A SUSTAINABLE CITY IN THE CONTEXT OF URBAN DEVELOPMENT

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DOI: https://doi.org/10.31410/ERAZ.2020.253

Abstract: *The concept of sustainable cities is based on a development paradigm that recognizes the rapid growth of urban population and makes an important contribution by forming a global urban plan. Sustainable city is organized in order to emphasize the importance of people and their needs. This paper will define what sustainable city is and show how certain innovative elements have been introduced in Copenhagen in order to achieve city sustainability. In that regard, an overview of innovative urban solutions in the context of environmental protection will be given. A comparative analysis of the achievement of the SDG 11 objective - Sustainable Cities and Sustainable Communities in Copenhagen will be carried out in relation to the other European Union capitals. The aim of this research is to determine whether Copenhagen is a sustainable city and how sustainable cities contribute to promoting the sustainable development goals. Finally, proposals will be made to achieve those objectives for other cities, based on the results achieved by the City of Copenhagen.*

Keywords: *Sustainable development, Sustainable city, Copenhagen, Environmental protection, Urbanism and urban revitalization.*

1. SUSTAINABLE CITY

In the 1980s, initially sustainable urban development was linked to environmental protection and later to environmental sustainability in the United Kingdom. Littig and Griessler, 2005 stated that every sustainable city should develop a political-institutional, environmental, economic and social dimension following the guidelines of the United Nations and the Commission on Sustainable Development. Kemp and Saeed (2015) emphasize that such an approach includes the level and scope of political allocation, the dominant orientation of the state and other institutions, and their interactions. Höjer and Wangel, (2015) state that sustainable urban development has become a precondition for sustainable development. Also, „smart" is a keyword that attracts huge interest from companies dealing with information and communication technologies (ICT) and ICT infrastructure. Marsal-Llacuna et al. (2015) state that smart city initiatives, using data and information technology, target more efficient services to citizens, monitor and optimize existing infrastructure, increase collaboration between different economic actors, and encourage innovative business models. According to Ferrara, (2015) smart cities include all aspects related to the environment and energy, more efficient urban transport systems and better waste disposal systems. Therefore, the concept of a smart city implies better use of resources and less polluting emissions (Ferrara, 2015: paragraph 2.1). Moreover, the United Nations adopts the New Urban Agenda (NUA) (2016), which sets out the principles for implementing the New Urban Agenda

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(NUA, 2016) and sets out the principle of „providing equal access to all physical and social infrastructure and basic services". Soewarno et al. (2019) emphasize the importance of green innovation concerning green products and processes, including energy-saving, pollution management, waste recycling, product design and environmental management. In a study by Ahvenniemi et al. (2017) predict that, according to the United Nations, by 2050, 66% of the world's population will live in urban areas, resulting in major challenges in the context of air pollution, waste management and human health. However, it should be noted here that recently there has been some progress in understanding the concept of cities and that more and more cities are striving to achieve the goals of a smart city (smart city) rather than the goals of a sustainable city. According to Falch and Maestrini (2019), the concept of smart cities includes five key factors; digital technology, environmental sustainability, civic initiatives, mobility and work. On the other hand, for example, the Smart Cities Index identifies 19 indexes, while others identify six macro areas of smart city intervention: smart people, smart governance, smart life, smart mobility, smart environment, and smart economy (Giffingeret al., 2007). Cities can be found to play a key role in combating climate change. Application of new innovative technologies is considered a key factor in reducing greenhouse gas emissions and improving energy efficiency in cities.

2. INNOVATIVE ELEMENTS FOR ACHIEVING COPENHAGEN SUSTAINABILITY

In 2009, the Copenhagen climate plan was adopted, which set the policy of achieving a 20% reduction in CO2 emissions by 2015 and the city strategic goal of becoming the first CO2-neutral capital in the world by 2025 (Climate Plan CPH 2025, 2012). Floater et al. (2014) state that 2011 CO2 emission was 1.9 million tonnes for the city of Copenhagen, with existing initiatives predicting that it will be reduced to 1.2 million tonnes by 2025. The majority of emission reductions (74%) are expected to come from energy production, transport sector (11%), energy consumption (7%), new initiatives (6%) and municipal operations (2%) (Floater et al., 2014, p. 86), Floater et al. (2014) emphasize that combined heat and power district heating networks exceeded 95% in Copenhagen, and certain generators rely considerably on fossil fuels. Copenhagen will generate higher, low-carbon electricity that can be exported in the grid, and will do so from its biomass cogeneration grid and wind farms outside Copenhagen. Ben Amer et al. (2019) have developed a model that shows how the greater city of Copenhagen in 2025 will reach zero emissions in the water and electricity sector, whereby Copenhagen can achieve its goal by phasing out fossil fuels. Ben Amer et al. (2019) state that CO2 levels in Denmark, but also in Copenhagen, will decrease between 2020 and 2025. In the context of waste management, as an innovative element that achieves sustainability of the city, Gottlieb (2019) drafted Plan 24 (Resource and Waste Management Plan 2024), which aims to make 70% of household waste recycled in 2024, compared to 45% from 2018. In 2010, an analysis was made that showed that only 27% of waste was recycled of which 41% of biowaste is incinerated. The plan is to reduce 59,000 tons of CO2 in 2024 with an emphasis on the utilization of biowaste in biogas (Resource and Waste Management Plan 2024, 2019). Falch and Maestrini (2019) analyse the solution of the Danish start-up company NordSense, which designed an innovative waste disposal solution in Copenhagen that includes various analytical tools for route planning and optimal placement as well as emptying of containers. Transport solutions that affect the sustainability of the city increase the proportion of residents who feel safe while cycling - from 67% in 2010, to 80% in 2015 and further to 90% in 2025 (Copenhagen, 2014). Those solutions were achieved with more and broader bicycle lanes, improved designed intersections and series of behavioural campaigns

(Copenhagen, 2014). In 2013, an intelligent bicycle sharing system was developed and integrated into a transport system with buses, trains and subways. The innovative solution has resulted in increased usage of public transportation and reduced use of cars.

3. INNOVATIVE URBAN SOLUTIONS IN THE CONTEXT OF ENVIRONMENTAL PROTECTION

Cucca (2017) states that national and local governments have promoted several urban development strategies in order to increase the attractiveness of the city. Those strategies presented Copenhagen as one of the most environmentally friendly cities in Europe. The strategy improves the quality of the urban environment related to waterfront redevelopment, new ecological neighbourhoods, green (social) housing and urban neighbourhood renewal in line with stability standards (Cucca, 2017). In the period from 2014 to 2018, the average price of real estate in Copenhagen increased at an annual rate of 5.7%, i.e. the total real estate prices in the city increased by more than 25% (Statistics Denmark, 2020). At the same time in Copenhagen, almost 40,000 new residents moved in, which affected the increase of real estate prices. Alves (2019) states that the transformation of obsolete dwellings into modern and attractive housing has led to the transformation of tenures and costlier housing. That confirms the thesis that Copenhagen will become a city reserved only for rich people. Winter (2018) states that a sustainable lifestyle is strongly associated with two contradictions: exclusivity and privileged which makes it available only to certain classes. She concludes that in Copenhagen, a sustainable lifestyle is a unique privilege, as well as that the suburbs and their higher ecological footprints damage the goals and image of Copenhagen. Alves (2019) analyses Copenhagen strategies in the context of housing policy and states that access to non-profit housing should be open to all, regardless of their income.

4. COMPARATIVE ANALYSIS OF SDG 11 ACHIEVEMENTS

Sustainable development Goal (SDG) 11 - Sustainable cities and communities include ensuring access to adequate, safe and affordable accommodation, expanding public transport, as well as improving inclusive and sustainable urbanization and sustainably manage communities. One of the most important points is to reduce the harmful impact of cities on the environment per capita and pay special attention to air quality and manage municipal and other waste. The SDG 11 data is stated in the report of the Sustainable Development Solutions Network published by the SDSN and Bertelsmann foundations in 2019.

Table 1 shows 10 individual indicators to measure the fulfilment of SDG 11 indicators which was set by the SDSN in 2019. Compared to other European Union capitals Copenhagen ranks 10th overall. Of the indicators set, Copenhagen fully met 3: satisfaction with public transport, ranking 11th place in the EU, satisfaction with cultural facilities (7th place), number of concerts and shows per 100,000 inhabitants (11th place). In Copenhagen, there are smaller challenges remaining in reducing the concentration of PM2.5 particles (microgram/m3) and increasing the number of charging stations for electric vehicles. The biggest challenge for Copenhagen is the reduction of NO2 emissions, ranking it 24th place in the EU. The indicator of satisfaction with affordable housing ranks Copenhagen 24th in the EU, and the rate of congestion of housing cost overburden rate in urban areas is almost the highest in the European Union (26th place).

Table 1. The European Union (EU) Cities SDG 11 Index – Performance by indicator

City	Overall score- SDG 11	Concentration PM2.5 (microgr/m3)	Emission of nitrogenoxides (kg/km2)	Satisfaction affordable housing (%)	Housing cost overburden rate in urban areas (%)	Recharging stations (per 10.000 people)	Satisfacton public trasnport (%)	Satisfaction cultural facilities (%)	Sights and landmarsk (per 100.000 people)	Museums (per 100.000 people)	Concerts and shows (per 100.000 people)
Stockholm	57,40	5,51	5,91	7	10,60	0,16	79	55	95	69	19
Helsinki	55,70	8,96	18,29	8	5,60	0,41	93	55	85	61	16
Copenhagen	57,50	11,27	16,00	8	22,40	0,73	75	54	148	78	34
Paris	60,80	17,50	5,24	4	6,80	0,24	79	44	468	216	239
Amsterdam	75,70	15,56	8,44	10	12,20	4,96	82	56	166	135	81
Luxembourg	47,30	16,30	23,97	13	14,60	1,10	80	42	36	16	4
Vienna	72,50	18,00	4,52	18	11,30	0,42	95	80	244	117	99
Ljubljana	54,80	20,26	5,54	27	7,20	0,43	75	45	53	29	11
Berlin	76,70	16,29	4,42	10	17,90	1,44	84	58	315	204	105
Dublin	60,30	10,55	12,49	12	6,30	0,90	75	42	182	89	71
Bruxelles	52,40	18,25	4,38	19	14,70	0,41	71	27	161	98	21
Bratislava	39,40	18,33	7,46	14	7,80	0,48	54	20	124	36	2
Prague	74,00	18,62	3,85	28	13,40	0,44	86	57	340	309	136
Madrid	60,50	9,95	5,99	37	11,30	0,16	72	23	376	112	137
Tallinn	57,50	8,22	9,26	17	5,90	0,79	71	46	87	86	11
Warsaw	49,00	26,30	6,57	24	9,00	0,14	76	30	118	60	19
Zagreb	53,30	21,84	7,69	50	5,90	0,11	76	31	56	39	13
Vilnius	48,90	22,99	3,86	33	5,60	0,11	56	39	83	44	9
Riga	45,50	16,80	6,78	23	7,00	0,03	67	29	69	57	10
Budapest	58,70	25,00	3,92	33	10,90	0,58	67	33	180	95	38
Sofia	45,70	21,86	4,49	41	17,70	0,08	74	13	50	21	11
Lisbon	49,70	11,15	6,52	14	7,90	0,89	54	15	163	88	54
Rome	46,70	17,02	3,49	19	11,70	0,25	30	19	795	191	94
Bucharest	45,00	22,89	2,45	42	9,60	0,04	48	19	105	47	24
Valletta	40,40	N/A	4,44	44	1,50	0,98	46	16	39	16	6
Nicosia	50,90	17,03	2,48	43	3,50	0,12	41	N/A	135	63	13
Athens	57,90	15,00	4,48	62	43,70	0,04	72	17	112	97	32

Source: https://euro-cities.sdgindex.org

5. CONCLUSION

Innovation has a positive impact on achieving the goals of sustainable development. Sustainable cities contribute to environmental protection as the natural ecosystem, together with social, economic and cultural elements are integrated into a single system. It is necessary to build sustainable cities and thus contribute to the implementation of sustainable development. The implementation of innovations in a sustainable and smart city achieves economic development and ensures a better quality of life for its inhabitants. The conducted research showed that Copenhagen is not the best city in meeting the set indicators of Sustainable Development Goal 11, but it is certainly on the way of becoming one. The City of Copenhagen recognized the importance of sustainable development in time and started raising citizens' awareness and developing the quality of life in urban areas early on. Copenhagen has made progress in certain areas, primarily traffic electrification and increasing the use of renewable energy sources. However, the results showed that the biggest problems are with the satisfaction of citizens with affordable housing, which should be solved by continuous urbanization by 2030. Based on the results of the City of Copenhagen, other cities could achieve the objectives of SDG 11 by implementing innovative elements in the areas of waste management, urban development, transport, energy, etc.

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