



Innovation for Social and Environmental Benefit: <u>An introduction</u>

Urbanization and growth of cities

If you live in a city, you belong to the majority of people on earth since 2008. Cities have long played a significant role in the influence that humans have on nature. Especially in the last century, the influence of cities has grown exponentially as cities grow globally in both size and number. This process is called urbanization. While in 2000 there were about 371 cities with more than a million people (globally), by 2018 there were 548, and by 2030 there will be about 706 (data: UN).

Tasks: What is it like in your area? Do you live in a city with a million inhabitants? Or where is the next city with more than a million people? And since when did it exceed the million people mark?

Of course, urban growth is closely linked to population growth, and thus part of urban growth is explained by the growing world population, which in 1950 was still around 2.5 billion people and is now 7.8 billion. Of these people, an increasing percentage live in cities. In 2018, for example, around 55.3 percent of the world's population lived in cities, and by 2030, it will probably be 60 percent (data: UN).

Tasks: What about the growth of cities in your country?

- How has the population in your country and/or city changed over time? Try to use data from official statistics or census here.
- How has the area of your city changed with time? Have a look at aerial photos or satellite images. How has the built-up or sealed area changed? How has the green space changed?

Effects of urbanization on people and the environment

Cities already account for a large proportion of greenhouse gas emissions. However, these emissions do not always take place in the city itself. E.g., the power plants that generate the electricity for a city are usually located outside of it. In addition, there are emissions that are indirectly caused by goods consumed in the city. Nevertheless, considerable emissions are also produced within the cities. Reasons are e.g. the dense road traffic with frequent stops in traffic jams or at traffic lights and also the heating systems of the buildings.

Tasks: Emissions: How do the CO_2 balances of urban and rural residents differ? Think about the living conditions and lifestyle of different people in the city and in the country. There are various calculators on the Internet for your personal CO_2 footprint (links below). Use one to calculate and compare the CO_2 footprint of city and country residents. Is it better to live in the country or in the city in terms of greenhouse gas emissions?

https://uba.co2-rechner.de/en_GB/

https://footprintcalculator.henkel.com/en

https://www.foe.ie/justoneearth/carboncalculator/

Exhaust gases do not only have an impact on the urban greenhouse effect and global warming, they also have negative effects on human health. Pollutants emitted besides the greenhouse gases such as nitrogen oxides and particulate matter also contribute to the negative health effects. The higher temperatures in the city caused by the effect of urban heat islands also lead to health problems and increased mortality rates, especially among the elderly and those who are already ill. A further health burden results from the constant noise pollution, as noise can have a negative effect on blood pressure and heart rate.

Tasks: What is the percentage of CO_2 emissions caused by cities (worldwide, in your country)? What is the share of your city in the emissions of your country?

How much more likely is it to suffer from a disease caused by dirty air in a city compared to the countryside? What about heat-related health problems?

What is the mechanism behind the urban heat islands? Here you can also contact PULCHRA schools that are working on City Challenges 2 or 3.

Against the background of climate change and the growing world population, agriculturally usable land and drinking water are very important resources. Both are in competition with cities, as the soil in the cities is sealed over large areas. Since cities were often founded where good agricultural conditions prevailed in the surrounding area, valuable land is lost to the growing cities. At the same time, rainwater can no longer seep into the soil and is therefore fed directly into rivers via sewerage systems. In this way, it no longer reaches the groundwater and it is missing from wells.

However, not only the physical and physiological processes are negatively affected in and by cities. There are also effects on a social and psychological level. For example, despite the high density of people in cities, there is a tendency towards social isolation. People who live in the city also suffer more often from stress.

Tasks: In this section, many negative effects of urbanization were presented. Can you think of any positive aspects? When it comes to living sustainably and being socially integrated, what opportunities does the city offer that are not available in the countryside?





Innovations for more sustainability

In contrast to the negative consequences of urbanization, there are also positive effects. Some of them you have certainly identified in the last task. Only two topics shall be mentioned here.

There are several trends towards food production in cities. In the private sector, "urban gardening" is becoming increasingly popular. Here, fruit and vegetables are grown on roofs, balconies or open spaces. There is usually no commercial background. Several city gardeners often join to form community gardens, with the positive side effect of counteracting the tendency towards social isolation in the city. Far beyond these small gardens is "urban farming". Here, agriculture in the city is practiced on a larger scale, often with an interest in profit. In urban farming, vegetables or cereals are usually grown in greenhouses, on open spaces, or on roofs. A special form is "Vertical Farming", in which the cultivation takes place on facades or several greenhouses are built in floors one above the other. The first working examples on a larger scale have been implemented in Singapore. It has also been shown that in connection with fish farming, it is possible to work in cycles in which plants clean the water and the excrements of the fish serve as nutrients for the plants.

All these approaches have the same main advantages. Emissions are reduced by eliminating longer transport distances. In addition, the additional plants in the city improve air quality. Furthermore, the loss of agricultural land through sealing is compensated for, since farming in the city requires virtually no additional land, but takes place on previously unused and often unusable space.

Apart from agriculture, other functions can also be integrated into cities. Solar plants (photovoltaic) and also special wind power plants can provide electric power directly in the city. This eliminates losses due to long cable runs and buildings heat up less under the solar collectors.

Tasks: Does urban gardening or urban farming also take place in your city? What about energy production in your city?

The city of Venlo in the Netherlands has a very innovative city hall. Find out which ideas have been implemented there.

Smart City

Another approach to address problems of cities is the concept of the "Smart City". Here, an attempt is being made to meet the strong urbanization and the many challenges it poses through innovative technologies and increased digitalization and networking. Holistic concepts based on advanced technologies are intended to make cities more efficient, more sustainable and at the same time more social.

In this context, futuristic-looking projects are often reported. For example, Amazon is testing drones to deliver parcels and Uber wants to offer "Uber Air" flight taxis from 2023. However, even if we leave out the all-too-futuristic sounding things, there are already examples today of how innovation and smart networking can help solve the problems of today's cities.





One example that many people use in their everyday lives is integrated city maps and navigation systems. The best known is probably Google Maps. In order to be able to offer the fastest possible routes in the navigation, the providers process GPS data from their users. This allows them to see where many smartphones are currently located. If, for example, many devices are moving slowly at one point or in stop-and-go mode, this can lead to the conclusion that there is a traffic jam. These places can then be avoided during navigation. Less traffic jams, reduced emissions, and less waiting time are the results.

This is an example for an already realized approach. In the Smart City concept, however, things are often thought some steps ahead. The idea is to bring together all accessible information about the city. In the field of traffic, this includes information on traffic lights or current positions of public transport vehicles. In the context of optimizing the energy supply, it can be information about the production and current consumption of electricity. In the event of overproduction of electricity from renewable sources, networked electricity consumers such as washing machines can then be started or electric cars can be charged. In this way, energy losses during intermediate storage of energy can be avoided and energy efficiency is increased.

However, the basic ideas of the Smart City also include active and creative self-initiative of the population and consistent citizen participation, e.g. in large construction projects.

Tasks: The Smart City approaches do not always have to be thought of as very big projects. Even in the personal sphere, access to and linking of information can help people to behave in a more sustainable way. Do you know technologies, such as apps, that can help? Are there any ideas in this area that promote sustainability and social interaction at the same time?

Many of the Smart City ideas are based on the evaluation and linking of enormous amounts of data. This is generally connected with the danger of data misuse. On the one hand, the collected data opens up possibilities to control people. What is technologically possible in this context is currently being tested in China, where people are given scores based on their individual behavior. Various aspects of social participation have been made dependent on this score. On the other hand, the partly uncontrolled use of data by private companies can also be a problem and is being strongly discussed. One example of this are the so-called smart speakers of the large internet companies. These devices constantly record the sounds of the surroundings to listen for instructions. Private conversations can also be recorded without the users being aware of it.

Tasks: Many people say, "I have nothing to hide" when it comes to whether they care about what information is available about them. Think about what information about yourself you would share with friends. Think further about what information you would make available to everyone, for example, by printing it on your T-shirt. Is there any information that is so private to you that you don't want anyone to know about it? How could important information be protected?

However, "smart" solutions do not necessarily have to be new technologies. Very practical approaches, which depend on the activities of the people involved, can also be innovative. Particularly relevant here are aspects of the "sharing economy", i.e. the joint use of things (e.g. car sharing). Food sharing, i.e. passing on food that is not needed, can also be mentioned





here. In addition, there are approaches such as repair cafés, where people meet to repair things, which can reduce consumption and resource consumption. Here it is up to each individual to get involved and develop the possibilities of the Smart City in terms of sustainability and social participation.

Tasks: If the personal rights of the citizens are protected, great opportunities seem to lie in the Smart City approaches. How could the implementation of these approaches be encouraged? What are the plans already in place in your city? What data from your city is already available for use? Which parties and groups of the urban society are fighting for it, which are opposed to it?

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