Analysis of Characteristics of Urban Communities in Slovenia for Smart City Development

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Abstract. *The paper addresses and analyses Slovenian specifics in comparison with other European cities, trying to decide whether Slovenia is a suitable market for smart cities. Analyses were made based on two existing researches. The first one included the citizens' opinions, based on a survey carried out by the European Statistical Office Eurostat, while the second one is based on an evaluation model that included several indicators divided into six categories, such as Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living. The comparisons indicated that Slovenia has many things in common with other European cities; however, there are some differences which need to be taken into consideration when creating a smart city.*

Keywords. Country characteristics. Smart city

1 Introduction

Urbanization is one of the main phenomena of the 21st century. More than half of the world's population live in cities. It is estimated that, by the year 2050, two-thirds of the population will live in urban areas (European Union, 2016). The largest world cities are located mainly in Asia (Tokyo, Delhi, Shanghai, Mumbai, Beijing) and South America (Sao Paulo, Mexico City, Buenos Aires), however, very large cities are rather untypical for Europe. Among the largest European cities are Moscow, Paris, and London. The latter are also the only mega-cities within the European Union (EU) with more than 10 million inhabitants. Currently, in the EU, 72% of people live in large or small cities and suburbs, and, by 2050, it is assumed that the proportion of the urban population will exceed 80% (GFS Inštitut, 2016).

The survey of European urban areas (European Union, 2016) shows that urbanization has a significant impact on the size and importance of cities within the EU. In particular, the capitals and other major cities represent the centres of education, employment, innovation, and the knowledge economy. In these urban areas, the use of technology ensures lower consumption, a better quality of life, and a brighter future for the next generation, making the creation of smart cities vital. Slovenia is no different; however, it does have some specifics that need to be taken into account when creating smart cities. In the past, several projects have already been carried out in Slovenian cities focused on creating a smart city. For example: In Ljubljana, in connection with Siemens, the project "Ljubljana, the smart city" was launched in 2010, focusing in particular on increasing the environmental performance. In the framework of the project, they wanted to improve the situation in the Energy and Environmental fields by informing and raising public awareness (Mestna občina Ljubljana, 2010).

In Maribor, the initiative "Smart City Maribor" (Košorokgartner, 2016) was established in 2013, aimed at ensuring sustainable development, promoting innovation and pilot projects, and, on the basis of this, to launch the activities of a smart city. The initiative covers smart living and planning, smart environment and energy, smart mobility and smart economics and integration (or characteristics of these areas). Within this initiative, the municipality has joined the partnership of established smart cities (Stockholm, Eindhoven, Karlsruhe), which are also comparable in size and complexity. Some changes have also been made in Kranj and Koper to establish the concepts of a smart city. In Kranj, in the context of the Development Centre for Information and Communication Technologies, technological solutions were introduced at the local level in 2018 (Hanc, 2014). In Koper, the main strategy is focused to become a smart city. Currently, they already provide a system of informing about the arrival of buses via SMS messages (Občina Koper, 2017).

Some of the above-mentioned examples developed into concrete solutions, while others were unsuccessful. Based on this fact, we investigate if Slovenia is a suitable market for smart cities.

2 Slovenia's specifics

Slovenia is one of the highly urbanised countries, but, due to a specific settlement pattern, the situation is somewhat different. Compared to European cities, Slovenian cities and urban centres are small to medium-sized; although there are 6,035 settlements on the territory of 20,273 km^2 (Mesta in urbana področja, 2011), among them only 156 towns. Instead of rapid urbanization, there is an above-average sub-urbanization rate, displacement of the population, jobs and urban activities from the central parts of cities to the suburbs and wider areas of the urban region, and, consequently, a comparatively low proportion of the population living in cities (Figure 1) (Mesta in urbana področja, 2011).

Among medium-sized towns with a population of between 100,000 and 500,000, only Ljubljana and Maribor meet the criteria. There are no major cities (between 300,000 and 1,000,000 inhabitants) in Slovenia, and among the smaller towns, only 16 with more than 10,000 inhabitants (Vlada Republike Slovenije, 2005): Ljubljana (258,873), Maribor (151,349), Celje (37,834), Kranj (35,587), Velenje (26,742), Ptuj (23.957), Koper (23.726), Novo mesto (22.415), Trbovlje (17,485), Nova Gorica (13,491), Jesenice (13,429), Murska Sobota (12,437), Škofja Loka (12,289), Kamnik (12,197), Domžale (11,582) and Izola (10,381).

The settlement structure in Slovenia is highly polycentric. The population density is 101.7 inhabitants per km^2. Since the eighties of the last century, the share of the urban population in Slovenia has not exceeded 50% of the population. The projection of the United Nations predicts that it will rise to 61% by 2050 (Albino et al., 2015).
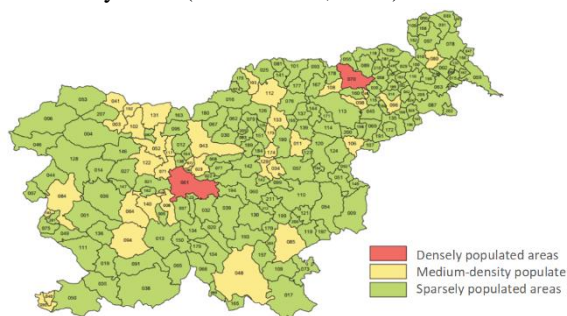

Figure 1 Urbanization rate in Slovenia

Slovenian towns represent mainly employment centres with highly educated people, since 95% of all employed people live in urban settlements, and 70% of the population of Slovenia have higher education. More than half of all jobs are concentrated in 11 urban centres (RS Ministrstvo za okolje in prostor, 2016)

The concentration of opportunities and jobs promotes extensive daily migration of people. This causes urban centres to experience great pressures on space and environmental resources. Among the key development challenges of Slovenia's urban centres are problems of air pollution, poor accessibility to public transport and problems of traffic bottlenecks, inadequate utilization of urban areas to provide economic development in degraded industrial areas. All cities also face the challenge of various forms of social exclusion and adaptation to ageing processes (RS Ministrstvo za okolje in prostor, 2016). Due to the listed facts, Slovenia is rather unique, although also ideal when applying the smart city concept.

3 Comparison of Slovene and other European cities

Slovenia stands out as a sub-urbanization in comparison with other European countries, where only a small percentage of people live in densely populated cities. Most people are settled on the outskirts of cities and rural areas (Eurostat statistics Explained, 2014). In order to be able to identify the specifics and to find particular opportunities for introducing the concepts of smart cities in Slovenian cities, we carried out a comparative analysis between Slovenian and other European cities. The aim was to highlight the advantages and disadvantages of Slovenian cities and to determine their characteristics.

- Urban paradox: Slovenia is characterised by a relatively low degree of urban paradox, which represents the difference between rich and poor in urban areas. Otherwise, it is typical for Europe that, in cities where 53% of GDP is generated, the standard of living is higher than in less populated areas.

- Labour market: The unemployment rate in Slovenian cities is below the European average, while, in suburban areas, this is slightly higher compared to other European countries. The difference in the unemployment rate with regard to the level of urbanization is minimal in Slovenia.

- Living conditions: The EU is characterised by the fact that people in town pay more for housing. In Slovenia, the average cost of housing is lower than the EU average compared to income.

- Education: In Slovenia, the share of people with higher education is above the European average, namely at all three levels of urbanization, where, in general, education in cities is higher than in rural areas.

- Security: The EU crime rate is, on average, higher in urban areas and lower in rural areas. Slovenia has a lower crime rate in cities and suburbs, while in less populated areas this is slightly above the European average.

3.1. Comparison based on citizens' opinions

A comparison between the City of Ljubljana and other European cities is made based on the data of the European Statistical Office Eurostat. The data were collected through a survey of the inhabitants from 86 European cities, of which only Ljubljana is included among the Slovenian cities. Nevertheless, in some points of the findings, we can generalise the findings to other Slovenian cities (Eurostat, 2017).

3.1.1. The satisfaction of people in the city

Inhabitants of Ljubljana agree with the inhabitants of other European cities in most areas. They highlighted the employability and quality of health services, with employability becoming more important in recent years. In contrast to the European average, the inhabitants of Ljubljana feel much more secure, and among the less important problems is education. According to the situation in 2015, citizens of Ljubljana would like to focus on social services.

In comparison with the European average, people in Ljubljana are above-averagely satisfied. With roads and buildings in the neighbourhood, people in Ljubljana are much more satisfied than in other European cities, but there has been a noticeable decline in satisfaction in the recent period. Public places (such as shops, markets, walkways, etc.) according to citizens in Ljubljana, are much more regulated than the average European city, or people are more satisfied, although perhaps infrastructure is better in other cities. Especially recently, satisfaction has improved with public places. It should be emphasised that satisfaction with public places correlates strongly with satisfaction with life in the city (Manville et al., 2014).

Regarding the adequacy and orderliness of sports facilities, satisfaction in the past was already higher, and, currently, it is moving within the European average. The satisfaction with cultural objects is slightly above the European average, but the situation deteriorated in the last observed period, which is why, according to the results of the surveys in 2015, Ljubljana was in 47th place (among 86). Satisfaction with educational institutions has decreased in the last period; however, Ljubljana is still above the European average in educational institutions. Regarding the health service, it can be concluded that the situation has deteriorated in recent times, and Ljubljana has now found itself in the European average.

3.1.2. The satisfaction of people in the city

In finding a suitable job, people in Ljubljana, especially in the years after the financial crisis, have bigger problems than most people in other European cities. Overall, satisfaction with the search for suitable employment was below the European average in 2015, and in the rankings of satisfaction, even to 65 out of 86 places. The search for a decent home presents more problems in Ljubljana than elsewhere in Europe, but

the situation has improved over the years. At this point, the respondents also took into account housing prices, which are significantly higher in our capital than in other Slovenian cities.

According to the European average, Ljubljana as a city is in favour of foreigners. Residents consider that they are relatively well integrated into society and the environment. In terms of an opinion on the good inclusion of foreigners, Ljubljana was in 11th place among 86 places. Concerning the sense of safety among residents, Ljubljana is one of the most secure places and ranked 14th from the top. According to previous surveys, people in the past felt even safer in the city. Similar findings apply to security in the neighbourhood, whereby Ljubljana also stands out in the positive sense from the average. Otherwise, both city safety and security in the neighbourhood are highly correlated with satisfaction with life in the city (Manville et al., 2014).

3.1.3. Environment

Citizens in our capital are increasingly satisfied with the quality of air. Satisfaction is higher than the average in other cities within the EU, where there has also been noticeable progress in recent years. About the noise in the city, people in Ljubljana are less enthusiastic, but they are still much more satisfied with the state of noise than the European average. Even in this area, the situation is improving.

According to its inhabitants, Ljubljana is an above-average clean city, ranking among the top 6. According to respondents, over the years, the adequacy and regulation of green areas is improving, and satisfaction with this element is also among the highest in comparison with other cities. People in Ljubljana generally agree that a city with various approaches, such as encouraging lower energy consumption or promoting public transport, is fighting climate change actively. This opinion has been strengthening over the years, and the situation in this field is much better than the EU average.

3.1.4. Traffic

In the field of Transport, the European Statistical Office has been involved in the use of means of transport, public transport, transportation to work, etc. On average, satisfaction with public transport in European cities has been increasing over the years. In the last period, satisfaction fell slightly in Ljubljana, but was still higher than the European average. Regular use of public transport is less popular in Slovenia than in other European cities, because people mostly use personal cars. The most frequent reason for not using public transport is poor flexibility and accessibility. Problems with flexibility are also exposed elsewhere in Europe, while accessibility is better.

Surveys show that, in Ljubljana, most people need 20 to 30 minutes to go to work, spending much less time than in other comparable cities. The most common means of transport are personal cars.

Regarding the use of personal vehicles, Ljubljana belongs in the European average, however, people in Ljubljana prefer to use bicycles rather than elsewhere in Slovenia.

Due to its city's layout, the traffic presents an important issue in Slovenia. More than half of the built-up areas in Slovenia are intended for traffic use (roads, railways, garages and parking lots). Sub-urbanised parts of settlements are more burdened with traffic use, especially automotive. Older block neighbourhoods were not built to use the car, but public, cycling and foot traffic. Between 2009 and 2011 traffic areas increased by 45.44 km2. Sub-urban parts of settlements have 10 to 50% more traffic than older village cores. Residents are aware of the non-sustainable traffic use threat and, as a rule, evaluate (car) road accessibility much lower than other values. When valuing their apartment, car parking is a very important parameter.

Although in Western countries the use of the car has already reached the point of saturation and shows signs of decline, in Slovenia this is not yet the case, presenting a specific for Smart City planning.
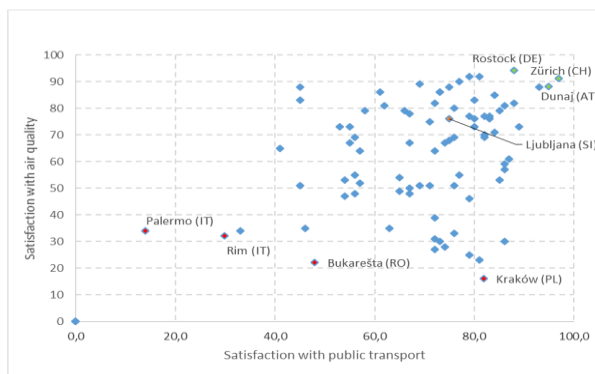

Figure 2 Satisfaction with air quality in relation to satisfaction with public transport

Transport as an important part of Slovenia, which has to be addressed within the smart city initiative, presents several issues, one of them being pollution. The relationship between people's satisfaction with air quality and satisfaction with public transport was evaluated in Figure 2, where it can be seen that there is a causal correlation between the variables. We conclude that, among other things, improvements in public transport can help improve the city's air. For comparison, the people who are most dissatisfied with air quality and public transport are people in Italian cities. The most satisfied people are in Austria (Vienna), Switzerland (Zurich) and Germany (Rostock). Ljubljana is above average; however, there is still room for improvement.

3.2. Comparison based on the evaluation model

Below is a comparison of European cities based on the model, which includes the largest Slovenian cities of Ljubljana and Maribor. In order to compare

European cities by areas of smart cities as described in the previous sections, the authors (Giffinger et al., 2007) prepared a model that ranks selected cities. The model within each area combines factors that can be measured using indicators (Občina Ravne na Koroškem, 2016): Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment and Smart Living.

Several (74) indicators were selected for evaluation of cities, which were collected from various European databases. Evaluation for medium-sized towns with inhabitants between 100,000 and 500,000 has been carried out three times in 2007, 2013 and 2014. The last evaluation included 77 cities, including Ljubljana, which is ranked in 15th place, and Maribor, ranked 40th.

From the above results, we find that Ljubljana, especially in the areas of smart economy and smart life, is ranked much higher than Maribor. We compared the data for Ljubljana and Maribor in the periods 2013 and 2014 according to individual factors. In the area of smart economics, Ljubljana is ranked higher compared to Maribor in all characteristics. In the "international inclusion" characteristic, data for Maribor are not available. On average, Ljubljana has progressed from 2013 to 2014, which does not apply to Maribor. Compared to other European cities, Ljubljana in the "smart economy" ranked among the 77 analyzed cities in the last evaluation period on the 6th place, while Maribor reached only 42nd place. In the area of "smart people", both Slovene cities are well-rated, Ljubljana is ranked 7th among the included European cities, while Maribor is ranked in 22nd place. In the field of "Smart Management" our cities are ranked relatively low (Ljubljana 34, Maribor 43). Given the detailed characteristics, we clearly have the biggest problems with transparency in Slovenia. In Ljubljana, compared with Maribor, there is room for improvement as far as the involvement of citizens in decision-making is concerned.

With smart mobility, the city of Ljubljana, in comparison with Maribor and other cities in Slovenia, benefits from international accessibility and available Information and Communications Technology resources. Otherwise, more attention should be paid to modernising the transport system. The smart environment is the only area where Maribor (15) is ranked higher than Ljubljana (21), although the two cities are affected very similarly. The biggest difference is in air quality, as well as transport, which again discovers one of the largest issues in Slovenia.

4 Conclusion

In this paper, we addressed Slovenia's Smart Cities experience, as well as its specifics, and compared them with other European cities based on data from existing researches. No full data were provided; however, the research provides insight to the following: Slovenian

cities are comparable with European average cities. However, the findings cannot be generalised based only on data from our capital city (Ljubljana). Slovenia has a specific city layout, making the transport issue one of the most important ones for Slovenian Smart Cities in the future.

When the largest Slovenian cities are compared by characteristics in the field of Smart Living, Ljubljana is much more attractive to tourists, has more quality cultural institutions, better health conditions and greater economic prosperity. On the other hand, personal security in the capital is somewhat lower than safety in other cities. Comparisons between several Slovenian cities can be found in the Urban Development Report (RS Ministrstvo za okolje in proctor, 2016).

Our future work will include a renewed analysis of Slovenia's specifics, readiness for smart city integration, and identification of fields where additional effort must be included. A survey covering all Smart City domains will be conducted among inhabitants of Slovenia's cities, focused on establishing the up to date opinions directly from smart city users.

Acknowledgments

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