Sustainable City Forms

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Abstract. Twenty first century characterises with approach of sustainability in different scales of spatial planning. During the pandemic in 2020 and 2021 more and more attention has been paid on health and well-being of population. Remembering that two thirds of all European population live in cities the theme of sustainability of living environment became even more important following SDG 11 “Sustainable Cities and Communities”. People in the cities more often seek for possibility to spend time outdoors, preferably in nature. It has become the important issue not only for individuals but also for governors of local municipalities and big cities providing such opportunity for their inhabitants. In order to find the best possible solution for development of urban environment it is important to know what are the choices available and best practise realized in spatial planning sustainability context. During the last five decades and even earlier different researchers and city planners have been defining possible city forms to ensure sustainability and well-being of todays and next generations. The purpose of research paper is to show the variety of sustainable city forms outlined in research papers and formed by collaboration of progressive cities. To strengthen the importance of new approaches in city planning, there are examples of the best practise of some European counties following SDGs in spatial planning of their territories showed. The analysis of situation in different countries clarifies that development of green infrastructure, use of local resources and support of local initiatives are the best approaches for any place to reach the sustainability because fulfilling the needs of local inhabitants for qualitative outdoors results in better life not only for locals, it plays also important role for forming good image of municipality and country increasing sense of proud of such place. City municipalities need to put more effort for developing sustainable communities providing healthy and attractive living environment for local and even new inhabitants in place where living, work and recreation are in balance with nature.

1. Introduction
In spite of all bad things what pandemic time brought to us, it was time to re-evaluate our true qualities in order to recognize what really is important in sustainability matters. This time has changed mindset of many people highlighting importance of nature and nature elements in everyone life. We more often appreciated possibility to attend city park or public square, we appreciate trails along the river shore in city of countryside for walking or jogging or riding a bicycle.

Post-pandemic time can now be used for rethink approaches and targets set in the spatial planning documents to improve or make possible cities to offer healthier environment. Many European cities implementing different approaches of sustainability more often offer society better living conditions. It is time to follow what municipalities do to improve life for their inhabitants. Big help in this process are Sustainable Development Goals set by UN and agreed worldwide.
2. Methods

Research was done to identify emergent themes for sustainability raised by spatial planners during the online webinars and conferences. Long practical experience in work with students in Latvian University of Life Sciences and Technologies was used to introduce forms of sustainable city developed worldwide. Literature review was done on selected topic. Information about latest findings were investigated also in official webpages of European Commission, UN and alliances of separate sustainable city networks. Set of variables was identified to characterize and compare forms of sustainable city. Evaluation of importance of chosen variables was done by experts and practitioners working in fields of spatial planning, architecture and landscape architecture.

3. Results and discussions

Dealing with issues about sustainability politicians and planners have always had a need to set a certain framework (or lens) for any place because of different location, history, possibilities and plans depending of resources and traditions of a nation living in concrete place with specific conditions. Although there are common megatrends nowadays challenging all the nations and they are: increasing number of population and need for more energy to operate all the existing and new equipment we produce.

Average of a calculated lifespan in 2030 worldwide is 81.5. Life expectancy is increasing in high income and upper middle-income countries (see figure 1). It is challenging situation for spatial planners to deal with such situation in order to provide health and wealth for population counting on resources we have left after speed of industrialization started in previous century.

The other megatrend defined in many of the political documents is that the number of people living in the cities will continue to increase and it is calculated that by year 2050 total number of the population living in urban environment will be at least 70%. All of them will need place to live, infrastructure to use and food to eat. These all are the items which need and could be improved, changed or developed by new innovative initiatives. Many of solutions are already on the market like new mobility systems, sharing economy (most likely known for transportation and living environment) or community gardens.

The other megatrend we need to count on is total consumption of energy. It will also continue to grow and by year 2035 it is forecasted that this raise can reach 30%. More and more power is needed to serve all the gadgets produced and there are more coming in near future. We should choose more carefully technologies for producing renewable types of energy not destroying the nature and natural resources. At the same time, it is necessary to think about gadgets, meters, software helping us to save energy or reduce consumption when it is not possible. This process needs to be wisely supervised by engineers who can create new technologies for producing new types of energy without wasting too much resources on production process. The other trend developing in energy sector is connected with savings. Engineers are working on environment more friendly batteries to keep the saved energy available in place or reuse of resources once used already in production process.

The last but not least megatrend influencing our lives is IoT – things are and will be more connected to each other, for example smartphones which can be used to communicate not just with friends or colleagues, but also to smart home meters. It helps us in many ways, whereas our privacy raises more questions of human rights. And this is not just because of mentioned challenges we face today, it is also migration and mobility we should care about, it is spread of our cities and not careful enough monitoring of construction processes in all the places. There is need for infrastructure (infrastructure which do not make up new heat islands but help to reduce them) and solutions for traffic jams in urban environment.
Given the challenges of urbanization, it is necessary to create more manageable and innovative cities. Many spatial planners, city planners, politicians, researchers are looking for the solution to all these trends. [2] New approaches in city planning that could change or improve situation in crowdly populated environment are offered providing the approach of sustainable city balancing needs and possibilities of people and natural environment. Table 3 shows dominant branches of professions involved in planning and development of a sustainable city.

Thinking of a place suitable for many people to live in it is obvious that all the needs and preferences of all the people will not be possible to fulfil, whereas it is possible to rethink about needs of people from perspective of processes ongoing in nature. [3] To ease that task, suggestion is to bring nature into the cities and do it wisely to make it possible to survive changes mostly activated by humans. One of the most common approach to bring nature into the cities is to bring nature elements in urban environment, and not just associated directly with greenery but also try to copy the forms of natural elements into the city environment. These processes can be observed in biophilic cities. Network of such places called “BiophilicCities” who support idea of connecting cities and nature has been established to

Figure 1. Life expectancy (calculated within the period of 1960 – 2019).
Source: The World Bank data [1]
“facilitate a global network of partner cities working collectively to pursue the vision of a natureful city within their unique and diverse environments and cultures” [4].

During 1970s and 1980s before even Bruntland Declaration came into force city planners worldwide has introduced approach of ecocity [5,6] stressing ecology as main setting. The importance of habitat change became important after the rapid growth of industrialization. Cities have became big consumers of resources while researchers pointed out necessity to balance use of energy, water and even food producing more and more waste and emissions. Ecocity idea lays on reduction of pollution and putting ecological values and healthy society in first places in city environment.

Looking forward was also the main issue for developers of green city approach. Even more – during the 1980s and 1990s scientific society started to talk more often about ecosystem services measuring impact what society laid on the environment. The importance of clean air and water gathered different groups of people willing to improve the situation on Earth. During the 1990s and 2000s ecosystem services concept has continued to expand and included socio-economic and cultural objectives. Different initiatives for development of green infrastructure were offered for large cities worldwide. Most known strategy for green infrastructure integration into the city planning was development of green belts around the cities providing green fringe actively use by society for recreation purposes. Green city combines also all the other characteristics given for other forms of sustainable cities mentioned before.

Although these approaches all seem similar because of main influence of nature as core strategy, there can be defined and observed more than this aspect in each case (see figure 2).

The progress of technologies made by population is obvious and is followed by changes in sustainable city’s categorization adding new directions of sustainability as well providing new solutions for healthier environment. The interesting thing is that not just environmental issues became more important for any place (the values of ecosystem services provided is no more question in city agenda), recognition of technology support in any of lifestyle or management categories seems logic and taken for granted because of simplicity what comes with it and ensure of safety, control or monitor possibilities they bring into the city environment. Technology progress in the industrial sector served a lot of possibilities for habitat environment allowing cities transfer to smart environment easing life for local citizens, widening services and improving security in cities. More often we choose to use software, sensors or gadgets to keep track on private property or personal belongings and for communication with family, friends and colleagues to follow the information provided by all these groups. These are important issues developed usually in smart cities.

To survive the shocks both man-made and natural origins cities need to find solutions for self-securing. [7] It can be done both by spending the resources and also production of them. Such solutions offer resilient city approach where consumption reduction and cycled flow of resources take the main position in any policy. In resilience, much more attention is put on management issues to deal with available resources and to provide maximum services and goods produced in place. Environment friendly energy used for operation of economically effective equipment is the way population support this direction of sustainability. We can see also how our landscape is changing in urban, suburban and rural environment. Changes in traditional economic sectors are also issue for the municipalities’ agenda, looking for the solutions to minimize transportation expenses and reduce emissions. New forms of agriculture can be observed in city environment mostly recognized in different forms of vertical farming. Figure 2 shows main characteristics of agenda in different forms of sustainable city, remembering that they all complement each other.
Besides already mentioned forms of sustainable city (see figure 2) there are classified even more forms of sustainable cities [8], each with specific dominant – lens through which can be observed and organized processes and support in municipality policies:

- Inclusive City / Happy city (people and their needs as central element);
- Healthy City (linking social health and well-being to environmental health);
- Compact Green City (brownfield solutions);
- Mobility City (providing safe and clean transport alternatives; green, intelligent mobility);
- Low-Carbon City (transitioning from fossil fuels to bio-based economy);
- Design City / Natureful city (similar to biophilic city concept);
- Innovative city / Creative city (all kind and form of creativity);
- Sharing city / Collaborative city (sharing economy);
- Cultural city (culture initiatives);
- Digital city (ICT solutions, smart solutions).

All of the sustainable city forms are closely connected to each other. Indicators characterising each of specific form of sustainable city are chosen just to highlight sectors where more effort are put to develop sustainability. Chosen strategy usually reflects also to all other processes in specific environment. Division of sustainable city into separate approaches is made because of choices made by
city planners to called them like this understanding that all the processes guided could be implemented in any form of sustainable city.

Nevertheless, in all the described city forms the sustainability most often is associated with environmental issues what could and should be changed or guarded in urban environment, although it is not the only issue to be concerned. Table 1 shows other sectors where specialists are looking for the solutions to improve the living environment. Table 2 shows the author’s evaluation of the importance of sector’s involvement in development of sustainable city forms characterised in figure 1.

### Table 1. Sectors important for sustainable development of a city.

| Sector                          | Description                                                                 |
|---------------------------------|-----------------------------------------------------------------------------|
| Nature, natural environment     | Protection (of separate elements, structures); new forms brought into the city environment |
| Technology                      | ICT solutions, sensors (and meters), IoT                                    |
| Infrastructure, industry        | Solutions for rainwater, savage, floods; electrical vehicles; multi-modal mobility |
| Energy                          | Renewables - Solar parks, wind parks, smart grids                           |
| Built environment               | Architecture, cultural heritage, art                                        |
| Economy                         | Services and goods; initiatives for changing traditional sectors like farming or forestry; reduction of use of any resources |
| Environmental issues, ecology   | Waste; global warming                                                       |

Although the environment of course is the main issue ensuring the sustainability of any place, however whatever model would be chosen for development of a city, local governors are invited to follow Sustainable Development Goals (SDG) set by United Nations within the strategy “The 2030 Agenda for Sustainable Development”. Regarding environment protection and wise management European Union member states will work closely also to reach the goals set in the latest strategy – EU Green Deal [9].

### Table 2. The importance of different sectors in sustainable city planning.

| Management sector of a municipality | Biophilic city | Eco city | Green city | Smart city | Resilient city |
|-------------------------------------|----------------|----------|------------|------------|----------------|
| Nature, natural environment         | X              | X        | X          | x          | X              |
| Technology                          |                |          |            |            |                |
| Infrastructure, industry            | x              | x        | X          | X          | X              |
| Energy                              |                |          |            |            |                |
| Built environment                   | X              | X        | X          | x          |                |
| Economy                             | x              | x        |            | x          |                |
| Environmental issues, ecology       | X              | X        | X          |            | x              |

Many European cities are implementing activities to reach SDGs caring for the well-being of the population. For example, Nordic countries (Norway, Sweden, Finland, Denmark, Island) have put much effort on solutions for waste reduction or production of renewable energy (afterwards used in households, industry and transportation system). Digitalization and technologies are much used to make urban environment safe and mobile. [10] Green materials are used for healthier urban structures to improve life quality of population. However, less effort is concentrated on SDGs connected to social aspects [11] whereas it can be explained by good social care systems Nordic countries can be proud of already for many decades.
Table 3. Branches of specialists involved in sustainable city planning.

| Branch               | Biophilic city | Eco city | Green city | Smart city | Resilient city |
|----------------------|----------------|----------|------------|------------|----------------|
| Architecture         | X              | X        | x          | X          | X              |
| Spatial planning     | X              | X        | X          | X          | X              |
| Landscape architecture| X              | X        | X          | x          | X              |
| Environment science  | X              | X        | x          | X          | X              |
| Ecology              | X              | X        | X          | x          | X              |
| Engineering          | X              | X        | x          | X          | X              |

Latest findings [11] show that cities are concentrating on new forms of sustainable city looking for the smart solutions for more compact usage of space. It becomes more important to provide common space for living, working and rest in order to reduce transportation distance and safe time spent on the road to work, back home or children afterschool activities. Table 4 includes description of most important aspects to be taken into consideration for planning a sustainable city.

The need for more complex solutions is clearly recognised through establishment and/or adjustment of policies incorporating sustainability visions and goals throughout the strategies developed by many Nordic cities, as well cities in Central and Western Europe, Asia, US and Pacific ocean countries [10].

Table 4. Important aspects of sustainability for spatial planning.

| Sustainability lens       | Description                                                                                                                                                                                                 |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scale                     | The scale is not dominant when we talk about actions to be taken for implementing sustainable solutions, but it is sufficient for actions which could vary at different scale – global, state, region, municipality or place. |
| (Local) resources         | All the economy is based and keep depending on resources – natural, financial, human. If you have or have raised any of them, you can think and act to foster development of concrete place.                                    |
| Maintenance of place      | During the centuries we can follow the development of any place depending on natural processes or built environment. Any development can be valued from different perspective – do we need to safe place untouched, think about conservation or protection, either do we need to use economic potential of the place – foster or intensify use of resources making place pleasant for citizens or industry. There is no right answer to all places, we need to rethink possibilities of any place in short term and long term to decide correctly on actions to be taken. |
| Differentiation of actions| There are plenty of possibilities for actions if the purpose is set – protection or development of place. The actions chosen will guide the changes and results in future. Actions are important part of strategy at any scale because actions are closely connected to results what we want to gain – satisfied locals or global warming. |
| Locals                    | People are the most important for cities, they actually make the cities (depending on culture and traditions). We see the change of our generations, and we see them changing (lifestyle, values, needs, preferences, “green” thinking). Do not forget that more and happy (especially happy) people raise the budget, working more and spending more for qualitative life they choose. |
Green infrastructure

We depend hardly on infrastructure in any branch, including industry (more associated with built environment) and tourism (more associated with natural environment). Nowadays more often we conclude / realise that places should be connected not only by roads (any type and cover(age)) but also followed the nature rules because the natural resources are run out and not renewable in many cases and the only solution is to keep then as long as possible. But we need to make the environment suitable for that developing green infrastructure where possible. We used to say it is important for people mostly but everything is made by people and important for people because we value any development form perspective of human needs.

Variable landscape

Every before mentioned component is important for development of places but we cannot forget that variety plays important role in human live. We choose whom to live with, what and how to eat, what to study or investigate, where to live and how to move from one place to other. But it is not less important to have a chance to change anything in our life – for example to see or visit other places to enjoy and inspire from different views. If we have a chance to experience something else we can more easily value what we have and what could be done to improve the local situation and what to do to improve situation also globally.

All the pointed variables need to be considered developing strategies and policies for spatial planning at any level because balance in production and consumption laid on environment will influence quality of life for all the society.

4. Conclusions

Last century brought huge progress in every branch of economy, rapid speed of industrialization offered new opportunities maximizing use of resources. At the same time industrialization brought wide range of new problems cities had to cope with – increasing number of inhabitants, uncontrolled pollution, need for flexible infrastructure serving comfort for residents and businesses. That was a turning point for many cities willing to serve better life conditions for their residents. Many of cities have changed their management methods providing more sustainable management of resource usage.

During the last decades different forms of sustainable city has formed, more attention putting on environmental issues and possibilities to reduce consumption of water, food and energy. Smart solutions brought new possibilities for safety and time saving in different branches. Many of new solutions are implemented helping to reach Sustainable Development Goals agreed worldwide. Digitalization era provide fast flow of information and new business models appears. Wise allocation of resources is and will continue to be the most important issue for governance of sustainable city.

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