

The aim of the article is to evaluate the current state of selected activities defined as key to SD based on the analysis of the current state of selected cities in the Slovak Republic. The main goal in the theoretical area of this article is the systematic elaboration of the theoretical basis of SD with special regard to the use of this concept in the local government of the Slovak Republic, by analysing the current state of knowledge of SD and synthesis of information to identify key factors (indicators) of SD. The main result of this article is the design of solutions for local governments in the Slovak Republic through a set of selected indicators of sustainable urban development. Specific proposals were formulated based on a detailed analysis of the current state of selected of more than 50,000 inhabitants in the Slovak Republic in the area of selected activities

defined as key for sustainable development in the field of intelligent transport. The two largest cities in the Slovak Republic, Bratislava and Košice, were chosen for the research.

Partial goal of the analytical part of this article: Verification of the application of a selected set of indicators of sustainable urban development to the conditions of the surveyed cities of the Slovak Republic with more than 50,000 inhabitants. *Based on this verification, we will evaluate the factors that are key to sustainable development in the field of transport in the conditions of the surveyed cities in the Slovak Republic.*

1. **Research hypothesis 1:** *The sustainable development of transport in the city of Bratislava reaches a value of more than 80%.*
2. **Research hypothesis 2:** *The sustainable development of transport in the city of Košice reaches a value of more than 80%.*
3. **Research hypothesis 3:** *The K indicator indicates the achievement of sustainable development in the field of transport in the city of Bratislava with a value of more than 50%.*
4. **Research hypothesis 4:** *The K indicator indicates the achievement of sustainable development in the field of transport in the city of Košice with a value of more than 50%.*

For the full use of SD indicators in its implementation phase, it is important that a comprehensive set of indicators is evaluated at regular intervals and that an overall assessment of the direction of the municipality or region towards sustainable development is carried out; we consider one calendar year as a suitable period. For such an evaluation, it is appropriate to use, for example, the following parameters: number of improving indicators compared to the number of deteriorating indicators, rate of improvement or deterioration of individual indicators (in the relevant units of measure), and "distance from target" – the further improvement needed to reach the target value. For this reason, the article works with its own colour semaphore differential that was designed and applied herein to evaluate and predict the improvement in SD in the surveyed cities in the Slovak Republic.

To meet the partial goal – verification of the application of a selected set of sustainable urban development indicators to the conditions of the surveyed cities, we modified and applied ISO 37120 indicator sets, Agenda 2030 indicator sets and ECI indicators, and we designed our own indicators for the area of transport in the surveyed cities. The modification was necessary due to the availability of statistical information as well as the addition of other appropriate indicators in this area. The proposed indicator set is listed and applied in the following tables. The proposed methodological semaphore of sustainable urban development is shown in Table 1.

4. Results

Public transport in Bratislava is delivered by the joint-stock company Dopravný podnik Bratislava

Table 1. Methodical Semaphore of Sustainable Urban Development in the Slovak Republic

Evaluation of indicators	Differential of colour semaphore	Sustainable development prediction
Baseline = 100% indicator achievement (max)	☺	A value of 100% indicates that this aspect of sustainable urban development is already at its maximum; there is no need to reduce or improve it in any way.
Medium status = arithmetic average of values surveyed in all cities for individual time periods = 50%	😐	A value above 50% indicates some achievement of this aspect of sustainable urban development; further attention and actions are needed to increase the value.
Negative status = higher or lower than the arithmetic average of the surveyed values in all surveyed cities for individual time periods = 0%	☹	The indicator value shows little or no achievement of this aspect of sustainable urban development; actions must be initiated for improvement.

Source: Own processing, 2021.

(DPB) with 100% ownership share of the capital of the Slovak Republic, Bratislava, on the basis of a contract for services in the public interest. Urban public transport in the city of Bratislava currently consists of a network of tram, trolleybus and bus lines, which are complementary to each other. The total length of the public transport network in the city is 479.4 km, of which 39.5 km (8.2%) comprises tram lines, 41.5 km (8.7%) comprises trolleybus and 398.4 km (83.1%) is bus routes. Currently, electric traction accounts for 37.2% of transport performance. In terms of transported persons, of the annual total volume of 4,302,600 person kilometres, trams account for 30.6% and trolleybuses for 11.4%.

In Bratislava, the lanes reserved for trolleybuses and buses constitute 23,050 m out of the total length of the 103,402 m of road network owned by the city. The city declares that out of 181 intersections and demanded pedestrian facilities, 13 are equipped with a preference for public transport vehicles (Ministry of Transport, Construction and Regional Development of the Slovak Republic 2013). In Bratislava, there is also a system of shared bicycles implemented under the names Rekola, Verejnýbicykel, Slovnaftbajk. Thus, there are three different companies operating in the city. The total length of the cycling network is advancing and at least 1 km of new cycling path is added every year. Almost every year, the price of a combined monthly ticket for all types of public transport in the centre and within a radius of 5–10 km for the study years has been growing. Ticket prices increased most between 2010 and 2011. The price for using the ecological taxi service for up to 5 km in the city centre is also growing almost every year. Unfortunately, the number of registered private cars in Bratislava is growing. The difference compared to 2010 is more than 37,000 registered passenger cars. Moreover, we can expect that this trend may worsen as people's wariness of shared transport increases in 2020 and 2021 in connection with the trend towards social distancing in response to the COVID 19 pandemic. This fact will of course be reflected in the number of people transported in public transport in 2019 and 2020. In 2018, the number of transported passengers in public transport was the highest since 2010, an increase of more than 100,000 passengers. On the other hand, the decrease in number of public transport accidents and fatal accidents, which are declining in the long term in the city, is to be seen in a positive light. As for the management of the transport company of the city of Bratislava, in the years 2014, 2015, 2016 it managed to achieve a surplus, but in recent years it has shown losses. The city of Bratislava also has very good conditions for supporting electromobility. Compared to 2018, the number of charging stations in the city has tripled. The city of Bratislava also currently offers 859 shared bicycles and 60 shared electric cars, thus contributing to promoting sustainable mobility in the city. This fact is also confirmed by the number of non-emission and low-emission public transport vehicles, which in 2020 represented more than 60% of all public transport vehicles in the city of Bratislava. Acknowledgment
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Indicator A indicates the achievement of SD in transport in Bratislava with a value of 100%; Indicator B with only 27.3%; Indicator C with 77.8%; Indicator D with only 30%; Indicator E with 60%; Indicator F with only 45%; Indicator G with 55%; Indicator H with only 30%; the CH indicator with 50%; Indicator I with 83.3%; Indicator J with 100%; and the K indicator with only 30%. The overall arithmetic average to reach 100% (ideal state) for sustainable development in the field of transport in the city of Bratislava is 70.7%. **Research hypothesis 1:** *The sustainable development of transport in the city of Bratislava reaches a value of more than 80%. This has not been confirmed to us: the value is 70.7%.* **Research hypothesis 3:** *The K indicator contributes to the achievement of sustainable development in the field of transport in the city of Bratislava with a value of more than 50%. This has not been confirmed to us: the value is only 30%.*

Košice

The city is a naturally attractive destination in terms of employment, education, shopping and services, healthcare, public administration, culture and sports for virtually the entire territory of the Košice self-governing region (KSR), the adjacent southern districts of the Prešov self-governing region (PSK)

Table 2. Modified indicator set of Sustainable Urban Development in transport in the Slovak Republic (Bratislava)

City	Indicator	MU	2010	2011	2012	2013	2014
Bratislava	**A. Length of bicycle infrastructure**	km	X	98,16	X	99,70	104,00
X = Data not available / not registered		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Baseline: increasing by min. 1.5 km per year		106.00	108.00	109.50	111.54	113.00	X
Medium condition: steadily increasing by <1.5 km / year		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Negative situation: not increasing, but remains the same year-on-year							
Bratislava	**B. Price of a combined monthly ticket for all types of public transport in the centre and within a radius of 5–10 km**	Euro	19.92	25.00	26.00	26.90	26.90
Baseline: below the average for the last 10 years (26.14)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (26.14), or increased by max. 0.30 euro/yr		26.90	26.90	26.90	26.90	27.66	27.66
Negative condition: above the average for the last 10 years (26.14)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**C. Price for ecological taxi for 5 km in the city centre during the day**	Euro	X	4.53	X	4.71	4.59
Baseline: below the average price for this service for the last 10 years (4.75)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average price for this service for the last 10 years (4.75)		4.59	4.59	4.62	4.62	5.00	5.50
Negative condition: above the average price for the last 10 years (4.75)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**D. Registered private cars as of January 1**	Quantity	136 613	103 208	159 524	130 777	153 925
Baseline: below the average for the last 10 years (150,859)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (150,859)		156 920	160 847	164 177	168 881	173 725	X
Negative condition: above the average for the last 10 years (150,859)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**E. Number of public transport accidents per calendar year**	Quantity	1 321	1 214	1 179	1 153	998
Baseline: below the average for the last 10 years (1,223)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (1,223)		1 131	1 175	1 308	1 373	1 379	X
Negative condition: above the average for the last 10 years (1,223)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**F. Number of traffic accidents with fatalities (total)**	Quantity	28	25	25	13	28
Baseline: below the average for the last 10 years (22.40)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (22.40)		23	24	21	18	19	X
Negative condition: above the average for the last 10 years (22.40)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**G. Economic management of the transport company of the city of Bratislava**	tho. eur	-6 816	-6 529	-1 884	-984	661
Baseline: positive economic results (+)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: economic results are negative, but smaller than last year's losses		572	753	-2 005	-2 076	3 745	X
Negative condition: negative economic results (-)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**H. Number of transported persons in public transport**	thousa.	237 248	274 193	251 944	230 680	248 557
Baseline: above the average number for the last 10 years (261,005)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the number for last year, or is equal to the average or increased		251 078	246 506	243 044	374 134	252 666	X
Negative status: below the average for the last 10 years (261,005)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**CH. Number of charging stations for electric cars**	Quantity	X	X	X	X	X
Baseline: more than 43 charging stations in the city (average for the years 2018–20)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: 30–43 charging stations in the city		X	X	X	23	30	76
Negative status: fewer than 30 charging stations in the city		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**I. Number of shared bikes (e-bike)**	Quantity	X	X	X	X	X
Baseline: above the average for the past 10 years (719)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equal to or below the average for the past 10 years. Initial state with expansion in following years		X	X	X	550	750	859
Negative condition: below the average for the past 10 years (719)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**J. Number of cars shared (electric car sharing)**	Quantity	X	X	X	X	X
Baseline: above the average in the city (42.50)		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equal to or below the average in the city. Initial state with expansion in following years		X	X	X	X	25	60
Negative condition: below the average in the city (42.50)		**MU**	**2010**	**2011**	**2012**	**2013**	**2014**
Bratislava	**K. Number zero-emission and low-emission public transport vehicles in %**	%	40.82	39.84	39.44	39.97	39.55
Baseline: LEPTs represent more than 50% of public transport vehicles		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: moderate share of LEPTs (40–50%)		38.00	43.60	48.36	49.00	X	60.74
Negative condition: LEPTs represent fewer than 40% of public transport vehicles							

Source: Own processing 2021, according to data published by the Statistical Office of the Slovak Republic, Transport Companies of the surveyed cities in the Slovak Republic – annual reports, Presidium of the Police Force of the Slovak Republic, Chargemap 2020, ISO 37120, Agenda 2030, ECI indicators. Sharengo application and public bike application. Association of public transport operators in urban agglomerations of the Slovak Republic and other strategy documents and situational analyses

Indicator	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A	X	100	X	100	100	100	100	100	100	100	X
B	100	100	100	0	0	0	0	0	0	0	0
C	X	100	X	100	100	100	100	100	100	0	0
D	100	100	0	100	0	0	0	0	0	0	X
E	0	100	100	100	100	100	100	0	0	0	X
F	0	0	0	100	0	50	0	100	100	100	X
G	0	50	50	50	100	100	100	0	0	100	X
H	0	100	0	0	50	50	0	0	100	0	X
CH	X	X	X	X	X	X	X	X	0	50	100
I	X	X	X	X	X	X	X	X	50	100	100
J	X	X	X	X	X	X	X	X	X	100	100
K	50	0	0	0	0	0	50	50	50	X	100
Total:	70,7%										

Fig. 1. Sustainable Development of transport in Bratislava according to the methodical semaphore
Source: Own processing 2021

and partly also for the adjacent northern districts of Borsod-Abaúj-Zemplén County (BAZ) of the Republic of Hungary. Most workers and school children are from towns and villages within 60 km of the city. Public Transport Company provides public transport with three transport modes – trams, trolleybuses and buses. In Košice, there is also a need to develop and support cycling as an equivalent means of transport service in the area and to integrate it into the main transport area. This will not be possible without quality and safe cycling roads and the necessary additional infrastructure. Košice urgently needs to connect important travel destinations, not only recreational ones, but above all routes from home to work, and thus needs to build a smooth, direct and safe cycling network that attracts cyclists. The city is required to renew and reconstruct existing bicycle roads, build new bicycle roads and multi-purpose lanes on existing city roads. At present (available data for 2018), the city has a cycling network of 177.02 km. Unlike 2017, this is a decrease of 2.18 km of bicycle network. This was mainly due to the construction (expansion) of car lanes in the city. The increase in this area occurred within two years. And the number of shared bicycles in the city is constantly increasing and enjoying the popularity of the population. The same applies to the use of car sharing in the city. In terms of the number of low-emission public transport vehicles, there was a significant shift in 2014 and 2015 due to the purchase of new trams. Subsequently, however, in the following years there is a declining or stagnant rate of renewal due to the decommissioning of old trams. The number of public transport accidents in 2020 was one of the lowest since 2012. This is also due to the decline in transport capacity in 2020. The increase in the number of charging stations for electric vehicles indicates an increasing pace of electromobility in the city. As for the price of a monthly public transport ticket, it remained unchanged from 2013 to 2018 but it increased significantly in 2019. Every year, the number of registered private cars grows. The number of people transported by public transport has been declining for the last 10 years, with a slight increase in recent years. However, this increase was halted in 2020, when there was a huge slump due to the global pandemic Covid19 epidemic and national restrictions. This is also reflected in the negative performance of the transport company. It has always ended up losing in the last 10 years. However, it is trying to gradually reduce the loss. The price of using an ecological taxi in the city has been reduced to a 10-year minimum since 2019.

Table 3. Modified indicator set of Sustainable Urban Development in transport in the Slovak Republic (Košice)

City	Indicator	MU	2010	2011	2012	2013	2014
Košice	**A. Length of bicycle infrastructure**	km	X	155.82	X	164.50	164,50
X = Data not available / not registered			**2016**	**2017**	**2018**	**2019**	**2020**
Baseline: increasing by min. 1.5 km per year			175.10	179.20	177.02	X	X
Medium condition: steadily increasing by <1.5 km / year			**2010**	**2011**	**2012**	**2013**	**2014**
Negative situation: not increasing, but remains the same year-on-year							
Košice	**B. Price of a combined monthly ticket for all types of public transport in the centre and within a radius of 5–10 km**	Euro	X	18.25	18.25	20.00	20,00
Baseline: below the average for the last 10 years (26.14)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (26.14), or increased by max. 0.30 euro/yr			20.00	20.00	20.00	25.00	25.00
Negative condition: above the average for the last 10 years (26.14)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**C. Price for ecological taxi for 5 km in the city centre during the day**	Euro	X	4.50	X	4.22	4,44
Baseline: below the average price for this service for the last 10 years (4.75)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average price for this service for the last 10 years (4.75)			4.56	4.68	4.68	3.00	3.00
Negative condition: above the average price for the last 10 years (4.75)							
			2010	**2011**	**2012**	**2013**	**2014**
Košice	**D. Registered private cars as of January 1**	Quantity	57 631	34 233	42 913	54 777	64 893
Baseline: below the average for the last 10 years (150,859)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (150,859)			67 201	68 437	70 074	71 588	X
Negative condition: above the average for the last 10 years (150,859)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**E. Number of public transport accidents per calendar year**	Quantity	568	494	407	455	548
Baseline: below the average for the last 10 years (1,223)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (1,223)			481	738	665	475	440
Negative condition: above the average for the last 10 years (1,223)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**F. Number of traffic accidents with fatalities (total)**	Quantity	40	45	31	29	26
Baseline: below the average for the last 10 years (22.40)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the average for the last 10 years (22.40)			25	22	30	42	X
Negative condition: above the average for the last 10 years (22.40)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**G. Economic management of the transport company of the city of Bratislava**	tho. Eur	-205 561	-1 394165	-517854	19625	-819984
Baseline: positive economic results (+)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: economic results are negative, but smaller than last year's losses			-1 815075	-900 706	-141114	-270109	X
Negative condition: negative economic results (-)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**H. Number of transported persons in public transport**	thous.	91 981	89 332	86 843	88 838	83 868
Baseline: above the average number for the last 10 years (261,005)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equals the number for last year, or is equal to the average or increased			83 144	82 540	82 003	82 656	56 200
Negative status: below the average for the last 10 years (261,005)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**CH. Number of charging stations for electric cars**	Quantity	X	X	X	X	X
Baseline: more than 43 charging stations in the city (average for the years 2018–20)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: 30–43 charging stations in the city			X	X	5	9	23
Negative status: fewer than 30 charging stations in the city			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**I. Number of shared bikes (e-bike)**	Quantity	X	X	X	X	X
Baseline: above the average for the past 10 years (719)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equal to or below the average for the past 10 years. Initial state with expansion in following years			X	X	X	350	500
Negative condition: below the average for the past 10 years (719)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**J. Number of cars shared (electric car sharing)**	Quantity	X	X	X	X	X
Baseline: above the average in the city (42.50)			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: equal to or below the average in the city. Initial state with expansion in following years			X	X	X	20	34
Negative condition: below the average in the city (42.50)			**2010**	**2011**	**2012**	**2013**	**2014**
Košice	**K. Number zero-emission and low-emission public transport vehicles in %**	Quantity	41.37	41.86	42.35	44.03	40,27
Baseline: LEPTs represent more than 50% of public transport vehicles			**2016**	**2017**	**2018**	**2019**	**2020**
Medium condition: moderate share of LEPTs (40–50%)		42,02	39.61	33.23	32.93	33.53	X
Negative condition: LEPTs represent fewer than 40% of public transport vehicles							

Source: Own processing 2021, according to data published by the Statistical Office of the Slovak Republic, Transport Companies of the surveyed cities in the Slovak Republic – annual reports, Presidium of the Police Force of the Slovak Republic, Chargemap 2020, ISO 37120, Agenda 2030, ECI indicators. Sharengo application and public bike application. Association of public transport operators in urban agglomerations of the Slovak Republic and other strategy documents and situational analyse

Indicator	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A	X	100	X	100	0	100	0	100	0	X	X
B	X	100	100	100	100	100	100	100	100	0	0
C	X	0	X	0	0	0	0	0	0	100	100
D	100	100	100	100	0	0	0	0	0	0	X
E	0	100	100	100	0	0	100	0	0	100	100
F	0	0	100	100	100	100	100	100	100	0	X
G	0	0	50	100	0	50	0	50	50	50	X
H	100	100	100	100	100	0	100	100	0	100	0
CH	X	X	X	X	X	X	X	X	0	50	100
I	X	X	X	X	X	X	X	X	X	50	100
J	X	X	X	X	X	X	X	X	X	50	100
K	50	50	50	50	50	50	0	0	0	0	X
Total:	54,3%										

Fig. 2. Sustainable Development of transport in Bratislava according to the methodical semaphore
Source: Own processing 2021

Indicator A indicates the achievement of SD in transport in Košice with a value of 57.1%; Indicator B with only 80%. Indicator C with 22.2%; Indicator D with only 40%; Indicator E with 54.5%; Indicator F with 70%; Indicator G with 25%; Indicator H with only 72.7%;

Indicator G with 25%; Indicator H with only 72.7%; the CH indicator with 50%; Indicator I with 75%; Indicator J with 75%; and the K indicator with only 30%. The overall arithmetic average to reach 100% (ideal state) for sustainable development in the field of transport in the city of Košice is 54.31%. **Research hypothesis 2:** *The sustainable development of transport in the city of Košice reaches a value of more than 80%. This has not been confirmed to us: the value is 54.3%.* **Research hypothesis 4:** *The K indicator indicates the achievement of sustainable development in the field of transport in the city of Košice with a value of more than 50%. This has not been confirmed to us: the value is only 30%.*

5. Summary and conclusion

The results of the research showed that the biggest factor in achieving the ideal state (100%) in the city of Bratislava in the field of transport (intelligent mobility) is indicator B, followed by indicators D, H, K. This means that the city of Bratislava should focus on reducing the price of the combined monthly public transport ticket – which is one of the highest of all the cities surveyed – by at least 1.52 euro. Consequently, the price of this service would correspond to the average price over the last 10 years. This could in turn lead to an increase in the number of people transported by public transport (indicator H). It is also necessary to focus on increasing the number of zero-emission and low-emission public transport vehicles. The biggest factor in achieving the ideal state (100%) in the city of Košice in the field of transport (intelligent mobility) is indicator C, followed by indicator G, K. This means that the city of Košice should focus on supporting ecological taxi transport in the city. This service has been expensive and poorly available in recent years. The changes occurred in 2019 and 2020, when the price fell below the average price over the last 10 years and at the same time the number of these vehicles increased. Furthermore, the city of Košice should focus on improving the management of the transport company, which in the long run achieves negative management results.

The only exception was 2013. As in Bratislava, it is also necessary to focus attention on increasing the number of non-emission and low-emission public transport vehicles.

Monitoring sustainable development indicators will enable local governments to:

1. identify strengths and reveal reserves for urban development and improving the quality of life,
2. present to the public the results of the work of local self-government and elected representatives,
3. provide relevant documents usable in strategic and community development documents, but also in the preparation of applications for subsidies from EU programmes and other sources,
4. get feedback on the priorities of the citizens of the city, municipality or region,
5. prepare a set (specific content and scope) of monitored indicators that optimally reflects the specifics and possibilities / priorities of the development of the city, municipality or region.

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