CIVITAS, 2023, 13(1), 108-123
www.civitas.rs

Otilija Sedlak[1]
Tibor Fazekaš[2]
Aleksandra Marcikić Horvat[3]
Boris Radovanov[4]
Dragan Stojić[5]
Reka Korhec[6]

UDC 330.341:711.45
Original scientific article
Received: 22/08/2023
Accepted: 20/09/2023

MEASURING DEVELOPMENT LEVEL AND DEFINING CRITERIA FOR RANKING SMART CITIES

Abstract: The authors have developed a conceptual framework aimed at analyzing sustainable development and city ranking. This framework relies on specific standardised criteria and smart city metrics.The aim of this research is to accentuate the differences in the corresponding characteristics and factors by measuring individual indicators, different

[1] Full Professor, Faculty of Economics in Subotica, University of Novi Sad, Subotica, Serbia, e-mail: otilija.sedlak@ef.uns.ac.rs, ORCID ID: https://orcid.org/0000-0002-7430-7027

[2] Secretary, Communal Inspection of the City Administration of the City of Subotica, Subotica, Serbia, e-mail: ftibi@gmail.com, ORCID ID: https://orcid.org/0009-0008-2891-9285

[3] Associate Professor, Faculty of Economics in Subotica, University of Novi Sad, Subotica, Serbia, e-mail: aleksandra.marcikic.horvat@ef.uns.ac.rs, ORCID ID: https://orcid.org/0000-0002-4199-4238

[4] Associate Professor, Faculty of Economics in Subotica, University of Novi Sad, Subotica, Serbia, e-mail: boris.radovanov@ef.uns.ac.rs, ORCID ID: https://orcid.org/0000-0002-4728-7286

[5] Associate Professor, Faculty of Economics in Subotica, University of Novi Sad, Subotica, Serbia, e-mail: dragan.stojic@ef.uns.ac.rs, ORCID ID: https://orcid.org/0000-0003-4067-570X

[6] Teaching Assistant, Faculty of Economics in Subotica, University of Novi Sad, Subotica, Serbia, e-mail: reka.korhec@ef.uns.ac.rs, ORCID ID: https://orcid.org/0009-0009-7343-9990

factors for individual criteria for medium and small towns. Guidelines and perspectives for further development will be determined through the built model. The measured values of individual factors will represent a database, on the basis of which cities can be ranked, i.e. identify advantages and disadvantages, determine their diversity, as well as comparative advantages in the region, in order to increase sustainability.

Keywords: smart cities, development, sustainability, ranking, criteria.

1. Introduction

Given the multidisciplinarity of the research subject, it is necessary to analyse the various criteria and methods of measurement applied so far, in order to determine the conceptual framework of standard and measurable indicators that have an impact on the emergence and survival of smart cities. Monitoring and respecting the opinions of experts will enable the research to have a well-founded basis for the creation and sustainable development of a smart city. Each city has its own unique economic, social and administrative characteristics, as well as different priorities. The developed conceptual model will contain basic, standardized criteria (indicators) that will enable cities to compare themselves. In addition to technological changes, the process of European integration is the one that reduces economic differences, differences in social and environmental standards, and thus provides a common market. By determining the values of components, through the values of their factors or indicators, the basis for ranking cities in our environment will be made. This will create preconditions for combining competitiveness and sustainable development in the region. Technological factors and their development are of key importance for the growth of the city into a smart city. A necessary, but not a sufficient condition for the development of smart cities is the correct functioning of infrastructure, mobile and virtual technologies and digital networks. In order for the city to become smart, it must also meet the condition that is related to both institutional and human factors. Institutional factors include adequate governance, policies and regulations, and the human factor encompasses different forms and levels of education.

2. Literature Review

Batagan (2011) developed a smart city indicator system across four indicator groups: education, health, transportation, and public administration. Other authors, such as Chourabi et al. (2012), identified components encompassing management, technology, city authorities, policies, human community, infrastructure, and environment. Carlia et al. (2013) laid out a framework that combined objective (physical infrastructure, public spaces, environment) and subjective (citizen satisfaction and well-being) indicators for smart city development classification. Firnkorn (2015) explored short and long-term smart city development, suggesting an initial focus on data collection and availability, and later emphasizing strategy integration and adaptability. Moreno (2015) emphasized technology availability, service design, ICT integration, openness, adaptability, and collaborative organization as determinants of smart city development. Canteneur (2015) highlighted Vienna's social-focused smart city development, considering energy efficiency, environmental preservation, and quality of life.

Sassen and Kourtit (2021) outlined fields with high socio-economic benefits from smart city policies: environmental and health transition, resource and energy transition, socio-demographic and spatial transition, cultural and community transition. Strüver et al. (2021) emphasized smartness tied to social justice and sustainability.

In 2016, the German Institute for Industrial Engineering in Stuttgart, Fraunhofer, initiated the "Morgenstadt" (city of tomorrow) initiative to explore urban systems' potentials for transforming into sustainable smart cities (Frauenhofer Society, 2016). The institute engaged in "CityLabs" projects with cities to derive development indicators and corrective actions. Nine critical sectors—mobility, buildings, water supply, city authorities, energy, finance, ICT, logistics, and flexibility—formulated the basis for assessing 28 indicators, grouped into quality of life, environmental protection, innovation, and flexibility categories. This led to the "Morgenstadt City Index," an online documentation showcasing values of development indicators for selected smart cities.

Budapest's ABUD (Advanced Building and Urban Design) launched the SmartCEPS (Smart City Evaluation Platform and Service) project in 2017, funded by the Eurostars-2 and EU Horizon 2020 programs. This project offers services for self-assessment and consultation to European cities on smart and sustainable city issues through an online platform (ABUD, 2017).

3. Research and Methodology

The reliability of city competitiveness analysis methods hinges on city selection and objective analysis via appropriate indicators. To achieve effective city ranking, three crucial aspects must be considered:

- ranking goal - which is shaped by the target audience, spatial scope, and analysed indicators;
- ranking methodology - data collection, processing methods, and limitations should be carefully addressed;
- presentation of results - how analysis results are evaluated, interpreted, and shared has a significant decision-making impact.

Ranking cities is a powerful tool to uncover strengths and weaknesses, helping local governments and potential investors. It offers straightforward guidance for optimizing city functionality. However, objectivity of citizens' input can be potentially unreliable, which can be mitigated through careful survey content and participant selection. Interpreting results across cities of varying sizes and statuses poses a challenge.

Key smart city components encompass technology, people and institutions. Table 1 shows the basic components of a smart city that served as a starting point in our analysis.

Table 1: Basic components of a smart city

Technological factors	**Human factors**	**Institutional factors**
Physical infrastructure Smart technologies Mobile technologies Virtual technologies Digital networks	Human infrastructure Social capital	Management Politics Regulations / directives

Source: Authors' calculations,, 2023

Research on the status and ranking of smart cities relies on defined criteria, on which measurements were made, statistical data collected and surveys conducted regarding the degree of satisfaction with these predefined items.

Our research introduces a novel approach to understanding smart cities. We consider both established and new factors in evaluating their level of smartness and citizen satisfaction. We identify key indicators related to smart city attributes and gather expert opinions on their significance. Experts also suggest new relevant characteristics. These descriptive traits are matched with numerical indicators and quantified citizen opinions. We calculate average characteristic scores using indicator weights from the survey (rated 1 to 10). This method enhances the reliability of smart city rankings and citizen satisfaction evaluations. Our study incorporates comprehensive features from existing literature, practical analysis, and research on smart settlements. We have identified a set of 116 measurable indicators, expandable with more research. Importance is determined per capita.

Expert opinions on the characteristics of cities are divided into six groups:

- 1: The importance of general characteristics of the city
- 2: The importance of strategic directions for the realization of the concept of smart cities
- 3: The importance of the principle of forming a management strategy for improving the environment in the city
- 4: The importance of solving environmental problems in cities
- 5: The importance of city administration measures for improving living conditions
- 6: The importance of elements of urban traffic

According to these groups, we have defined a total of 92 questions, which reflect the opinion of experts on the most important features of cities, from the point of view of reaching a certain degree of smartness. Questions related to some characteristics can be found in several groups, in order to shed light on the problem from several different points of view, and at the same time it allows to assess the reliability and validity of the survey, according to a certain quantitative procedure (correlation coefficient, regression coefficient and Cronbach's a-coefficient).

The possibilities of obtaining statistical data have determined a set of characteristics of cities for empirical research in this paper, which aim to present the proposed innovative approach to the formation of a composite index that reflects the achieved level of development within the concept of smart cities.

3.1. Methodology of composite index formation

Let n cities G_i, i=1,2,…,n be investigated, for which composite indices should be calculated so they reflect the degree of achieved development of the smart city property, and let data on m characteristics K_{ij}, j=1,2,…,m be available for each city. In order to create comparable results, the standardization of the indicator values was performed, according to the following procedure:

Average value of the j-th characteristics for the set of cities i=1,…,n:

$$\overline{K_j} = \frac{1}{n}\sum_i K_j , \forall j$$

Standard deviation of the j-th characteristics:

$$\sigma_j = \sqrt{\frac{1}{n}\sum_i (K_j - \overline{K_j})^2} , \forall j$$

Standardized value of the j-th characteristics for the i-th city:

$$S_{ij} = \frac{K_j - \overline{K_j}}{\sigma_j}$$

Standardized values measure the difference in standard deviations between the given data and the average value. The higher the standardized value, the better the position of a given city in a city set.

In order to further clarify the cities' ranks according to individual measured indicators, the obtained standardized values are further normalized in the interval from 50 to 100. The normalization interval is set to 50-100 range so that possible weights also affect the characteristics with the lowest values. The city that has the weakest position for a given characteristic is awarded 50 points, and the city that is of the highest quality according to a given characteristic receives 100 points; the points numbers of other cities and for the given characteristic j are calculated according to:

$$Q_{ij} = 50 + \frac{S_j - \min_i(S_j)}{\max_i(S_j) - \min_i(S_j)} \cdot 50 \ , \forall j$$

We calculate *The competence index of cities* in two ways:

1. in the traditional way[7], as the sum of points obtained by individual characteristics:

$$I_i = \sum_j Q_j \ , \forall i$$

2. in a modified way, as suggested in this paper, by including the importance of certain characteristics in the form of weights, derived from the experts' opinions:

$$M_i = \sum_j A_j Q_j \ , \forall i$$

Where A_j denotes the weight value, ie. average expert assessments of the importance of individual characteristics (as shown in section 3.1 of this paper), which are then multiplied by the values of individual characteristics.

We hypothesise that by including the degree of importance of certain characteristics, more reliable and credible indices of competence of individual cities are obtained, in the way which better reflects the state and perspectives of cities in their efforts and aspirations on the way to an ideal position of "perfect smart city".

The scores from the surveys are used as weights for the numerical values of the characteristics in the calculations of the competitiveness index of cities.

4. Results and Discussions

A total of 92 experts participated in the survey, and 84 correctly completed survey questionnaires were obtained. Of the 84 respondents,

[7] See e.g. Bosch et al. (2017), ABUD (2017), Carlia et al. (2013), Batagan (2011), Giffinger et al. (2007)

41 were female and 43 male. The mean age of the subjects was 37.74 (± 14.13) years. The length of work experience of the respondents averaged 15.89 (± 13.89) years. Of all respondents, only two were unemployed, and the rest were part-time or full-time employees.

In the preliminary part of the survey, the experts stated about the attitude and interest of citizens and city authorities towards issues of quality of life in the city in general. The answers were given according to the Likert scale (McLeod, 2014): 1 - slightly, 2 - weak, 3 - medium, 4 - sufficient and 5 - complete. Results show that there is a general disinterest in these questions: out of all given answers, as many as 41% have a grade of two, and the average grades in all questions are between 2 (low interest) and 3 (medium interest). The results, sorted by average grade, are shown in the following table (Table 2).

Table 2: Experts' responses

No.	Question	Average	St.deviation
1	How interested are the citizens in the quality of life as a part of the development of their city as a smart city?	2.85	1.05
2	How interested are the citizens in general issues concerning city development?	2.77	0.88
3	Are the citizens sufficiently engaged with general transport issues in their city?	2.55	0,86
4	Are the city authorities sufficiently engaged in improving public urban passenger transport?	2.30	0.90
5	In your opinion, are civic initiatives sufficiently present in order to improve public urban passenger transport as part of the smart city development?	2.20	0.85

Source: Authors' calculations, 2023

Experts evaluated smart city characteristics using a Likert scale of 1 to 10 across six distinct problem groups. The combined average rating stood at 7.54. Analyzing individual expert responses, the range spanned from a low of 3.41 to a high of 9.80. However, the distribution of these scores exhibited non-normal flatness (K=3.11) and notable negative skewness (S=-0.95), thereby deviating from a normal distribution (Jarque-Bera statistics JB=12.66, p=0.002). To identify extreme values, a non-parametric approach was adopted, employing an extreme value threshold below 3.26 and above 12.01. This assessment did not uncover any extreme values within this range.

The internal consistency of the survey underwent assessment through Cronbach's α coefficient across three criteria: grouped questions, questions related to public services (such as education, health, utilities, security, fire protection, and cleanliness), and individual question groups. Further employing the principal components method, clusters of questions that could be summarized under one factor were identified. The findings indicated that the assigned survey grades exhibited a suitable level of consistency, rendering them appropriate for subsequent analysis. Higher values of the Cronbach's α coefficient corresponded to enhanced internal consistency. An *acceptable* threshold for internal consistency is 0.6, values of 0.8 or above are considered *good*, while those surpassing 0.9 signify *excellent* internal consistency. The specific values of α coefficients, categorized by groups of questions, indicate *excellent* or *good* levels of internal consistency for each group.

For each question in each group, the medians, mean values, and standard deviations of the scores assigned by the experts were calculated. All items by groups are ranked according to the average grade, from the most important question in the opinion of experts, to the least important. The normalized values of grades ranged between 0.82 and 0.94 for groups, which were used as weights in the derivation of the modified index of competence of cities.

4.1. Comparative analysis of survey results by groups of questions

When observing the answers of all surveyed experts to all questions, an average score of 7.54 was obtained, on a scale from 1 to 10. The medians, average scores and standard deviations of the answers of experts by groups of questions are shown in Table 4.

Table 4: Experts' assessments on the importance of individual groups of indicators

Rank	**The importance of smart city development indicators**	**Median**	**Average**	**St. dev.**
1	Group 5	8.00	7.85	2.14
2	Group 4	8.00	7.81	2.08
3	Group 6	8.00	7.77	2.22
4	Group 3	8.00	7.59	2.36
5	Group 2	8.00	7.25	2.38
6	Group 1	8.00	7.14	2.27
	Average indicator value for all questions	**8.00**	**7.54**	**2.26**

Source: Authors' calculations, 2023

A comparative analysis of the statistical significance of the differences between the arithmetic means of the scores assigned to individual groups, using the t-test, gave the results shown in Table 5.

Table 5: T-test of the significance of differences between arithmetic means

Group	5	4	6	3	2	1
5		t=0.482 p=0.630	t=0.942 p=0.346	t=3.063 p=0.002 *	t=6.789 p<0.001 *	t=9.676 p<0.001 *
4			t=0.417 p=0.676	t=2.259 p=0.024 *	t=5.625 p<0.001 *	t=7.703 p<0.001 *
6				t=1.797 p=0.073	t=5.073 p<0.001 *	t=7.085 p<0.001 *
3					t=3.285 p=0.001 *	t=5.071 p<0.001 *
2						t=1.206 p=0.228
1						

Source: Authors' calculations, 2023

In the above table, the values of p <0.05 show the nonexistence of a statistically significant difference between the mean values. The symbol * indicates fields that refer to a pair of groups of questions between whose mean values there is no statistically significant difference. According to these results, groups of questions can be classified into three clusters:

- **First cluster** with the highest average grades includes Group 5, 4 and 6;
- **Second cluster** with medium average grades includes these Group 3;
- **Third cluster** with the lowest average grades includes Group 2 and 1.

For researching the development of chosen European smart cities, basic attributes, stats, and surveys from the Eutrostat database (European Statistical Office, 2021) and available documents (Paredes Muse, Frazer, & Fidler, 2020) (CEN-CENELEC, 2020) (Mourshed, Bucchiarone, & Khandokar, 2016) were collected. Data cover EU, national, and NUTS-classified regional levels. Methodology included 28 EU capitals, inhabitants on Dec 31, 2018, and data refer to the size of cities, use of urban areas, population and demographic, living conditions, social exclusion and crime rate, economic activities and economic accounts of cities and households, structural business statistics, development digital economy and digital society, protection of intellectual property, labor market, education, scientific research and technological development, ecology, environmental protection and waste management, culture and tourism, urban transport, health care and the results of population satisfaction surveys. Data sets encompass 26 sets, 125 folders, and 342 variables from 2018. Most data from EU site; gaps filled from national/city stats or 2018 estimates with historical trends.

The variables included in the analysis can be divided into two basic groups: the first group contains basic, most important indicators related to the analysed measured variables, while the second contains indicators derived from surveys of EU capitals' citizens regarding their attitudes on quality of life and characteristics of the city they live in. The results of the survey served us as control values, and the selected measured variables are included in the database for calculating the composite index, as a summary indicator for comparing and ranking EU capitals, in terms of competitiveness and 'smartness' level of development.

The database includes a total of 48 variables, which reflect the characteristics of the examined cities. The variables are classified into the subgroups:

- population,
- living conditions,
- employment,
- economic development,
- education,
- health and social care,
- culture,
- tourism,
- ecology,

- information and communication technologies and
- urban transport (Stojić, Ćirić, Sedlak, & Marcikić Horvat, 2020).

In order for characteristics to be comparable, the data were normalized within the range 0-100. Let K_{ij} be the j-th characteristics for the city i. Then the normalised values of the j-th characteristics for the set of cities G_i is given:

$$N_{ij} = \frac{K_j - \min_i(K_j)}{\max_i(K_j) - \min_i(K_j)} \cdot 100, \forall i, j$$

Normalized values are equal to zero if minimal and 100 if maximal. A comparative analysis of normalized values of characteristics averaged over cities, shows that of all the examined attributes, the highest normalised values belong to group *Living conditions*, namely Share of population with access to public city sewerage network and Share of population with access to public drinking water supply network is at a level over 85/100 on average for all cities. At the second highest level are *employment indicators* (Share of employed young people around 71/100, Share of employed population around 61/100). The lowest normalised value is, surprisingly, *Research and development expenditures in educational institutions per capita* in euros (around 23/100).

4.2. Results of residents of EU capitals' survey

Survey questionnaires were created in which the data on the attitudes of residents of EU capitals regarding the quality of life in their cities was collected. There is also used a *table of ranks awarded to individual items* from the survey of EU capitals. Data on the results of the survey are published on the EU website for years 2004, 2006, 2009, 2012 and 2015. Some survey questions are repeated from year to year, some are omitted, additional questions are formulated, and some are given in a modified form. In processing the data, we took into account the results for year 2015.

The answers to the questions asked can be grouped into five types. Tables display average points by survey question groups. Omitted are

'Population' and 'Information and communication technologies,' replaced with 'City Administration' and 'Security.' More points signify higher indicator quality. Notably, 'Possibility of finding a suitable apartment at an affordable price' (31.50) and 'Possibility of finding a suitable apartment at an affordable price' (43.57) scored lowest. Respondents favored 'High level of satisfaction with living conditions in this city' (80.79) and 'The quality of life in this city' (77.45) most.

EU capitals rank using composite index calculation. There are two methods: sum of original attribute points, or weighted values from expert surveys. According to both methodologies, the composite index of the highest value was assigned to Stockholm, and the lowest value to Zagreb. By introducing weights as an indicator of the importance of individual attributes, the order of the analysed cities in certain positions is modified. The adjusted values show an improvement for Prague, Helsinki, Dublin, Nicosia and Bucharest, which means that in those cities, those indicators are relatively better, to which experts attach a greater degree of importance. In other cities, the adjusted values are unchanged or reduced. As a result of these changes, after the introduction of the weight of attribute importance, the relative position on the ranking list of cities has improved for Tallinn, Berlin, Ljubljana, Bratislava, Vilnius and Bucharest.

5. Conclusion

We've systematized smart city components from various literature and institutions, presenting key aspects in the first chapter. Drawing from research, literature, and practical applications, we've established a comprehensive set of characteristics. These attributes aid in city ranking and composite index definition. Our approach proposes composite indices and rankings for EU capitals based on different attributes and citizens' satisfaction levels. These indices efficiently rank cities based on 'smartness'. Ongoing research could expand or streamline these features. Expert opinions helped group 92 evaluation questions into 6 categories for the composite index formulation. This index reflects smart city development. Our ranking method provides an effective way to assess cities, aiding local authorities in optimizing solutions for normal functioning. Through expert surveys, we determined the importance of city characteristics, strategic directions, management strategies, environmental concerns, administration measures, urban transport, and more. The process includes comparative analysis, result organization, database formation, and composite index methodology.

References

ABUD (2017). *SmartCEPS - Smart City Evaluation Platform and Service*. Retrieved Jun 23, 2021, from http://www.abud.hu

Batagan, L. (2011). Smart cities and sustainability models. *Informatica Economica, vol. 15, No. 3,* pp. 80-87.

Bosch, P., Jongeneel, S., Rovers, V., Neumann, H.M., Airaksinen, M., & Huovila, A. (2017). *CITYkeys list of city indicators, EC.* Retrieved Jun 23, 2021, from http://nws.eurocities.eu/MediaShell/media/CITYkeyslistofcityindicators.pdf

Canteneur, P. (2015). Vienna nurtures a social vision of the smart city. *L`Atelier Weekly Newsletters, July 2015*. Retrieved August 16, 2021, from https://atelier.bnpparibas

Carlia, R., Dotolia, M., Pellegrino, R., & Ranieri, L. (2013). Measuring and Managing the Smartness of Cities: a Framework for Classifying Performance Indicators. *Smart Cities Communities and Social Innovation research and competitiveness program*. Italian University and Research Ministry. Retrieved Jun 23, 2021, from www.researchgate.net/publication/262165246

CEN-CENELEC (2020). *CEN-CENELEC Guide 29.* CEN/CENELEC Workshop Agreements A Rapid Way to Standardization. Retrieved July 18, 2021, from https://ftp.cencenelec.eu/EN/EuropeanStandardization/Guides/29_CENCLCGuide29.pdf

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., et al. (2012). *Understanding Smart Cities: An Integrative Framework. 45th Hawaii International Conference on System Sciences* (pages. 2289-2297). doi: 10.1109/HICSS.2012.615

European Commission (2018). *White Paper on Resilience Management Guidelines for Critical Infrastructures. From Theory to Practice by Engaging End-Users: Concepts, Interventions, Tools and Methods*. Retrieved Jun 10, 2021, from https://smr-project.eu/fileadmin/user_upload/Documents/Resources/WP_7/DRS_7_WHITE_PAPER_final_April2018.pdf

European Statistical Office (2021). Retrieved Jun 14-30, 2021, from https://ec.europa.eu/eurostat/data/database

Firnkorn, J. (2015). A city becomes `smart` when it knows how to use its data. *L`Atelier.* Interview with Joerg Firnkorn, May 2015. Retrieved Jun 18, 2021, from https://atelier.bnpparibas

Frauenhofer Society (2016). *Morgenstadt – City of the Future*. Retrieved Jun 23, 2021, from www.morgenstadt.de/en

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. (2007). *Smart Cities: Ranking of European Medium-Sized Cities, Vienna, Austria, Centre of Regional Science (SRF)*. Vienna University of Technology. Retrieved Jun 3, 2021, from http://www.smartcities.eu/download/smart_cities_final_report.pdf

McLeod S. (2014). *Likert Scale*. Retrieved April 23, 2021, from http://www.simplypsychology.org /Likert-scale.html/pdf

Moreno, C. (2015). How smart is my city? Visions of the smart city in the 21st century. *L`Atelier Weekly Newsletters, October 2015.* Retrieved Augustl 16, 2021, from https://atelier.bnpparibas

Mourshed, M., Bucchiarone, A., & Khandokar, F. (2016). *SMART: A process-oriented methodology for resilient smart cities. Proceedings of the 2016 IEEE International Smart Cities Conference (ISC2)* (pages. 1–6). Trento, Italy, 12–15 September 2016. doi: 10.1109/ISC2.2016.7580872

Paredes Muse, L., Frazer, J., & Fidler, E. (2020). *The IEEE P2784 Standardization Process Workshop: The use of Delphi method and interactive evaluation tools to identify perceptions about Smart Cities. In Proceedings of the 2020 IEEE International Smart Cities Conference (ISC2)* (pages. 1–6). Piscataway, NJ, USA, 28 September–1 October 2020. Retrieved Jun 3, 2021, from https://ieeexplore.ieee.org/document/9239067

Sassen, S., & Kourtit, K. (2021). A Post-Corona Perspective for Smart Cities: 'Should I Stay or Should I Go?'. *Sustainability 2021, 13(17).* doi: 10.3390/su13179988

Stojić D., Ćirić Z., Sedlak O., & Marcikić Horvat A. (2020). Students' Views on Public Transport: Satisfaction and Emission. *Sustainability 2020, 12(20), 8470.* doi: 10.3390/su12208470 (This article belongs to the Special Issue Sustainable Transport and Air Quality)

Strüver, A., Saltiel, R., Schlitz, N., Hohmann, B., Höflehner, T., & Grabher, B. (2021). A Smart Right to the City—Grounding Corporate Storytelling and Questioning Smart Urbanism. *Sustainability 2021, 13(17), 9590.* doi: 10.3390/su13179590