Urban Planning Tools

City Planning Labs

Municipal Spatial Data Infrastructure

The last decade has witnessed an urban data revolution, as cities internationally have started mobilizing geospatial data to harness the potential of urbanization and address its challenges.

City Planning Labs (CPL) is a Technical Assistance program of the World Bank, which aims to enhance the technical and institutional capacity of municipal governments to produce, share, and utilize geospatial data for evidence-led urban planning. The foundation of CPL includes the establishment of a robust and innovative **Municipal Spatial Data Infrastructure (MSDI)** platform. An MSDI ensures the sustainability of geospatial innovations being introduced, and is being pioneered by partner cities in Indonesia. In addition, agile and adaptable **Urban Planning Tools** are aimed at empowering cities to make informed decisions to improve the quality of life of their residents.

CPL's approach is aligned with the **World Bank's Build, Boost and Broker framework** as it Builds critical municipal spatial data foundations and institutionalizes them; Boosts their capacity to utilize information for evidence drive planning, and; Brokers the relationships between city governments and the private sector to leverage innovation in technology.

Municipal Spatial Data Infrastructure (MSDI) is the platform that facilitates the organization, sharing and utilization of geospatial information to tackle the challenges to achieve sustainable urban development. It is the cornerstone of any strategy for cities aspiring to embrace digital transformation and for the long-term success of smart city initiatives.

Clear action plans for MSDI operationalization i.e., **MSDI Roadmaps**, have been developed by CPL partner cities using a **four-pillar IPDS framework**. IPDS pillars correspond to **Institutional Arrangements** (local regulations and data governance protocols), **People** (competency frameworks and skill development), **Data** (collection, processing, management, utilization, and data driven tools), and **Systems** (Integrated Data Platform i.e., Geoportal).

This comprehensive IPDS framework enables **governance and regulatory innovations** to go hand in hand with technological solutions, and also takes into account the importance of human resources to strengthen data foundations. The IPDS framework is **agile, flexible, and scalable to cities with varying levels of capacity within Indonesia and globally**.

Gayatri Singh, Task Team Leader – gsingh9@worldbank.org **Seetha Raghupathy** – sraghupathy@worldbank.org **Champaka Rajagopal** – crajagopal@worldbank.org **Aurora Dias Lokita**– alokita@worldbank.org **Tony Hartanto Widjarnarso** – twidjarnarso@worldbank.org **Irene Arifin** – ikarifin@gmail.com **Rebekka Hutabarat** – rhutabarat@worldbank.org

"Data-driven urban planning will help the city to avoid duplication of city programs which will lead to budget efficiency (...) valid data will enable city staff to develop targeted programs for service delivery."

– Head of the City Planning Agency (BAPPEDA) Semarang

CPL-Urban Planning and Management Tools
Urban Planning Tools (UPT)

PAIRING CITY PLANNING WITH SPATIAL DATA ANALYTICS

The World Bank's City Planning Labs (CPL) aims to help Indonesian cities achieve a more sustainable, resilient and inclusive urban development. Among the objectives of CPL is to contribute to local development using UPTs, and to model urban growth scenarios as inputs for evidence-based decision-making. This is complemented by working collaboratively with local governments to build capacity to use and develop enhanced urban geospatial data for city planning.

Cities serve as a hub for opportunities, and must serve this purpose while contributing to the quality of life of its inhabitants. The planning decisions that city governments make today will impact the lives of millions.

According to the United Nations (2018), "the current rapid urbanization —especially in cities of the developing world— is bringing about many challenges in the spatial distribution of people and resources, as well as in the use and consumption of land." Left unmanaged, urbanization can lead to urban sprawl, stretching the limited resources of cities to service its fringe areas, and affecting the overall competitiveness of cities.

Cities require a comprehensive information infrastructure in order to effectively manage their urban growth. Such infrastructure supports governments to make strategic decisions based on data analysis and interpretation; thus the availability and quality of data plays a fundamental role in the decision-making process. Geospatial data offers several opportunities to boost the decision-making processes by promoting deeper analysis of the present conditions, and improve the city's future performance based on evidence.

The incorporation of data-driven analytics with urban design and policy-making is important for maximizing development opportunities. Transitioning to this approach, however, is challenging.

Estimates and Projections of the World Urban and Rural Population
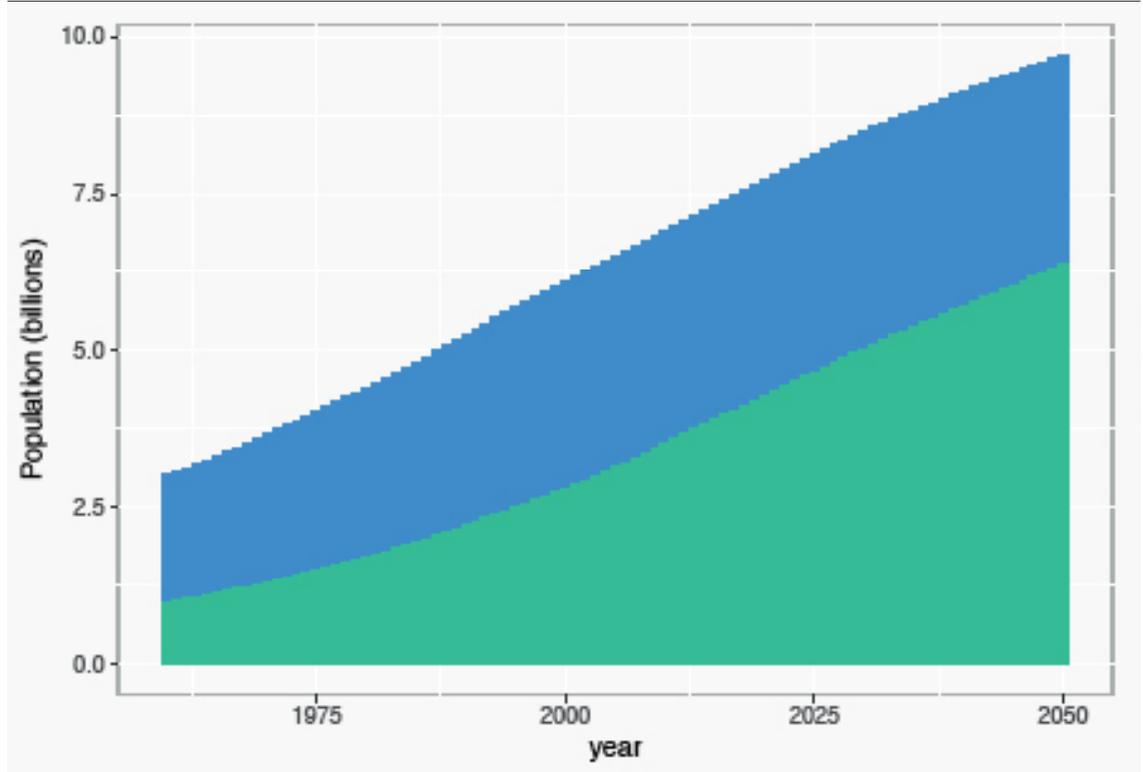
Rural population
Urban population

Source: World Bank Data, 2017 [1].

Data generation and analysis is time-consuming and resource-intensive. The process of collecting and computing data needed to analyze a given issue can take several months, which limits the time available for analysis and informed decision-making.

Further, policy and decision makers are confronted with day-to-day urgent matters and often lack time and adequate staff support for data analysis and integrated planning.

To succeed at evidence-driven policy making, city governments need tools and resources to enable robust calculation methods, numerical evidence, highly effective communication, and well-coordinated processes between stakeholders and the agencies generating information.

Urban Planning Tools (UPT)

UPTs simplify complex planning and urban management processes by providing data and methods for comprehensive assessments, agile communication, coordination and decision-making processes. Decisions based on evidence facilitate the connection between research and professional planning practices. UPTs provide insights to help simplify the assessment of evidence, and communication of potential future scenarios to aid the decision-making process.

UPTs do this by hosting spatial and quantitative data and performing a series of mathematical operations to output useful indicators for each set of scenario inputs considered.

CPL's work in Indonesia has focused on adapting two UPTs: **Suitability and Urban Performance**. As part of these activities, CPL has engaged in a dissemination and capacity development process with participating city governments to help local stakeholders take ownership of the tools and use them to foster evidence-led planning and service delivery.

Decisions based on evidence facilitate the connection between research and professional planning practices.

URBAN PLANNING TOOLS, INPUTS AND OUTPUTS

Spatial Data

Tabular Data

Mathematical operations

Indicator(s)

EVIDENCE BASED DECISION MAKING CYCLE

DATA
Spatial
Information

IMPROVE
Based on
evidence

ANALYSIS
Present and possible
future conditions

INFORMATION

METHODS

EVIDENCE

COMMUNICATION

COORDINATION
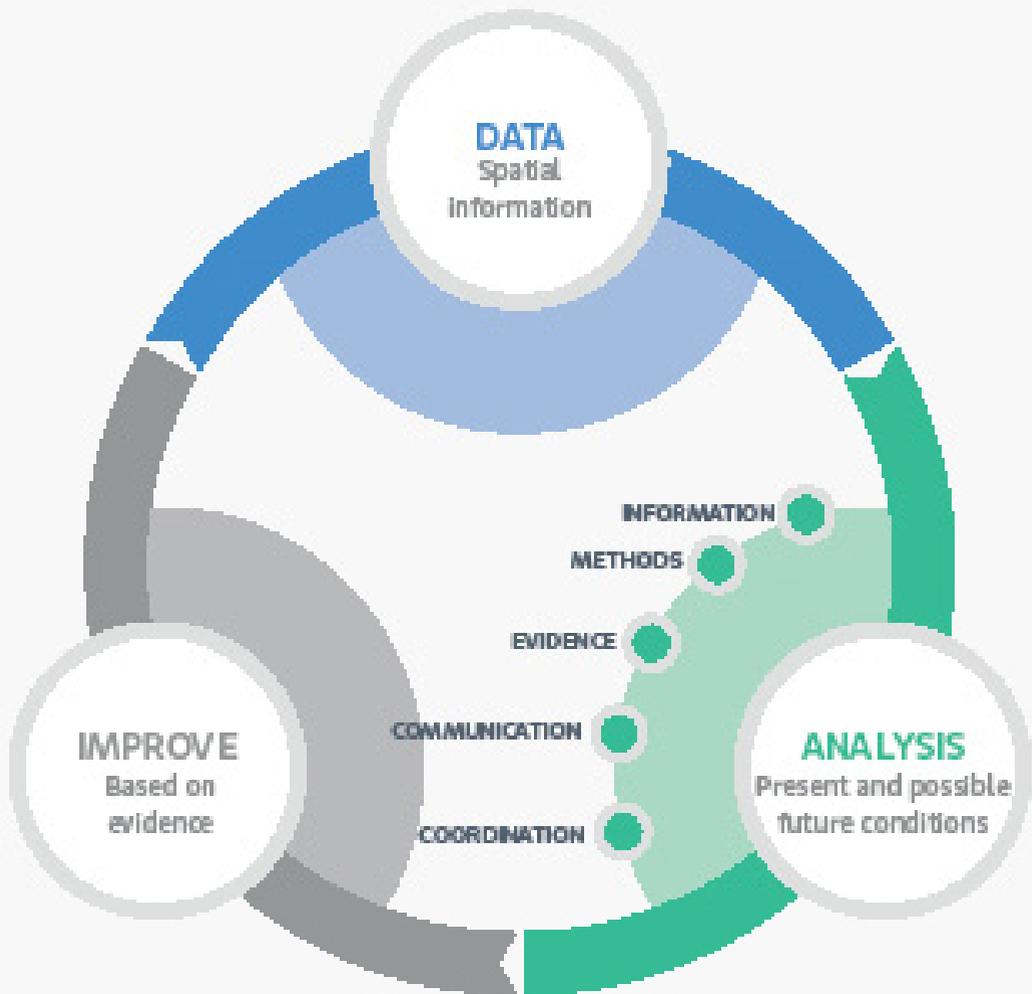
UPT eases the creation of consensus.

Several actors can use a common platform to simulate their choices and compare performance results of various planning scenarios. By modeling different alternatives, stakeholders can test, validate and agree on the priorities for their cities.

UPT simplifes the communication of scenarios.

Collaboration and cooperation are fundamental for better urban planning. Scenarios are key to communicate integrated solutions and organize teams to pursue a common goal.

SuitAbility ^0.92

SUITABILITY: IDENTIFYING OPTIMAL LOCATIONS FOR INFRASTRUCTURE ACROSS THE CITY

Suitability Tool (ST) identifies optimal locations for the implementation of a specific policy or project by evaluating the availability of infrastructure, urban services and the distance between services and amenities in neighborhoods across the city. Suitability applies Geographic Information Systems (GIS) software to map infrastructure gaps, identify optimal locations for social housing, strategically allocate investment funds, and more.

ST simplifies the evidence-based decision-making process, allowing users to focus on assessing and using data without spending time requesting or downloading it, cleaning it, organizing it, and correcting coordinate reference systems.

User Interface (UI) of the Suitability Tool (ST)
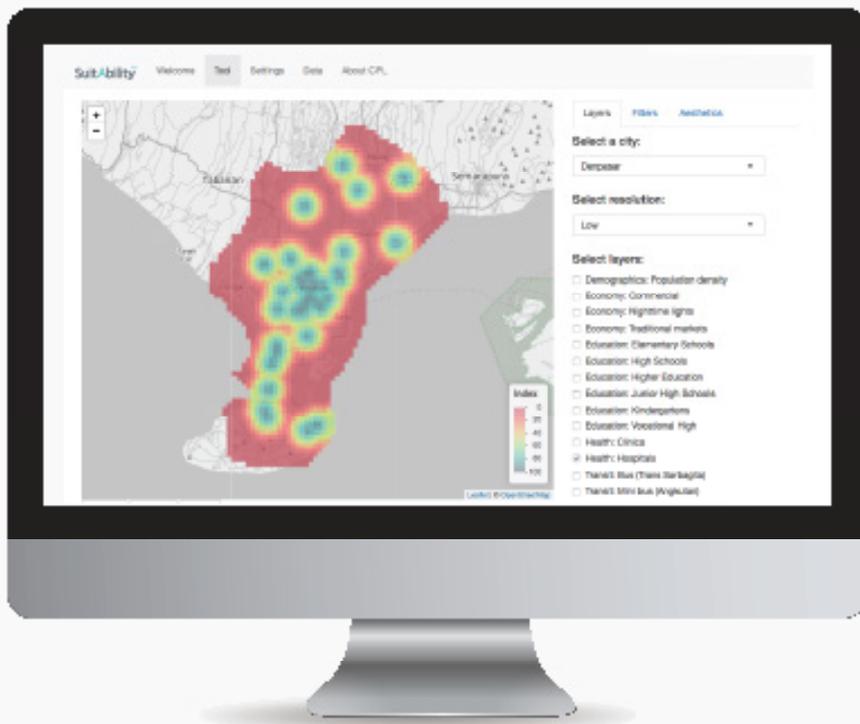
The Suitability Tool helps identify optimal locations for the implementation of a specific policy or project.

Users can open the application and start an analysis in seconds.

ST is flexible and adaptable to the specific needs of end-users. If needed, users can develop and load datasets to complement the pre-loaded database.

Additionally, as ST is a web application, it does not require licensing or software installation.

Conventional Practice versus using the Suitability Tool

Conventional practice

| DATA | STANDARDIZATION | ANALYSIS | COMMUNICATION |

Each stakeholder builds and standardizes data
(parallel effort)

Long time for analysis, communication
and coordination

Suitability tool

| DATA | STANDARDIZATION | ANALYSIS | COMMUNICATION |

Stakeholders share the same dataset
(cooperation)

Time for analysis, communication
and coordination shortens

In conventional practice, each institution generates, downloads or requests, and standardizes their own data. Analysis, communication, and creating consensus are highly demanding in terms of time and resources.

The Suitability Tool simplifies the process of retrieving and standardizing data and shortens the time for analysis, communication, and consensus building.

UP URBAN PERFORMANCE

URBAN PERFORMANCE:
MODELING URBAN GROWTH SCENARIOS

The Urban Performance tool forecasts the city's future performance by modeling specific policies or projects with a range of indicators.

Complementary to Suitability, the Urban Performance Tool (UP) facilitates the simulation and assessment of a city's possible future conditions in relation to urban policies.

When planning urban policies, decision makers face time constraints to assess and agree on integrated solutions. Planning for a complex urban environment requires the assessment of many interlinked variables that have a direct impact on citizens' lives. Modeling urban growth scenarios requires collecting, standardizing, and integrating information from different sources and performing several statistical processes and validations before forecasting future conditions.This process might take several months, especially if decision makers wish to compare various scenarios. Urban Performance has automated these calculations

User Interface (UI) of Urban Performance (UP) Tool
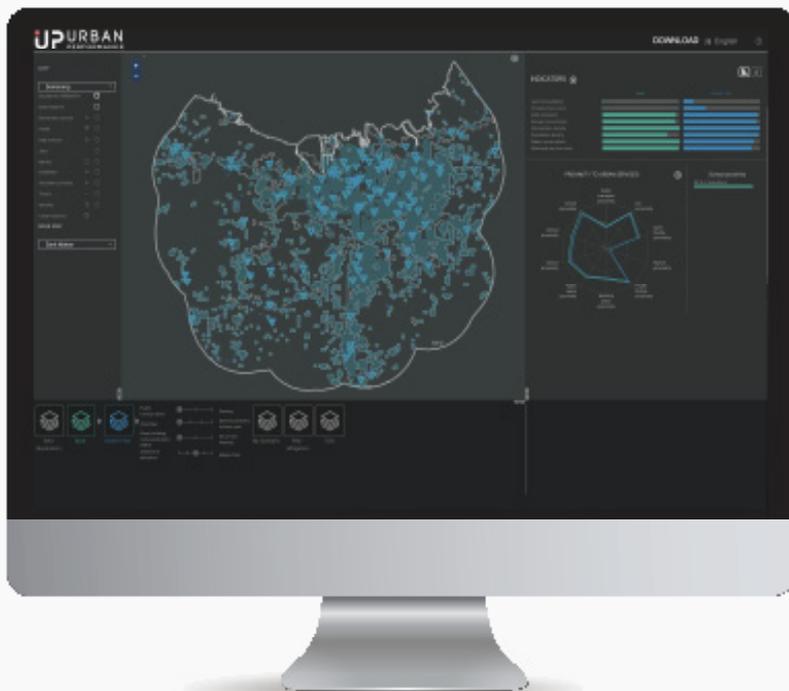
Interaction Between ST and UP Tool

Find areas with a lack of educational and health centers.

Export

Upload a policy lever to cover need for educational and health need.

Get results within a range of indicators
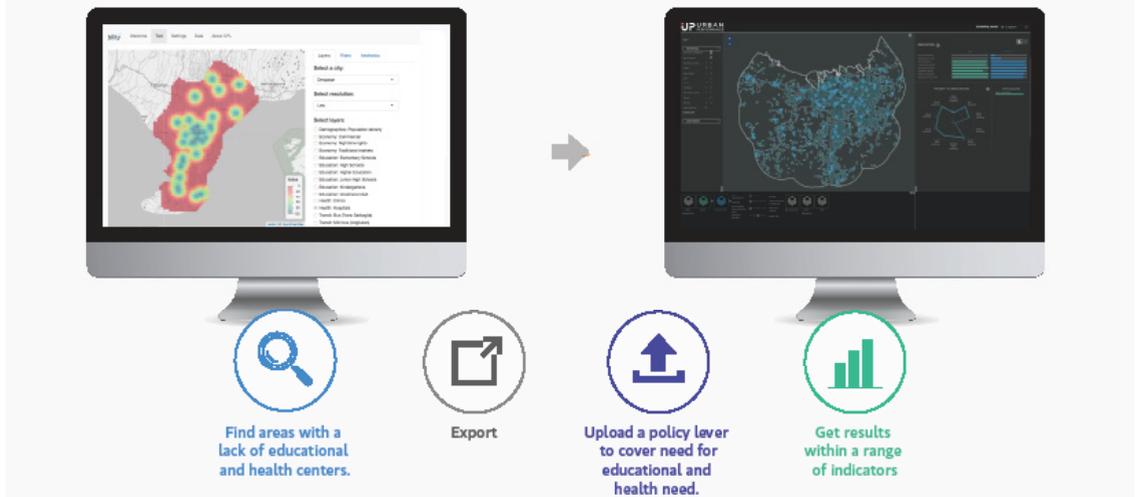
and presents results for several indicators within minutes. The tool does depend on organized and updated data, but once inputs are ready, decision-makers can assess hundreds of possible scenarios in no time.

For instance, the UP tool models the improvement of public transportation systems, land use changes, development of new hospitals, and Transport-Oriented Development (TOD), among others. These projects or plans are called policy levers because users can activate or deactivate them in the software to examine resulting outcomes.

A scenario is a combination of policy levers, and the tool presents a set of scenarios, describing the forecasted expansion and the city's performance by a horizon year (such as 2030 or 2050). The tool presents the results across a diversity of indicators, such as urban services proximity, GHG emissions, municipal costs, water and electricity consumption, and others.

Decision-makers can analyze the positive impacts of creating synergies and therefore move from sectoral planning to integrated planning.

> *The Suitability and Urban Performance Tools complement each other.*

Also, they can identify solutions such as those that minimize investment costs or risks and maximize social welfare.

Modeled scenarios provide a quantitative forecast and visualization of the benefits and drawbacks of policies and projects on environmental, social and economic dimensions. Consequently, discussions among stakeholders can be driven by data and evidence, helping to reach consensus, request funding, and define urban priorities.

The ST and UP tools complement each other. For example, by using Suitability, areas that lack education facilities and health centers can be located. Then, the results can be exported and introduced to UP to assess infrastructure investment scenarios and evaluate the impacts of those measures on the educational and health needs of the population. In Indonesia, UP is already supporting cities' operations, and results from Suitability are being used to conduct deeper analysis for two national-level projects: the National Affordable Housing Project (NAHP) and the National Slum Upgrading Project (NSUP).

* The BAU scenario represents the city's future if no significant changes in urban policy are made, used as a baseline to compare with more ambitious scenarios.

The City of Denpasar has undertaken an urban retrofit project to upgrade and improve traditional markets, public spaces, and neighborhoods. Denpasar's department of economy developed the concept to attract visitors to villages that are not part of the most famous tourism destinations (such as beaches and temples). With ST, it is possible to define the optimal locations for these projects, and the UP tool for Denpasar includes EcoVillages as a policy lever.

The results from UP reveal that the city's performance, in relation to the Business as Usual* (BAU) scenario, improve with the implementation of EcoVillages. As observed in the radar chart, there is an upturn in several of the proximity indicators, the public space proximity being the most significant with an increase from 8% to 79% of the population living within the recommended service radius from public space. From these results, we observe that promoting the development of more EcoVillages will increase economic growth, avoid settlements in conservation areas, and increase accessibility to parks.

PROXIMITY TO URBAN SERVICES AS INDICATORS

Capacity Building as an Essential Component

Long-term sustainability of the tools requires the involvement of stakeholders during their initial development. The CPL engagement includes a capacity building program, planned to ensure complete knowledge transfer of the development, use, and management of both UPTs.

These activities aim to develop a sense of ownership of both methodologies through training sessions and customized learning material, available online as well as in-person. This promotes the generation of high quality and up-to-date data.

UPTs on Display and being used for Analysis at Denpasar's Command Centre

UPTs Capacity Building Session at the City of Denpasar

UPTs Capacity Building Session at the City of Semarang

Next Steps

These improvements will not only speed up the process and solve bottlenecks, but will also increase the quality and the efficiency of the system.

The required infrastructure for spatial data must be complemented with effective management, maintenance.

To support data infrastructure at the national level, the Indonesian Ministry of Agrarian and Spatial Planning (ATR) and CPL are working together to solve bottlenecks in the RDTR (Detailed Spatial Plan) development pipeline. The collaboration aims to reduce the RDTR development process from 18 months to 10 months and allow ATR to process more than 150 RDTRs before 2020. To attain these ambitious goals, CPL has proposed a whole-system-approach, which includes adapting the UPTs to match the specific needs of ATR. CPL's proposes to adapt

the Suitability Tool so that it can provide two preliminary assessments in the RDTR development pipeline: Land Suitability and Urban Carrying Capacity. These assessments are inputs for the RDTR building process.

Urban Performance will provide a consistent methodology for RDTR evaluation and approval.

Fully integrated system approach
RDTR DEVELOPMENT PIPELINE

Data development → Land suitability

Urban carrying capacity → RDTR development ↔ RDTR approval → RDTR publication

Public consultation → RDTR development

RDTR publication → RDTR monitoring