Experimenting with data for urban planning in the city of Maceió, Brazil

A results and recommendations article by UNITAC Hamburg

HAMBURG UNITAC
United Nations Innovation Technology Accelerator for Cities

Contents

Grotas in Maceió, Brazil. Image provided by UN-Habitat Brazil regional office.

Summary

The New Urban Agenda calls for the creation of open, user-friendly, and participatory data platforms that use technological and social tools to enhance planning and management, efficiency and transparency through e-governance. It further highlights the advantages of approaches assisted by information and communications technologies (ICT) and geospatial information management.

Within this scope, the United Nations Innovation Technology Accelerator for Cities, UNITAC – Hamburg, worked with the UN-Habitat regional office in Brazil to explore new ways of collecting and visualizing data as part of a local project to create an 'Observatory of Public Policy' in the State of Alagoas, Brazil.

In this document, we discuss the main findings derived from research into relevant tools for better data collection and management. Additionally, we present a case study and pilot tool to demonstrate how open data can be used for public policy and decision making processes in the city of Maceió.

Section one gives an introduction of UNITAC and the importance of urban governance. **Section two** provides an overview of existing mapping tools available for local governments, including the Quick Participatory Mapping methodology (QPM). **Section three** describes international best practices on open data governance and urban observatories, providing a sample of strategies that aim to create the right conditions for data to be translated into policy and selected innovation that look to meet the needs of the people. **Section four** reflects on how data visualization can be used as a tool for improved decision making processes, and describes insights drawn from the "Grotas Panel" dashboard - an open data site with data collected from the informal settlements of Maceio, Alagoas. **Section five** presents a case example that includes the application of a prototype mapping methodology for informal settlements that uses open-source tools, developed by UNITAC based on the enhancement opportunities identified during the project. Finally, we conclude with learning experiences and recommendations on how best to improve data collection and visualization in the context of urban planning in the city of Maceió.

Background

The Observatory of Public Policies (OPP) is part of the ongoing "Sustainable and Inclusive Urban Prosperity in the State of Alagoas" project. The project is situated in the city of Maceió, and looks to build local capacity to produce and incorporate data in planning processes and policy making. In the past years, the regional UN-Habitat team, in collaboration with the local government, have applied the Quick Participatory Mapping (QPM) methodology in various parts of the city to identify the state of vulnerability, infrastructure and of urban basic services.

Since 2017, the UN-Habitat team in Brazil has focused on the production of qualified spatialized data on urban settlements inMaceió, mapping 100 Grotas, or informal settlements, through an innovative methodology called "Quick Participatory Mapping" and conducting a socio-economic profile that produced disaggregated data on slum households. Now, the team is supporting the implementation of an Observatory of Public Policies (OPP), inspired by UN-Habitat's global methodology of urban observatories.

The OPP aims to provide a permanent shared platform dedicated to the production and analysis of data, information and knowledge, and to the promotion of evidence-based decision-making processes at all levels of governance. Ultimately, the OPP looks to contribute to improved accountability, dialogue and transparency in policy making. The OPP is expected to provide inputs for the Planning and Project Laboratory for Sustainable Urban Development in Alagoas (Lab), which will promote the use of innovation to formulate urban projects and policies.

Open, transparent, and participatory governance of data

Cities worldwide are striving to organize urban processes more efficiently and sustainably through the digital collection, processing, and analysis of data. For one, the publication of urban data resources with the establishment of transparency laws and open data policies enable new forms of cooperation between administration, politics, civil society, business and science. Open data has made it possible for different urban actors to contribute and curate new ways of decision-making. It further facilitates inclusive, participatory and collaborative urban planning processes. Urban governance, from this point of view, has become increasingly dependent on flows of data, information, and the knowledge derived from them.

Different data collection methods can shed light on different aspects of the urban space. Some can cover physical structures and infrastructure, while other methods can uncover socio-economic profiles and population density. The data collected through different methods is an important, if not the foundational, element that will feed the models used for decision-making.

There is no specific approach to mapping informal settlements. First and foremost, there lacks consensus on the definition of informal settlements. Second, there is a diversity of morphologies of informal settlements around the world. Local contexts benefit from developing its own tools, as is the case of the QPM methodology. It supports the

Grotas in Maceió, Brazil. Image provided by UN-Habitat Brazil regional office.

collection of data that helps the government of Alagoas to better understand the state of infrastructure in Grota. QPM includes a team who surveys the community using observation techniques and a questionnaire. When there is unclarity or unavailability of information, community leaders are consulted to confirm facts and details, such as the interruption of basic services provision like water or energy. The QPM could contribute further to policy making by improving the visualization of its datasets. It is an example of the importance of both mapping and visualization practices for effective urban governance.

Why does mapping vulnerable areas matter?

The different morphologies of informal settlements, from small to large scales, impact the planning capacity of local governments. The presence of such forms of urbanization is starkly high in the Global-South, and often become permanent infrastructure. These informal developments start as a demand from low-income people for housing, spatially growing in incremental ways over time and who struggle to access basic infrastructure networks of water and sanitation, information and communication technologies, electricity, transport, and others. Understanding better the dynamic of how informal settlements develop and the relationships of people with the built environment is crucial to improve the lives of its residents, leaving no one behind and achieving the Sustainable Development Goals.

Engagement of public servants and stakeholders with data visualization dashboards is dependent on different factors. As seen in cities across the world, the same is noticed in Maceió, where there is insufficient engagement with the data available in the open data Grotas Panel developed to visualize the data collected through the Quick Participatory Mapping methodology. Accountability is then fragile in such places, as there is incipient data available to follow-up on government policy and impact. It highlights the importance of not only data being available, but the need for structures and investments in making it accessible and used by the population and other stakeholders.

Challenges in using data for effective policy making

One of the challenges with urban observatories, and data collection in general, is turning data into effective policy making. This may be particularly difficult when data is collected by external institutions from where the policy makers are based, as in 75% of the cases identified in UN-Habitat's comparative review of urban observatories. There is also often a capacity gap. In informal settlements, the collection of data is especially challenging due to safety concerns, difficulties in access, and the variety of morphologies and the size of the informal areas. In the so-called Global South, costs and technologies such as Very High Resolution (VHR) satellite images are not affordable options.

Based on consultations and previous analysis shared by the regional office in Brazil, it appears that the data culture in Alagoas is uneven across government departments. The employment of data is also not a frequent government-wide practice, with more data available at the Federal level. For example, one of these moments when data was applied happened during the pandemic of COVID-19, with the creation of a general dashboard of COVID-19 data in Alagoas.

COVID-19 has further illustrated the need for evidence-based policymaking. Cities have used data to make decisions about social distancing and to identify outbreak risk areas. The pandemic has highlighted the vulnerability of the urban poor and the pressing need for inclusion of the marginalized. At the onset of

COVID-19, cities needed to mobilize resources and capacity to apply knowledge in efforts to recover in a post-pandemic world.

According to UN-Habitat's Urban Observatories review, its functions are to collect, analyze and present data. Examples seen in case studies explored in this research have shown that previously available data has been reused in COVID-19 responses, which highlights how observatories can serve the communities and policymakers. Its success depends heavily on the structure, objectives, and partnerships of the observatories.

The 'Quick, Participatory Mapping' methodology

The State of Alagoas, in Brazil, located in the Northeastern part of the country, has approximately 3,350,00 inhabitants and 102 municipalities. Maceió is the capital and accounts for almost one third of the state's population (1,021,709 persons estimated in 2016), with a density of 1,854 inhabitants per km2. In Maceió, some 10% of the population (100.002 inhabitants) lives in informal settlements.

The informal settlements in Brazil were only included in the demographic census since the 1950s. Nonetheless, important data, such as the coverage and conditions of basic services and infrastructure that exist in these communities, are still missing. As such, there was a need for data collection methodologies that take into consideration the complexity of the local context. These datasets, including , waste collection, public lighting, water provision and sanitation, road pavement and sewage treatment, are often not captured by the demographic census.

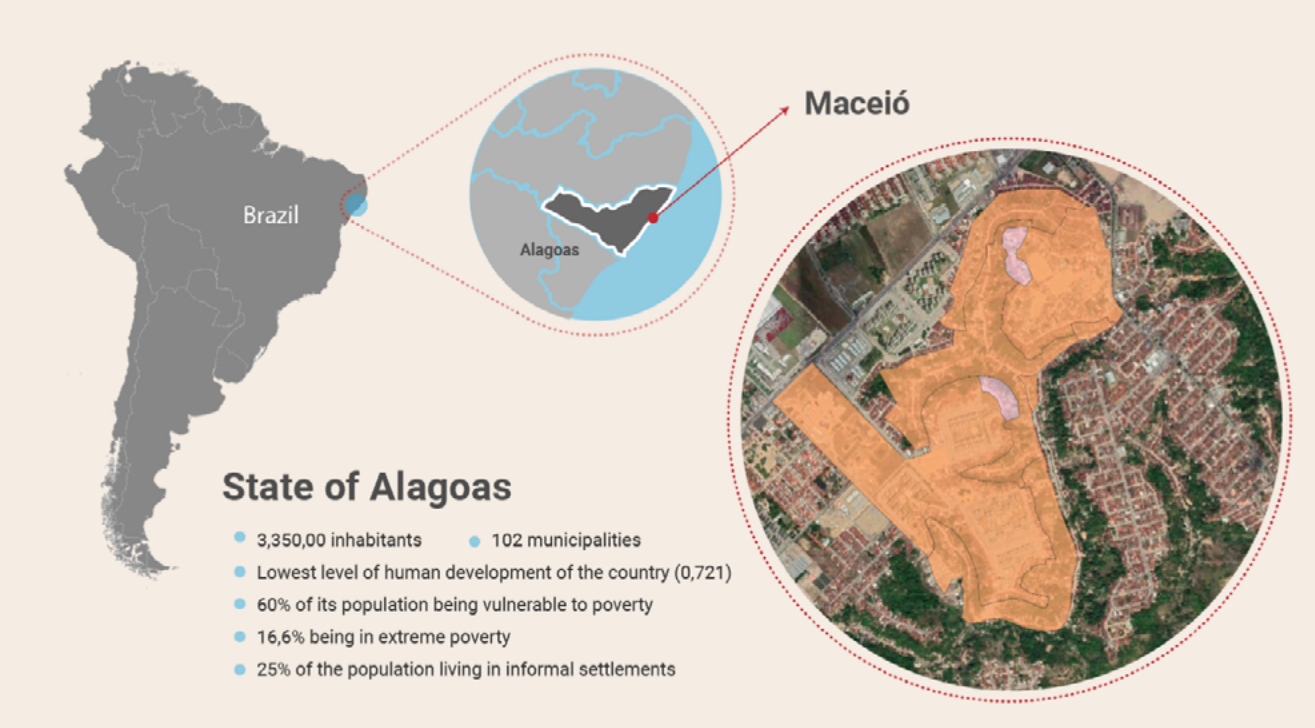
The UN-Habitat regional office in Brazil, together with the Pereira Passos Institute (IPP) and the municipal government of Rio de Janeiro developed the Quick Participatory Mapping methodology (QPM), later adapted to the context of Macéio. It is a low-cost mapping solution for informal and socially vulnerable areas.

Due to the distinct spatial characteristics of informal settlements, QPM builds upon 'micro areas' that aim to capture the variation that exists within localities.. The methodology is based on a questionnaire, which produces data based on qualitative observations of a surveyor, often a person from within the community. The surveyor receives dedicated training and is responsible for manually entering the empirical information in predefined categories of the questionnaire

The production of knowledge based on the QPM focuses mainly on the:

1. Identification of the spatial coverage of the infrastructures,services offered, and their particularities in micro-local terms (coverage);

2. Identification of the way in which the service works or the quality of specific infrastructures in a given micro-local context;



3. Identification of additional influences that may impact the quality of the infrastructure or urban service offered in the micro-site.

The QPM encompasses questions that are associated with various aspects of public service provision.

Mapping and data collection tools

Data is the backbone of urban observatories. Visualization and simulations are considered critical for policy making. However, there exists a gap in access to advanced techniques and technologies. Mapping locations is seen as a challenge for data integration, which includes connecting data from multiple stakeholders with traditional data such as statistics, surveys and database sources. Different methods and tools for data collection are described below:

To collect data from different stakeholders and their environments, the Quick Participatory Mapping is a methodology that supports the collection of evidence-based data from complex urban scenarios such as low-income and vulnerable areas, focusing specifically on the basic urban services and the state of infrastructures. Information captured on the field is entered manually into predefined categories.

Kobo Toolbox, is a free and open source tool that can be adapted to accommodate different questions to collect data in challenging environments, offline or online, with the capacity to disaggregate data as gender, region or educational level.

Other data collection methods focus on specific themes, such as public spaces in the case of the City-Wide Public Space Assessment Toolkit, guiding cities to understand aspects of their public spaces like network, distribution, accessibility, quantity and quality of public spaces; or on land information management, for example, with the Social Tenure Domain Model (STDM), to gather evidence from the field, even when the land tenure type is not formally registered.

It is not only about data: Research on urban observatories and data governance

Cities produce a huge amount of data every day and governments must be able to make use of the available data to make better decisions to serve its communities. UNITAC's research into urban observatories highlights the importance of evidence to inform decision-making while also presenting opportunities for stronger collaborations with multiple stakeholders around urban issues.

What are Urban Observatories'?

For UN-Habitat, the concept of data for planning, governance and management of cities is closely linked to the concept of the 'data observatory'. Over the last years, UN-Habitat has developed the urban observatory model for urban data monitoring, collection and analysis.

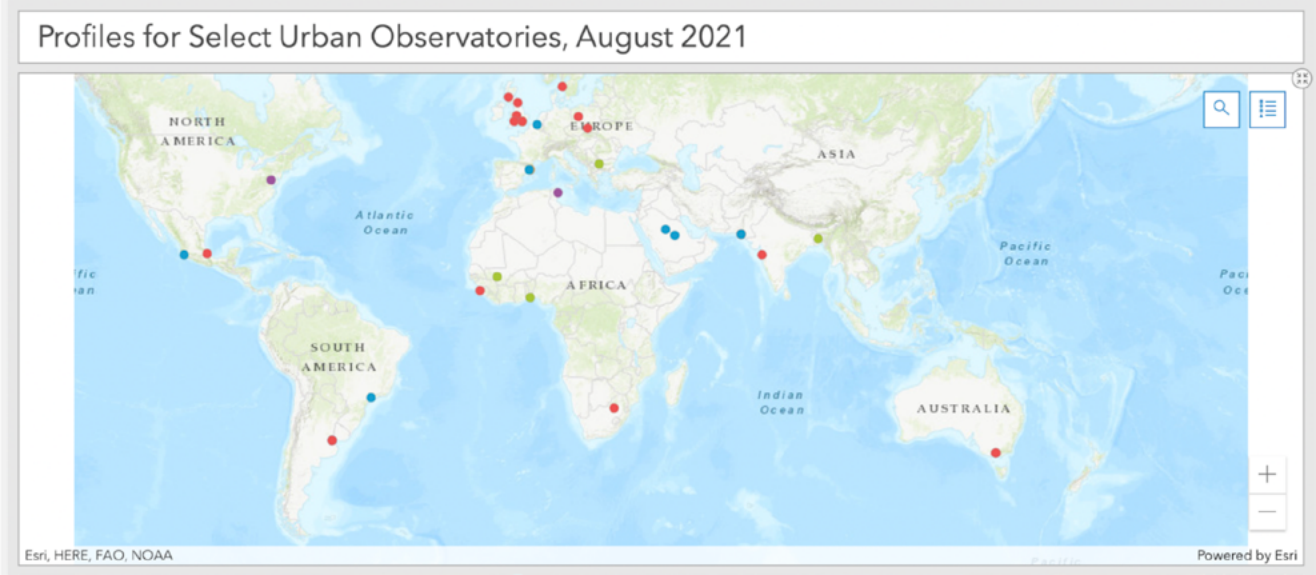
Today, UN-Habitat's Global Urban Observatory is overseeing and coordinating 374 urban observatories worldwide. Broadly, urban observatories serve to collect and analyze urban data and present the knowledge derived from the process. Many do so explicitly for decision-makers who can then mobilize these insights in practical urban development. Many observatories have vast stores of data, information and knowledge as well as researchers familiar with them who can manipulate and present in an explanatory way to the public, decision-makers, or other urban actors.

Urban data observatories are used to collect and analyze data on a set of localized indicators to monitor a range of local or national priority issues, for example social development, the state of service delivery or economic performance, while strengthening accountability and transparency. A key aspect is that urban data is used effectively in planning and policy making as well as measuring the impact of policies and monitoring progress towards the Sustainable Development Goals. Urban observatories should also provide assistance to local government officials to help them collect, manage and maintain information on urban development;

In its 2021 study of urban observatories,The University of Melbourne Connected Cities Lab, working with UCL and UN-Habitat reviewed 32 data observatories from across the world. Of these, around half were hosted by universities, one quarter independent and one fifth government-hosted. In this study, four main types of aspirations stand out when considering the ways in which our sample of observatories has framed their strategic visions:

1. To collect and produce urban knowledge about a defined area

2. To mobilize urban knowledge to shape urban governance, decision-making and



Source: UN-Habitat

development

3. To network urban knowledge and drive knowledge exchange

4. To offer a platform for dialogue about urban challenges between different stakeholders.

The report demonstrates how observatories serve as intermediaries – between research and decision-making, but also between communities and decision-makers. It also highlights the need to account for observatories' role in urban governance, particularly with regards to their advocacy and capacity building functions. It is crucial that observatories build strong, trust-based relationships with stakeholders, including decision-makers, individuals and communities to ensure that the data collected can be used to supplement state data, or in some cases, be the only sources of data when state capacity is weak.

Departing from such need, UNITAC-Hamburg team reviewed best practices for open data and data governance globally, identifying key elements with the capability of enlightening the path of governments towards better governance of data, or what we call: **data governance symmetry.**

Data governance symmetry

Data does not automatically translate into policy advice. A disproportionate investment in data collection or urban statistics without considering similar focus on the analytical aspect, composed of planning capacity and contextualisation, will contribute to the misidentification of causal relations. If there is a lack of capacity to translate insights into action, data may not provide practical guidance for policy and urban planning. Rather, it will create an unbalanced strategy that fails to improve people's lives in cities.

To better govern the urban area, the axis of transparent, open and people-centered data governance must rely on more symmetrical investments in different areas that influence how well statistics can be translated into actions.

To support this endeavor, UNITAC proposes key elements for the effective collection, application, and interpretation of data:

- Purpose, goals and mandates as foundations for data governance centered in people

- Capacity building in open data governance for public servants
- Evidence-based organizational culture
- Advocacy
- Social tools

Strong **foundations for data governanc**e start with clear definitions of goals and mandates, and a vision of tools and regulations needed in place to create the environment where data can be efficiently applied. A set of clear indicators that can influence policy architecture is needed, for example, subjective (happiness, life satisfaction) and objective (employment rates, life expectancy) parameters should be define. As part of the governance, contractual rules, terms and conditions, decrees and laws, stipulate mandates for data sharing is needed at the local level between stakeholders. They include agreements for specific format of datasets, guidelines for the production and quality of datasets; rules about publishing and reuse of datasets; and information tools such as datasets templates, which can aid in the sourcing of data from other ministries.

Capacity building for public servants is also mentioned in several cases as a crucial step for a strong foundation in data management. A successful case is the employment of "GovCamps", which consists in one or more days of training for public servants to understand open data governance. Government staff must rethink the ways of working and experiment with a mix of design principles and agile processes. During the early stages of development, these processes can be redefined on a daily basis, if needed. In educating and training public servants on data-related mechanisms, the data-to-policy pipeline can be strengthened and improved.

Fostering an evidence-based decision-making culture requires governments to set different practices across the organization, and in collaboration with other stakeholders.

Existing approaches with a record of success include the identification of "open data champions" within the organization; the establishment of working groups to lead the publication and process of open data application; a focus on organizing and maintaining multi-level stakeholders communities of practice (with engineers, designers, software developers) across different organizations within the central government, local authorities, digital communities, including the private sector and the community.

As mentioned above, the UNITAC's research reinforces the role of stakeholders in the data governance of urban observatorie. Advocacy through conferences and forums contribute to the development of a strong ecosystem of data, and can improve innovation based-collaboration between various stakeholders.

Social Tools are defined as the methodologies and mechanisms to engage with the community and other stakeholders through a participatory and inclusive process. It can include hackathons and the creation of an innovation lab for the city. Diversity in urban observatories is key to prevent bias in the design and application of technology, a\s well as the collection and analysis of data. Diversity and gender representation is therefore a crucial aspect to be taken in consideration when recruiting and engaging the community.

Data visualization for urban policy-making

Rapid urbanization and the acceleration of information technologies are transforming cities into enormous data pools. This data, if collected and utilized with care, can reveal the hidden dimensions of the city and provide a better understanding of the processes taking place within its physical boundaries.

In some cases, data collection does not improve evidence-based policy-making processes. This in part, is due to the gap in knowledge prohibiting the translation of raw data into useful knowledge, fortunately, studies show that including information visualization in the policy-analysis process can improve this separation.

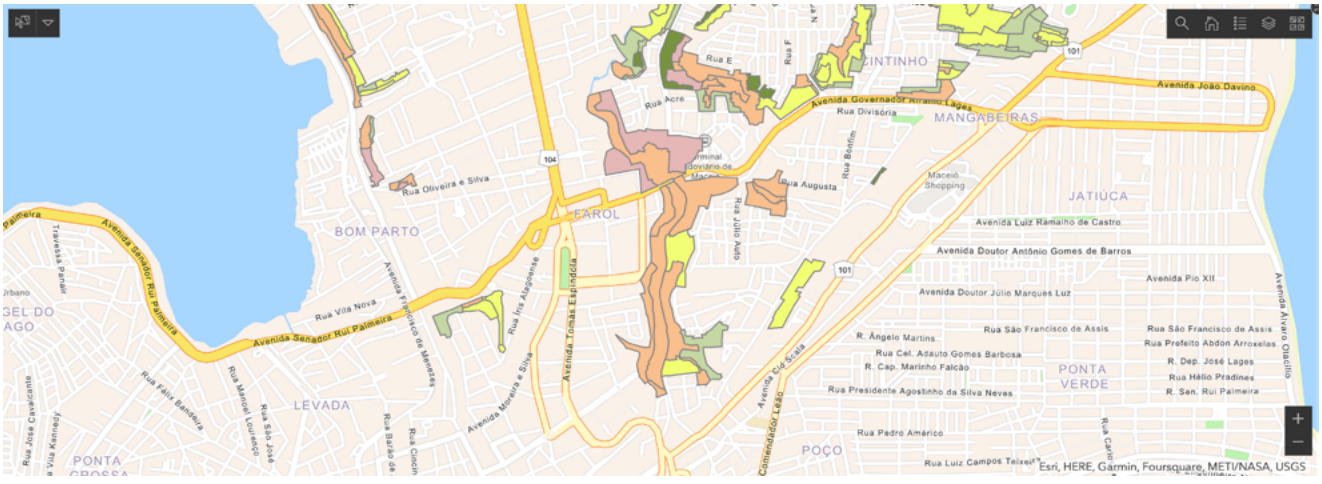
Visual representations and interaction techniques allow users to see, explore, and understand large amounts of information at once. Data visualization helps tell stories by curating data into a form that is easier to understand, highlighting trends and outliers.

A good visualization tells a story, removing the noise from data and highlighting helpful information. Data visualization may be static or interactive; it should be simple to facilitate understanding, decision, and action.

The journey from data to policy is a complex one, hence dashboards and other visualization techniques should facilitate the translation of the data collected into practical insights that guide policymaking. When such facilitation does not happen, dashboards and panels for data visualization will have low traffic and usage, being considered not user-friendly.

The analysis of the Grotas Panel dashboard has highlighted findings related to the navigation of the dashboard, the design of indicators, and the reference to the questions used in the Quick Participatory Mapping questionnaire.

The Grotas dashboard



In exploring the data collected through the QPM and the Grotas dashboard navigation, there is no option to simultaneously overlap the indicators and understand the vulnerability of an area for two or more different indicators. An example of a good visualization opportunity would be to see if in each area, the lack of waste collection is related to the lack of access by large vehicles. As seen in the case study presented in the final section. This is also true in understanding which areas do not have public street lighting in relation to available bus stops.

Indicators in dashboards should also reflect principles, goals and mandates that motivate the data collection process. In other words, indicators used to define policy making can benefit such processes by being clearly connected to a purpose.

Dashboard of COSI (Cockpit of Social Infrastructure) - City Science Lab/HafenCity University.

Grotas in Maceió, Brazil. Image provided by UN-Habitat Brazil regional office.

Creating safer streets using open source data

The New Urban Agenda highlights the need to promote a safe, healthy, inclusive, and secure environment in cities and human settlements enabling all to live, work and participate in urban life without fear of violence and intimidation, taking into consideration that women and girls, children and youth, and persons in vulnerable situations are often particularly affected.

Infrastructure in urban settlements plays a major role in creating a safe and secure environment for residents. Public street lighting is known to strongly influence the perception of safety, especially at night. Whether walking to a bus station, conducting business or enjoying free time at the park, good lighting makes people feel a lot safer, so it has become a crucial aspect of the city's infrastructure. Sustainable Development Goal 11.7.1 calls for universal access to safe, inclusive and accessible, green and public spaces, in particular for the vulnerable population.

In some cities, especially in the Global South, many people, often women, spend much of their time in public places. Having adequate lighting at night can dramatically improve personal safety and create a sense of wellbeing. However, in many cities, public lighting installations are outdated and therefore inefficient. Additionally, there is no data available to manage the state of

Images by UNITAC Hamburg showing a prototipe of how to map the public lighting.

public street lights. Collecting and providing good quality, open, georeferenced data could have a great impact for the planning and management of the city's infrastructure.

Maintenance of the transportation infrastructure to increase the perception of user safety is also necessary and this can be achieved by improving lighting conditions in bus stations, stops, or high traffic areas, and along pedestrian routes or places where there is a constant flow of people.

During the process of exploring possibilities with data in Maceió and the Grotas Panel, UNITAC analyzed different sets of data for a specific micro area in the city. Data was available from open source data platforms.

The analysis drew its reflections from the multiple sources mentioned in earlier sections, from the different mapping methodologies to the research on urban observatories and data visualization.

One of the key data collected and analyzed was the location of all of the street lamps and bus stations available in the selected micro area in Maceió using Google Earth.

Additionally, information about population density was obtained from the Global Human Settlement Layer (GHSL) to estimate the number of inhabitants within a Grota. The GHSL is an open and free data and tool for assessing the human presence on the planet. Local and national sources are available in most locations, and can be consulted.

By obtaining the exact location of street lamps, bus stations and population density, the UNITAC team was able to create a pilot open data platform using QGIS and develop a solution that provides a base for a smart, connected system in the city of Maceió.

Illuminating the way for women and girls

Women and girls face increased and distinct safety concerns when using poorly planned lighting. Providing adequate lighting can improve the feeling of being safe for them, but even more so when they have control over where and how it is provided and provide feedback on the lighting conditions in a specific area.

With the prototype developed by UNITAC, a user can get accurate and real time

information about the luminosity of a specific street, the availability of lighting at a specific bus station, and the proximity to a specific point. In this way, women can easily get information on the safest and closest routes to a desired location. Additionally, users can rate public areas on safety criteria and pinpoint areas of concern (safety pin case study).

The points develop a map of where and how the design of the city itself disadvantages women and girls, bringing a gender-balanced perspective to urban design and informing more accessible and inclusive city planning policies.

Smarter decisions for policymakers

An open data platform built on this kind of prototype could help policymakers monitor the condition of lighting and bus stations to predict future trends, create new opportunities, and save on running costs, based on data insights, especially when collaborating with citizens.

When integrating the collected data layer with existing layers from the Maceió local team, it is possible to have a deeper understanding of the problems. For example, the data on the luminosity can be correlated with data about locations of public transport in different zones of the city to inform decisions about improving the situation.

A better-informed government and more engaged community will improve the decision-making process and find evidence based solutions to solve difficult problems. The government's services will also be faster using a data-based approach.

In the future, long-term data collection will enable predictive analytics to anticipate and reduce incidents. Having an open data platform will allow the governments to centrally manage city lighting, and assets individually or in groups. These controls ensure that lighting levels are in the right place, at the right time to improve the safety of city residents.

When anyone can access data through a central web portal, transparency and trust can bring a way to engage citizens. Having this data platform provides the basis for rapid decision making and coordination between departments such as police and health, especially when crises occur.

Conclusions

- With this work, we conclude that the journey to urban governance does not start with the urban observatories itself, or by just having data available. There is a need for digital governance strategies to balance investment in capacity building, participatory processes, planning and context analysis as much as it invests in technical capacity and data collection.
- In the state of Alagoas in Brazil, the decision-making process can be strengthened if data is considered and becomes part of the policy process. The visualization of existing datasets from the Grotas through the Grotas Panel is not fully explored by the local public administration because of its interface design and lack of supporting information for the data that is available.

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City-Wide Public Space Assessment Toolkit

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https://qgis.org/en/site/

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About UNITAC Hamburg

The United Nations Innovation Technology Accelerator for Cities (UNITAC Hamburg), is a partnership between the United Nations Human Settlements Programme (UN-Habitat), the United Nations Office for Information and Communication Technology (OICT), and HafenCity University, a German technical university with a focus on the built environment.

UNITAC Hamburg supports national and local governments with their digital transition, applying a multi-level governance strategy and helping them build skills and capabilities to develop, procure and effectively use digital technologies in an ethical and inclusive way to make sure that no one is left behind. UNITAC Hamburg is part of the “People-Centered Smart Cities” Flagship program of UN-Habitat, which provides strategic and technical support on digital transformation to national, regional and local governments. The projects and tools developed by UNITAC aim to accelerate the achievement of the Sustainable Development Goals, and more specifically goal 11: make cities and human settlements inclusive, safe, resilient and sustainable.

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