Environmental urbanism and sustainable cities

M Ostárek

1Technical University of Ostrava, Faculty of Civil Engineering, Ludvíka Poděště 1875/17, Ostrava-Poruba, 708 33, Czech Republic

Abstract. The paper focuses on the links between sustainability and urbanism with a focus on the environment. In order to achieve the sustainability of cities, it is necessary to monitor the balance between economic, social and environmental interests, and urbanization is closely linked to this. Urbanism with a focus on the environment or ecological urbanism is a type that focuses on projects in ecological aspects, such as humidification, temperature reduction in the city, energy buildings, planting, urban surfaces, etc. Sustainability of cities is also one of the topics of the United Nations which generally addresses Sustainable Development Goals. In order to achieve the goal of sustainable cities, it is necessary to ensure access to trouble-free and affordable housing and services for all citizens by 2030. This development program is set for the time period 2015-2030. As far as the city is concerned, this in itself fundamentally affects the quality of the surrounding environment, especially interventions in undeveloped areas, land use and city administration. Spatial urban development is also focused in detail on searching and regeneration of unused areas which can have a negative impact in the form of slower growth or decline. The newly emerging BIM method, which demonstrably streamlines the management and development of cities, can also contribute to overall sustainability which further leads to the concept of smart cities. It is a concept of smart cities of urban development that moves to the sectors of management, energy, environment, infrastructure and population in an effort to streamline the management and development of cities using new methods. The result of the work is to show cities as the powerful player in reducing of greenhouse gas emissions which can help to build more liveable environment. Cities are not the biggest problem but the biggest opportunity for change.

1. Introduction
Cities are places of innovation that drive the economy and at the same time they are the places where most people live. Therefore it is important to provide them with pleasant and safe living with respect for the environment. The Sustainable Development Plan addresses this issue and it is set for the end of 2030. Another challenge is the uncontrolled expansion of cities which is an important factor that affects the urban environment by changing natural conditions. Urbanization mainly changes surface conditions and this change is reflected in the absorption of solar radiation, heat release back, water conditions, etc. Higher heat and loss of groundwater can be observed in built-up areas compared to undeveloped areas. These interventions in the landscape cause unsustainability due to the loss of drinking water and unacceptable heat waves, which have a negative effect on the human body, and therefore these problems must be taken into account more and more. With a larger influx of inhabitants and the rapid expansion of cities, the question of urban governance and the use of innovative technologies also arises, thus the first smart cities are being created, which seek to apply more effective tools for the organization and management of the city.
2. **Environmental urbanism**

Environmental or ecological urbanism is an urban architectural landscape style that focuses on ecological aspects. These environmental aspects focus on elements that humidify the air and lower the temperature in cities. More precisely, they are park plantings, green roofs, natural or technical water elements, permeable surfaces and seepage. With regards to climate changes together with urbanization, cities are struggling to cope with these challenges and focus more on ecological urbanism. Heat waves in cities are starting to be longer, more intense and also more frequent which has a negative effect on the health of the city's population. These adverse effects can be at least partially prevented, it is only necessary to set mitigation and adaptation goals [3, 10].

Adaptation is timely adaptation to the expected negative effects, it is possible to adapt, for example, by retaining and using rainwater, using greenery, changing farming, etc. with a quick visible effect. Mitigations are measures aimed at reducing greenhouse gases using renewable resources and are more likely to be felt in the longer term.

2.1. **Solutions in warming cities**

Problems with overheating of areas in cities are everywhere where there is not enough greenery. Shaded tree areas can reach half the temperature of unshielded areas. However, trees also bring negative effects, such as breaches of engineering networks, environmental pollution or even crime. Another way to reduce the temperature in cities is to use green roofs, green facades, vertical gardens, restoration of parks as well as open water areas. We know from experience that green areas play an important role in climate regulation, protection against noise, wind, dust and exhaust gases [3, 10].

3. **Sustainable cities**

The concept of sustainable cities appeared at the turn of the 60s and 70s of the last century, depending on environmental pollution and the risk of depletion of minerals. Another link with sustainable cities is the uncontrollable growth of cities and the decline in the quality of life in cities. These issues are addressed in more detail by the United Nations which also mention the sustainability of cities in one chapter of the Sustainable Development Plan. The problem is that around 60% of the population should live in cities in 2030, and in the coming years the urban population should continue to grow. Today, the share of the urban population is about 50% while in the percentage of the urban population in 1950 was only 29%. Due to this enormous increase of urban population of 30%, urbanization must be built on the top of our interest. The city is the key to global economic growth, but it also poses a huge risk to the environment. Rapid and uncontrolled urbanization makes cities highly vulnerable to climate change, such as floods, droughts and heat waves. The aim is therefore to ensure that all people have access to safe and affordable housing and services by 2030, which will not be easy at all, as many cities still contain slums. This rapid urban development and the relocation of the population to cities continue to put pressure on the environment. Energy intensity is linked to urban development and we are pushed into renewable resources by carbon limits where water, sun and wind serve as our source. Greener energy brings us a reduction in the cost of running the city and a reduction in pollution. Together, these aspects create a cheaper city with a better quality of life. In order for cities to be sustainable, there is a need to move to sustainable energy sources. Today, the energy used in cities is mainly generated from fossil fuels. Interestingly, even though cities occupy only 2% of the earth's surface, they consume 60-80% of energy and at the same time generate ¾ greenhouse gas emissions thereby this situation is not sustainable [1, 4, 6].

3.1. **Ecological cities**

This type of city focuses more on environmental sustainability than on economic and social indicators. The ecological city is based on analytical categories such as development, which takes place through multiple domains and is also supported by political processes. The most important thing for an ecological city is sustainable urban development and transport. The Table 1 lists the types of ecological cities, where you can see a possible development towards the third type of city and where the ambition is to have cities both smart and green [4].
Table 1. Ecological city models.

| Type 1                  | Type 2                  | Type 3                  |
|------------------------|-------------------------|-------------------------|
| Eco-village            | Eco-City                | Symbiotic City          |
| Solar City             | Eco-District            | Carbon Neutral City     |
| Solar Village          | Environmental City      | Zero Energy City        |
| Cohousing              | Green City              | Zero Carbon City        |
| Sustainable housing    | Garden City             | Net Zero Carbon Community|
|                        | Sustainable Neighborhood|                         |
|                        | Sustainable Community   |                         |
|                        | Sustainable Urban Living|                         |
|                        | Living Machines         |                         |

3.2. Sustainable city and transportation in the city

All cities are dependent on transport and without a functioning transport system they are almost uninhabitable. If we want a sustainable city we need also reduce cars in cities and replace them with more sustainable transport as is public transport, bicycle etc. Copenhagen, for example, is decarbonising transport, providing bicycles for transport, and public transport is more focused on the use of renewable energy sources. Furthermore in transport, it is necessary to think about even the weakest groups of the population and ensure their access to quality public transport. It means to have the whole city covered by public transport. It is interesting that smaller cities have more registered cars than larger cities and this results in more pollution. The more efficient public transport in large cities leads to reduction the need to own a car for transport in the city [2].

4. Smart city

Cities across Europe and elsewhere in the world are transforming into smart cities, which is an effort to innovate in urban development. This concept can be divided into two basic categories: the first category focuses on the implementation of new innovative technologies in transport, infrastructure and expansion of services among the population, the second category focuses on cooperation between stakeholders, public sector, business and academic, non-profit organizations and city residents who are involved in the changes and development of the city.

For reasons of sustainability and sustainable development, there is a need to be able to understand and organize the city in more detail in order to achieve greater habitability. Therefore, traditional cities are beginning to develop new ways of organizing that lead to the concept of smart cities. Over the last 20 years, the concept of smart cities has become so popular that almost everyone is considering innovative technologies to turn them into smart cities. Smart cities have the task of using data and technology in order to increase efficiency and sustainability and, above all, to improve the quality of life in the city [5, 7, 9].

4.1. City information model

The creation of the City Information Model (CIM) is essential for the digitisation of the whole process of construction, facility management and other elements in the city. This model contains GIS data, which is a model containing geographic objects or surfaces as data. It also contains a digital building model or BIM model, IoT, AI and other data. As a result, we have the entire city in a three-dimensional environment and with high accuracy. Thanks to CIM, we can perform various visualizations of the entire city, plan construction more efficiently and streamline the entire process of spatial planning, construction and traffic management [5, 9].
4.2. Definition of smart cities
“Smart city is a concept of urban transformation that should aim to achieve a more environmentally sustainable city with a higher quality of life that offers opportunities for economic growth for all of its citizens, but with respect to the particularities of each locality and its existing inhabitants. This transformation is currently enabled by various types of technologies…that are embedded into the city's infrastructure system.”

4.3. Standardization of smart sustainable cities
International standardization work is carried out by ISO and ITU organizations worldwide and also by the European standardization organizations CEN, CENELEC and ETSI in the Sector Forum on Smart and Sustainable Cities and Communities (SFSSCC), which was created in January 2017. Today, there are six international standards cities which can be assessed to see if they meet the requirements of a sustainable city. ISO standards have been developed with sustainability as a guiding principle and can be used in conjunction with a holistic approach to urban sustainability. The World City Data Council is working on the development of ISO indicators to certify cities. ISO standards that deal with sustainable cities are ISO 37120: 2018 - Sustainable cities and communities - Indicators for city services and quality of life, ISO 37122: 2019 - Sustainable cities and communities - Indicators for smart cities and the third standard ISO 37123: 2019 - Sustainable cities and communities - Indicators for resilient cities [8].

5. Conclusion
The area of environmental urbanism and sustainable cities will be an increasingly discussed topic in the coming years due to uncontrolled urban sprawl, climate change and population growth. If we want to give a habitable, safe and pleasant place on earth to our descendants, we must adhere to the Sustainable Development Plan, which is discussed in detail by the United Nations. A big problem that is being addressed everywhere is car transport in cities, which reduces the quality of life. Therefore, many large cities have decided to push cars out of cities and replace them with greener transport. It is necessary to push government, academic and business sector and everyone of us focuses more on preventing abnormal overheating and help in a better quality of life in cities such as greenery in cities, parks, green buildings, etc.

Thanks to digitisation, the smart cities concept is on the right track for greater efficiency. It can bring considerable benefits in the area of asset management, registration and economy. All records should be standardized for better use of data. Today, there are already different standards for smart cities, and many cities are trying to follow these standards.

To conclude, cities contribute the most of greenhouse gas emissions, and yet, at the same time, they offer the best hope for reducing the ecological footprint on a global scale. The sustainability of cities is a right way to achieve that goal. I believe that everyone will start to think about the environment around him and will contribute to better place on earth. Cities are our home, place for work and place where we live almost whole life.

References
[1] Bibri S E, Krogstie J and Kärrholm M 2020 Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability Developments in the built environment 4 100021
[2] Bibri S E 2021 Data-Driven Smart Sustainable Cities of the Future: An Evidence Synthesis Approach to a Comprehensive State-of-the-Art Literature Review Sustainable Futures 100047
[3] Casanelles-Abella J, Chauvier Y, Zellweger F, Villiger P, Frey D, Ginzler C, ... and Pellissier L 2021 Applying predictive models to study the ecological properties of urban ecosystems: A case study in Zürich, Switzerland Landscape and Urban Planning 214 104137
[4] Crane M, Lloyd S, Haines A, Ding D, Hutchinson E, Belesova K, ... and Turcu C 2021 Transforming cities for sustainability: A health perspective Environment international 147 106366
[5] Deng T, Zhang K and Shen Z J M 2021 A Systematic Review of a Digital Twin City: A New Pattern of Urban Governance toward Smart Cities *Journal of Management Science and Engineering*

[6] Kuklina V, Sizov O and Fedorov R 2021 Green spaces as an indicator of urban sustainability in the Arctic cities: Case of Nadym *Polar Science* 100672

[7] Haarstad H and Wathne M W 2019 Are smart city projects catalyzing urban energy sustainability? *Energy Policy* 129 p 918-925

[8] Huovila A, Bosch P and Airaksinen M 2019 Comparative analysis of standardized indicators for Smart sustainable cities: What indicators and standards to use and when? *Cities* 89 141-153

[9] Nunes S A, Ferreira F A, Govindan K and Pereira L F 2021 “Cities go smart!”: A system dynamics-based approach to smart city conceptualization *Journal of Cleaner Production* 127683

[10] Yang Z, Chen Y and Wu Z 2021 How urban expansion affects the thermal environment? A study of the impact of natural cities on the thermal field value and footprint of thermal environment *Ecological Indicators* 126 107632