Jurlina Alibegović, Dubravka

Book

Smart city indicators

Dubravka Jurlina Alibegović, Željka Kordej-De Villa and Mislav Šagovac

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Dubravka Jurlina Alibegović
Senior Research Fellow
The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7
10 000 Zagreb, Croatia
E. djurlina@eizg.hr

Željka Kordej-De Villa
Senior Research Fellow
The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7
10 000 Zagreb, Croatia
E. zkordej@eizg.hr

Mislav Šagovac
PhD candidate
University of Zagreb, Faculty of Economics and Business
Trg J. F. Kennedyja 6
10 000 Zagreb, Croatia
E. mislavsagovac@yahoo.com

www.eizg.hr

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IZDAVAČ / PUBLISHER:
Ekonomski institut, Zagreb / The Institute of Economics, Zagreb
Trg J. F. Kennedyja 7
10 000 Zagreb
Hrvatska / Croatia
T. +385 1 2362 200
F. +385 1 2335 165
E. eizagreb@eizg.hr
www.eizg.hr

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Sadržaj

Smart City Indicators: Can They Improve Governance in Croatian Large Cities?

Abstract:
The focus of this research is to implement the smart city methodology and develop smart city indicators for twenty-five large Croatian cities in order to develop a reference model for monitoring the success of Croatian large cities. Starting from the fact that only two Croatian cities have prepared a smart management strategy and that only thirty cities have developed smart projects in various sectors, the purpose of this research is to show the development of smart city indicators for the large cities through six dimensions of the smart city model: smart economy, smart people, smart governance, smart mobility, smart environment and smart living. The smart city indicators are based on publicly accessible data and easily available sources. In addition, web scraping techniques were used to obtain data that are not available from public sources. After data collection, all variables were standardized, allowing the comparison of indicators of different measuring units. Twenty-nine indicators were identified and used to compare the twenty-five large Croatian cities and evaluate their comparative advantages. The main results of the research include an assessment of the smart urban development index and ranking of cities according to the degree of urban development. The smart city indicator is above average in only eleven large cities. Measures for promoting smart development have been proposed to city policy-makers. The research results have implications for increasing rationality in the use of local public resources.

Keywords: smart city, indicators, smart urban development index, smart governance, large cities, Croatia
JEL classification: H70, O20, C38

Pokazatelji pametnog grada: Mogu li pomoći u upravljanju hrvatskim velikim gradovima?

Sažetak:
Fokus ovog istraživanja je na osnovi metodologije pametnog grada razviti pokazatelje za dvadeset i pet hrvatskih velikih gradova s ciljem da se pokazatelji koriste u donošenju strateških odluka i za izradu referentnog modela za praćenje uspješnosti hrvatskih velikih gradova. Polazeći od činjenice da su samo dva hrvatska grada pripremila strategiju pametnog upravljanja i da je samo tridesetak gradova razvilo pametne projekte u različitim sektorima, svrha ovog istraživanja je prikazati razvoj pokazatelja pametnog grada u hrvatskim velikim gradovima u šest dimenzija modela pametnog grada: pametno gospodarstvo, pametni građani, pametno upravljanje, pametna mobilnost, pametni okoliš i pametno življenje. Na temelju podataka iz javnih i slobodno dostupnih izvora kreirani su pokazatelji pametnog grada za velike hrvatske gradove. Korištena je *web scraping* tehnika za dobivanje podataka koji nisu dostupni iz javnih izvora. Nakon prikupljanja podataka standardizirane su sve varijable koje omogućuju usporedbu pokazatelja različitih mjernih jedinica. Pripremljeno je dvadeset i devet pokazatelja za uspoređivanje dvadeset i pet hrvatskih velikih gradova i procjenu njihove komparativne prednosti. Glavni rezultati istraživanja su procjena gradskog indeksa pametnog urbanog razvoja i rangiranje gradova prema stupnju urbanog razvoja. Samo jedanaest velikih gradova ima vrijednost pokazatelja pametnog grada iznad prosjeka. Donositeljima gradskih političkih odluka predložene su odgovarajuće mjere za poticanje pametnog razvoja. Rezultati istraživanja imaju implikacije na povećanje racionalnosti u korištenju lokalnih javnih sredstava.

Ključne riječi: pametni grad, pokazatelji, indeks pametnog urbanog razvoja, pametno upravljanje, veliki gradovi, Hrvatska
JEL klasifikacija: H70, O20, C38

1 Introduction[1]

One of the reasons why cities are so important is because they represent a global phenomenon of urbanization, which is likely to continue in the next decades. The degree of urbanization is not the same everywhere in the world. The largest is in Europe, where 73.6 percent of the European Union's (EU) inhabitants live in urban areas. In 2005, almost half of the world's population (49.1 percent) lived in cities (EC and UN-HABITAT, 2016). Based on UN-HABITAT (2016) research, we expect that 58.2 percent of the world and 75.8 percent of the European population will be living in urban areas by 2025. According to current projections, by 2050 two-thirds of the world population will be living in cities.

The situation in Croatian cities is similar. Currently, 59 percent of the Croatian population lives in urban areas and it is expected that 62.6 percent of the population will be living in cities by 2025. Cities are coping with many complex challenges and population density is one of them. At the moment, the average population density in Croatian large cities is 817 inhabitants per square kilometer. Balancing economic performance and living conditions as well as more efficient use of infrastructure (renewable energy sources, increase in energy efficiency, and reduction of emissions) are also important challenges for Croatian cities.

To solve these challenges, cities need smart solutions for economic prosperity and the welfare of citizens, aiming to reduce public expenditures. This can be provided by a smart city model which combines diverse technologies to reduce environmental impact and offer citizens better lives. In addition, smart solutions optimize decision making in the short and long term, manage and control city systems to enable real time functioning and mitigate current urban problems.

The goal of this research is to identify the significant indicators for measuring the urban development of twenty-five Croatian large cities through six dimensions of the smart city model, and then rank the cities according to the smart urban development index, which will enable city authorities to use the available information in the preparation and implementation of strategic decisions.

The scientific contribution of the research is that it presents the first implementation of the smart city model for Croatian large cities and enables their comparison with other European cities. The results help to identify and propose various measures that can be implemented in order to develop cities with better living and working conditions.

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The structure of this paper is as follows. After a short introduction, the second part of the paper presents the literature review. The methodology of the research and data are described in the third part. The fourth part focuses on the implementation of the smart city concept for twenty-five Croatian large cities. The last part includes the conclusion, future research agenda and recommendations for policy-makers. This paper also contains an Annex with an explanation of all indicators and data of the smart city model for twenty-five Croatian large cities.

2 Literature Review

The high concentration of population in a relatively small space creates a large number of challenges for the development of cities[2]. Cities, as high density places, are faced with constant need to increase energy consumption, transportation, buildings, public spaces, etc. (OECD, 2015). That is why cities require "smart" solutions, which mean efficient and sustainable solutions, as well as solutions that ensure economic prosperity and social wellbeing for the city population. The most efficient way to achieve this is by mobilizing the city's resources and actors using new technologies and policies. In the literature this concept is known as *smart city* (Giffinger et al., 2007; Giffinger and Gudrun, 2010; Giffinger, 2015; Lazaroiu and Roscia, 2012).

The concept of the intelligent city (Komninos, 2002) is the precursor of the smart city concept (Yigitcanlar, 2006; Yigitcanlar, 2016). Although there are thorough discussions about the smart city concept, there is still a lack of consensus on its definition (Hortz, 2016; Angelidou, 2015; Scheel and Rivera, 2013; Cocchia, 2014).

The term *smart city* can be seen as an umbrella concept which contains different themes such as smart economy, smart urbanism, smart environment, smart technology, smart mobility, etc. (Lara et al., 2016). Numerous authors describe the main notions of the smart city (Chourabi et al., 2011). Thus, Caragliu et al. (2011) emphasize administrative and economic efficiency, networked infrastructure, business-oriented development, social inclusion, creative industries, social and relational capital as the most important characteristics of a smart city. Many researchers analyze the relation between the digital and smart city concept (Jong et al., 2015), wherein "digital" is frequently considered as a critical element of "smart", as well as interactions between sustainable and smart cities (Ahvenniemi et al., 2017).

Nam and Pardo (2011) emphasize three critical dimensions of a smart city: population (education, creativity, and diversity), technology (and infrastructure) and institutions

[2] An increase in citizens' income in a city measured by real per capita income in the city is a basic definition of a city's economic development.

(policy, governance). Based on these insights, we wish to highlight the following operational and comprehensive description of the smart city concept: "Investments in technology, population and institutions aiming at the concept of smart city generate sustainable development and quality of life, promoting responsible management of natural resources and allowing institutions to contribute with innovation and better services for citizens, strengthening the debates and political participation" (Caragliu et al., 2011: 70).

Based on the work of Giffinger et al. (2007), Giffinger and Gudrun (2010) and Giffinger (2015), the essential dimensions of the smart city concept are smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. This means that the smart city concept contains several dimensions of a city related to smart economy (innovation, entrepreneurship, trademarks, productivity and flexibility of the labor market and integration in the national and international market), smart people (the level of education of citizens, the quality of social interactions regarding integration and public life and openness towards the world), smart governance (political participation, services for citizens and functioning of city administration), smart mobility (local and international accessibility, the availability of information and communication technologies, modern and sustainable transport systems), smart environment (natural conditions such as climate, green spaces, etc., pollution, resource management and efforts towards environmental protection), and smart living (quality of life in different areas such as culture, health, safety, housing, tourism, etc.) (Lazaroiu and Roscia, 2012; Lee et al., 2014; Jong et al., 2015). These six dimensions are related to traditional regional and neoclassical theories of urban growth and development and therefore this framework is seen as a solid background for our exercise in calculating smart city indicators for twenty-five Croatian cities. The following paragraphs shortly explain the main features of the six dimensions.

Economy is seen as the major driver of the smart city. Giffinger et al. (2008) stress that one of the most important indicators of a city's competitiveness is its capacity as an "economic engine". Smart economy includes indicators on innovation, entrepreneurship, trademarks, productivity and flexibility of the labor market, and integration in the national and international market (Carillo et al., 2014).

The smart people dimension has been traditionally neglected in the literature (compared to technology and policy issues). According to Chourabi et al. (2012), the most important factors related to people and communities are the following: participation and partnership, communication, digital divide, education, quality of life and accessibility. It is important to take into consideration not just citizens as individuals, but also as a group and community with specific needs within the city (Giffinger et al., 2007; Giffinger and Gudrun, 2010).

In the smart city, citizens are invited to participate in the city governance. Smart governance consists of indicators on political participation, services for citizens and

functioning of city administration. Private-public partnership, collaboration, leadership, communication, data exchange, accountability and transparency are additional issues discussed in the context of smart governance (Giffinger et al., 2007; Odendaal, 2003; Mooij, 2003; Chourabi et al., 2012; Johnston and Hansen, 2012; Carillo et al., 2014). Cohen and Amoros (2014) analyze the role of local government in smart city development.

Smart mobility consists of local and international accessibility, the availability of information and communication technologies, as well as modern and sustainable transport systems. Infrastructure is an essential part of this dimension, as cities that monitor the development of major infrastructure are more successful in providing services to their citizens (Hall, 2000; Giffinger et al., 2007; Harrison et al., 2010).

Smart environment includes natural conditions (climate and weather), environmental amenities (green spaces and parks) and environmental protection efforts (pollution abatement and resource management). Environmental protection has been in the focus of the smart city concept since its introduction (Giffinger et al., 2007; Hall, 2000; Carillo et al., 2014).

Smart living is defined as quality of life in terms of availability and quality of public services, such as culture, health, safety, housing, etc. (Giffinger et al., 2007; Giffinger et al., 2008; Nam and Pardo, 2011).

There are three essential prerequisites for a smooth transition to a smart city. First, it requires a supporting policy environment. Policy context is critical as government cannot innovate without normative changes. The policy context characterizes institutional and non-technical urban issues and creates enabling conditions. Gil-Garcia and Pardo (2005) identify regulatory, legal, institutional and environmental challenges of smart government, which also influence the policy context. There are also challenges related to horizontal and vertical coordination, as well as institutional framework. Marsal-Llacuna et al. (2015) emphasize the role of monitoring smart city initiatives for a successful transition from a regular to a smart city.

Managerial and organizational issues are the second critical precondition that needs to be discussed in the context of the smart city concept. These are horizontal themes essential for all six dimensions of the smart city concept (Gil-Garcia and Pardo, 2005), and it is useful to stress that the size of their impact is dependent on the specific time and contexts, which means that some are more influential than others depending on the specific situation.

Technology, primarily information technology (IT), has been identified as the third essential prerequisite for the implementation of the smart city concept. Hollands (2008) assumes that information and communication technology is a key driver of new smart

initiatives which offer new opportunities and improve the management and organization of cities. Although technology has the potential to improve living conditions in cities, there are also possible negative aspects of using technology—potential increase in inequality and digital divide (Odendaal, 2003). Ebrahim and Irani (2005) highlight certain challenges related to the implementation of technology in cities. The most critical issues are lack of cross-sectoral cooperation and coordination, unclear vision of IT management, policy and culture issues.

The smart city concept has been recognized in European strategic documents. It is also a part of the Europe 2020 Strategy for smart, sustainable and inclusive growth[3] and Smart Specialization Strategies (OECD, 2013). The smart specialization approach combines industrial, educational and innovation policies to help cities in recognizing priority areas for knowledge-based investments. Smart specialization strategies are promoted by the EU Cohesion Policy[4]. There is a strong link between smart specialization and cities. The majority of educational and research institutions are located in cities, as well as research and development (R&D) activities (European Parliament, 2014). The role of smart cities is also recognized by the EU's Smart Cities and Communities Innovation Partnership[5]. It links cities, industry and citizens to improve urban life through using innovation potential and more sustainable integrated solutions in the crucial areas of energy, transport and mobility. The Urban Agenda for the EU[6] also promotes cooperation between member states, the European Commission and cities in order to stimulate growth, livability and innovation in EU cities.

Everywhere in the world, cities have been identified as carriers of development activities in the country. In addition to the definition and different measurement of urban smartness (Albino, Berardi and Dangelico, 2015; Baron, 2012), scientific literature gives some attention to the role of cities in smart specialization (Giffinger et al., 2007; Deakin, 2012; Dvir and Pasher, 2004; Komminos, 2002; Kuk and Janssen, 2011) and their potential in promoting development (Lee, Phaal and Lee, 2013; Winters, 2011; Yigitcanler, Velibeyoglu and Martinez-Fernandez, 2008; Johnson, 2008). Most available are research results on the role of the largest cities, world metropolises and capitals. One of such examples is research on making city data accessible and understandable to citizens to give them information on new public services and solutions to urban problems. For instance, London, Hamburg and Rome are involved in the creation of a web platform that enables interested citizens to support the decision-making process.

[3] More information at: https://ec.europa.eu/info/strategy/european-semester/framework/europe-2020-strategy_en.

[4] More information at: http://s3platform.jrc.ec.europa.eu/home.

[5] More information at: http://ec.europa.eu/eip/smartcities/.

[6] More information at: http://urbanagendaforthe.eu/.

Unfortunately, there is not enough evidence in scientific literature on the implementation of the smart city concept in the new EU member countries. One exception is a report by the European Investment Bank's Economic Department (Kollar, Bubbico and Arsalides, 2018). In that report, smart investment in Central, Eastern and Southeastern Europe was explored with an aim to help cities with their investment planning and coordination. The focus of our paper is to implement the smart city methodology and develop smart city indicators for Croatian large cities with the aim of using the indicators in strategic decision-making. Although the smart city is a component of the Croatian Smart Specialization Strategy (Ministry of Economy, 2015), which is now strongly supported by the Ministry of Economy, Entrepreneurship and Crafts of the Republic of Croatia, research studies show that key decisions in Croatian large cities have mostly been made without much strategic consideration. To overcome the lack of strategic orientation, our research follows the methodology set out in Giffinger et al. (2007) to identify the most important indicators for measuring the economic competitiveness of Croatian large cities. Although this research is based on the six dimensions of the smart city, it differs from the model primarily because of the selection of data used. The data used reflect certain specificities of Croatian cities in all six dimensions, but predominantly in the dimensions of smart people, mobility, environment and living. Based on these features, in our research we develop the indicators for calculating the competitiveness of twenty-five large cities in six dimensions of the smart city model. We also rank the analyzed Croatian cities according to the smart urban development index. This information will provide mayors and town councilors with additional input for strategic decision-making in cities.

Web scraping techniques were used to collect publicly available data to measure indicators that represent the degree of urban development of Croatian large cities. Twenty-nine indicators were used to compare twenty-five Croatian large cities and to assess their comparative advantage in a wider international context. Special attention was given to the comparison of different Croatian cities in the field of local innovation capacity and many other components that contribute to local development, such as educational capacity, urban management and governance, social development, and environmental management in a particular city.

The purpose of this research is to use the smart city methodology to develop smart city indicators for twenty-five Croatian large cities across the six dimensions. In addition, the results of this research could be seen as a tool for evaluating local policies. They can help to position Croatia as one of the few Southeast European countries with a smart city indicator framework. The research also provides recommendations and can assist policy-makers in adopting appropriate measures to promote smart, locally led development.

3 Methodology and Data

Numerous international institutions have been involved in the development of various urban indicators. However, there is poor representation of cities from the new EU member states in the development of these indicators. One of the exceptions is the UN-HABITAT Report on European Cities in Transition (UN-HABITAT, 2013) that includes several Southeast European countries, including Croatia. European Commission city statistics and the Urban Audit database provide information and comparable measurements on different aspects of urban life in European cities. However, the Urban Audit database provides data for only a few cities from the new EU member states. Only five Croatian cities are included.[7] Unfortunately, data for these five cities are deficient. There are also urban sustainability indicators for selected European cities.[8] These indicators are focused on urban patterns, current urban designs, infrastructure, policies, waste disposal systems, pollution and access to services by citizens. However, the urban sustainability indicators database does not contain indicators for Croatian large cities.

This research focuses on twenty-five Croatian large cities that are crucial drivers of the socio-economic development in the country. The aim of this research is to implement the smart city concept on data for the twenty-five large cities and present the development of their smart city indicators. The role of smart cities is to link cities, industry and citizens to improve urban life through using innovation potential and more sustainable integrated solutions. The most recent amendments to Croatian legislation[9] have resulted in a new definition of large cities. Large cities are urban settlements with more than 35,000 inhabitants or county centers. Twenty-five Croatian cities have the status of a large city; 17 cities have more than 35,000 inhabitants, including the city of Zagreb as the capital city; and 8 cities are county centers with less than 35,000 inhabitants (see Table A1 in the Annex). There are in total 127 cities in Croatia. Such a definition of large cities is, of course, different from the definitions used in Giffinger et al. (2007). The average size of the Croatian large cities is about 105,000 inhabitants, and the county centers have around 19,000 inhabitants. This division marks the Croatian context.

Past research studies have shown that key decisions in Croatian large cities have mostly been made without much strategic consideration, being primarily reduced to setting *ad hoc* goals, activities and measures for their achievement (Perko Šeparović, 2006; Petak, 2009; Đulabić and Manojlović, 2011; Maleković, Puljiz and Polić, 2007; Jurlina Alibegović and Blažević, 2010; Jurlina Alibegović and Slijepčević, 2010).

[7] These are Zagreb, Split, Rijeka, Osijek and Slavonski Brod.

[8] More information at:
http://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators_for_sustainable_cities_IR12_en.pdf.

[9] Law on Local and Regional Self-Government (Official Gazette No. 33/01, 60/01, 129/05, 109/07, 125/08, 36/09, 36/09, 150/11, 144/12, 19/13, 137/15, 123/17).

To overcome the lack of strategic orientation, in this research we identify the most important indicators for measuring the competitiveness of Croatian large cities following the methodology set out in Giffinger et al. (2007). This provides the first step in the cities' strategic analysis.

The methodology of this research consists of several activities. The first activity involved collecting available data to measure the indicators through six dimensions of the smart city model (smart economy, smart people, smart governance, smart mobility, smart environment and smart living). The second activity consisted of preparing surveys for city administration, in order to collect additional information to measure smart city indicators. The third activity was the development of twenty-nine indicators to compare twenty-five Croatian large cities. Estimation of the smart urban development index was the fourth activity. The fifth activity involved comparing the cities according to the smart urban development index, which will enable city mayors and councilors to use the available information and smart city indicators in the preparation and implementation of strategic decisions aiming to promote smart, locally led development.

The first task was to collect a set of data for Croatian large cities. The data were derived from publicly and freely available data sources to create all the indicators that jointly describe the factors of a smart city model for Croatian large cities. The data were obtained from the Urban Audit database and the Croatian Bureau of Statistics. Some datasets, like labor market indicators, were obtained from statistical institutions and other public institutions. Web scraping techniques were also used to obtain data that were not available from statistical institutions in a clean, structural form. The public registers that were used include the registers of the Financial Agency (FINA), the State Intellectual Property Office, the Croatian Pension Insurance Institute, the Croatian Employment Service, the Ministry of Justice Court Register, the Zagreb Stock Exchange, the State Election Commission, the Register of Political Parties, the Ministry of Public Administration, the Ministry of Finance, Budget execution of local and regional self-government units, the Institute of Public Finance, the Croatian Meteorological and Hydrological Service, the Croatian Environment Agency and HEP Distribution System Operator.[10] The use of these resources allowed us to obtain data that have not been used in previous research, such as the number of patents in the city or the number of trademarks of firms that have their headquarters in the city. There are many papers that have identified which indicators are important in measuring the smartness of cities,[11] but significantly less papers measure the same indicators on a regular (yearly) basis for all cities in the country.

[10] The last available data were used, primarily for 2016 and 2017. Population data are from Census 2011.

[11] Caragliu and Del Bo (2012), Caragliu, Del Bo and Nijkamp (2011), Giffinger and Gudrun (2010), Giffinger et al. (2007), Carli, Dotoli, Pellegrino and Ranieri (2013, October).

For countries in the European Union, researchers usually use datasets that are available in the Eurostat database, but using data from other national registers can generate new insights in measuring the smartness of cities. In our case, we use twenty-nine indicators to compare twenty-five Croatian large cities and to assess their comparative advantage in a wider international context.

Table 1 shows the design of the smart urban development index across six dimensions of the smart city (smart economy, smart people, smart governance, smart mobility, smart environment and smart living). The indicators and data that have been used differ to a certain extent from the methodology in Giffinger et al. (2007). The three indicators that describe smart people (students and universities, foreign language schools and net migration) are different from those originally used. In Table 1 the indicators and data are marked bold if they are the same as in Giffinger et al. (2007). It is obvious that twenty-one indicators (out of twenty-nine) and twenty-six data items (out of forty-six) are the same as the indicators and data in Giffinger et al. (2007). Details on the structure of the smart city indicators and data sources are given in Tables A2, A3, A4, A5, A6 and A7 in the Annex.

Table 1 **Smart Urban Development Index**

Dimensions of the smart city	**Indicator**	**Data**
Smart economy	R&D expenditure, plant and equipment	**1. R&D expenditure**
		2. Plant & equipment expenditure
	Knowledge-intensive industries	**3. Employment in knowledge-intensive industries**
	Patent applications	**4. Patent applications**
	Entrepreneurship	**5. Self-employment rate and flexibility of labor market**
		6. Newly established enterprises
	Trademarks	7. International trademarks
	Productivity	8. Labor productivity
		9. Part-time employment
	Employment and flexibility of labor market	**10. Unemployment rate**
		11. Employment intensity
	International presence	**12. Number of companies quoted on the Zagreb Stock Exchange**
		13. Export intensity
		14. Enterprises with foreign origin of capital
		15. Foreign direct investment
Smart people	Students and universities	16. Number of institutions of higher education
		17. Students enrolled in university studies
	Foreign language companies	18. Number of companies whose business is a foreign language
	Net migration	19. Number of emigrated people
	People working in creative industries	**20. Share of employees in cultural industries**
	Voter turnout at European elections	**21. Voter turnout at European elections**
	Voter turnout at local elections	22. Voter turnout at local elections

Smart governance	**Participation in decision making**	**23. Number of city council members per 1,000 inhabitants**
		24. Proportion of women council members to the total number of city council members
		25. Number of political parties per 1,000 inhabitants
	Public and social services and transparent governance	**26. Share of children in nurseries and kindergartens in the total number of children aged 0 to 6 in the city**
		27. Total expenditures in city budget per capita
		28. Budget transparency in 2017
Smart mobility	**Local accessibility**	29. Number of city bus lines
		30. Number of bus stations in the city
		31. Length of bicycle trails in the city, in kilometers
Smart environment	**Sunshine hours**	**32. Sunshine hours**
	Green space	**33. Share of green spaces**
	Mixed municipal waste	34. Mixed municipal waste
	Use of water	**35. Use of water**
	Use of electricity	**36. Use of electricity**
Smart living	**Cultural facilities**	**37. Theatre attendance per inhabitant**
		38. Cinema attendance per inhabitant
		39. Museum visitors per inhabitant
	Hospital beds	**40. Hospital beds per 1,000 inhabitants**
	Doctors	**41. Doctors of medicine per 1,000 inhabitants**
	At-risk-of-poverty rate	**42. At-risk-of-poverty rate in 2011**
	Housing quality	43. Residential area per capita in m^2
	Aging of population	**44. Life expectancy**
	Tourist attractivity	45. Number of tourists compared to the number of inhabitants in the city
		46. Number of overnight stays in relation to the total number of inhabitants in the city

Source: Authors' classification.

When referring to the original indicators and comparing data in this research to the original source Giffinger et al. (2007), it is important to mention that part of the indicators are specific to Croatia (for example, tourist indicators and migration balance).

Furthermore, a survey was sent to the twenty-five cities to collect additional data and information.

After data collection, all variables were standardized, which enabled a comparison between indicators of various measurement units. Following Giffinger et al. (2007), z-transformation was used to standardize all indicators. This method transforms all indicator values into standardized values with an average of 0 and a standard deviation of 1. Standardization has the advantage of "considering the heterogeneity within groups and maintaining its metric information" (Giffinger et al., 2007: 14).

After data standardization, the smart urban development index was calculated for each city. The smart urban development index was constructed as the sum of all standardized values across all smart city dimensions. No weighting was used in the aggregation process. Due to data constraints, more formal statistical analyses such as cluster or principal component analysis were not used. The aim was to compare the cities by level of smart urban development index.

4 Implementation of Smart City Indicators

The following eight figures present the main findings of the research on the implementation of the smart city model. In this research, data for the city of Zagreb are not included because it has a dual status of a city and a county center.

Figure 1 presents the position of Croatian large cities in the first dimension of the smart city model—smart economy. There are eight different indicators that describe smart economy. None of the cities in the sample have all positive indicators of smart economy. Pula has the best results with only one negative score in number of international trademarks. Rijeka and Zadar are in second place because they have only two negative scores, in the number of patent applications and number of international trademarks. Virovitica is the only city with negative results in all the indicators of smart economy. All other cities have some positive and some negative indicators. The results of the cities' ranking by smart economy show that the cities can improve their position in all indicators in this dimension of the smart city—research and development expenditure, plants and equipment, patent applications, knowledge-intensive industries, entrepreneurship, trademarks, productivity, employment and flexibility of the labor market, as well as international presence. Local decision-makers can provide various measures to boost the position of the city in the smart economy ranking. Self-employment rate and rate of newly established enterprises can be improved by advancing the development of digital skills and IT sector to increase self-employment and the number of newly established companies. The results of such measures can also contribute to decreasing unemployment in the city.

Croatian large cities are compared according to the dimension of smart people in Figure 2. Based on the six indicators of smart people, Varaždin is a positive example with almost all positive indicators of smart people, and Bjelovar and Slavonski Brod are on the opposite side with all negative indicators. The score in smart people can be improved by implementing active city measures to increase the number of educational institutions in different cities (Bjelovar, Koprivnica, Krapina, Pazin, Samobor, Velika Gorica and Vinkovci). Voter turnout at local elections can be improved by increasing the level of transparency and positive media promotion of local elections in cities.

Figure 3 shows the comparison of Croatian large cities in the dimension of smart governance, which consists of two indicators: participation in decision making, and public and social services and transparent governance. Both indicators are positive in seven Croatian cities: Krapina, Pazin, Zadar, Pula, Koprivnica, Karlovac and Čakovec, with Krapina ranking the highest. City political parties can be more active in increasing the proportion of women in the city council. This proportion can be increased by 10 percentage points if city political parties follow the electoral legislation that prescribes 40 percent of women council members. City decision-makers are able to initiate activities and measures to establish new nurseries and kindergartens in the city with an aim to increase the share of children in nurseries and kindergartens. City mayors are responsible for increasing budget transparency in their cities. In 2017, the average level of budget transparency was 4.2, meaning that five key budget documents were published on the official city websites (annual budget execution for the year 2016, biannual budget execution for the year 2017, budget proposal for the year 2018, voted budget for the year 2018 and budget for citizens for the year 2018). In 2017, the city of Gospić did not have publicly available any of these five budget documents. Požega published only two budget documents; Sisak and Varaždin published three budget documents.

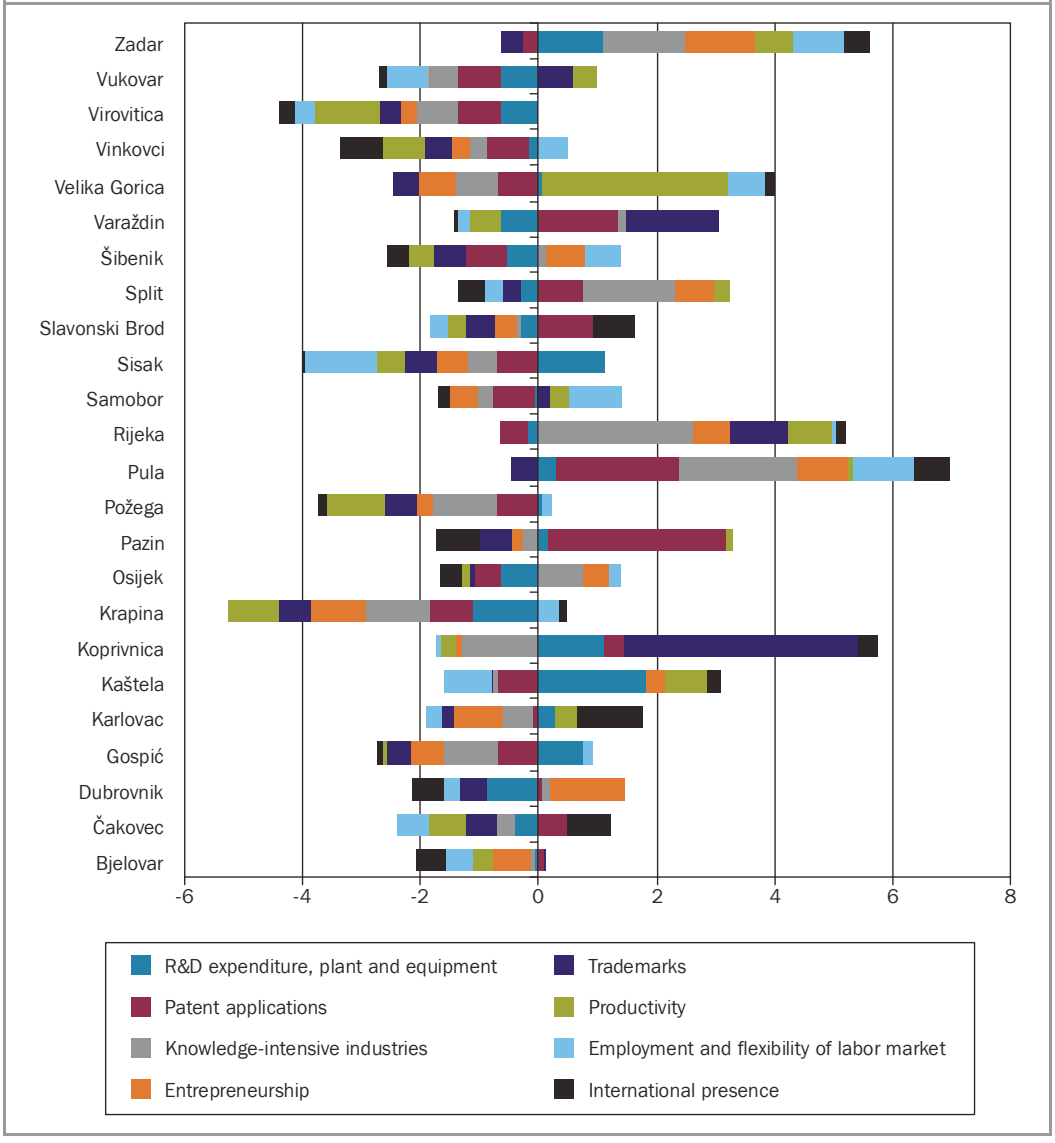
The fourth dimension of the smart city model, smart mobility, comprises only one indicator, local accessibility (Figure 4). Relatedly, eight Croatian large cities have an above-average number of city bus lines, bus stations, and bicycle trails in the city, which all together form the indicator of local accessibility. The highest value is in the city of Pazin. City leaders can introduce various measures that can secure higher local accessibility.

Figure 5 presents the fifth dimension of the smart city model, smart environment. This dimension of the smart city model has five indicators: sunshine hours, green space, municipal waste, use of water and use of electricity. Zadar presents the most positive results, except for data on mixed municipal waste, which is the only negative part of the figure for the city of Zadar. Bjelovar and Vukovar are two cities with negative results in all five components of smart environment. The role of local policy-makers is substantial in this dimension of the smart city, and is highly dependent on regulations in the environmental, waste management and energy efficiency field.

Seven different indicators present smart living in Figure 6. Residential area per capita is one of the critical indicators in smart living. City mayors and council members can influence this indicator because they have the power to propose measures to improve this component of smart living. Velika Gorica and Krapina exhibit the worst results in this dimension of the smart city model.

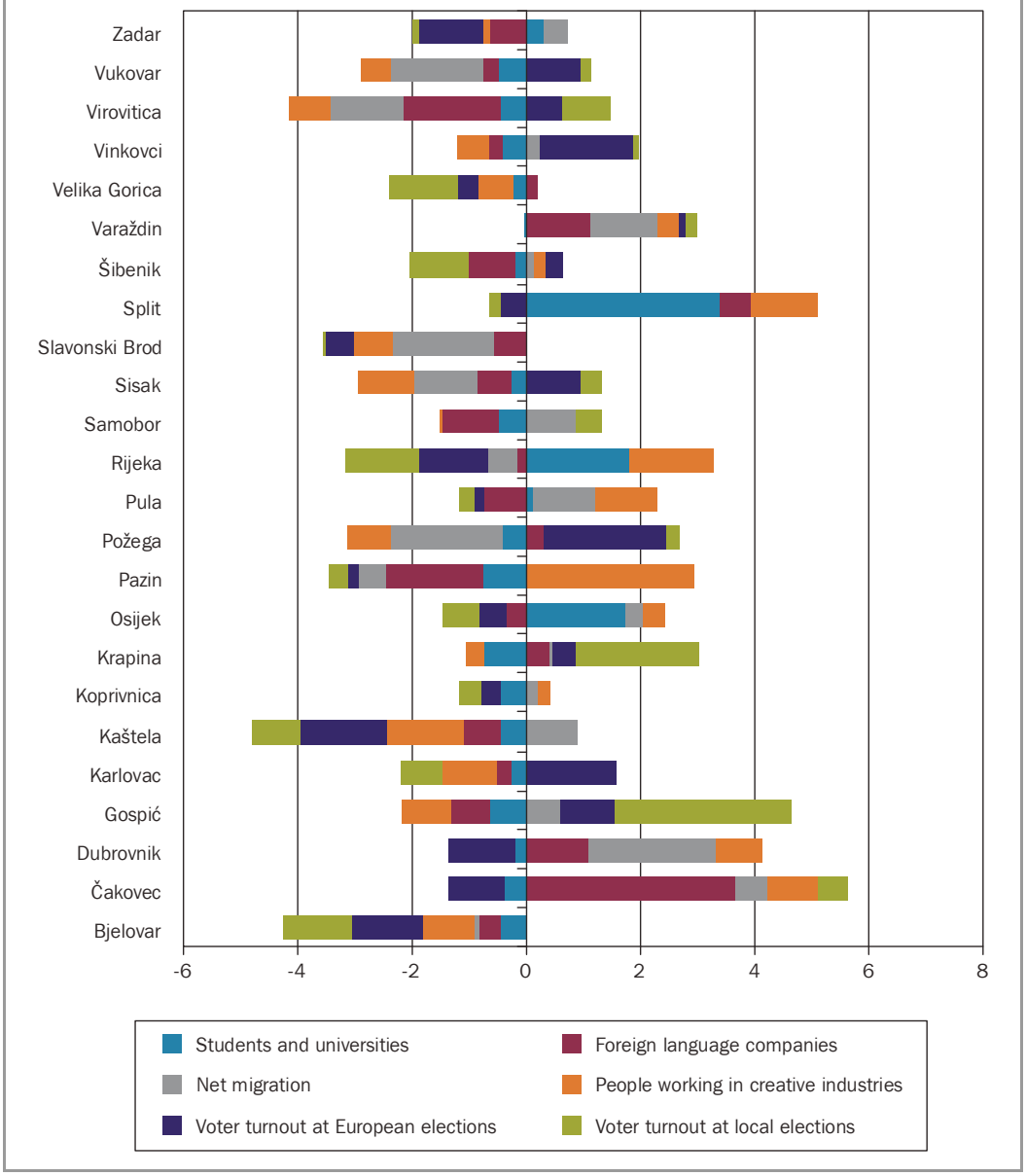
These six figures clearly demonstrate the heterogeneity of the cities in all smart city indicators. This conclusion is a good introduction to the smart urban development index of the twenty-five Croatian large cities.

Figure 1 **Croatian Large Cities, Smart Economy**



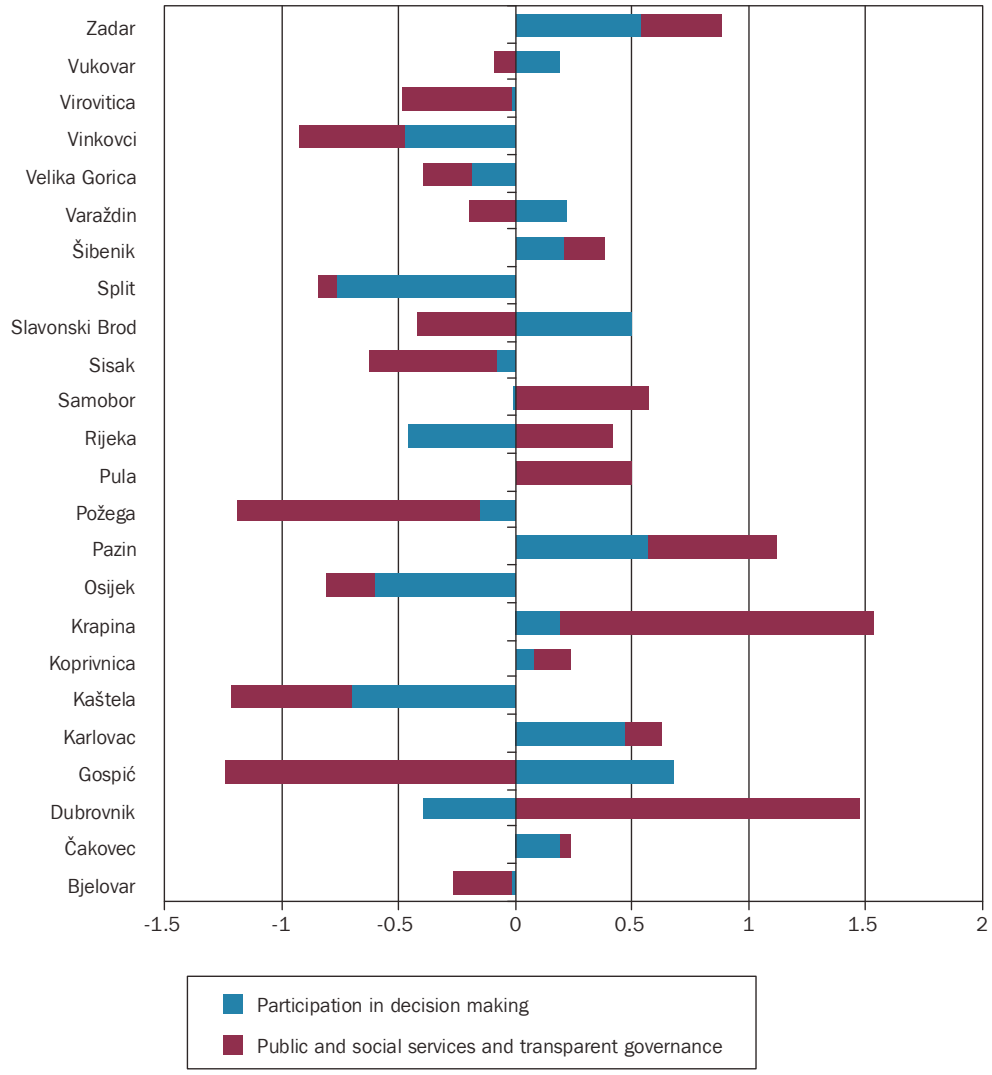
Source: Authors' systematization.

Figure 2 **Croatian Large Cities, Smart People**



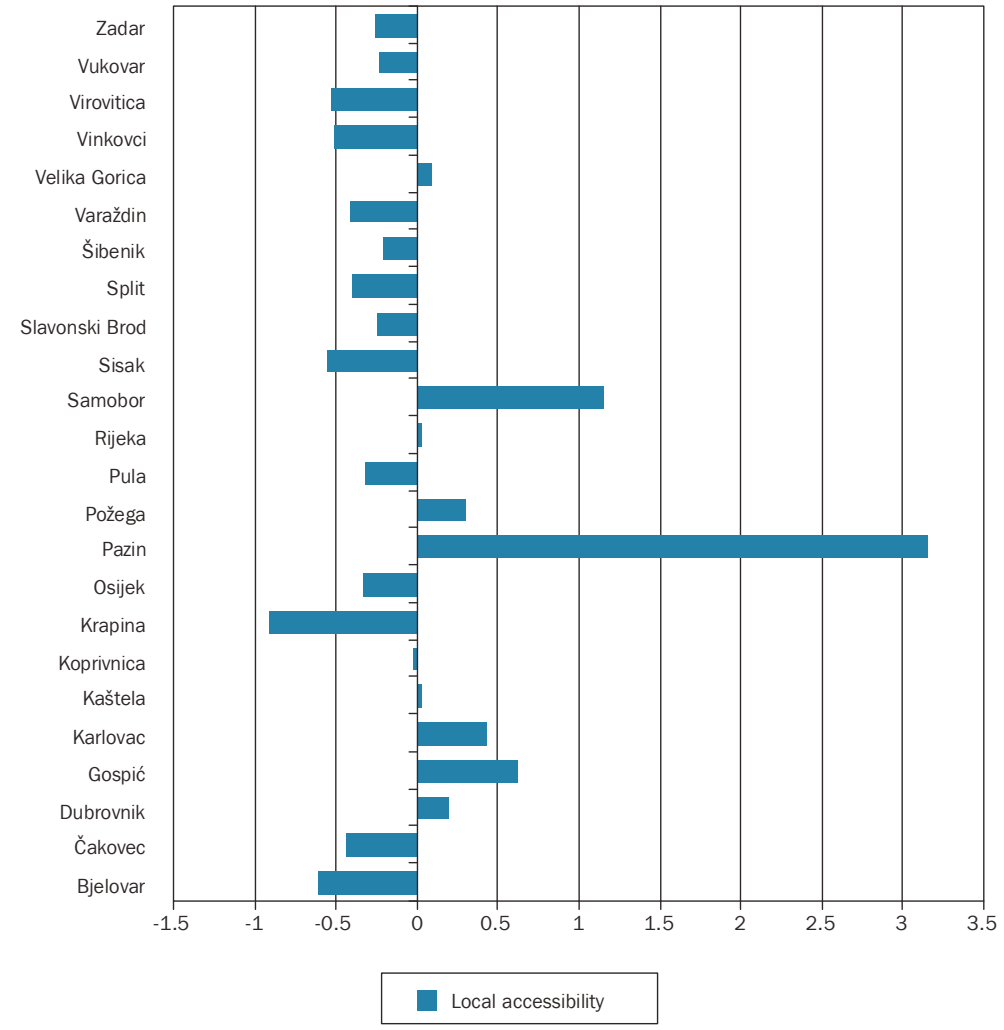
Source: Authors' systematization.

Figure 3 **Croatian Large Cities, Smart Governance**



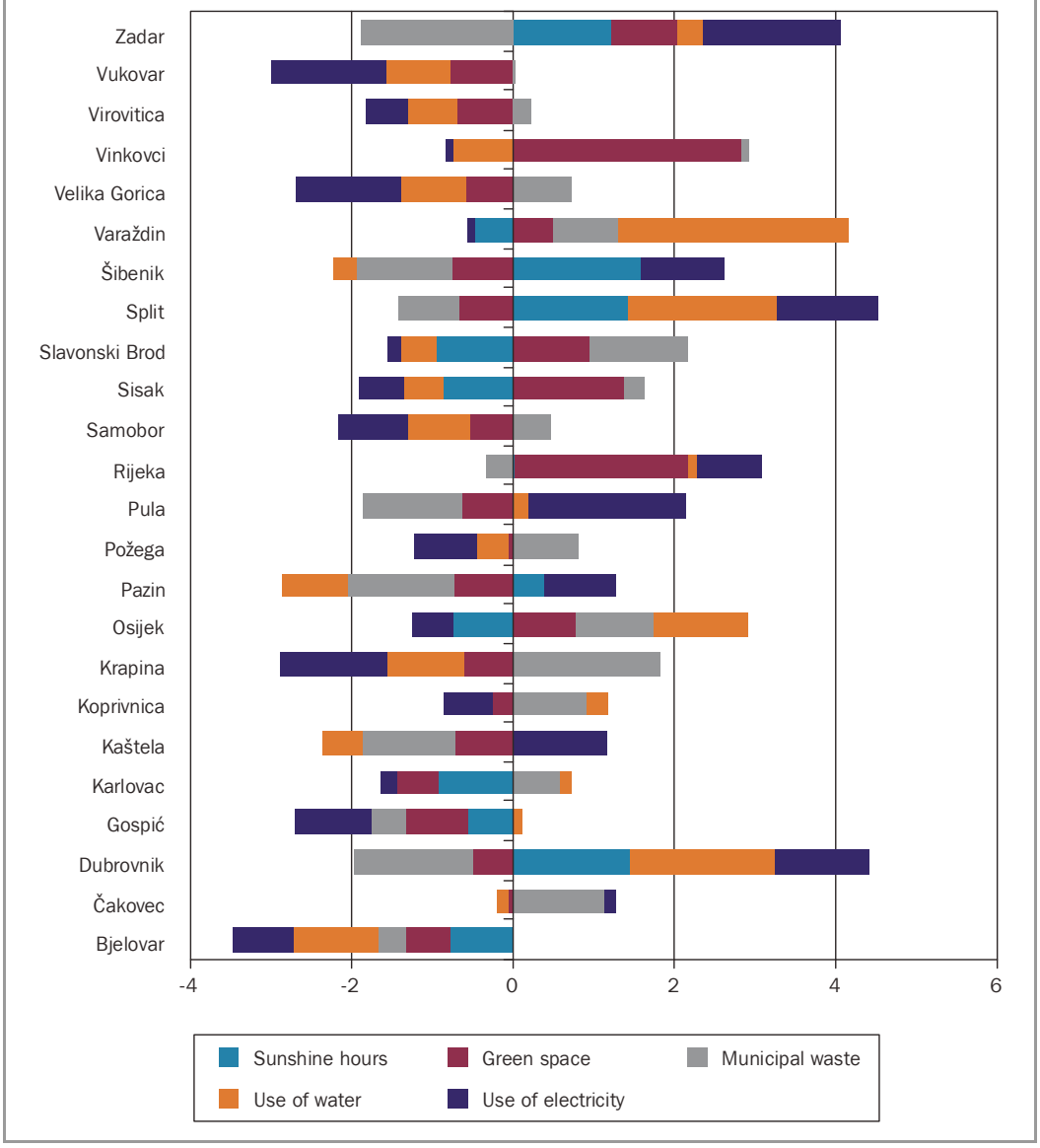
Source: Authors' systematization.

Figure 4 **Croatian Large Cities, Smart Mobility**



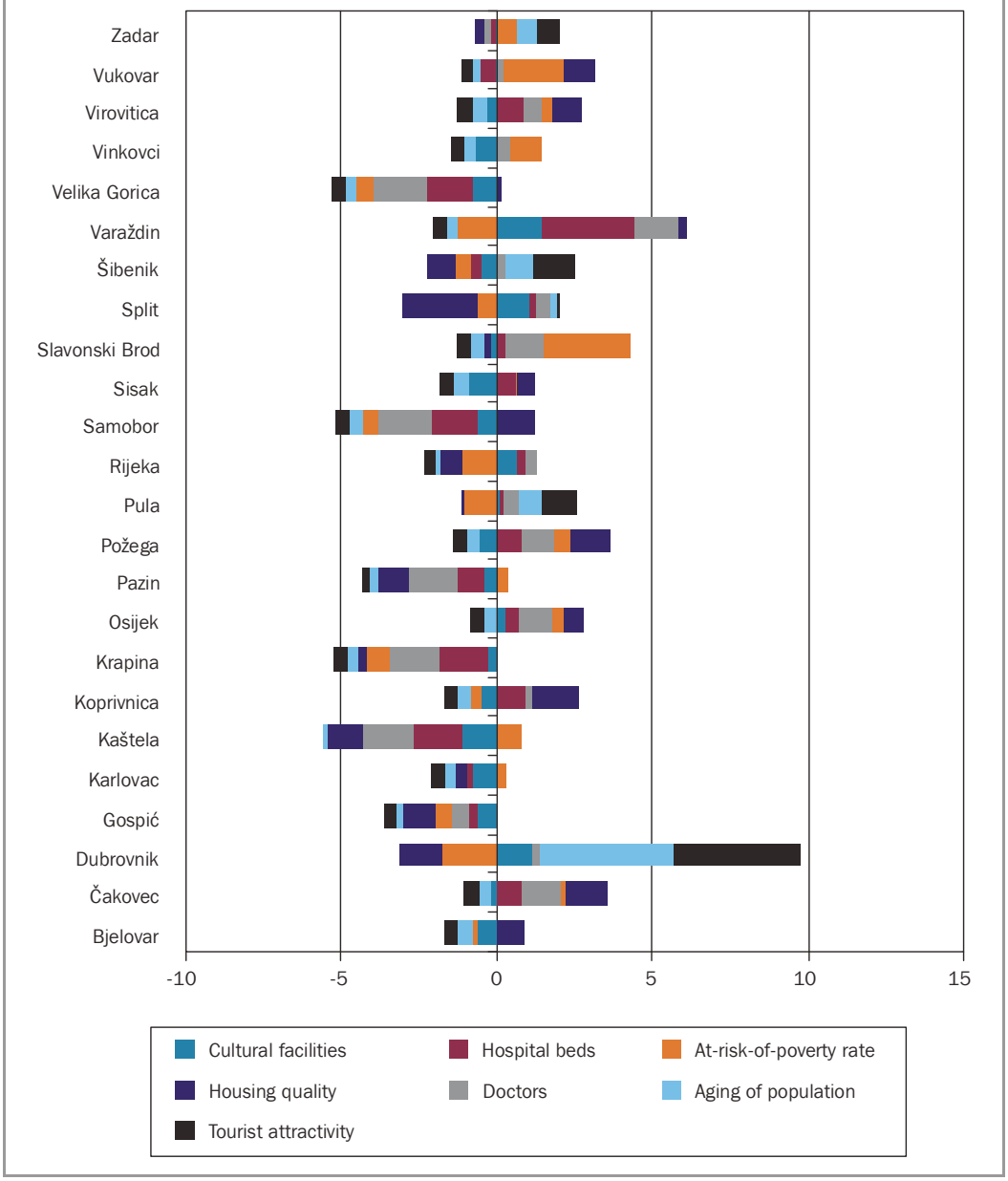
Source: Authors' systematization.

Figure 5 **Croatian Large Cities, Smart Environment**



Source: Authors' systematization.

Figure 6 **Croatian Large Cities, Smart Living**



Source: Authors' systematization.

The smart urban development index for twenty-five Croatian cities is presented in Figures 7 and 8. Figure 7 does not include data for the city of Zagreb, while Figure 8 does. Only eleven cities or 44 percent of Croatian large cities are above average in terms of the smart city model. These cities are Pazin, Dubrovnik, Varaždin, Pula, Rijeka, Zadar, Čakovec, Split, Koprivnica, Samobor and Karlovac. Eight of these eleven cities are cities that are located on the Adriatic coast. This location factor gives these cities special importance in the smart urban development index. Special cases are the cities of Čakovec, Koprivnica and especially Pazin with a population of less than 10,000 inhabitants. These cities are large

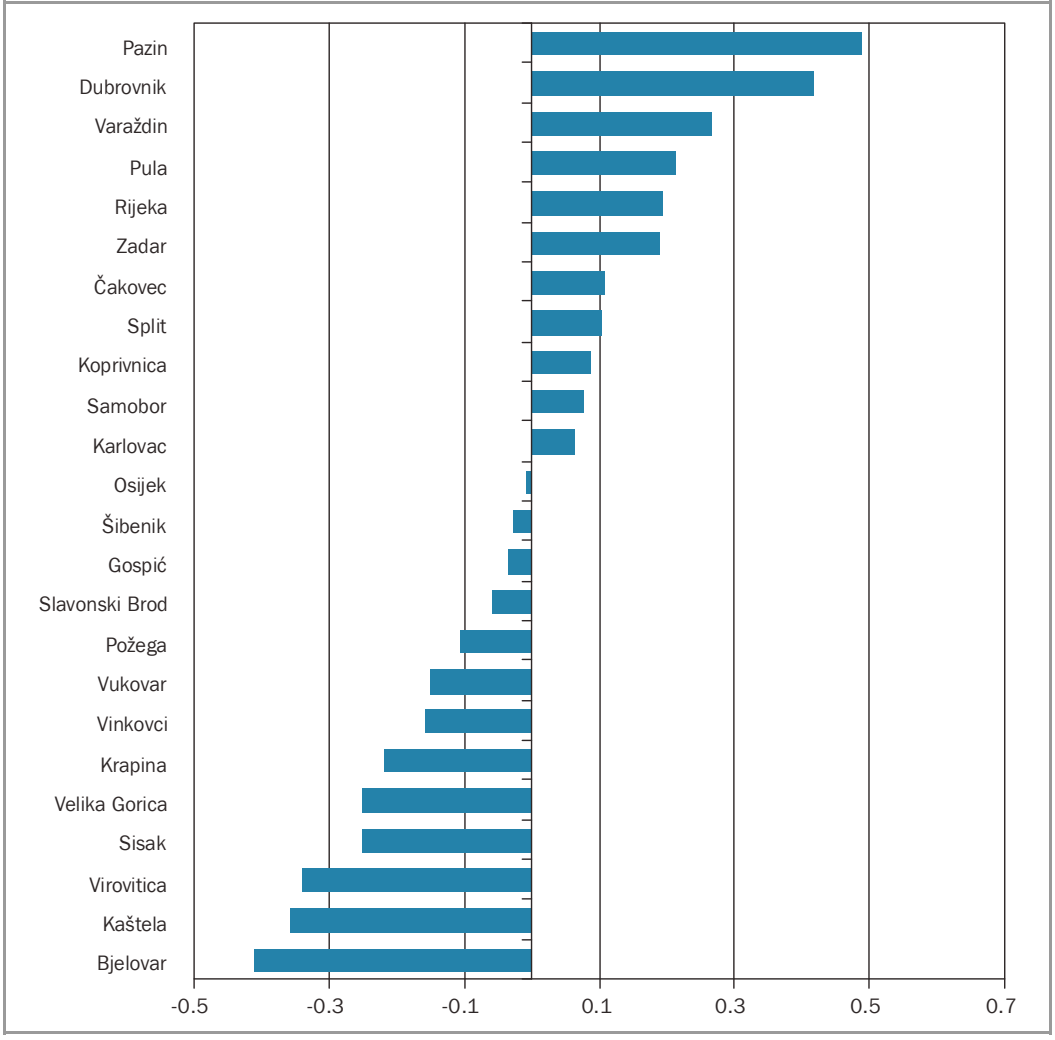
cities with less than 35,000 inhabitants; they are county centers and perform many functions for the local community. These three cities are ranked above the average of Croatian large cities. Their rank, however, is not surprising, because they exhibit all the characteristics of developed urban centers. It is possible to separately present the ranking results for large cities and county centers (see Figure 9).

On the other hand, when the ranking of cities includes the city of Zagreb, the situation is different. The reason for this is the huge influence of the capital on the behavior of other cities in many different sectors. The first position is not changed and the city of Pazin takes the leading role in both rankings. Zagreb is in second place and Dubrovnik in third. On the bottom of the scale, the situation is more or less the same. This means that the city mayors and councilors of Bjelovar, Kaštela and Virovitica need to take a lot of measures to achieve a better position of their cities in the ranking by smart city indicators. These measures would improve the everyday life of citizens and business conditions for entrepreneurs. It should be noted that the middle of the list was significantly redistributed by the entry of the city of Zagreb. These results are an excellent argument when researchers and consultants speak about the specificity and the monolithic nature of the city of Zagreb or the monocentricity of the country itself. The presented ranking of cities is just a reflection of the level of urban development.

The position of each city ranked according to the smart urban development index gives the mayors and members of city councils clear information on where they should direct their activities with the aim of improving the city's urban development.

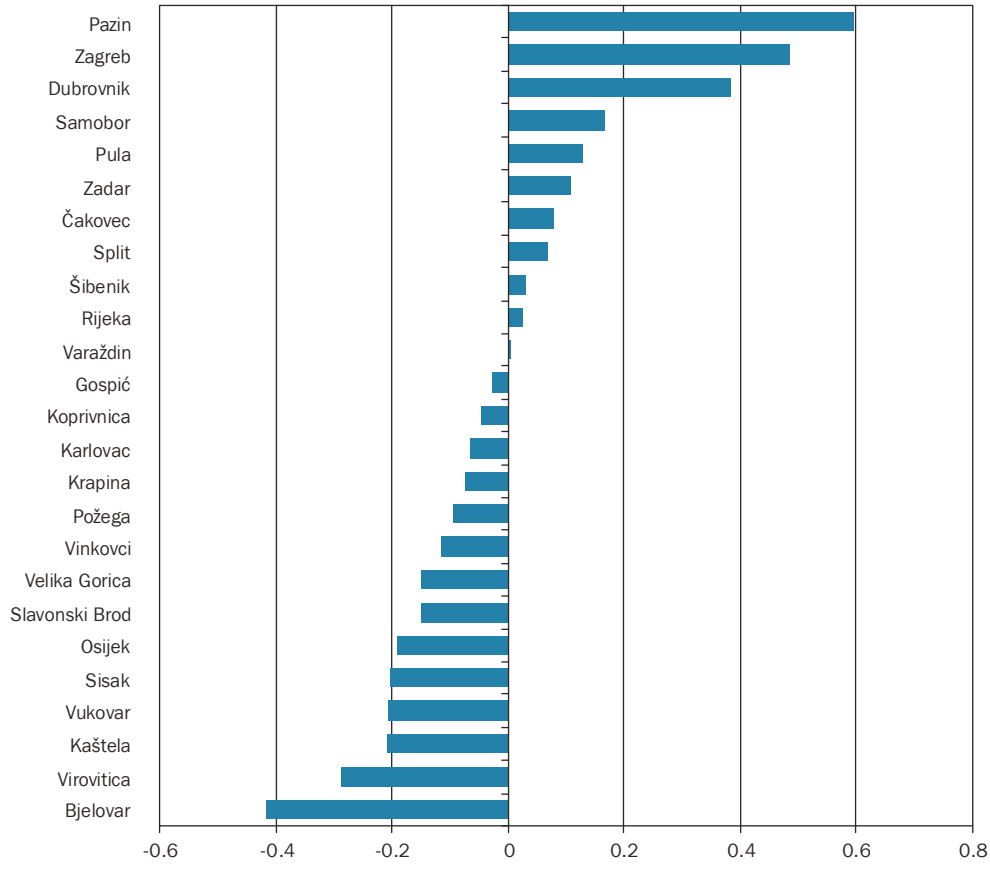
It should be mentioned that smart city indicators can also be used to compare two cities in terms of their level of urban development. In this research, we have made two such comparisons in two dimensions of the smart city—smart economy and smart living. Figure 10 shows the comparison of the cities of Split and Rijeka in the dimension of smart economy. We can notice that Split is better positioned than Rijeka in only two indicators of smart economy—patent applications and entrepreneurship. Split is ranked worse in all other indicators of smart economy. Figure 11 provides information regarding the smart living dimension in the cities of Dubrovnik and Bjelovar. These two cities are compared because both have approximately the same number of citizens: Dubrovnik 42,615 and Bjelovar 40,276 (Census 2011). We conclude that Bjelovar is better only in terms of the housing quality indicator (residential area per capita in m^2). Dubrovnik is better in all other indicators of smart living. The findings provide clear guidelines to city leaders for proposing measures, activities and concrete projects to strengthen the urban competitiveness of each city.

Figure 7 **Croatian Large Cities, Smart Urban Development Index (without the City of Zagreb)**



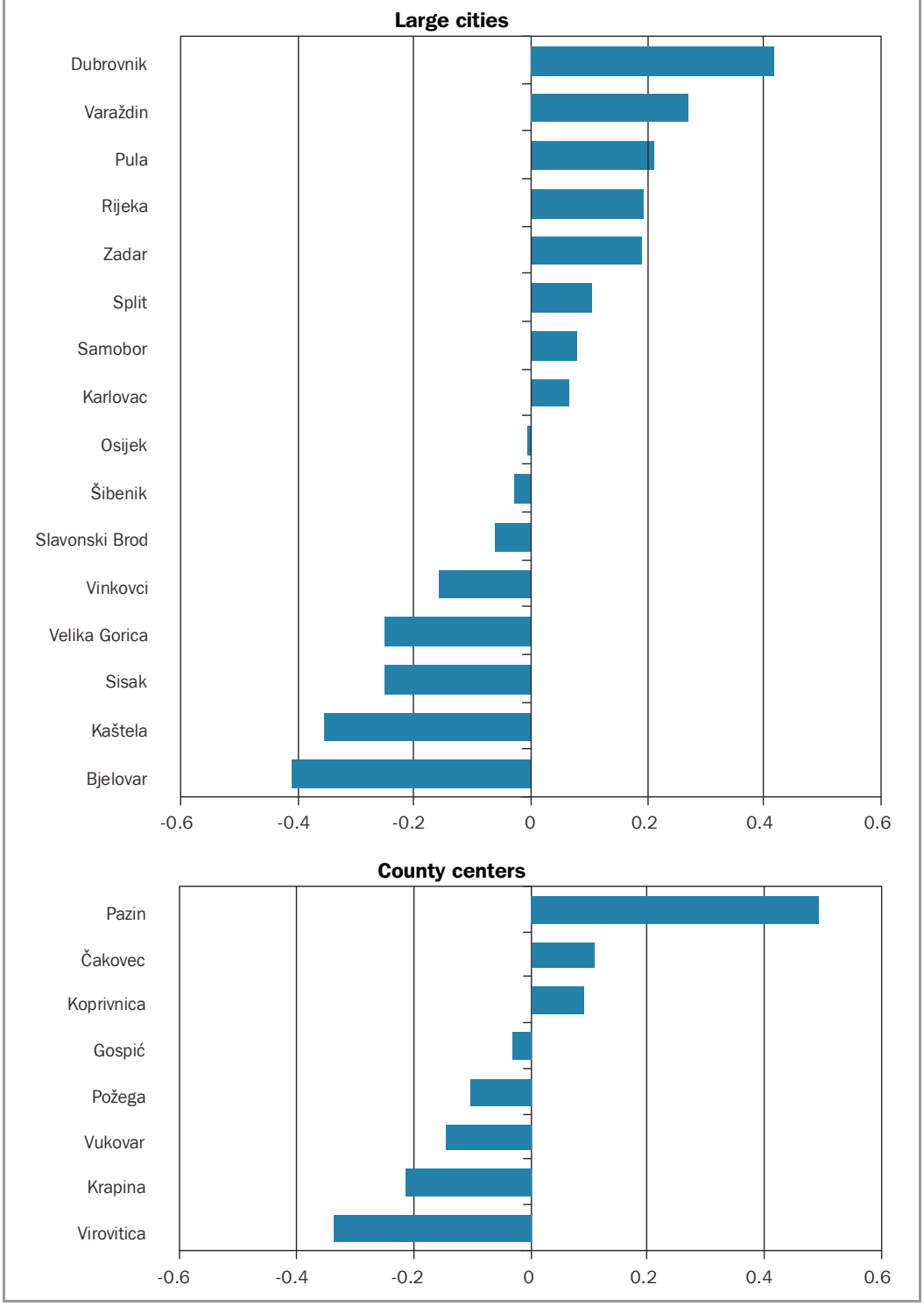
Source: Authors' systematization.

Figure 8 **Croatian Large Cities, Smart Urban Development Index (with the City of Zagreb)**



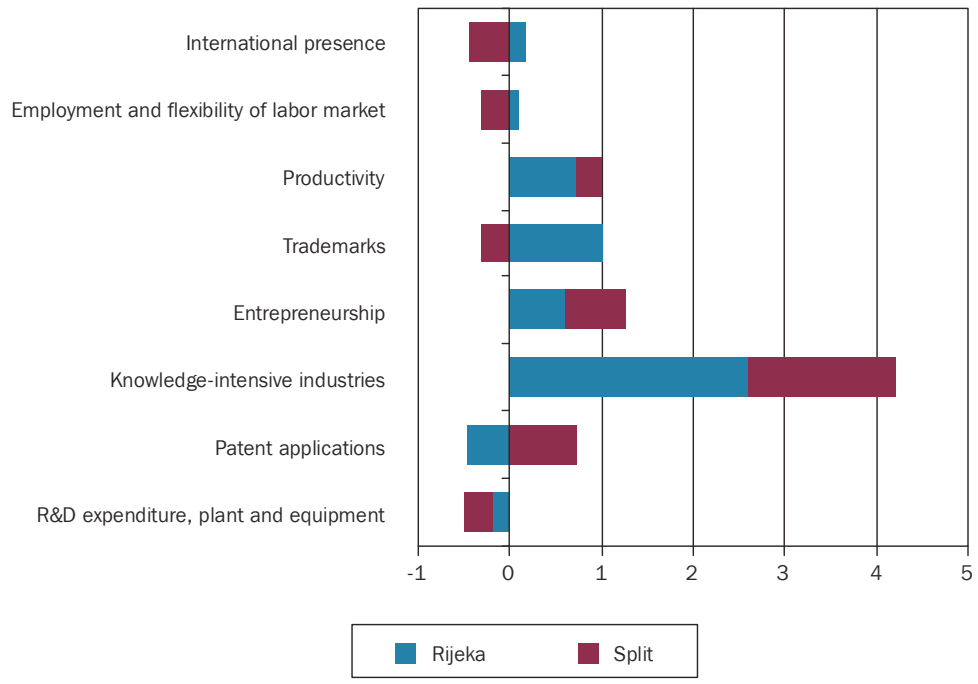
Source: Authors' systematization

Figure 9 **Ranking of Croatian Large Cities and County Centers, Smart Urban Development Index (without the City of Zagreb)**



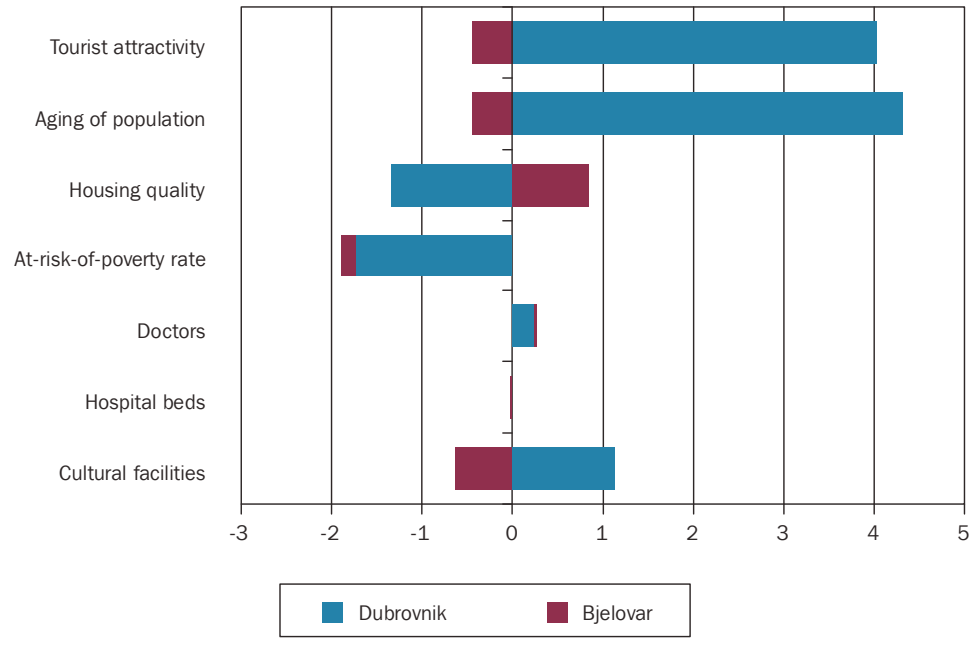
Source: Authors' systematization.

Figure 10 **Comparison of the City of Split and the City of Rijeka, Smart Economy**



Source: Authors' systematization.

Figure 11 **Comparison of the City of Dubrovnik and the City of Bjelovar, Smart Living**



Source: Authors' systematization.

5 Conclusions

While there is a vast amount of indicator systems presented in the literature to evaluate specific issues, such as energy and environment management, technology, economy, mobility, governance, etc., an integral indicator system for evaluating smart cities is relatively new in all parts of the world. One of the reasons for this might be the still vague concept of smartness (despite an abundancy of definitions) and the notion that the concept includes issues that are challenging to measure. The formulation of an integral smart indicator framework is particularly rare in Southeastern Europe.

This research presents the first implementation of the smart city methodology for Croatian large cities based on the methodology developed under the European Smart Cities project (Giffinger et al., 2007). It was constructed using data obtained from the Urban Audit database, the Croatian Bureau of Statistics, local databases of twenty-five Croatian cities, city data obtained through a survey in twenty-five Croatian cities, and secondary data obtained from different research documents.

Establishing a comparable dataset by cities through the creation of smart city indicators enables us to analyze the role of Croatian large cities in smart specialization, describe the development impact of local government's policies in these cities, and conduct a comparison of Croatian large cities.

There are three main contributions of this research.

First, in this research web scraping techniques are used to collect, clean and harmonize annual data that are not usually available from national statistical institutions, and to estimate the city smart urban development index.

Second, a comparison of the competitiveness of Croatian large cities is made by ranking the cities according to the smart urban development index. A total of twenty-five Croatian large cities are ranked by the smart urban development index and its six dimensions—smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. In the research, two smart urban development indices for twenty-five Croatian cities are calculated. The first one does not include data for the city of Zagreb and the second one does. In terms of the calculated smart urban development index, only eleven Croatian large cities are above average in the smart city model. These cities are Pazin, Dubrovnik, Varaždin, Pula, Rijeka, Zadar, Čakovec, Split, Koprivnica, Samobor and Karlovac.

It is important to stress here that the ranking of cities according to the smart urban development index indicates their strengths and weaknesses. The implications of the ranking results for smaller towns or county centers are particularly important. Of eight

cities, there are only three—Pazin, Čakovec and Koprivnica—above the average according to the smart urban development index.

The situation is more or less the same if the ranking of cities includes the city of Zagreb. In both rankings, the first position is held by the city of Pazin. The city of Zagreb is in second place and the city of Dubrovnik in third. On the bottom of the list are the cities of Bjelovar, Kaštela and Virovitica. The mayors of these cities need to undertake a number of activities and measures to achieve a better position in the ranking. These measures would improve the everyday life of citizens and business conditions for entrepreneurs.

Third, based on a city's smart urban development index, it is possible to suggest to city policy-makers which measures would promote smart development in the city. Several measures can be proposed to promote smart economy in cities. Development of digital skills and advances in the IT sector to increase self-employment and the number of newly established companies are examples of measures that can help to increase the self-employment rate and rate of newly established enterprises. The results of these measures would be visible in positive city labor market trends, namely lower unemployment. The smart people dimension can be improved by active city measures to increase the number of institutions of higher education and by improving voter turnout at local elections. Smart governance can be enhanced by various measures, for example, increasing the proportion of women in the city council and increasing budget transparency in the city. On the other hand, building new nurseries and kindergartens in the city with an aim to improve the share of children in nurseries and kindergartens is not needed in every city. Researchers believe that it would be more useful to expand the capacities of existing kindergartens in smaller cities to ensure a higher quality of pre-school education. The situation is similar with the indicator of residential area per capita because this indicator can be considered in terms of numerous possibilities of different, better quality urban planning. City mobility can be improved by increasing the number of city bus lines, bus stations and bicycle trails in the city. These measures can secure higher local accessibility. Local policy-makers can increase the level of smart environment by measures that result in increased share of the total green areas and parks in the city and higher amount of collected mixed municipal waste. Smart living can be improved by implementing various measures to increase the residential area per capita in the city, for example, subsidizing housing prices for targeted groups of residents.

The smart urban development index clearly shows the heterogeneity of Croatian large cities in all six dimensions of the smart city. Few cities have positive results in any of these dimensions of the smart city model, which should encourage key city decision-makers to use the available information and apply it in preparation and implementation of their smart city forward-looking strategies. All large Croatian cities need to improve in all dimensions of the smart city. Urban authorities need to direct their measures and activities to improve

urban life for citizens and entrepreneurs. This means that the eleven cities that are above the average according to the smart urban development index also need to improve. All proposed measures are in the hands of local political leaders. At the same time, all of these measures would save city budget funds by investing budget revenues in other activities that would provide better results and outcomes in the local community.

The system of indicators itself, as any such system, has its shortcomings. It seeks to comprehensively cover the broad dimensions of the smart city concept. This depends on the quality of available statistics (either official or internal). For this reason, it is necessary to consider the broader context and to take into account the secondary sources of the survey results. Furthermore, smart city indicators could address the readiness of Croatian cities, particularly tourist centers, to respond to seasonal infrastructure pressures. It is also possible to set some new indicators (for example, speed of solving malfunctions in the electrical distribution system during the tourist season, in hours) that would refer to the distribution of water, waste disposal, etc.

This research was conducted on the basis of available data and information for twenty-five Croatian large cities. The limitations of this research are primarily related to the availability of city data from public sources and the readiness of cities to provide data in the short term. However, despite the existing shortcomings, future research in the area of the smart city should be carried out on a larger sample, for all 127 cities throughout Croatia. Similar research should also be performed in other Southeast European countries, in order to enable a comparison of the results. This research paves the way for future investigation, through which we will be able to continuously measure all six dimensions of the smart city concept, aiming to emphasize the use of smart city components for evidence-based monitoring of urban development of Croatian large cities.

References

Ahvenniemi, H., Huovila, A., Pinto-Seppä, I. and Airaksinen, M. (2017). What are the differences between sustainable and smart cities? *Cities*, 60, 234–245.

Albino, V., Berardi, U. and Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, 22(1), 3–21.

Angelidou, M. (2015). Smart cities: A conjuncture of four forces. *Cities*, 47, 95–106.

Anthopoulos, L. G. (2017). *Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?* Cham: Springer.

Auci, S. and Mundula, L. (2012). Smart Cities and a Stochastic Frontier Analysis: A Comparison among European Cities. *SSRN Electronic Journal*, 10.2139/ssrn.2150839.

Baron, M. (2012). Do we need smart cities for resilience? *Journal of Economics & Management*, 10, 32–46.

Bătăgan, L. (2012). Methodologies for local development in smart society. *Economics of Knowledge*, 4(3), 23–34.

Bătăgan, L. (2011). Smart cities and sustainability models. *Informatica Economică*, 15(3), 80–87.

Bayulken, B. and Huisingh, D. (2015). Are lessons from eco-towns helping planners make more effective progress in transforming cities into sustainable urban systems: A literature review (part 2 of 2). *Journal of Cleaner Production*, 109, 152–165.

Begg, I. (1999). Cities and Competitiveness. *Urban Studies,* 36(5–6), 795–810.

Carli, R., Dotoli, M., Pellegrino, R. and Ranieri, L. (2013, October), Measuring and Managing the Smartness of Cities: A Framework for Classifying Performance Indicators. Paper presented at the 2013 IEEE International Conference on Systems, Man, and Cybernetics, available from https://www.researchgate.net/publication/262165246_Measuring_and_Managing_the_Smartness_of_Cities_A_Framework_for_Classifying_Performance_Indicators, doi: 10.1109/SMC.2013.223

Caragliu, A. and Del Bo, C. (2012). Smartness and European urban performance: Assessing the local impacts of smart urban attributes. *Innovation: The European Journal of Social Science Research*, 25(2), 97–113.

Caragliu, A., Del Bo, C. and Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, 18(2), 65–82.

Carrillo, J., Yigitcanlar, T., Garcia, B. and Lonnqvist, A. (2014). *Knowledge and the city: Concepts, applications and trends of knowledge-based urban development*. New York: Routledge.

Cocchia, A. (2014). Smart and digital city: A systematic literature review. In R. Dameri and C. Rosenthal-Sabroux (Eds.), Smart city (pp. 13–43). Cham: Springer.

Coe, A., Paquet, G. and Roy, J. (2001). E-governance and smart communities: A social learning challenge. *Social Science Computer Review,* 19(1), 80–93.

Deakin, M. (2012). Intelligent cities as smart providers: CoPs as organizations for developing integrated models of eGovernment Services. *Innovation: The European Journal of Social Science Research*, 25(2), 115–135.

Dvir, R. and Pasher, E. (2004). Innovation engines for knowledge cities: An innovation ecology perspective. *Journal of Knowledge Management*, 8(5), 16–27.

Đulabić, V. and Manojlović, R. (2011). Administrative Aspects of Regional and Cohesion Policy in Croatia: In Search of a Better Coordination of Parallel Process. *Croatian and Comparative Public Administration,* 11(4), 1041–1074.

Ebrahim, Z. and Irani, Z. (2005). E-government adoption: Architecture and barriers. *Business Process Management Journal*, 11(5), 589–611.

European Commission, *Europe 2020 – A strategy for smart, sustainable and inclusive growth*, available from https://ec.europa.eu/info/strategy/european–semester/framework/europe–2020–strategy_en.

European Commission, *The European Innovation Partnership on Smart Cities and Communities*, https://ec.europa.eu/digital–single–market/en/news/european–innovation–partnership–smart–cities–and–communities–general–assembly–2016.

European Commission, *The Urban Agenda for the EU*, available from http://ec.europa.eu/regional_policy/en/policy/themes/urban–development/agenda/.

European Commission and UN-HABITAT, *The State of European Cities Report 2016. Cities leading the way to a better future*, available from http://ec.europa.eu/regional_policy/sources/policy/themes/cities–report/state_eu_cities2016_en.pdf.

European Parliament, *Mapping Smart City in the EU,* available from http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL–ITRE_ET(2014)507480_EN.pdf.

Giffinger. R. (2015). Smart City Concepts: Chances and Risks of Energy Efficient Urban Development. In K. Krempels, et al. (Eds.), Smart Cities, Green Technologies, and Intelligent Transport Systems (pp 3–16). Cham: Springer Verlag.

Giffinger, R. and Gudrun, H. (2010). Smart cities ranking: An effective instrument for the positioning of cities? *ACE: Architecture, City & Environ*, 4(12), 7–25.

Giffinger, R., Kramar, H. and Haindl, G. (2008, October). The role of rankings in growing city competition. Paper presented at the 11th European Urban Research Association (EURA) Conference, Milan, Italy, available from http://publik.tuwien.ac.at/files/PubDat_167218.pdf.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N. and Meijers, E. (2007). Smart Cities: Ranking of European Medium-Sized Cities. Vienna: Centre of Regional Science (SRF), Vienna University of Technology, available from http://www.smartcities. eu/download/smart_cities_final_report.pdf.

Gil-Garcia, J. R. and Pardo, T. A. (2005). E-government success factors: Mapping practical tools to theoretical foundations. *Government Information Quarterly*, 22(2), 187–216.

Hall, R. E. (2000, September). The vision of a smart city. Paper presented at the 2nd International Life Extension Technology Workshop, Paris, France, available from http://www.osti.gov/bridge/servlets/purl/773961–oyxp82/webviewable/773961.pdf.

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J. and Williams, P. (2010). Foundations for Smarter Cities. *IBM Journal of Research and Development*, 54(4), 1–16.

Hollands, R. (2008). Will the real smart city please stand up? Intelligent, progressive, or entrepreneurial? *City: Analysis of Urban Trends, Culture, Theory, Policy, Action*, 12(3), 303–320.

Hortz, T. (2016). The smart state test: A critical review of the smart state strategy 2005–2015's knowledge-based urban development. *International Journal of Knowledge-Based Development*, 7(1), 75–101.

Johnson, B. (2008). Cities, systems of innovation and economic development. *Innovation: Organization & Management*, 10(2–3), 146–155.

Jong, M., Joss, S., Schraven, D., Zhan, C. and Weijnen, M. (2015). Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*, 109, 25–38.

Johnston, E. W. and Hansen, D. L. (Forthcoming). Design lessons for smart governance infrastructures. In D. Ink, A. Balutis and T. F. Buss (Eds.), American Governance 3.0: Rebooting the Public Square?

Jurlina Alibegović, D. and Blažević, Lj. (2010). Pokazatelji uspješnosti i upravljanje lokalnim razvojem: Primjer Fonda za obnovu i razvoj Grada Vukovara. *Ekonomski pregled,* 61(11), 631–665.

Jurlina Alibegović, D. and Slijepčević, S. (2010). Uloga vijećnika u upravljanju i razvoju gradova u Hrvatskoj. *Hrvatska i komparativna javna uprava*, 10(2), 399–426.

Jurlina Alibegović, D. and Šagovac, M. (2018). Evaluating Smart City Indicators: A tool for Strategic Decision-making for Croatian Large Cities. Summary of key findings at SmartEIZ – H2020-TWINN-2015 Strengthening scientific and research capacity of the Institute of Economics, Zagreb as a cornerstone for Croatian socioeconomic growth through the implementation of Smart Specialisation Strategy. Zagreb: The Institute of Economics, Zagreb, pp. 22.

Kollar, M., Bubbico, R. L. and Arsalides, N. (2018). Smart Cities, Smart Investment in Centralm Eastern and South-Eastern Europe. A report by EIB Economics Department. Luxembourg: European Investment Bank.

Komminos, N. (2002). *Intelligent cities: Innovation, knowledge systems and digital spaces*. London and New York: Routledge.

Kondepudi, S. N. (2014). *Smart sustainable cities: An analysis of definitions*. The ITU-T focus Group for Smart Sustainable Cities, Washington, D. C.: United Nations.

Kourtit, K., Nijkamp, P. and Arribas, D. (2012). Smart cities in perspective – a comparative European study by means of self-organizing maps. *Innovation: The European Journal of Social Science Research*, 25(2), 229–246.

Kuk, G. and Janssen, M. (2011). The business models and information architectures of smart cities. *Journal of Urban Technology,* 18(2), 39–52.

Lara, A., Costa, E., Furlani, T. and Yigitcanlar, T. (2016). Smartness that matters: Comprehensive and human-centred characterisation of smart cities. *Journal of Open Innovation*, 2(8), 1–13.

Lazaroiu, G. C. and Roscia, M. (2012). Definition methodology for the smart cities model. *Energy,* 47(1), 326–332.

Lee, J. H., Hancock, M. G. and Hu, M. C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*, 89, 80–99.

Lee, J. H., Phaal, R. and Lee, S.-H. (2013). An integrated service-device-technology roadmap for smart city development. *Technological Forecasting & Social Change*, 80(2), 286–306.

Leydesdorff, L. and Deakin, M. (2011). The triple-helix model of smart cities: A neo-evolutionary perspective. *Journal of Urban Technology,* 18(2), 53–63.

Lombardi, P., Giordano, S., Farouh, H. and Yousef, W. (2012). Modelling the smart city performance. *Innovation: The European Journal of Social Science Research*, 25(2), 137–149.

Maleković, S., Puljiz, J. and Polić, M. (2007). Institutional Capacity for Regional Development in Croatia on the County Level. *Croatian International Relations Review*, 12(44/45), 139–148.

Mooij, J. (2003). Smart governance? Politics in the policy process in Andhra Pradesh, India. *ODI Working Papers*, 228, available from http://www.odi.org.uk/resources/download/1793.pdf.

Marsal-Llacuna, M. L., Colomer-Llinàs, J. and Meléndez-Frigola, J. (2015). Lessons in urban monitoring taken from sustainable and livable cities to better address the smart cities initiative. *Technological Forecasting and Social Change*, 90, 611–622.

Ministarstvo gospodarstva Republike Hrvatske (2015). *Strategija pametne specijalizacije Republike Hrvatske za razdoblje od 2016. do 2020. godine i Akcijski plan za provedbu Strategije pametne specijalizacije Republike Hrvatske za razdoblje od 2016. do 2017. godine.* Zagreb: Ministarstvo gospodarstva Republike Hrvatske.

Nam, T. and Pardo, T. A. (2011). *Smart city as urban innovation: Focusing on management, policy, and context*, available from http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=1E7AE9DD70EEA413FD04705E6DDAFA3B?doi=10.1.1.432.7839&rep=rep1&type=pdf.

Nam, T. and Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. Paper presented at the 12th annual international digital government research conference: Digital government innovation in challenging times (pp. 282–291) ACM, available from https://inta-aivn.org/images/cc/Urbanism/background%20documents/dgo_2011_smartcity.pdf.

National Academy of Public Administration, Understanding Smart Cities: An Integrative Framework, available from http://icma.org/en/icma/knowledge_network/documents/kn/document/301540/design_lessons_for_smart_governance_infrastructures.

Nijkamp, P. and Kourtit, K. (2013). The 'new urban Europe': Global challenges and local responses in the urban century. *European Planning Studies*, 21(3), 291–315.

Odendaal, N. (2003). Information an communication technology and local governance: Understanding the difference between cities in developed and emerging economies. *Computers, Environment and Urban Systems*, 27(6), 585–607.

OECD (2015). *Governing the City*. Paris: OECD.

OECD (2013). *Innovation-driven Growth in Regions: The Role of Smart Specialisation*. Paris: OECD.

Parkinson, M., et al. (Eds.) (2003). *Competitive European Cities: Where Do The Core Cities Stand? Report to the Core Cities Working Group*. Liverpool: John Moores University.

Sauer, S. C. (2012). Do smart cities produce smart entrepreneurs? *Journal of Theoretical and Applied Electronic Commerce Research*, 7(3), 63–73.

Perko Šeparović, I. (2006). *Izazovi javnog menadžmenta. Dileme javne uprave*. Zagreb: Golden marketing – Tehnička knjiga.

Petak, Z. (2008). Policy pristup reformi javne uprave. In E. Pusić (Ed.) Hrvatska državna uprava: stanje i perspective (pp. 155-169). Zagreb: Hrvatska akademija znanosti i umjetnosti.

Scheel, C. and Rivera, A. (2013). Innovative cities: In search of their disruptive characteristics. *International Journal of Knowledge-Based Development*, 4(1), 79–101.

Scholl, H. J., Barzilai-Nahon, K., Ahn, J-H., Olga, P. and Barbara, R. (2009, January). E-commerce and e-government: How do they compare? What can they learn from each other? Paper presented at the 42nd Hawaiian International Conference on System Sciences (HICSS 2009), Koloa, Hawaii.

Schuurman, D., Baccarne, B., De Marez, L. and Mechant, P. (2012). Smart ideas for smart cities: Investigating crowdsourcing for generating and selecting ideas for ICT innovation in a city context. *Journal of Theoretical and Applied Electronic Commerce Research*, 7(3), 49–62.

Shapiro, J. M. (2006). Smart cities: Quality of life, productivity, and the growth effects of human capital. *Review of Economics and Statistics,* 88(2), 324–335.

Tapscott, D. and Agnew, D. (1999). Governance in the digital economy: The importance of human development. *Finance & Development,* 36(4), 34–37.

Thornley, A. (2000). Strategic Planning in the Face of Urban Competition. In W. Salet and A. Faludi (Eds.), The Revival of Strategic Spatial Planning. Proceedings of colloquium. Amsterdam: Royal Netherlands Academy of Arts and Sciences.

Tranos, E. and Gertner, D. (2012). Smart networked cities? *Innovation: The European Journal of Social Science Research*, 25(2), 175–190.

UNESCAP (2007). What is good governance?, available from http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/gg/governance.asp.

UN-HABITAT (2016). *World Cities Report 2016.* Urbanization and Development. Emerging Futures, available from https://unhabitat.org/books/world–cities–report/.

UN-HABITAT (2013). The State of European Cities in Transition 2013, Taking Stock after 20 Years of Reform. Executive Summary, available from http://unhabitat.org/books/the–state–of–european–cities–in–transition–2013–executive–summary/.

United Nations (2014). World Urbanization Prospects: The 2014 Revision, available from https://esa.un.org/unpd/wup/Publications/Files/WUP2014–Highlights.pdf.

Vasseur, J. (2010). Smart cities and urban networkd. In J. Vasseur and A. Dunkels (Eds.), Interconnecting Smart Objects with IP: The Next Internet (pp. 360–377), Burlington, MA: Morgan Kaufmann.

Washburn, D., et al. (2010). *Helping CIOs Understand 'Smart City' Initiatives: Defining the Smart City, its Drivers, and the Role of the CIO*. Cambridge, MA: Forrester Research.

Willke, H. (2007). *Smart Governance: Governing the Global Knowledge Society*. New York: Campus Verlag.

Winters, J. V. (2011). Why are smart cities growing? Who moves and who stays. *Journal of Regional Science*, 51(2), 253–270.

Yigitcanlar, T., Velibeyoglu, K. and Martinez-Fernandez, C. (2008). Rising knowledge cities: The role of urban knowledge precincts. *Journal of Knowledge Management*, 12(5), 8–20.

Yigitcanlar, T. (2016). *Technology and the city: Systems, applications and implications.* New York: Routledge.

Yigitcanlar, T. (2015). Smart cities: an effective urban development and management model? *Australian Planner*, 52(1) 27–34.

Yigitcanlar, T. (2006). Australian local governments' practice and prospects with online planning. *URISA Journal*, 18(2), 7–17.

Table A1 **List of Croatian Large Cities**		
Large cities, more than 35,000 inhabitants		**Number of inhabitants**
1.	Zagreb	790,017
2.	Split	178,102
3.	Rijeka	128,624
4.	Osijek	108,048
5.	Zadar	75,062
6.	Velika Gorica	63,517
7.	Slavonski Brod	59,141
8.	Pula	57,460
9.	Karlovac	55,705
10.	Sisak	47,768
11.	Varaždin	46,946
12.	Šibenik	46,332
13.	Dubrovnik	42,615
14.	Bjelovar	40,276
15.	Kaštela	38,667
16.	Samobor	37,633
17.	Vinkovci	35,312
Large cities, county centers		**Number of inhabitants**
18.	Koprivnica	30,854
19.	Vukovar	27,683
20	Čakovec	27,104
21.	Požega	26,248
22.	Virovitica	21,291
23.	Gospić	12,745
24.	Krapina	12,480
25.	Pazin	8,638

Source: Croatian Bureau of Statistics, Croatia – Census 2011.

Table A2 **Factors and Indicators Defining Smart Economy in Croatian Large Cities**

Indicator	Data	Data definition	Data sources
R&D expenditure, plant and equipment	R&D expenditure	The share of book value of R&D and patents in the total value of the assets of all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
	Plant & equipment expenditure	The share of book value of plants and equipment in the total book value of the assets of all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
Knowledge-intensive industries	Employment in knowledge-intensive industries	The share of employees in knowledge-intensive industries in the total number of employees in all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
Patent applications	Patent applications	The number of registered patents whose inventors listed the city as their place of residence in the patent application.	The State Intellectual Property Office of the Republic of Croatia, http://www.dziv.hr/hr/e–usluge/pretrazivanje–baza–podataka/patent/
Entrepreneurship	Self-employment rate and flexibility of labor market	The share of self-employed in the total number of employees in the city.	Croatian Pension Insurance Institute, http://www.mirovinsko.hr/
	Newly established enterprises	The share of newly registered enterprises in the total number of companies in the city.	Ministry of Justice Court Register, https://sudreg.pravosudje.hr/registar/f?p=150:1
Trademarks	International trademarks	The number of recognized international trademarks of companies with headquarters in the city.	The State Intellectual Property Office of the Republic of Croatia, http://www.dziv.hr/hr/e–usluge/pretrazivanje–baza–podataka/medjunarodni–zig/
Productivity	Labor productivity	The ratio between value added and the number of employees in all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
	Part-time employment	The share of paid employees who work part-time and the total number of employees in all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
Employment and flexibility of labor market	Unemployment rate	The share of unemployed persons in the city in the total population according to the 2011 Census.	Croatian Employment Service, http://statistika.hzz.hr/Statistika.aspx?tipIzvjestaja=1
	Employment intensity	The ratio of the number of employed and the number of unemployed persons in the city.	Croatian Employment Service, http://statistika.hzz.hr/Statistika.aspx?tipIzvjestaja=1,
International presence	Number of companies quoted on the Zagreb Stock Exchange	The number of companies with headquarters in the city quoted on the national stock market.	Zagreb Stock Exchange, http://www.zse.hr/default.aspx?id=26474
	Export intensity	The share of revenue from exports in the total revenues of all companies with headquarters the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
	Enterprises with foreign origin of capital	The ratio of revenue of enterprises with a share of foreign capital greater than 49% and the total revenues of all companies with headquarters in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
	Foreign direct investment	The value of foreign direct investment is a multiplication of changes in the share of foreign	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp

		capital and the value of capital at the level of companies with headquarters in the city. It is approximated by the following equation: $fdi_t = (foreignCapital_t - foreignCapital_{t-1}) * book\_equity_t$.	

Source: Authors' systematization.

Table A3 **Factors and Indicators Defining Smart People in Croatian Large Cities**

Indicator	Data	Data definition	Data sources
Students and universities	Number of institutions of higher education	The number of institutions of higher education located in the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr
	Students enrolled in university studies	The number of students enrolled in university studies located in the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr
Foreign language companies	Number of companies whose business is a foreign language	The number of companies whose business is a foreign language located in the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
Net migration	Number of emigrated people	The difference between the population that settled in and emigrated from the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr
People working in creative industries	Share of employees in cultural industries	The share of employees in cultural industries located in the city in relation to the total population of the city.	Financial Agency (FINA), http://rgfi.fina.hr/JavnaObjava–web/jsp/prijavaKorisnika.jsp
Voter turnout at European elections	Voter turnout at European elections	The share of voter turnout at European elections in the city.	State Election Commission, https://izbori.hr
Voter turnout at local elections	Voter turnout at local elections	The share of voter turnout at local elections in the city.	State Election Commission, https://izbori.hr

Source: Authors' systematization.

Table A4 **Factors and Indicators Defining Smart Governance in Croatian Large Cities**			
Indicator	**Data**	**Data definition**	**Data sources**
Participation in decision making	Number of city council members per 1,000 inhabitants	The number of city council members per 1,000 inhabitants in the city.	State Election Commission, https://izbori.hr
	Proportion of women council members to the total number of city council members	The proportion of women council members to the total number of city council members.	State Election Commission, https://izbori.hr
	Number of political parties per 1,000 inhabitants	The number of political parties per 1,000 inhabitants in the city.	Register of political parties, Ministry of Public Administration, https://uprava.gov.hr/registar-politickih-stranaka/825
Public and social services and transparent governance	Share of children in nurseries and kindergartens in the total number of children aged 0 to 6 in the city	The share of children in nurseries and kindergartens in the total number of children aged 0 to 6 in the city.	Croatian Bureau of Statistics, Statistical Report 1543/2015 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
	Total expenditures in city budget per capita	The total expenditures in city budget per capita.	Ministry of Finance, Budget execution of local and regional self-government units, 2016, http://www.mfin.hr/hr/ostvarenje-proracuna-jlprs-za-period-2014-2016
	Budget transparency in 2017	Budget transparency in 2017 measured by the number of key budget documents published on the official city websites.	Institute of Public Finance, http://www.ijf.hr

Source: Authors' systematization.

Table A5 **Factors and Indicators Defining Smart Mobility in Croatian Large Cities**			
Indicator	**Data**	**Data definition**	**Data sources**
Local accessibility	Number of city bus lines	The number of city bus lines in the city.	City data obtained through a survey
	Number of bus stations	The number of bus stations in the city.	City data obtained through a survey
	Length of bicycle trails	The length of bicycle trails in the city, in kilometers.	City data obtained through a survey

Source: Authors' systematization.

Table A6 **Factors and Indicators Defining Smart Environment in Croatian Large Cities**			
Indicator	**Data**	**Data definition**	**Data sources**
Sunshine hours	Sunshine hours	Sunshine hours per year. Sum of average monthly values (average in the period 1872–2016).	Croatian Meteorological and Hydrological Service, http://klima.hr/klima.php?id=k1&param=s
Share of green spaces	Share of green spaces	The share of green areas in total area of the city. Green areas include parks and grassy area.	City data obtained through a survey
Mixed municipal waste	Mixed municipal waste	Produced mixed municipal waste per inhabitant. Quantity of waste (kg) in 2016 in relation to the population of the city.	Croatian Environment Agency, http://envi.azo.hr Croatian Bureau of Statistics, Statistical Report 1543/2015 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
Use of water	Use of water	Water supplied to all users (m^3 per capita)	City data obtained through a survey
Use of electricity	Use of electricity	Electricity delivered to households (MWh per capita)	HEP Distribution System Operator

Source: Authors' systematization.

Table A7 **Factors and Indicators Defining Smart Living in Croatian Large Cities**			
Indicator	**Data**	**Data definition**	**Data sources**
Cultural facilities	Theatre attendance per inhabitant	The number of theatre visitors in the city in 2016/2017 in comparison to the number of inhabitants in the city.	Croatian Bureau of Statistics, Culture and Art in 2015, https://www.dzs.hr 2015. Croatian Bureau of Statistics, Statistical Report 1543/2015 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
	Cinema attendance per inhabitant	The number of cinema visitors in the city in 2016 in comparison to the number of inhabitants in the city.	Croatian Bureau of Statistics, Culture and Art in 2015, https://www.dzs.hr 2015. Croatian Bureau of Statistics, Statistical Report 1543/2015 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
	Museum visitors per inhabitant	The number of museum visitors in the city in 2015 in comparison to the number of inhabitants in the city.	Croatian Bureau of Statistics, Culture and Art in 2015, https://www.dzs.hr 2015. Croatian Bureau of Statistics, Statistical Report 1543/2015 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
Hospital beds	Hospital beds per 1,000 inhabitants	The number of hospital beds in 2016 in the city in comparison to the number of inhabitants in the city.	Croatian Health Statistics Yearbook 2016, Inpatient Health Care, https://www.hzjz.hr/periodicne-publikacije/hrvatski-zdravstveno-statisticki-ljetopis-za-2016-tablicni-podaci/
Doctors	Doctors of medicine per 1,000 inhabitants	The number of medical doctors in 2016 in the city in comparison to the number of inhabitants in the city.	Croatian Health Statistics Yearbook 2016, Inpatient Health Care, https://www.hzjz.hr/periodicne-publikacije/hrvatski-zdravstveno-statisticki-ljetopis-za-2016-tablicni-podaci/ Note: Doctors of dental medicine are not included.
At-risk-of-poverty rate	At-risk-of-poverty rate in 2011	The estimated risk-of-poverty rate in 2011 was calculated at 19.2 percent of annual income for a single-member household (the income criteria).	Croatian Bureau of Statistics, http://geostat.dzs.hr
Housing quality	Residential area per capita in m^2	The size of residential area per capita in m^2 in the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr
Aging of population	Life expectancy	The share of the population over 65 in the total number of inhabitants in the city.	Croatian Bureau of Statistics, Statistical Report 1468 Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html

Tourist attractivity	Number of tourists compared to the number of inhabitants in the city	The number of tourists compared to the number of inhabitants in the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html
	Number of overnight stays in relation to the total number of inhabitants in the city	The number of overnight stays in relation to the total number of inhabitants in the city.	Croatian Bureau of Statistics, Towns in Statistics, https://www.dzs.hr Croatian Bureau of Statistics, Census of population, households and dwellings in 2011, https://www.dzs.hr/hrv/censuses/census2011/results/htm/H01_01_03/H01_01_03.html

Source: Authors' systematization.

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