

Modelling the smart city performance, Croatian Case

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Modelling the smart city performance, Croatian Case

1. Introduction

2. The methodology of the research

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The Objectives of this research

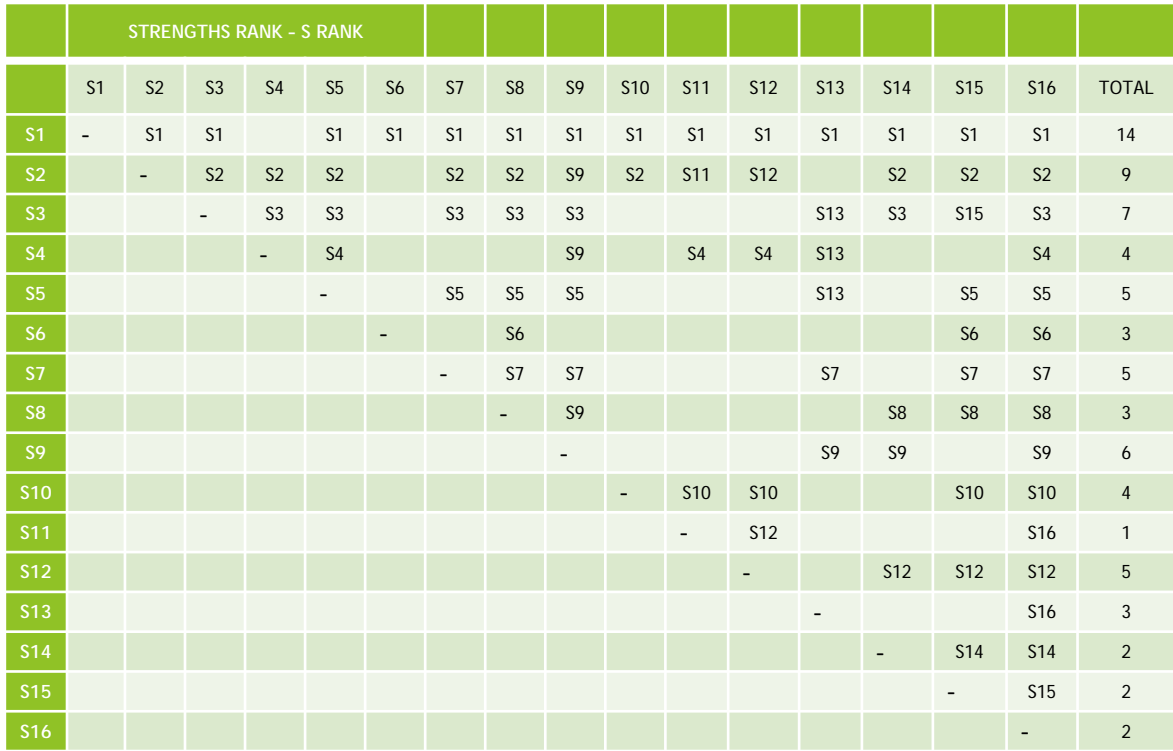
- ▶ use context analysis method - SWOT to identify the factors of strategic importance to the organization,
- ▶ to implement methodologies for a set of indicators which are used to govern in accordance with the strategy,
- ▶ measure the performance and improve the quality of life using ISO 37120 Sustainable development of communities - Indicators for city services and quality of life, and
- ▶ to indicate the problems and issues which appeared in collecting data process

| | POSITIVE | | | NEGATIVE | | |
|----------|--------------------|-----|---|------------|--|--------------------|
| | STRENGTHS | | | WEAKNESSES | | |
| INTERNAL | SMART GROWTH | S1 | County GDP higher than the national average | W1 | reduction in entrepreneurs' income | SMART GROWTH |
| | | S2 | stable number of entrepreneurs in the City | W2 | lack of competitiveness of SMEs | |
| | | S3 | current capacities and know-how in the manufacturing industry | W3 | lack of investment and know-how in research and development and innovation | |
| | SUSTAINABLE GROWTH | S4 | advantageous geographical position | W4 | lack of specialization at SMEs | |
| | | S5 | well-designed energy development | W5 | difficult access to affordable capital for SMEs | |
| | | S6 | possessing competencies in sustainable building | W6 | lack of interest in entrepreneurship for SMEs | |
| | | S7 | existing integrated waste management system | W7 | incoherence of support institutions in the SME sector | |
| | | S8 | good coverage of municipal infrastructure | W8 | poor inter-sector cooperation (culture-tourism-nature-gastronomy) | SUSTAINABLE GROWTH |
| | | S9 | potential large capacity of existing sources of drinking water | W9 | high unemployment rate (growth in the last 10 years to 4.3%) | INCLUSIVE GROWTH |
| | | S10 | rich cultural heritage | W10 | a high proportion of young people (20-25) and the contingent of unemployed | |
| | | S11 | cultural events | W11 | lack of specific highly educated employees | |
| | | S12 | modern and innovative facilities and culture | W12 | educational structure and the County's lagging behind the national average | |
| | | S13 | preserved natural heritage | W13 | declining interest and verified programs | |
| | INCLUSIVE GROWTH | S14 | <u>establishment of CICC[1] with services for the unemployed (information, education, counseling)</u> | W14 | high school graduates (62% of respondents) are not familiar with the possibilities of studying in Koprivnica | |
| | | S15 | The existence of a comprehensive program of learning and Koprivnica | | | |
| | | S16 | the existence of network of formal, informal and informative education | | | |

| | POSITIVE | | | NEGATIVE | | |
|----------|--------------------|-----|--|----------|---|--------------------|
| | OPPORTUNITIES | | | THREATS | | |
| EXTERNAL | SMART GROWTH | 01 | MPS are using funds from the European Regional Development Fund (grants or soft loans) | T1 | continued recession in Croatia | SMART GROWTH |
| | | 02 | connectivity, enterprise and linking SMEs with large companies, cooperation with scientific sector | T2 | lack of interest and knowledge of SMEs and R & D | |
| | | 03 | the development of R & D infrastructure (INNOTECH) | T3 | unavailability of capital for entrepreneurial projects | |
| | SUSTAINABLE GROWTH | 04 | the development of integrated tourism offer, which includes natural and cultural heritage | T4 | insufficient investment and the establishment of an enabling business environment | |
| | INCLUSIVE GROWTH | 05 | further development of an integrated waste management system | T5 | growing trend of natural disasters (floods and droughts) | SUSTAINABLE GROWTH |
| | | 06 | <u>better linking with higher education institutions also with employers and CES[1]</u> | T6 | project Piškornica - financial and environmental risk for the City of Koprivnica | |
| | | 07 | new programs of training for self-employment (EU funds) | T7 | continuation of public funding and abundant supply | INCLUSIVE GROWTH |
| | | 08 | the existence and development of institutions of higher education (high school, POU) | T8 | continuation of the economic crisis and the inability to create new jobs | |
| | | 09 | capacity building and activities for community wellbeing | T9 | insufficient information about study opportunities in Koprivnica | |
| | | 010 | recognizing and encouraging the potential of young people in Koprivnica | T10 | growth of population at risk of poverty | |
| | | | | T11 | depopulation | |
| | | | | T12 | lack of an unified cultural strategy | |

Table 2: Recapitulation of the factors influencing the future development and growth City of Koprivnica

| | P O S I T I V E | | N E G A T I V E | |
|-----------------|--------------------|----|--------------------|---|
| I N T E R N A L | STRENGTHS - 16 | | WEAKNESSES - 14 | |
| | SMART GROWTH | 3 | SMART GROWTH | 7 |
| | SUSTAINABLE GROWTH | 10 | SUSTAINABLE GROWTH | 1 |
| | INCLUSIVE GROWTH | 3 | INCLUSIVE GROWTH | 6 |
| E X T E R N A L | OPPORTUNITIES -10 | | THREATS - 12 | |
| | SMART GROWTH | 3 | SMART GROWTH | 4 |
| | SUSTAINABLE GROWTH | 1 | SUSTAINABLE GROWTH | 2 |
| | INCLUSIVE GROWTH | 6 | INCLUSIVE GROWTH | 6 |

[illegible]

| | |
|-------|--|
| | |
| TOTAL | |
| 7 | |
| 4 | |
| 6 | |
| 4 | |
| 3 | |
| 2 | |
| 3 | |
| 2 | |
| 2 | |
| 1 | |
| - | |
| 1 | |

| TOWS | | STRENGTHS | | WEAKNESSES | |
|---------------|--|---------------------------|---|---------------------------|---|
| | | S1 | County GDP higher than the national average | W1 | reduction of entrepreneurs' income |
| | | S2 | stable number of entrepreneurs in the City | W2 | lack of SME'S competitiveness |
| | | S3 | current capacities and know-how in the manufacturing industry | W3 | lack of investment and know-how in research and development and innovation |
| | | S9 | potential large capacity of existing sources of drinking water | W4 | lack of specialization at SMEs |
| | | S12 | modern and innovative facilities in culture | W5 | difficult access to affordable capital for SMEs |
| | | | | W6 | lack of interest in entrepreneurship for SMEs |
| | | | | W7 | incoherence of support institutions in the SME sector |
| | | | | W8 | poor inter-sector cooperation (culture-tourism-nature-gastronomy) |
| OPPORTUNITIES | | SO STRATEGIES (MAXI-MAXI) | | WO STRATEGIES (MINI-MAXI) | |
| O1 | MPS are using funds from the European Regional Development Fund (grants or soft loans) | 1. | connect SMEs with strong companies in the manufacturing industry in the City of Koprivnica, which will strengthen the business and SME development (S3, O2) | 1. | connect SMEs with large manufacturing companies in the city and to increase the income of SMEs and their competitiveness (W1, W2, O2) |
| O2 | connectivity, enterprise and linking SMEs with large companies, cooperation with scientific sector | 2. | Using the EU funds to develop entrepreneurs' business, which will increase the number and power of the entrepreneur (S8, O1) | 2. | connect SMEs with large manufacturing companies in the city that have developed know-how and are investing significant resources in R & D (W2, O3) |
| O3 | the development of R & D infrastructure (INNOTECH) | 3. | EU funds to use to enrich the content of culture and tourism and to include the natural and cultural heritage (S12, O1, O4) | 3. | to assist SMEs in obtaining funds from the EU funds by investing in the development of SMEs (specialization, competitiveness, increase interest in entrepreneurship, better connections with educational institutions (W2, W4, W6, O1) |
| O4 | the development of integrated tourism offer, which includes natural and cultural heritage | 4. | connecting high educational institutions with strong companies in the manufacturing industry and SMEs to open new employment opportunities (S2, S3, O6) | 4. | develop an integrated tourist offer of undertakings that will benefit and which will contribute to increasing the income of entrepreneurs (W1, O4) |
| O6 | better linking with higher education institutions, with employers and CES | 5. | take advantage of a larger GDP and develop R & D based on the smart city concept linking large companies and SMEs (S1, O2, O3) | 5. | create more effective and more efficient city government, strengthen the support of city institutions and services and to take measures and activities that will provide assistance and training to entrepreneurs and increase their interest in entrepreneurship (W4, W6, W7 |



| THREATS | | ST STRATEGIES (MAXI-MINI) | | WT STRATEGIES (MINI-MINI) | |
|---------|---|---------------------------|--|---------------------------|---|
| T1 | continued recession in Croatia | 1. | Take advantage and use increase of GDP to soothe and partially eliminate the impact of the current recession in Croatia on business entrepreneur and City Development (S1, T1, T3, T4, T7) | 1. | in the Budget of the City to provide funds that will influence on the increasing competitiveness of SMEs, encourage the newly established businesses, stimulate job creation and enterprise development (W1, W2, W3, W7, T3, T4) |
| T3 | unavailability of capital for entrepreneurial projects | 2. | in cooperation with large companies in Koprivnica to increase the interest of SMEs in R & D (S3, T2) | 2. | organize free training for entrepreneurs in order to inform and educate the research, development and innovation based on the Smart City concept in order to increase specialization in business operations and for the access to capital through EU funds (W3, T2, T3, T4) |
| T2 | lack of interest and knowledge of SMEs and R & D | 3. | Redirect the part of an investments in the prevention of the impact of natural disasters (mixed drainage system, etc.), (S1, T5) | | |
| T4 | insufficient investment and the establishment of an enabling business environment | | | | |
| T5 | growing trend of natural disasters (floods and droughts) | | | | |
| T7 | continuation of public funding and abundant supply | | | | |

The most significant impact the City of Koprivnica has on the indicators

- Solid waste – the impact on all 10 indicators (3 core and 7 supporting)
- Environment - the impact of the 7 out of 8 indicators (3 core and 4 supporting)
- Water and sanitation – the impact on all seven indicators (4 core and 3 supporting)
- Economy – the impact on 6 of the 7 indicators (3 core and 3 supporting)
- Water and sanitation – the impact on the 5 indicators (5 core)
- Governance - the impact on the 5 out of 6 indicators (2 core and 3 supporting)
- Transportation – the impact on the 5 out of 9 indicators (1 core and 4 supporting)
- Other areas of the city's impact - the impact on the total of 15 indicators (4 core and 11 supporting).

| ID | ABR. | AREA | NUMBER OF THE INDICATORS | | | | | |
|----|------|----------------------------------|--------------------------|------------|-------|-------------------------|------------------------|------------------------------|
| | | | CORE | SUPPORTING | TOTAL | LOCAL INFLUENCE - TOTAL | LOCAL INFLUENCE - CORE | LOCAL INFLUENCE - SUPPORTING |
| 1 | EC | Economy | 3 | 4 | 7 | 6 | 3 | 3 |
| 2 | ED | Education | 4 | 3 | 7 | 3 | 2 | 1 |
| 3 | EN | Energy | 4 | 3 | 7 | - | - | - |
| 4 | EV | Environment | 3 | 5 | 8 | 7 | 3 | 4 |
| 5 | FN | finance | 1 | 3 | 4 | 2 | - | 2 |
| 6 | FR | Fire and emergency response | 3 | 3 | 6 | 3 | 1 | 2 |
| 7 | GV | Governance | 2 | 4 | 6 | 5 | 2 | 3 |
| 8 | HL | Health | 4 | 3 | 7 | - | - | - |
| 9 | RE | Recreation | | 2 | 2 | 2 | - | 2 |
| 10 | SF | Safety | 2 | 3 | 5 | - | - | - |
| 11 | SH | Shelter | 1 | 2 | 3 | 1 | - | 1 |
| 12 | SW | solid waste | 3 | 7 | 10 | 10 | 3 | 7 |
| 13 | TV | Telecommunication and Innovation | 2 | 1 | 3 | - | - | - |
| 14 | TR | Transportation | 4 | 5 | 9 | 5 | 1 | 4 |
| 15 | UP | Urban planning | 1 | 3 | 4 | 4 | 1 | 3 |
| 16 | WW | wastewater | 5 | | 5 | 5 | 5 | - |
| 17 | WS | Water and sanitation | 4 | 3 | 7 | 7 | 4 | 3 |
| | | TOTAL | 46 | 54 | 100 | 60 | 25 | 35 |

Results presented in this paper:

- ▶ the joint methodology of SWOT and ISO 37120;
- ▶ the possibility of data integration, problems and issues which occurred during the survey;
- ▶ the model of collecting data indicators value used in measuring the compliance with the factors of strategic importance to the City of Koprivnica.

The key contribution of this paper

- ▶ is the systematic research of every data source needed,
- ▶ the procedure of receiving data, intervals, reporting the issues discovered,
- ▶ raising the awareness of the need to have publicly available data, and
- ▶ combining SWOT with ISO 37120 methodology.



Koprivnica – first Croatian „Smart City“ certified by ISO 37120:2014



ICT solutions for Smart City



Technique and infrastructure

- Structural networking and telecommunication infrastructure
- Computer and Communication Network
- Security, WAN, LAN, WiFi (indoor&outdoor), HotSpot



Smart Mobility

- Cloud monitoring vehicles
- Parking solutions
- System of public bikes
- filling stations for electric cars



Smart government and services to citizens

- smart bench
- managing mobile phones
- e-bill
- ERP and GIS systems
- Big data services



Energy and environment

- waste management
- Public lighting control
- Air quality control

Implemented projects

<http://www.komunalac-kc.hr/en/eu-projekti/civits-dynamo/>

<http://www.komunalac-kc.hr/en/eu-projekti/bicko-sustav/>

<http://www.komunalac-kc.hr/en/eu-projekti/biciklisticki-centar/>

<http://koprivnica.hr/novosti/bigbelly-pametni-sustav-za-zbrinjavanje-otpada/>

<http://koprivnica.hr/novosti/grad-koprivnica-dobio-prve-pametne-klupe/>

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WCCD

ISO 37120

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ISO 37120 indicators can be used to track and monitor a city's progress in delivering city services and ensuring quality of life. These performance indicators assist cities in setting targets and monitoring achievements. In order to achieve sustainable development, the whole city needs to be taken into consideration.

As outlined in the ISO 37120 standard, performance indicators have been divided into core and supporting and grouped by themes according to the different sectors and services within a city. This classification has no hierarchical significance and indicators are organized according to how they appear in the ISO 37120 standard.

Profile indicators are also included that provide basic statistics and background information about each city.

ECONOMY

KOPRIVNICA (2016)

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5 ECONOMY

5.1 CITY'S UNEMPLOYMENT RATE (CORE)

10.37 % (2016)

5.2 ASSESSED VALUE OF COMMERCIAL AND INDUSTRIAL PROPERTIES AS A PERCENTAGE OF TOTAL ASSESSED VALUE OF ALL PROPERTIES (CORE)

53.99 % (2015)

5.3 PERCENTAGE OF CITY POPULATION LIVING IN POVERTY (CORE)

33.8 % (2014)

5.4 PERCENTAGE OF PERSONS IN FULLTIME EMPLOYMENT (SUPPORTING)

51.51 % (2015)

5.5 YOUTH UNEMPLOYMENT RATE (SUPPORTING)

8.5 % (2016)

5.6 NUMBER OF BUSINESSES PER 100 000 POPULATION (SUPPORTING)

1 626.07 /100 000 (2015)

5.7 NUMBER OF NEW PATENTS PER 100 000 POPULATION PER YEAR (SUPPORTING)

0 /100 000/yr (2015)

6 EDUCATION

6.1 PERCENTAGE OF FEMALE SCHOOL-AGED POPULATION ENROLLED IN SCHOOL (CORE)

124.41 % (2015)

6.2 PERCENTAGE OF STUDENTS COMPLETING PRIMARY EDUCATION: SURVIVAL RATE (CORE)

100 % (2015)

6.3 PERCENTAGE OF STUDENTS COMPLETING SECONDARY EDUCATION: SURVIVAL RATE (CORE)

97.93 % (2015)

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WCCD

ISO 37120

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Profile indicators are also included that provide basic statistics and background information about each city.

KOPRIVNICA (2016) *

FINANCE

ZAGREB (2016) *

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9 FINANCE

9.1 DEBT SERVICE RATIO (DEBT SERVICE EXPENDITURE AS A PERCENTAGE OF A MUNICIPALITY'S OWN-SOURCE REVENUE) (CORE)

5.71 % (2015)

3.9 % (2016)

9.2 CAPITAL SPENDING AS A PERCENTAGE OF TOTAL EXPENDITURES (SUPPORTING)

6.21 % (2015)

5.41 % (2015)

9.3 OWN-SOURCE REVENUE AS A PERCENTAGE OF TOTAL REVENUES (SUPPORTING)

70.58 % (2015)

29.48 % (2015)

9.4 TAX COLLECTED AS PERCENTAGE OF TAX BILLED (SUPPORTING)

75.09 % (2015)

— NOT AVAILABLE —

10 FIRE AND EMERGENCY RESPONSE

10.1 NUMBER OF FIREFIGHTERS PER 100 000 POPULATION (CORE)

220.26 /100 000 (2015)

46.08 /100 000 (2015)

10.2 NUMBER OF FIRE RELATED DEATHS PER 100 000 POPULATION (CORE)

0 /100 000/yr (2015)

0.51 /100 000/yr (2015)

10.3 NUMBER OF NATURAL DISASTER RELATED DEATHS PER 100 000 POPULATION (CORE)

0 /100 000/yr (2015)

0 /100 000/yr (2011)

10.4 NUMBER OF VOLUNTEER AND PART-TIME FIREFIGHTERS PER 100 000 POPULATION (SUPPORTING)

579.81 /100 000 (2015)

1 119.47 /100 000 (2015)

10.5 RESPONSE TIME FOR EMERGENCY RESPONSE SERVICES FROM INITIAL CALL (SUPPORTING)

1.47 min (2015)

2.26 min (2014)

10.6 RESPONSE TIME FOR FIRE DEPARTMENT FROM INITIAL CALL (SUPPORTING)

1 min (2015)

7.49 min (2015)

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HR

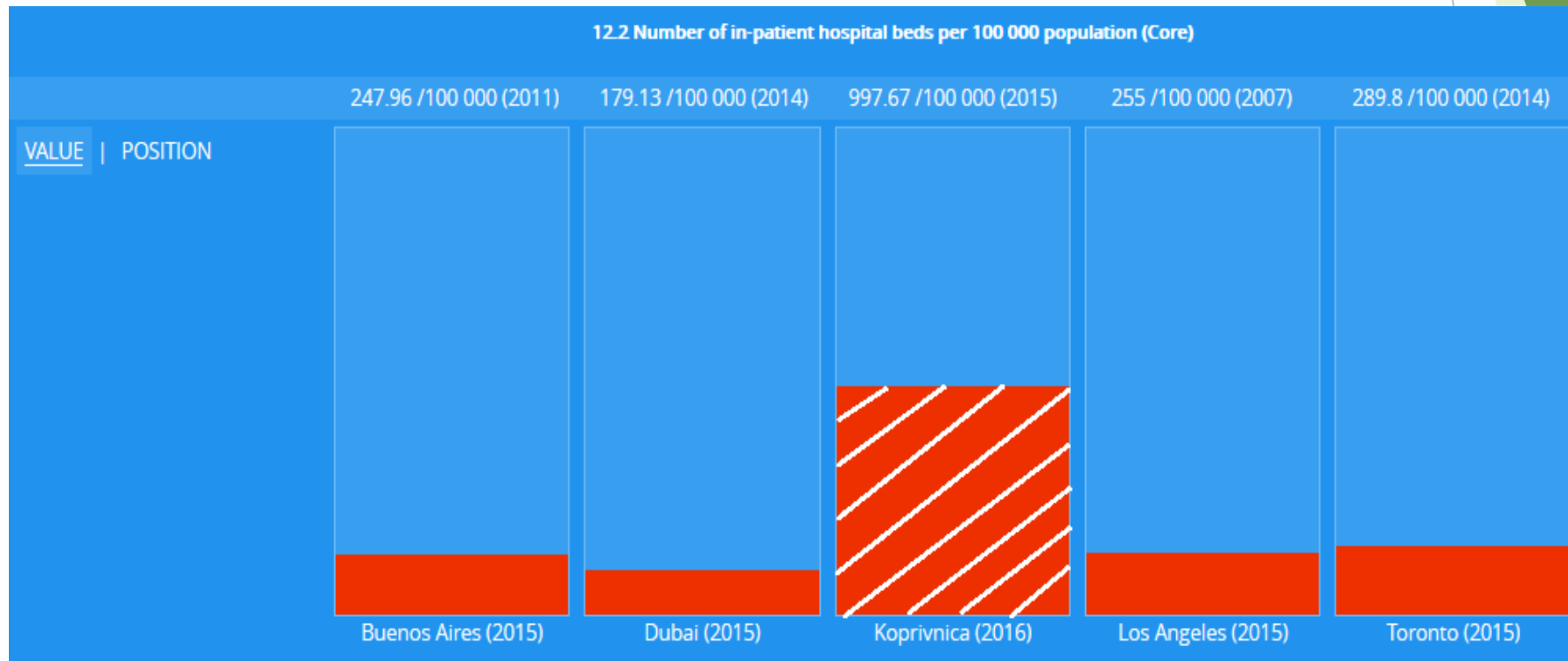
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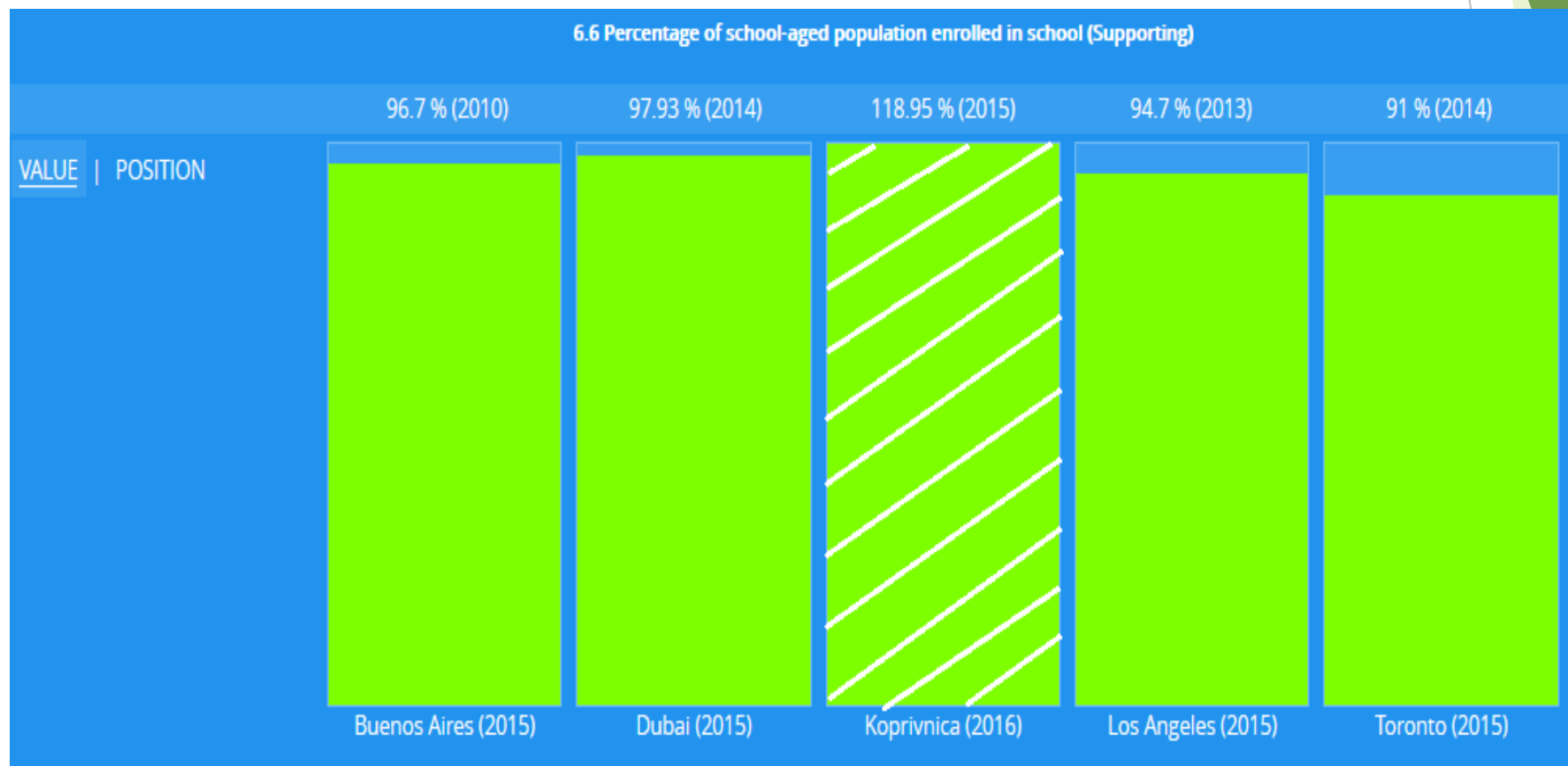
Benchmark with other cities

Koprivnica has the best position in:

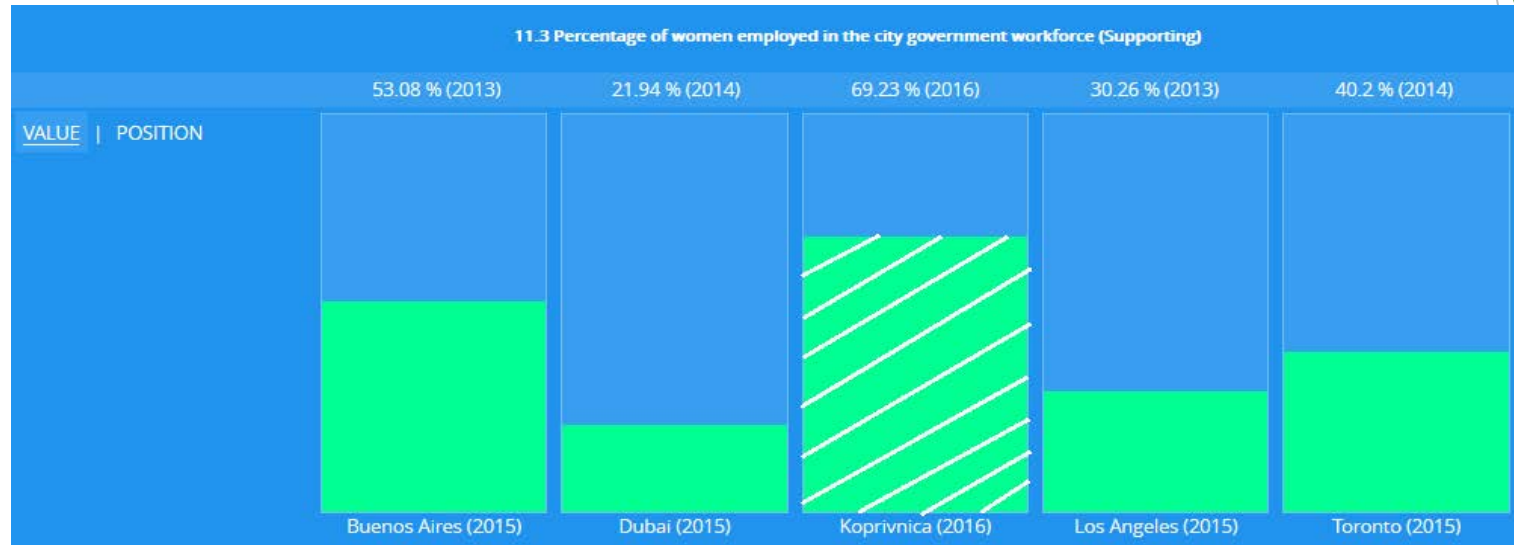
- Number of in-patient hospital beds per 100 000 population



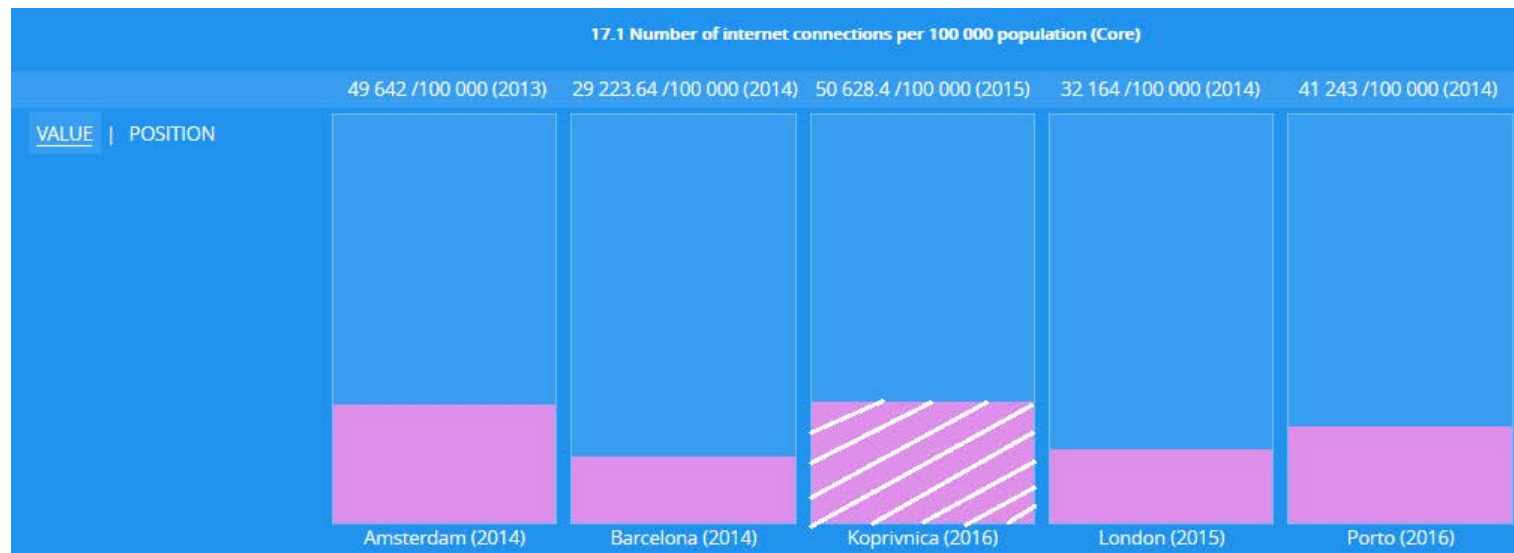
► Percentage of school-aged population enrolled in school



- Percentage of women employed in the city government workforce

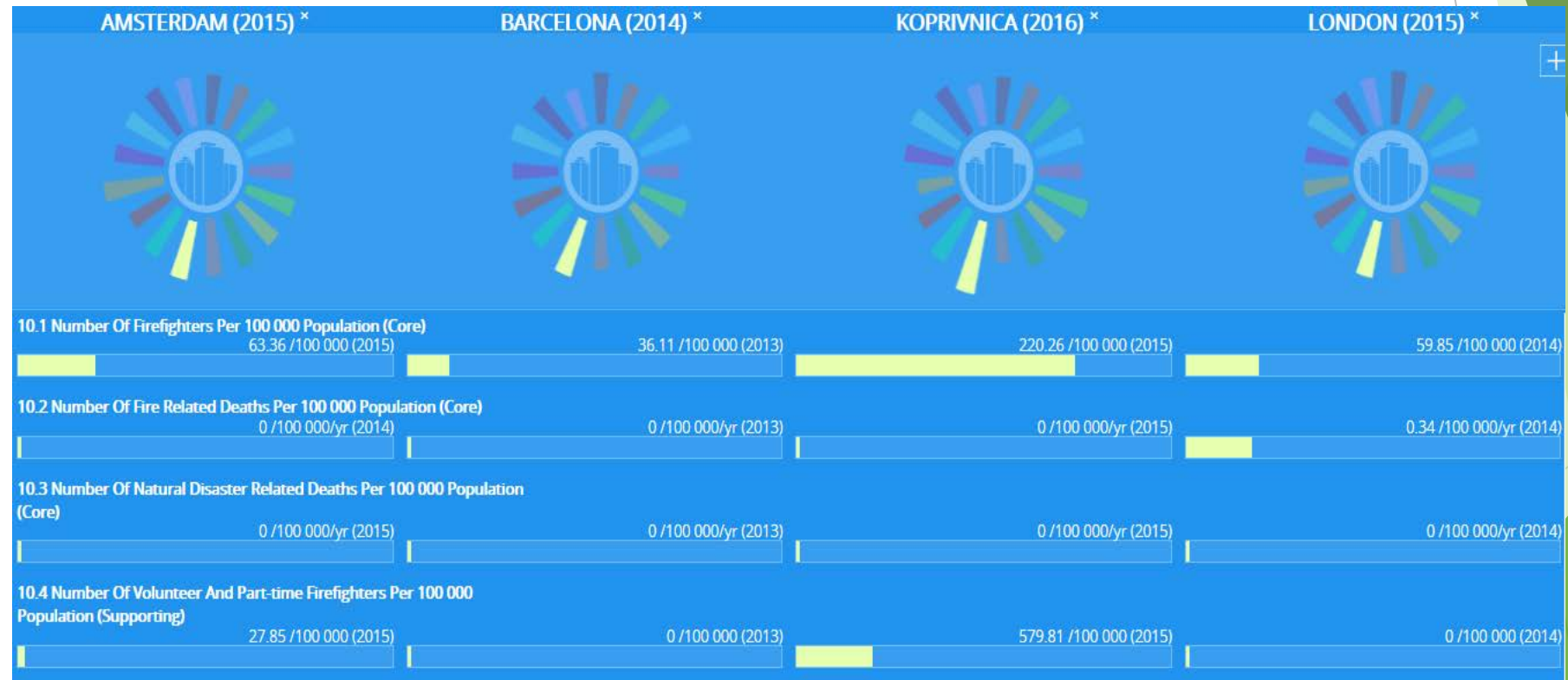


- Number of Internet connections per 100 000 population



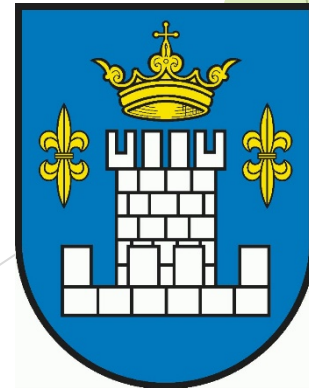
Comparing Koprivnica and other EU cities

- Number of Firefighters per 100 000 population



Important indicators to consider in next period

- 5. Economy – decrease the unemployment rate, decrease the poverty rate, stimulate innovations and increase number of patents
- 8. Environment – % change in number of native species and Noise pollution haven't been measured;
- 13. Recreation – Square meters of public indoor recreation space per capita and Square meters of public outdoor recreation space per capita



Further projects

- ▶ Implementing living lab
- ▶ Smart street
- ▶ Air quality measurement
- ▶ Digitalised system of waste bins for managing