INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)

Geneva, Switzerland
17-19 November 2021

Contribution by UNOOSA

to the CSTD 2021-2022 priority theme on "Science, technology and innovation for sustainable urban development in a post-COVID world"

UNITED NATIONS
Office for Outer Space Affairs

UNOOSA Inputs for CSTD 2021-2022 Priority Themes

1. Can you give examples of projects/policies in your organization helping countries undertake transition towards urban sustainability so that cities are productive, inclusive, and liveable? What are the main challenges confronted while trying to implement these projects/policies?

UNOOSA does not have any direct initiatives that are particularly geared towards only urban sustainability. However, multiple UNOOSA projects may have impacts on the future of urban sustainability.

- **United Nations Programme on Space Applications** has made substantial progress in furthering knowledge and experience of space applications around the world. Provision of country capacity-building, education, research and development support and technical advisory services by the Programme have all helped to reduce the gap between the industrialized and developing countries.

- **Access to Space for All**, allows UNOOSA to utilize its global reach to build partnerships with established space stakeholders to support emerging and non-spacefaring countries. This could include the creation of data gathering practices that can be used to support the transition to sustainable urban development.

- **UN-SPIDER**, is a particularly relevant programme with the emerging environmental crisis. SPIDER stands for the United Nations Programme on Space-based Information for Disaster Management and Emergency Response. Here UNOOSA facilitates the use of Space-based data and services in the entire disaster management cycle. An understanding of how disasters can impact urban developments can inform the development of sustainable urban centers so that they are able to build stronger infrastructure that will last throughout any natural disasters.

- **The International Committee on Global Navigation Satellite Systems (ICG),** established in 2005 under the umbrella of the United Nations, promotes voluntary cooperation on matters of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services. The ICG contributes to the sustainable development of the world. Among the core missions of the ICG are to encourage coordination among providers of global navigation satellite systems (GNSS), regional systems, and augmentations in order to ensure greater compatibility, interoperability, and transparency, and to promote the introduction and utilization of these services and their future enhancements, including in developing countries, through assistance, if necessary, with the integration into their infrastructures. The ICG also serves to assist GNSS users with their development plans and applications, by encouraging coordination and serving as a focal point for information exchange.

- **The Space Economy Initiative** Space economy is a term to capture the economic benefits of a dynamic space sector and the role space can play in prosperous socio-economic development. While most space economy activities originate from space-faring countries, emerging space-faring nations do not benefit as much as they could from this area. By leveraging on its experience supporting international cooperation in the peaceful uses of outer space, UNOOSA works to bring the international space community together in support of emerging space-faring nations to take part in the global space economy responsibly and sustainably.
  As we look to the future, with many countries considering how to 'build back better', it is clear that healthy, dynamic space economies can play a huge role in accelerating sustainable socio-economic development.
  The Space Economy initiative unpacks this complex topic, breaking down the issue to core elements, providing a road map on how to build a strong space economy that delivers tangible socio-economic benefits.

- **World Space Forum.** Finally, UNOOSA, since 2019, has hosted the World Space Forum, to bring together state and non-state actors. This platform presents new space technologies and furthers our work of raising awareness and ensuring all stakeholders have a voice. Sustainable urban development practices supported via space technologies could be presented or supported through networking at this event. UNOOSA's next World Space Forum will be in December 2021 in Vienna and will feature two matchmaking sessions to connect space providers with users.

2. In your organization's view, how has the Covid-19 pandemic so far impacted on sustainable urban development, and what lessons could we draw from the Covid-19 pandemic on sustainable urban development?

N/A

3. Could you share specific examples, projects or initiatives that have used science, technology, and innovation (STI), including frontier technologies (e.g., AI, drones, blockchain, 3D printing, etc.) or other forms of innovation in general in addressing the above challenges in relation to urban sustainability transition?

Space technologies are utilised for:

- Urban planning, to pinpoint structures and reference points for cadastral and urban planning purposes
- Smart Cities, through the application of Global Navigation Satellite Systems, Earth Observation and Satellite Telecommunications
- Improvement of city services, such as smart waste management systems
- Air quality monitoring
- Disaster management
- Infrastructure monitoring
- Search and rescue operations

The combined use of satellite applications is key to understanding cities, how they grow, how their resources are utilized, the distribution of basic services, their impact on the environment and the mapping of informal settlements and inadequate housing.

Global Navigation Satellite System (GNSS) are widely used for urban planning, to pinpoint structures and reference points for cadastral and urban planning purposes. It also allows the monitoring of displacements and detection of potential structural risks due to movement.

In addition, GNSS offers numerous opportunities to design and improve city services such as smart waste management systems with sensor-embedded garbage bins and the synchronization of smart grids. Within smart lighting technology, new streetlights are equipped with low-cost GNSS receivers and connected to a mesh radio network that relays their data to a Cloud Gate Gateway device for review and analysis in a centralized location. In this way defective lamps communicate their status in real time and can be precisely located for replacement, improving the maintenance process, which reduces maintenance costs by up to 30 per cent.

Earth Observation Satellites take images over cities that make it possible to monitor them. Satellites are able to provide information concerning air pollution and the quality of air over cities through the atmosphere monitoring service, which includes air quality. An understanding of disaster risk, proper preparations to reduce this risk and to improve resilience, response and the capacity to recover from disasters all need to be considered when planning and managing a city.

Satellite data helps to support, plan and monitor migration and mobility of people, either in the case of human migration between different areas of the world, or mobility within urban centres, and assist disaster planning and emergency response.

GNSS is also very important when it comes to the mapping with extreme precision of disaster areas that have been already accessed by rescue teams, avoiding the need to survey the same area twice. The satellite images could help monitor the risk of a disaster and reduce the economic loss and number of deaths and missing persons if it occurs.

Satellites can also help in monitoring the world's cultural heritage, increasing awareness and detecting activities that may result in damage to these sites. Similarly, GNSS location data contributes to develop ad hoc AR applications supporting the preservation of the world heritage by recreating 3D models of historical monuments.

Finally, satellite data from both the programmes are beneficial to support, plan and monitor migration and mobility of people, either in the case of human migration between different areas of the world, or mobility within urban centres.

See:
https://unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace71_0_html/st_space_71E.pdf

While aerial data has been a method of monitoring land use and tracking urban growth for many years the last decade has witnessed an urban data revolution, as cities globally have started mobilising geo-spatial data to harness the potential of urbanization. The use of Earth Observation

satellites and remote sensing for urban planning is now gathering pace as the application of big data and very high-resolution imagery allows for information to be gathered more swiftly, more cost effectively and in greater quantities. This data provides a more timely and effective response to the changes in use of land, infrastructure and the environment.

AI can contribute heavily to the practical applications of space technology. Currently the world has terabytes of date coming in from space that is not being used to its fullest potential, including data that has significant applications towards the urban sustainability transition. With artificial intelligence processing these vast amounts of data, sustainability decisions can be more informed, backed by concrete data, and easier to make. It will also make long term policy decisions and their results more tangible with better monitoring and forecasting capabilities.

4. Can you provide examples of policies/projects/initiatives specifically aimed at strengthening national STI capabilities to promote urban sustainability transition?

- **Air quality monitoring supported by EO and GNSS**

An efficient management of air quality is one of the most challenging environment-related tasks faced by industry today. Air pollution is responsible for more than 450,000 premature deaths in Europe each year. To enhance the monitoring process, Aircheckr has developed a solution providing functional air quality data which otherwise are too complex and coarse for personal use. The Aircheckr air quality data are modelled and enriched with crowdsourced local air quality sensor data and EO-derived contextual information. The Copernicus product "Urban Atlas" provides pan-European comparable land use and land cover data for large urban zones, while GNSS is primarily used to track the precise location of individual users accessing the Aircheckr database through APIs. Additionally, GNSS enables the positioning of newly installed sensors, which is key for contextualizing the collected data.

https://artes-apps.esa.int/projects/aircheckr

- **Satellites help to design more habitable cities**

In cities, temperatures can be several degrees higher than in surrounding rural areas, especially at night. Prolonged periods of high temperatures increase the demand for energy and water, trigger health problems and increase air pollution and the greenhouse effect. Copernicus medium and high-resolution multispectral satellites with thermal-infrared sensors provide information about thermal patterns, thereby helping to improve urban climate and weather prediction models. An improved understanding of complex urban heat islands makes it possible to develop more efficient alert systems, helping decision- and policy-makers to adopt effective mitigation strategies and improve urban planning.

http://www.copernicus.eu/sites/default/files/documents/Copernicus_Briefs/Copernicus_Brief_Issue16_Urban_Heat_Islands_Sep2013.pdf

- **Copernicus and GNSS help to monitor landslides**

In November 2000, a 1.2 million m³ landslide slid down from Stože Mountain in north-west Slovenia. It partly or totally destroyed 23 buildings and killed seven people. Potential mass debris

flows of a similar size occur in many locations across the world and present a hazard to citizens. Identifying the precursors of such events requires very precise measurement of vertical and horizontal displacements. The project I2GPS developed a novel, integrated approach for the use of synthetic aperture radar interferometry (InSAR data from Copernicus) and GNSS to monitor subsidence, tectonic changes or other environmental hazards, which can only be identified by millimetric precision survey techniques.

https://www.gsa.europa.eu/integrated-interferometry-and-gnss-precision-survey

- **Use of Copernicus for urban housing density analysis**

Rapid urban population growth can hinder the execution of any well-thought-out urban plan. To ensure the well-being and productivity of citizens, there is a need to set up the required infrastructure and services, such as water supply, housing and sanitation facilities. It is therefore crucial to have a timely understanding of, and to monitor changes in, urban density, to help policy-makers react promptly to any sudden change in urban dynamics and make the best decision regarding the allocation of resources. This is especially true in developing countries, where urbanization is on the increase. The Centre for Remote Sensing and Geographic Information Services (CERSGIS) used EO Sentinel-2 imagery to map the urban housing density in Accra (Ghana). By observing similar spectral reflections exhibited by pixels in the images, they identified three urban density levels in built-up areas: high, medium and low density.

http://cersgis.org/

- **An electric scooter sharing service for sustainable urban mobility**

Vehicle sharing services benefit from GNSS information in order to track the vehicles, which are widely distributed across the city. In the case of "floating sharing", where vehicles are not parked in specific stations, GNSS is the main source of information for users to locate the vehicle. It also enhances security of the system by alerting about unexpected movements and tracking a vehicle in the event of theft. G-MOTIT is a European-funded project that has developed an electric scooter sharing service in order to solve urban mobility problems potentially in major metropolitan areas in Europe. It allows users to reserve a scooter with their smartphone, receive a notification with the position of the assigned vehicle, drive it and drop it off wherever they want. The service aims to enhance vehicle positioning performance by developing g and integrating EGNSS-based location technology, which is key for the success of the service.

http://gmotit.pildo.com/

- **TehnoGIS: Copernicus-EGNSS enabling cost-effective solutions for surveying and infrastructure development**

TehnoGIS is an independent start-up delivering geo-referenced data using EGNOS, Galileo and Copernicus data in complementarity with other sensors (IMU, UAV, etc.) to provide affordable solutions to farmers, as well as to city and land administrators, and other users. Project portfolios range from determining flood areas and conducting preparatory studies for new infrastructure

(highways, railways, etc.), in Eastern Europe, to 3D modelling for Western European city planners and building companies.

http://www.tehnogis.ro/index.php/ro/

5. Could you share case studies of regional and international cooperation that have strengthened STI capacities of developing countries in dealing with urban sustainability transition?

- https://www.researchgate.net/publication/306920856_Sustainable_and_smart_city_planning_using_spatial_data_in_Wallonia

6. Could you suggest some contact persons responsible for projects/policies, related technologies and international collaboration in this context as well as any experts dealing with projects in this area? We might contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

UNOOSA would be happy and available to provide contacts to experts from different Space Agencies who could speak from an expert view about the subject.

UNOOSA would suggest the following individuals:

(1) **Mr. Peter Oborn** (peter.oborn@peteroborn.com)

Mr. Oborn is a Chartered Architect, Strategic Client Adviser, CAA Senior Vice President, Design Council Ambassador, and member of UN Habitat Stakeholder Advisory Group (SAGE). He has been working with geospatial data as a powerful tool available to governments in supporting sustainable urbanisation. He works directly with the Ordnance Survey that works with sustainable urbanization. (https://www.ordnancesurvey.co.uk/business-government/international/urbanisation).

(2) **Ms. Cassie Lee** (cassie.l.lee@lmco.com)

Ms. Lee is the Advanced Programs Lead for Weather and Remote Sensing at Lockheed Martin Space and a Strategic Advisor to Bye Aerospace, a world leader and innovator of electric and solar-electric aircraft. She is also a global activist for women in aerospace, serving as a Mentor for the United Nations Office for Outer Space Affairs (UNOOSA) Space4Women Network, a cohort of space industry leaders who have committed to promoting gender equality and empowerment for women and girls in the space sector around the world. She works directly with PLACE, is a non-profit technology organization established to build and maintain data infrastructure in the public interest (https://www.thisisplace.org/).