

Main theses of the PhD dissertation

Doctoral School of Earth Sciences

**Cities in competition for sustainability: a political, environmental and
liveability analysis of the cities applied for the European Green Capital
Award**

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Pécs, 2023

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1. Introduction

The majority of scientific studies agree that cities play a key role in mitigating and adapting to climate change. The role and potential of local governments and local initiatives is particularly important when nation states and international organisations fail to deliver on appropriate policies. However, the level of commitment and interest in sustainability varies considerably between cities.

European cities also have a regional actor, the European Union, which must be taken into account in environmental governance. Nowadays, the European Union is investing considerable funds and focuses on the creation of liveable, sustainable, resilient and green cities, which can provide a long-term commitment and solution to the negative effects of climate change, and thus represent an inevitable development path for the future of municipalities. The European Green Capital Award (EGCA), launched by the European Commission in 2008, aims to reinforce this and encourage municipalities to adopt a green approach. The aim of making cities sustainable and green is not only about adapting to climate change, but also about improving the quality of life of local people and the liveability of the city.

On this basis, the thesis analyses the cities that have and have not yet applied for the EGCA award on the topics of municipal policy, environmental indicators and urban liveability. Each of the three themes is of great importance in the development of sustainable and green cities, as local policy and decision-makers determine the direction of development and decide on the application for the award, environmental indicators show the changes in the environmental status of cities and liveability, or more precisely the perceived quality of life, illustrates the level of satisfaction of the inhabitants of a municipality. By focusing on the gap(s) identified in the thematic areas, cities can manage their financial and time resources more effectively, improve their cities along the priority sustainability themes, thus increasing not only their chances of success in the award but also their sustainability. The results of the thesis can contribute to the development of sustainable, resilient and green cities, serve as a good example for city leaders and even as a guide for successful participation in the award.

2. Research Aims

The dataset of the EGCA winners, finalists and other candidates now provides sufficient data to run various statistical tests to detect differences between cities. My aim is also to provide guidance to city governments

considering applying for the award, so that they can get a realistic picture of the environmental status of their cities. The information and findings in this thesis can be useful and can serve as a guide for their development.

The application for the EGCA award is always a matter of political decision by the city administration, i.e., it is highly dependent on the composition, goals, priorities and decisions of the government in power, thus raising the following questions:

1. Is the presence of Green Party representatives on the city council linked to the application and the outcome of the competition?
2. What other political factors are associated with the application for the award and the outcome of the competition?

Following the submission of applications for the award, cities are ranked according to themes and indicators defined during the evaluation process. For the environmental indicators, I was looking for answers to the following questions:

3. What are the differences in the indicators between the finalist cities and the other applicant cities?
4. Do the results and the quantitative characteristics of the cities show any geographical pattern?
5. To what extent can the outcome of an application for the award be reliably modelled?
6. Which environmental variables are most closely linked to the success of the application?

A further aim of the thesis is to examine the environmental indicators of cities in the Carpathian Basin that meet the criteria for the award, after the "pan-European" level, and compare them with the values of the geographically closest winning city, Ljubljana. No city from the Carpathian Basin has yet been selected as a finalist, so my aim is to showcase the potential of the cities located in the Carpathian Basin to reach the final. I have posed the following questions in this section:

7. Which environmental indicators show considerable differences between cities in the Carpathian Basin that have already applied and those that have not yet applied?
8. Which city in the Carpathian Basin is most similar to the 2016 winner, Ljubljana, in terms of the environmental indicators included in the analysis?
9. Where do Hungarian cities stand in the ranking of environmental indicators?
10. What are the chances of the cities in the study to make it to the final?

The perception of the municipalities by the population can be a very important feedback for the city administration. My aim is to investigate public perceptions of cities' sustainability efforts by means of a long-term European survey. I was looking for answers to the following questions:

11. Is the satisfaction of people living in EGCA-winning or finalist cities higher than in non-finalist cities?
12. Is there a difference between the perceived quality of life of people living in settlements already applied and those not yet applied?
13. What differences and patterns can be observed in satisfaction with green spaces, air cleanliness and noise pollution levels?

Finally, I will compare the environmental, political and liveability indicators of Pécs with those of the winning and finalist cities. The reasons for presenting Pécs in more detail are, on the one hand, my personal attachment to the city as a resident of Pécs and, on the other hand, the fact that, of the Hungarian cities, only Budapest and Pécs have been repeated applicants for the award, but due to Budapest's size and capital city character, it cannot be compared in a suitable way with other major Hungarian cities. I would also like to present the strengths and weaknesses of Pécs and to illustrate best practice in the development of some of the winning cities in relation to the EGCA themes, which could serve as good examples for the Pécs city administration. The following questions were raised:

14. Where does Pécs rank among the 12 EGCA themes and indicators compared to the other municipalities that have applied for the award?
15. Which indicators are lagging behind the most?

3. Research methods

In total, 296 cities are included in the thesis (Figure 1), while the 110 cities that applied for the EGCA are the main focus of the thesis. Of these, all are included in the section on the political context, the number has been reduced to 100 for the environmental indicators due to lack of data, while the research section on subjective quality of life includes 43 already applied cities due to the limitation of the pan-European questionnaire. The applicant cities were supplemented by control cities for the political analysis, cities which took part in the Urban Audit Survey but not yet applied for the award, and 15 additional municipalities in the Carpathian Basin.

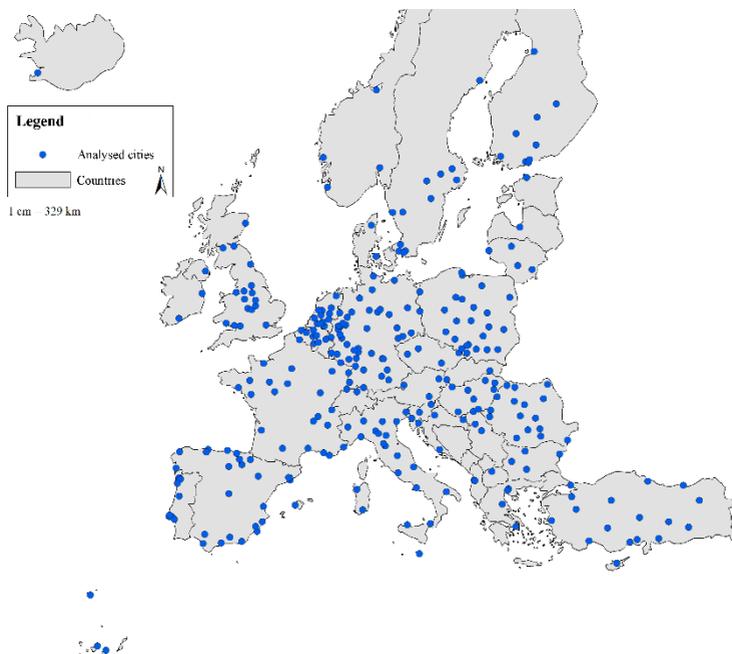


Figure 1. The cities included in the thesis. Source: own editing

The data used in the analysis are taken from databases provided by the European Commission, the European Environment Agency, Eurostat, other European associations, statistical offices and documents prepared by local authorities, and from the results of various surveys.

The thesis partly follows the methodology of exploratory data analysis (EDA) and partly uses explanatory regression. I used independent-samples t-test, Mann-Whitney U-test and Chi-square test to detect differences and associations in environmental and liveability outcomes between different groups of cities; a dimensionality reduction procedure (MFA) to reduce the number of environmental indicators; and binary logistic regression to examine the association between the real-world outcomes of the applications and the selected environmental and political factors. To estimate the chances of Carpathian Basin cities being finalists, I used random forest method, while to find the most similar Carpathian Basin city to Ljubljana, I used similarity search. For other analyses concerning Pécs, I referred to the evaluation documents of the applications submitted for the award and to the applications of the winning cities as "best practice". The spatial patterns were visualised

using geographic information software and I also used the results of several questionnaires collected through an online interface.

4. Summary of results

The EGCA is an environmental, political and marketing initiative that incorporates elements of several urban models (sustainable, resilient and green city), with a complex, long-term focus on environmental, political and marketing objectives that affect the quality of life of city dwellers and the liveability of cities. The EGCA is not a goal in itself, but a tool in the drive for sustainability, helping to move cities' sometimes stalled local policies towards a "green path" and providing a guide for development.

The first part of the results of the thesis addressed the political factors associated with the application for the award and the outcome of the competition:

1. Is the presence of Green Party representatives on the city council linked to the application and the outcome of the competition?

The results show that in East-Central Europe, Green parties are either absent or very weak in both the cities that have not yet applied and those that have. Nevertheless, the proportion of Green Party representatives in local councils is correlated with the submission and success of the application: the higher the proportion of Green Party representatives, the better the chances of applying for the award and reaching the final. The study supported the results of the national level analysis and showed the positive role of Green parties at local level.

2. What other political factors are associated with the application for the award and the outcome of the competition?

The results show that the variables of left-wing city governance, stability and fragmentation are linked to the submission of bids. Furthermore, the results suggest that stable city leadership, i.e., a long-term commitment to sustainability, is an advantage for submitting an application. The environmental index, experience and stability were found to be related to the outcome of the application. The lower the value of the index, the more the local council prioritises environmental protection and sustainability, meaning that municipalities with a lower environmental index submit more successful applications. However, I should highlight the cities in Central and Eastern Europe, where political power is usually characterised by a high environmental index, and therefore the success rate of the cities that apply is lower. Experience is positively correlated with the outcome of the competition: the more times a municipality competes for the award, the greater the chance of winning. Beyond this, the results also suggest that there

is a negative correlation between the success of the outcome of the competition and stability. In several of the cities included in the analysis, it was observed that after a change of power, another party took the credit for the efforts of the previous administration, but a new administration can also bring innovation in terms of improvements.

I have posed the following four questions to compare the environmental performance of cities that have and have not yet applied for the EGCA.

3. What are the differences in the indicators between the finalist cities and the other applicant cities?

The results of the different statistical analyses show that there are clear differences with at least medium effect size for a total of 12 variables, related to transport, land use, air and noise pollution and waste management. In these indicators, the group of winner-finalist cities performed better. The smallest differences between the two groups (winners and finalists, other candidates) are found in the proportion of people walking, the amount of carbon dioxide emissions per capita per year and the amount of green space per capita. Looking at the binary variables, there was a notable difference between ICLEI membership, being a signatory of the Aalborg Charter and having a climate strategy, which were much more frequent among the winners and finalists.

4. Do the results and the quantitative characteristics of the cities show any geographical pattern?

For some indicators, there is a dichotomy between Western and Northern Europe and between Southern and East-Central Europe. For example, the ratio of electric car charging stations per 1000 inhabitants, where Belgian and Dutch cities are clearly in the lead. In Western and Northern European cities, the length of cycle paths per capita is higher than in Central and Eastern European cities. The Belgian, Dutch, German and Swedish municipalities have the highest share of cycling. In terms of the annual value of particulate matter, the British, Finnish and Spanish cities have the highest values. The cities in the Ruhr area and some Belgian and Italian cities are the best in waste recycling. For cities in Southern and East-Central Europe, only the higher proportion of people using public transport can be highlighted as an environmentally beneficial variable. Central and Eastern European cities have higher car ownership and higher particulate matter than the national average, while Polish cities are the worst performers in terms of recycling.

5. To what extent can the outcome of an application for the award be reliably modelled?

Based on the results of the analysis of the political factors in relation to the outcome, the accuracy of the final model (dependent variable: the fact of being

a finalist) was 82.9%, where the classification of the non-finalist cities corresponding to their real results was 92.5%.

For the environmental indicators, the categorisation of the winner-finalists and the other applicant cities according to their real results was also tested using binary logistic regression, first by ignoring the number of applications and second by taking this into account. Overall, the former model proved to be more reliable, with an accuracy of 79% using a threshold of 40%. The classification of the winners and finalists according to their real results is also the most reliable (75.7%). However, the study also showed that for the cities that were not finalists, this method is more accurate when a classification threshold of 50% is applied.

6. Which environmental variables are most closely linked to the success of the application?

As regards the environmental indicators, the first, second and fourth dimensions are the most relevant for the success of the project. These include variables related to noise levels, waste management, land use, water use, waste water treatment, transport, air pollution, energy consumption, governance and mitigation of the negative effects of climate change. These indicators are also interlinked, for example, a higher proportion of green spaces and a change in the modal split of transport have a positive effect on air and noise pollution, and mitigation of the negative effects of climate change can be linked to governance.

In addition to showing the differences in the environmental indicators for the cities of the Carpathian Basin with a population of more than 100,000 inhabitants, not yet and already applied for the award, I sought to answer the following questions:

7. Which environmental indicators show considerable differences between cities in the Carpathian Basin that have already applied and those that have not yet applied?

The results showed that there was no major difference between those who had already applied and those who had not yet applied, with 11 of the 33 environmental indicators reaching the medium effect size. For eight of these variables, the scores of those who had already applied were more favourable from an environmental point of view, and the various international memberships and documents were more prominent. In terms of recycling rates relative to the national average, only a certain geographical pattern emerged: Romanian municipalities performed exceptionally well, while Hungarian cities were among the worst performers. It should be stressed, however, that

the cities rated better in the tests tend to be in the bottom third of the European ranking of the total 115 cities.

8. Which city in the Carpathian Basin is most similar to the 2016 winner, Ljubljana, in terms of the environmental indicators included in the analysis?

The results of the comparison with the environmental values of Ljubljana, the only winning city in the region, show that the most comparable cities are Bratislava, Zagreb, Maribor, Vienna and Graz (Figure 2), the first and last of which have not yet applied for the award. The similarity analysis also revealed some geographical patterns: the degree of similarity decreases as one moves eastwards. In the ranking databases generated by the different statistical methods, Ljubljana was found to be better than every other city in the region for only two of the 33 variables. This may suggest that the five-time application and continuous improvement have finally brought the city considerable success.

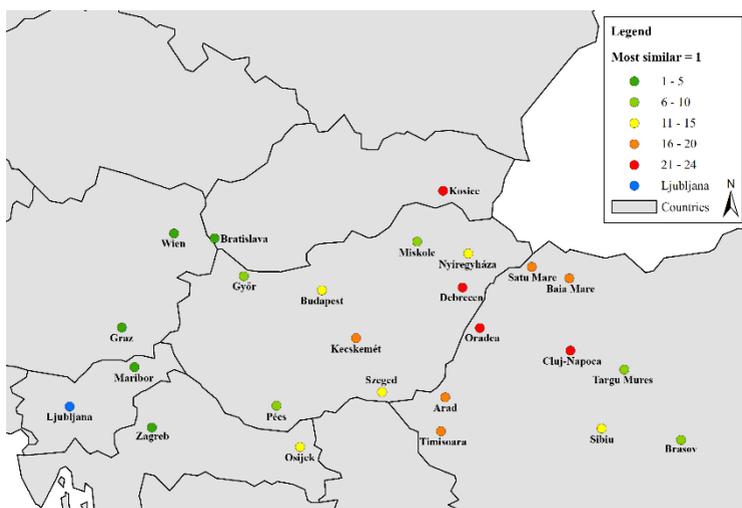


Figure 2. Cities with a population of more than 100,000 inhabitants that are the most and least similar to Ljubljana in terms of environmental values.
Source: own editing

9. Where do Hungarian cities stand in the ranking of environmental indicators?

Among Hungarian towns and cities, the lowland municipalities lead in the proportion of people using bicycles, the amount of green space per capita and

daily drinking water consumption, but have poor air pollution scores. Of the Hungarian municipalities with a population of more than 100,000, Pécs was the best and Debrecen the worst in the similarity search. Overall, the Hungarian cities in the study are in the second half of the mid-pack.

10. What are the chances of the cities in the study to make it to the final?

Of all the cities in the Carpathian Basin that have already applied for the prize, Vienna would have the best chance of making it to the final. The results for those not yet entered were broadly similar to the similarity test, with Bratislava, Târgu Mures, Graz, Miskolc and Győr having the best chance of making it to the final, while Oradea had the lowest. Of the two tests, the random forest is the more appropriate for estimating the chances of making the final.

The analysis of the perception of the municipalities by the population has not yet been carried out for the cities that have applied for the EGCA, so it is considered a novelty. Several questions were answered during the research:

11. Is the satisfaction of people living in EGCA-winning or finalist cities higher than in non-finalist cities?

The results of the analysis show that overall, residents of the winning or finalist cities are more satisfied with their place of residence than those who only applied, but the difference between the two groups is not considerable. Of the 25 indicators examined, only three had a minimum medium effect size: stagnation or improvement in quality of life compared to five years ago and dissatisfaction with the commitment of the city authorities to fight climate change. The latter is more prominent in the non-finalist cities, i.e., residents in the winner-finalist cities are more satisfied with their city government in this respect. It is important to note, however, that this good score did not show a steadily improving trend, and the scores of several of the winning cities show a striking decline in their scores after the EGCA winning year. For the non-finalist cities, quality of life has improved compared to five years ago according to residents, which is most noticeable in the post-socialist municipalities, while for the winners-finalists, quality of life has not changed. Overall, it is true that more people in the winner-winner group use bicycles (and fewer use other modes of transport) and are more satisfied with public transport, even though fewer people use it. People in this group were also more satisfied with urban green spaces and levels of air and noise pollution. Residents of these cities consider their towns and cities to be healthy.

12. Is there a difference between the perceived quality of life of people living in settlements already applied and those not yet applied?

There is no major difference between those not yet applied and those already applied in terms of perceived quality of life indicators. The only variable with

a medium effect size was perception as a healthy city. Residents of capital cities with a socialist past and Balkan capitals were the most likely to think that their city was unhealthy, but an interesting 'reversal' was also revealed, as contrary to expectations, only one applicant city (Bordeaux) was found among the ten cities considered healthiest. The small effect size indicators show that residents of the cities already applied are more satisfied with public transport, cycling and green spaces, and that the quality of life of residents has improved, but are less satisfied with car and pedestrian traffic, air quality and noise levels. In the cities already applied, however, residents are less satisfied with air quality and noise levels, which are also seen as a serious problem, an interesting result. There is also a higher level of doubt about the commitment of city governments to fight climate change. Nevertheless, the quality of life in these cities has improved compared to five years ago.

13. What differences and patterns can be observed in satisfaction with green spaces, air cleanliness and noise pollution levels?

The magnitude of the effects of these three variables remained small throughout, which means that there are no major differences between groups of cities. Compared to residents of the other applicant municipalities, residents of the winning or finalist cities are more satisfied with green spaces, air and noise pollution levels, but also consider the latter two to be problems.

Residents in cities that have already applied are more satisfied with green spaces, while residents in cities that have not yet applied are more satisfied with air quality and noise pollution.

After examining the cities of Europe and the Carpathian Basin, I further narrowed down the scope to one specific city, Pécs, which was named European Capital of Culture in 2010. Zsolt Páva (former mayor of Pécs), in a speech to the city council, also stressed that several previous European Capitals of Culture have also been awarded the EGCA title, and that Pécs is therefore a candidate for the award. However, as can be seen below, Pécs is not yet close to winning the EGCA.

14. Where does Pécs rank among the 12 EGCA themes and indicators compared to the other municipalities that have applied for the award?

Pécs was ranked eighth out of 12 cities in the first (2017) entry, eighth in the second (2019) entry, but this time out of 14 cities, and thirteenth out of 18 in the third (2022) entry. This makes the second bid the best ever entry. The environmental status of Pécs and its green developments were not sufficient to qualify for the final, as the results of the thesis confirm. The binary logistic regression model has correctly placed the city in the group of non-finalist cities. Whether or not the number of applications is taken into account, Pécs

is in the bottom quarter of the ranking of 100 cities. Pécs is followed in the ranking only by post-socialist and a few Western and Southern European cities. Based on an analysis of the chances of Carpathian Basin cities to reach the final, the chances of Pécs making the final are low.

15. Which indicators are lagging behind the most?

In terms of the 33 environmental indicators for cities, Pécs was worse than the group of winners and finalists in a number of cases. The biggest gaps were in the length of cycle paths per capita and the proportion of people cycling. In addition, there were substantial differences with the winning cities in the size of green spaces per capita, average annual air pollution levels, recycling rates, and the existence of various documents and international memberships.

List of publications on this topic:

Schmeller, D., & Sümeghy, D. (2023). Is the rival city always greener? – An analysis of the indicators for European Green Capital Award shortlisted and applicant cities. *Regional Statistics*, 6. (Under publication) (Q2)

Sümeghy, D., & **Schmeller, D. (2023).** Giving the green light to sustainability – key political factors behind the European Green Capital Award applications. *Journal of Urban Affairs*. (Under publication) (Q1)

Schmeller, D. (2023). Élmények a zöldfelületeken: A megélt tér különbségei Stockholmban. *Területi Statisztika*, 63(2), 234–266. (Q3)

Schmeller, D. (2022). A fenntartható városi közlekedés fejlesztése Nantes példáján. *Közlekedéstudományi Szemle*, 2, 24–43.

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Schmeller, D. (2020). A pécsi parkhasználat térbeli különbségeinek vizsgálata. *Területfejlesztés és Innováció*, 13(1-2), 30–42.

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