Sustainable Development Report 2023 – Annex

Methodological Summary and Data Tables

SDG TRANSFORMATION CENTER

A.1 Pedestrian accessibility indicators for the SDGs (SDG 9.1.1)

In the 2030 Agenda for Sustainable Development and the associated New Urban Agenda, the UN urged cities to provide more accessible, well-connected infrastructure for bringing people into public spaces and improving walkability.

Pedestrian accessibility is the extent to which the built environment supports walking access to destinations of interest, or the ability of urban residents to access services and opportunities.

While this metric is highly related to the promotion of good health and well-being (SDG 3) and the access to key services in education (SDG 4) and transportation infrastructure (SDG 9), its main use lies in assessing the sustainability and quality of the urban built environment. It is particularly useful for assessing spatial justice in cities, usually represented by underprivileged communities which are pushed to live in deteriorated urban areas receiving a minor share of public investments and thus low levels of accessibility.

Monitoring spatial indicators of pedestrian accessibility helps planners and policymakers evaluate the impacts of urban design and transport interventions and guides targeted interventions towards achieving SDG 11 by creating healthy, sustainable cities. Urban pedestrian accessibility is represented in the UN SDG Indicator Framework by two different indicators: Urban access to public transportation (SDG 11.2.1) and Urban access to public spaces (SDG 11.7.1).

As part of its effort to develop new geospatial indicators for the SDGs, the SDG Transformation Center and the 2023 Sustainable Development Report present this dataset for pedestrian accessibility indicators. In the 2023 SDR, this data is implemented as the proportion of urban residents with access to a range of key services (education, health, open public spaces, public transportation infrastructure and food choices) in a under-15-minute walk.

Methodology

Data sources

Two main sources of data are behind this study. OpenStreetMap is used to collect data on pedestrian infrastructure and geographically allocated places of interest (POI): hospitals, schools, supermarkets, restaurants, schools, etc. Pedestrian infrastructure networks are returned by the OpenStreetMap API as networks of nodes and edges, where each node represents a street intersection and each edge represents a segment of road with walkable features. Data on population density for every city is retrieved from the European Commission's 2020 Global Human Settlement Layer (GHSL). This data is retrieved in the form of a grid of 100m by 100m cells and their associated population values covering the entire world.

Geographical extent

The geographical extent of a particular city or region often varies according to different authorities and interpretations. Novel projects, such as the Global Human Settlements (GHS) Urban Centers Database (UCDB), seek to establish a consistent, shared geographic definition of “urban centers” globally. This study does not consider municipal boundaries for defining city borders. Rather, it considers "Functional Urban Areas" as defined by the OECD and the European Commission. The boundaries of Functional Urban Areas consider urbanization factors such as commuting flows and population density, and are less arbitrary than municipal boundaries. For this reason, cities presented here may have a different (and often bigger) shape expected.

Accessibility analysis

To measure accessibility to services for each city, we perform a network analysis on the pedestrian street networks and POIs data to quantify and map accessibility at the street intersection level.

The distance from each street intersection to the closest point of interest in each of the predefined categories is measured. These distances are averaged to generate the final average walking time to services in general. Distances are transformed into minutes by applying a multiplication factor of 0.0125, meaning that pedestrians are estimated to walk at 3 mph. The resulting walking times for each category are averaged for the population grid cells. For each 100m cell from the population grid data, the resulting walking time reflects the time that the average person residing inside that cell would have to walk for, using the existing pedestrian infrastructure, to reach the first amenity from a given category of services. The analysis was performed using geopandas and pandana python packages.

These scores were then be generalized for each country, by taking the population weighted average of the accessibility score for each point in the population grid.

Data validation

These calculations were performed for all cities where at least one POI could be identified for each square kilometer. This threshold is applied in order to enforce representativity and accuracy. Countries where less than 40% of the urban population is represented after applying the aforementioned thresholds were excluded from the final dataset.

Known limitations

The fact that the underlying POI and street-network data (from OpenStreetMap) are voluntarily collected represents the biggest limitation of these indicators. As a result, the accessibility results that we present may be more or less accurate depending on the city. In general, research has shown that OpenStreetMap data is more representative of real-world land use patterns, with its street network being 83% accurate as of 2019. There are, however, large disparities from place to place.

Urban, rural and suburban settlements

It's important to notice that we're not just comparing countries, but rather the urban settlements of countries, weighted by population. Some developing countries, especially small ones, might not have very large urban populations. This means that even if the majority of people might be living in urban settlements, those won't be reflected by these scores, as they're exclusively about urban settlements as defined by GHS UCDB.

Some countries will have very few urban centers. N'Djaména and Bangkok, for instance concentrate the vast majority of their respective countries' urban populations, so when we compare Chad and Thailand, we're really mostly comparing these two cities.

References

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