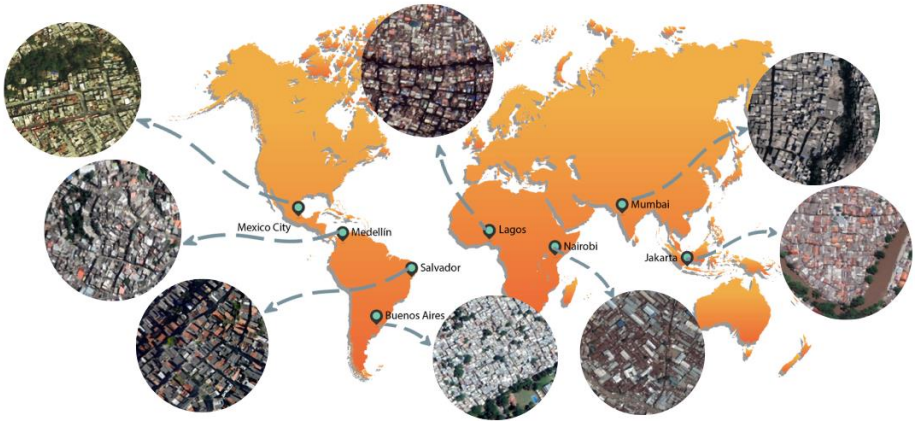
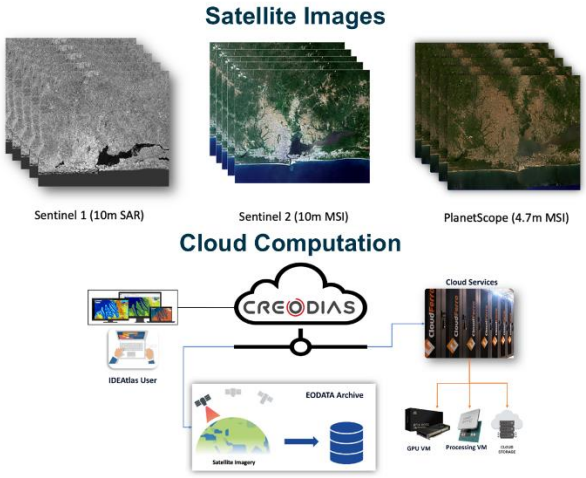
EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

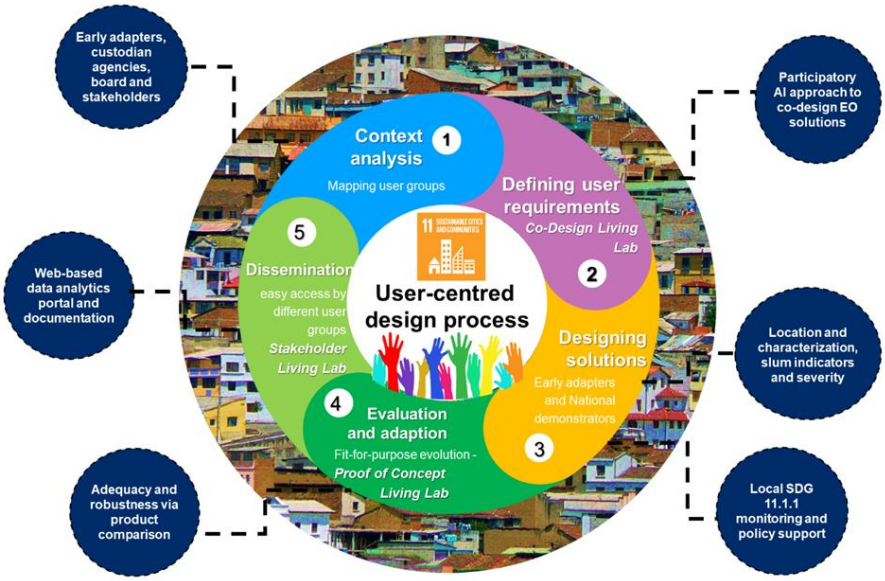
EO-based SDG Indicator Country Use Case

SDG Indicator/ Sub-indicator	**SDG 11.1.1:** Proportion of urban population living in slums, informal settlements, or inadequate housing
Country or region	The ESA-funded **IdeAtlas** project works on a global sample of cities, which are diverse in terms of geography and urban morphology. The pilot locations include: • Lagos, Nigeria • Mexico City, Mexico • Medellin, Colombia • Buenos Aires, Argentina • Nairobi, Kenya • Salvador, Brazil • Mumbai, India • Jakarta, Indonesia  esa 11 IDEAtlas INFORMAL SETTLEMENTS

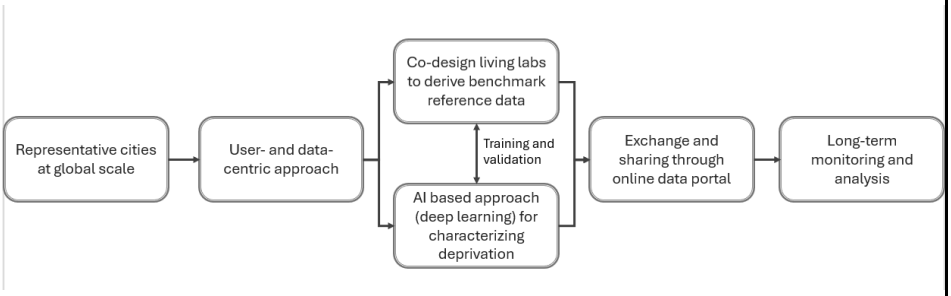
Project Status *(mark with an x)*	_ being used in official SDG Indicator reporting X being verified or tested by country _ studying feasibility
Earth Observation Data Used *(include web links)*	High-resolution EO imagery from various sources. The following High-Resolution (HR) Imagery were used: • **Sentinel-2:** Provides 10-meter spatial resolution imagery, which is free of charge. This data is used for citywide mapping to identify the general extent of slum areas.(https://scihub.copernicus.eu/) **Very-High-Resolution (VHR) Imagery:** • **SPOT6-7:** Offers 1.5-meter spatial resolution imagery. (https://earth.esa.int/eogateway/missions/spot) • **WorldView-3:** Provides 0.30-meter spatial resolution imagery. (https://earth.esa.int/eogateway/missions/worldview-3) • **PlanetScope image**: Provides approx. 3-meter resolution imagery (https://earth.esa.int/eogateway/missions/planetscope) **EO Derived auxiliary information:** • Building locations (https://sites.research.google/gr/open-buildings/) • Built patterns, e.g. density.(calculated using https://docs.momepy.org/en/stable/)
Additional/Other Data Used *(include web links)*	Portal with an interactive map https://portal.ideatlas.eu/ Integrated with existing data and methodologies from IDEAMAPS and SLUMAP initiatives. https://www.ideamapsnetwork.org/ https://slumap.ulb.be/

Description of data access, processing, and analysis, including methodology that was developed, associated tools or applications, and how these are applied to compute SDG Indicator	IdeAtlas fosters a data and user-centric approach to develop models and an open benchmark dataset (but also privacy-preserving) for the knowledge development of urban deprivation. It leverages AI, specifically the deep learning models to identify and map informal settlements using Earth Observation (EO) data. We designed a custom Multi-Branch Convolutional Neural Network (MB-CNN) architecture based on U-Net, which can fuse multi-modal input channels, i.e., optical bands, SAR channels, and morphometric features. We reduced the number of levels, which led to a substantial decrease in parameters, contributing to a more lightweight yet powerful model. The models and computation is using a cloud system (CreoDias).  Both the input and output of model are openly communicated through an online data portal listed in the previous section, leading to a benchmark information for developing further knowledge about urban deprivation. The system enables temporal monitoring, knowledge exchange, data updating, and analysis of informal settlement dynamics. The final mapping products are used for city-level SDG statistics (SDG 11.1.1) to support local SDG monitoring.

Workflow	The project incorporates a co-design methodology with a series of Living Labs in all eight cities that are involving a large number of local stakeholders to ensure tools meet community and governmental needs.



The major steps in this project are summarized along the directed workflow below. Our long-term plan is to gradually build a monitoring and analysis system that allows feedback from local users on mapping outputs.



Lessons learned, any gaps, key issues and recommendations

- Need for a user-centered approach to ensure tools are locally relevant.
- AI-based solutions require adaptions across diverse socio-economic and geographic contexts.
- Need for representative and openly available reference data to boost progress in this field.
- Importance of stakeholder involvement in the model development process.
- To overcome the fragmented approach to this topic and foster collaboration between research teams, we, together with IDEAMAPS, have launched a Community of Practice (CoP), which can be found here.

Supporting material about this use case. ***(include links, publications, etc.)***

https://ideatlas.eu/

Name(s) and email address of individual(s) involved in this effort. Please note the principal point(s) of contact (POCs).	PI: Monika Kuffer m.kuffer@utwente.nl and ideatlas@utwente.nl Organizations involved: ITC (University of Twente, NL), GeoVille (Austria), UN-Habitat, UN-Stats, IDEAMAPS, University of Lagos (Nigeria), APHRC (Kenya), Federal University of Bahia (Brazil), MapBiomas (Brazil), ReNaBaP (Argentina), Universidad EAFIT (Colombia), INEGI (Mexico), KRVIA Mumbai (India), Pillai College of Engineering (India) and URDI (Indonesia)