Development of SDG indicators based on geospatial information

The **2030 Agenda for Sustainable Development** is a set of global development goals **established in September 2015** by the **United Nations Sustainable Development Summit,** building on the accomplishment of the Millennium Goals (MDGs). In order to **end poverty** and **create a more sustainable world**, the 2030 Agenda established **"17 Sustainable Development Goals (SDG)"** consist of **17 goals**, **169 Target** and **248 indicators** (revised during 53rd United Nations Statistical Commission session in March 2022). The Sustainable Development Goals (SDGs) are global objectives that apply to both developed and developing nations.

Figure 1: Sustainable Development Goals Wheel
Source:https://sdgs.un.org

Goal 11: Sustainable Cities and Communities is one of the SDG Goals that has received widespread attention. This is owing to the fast expansion of cities as a result of rising populations and increased migration, which has resulted in a boom in mega-cities, particularly in the developing world, and slums are becoming a more prominent component of urban life.
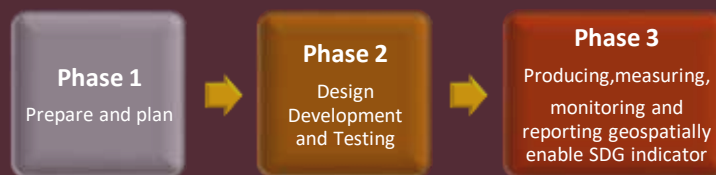
SDG 11's main objective is to **make cities more inclusive, safe, resilient, and sustainable**. In order to reach this SDG 11 goal, there are **10 targets** and **15 indicator** scattered throughout. Current progress of SDG 11, DOSM in the process of developing the **3 indicators** which cover SDG 11.1.1, 11.2.1 and 11.7.1.

What is Geospatial Information?

Geospatial information is a nation's 'digital currency' for evidence-based decision-making. It is a critical component of a national infrastructure and knowledge economy that contribute to economic growth, national security, sustainable and equitable social development, environmental sustainability and national prosperity.

There are **three phases** in order to link the statistical and geospatial actors working within the Global Indicator Framework. The 1st phase of the SDGs Geospatial Roadmap focuses on delivering important activities to develop a foundation for using geospatial information to achieve the SDGs. The 2nd phase finds resources that aid in analyzing and selecting on which data, techniques, issues, and GIS implementation in the SDGs to use. Finally, phase 3 involves defining important activities that support the process from the creation of an indicator through its distribution and reporting.

Phase 1
Prepare and plan

Phase 2
Design Development and Testing

Phase 3
Producing,measuring, monitoring and reporting geospatially enable SDG indicator

Figure 2 : Phase of SDGs Geospatial Roadmap
Source:https://ggim.un.org/meetings/GGIM-committee/11th-Session/documents/The_Geospatial_SDGs_Roadmap_WGGI_IAEG_SDGs_20210804.pdf

SDG 11.1.1 : Proportion of Urban Population Living in Slums

According to UN-Habitat, classified a 'slum household' as one in which the inhabitants suffer one or more of the following 'household deprivations". The target for SDG 11.1.1 is ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums by 2030.

Figure 3: Slum area in Kuala Lumpur Malaysia
Source: https://asia.fes.de/news/for-low-income-malaysia-a-lifeline-amidst-a-crisis

Figure 4: People living in slum area in Kuala Lumpur
Source:https://www.thestar.com.my/news/focus/2020/11/01/the-poor-in-malaysian-cities-are-getting-poorer

The Department of Statistics Malaysia (DOSM) has taken the initiative to identify the Areas and the population living in slums in order to achieve the SDG 11.1.1 objective. GIS data on slums and Malaysia Census 2020 data are utilized by DOSM to identify slums. The slum data is obtained in collaboration with PLAN Malaysia, while population data is derived from the findings of the Malaysia Census 2020. The Department of Statistics Malaysia uses both of these raw data to determine the total population, age, gender, and number of homes in slum areas under Local Authority (PBT) which can seen in figure 5.

Figure 5: Spatial distribution of slum settlement in Alor Setar , Kedah
Source: GIS data ,Department of Statistic Malaysia

Formula for SDG 11.1.1 Index

The formula based on figure 5 is been used in order to determine the SDG 11.1.1 Index

$$\frac{\% \text{ of living in slum}}{\text{Urban/City Population}} = 100 \left[\frac{\text{Number of people living in SISH}}{\text{Urban/City population}} \right]$$

Top 5 Ranking SDG 11.1.1 index by countries

1. Central African Republic (2018) - 98.5%
2. South Sudan (2018) - 97.3%
3. Sudan (2018) - 93.7%
4. Somalia (2018) - 93.6%
5. Madagascar (2014) - 77.2%

This indicator considers the number of persons living in urban slums in relation to the urban population. This indicates that the smaller the proportion of the index, the fewer the countries that have urban slums region.

SDG 11.2.1: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities safe, resilient and sustainable.

By 2030, all people should have access to safe, affordable, accessible, and sustainable transportation options. This will improve road safety, particularly by boosting public transportation and paying particular attention to the needs of those who are vulnerable, such as women, children, people with disabilities, and the elderly. The **public transport** system is **considered convenient** when a stop is **accessible within 1km** of a reference point (home, work place and etc).

Figure 6 : Linkage between Public Transport
Source: https://busride.com/how-cities-can-make-public-transit-more-convenient-than-your-car/

Figure 7 : Transit Oriented Development (TOD) concept in Kuala Lumpur
Source: https://www.iproperty.com.my/news/transit-oriented-developments-tods-are-they-actually-affordable/

The Department of Statistics Malaysia (DOSM) has taken the initiative to identify the urban population that has access within a **1km radius** of the nearest terminal, bus station, jetty, and so on. The analysis is carried out by the Department of Statistics Malaysia using GIS data that has been provided.

DOSM makes use of **terminal land use** data provided by **PLAN Malaysia**, as well as **road data** obtained from the **Malaysian Public Works Department.** The population data are being used in the 2020 Malaysian Census. This is depicted in Figure 7

Figure 8 : 1km radius population from Terminal and transit at Kuala Lumpur
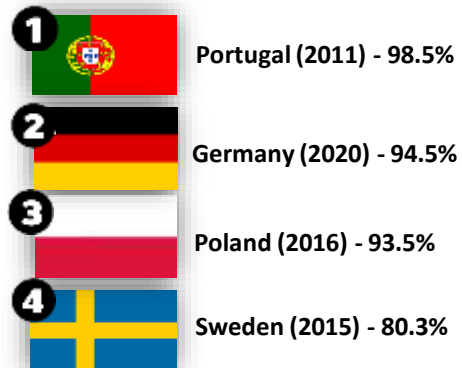Source: GIS data ,Department of Statistic Malaysia

Formula for SDG 11.2.1 Index

The SDG 11.2.1 Indicator is calculated using the formula shown below.

$$\frac{\text{Total population within merged service area for low and (or) high capacity public transport stops}}{\text{City Population}} \times 100$$

Top 4 Ranking SDG 11.2.1 index by countries

1. Portugal (2011) - 98.5%
2. Germany (2020) - 94.5%
3. Poland (2016) - 93.5%
4. Sweden (2015) - 80.3%

This indicates that the larger the index percentage the better the accessibility of public transport in 1km radius by the urban community.

SDG 11.7.1 : AVERAGE SHARE OF THE BUILT-UP AREA OF CITIES THAT IS OPEN SPACE FOR PUBLIC USE FOR ALL

Built up areas are defined by UN-Habitat as areas occupied by buildings and other artificial surfaces. SDG 11.7. goal that by 2030, it would ensure universal access to **secure, inclusive and accessible, green and public places, in particular for women and children, elderly individuals and persons with disabilities**. SDG 11.7 is split up into two targets: 11.7.1 and 11.7.2.

It aims for **11.7.1** to **be the average share of city built-up area** that **is open space for public use for everybody** while **11.7.2** looks at the **proportion of people** who have **experienced physical or sexual harassment** in the past 12 months**, broken down by gender, age, disability status, and location.

Figure 9 : Open space in Bukit Jalil, Kuala Lumpur
Source: https://busride.com/how-cities-can-make-public-transit-more-convenient-than-your-car/

Figure 10 : Open space in Kuala Lumpur
Source:
https://www.malaymail.com/news/malaysia/2022/04/30/youth-and-sports-ministry-sporting-recreational-activities-allowed-without/2056534

The Department of Statistics Malaysia (DOSM) has undertaken the initiative in implementing SDG 11.7.1, which emphasizes on the average share of built-up land in cities that is open space for public use for everyone.

In order to achieve the SDG 1.7.1 target, the analysis is carried out utilizing provided GIS data. DOSM makes use of land use data from PLAN Malaysia, and population data from Census Malaysia. This is to ensure that there is adequate open space and facilities to accommodate the population growth rate.

Figure 11 : Spatial Distribution of Built Up Area and Open Space at Ayer Keroh , Melaka
Source: GIS data ,Department of Statistic Malaysia

Formula for SDG 11.7.1 Index

$$\frac{\text{Public Use}}{\text{Built-up Area Of Cities}} \times 100$$

Top 2 highest SDG 11.7.1 index city

This Index to ensure that there is adequate open space and facilities to accommodate the population growth rate. This shows 4 city with highest and lowest Open Public Space (%).

1 Ôzgôn , Kyrgyzstan (2020) - 96.11%

2 Regina , Canada (2020) - 95.49%

Top 2 lowest SDG 11.7.1 index city

1 Comilla, Bangladesh (2020) - 11.46%

2 Mawlamyine, Myanmmar (2020) - 11.49%