Source: UN 2021

THE GLOBAL URBAN MONITORING APPROACH TAKEN BY UN-HABITAT

Recent Experiences on Implementing SDG 11

UN-Habitat bases its worldwide urban development monitoring system on National Samples of Cities and the Global Human Settlement Layer. Monitoring the development of built-up areas for settlement and transport purposes under the Sustainable Development Goal 11.3.1 constitutes one of the basic elements of UN-Habitat's Data and Analytics Section.

Dennis Mwaniki
Dr. Robert Ndugwa
are leading scientists at the Data and Analytics Section of UN-Habitat – the Programme for Housing and Human Settlements of the United Nations – in Nairobi.
dennis.mwaniki@un.org
robert.ndugwa@un.org

Introduction

Urbanization is not only a demographic or spatial phenomenon, but a force which if steered and deployed correctly can help the world overcome some of its major global challenges including poverty, inequality, environmental degradation, climate change, fragility and conflict, which are all critical elements of the New Urban Agenda and the urban dimension of the 2030 Agenda. However, a higher proportion of cities ultimately formulate policies and action plans without clear evidence. It is estimated that as high as 65 % of local authorities do not know how and why the city is growing and who or what is behind this growth (Cuberes 2011; Córdoba 2008). Despite considerable progress in recent years, still whole groups of people and places are not being counted and important aspects of people's lives and city conditions are not properly measured. For people, this can lead to the denial of basic rights, and for the city, the likelihood that they do not take full advantage of the transformative potential of urbanization.

The use of data and translating such evidence into knowledge are fundamental principles that are key to guide and understand urbanization gaps and needs for many local governments. Indeed, many cities are now recognizing the need to critically link data to evidence based policy formulation and the development of actions plans.

At present, 54 % of the global population live in urban areas, representing 3.9 billion people. In Latin America, the Caribbean and North America, this figure exceeds 80 %. In Europe, roughly 73 % of the population live in cities, whereas in Asia and Africa the rates are 48 % and 40 % respectively. Nearly 50 % of the world's urban population now live in cities of less than 500,000 inhabitants (UN DESA 2018). This shift has already taken place in many small and large countries such as Germany, China, Kenya, Rwanda – where more people are now living in cities and towns than rural areas (UN DESA 2018). The urbanization geographical shifts today are taking place more rapidly in the developing world than elsewhere. Urban transitions that used to take centuries are now occurring in a few decades, which generates huge challenges for how we plan and design our urban formations for the future. Unfortunately, few countries are adequately prepared for these challenges, and even fewer are trying to manage them in a planned manner. In fact, the majority of the policy discussion concerning global urbanization trends tend to focus on megacities and large urban agglomerations that have more decision-making power and a larger share of specialized activities with high added value and less on small cities, yet a lot of the growth is occurring in small and medium sized cities (Lacour/Puissant 2008). Many huge urban agglomerations have to cope with a whole series of new requirements and vulnerabilities such as climate change related concerns that have to be addressed creatively and equitably.

At the same time, we must not lose sight of many other emerging problems that small and medium-sized cities face, such as a lack of basic infrastructure and services.

For example, in India the 2011 Census results showed that, there was a huge increase in the number of urban conurbations in the preceding ten years, from 5,161 in 2001 to 7,935 in 2011, an increase of 54 % that dwarfs the 32 % growth in the country's urban population (Government of India 2019). This was partially because of reclassification of settlements from rural to urban as they started showing higher population density (more than 1,000 persons per km²) and as non-agricultural work becomes dominant. The highly significant increase in areas still not officially recognized as "urban" (and therefore lacking the institutional and administrative machinery provided to urban areas) accounts for more than 90 % of the increase in the total number of urban settlements (Government of India 2019).

In many countries, particularly in the developing regions, the growth and patterns of urban settlements have largely been unmonitored, resulting in urbanization without proper provisions for even essential services like all-weather roads, piped water and – above all – sanitation and waste disposal. Governments at national and regional level tend to turn a blind eye to these new urban settlements, because they simply cannot handle the scale of the likely demands relative to their own resources. This is why many member states agreed for the first time to work with a global goal (SDG 11) that focuses on how to ensure that we turn our cities and human settlements from what they are today to spaces that are inclusive, safe, resilient and sustainable. SDG 11 comes with ten targets which are great opportunities to address the many challenges that cities and urban areas are facing. These targets include addressing the housing and slums, urban planning and design, civic engagement in urban management, transport systems, culture, air quality, waste management, disaster risk reduction, national urban policies, water and sanitation which are all relevant issues to sustainable urban development (see figure 1). However, part of the success for SDG 11 requires harmonization of various urban concepts including city definitions.

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SDG 11 targets and indicators

Target	Indicator
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	**11.1.1** Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	**11.2.1** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	**11.3.1** Ratio of land consumption rate to population growth rate **11.3.2** Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	**11.4.1** Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional, and local/municipal)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	**11.5.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population **11.5.2** Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	**11.6.1** Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities **11.6.2** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	**11.7.1** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities **11.7.2** Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	**11.a.1** Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	**11.b.1** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 **11.b.2** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	

Source: UNStats 2020

Over the years, UN-Habitat has developed a set of tools and resources aimed at promoting, enhancing and accelerating urban monitoring efforts in line with the requirements of the SDGs, New Urban Agenda as well as other global agendas. Some of the tools which have proven valuable for urban monitoring include work on attainment of a globally harmonized definition of urban and rural settlements for monitoring purposes, the National Sample of Cities and the urban observatory model.

The city definition for global reporting purposes

Many indicators in SDG 11 require us to monitor and report progress at the city level, and aggregate national level performance from these cities. Some of the indicators falling into this category include those on convenient access to public transport (11.2.1), land consumption (113.1), solid waste (11.6.1), air quality (11.6.2) and public space (11.7.1). Having a city as the unit of analysis is new for many countries, with previous reporting having been done with the dichotomy of urban versus rural areas. This Goal 11 challenge prompted UN-Habitat and many partners (European Commission, FAO, OECD, World Bank, and National Statistical Offices) to work towards a harmonized global city (urban) and rural areas definition that would be used for global reporting purposes on the New Urban Agenda/SDGs urban related targets (UN-Habitat 2018). In March 2020, the UN Statistical Commission endorsed this harmonized global definition of a city and a metropolitan area[1]. This definition captures the full extent of a city/urban area, including the dense neighbourhoods beyond the boundary of the central municipality. This new definition is designed to facilitate the comparison of cities as national definitions vary depending on legal, administrative, political, economic or cultural criteria in the respective countries and regions.

National Sample of Cities

There are many other global monitoring challenges related to cities such as the need to use and apply geospatial data for some indicators, putting in place local data coordination, collection and reporting teams, and handling and applying appropriate data disaggregation and aggregation techniques to ensure that no one is left behind. For developing countries with limited resources or developed countries with many cities, monitoring at the city level may require huge resources which could translate into millions of dollars annually. Consequently, many national governments and statistical offices now recognize that it is not possible, and perhaps not necessary, to study each and every city in the country to monitor national trends on SDGs urban indicators.

Similarly, SDG 11 and other urban specific SDGs require the production of data at the city/urban level and, aggregation of this data to national trends, which then inform regional and global aggregates and reporting. In principle, this means that data should be collected for each city/urban area in a country for each of the urban specific indicators and the average value used to report the national performance against the indicator (see figure 2). While this requirement promotes understanding of urban level trends which have a significant contribution to the attainment of sustainable development[2], the data needs are significantly high (and span many rapidly changing sectors), especially where well-structured local monitoring processes are not in place. In addition, the presence of many city/urban areas in some countries, some of which grow rapidly (requiring more frequent monitoring) demand many resources to monitor trends at the right frequency, which makes it difficult and impractical for many national statistical offices and urban authorities to effectively collect data and report.

2

Steps for undertaking the National Sample of Cities

Source: UN-Habitat 2020

Cognizant of this, UN-Habitat developed the National Sample of Cities (NSC) approach, through which a representative sample is drawn from the pool of functionally diverse urban areas in a country. The National Sample of Cities approach (UN-Habitat 2020) allows countries to derive from a complete listing of all their urban centres/cities a representative sample of cities that reflects their systems of cities and ensure that they take into account sub-regional and city specific characteristics and variances. Regular monitoring is then done for the sampled cities/urban areas and results aggregated to represent the national urban trends. The development of the NSC approach was based on the overall identification that, while many countries produce statistical data that can be disaggregated to urban and rural trends at the national level, very limited data is available at the individual city/urban level. In fact, for many countries – both in the developed and developing regions, urban specific data is largely limited to capital cities and/or the largest urban areas, which would create a bias on progress reporting if such information was used to report against SDG 11 and other urban indicators.

NSC offers diverse benefits both for the national and global urban monitoring processes, some of which include:

- An integrated low-cost option for monitoring cities with the possibility to assess city performance in a more systematic manner.
- Integration of cities of all sizes, functions and types as part of a representative national urban monitoring system. This helps to produce consistent data and information that can be used to prioritize activities, ensure strategic investments, monitor coverage of plans and measure their impact.
- Structuring the aggregation of locally produced city indicators for national monitoring and reporting as well as for production of regional and global aggregates. The sample also provides options to calculate both weighted and un-weighted national averages on performance against indicators.
- Facilitating a systematic disaggregation of information at national, sub-national and city levels along key SDGs indicators and dimensions of development.

Using the National Sample of Cities approach, UN-Habitat and partners have assisted countries in creating conditions to monitor and report on a consistent set of cities that enable them to produce time series analysis to measure national progress in a more systematic and scientific manner. In addition, the National Sample of Cities facilitates an economical way of targeting and setting up appropriate monitoring and reporting systems for cities in countries where resources are a big constraint. The National Sample of Cities model thus seeks to promote the production of data at the right resolution across SDG 11 indicators, using a scientifically tested approach that produces representative data across the often heterogenous urban settings of different countries.

The urban observatory model

In the absence of the institutional data management frameworks at the city or municipality levels, it becomes difficult for leaders and policy makers to know whether they are making progress or not, or even to identify bottlenecks in their cities. UN-Habitat developed the concept of the urban observatory as a local think tank to help local leaders to work with data and evidence to inform their decision and policy making processes. Urban observatories[3] are well-positioned to address the frequently expressed need for reliable, high resolution urban datasets specific to the cities and immediate city-regions in which they operate. They assist in strengthening data capacities at national, sub-national, and local levels, providing platforms to facilitate effective knowledge exchange and promote evidence-based governance built on a shared knowledge base.

Over the years, UN-Habitat has been providing systematic guidance on setting up these observatories to many countries leading to the development of a global network of local, national and regional urban stations, the Global Urban Observatory Network (GUO-Net), a worldwide information and capacity-building network to help implement the New Urban Agenda at the national and local levels. Urban observatories constitute a very important asset for the monitoring and reporting of the international agendas such as the New Urban Agenda and the SDGs as they

(1) A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons may be found at https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Recommendation-E.pdf

(2) Cities and urban areas, being home to majority of the global population are centers where opportunities for sustainability are concentrated, but also where risks for being left behind converge.

(3) See also https://unhabitat.org/sites/default/files/2020/06/urban_observatory_guide.pdf

lead the local level engagements on collecting, analyzing and interpretations of data for urban indicators through consultative and inclusive processes. COVID-19 has already had a huge impact on our way of life and all the phenomena that we describe in our urban data and statistics strategies have largely been affected. According to UN HABIAT's assessment, cities attached to the urban observatories have coped much better to handle the collection and compilation of COVID-19-related urban data. These cities were also much better able to ensure that the data are used in good time to inform local politicians and authorities in order to develop strategies on the economy, the environment, housing, food security, culture and tourism, work, migration, health (beyond COVID-19), education, crime, etc. to develop.

Spatial data supporting global urban monitoring

Data needs for the global SDG indicator framework demands the use of a mix of statistical, geospatial and community data, which can be complemented by information from big data avenues. For SDG 11 and other urban SDGs, the use of alternative data sources is deeply entrenched into the indicators and their measurement, with some indicators requiring use of geospatial data for monitoring and others requiring use of community volunteered data and social surveys (see figure 1). While many indicators have a spatial component (i. e. trends and conditions can be analyzed and visualized to a geographical unit to show variations in intra-urban performances), there are specific indicators within SDG 11 where more than 80 % of the measurement is reliant on the use of earth observation and geospatial data and related technologies and processes. These indicators include 11.3.1, which measures spatial urbanization versus the population change trends, indicator 11.2.1 which assesses the availability of and access to public transport, and indicator 11.7.1 which measures the availability and access to open public spaces within urban areas. For this paper, we demonstrate the methodological process for indicators 11.3.1 and 11.7.1 and how they integrate geospatial data.

Assessing urbanization trends using geospatial data (Indicator 11.3.1)

Indicator 11.3.1, ratio of land consumption rate to population growth rate is a measure of how urbanization manifests both in space and in terms of population changes. The computation of indicator 11.3.1 thus requires two important inputs: data on how and where urban areas grow over time and data on how populations change over the same period. The first input demands exclusive use of earth observation data, which mainly constitutes historical satellite imagery analysis, while the second input requires a mix of statistical and geospatial data. The indicator computation follows the five generic steps described below.

a. Deciding on the analysis period/years – this step involves selecting the time period during which the measurement of the indicator will be undertaken. Since this indicator considers historical growth of urban areas, analysis can be done annually, in five year or ten year cycles. Cycles of five or ten years are commended, especially where mid-to-high resolution satellite imagery is used to extract data on built up areas, which is used to compute the land consumption rate component of the indicator.

b. Delimitation of the urban area or city which will act as the geographical scope for the analysis – in this step, the definition of the spatial analysis scope within which indicator 11.3.1 will be measured is undertaken. The use of the harmonized global definition of cities for global reporting purposes described previously is recommended.[4]

c. Spatial analysis and computation of the land consumption rate – urban areas and cities grow in different ways, the most common of which include infill (new developments within existing urban areas resulting in densification), extension (new developments at the edge of existing urban areas), leapfrogging (new urban threshold developments which are not attached to the urban area but which are functionally linked) and inclusion (engulfing of outlying urban clusters or leapfrog developments into the urban area, often forming urban conurbations) (Angel/Blei/Parent/Lamson-Hall/Galarza 2016). Key to note also is that growth of urban areas is not always positive since some urban area mass can be lost during disasters or deliberate urban regeneration programmes. Since the different urban growth types manifest differently in space, the use of the built up areas within the analysis geographical scope is viewed as true measure of the urbanization process (UN-Habitat 2018). This step, which fully relies on the use of earth observation and geospatial analysis techniques, involves extraction of multi-temporal information from satellite imagery on the built-up areas within the analysis area, and calculation of the total built up area for each analysis year. The calculated areas are then used to compute an annualized land consumption rate for the analysis period, which is implemented using the formula:

$$\textbf{Land consumption rate i. e. LCR} = \frac{V_{present} - V_{past}}{V_{past}} * \frac{1}{(t)}$$

Where

- $V_{present}$ is total built up area in current year
- V_{past} is total built up area in past year
- t is the number of years between $V_{present}$ and V_{past} (or length in years of the period considered)

When multiplied by 100, the resulting figure from the above formula gives the percentage annual land consumption rate for the analysis urban area and time period.

d. Spatial analysis and computation of the population growth rate – this step, which requires a mix of geospatial and statistical analysis techniques, involves the calculation of the total population within the analysis geographical scope (the urban area) and year. Its implementation demands the use of high-resolution population data that can be acquired from the national statistical offices or modelled population data. The calculated or estimated population for the analysis years, which should match the analysis geographical scope (delimited urban area/city) is then used to compute the population growth rate using the formula:

$$\textbf{Population Growth rate i. e. PGR} = \frac{LN(Pop_{t+n}/Pop_t)}{(y)}$$

Where

- LN is the natural algorithm value
- Pop_t is the total population within the urban area/city in the past/initial year
- Pop_{t+n} is the total population within the urban area/city in the current/final year
- Y is the number of years between the two measurement periods

When multiplied by 100, the resulting figure from the above formula gives the percentage annual population growth rate for the analysis urban area and time period.

e. Computation of the ratio of land consumption rate to population growth rate (LCRPGR) – this is computed by dividing the resultant value for the Land Consumption Rate (LCR) with that of the Population Growth Rate (PGR).

While the computation of the individual LCR and PGR values as well as the LCRPGR ratio provides critical information to understanding urbanization trends for the analysis areas, UN-Habitat recommends measurement of two secondary indicators which use the same inputs as those required for the LCRPGR:

- the built up area per capita – which is measured by dividing the built up area (in square meters) by the total population for each analysis year and
- the total change in built up area – which is measured as the percentage change in the built up area over two time periods using the formula (UN-Habitat 2018):

$$\textbf{Total change in built up area (\%)} = \frac{(UrBU_{t+n} - UrBU_t)}{UrBU_t}$$

Where

- $UrBU_{t+n}$ is the total built-up area in the urban area/city in time the current year
- $UrBU_t$ is the total built-up area in the urban area/city in time the previous year

(4) A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons may be found at https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Recommendation-E.pdf

Measuring availability of and access to open public using geospatial data (Indicator 11.7.1)

Indicator 11.7.1 measures both the share of city/urban area that is occupied by open public spaces as well as the estimated share of population with access to such spaces. Open public spaces are defined as areas which are accessible to the public without charge and provide recreational functions to residents and those which help to enhance the beauty and environmental quality of neighborhoods. The character of open public spaces vary across cities and countries and can include green, blue or artificial surfaces. In the context of indicator 11.7.1, open public spaces include two major elements: a) public areas such as riparian reserves, parks and urban forests, playgrounds, squares, plazas, waterfronts, sports fields, community gardens, parklets and pocket parks, etc. – as long as they are openly accessible to the public without charge and b) streets.

The computation of indicator 11.7.1 follows the five generic steps:

a. Delimitation of the urban area or city which will act as the geographical scope for the spatial analysis – the use of the harmonized global definition of cities for global reporting purposes described previously is recommended.[5]

b. Spatial analysis to identify streets and estimation of the total area allocated to streets – which entails identifying all the streets within the analysis area and computing the total area they occupy.

c. Spatial analysis to identify open public spaces and calculation of the total area they occupy – this step, which heavily relies on earth observation and geospatial analysis techniques, involves identifying all the spaces which meet the basic criteria for an open public space[6], which can be extracted from satellite imagery and validated through ground truthing, expert and community engagement.

d. Computation of the share of urban area occupied by streets and open public spaces – which is implemented using the formula:

Share of city area that is open space in public use (%)

$$= 100\ \frac{\text{Total area of open public spaces} + \text{Total land allocated to streets}}{\text{Total urban area}}$$

e. **Estimation of share of population with access to open public spaces** – which is measured as the share of population who can access an open public space within 400 meters walking distance out of the total population in the city/urban area. The implementation of this step relies on geospatial analysis techniques and requires the creation of a network service area in a geographic information system/application to define the areas where open spaces can be accessed within 400 meters walking distance. The integration of high-resolution population (from national statistical offices or modelled population data) to estimate how many people live within the defined service areas follows. Assumptions on uniform access for populations within the defined service areas are made where detailed data is missing on aspects such as conditions of streets, their friendliness for pedestrian walking, as well as the presence of barriers to access the open spaces (such as lack of pedestrian crossings)[7]. The share of population with access to open public spaces is then computed using the formula:

Share of population with access to open space in public spaces (%)

$$= 100\ \frac{\text{Total population within 400 m service area}}{\text{Total urban population}}$$

The access to open public spaces should be disaggregated by sex, age and persons with disabilities, which can be attained where high resolution and detailed population data is available.

(5) A recommendation on the method to delineate cities, urban and rural areas for international statistical comparisons may be found at https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Recommendation-E.pdf

(6) For a detailed description on the qualifiers of open public spaces refer to https://unhabitat.org/sites/default/files/2020/07/indicator_11.7.1_training_module_public_space.pdf

(7) For detailed explanations refer to https://unhabitat.org/sites/default/files/2020/07/indicator_11.7.1_training_module_public_space.pdf

Some emerging challenges and opportunities

From these two examples, we have learnt many lessons from the methodology development, testing and rollout to countries.

Challenges

Multiple data demands: A significant challenge for many countries are the various data demands from the 232 SDG indicators, which are also compounded by other existing national and local urban monitoring needs. As a result, many countries have prioritized some indicators within the global SDG monitoring framework, where some complicated SDG indicators such as those under SDG 11 indicators may not be tagged as "priority indicators" for short term monitoring. At the same time, there are variations in national and local monitoring and reporting targets, wherein some indicators of national priority monitoring may vary from the local urban monitoring priorities (some of which are aligned to SDG 11 indicators), and whose monitoring would inform and accelerate actions towards sustainable urbanization where no one and no place is left behind. Through continuous discussions with many countries, UN-Habitat has been promoting more uptake and integration of earth observation and geospatial analysis techniques, directly supporting countries to produce city/urban level data from the associated resources and technologies, as well as lobbying its global partners to produce data and information, which could help countries to accelerate their SDG 11 monitoring needs. As a result, there has been a high uptake of SDG 11 indicators, which rely on these technologies, which is significantly improving data availability on indicators 11.3.1, 11.2.1 and 11.7.1.

Capacities: For urban indicators, the uniqueness of deploying earth observation data offers both opportunities and challenges for many national statistical systems, which range from technological to financial and human resource capacities needed to put in place the right systems and data architecture. Since monitoring needs for SDG 11 cascade to the local level, we have also witnessed similarly huge capacity challenges, which would facilitate the required data generation, flow and cooperation between the city or the local government level and the national statistical systems. As a result, many countries and partners require direct support to set up or configure the required systems – including the introduction and provision of access to new cloud-based resources as well as re-skilling to use the earth observation technology before they can comfortably work with the proposed methodologies for global monitoring. As a result, UN-Habitat has spent nearly five years on capacity development work at the national and city levels to build the skills of the focal points, and has been lobbying its global partner network to offer different kinds of support to different countries depending on their needs.

Multiple actors and varying interests: Monitoring the SDGs requires a multi-stakeholder approach. However, many stakeholders come with varied interests and concerns and often this can derail the discussions on how, when and where to map out to report on these indicators. Often, a key stakeholder needs to be the citizens themselves, and with new technology we have found innovative ways to work with citizens to produce and validate some of the required data through approaches such as neighborhood mapping and community volunteered data activities.

Interest in processes yet lack of structures for sustainability: At the city and local government levels and a few national level structures, we find many processes and bureaucracy that has often affected the pace of update for monitoring as well as for sustainability. Many local governments are not fully aware of their contributions to SDGs, leaving this role often to the national level structures. As such, we have had to introduce the entire SDG framework prior to them committing to the local level data collection. In cities and local governments where urban observatory exist, we find a more conducive environment for uptake and sustainability of the data collection processes.

Harmonized city definition: With a harmonized approach to defining cities/urban and rural areas, countries and cities are recommended to use this new approach to ensure that the data which is collected is easily comparable with other cities within the country and globally. However, rolling out the methodology of the harmonized approach at the local requires further dissemination. This is a process that we are currently engaged in all the regions.

Scope of applying the National Sample of Cities approach: The scale of monitoring more than 10.000 cities globally is very challenging for any organization and equally for the national statistical systems. Consequently, the National

Sample of Cities, which allows countries to sample out a representative set of cities for global average reporting has worked well. However, even with a very objective criteria, some cities are often not happy when not selected. Many fear that sampled cities could eventually be prioritized for resource allocation and other improvements.

Opportunities

Accelerated interest on urban monitoring has attracted multiple actors. However, we need to continuously review the priorities of the global partnerships for enhancing the production of urban SDG data. A more flexible yet institutional approach is needed to accommodate the needs of different actors while maintaining coherence and the involvement of official and non-official urban spatial data producers.

More than ever, the increasing understanding of the usefulness of earth observation and geospatial information for urban monitoring as well as for producing information that communicates to all audiences has created many opportunities for local, national and global monitoring efforts and is expected to significantly improve urban data availability in all countries. Today, the rapidly advancing technology and growing pool of geospatial resources and tools, which are directly relevant to urban monitoring, is very much in favor of enhanced data production and reporting against SDG 11, other urban indicators and the New Urban Agenda.

The ever-growing good practices and experiences from countries, especially those in the developing regions, is further creating attention to and increasing interest in the use of earth observation and geospatial techniques for urban monitoring and thereby increasing prospects for accelerated urban monitoring over the next five years. In addition, UN-Habitat's engagement with diverse actors in the earth observation and geospatial information areas of expertise, and a consistent push for more harmonization of methods to respond to the data needs for the urban SDGs is also increasing the availability of relevant data, which is already providing many countries with a good baseline to kick-off their monitoring efforts.

Finally, the geospatial techniques, which in themselves allow for consistency, repeatability, scalability, continuous training and improvement of models as well as independent evaluations, have also created unique opportunities that will help in their high uptake and adoption in urban monitoring processes. The ability to train models and apply them repeatedly for example reduces the amount of time and resources required for data production. The human-technology interface of the existing and emerging data mining/processing models, coupled with a growing community of volunteers willing to contribute to the data validation processes, also allows for continuous improvement to the data quality. This is particularly critical for increasing data accuracy and enhancing the trust in these technologies as well as their ultimate universal adoption across cities and countries.

Conclusion

Compared to the era of the Millennium Development Goals, UN-Habitat has 15 times more indicators to nurture and support the SDGs, with many indicators being new or requiring geospatial technologies and skills to produce. A recent report by PARIS21 found that even among highly developed countries less than 50 % can report on more than 40-50 % of the urban spatially inclined SDG indicators (PARIS21 2019). Despite the many challenges, there is a growing appetite for the use of spatial data application in many countries and cities. Technology is also becoming cheaper, with more internet penetration growing across all regions (ITU-D 2020). Analysis from the voluntary national reviews confirms that, with some good exceptions, countries have been slow in committing to report on global urban SDG indicators. Certainly, there is a long list of concrete institutional, operational, financial and capacity constraints that hamper countries' ability to report on them. Key has been a delayed conceptually well-developed definition to delineate cities, towns, and rural areas. The Statistical commission endorsed a global definition in March 2020, and therefore we expect this to accelerate the reporting levels for the urban related indicators. Finally, continuous advocacy and capacity development is one solution to overcome some of the existing SDG urban monitoring-related challenges, but locally institutional strengthening will be key to get us back on track. We need a drastic expansion of collaboration between national and sub-national institutions and for them to appreciate that in an urbanizing world, this multi-tiered collaboration is key for urban monitoring and reporting to succeed.

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