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SMART CITIES AND QUALITY OF LIFE: THE ANALYSIS OF PERCEPTIONS DATA

Abstract: One of the unavoidable effects of social and economic development is the intensified migration from rural to urban areas and consequent growth of urban population, imposing severe challenges to urban development. Growing economic and environmental problems are related to the management of urban infrastructure and resources: transportation, housing, health-care, sanitation, energy, clean water, education. The *smart city* concept has appeared as a solution for coping with the challenges of urban population growth and cities' transformation into complex, but economically efficient and socially sustainable environments. The concept includes various aspects of urban development that can be analysed as determinants of urban regions' competitiveness in attracting business, educated labour force and improving the quality of life. The essence of the concept is in creating policies that target sustainable development, economic growth and quality of life of the citizens. One of the ways of evaluating the quality of life in modern cities is by assessing citizens' perceptions on various aspects of urban life – quality of services provided in the cities, employment prospects, housing conditions, the level of social integration and safety and the effectiveness of local government administration. The aim of this study is to evaluate and compare cities in different European regions based on perceived satisfaction with the quality of urban life. Using 26 different indicators across five categories, the significance of differences in smart performance and quality of life between the cities of various European regions is tested. Based on *Urban Audit Perception Survey* database, ANOVA and post-hoc analysis indicates significant differences in the perceived quality of life between European regions.

Keywords: Quality of Life, Smart City, Statistical Analysis

1. INTRODUCTION

Intensified urbanization, as one of the manifestations of social and economic development, has posed significant challenges to urban development policy makers. Modern cities face a number of problems, varying from pollution, crowdedness, climate change to the social challenges such as poverty and social exclusion. On the other hand, cities also serve as hubs of technology development, research and innovation enhancement, this way attracting educated labour force and investments. It appears that modern cities at the same time represent the sources as well as the solutions to most important social, economic and environmental challenges of the present day. This is why cities and urban areas have been recognized as central elements of national and regional sustainable development policies. The EU cohesion policy, designed to strengthen economic, social and territorial cohesion of the EU countries by promoting competitiveness, growth and sustainable development across regions and cities, has dedicated a large effort towards urban innovative actions and inter-city policy exchanges. This strategy has focused investment priorities on sustainable urban mobility, the regeneration of deprived communities, or improved research and innovation capacity, aiming to improve the overall quality of life experienced by people (EC, 2019). Urban development has been placed at the heart of regional policies, especially in regards to fighting poverty and social exclusion. Furthermore, the new European Commission multiannual financial framework (COM (2018) 321 final) for the period of 2021-2027 is aimed at *urban earmarking*. The EU Smart Specialization Strategy, aimed at boosting jobs and growth in Europe, among other approaches, enforces the national smart specialization by developing *smart cities*, exploring the competitive advantages

of cities and turning them into corner stones of sustainable urban development. The *smart city* concept includes various aspects of urban development - economy, society, governance, environmental conditions and is therefore a valuable tool for evaluating the quality of life in the urban areas. The main benefits of smart cities are efficient resource allocation, improved security and the overall quality of life of urban dwellers.

On the other hand, national statistics can no longer support comprehensive comparisons between states, taking into account the disparities within the countries and differences in their growth patterns. Therefore, comparing data on regional and urban levels can often be more meaningful and highlight the specificities beyond national information and specific needs of national and subnational territories. Recognizing the importance of urban statistical information as a tool for quantifying the impact of policy measures, the EU statistics provide urban level data on population, health, education and training, the labor market, the economy, structural business statistics, research and innovation, the digital economy and society. One of the ways for evaluating the quality of life in modern cities is by assessing citizens' perceptions on various aspects of urban life – quality of services provided in the cities, employment prospects, housing conditions, the level of social integration and safety and the effectiveness of local government administration.

The aim of this study is to compare cities in different European regions based on citizens' perceptions concerning various aspects of urban living (infrastructure, living conditions, environment, finance and governance) as indicators of the quality of life. Using 26 different indicators, grouped into five categories, we will test the significance of differences between the cities belonging to different European regions. Additionally, two more indicators will be included, in order to assess citizen satisfaction with living in their city, as well as the satisfaction with the lives they lead. Further on, by exploring the differences in detail using post-hoc analysis, we will determine which regions specifically differ from each other, based on different aspects of perceived quality of life.

The paper will be structured as follows: after introductory notes, a brief literature review on the importance of the *smart city* concept and its multidimensional nature for assessing the quality of life will be presented. In the next chapter, methodology and data sources used in the paper will be described, followed by the presentation and discussion of main results of ANOVA and post-hoc procedures. Finally, some concluding remarks will be offered.

2. LITERATURE REVIEW

The *smart city* concept is often referred to as a suitable framework for assessing both the achievements of sustainable urban development and urban life quality. It is seen as a holistic process of redesigning urban areas, aimed at achieving sustainable urban growth, efficient service systems and increasing the citizens' quality of life (Stankovic et al. 2017).

Although there is an abundance of literature on the smart city concept, there is no universally accepted definition, since the concept includes a wide list of issues, stakeholders and components. Terms frequently used in the literature on smart cities can broadly be categorized into the following main aspects:

- *Social* (people, education, health and safety, social capital, mobility, inclusion);
- *Economic* (economic growth, jobs, finance, business-friendly environment);
- *Environmental* (energy, natural resources, sustainability),
- *Technological* (ICT, communication, transport, infrastructure, innovation) and
- *Political* (good governance, civic participation).

This categorization is helpful in determining the main components of smart cities, as well as priority areas of smart city development. It should be kept in mind that some of the mentioned terms can fall into more than one category and that various aspects of smart city development are mutually interdependent (for example, infrastructure in terms of public transport defines the mobility capacities of urban dwellers; educated individuals will be included in more intensive civic participation activities; economically thriving cities offer wider possibilities for sustainable energy usage, etc.). Although the smart city concept is built on the use of technologies in the cities, its essence is in creating policies that target sustainable development, economic growth and quality of life of its citizens (Ballas, 2013). This means that the main purpose of ICT diffusion is to enhance the quality of life (Batty et al., 2012).

The *infrastructure* is considered to be the core component of smart cities. There is a distinction between “hard infrastructure”, that includes physical infrastructure and ICTs and “soft infrastructure” relating to education, knowledge networks and citizens' participation (Del Bo and Florio, 2008). Technological factors are corner stones of smart cities' viability, so most definitions stress the importance of using ICT in various areas of urban life – economic, social, environmental and governmental (Hollands, 2008; Komninos, 2002; Lee et al., 2013). Therefore, the quality and availability of ICT infrastructure (phones, satellite TVs, computer networks, and internet services) and physical infrastructure (transport lines, buildings, and utilities) determine the quality of communication, mobility and accessibility, representing the core component of a smart city.

Social component of a smart city (people with their human and social capital) differentiates it from digital cities, implying that the main goal of building smart cities is to improve the well-being and the quality of life of citizens. This approach emphasizes the role of educated and skilled labour force for urban development (Gleaser and Berry, 2005), considering that people employed in “creative industries” (Florida, 2002), such as science, engineering, education, computer programming, research, contribute to urban performance. The availability of social and relational capacity determines the possibility of the community to learn and innovate. Civic participation and social interactions between the citizens and city administration largely determine the development and the implementation of social policies and

practices (Mullen, 2014). The inclusion of citizens in various social activities and services provides solid grounds for an equitable urban development.

Governmental aspects of smart cities include regulatory, compliance and governance mechanisms, based on political participation, effective service provision and e-government. Achieving the right balance of state, market and civic society enables inclusive and democratic forms of development (Heller, 2013). Participatory democracy principles empower citizens to take an active role in building efficient and citizen-centered urban environments.

Smart economy reflects the economic characteristics of smart cities, and encompasses issues that relate both to economic inputs and outputs. On the input side, economic indicators point to the profitability and cost effectiveness of building smart infrastructure. In order to make a city smart, high capital investments are needed for establishing both traditional and social infrastructure. On the other hand, investing in the infrastructure makes a city business friendly and attractive for investors and starting a business (Hollands, 2008). Resources offered by cities as business communities, besides infrastructure, include labour force, real estate and the market. Most often, smart economy is referred to as the implementation of ICT's in business operations, such as e-commerce, and is measured by indicators such as: share of enterprises with Internet connection, with own website, investment in hardware/software, etc. On the output side (how the smart city contributes to urban development) stands the increasing efficiency and competitiveness of cities, the acceleration of economic growth, declining unemployment levels, improving the innovativeness and entrepreneurship.

An important aspect of urban sustainability relates to *environmental* conditions – pollution, resource usage and management, ecological awareness. A renewable use of scarce natural resources enabled by implementing smart and innovative technologies is one of the most important conditions for cities' survival and sustainability. Smart city implies the reasonable management of land, water and other natural resources, harmonizing the built and natural environment.

Based on described fields of activities that relate to smart city development, there have been numerous attempts for defining the concept. Emphasizing six broad characteristics of a smart city (smart economy, smart people, smart governance, smart mobility, smart environment and smart living), Vienna Centre of Regional Science defines a Smart City as “city well performing in a forward-looking way in these six characteristics, built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens.” (Giffinger et al., 2007). From another point of view, a city is smart when “investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” (Caragliu et al., 2009).

3. DATA AND RESEARCH METHODOLOGY

The analysis presented in this paper utilises empirical data on perceptions of different aspects of living in European cities - *Urban Audit Perception Survey*, as a part of the official EU statistics on cities (Statistical Office of the European Union - EUROSTAT, 2015).

Urban Audit (City Statistics) is the Eurostat's database that provides datasets on various aspects of quality of life in individual cities and their commuting zones. It covers a wide set of topics such as demography, housing, health, economic activity, labour market, income disparity, education, environment, climate, travel patterns, tourism and cultural infrastructure. As a complement to objective data, there are surveys that measure the local perceptions of quality of life in selected cities. These surveys cover a range of issues such as employment, environment, housing, transport, culture, city services and immigration and have been conducted every three years since 2004. The survey includes all capital cities (except in the case of Switzerland, where Genève and Zurich are included), along with one to six more cities in the larger countries, with around 500 respondents per city.

For the purpose of our analysis, the most recent perceptions survey, conducted in 2015, is used, covering 31 countries from all European regions, with a total of 79 cities and more than 40,000 interviewed citizens (Quality of Life in European Cities 2015, Flash Eurobarometer 419). In the aim of exploring citizen perceptions on quality of life in cities across different European regions, the countries in the sample have been aggregated into geographic areas: Western Europe, Central and Eastern Europe, Northern Europe and Southern Europe, as presented in Table 1.

Table 1: Structure of the sample (countries and number of cities included)

Area	Countries included	Total number of cities included
Western Europe	Austria, Belgium, France, Germany, Ireland, Luxembourg, Netherlands, Switzerland, UK	31
Central and Eastern Europe	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, Slovakia	20
Northern Europe	Denmark, Finland, Iceland, Norway, Sweden	8
Southern Europe	Greece, Italy, Malta, Portugal, Spain, Turkey	20
Total	31 countries in the sample	79

Source: authors' preview

The respondents in the selected cities have been interviewed about their overall satisfaction with regard to the cities they live in, but also on their satisfaction with the quality of various services: infrastructure and facilities (public

transport, health care services, sports, cultural and educational facilities, state of the streets and buildings, public spaces and availability of retail shops). The survey also provides information about citizens' views on employment opportunities, housing situation, integration of foreigners, trust and safety and city administrative services, as well as environmental issues. On each of these issues, the respondents express their views using one of alternative responses: very satisfied, rather satisfied, rather unsatisfied, not at all satisfied and don't know/no answer. Each response has been assigned a value of the Likert scale (4 for "very satisfied", 1 for "not at all satisfied", while the "don't know/no answer" responses are not taken into account). The indicators used in this paper have been calculated as mean values of the responses.

For the purpose of measuring the satisfaction with different aspects of urban life, that adhere to the cities' *smart performance* categories, the indicators are grouped into five categories: Infrastructure, Living and housing conditions, Environment, Employment and finance and Governance, trust and safety. The indicator of each category has been calculated as a mean value of assigned indicators. Table 2 represents the list of indicators grouped in categories.

Table 2: List of indicators and categories

Categories	Indicators
Infrastructure	Public transport in the city (bus, tram or metro)
	Availability of retail shops
	Public spaces in the city (markets, squares, pedestrian areas)
Living and housing conditions	Health care services, doctors and hospitals
	Schools and other educational facilities
	Sports facilities (sport fields and indoor sport halls)
	Cultural facilities (concert halls, theatres, museums and libraries)
	It is easy to find good housing at a reasonable price in the city
	The state of streets and buildings in your neighborhood
Environment	Green spaces (parks, gardens)
	This city is committed to fight against climate change (energy efficiency, green transport)
	The quality of the air
	The noise level
	The cleanliness
Employment and finance	It is easy to find a job in the city
	Difficulties paying bills at the end of the month
	Your personal job situation
	The financial situation of your household
Governance, trust and safety	Foreigners who live in this city are well integrated
	The administrative services of the city help people efficiently
	The presence of foreigners is good for this city
	Generally speaking, most people in this city can be trusted
	I feel safe in this city
	I feel safe in my neighborhood
	Generally speaking, most people in my neighborhood can be trusted
	Generally speaking, the public administration of the city can be trusted

Source: authors' preview

Beside the indicators listed above, the survey measures the level of citizen satisfaction with the city they live in, but also assess the respondents personal situation – the satisfaction with the lives they lead. These indicators serve as general indicators of quality of life in the cities. The overall satisfaction of respondents concerning life in their cities is described by the last two indicators in Table 3.

Table 3: Descriptive Statistics of included categories and indicators of citizen satisfaction

	N	Minimum	Maximum	Mean	Std dev	Variance
Infrastructure	79	2.354	3.392	3.069	.216	.047
Living and housing conditions	79	2.204	3.247	2.716	.228	.052
Environment	79	2.009	3.207	2.777	.306	.094
Employment and finance	79	2.099	2.716	2.479	.160	.026
Governance, trust and safety	79	2.201	3.308	2.871	.240	.058
Satisfaction with living in their city	79	2.710	3.850	3.466	.248	.061
The life you lead	79	1.556	2.390	2.080	.187	.035
Valid N (listwise)	79					

Source: authors' calculation

According to the data in Table 3, the overall satisfaction of the city life and the quality of its various services is rather high. The highest levels of satisfaction are expressed regarding the infrastructure (3.07 of possible 4), while employment and finance are perceived as the most serious challenge (2.48). The highest score for the infrastructure is achieved in Switzerland cities (3.32 on average), while the evaluations of employment and finance indicate the highest level of satisfaction in Norway, while the lowest is in Hungary.

The first indicator of the quality of life in European cities analysed in this survey is the overall satisfaction of respondents with living in their city. The results of this question show a high level of satisfaction (mean value is 3.47). The highest values of this indicator are in the cities of the following countries: Norway, Sweden, Austria and Lithuania, while the satisfaction with living in the cities of Greece, Italy, Hungary and Portugal seems to be at the lowest. The data indicate that the level of satisfaction with living in a city tends to be lower in capital cities, as well as in large ones.

On the other hand, the satisfaction with the citizens personal situation – the lives they lead is much lower (only 2.08). It is interesting that the countries where the citizens express high levels of satisfaction with living in certain cities at the same time display the lowest level of satisfaction with the life they lead and vice versa. Countries with the highest values of this indicator are Portugal, Estonia and Latvia, while the lowest value is in Denmark, Iceland and Austria.

Concerning the citizen perceptions on the issues that deserve particular attention in their city, health services, unemployment and education and training are perceived as the most important (Table 4). These three aspects are ranked above safety, public transport, road infrastructure, air pollution, housing, social services and noise.

Table 4: Descriptive Statistics of the most important issues in the cities (in %)

	N	Minimum	Maximum	Mean	Std deviation	Variance
Urban safety	79	12.00	52.00	27.835	8.258	68.191
Air pollution	79	5.00	76.00	22.810	13.723	188.310
Noise	79	2.00	35.00	9.608	5.534	30.626
Public transport	79	4.00	49.00	23.481	8.910	79.381
Health services	79	7.00	67.00	43.620	13.525	182.931
Social services	79	10.00	31.00	19.481	5.401	29.176
Education and training	79	4.00	60.00	37.785	13.319	177.402
Unemployment	79	5.00	73.00	38.899	15.335	235.169
Housing conditions	79	3.00	61.00	23.418	14.145	200.093
Road infrastructure	79	7.00	52.00	24.025	10.845	117.615
Valid N (listwise)	79					

Source: authors' calculation

In more detail, health services are cited as one of the three most important issues in 63 cities and are identified as the top issue in 27 cities. Unemployment is referred to as one of the top three most important issues in 52 cities and ranks top in 23 of them. In 59 cities, education and training is cited among the three most important issues and in 18 cities it ranks highest.

Based on descriptive statistics of the sample, it can be concluded that there are differences in the perceptions of urban development and quality of life in different parts of Europe. Thus, the paper is aimed to identify particular indicators that display such differences, as well as to determine the significance of the differences between European regions.

4. RESULTS AND DISCUSSION

The methods applied in order to identify differences between European areas in regards to citizen perceptions of urban development and quality of life are One-way ANOVA and Post Hoc Test.

As already indicated, the most important issues facing European cities are health services, as more than 50% of respondents in Northern and Central and Eastern Europe perceive health services as the top issue. Education and training is the most important issue for 47% of respondents in Northern Europe and 46.19% of respondents in Western Europe. On the other hand, the most important issue in Southern Europe is unemployment.

Descriptive statistics of urban development categories across European areas indicates that the majority of categories is most highly evaluated in Northern Europe (living and housing conditions, environment, employment and finance and governance, trust and safety), while the infrastructure is most highly assessed in Western Europe.

Indicators of the quality of life clearly point out that the citizens are most satisfied with living in cities in Northern Europe (3.70), while Western Europe has just a slightly lower value of this indicator and it amounts to 3.53.

At the same time, the satisfaction with the life they lead in Central and Eastern Europe is 2.204 and just slightly lower in Southern Europe (2.181). These data clearly indicate that satisfaction with living in a particular city does not necessarily correlate with being satisfied with one's own life.

Table 5: Results of ANOVA

		Sum of squares	Df	Mean square	F	Sig.
Infrastructure	Between Groups	1.703	3	.568	21.973	.000
	Within Groups	1.938	75	.026		
	Total	3.641	78			
Living and housing conditions	Between Groups	1.644	3	.548	17.107	.000
	Within Groups	2.402	75	.032		
	Total	4.046	78			
Environment	Between Groups	2.919	3	.973	16.627	.000
	Within Groups	4.390	75	.059		
	Total	7.309	78			
Employment and finance	Between Groups	.843	3	.281	18.149	.000
	Within Groups	1.161	75	.015		
	Total	2.004	78			
Governance, trust and safety	Between Groups	1.593	3	.531	13.649	.000
	Within Groups	2.917	75	.039		
	Total	4.509	78			
You are satisfied to live in this city	Between Groups	1.239	3	.413	8.735	.000
	Within Groups	3.546	75	.047		
	Total	4.785	78			
The life you lead	Between Groups	1.246	3	.415	20.829	.000
	Within Groups	1.495	75	.020		
	Total	2.741	78			

Source: authors' calculation

The ANOVA results, presented in Table 5 confirm that not all of the group means are equal. There are statistically significant differences in citizen satisfaction with all of the urban development categories as well as in both indicators of quality of life (sig. .000 for all observed parameters). In order to explore the differences between the four European regions in more depth, we use the post hoc analysis, which is to identify the particular differences between the pairs of means that are significant. In other words, the test is to explain which European regions differ between themselves in regards to citizen satisfaction with particular urban development categories and with the quality of their lives.

The results of the post hoc test for all the indicators in our analysis are presented in Table 6. Concerning the aspects of urban development, it appears that Northern and Western Europe are most homogenous regions – there are almost no statistically significant differences except in the cases of Governance, trust and safety. On the other hand, perceptions of quality of life, including both indicators significantly differ - citizen satisfaction with living in a city in favour of Northern Europe and citizen satisfaction with the lives they lead in favour of Western Europe. This indicates that although there are statistically significant differences in some categories between Northern and Western Europe, concerning the majority of urban development categories there are no significant differences in citizens perceptions between these two European regions.

However, the majority of the other pairs of means (excluding a few exemptions) differ significantly between each other. Comparing Northern and Western Europe on one side and Central and Eastern Europe or Southern Europe on the other, there are statistically significant differences in almost all urban development categories, as well as in both indicators of quality of life. The satisfaction with living in a city seems to be the highest in the cities of Northern and Western Europe, which indicates a connection between the satisfaction with the urban development categories and with living in a particular city. On the other hand, satisfaction with one's personal life cannot be linked to urban qualities. Citizens that are most satisfied with personal lives live in CEE and Southern Europe.

Table 6: Post Hoc Test

Dependent variable	(I) Area	(J) Area	Mean difference (I-J)	Std error	Sig.	95% confidence interval	
						Lower bound	Upper bound
Infrastructure	Western Europe	CEE	.109*	.046	.021	.017	.201
		Northern Europe	.015	.064	.819	-.112	.146
		Southern Europe	.361*	.046	.000	.270	.453
	CEE	Northern Europe	-.094	.067	.166	-.228	.040
		Southern Europe	.253*	.051	.000	.151	.354
	Northern Europe	Southern Europe	.347*	.067	.000	.213	.481
Living and housing conditions	Western Europe	CEE	.207*	.051	.000	.105	.310
		Northern Europe	-.043	.071	.545	-.184	.098
		Southern Europe	.325*	.051	.000	.223	.427
	CEE	Northern Europe	-.251*	.075	.001	-.400	-.101
		Southern Europe	.117*	.057	.041	.005	.230
	Northern Europe	Southern Europe	.368*	.075	.000	.219	.517
Environment	Western Europe	CEE	.215*	.069	.003	.076	.353
		Northern Europe	-.118	.096	.223	-.309	.073
		Southern Europe	.430*	.069	.000	.291	.568
	CEE	Northern Europe	-.332*	.101	.002	-.534	-.131
		Southern Europe	.215*	.077	.006	.063	.368
	Northern Europe	Southern Europe	.548*	.101	.000	.346	.749
Employment and finance	Western Europe	CEE	.133*	.036	.000	.061	.204
		Northern Europe	-.065	.049	.194	-.163	.0349
		Southern Europe	.225*	.036	.000	.154	.297
	CEE	Northern Europe	-.197*	.052	.000	-.301	-.094
		Southern Europe	.093*	.039	.021	.015	.171
	Northern Europe	Southern Europe	.290*	.052	.000	.186	.394
Governance, trust and safety	Western Europe	CEE	.159*	.057	.006	.047	.272
		Northern Europe	-.203*	.078	.011	-.359	-.047
		Southern Europe	.257*	.057	.000	.145	.370
	CEE	Northern Europe	-.362*	.082	.000	-.527	-.198
		Southern Europe	.098	.062	.120	-.026	.222
	Northern Europe	Southern Europe	.460*	.082	.000	.296	.625
You are satisfied to live in this city	Western Europe	CEE	.071	.062	.258	-.053	.195
		Northern Europe	-.177*	.086	.044	-.349	-.005
		Southern Europe	.244*	.062	.000	.120	.368
	CEE	Northern Europe	-.248*	.091	.008	-.429	-.067
		Southern Europe	.173*	.069	.014	.036	.310
	Northern Europe	Southern Europe	.421*	.091	.000	.240	.602
The life you lead	Western Europe	CEE	-.201*	.040	.000	-.281	-.120
		Northern Europe	.186*	.056	.001	.074	.298
		Southern Europe	-.178*	.040	.000	-.259	-.097
	CEE	Northern Europe	.387*	.059	.000	.269	.504
		Southern Europe	.023	.045	.613	-.066	.112
	Northern Europe	Southern Europe	-.364*	.059	.000	-.482	-.246

*The mean difference is significant at the 0.05 level

Source: authors' calculation

5. CONCLUSION

Drawing upon the linkage between the smart city concept, as the modern approach to urban development, and the quality of urban life, this paper assesses the regional differences in the citizen satisfaction with various categories of urban development, that serve as a foundation for the evaluation of the quality of life in European cities. Taking into account that urban development policies involve the implementation of various socio-economic, environmental, infrastructural and technological requirements, we use data on a number of aspects of urban living, as perceived by their citizens.

The analysis in this paper is focused on subjective perceptions of citizens' life satisfaction and quality of services in urban areas across European regions. The empirical data indicate a high level of satisfaction with urban development categories in Northern Europe, where the living and housing conditions, environment, employment and finance and

governance, trust and safety were highly assessed. The highest level of satisfaction with infrastructure is recorded in Western Europe.

The first indicator of quality of life, satisfaction with living in a city, was also highly rated in Northern Europe and just slightly lower in Western Europe. On the other hand, the second indicator of quality of life, satisfaction with life they lead (individuals' personal situation), has the highest value in Central and Eastern Europe, followed by slightly lower values in Southern Europe.

The significant differences in citizens' perceptions on urban development and quality of life in Northern and Western Europe opposed to Central and Eastern and Southern Europe, indicate a connection between the urban development categories, conceptualized within the smart city framework, and the first indicator of quality of life – subjective satisfaction with living in the city. This conclusion does not hold for the second indicator of life quality. The satisfaction with someone's personal life is not affected by the level of urban development.

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