

# Implementation of Geospatial Technologies for Sustainable and Smart Cities



**WFEO / FMOI**

**The World Federation of Engineering Organizations**

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[www.wfeo.org](http://www.wfeo.org)



# *Engineering* for Sustainable Development



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Cyprus  
Czech Republic

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Egypt  
Ethiopia  
Fiji  
France  
Germany  
Ghana  
Greece  
Honduras  
Hong Kong, China  
Hungary  
India  
Iraq  
Italy  
Ivory Coast  
Japan  
Jordan  
Kenya  
Korea  
Kuwait

Lebanon  
Libya  
Macedonia (FYROM)  
Madagascar  
Malawi  
Malaysia  
Malta  
Mauritius  
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New Zealand  
Nigeria  
Pakistan  
Palestine  
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Poland

Portugal  
Puerto Rico  
Qatar  
Romania  
Russia  
Rwanda  
Saudi Arabia  
Senegal  
Serbia  
Sierra Leone  
Singapore  
Slovakia  
Slovenia  
South Africa  
Spain  
Sri Lanka  
Sudan  
Switzerland  
Syria  
Tanzania

The Philippines  
Tunisia  
Turkey  
Uganda  
Ukraine  
United Arab  
Emirates  
United Kingdom  
United States  
Uruguay  
Yemen  
Zambia  
Zimbabwe



# Engineering and the UN Sustainable Development Goals



- A key objective of the World Federation of Engineering Organizations is to **advance the UN SDGs through engineering**
- We need to build capacity to understand how technology and engineering can be used for sustainable development
- The report on the use of geospatial engineering has the objective of **building capacity for the implementation of this advanced technology** with case studies from around the world.

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The WFEO WGIC UN GGIM White paper: “The value of Integrated Geospatial and Building Information Modelling (BIM) solutions to advance the United Nations Sustainable Development Goals (Agenda 2030) with specific focus on resilient infrastructure”

- **Collaboration between World Federation of Engineering Organisations (WFEO), World Geospatial Industry Council (WGIC) and UN Committee of Experts on Global Geospatial Information Management (UN-GGIM).**
- **Project initiated in 2019, completed in 2020.**
- **Brings together experts and leaders from around the world.**
- **Demonstrates the importance of geospatial information.**
- **Builds capacity by demonstrating implementation of geospatial technology.**
- **Identifies critical challenges to implementation.**
- **Recommends on approaches for successful implementation based on the UN-GGIM Framework.**



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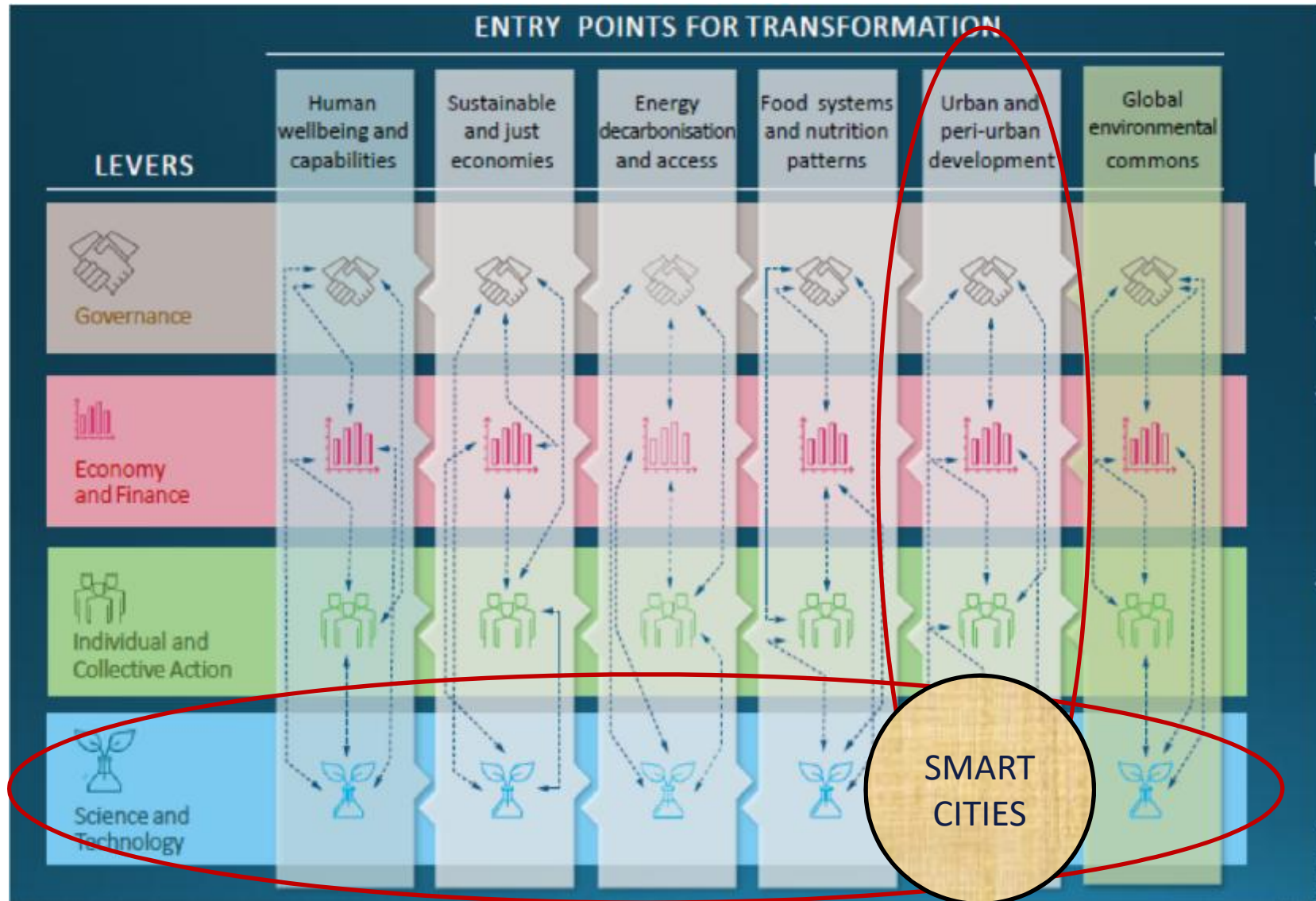
# Science and Engineering and the Lever and Sustainable Cities as the Pathway

- The UN Global Sustainable Development Report has identified science and engineering as one of four levers to accelerate sustainable development.
- Urban and peri-urban environments have been identified as one of six pathways that can accelerate transformation for sustainable development.

See: [https://sustainabledevelopment.un.org/content/documents/24797GSDR\\_report\\_2019.pdf](https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf)



# Science and Engineering as the Lever Urban and Peri-urban environments as the transformation pathway



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# Why Urban and Peri-Urban Environments?

- The world's urban population is increasing rapidly especially in developing countries.
- There is an urgent need to ensure that these cities are sustainable and liveable in terms of affordable housing, sustainable transport, energy use, water and sanitation facilities, resilience against climate change and that no one is left behind.



Image source: <https://www.mckinsey.com/featured-insights/urbanization/urban-world-mapping-the-economic-power-of-cities>



# Key messages for sustainable cities from UN Global Sustainable Development Report 2019

- 1. Sustainable cities are central to achieving all 17 Sustainable Development Goals, because by 2050, cities will contain approximately 70 per cent of the world's population and produce 85 per cent of global economic output.**
- 2. Urban development should be well-planned, integrated and inclusive, accessing technology for cities and sharing good practices.**
- 3. Sustainable Cities should prioritise access to jobs and affordable housing, health care and education, sustainable transport, attractive public spaces for all.**
- 4. Cities should promote sustainable consumption and production and consider environmental impacts.**
- 5. Sustainable and liveable cities have a close connection between people and nature, to enhance human health and well-being, protect biodiversity, and strengthen climate change resilience.**

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Image Source:  
[www.greenmatch.co.uk](http://www.greenmatch.co.uk)

See:  
[https://sustainabledevelopment.un.org/content/documents/24797GSDR\\_report\\_2019.pdf](https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf)





# Science, technology and engineering in sustainable cities

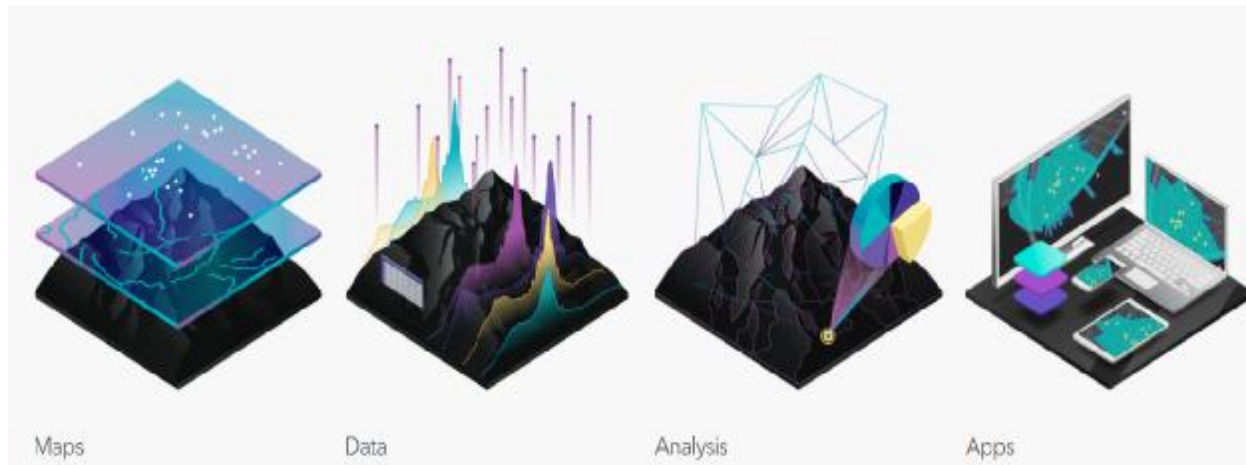


- 1. Cities are hubs of innovation and creativity, usually with their concentration of universities and research institutions.**
- 2. Technology is changing the way people live, with communication and digital connectivity making work and leisure interactions possible online without leaving our homes. Commerce has been transformed, and online shopping for everything from groceries to medical services is the new norma.l**
- 3. Smart cities, where technology is leveraged to improve the lives of urban citizens, provide services more effectively - reduce traffic congestion and accidents, optimise energy and water services, adapt for climate change, address pollution and improve health and safety.**
- 4. Sharing knowledge on smart technologies for cities will build capacity and accelerate sustainable development.**

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# Importance of Geospatial Information



Source: [www.esri.com](http://www.esri.com)

- Geospatial Information reflects the physical world in which all human, economic and environmental activity takes place.
- It provides the digital version with information that enables a digital economy.
- Geospatial information describes the physical location of geographic data and links to other associated data.
- Geospatial information is presented in many forms and mediums including maps, satellite imagery and aerial photography.
- Geospatial information tells us what happens where and enables decisions about critical infrastructure and services linked to people's needs.



# Geospatial information in sustainable cities

## Infrastructure, utilities and services

- Land administration and management
- Environmental protection
- Urban Planning and land use
- Transport networks and hubs
- Health infrastructure (hospitals)
- Education facilities (schools, universities)
- Water networks and facilities
- Nature reserves and parks
- Natural Disaster prone areas
- Population and income data and demographics
- Telecommunications and digital data (mobile, broadband)



Image Source: [www.greenmatch.co.uk](http://www.greenmatch.co.uk)

## Social and economic policies

- Smart transportation
- Smart Energy use
- Public transport
- Waste management
- Citizen information and engagement
- Crime investigation
- Health and Education
- Affordable housing
- Recreation and Social services



# Case Study: Geospatial Information in Lisbon Portugal for drainage management and flood mitigation

Downtown Lisbon Flood Mapping  
using digital twin  
Source: City of Lisbon



- Geospatial data includes terrain information, mapping of water, sewerage and stormwater networks, real-time sensors, video surveillance, public reporting.
- Modelling of city's water and stormwater networks and predictive analysis of capacity limitations in flood events.
- Enabled the development of appropriate planning for infrastructure, increase in existing capacity and emergency response.
- Greatly reduced events that resulted in significant inundation.
- Important for mitigation climate change impacts with sea-level rise.

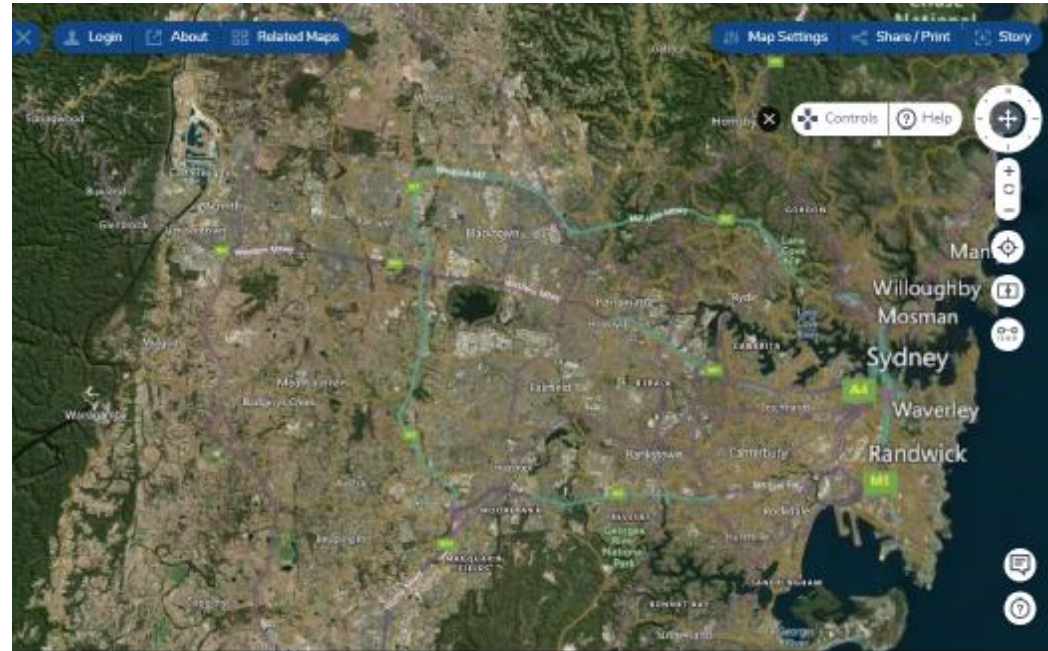
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# Case Study: Geospatial Information for Digital Twin for Sydney Australia

See Live data and the twin at:

<https://www.spatial.nsw.gov.au/what-we-do/projects/digital-twin>

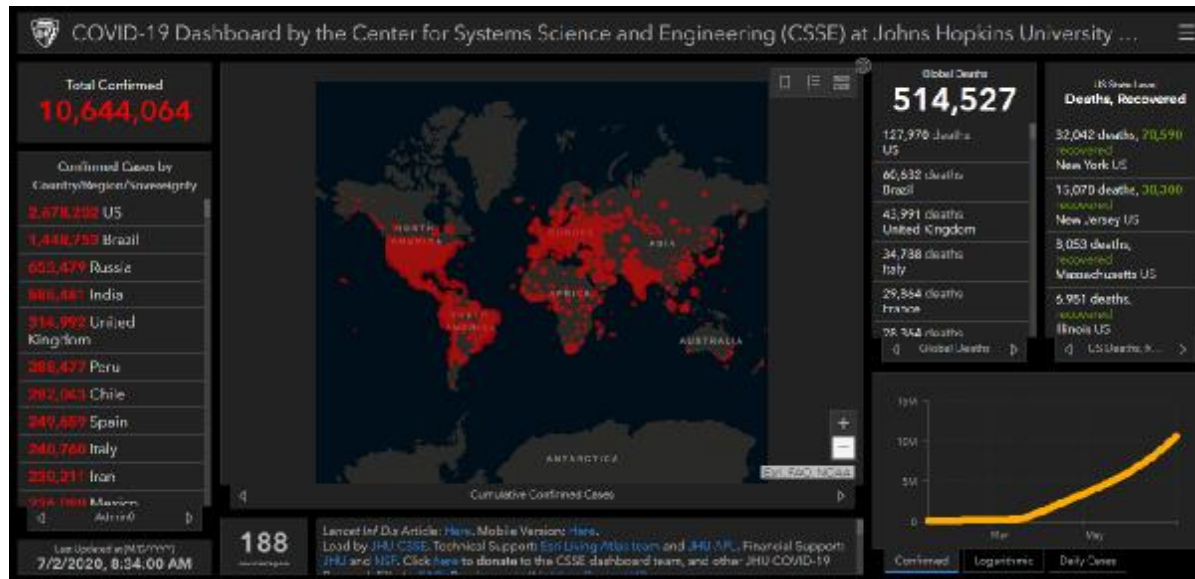


- Transform urban planning and design using Spatial Digital Twin based on 3D and 4D digital spatial data of the built environment – today and tomorrow.
- integrates data sets from across the government including:
  - real-time transport data, above and belowground utilities (electricity, gas, water, broadband), building information, property data, health infrastructure, 22 million trees with height and canopy attributes, almost 20,000 km of roads, and 546,206 buildings.

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# Case Study: Geospatial Information and smart mapping of health data such as COVID-19 cases



See Live data at:  
<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>

- Geographical Information System (GIS) used to track COVID-19 cases in cities.
- Variety of data sources including credit card transactions, mobile phone location to track and trace locations of confirmed cases.
- Spatial information enables policy makers to implement travel bans and events and other lockdown policies.
- Medical services such as hospitals are supported based on location and trends in cases.



# Smart Cities, buildings and infrastructure – essential for sustainable development



Smart cities are essential for sustainable development, economic growth and resilience. Geospatial information and technologies is an important enabler, enabling the lever of science and technology to accelerate sustainable development through urban and peri-urban environments.





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- **Participation**
- **Influence**
- **Representation**





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For a better,  
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