Towards Developing a Digital Twin and Three-Dimensional Cadaster for Smart Land and Infrastructure Management in Indonesia

PROJECT OVERVIEW

PROJECT NAME	Program to Accelerate Agrarian Reform (One Map Project) (P160661)
GLOBAL PRACTICE	Urban, Disaster Risk Management, Resilience and Land
REGION	East Asia and Pacific
COUNTRY	Indonesia
GEOGRAPHICAL SCOPE	National program with Jakarta pilot
COUNTERPART	Ministry of Agrarian Affairs and Spatial Planning/National Land Agency

GLOBAL SMART CITY PARTNERSHIP PROGRAM SUPPORT OVERVIEW

ASSIGNMENT OBJECTIVE	Conceptualizing and developing a 3D cadaster mapping system and geospatial solutions based on a digital twin
OUTPUT	• Assessment on country's capabilities in data, maps, systems, and services • International benchmarking • Architecture and business model design

JAKARTA, INDONESIA

CHALLENGES

Indonesia is one of the world's fastest urbanizing countries. As of 2019, 151 million Indonesians lived in cities (with 57 percent residing in metropolitan areas); this number is expected to increase to 220 million by 2045. The country's urban growth has been driven by the country's economic transformation, specifically the expansion of its manufacturing and service sectors. The Government of Indonesia's goal is to increase the sustainability of its cities in light of these trends.

Sustainability requires making the best use of urban land and enhancing the country's resilience to shocks. Indonesia's cadastral maps display land parcels, along with their associated legal rights, only in two dimensions (2D). This is inadequate for multi-level properties. A new method called

"digital twin"—a virtual representation of a city's objects that allows dynamic analyses under simulated real-world conditions—can help Indonesia achieve its Smart City goals and better manage complex assets, by enabling the definition of property rights, restrictions, and responsibilities in three-dimensional (3D) space.

APPROACH

The World Bank finances the One Map Project that is designed to assist Indonesia's Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) with conceptualizing and developing a 3D cadaster mapping system and geospatial solutions based on a digital twin. The project aims to (i) improve the recording and transacting

of rights in multilevel properties; and (ii) enable needs assessments of stakeholders and analysis of data availability, systems, services, and potential barriers.

The Global Smart City Partnership Program (GSCP) supported conceptualizing the project through experts who assessed the government's existing mapping systems and service delivery status, and its technical capacity. They also identified needs through a bottom-up approach, and assessed opportunities and constraints in relation to relevant global good practices. The second support phase focused on developing business models for the 3D cadaster and defining the system architecture, boosting ATR/BPN's technical capacity and strengthening institutional enablers.

RESULTS

Based on the needs identified via workshops and a questionnaire, and the benchmarking of global best practices, the GSCP team proposed technical architecture solutions, as well as policy changes to guide and prioritize implementation strategies. The test-bed strategy to pilot the identified technical approaches included a potential public-private partnership (PPP) or joint venture business model. The project has boosted ATR/BPN's capacity, so staff can continue refining the conceptualized models and develop and maintain a tailored 3D cadaster system. The results informed ATR/BPN's 'Smart Land Initiatives' to design and advance multi-dimensional cadastre.

LESSONS LEARNED

• Visual demonstrations of real Smart City solutions give cities ideas of what is achievable. Sharing video clips of such simulations in advance of meetings is an effective strategy when internet bandwidth is limited during virtual meetings.

• In-depth technical discussions can be time- and resource-intensive, but are critical for building capacity. An extended assignment period or phased approach to longer-term support may be required.

• Such projects call for a range of expert skills and a collaborative approach. The lead expert provided strategic guidance, while the second GSCP expert worked with practitioners on technical issues.

• The kick-off workshop identified a broad range of demands from ATR/BPN staff that proved difficult to consolidate. A follow-up structured questionnaires led to deeper insights
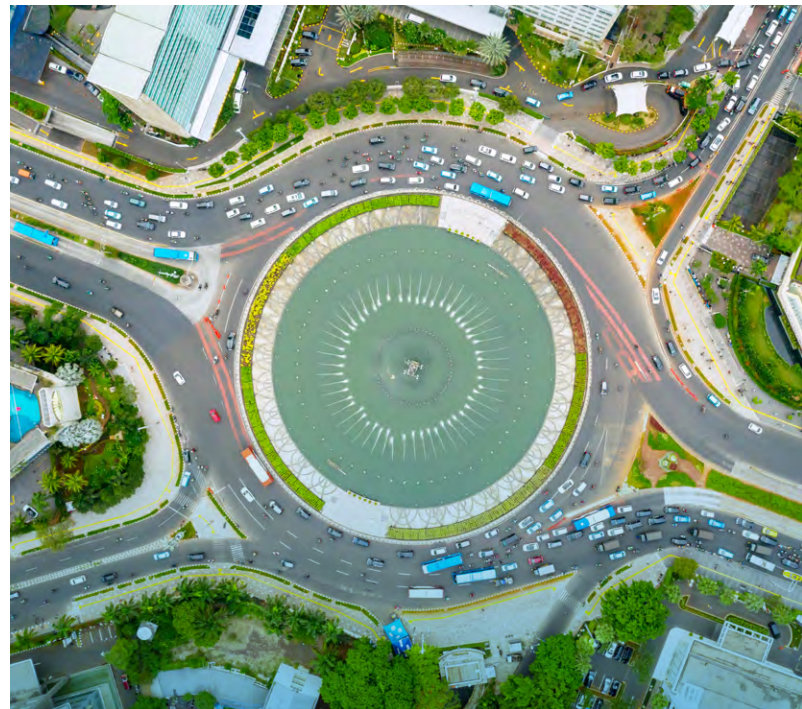
about the requests, and enabled the experts to better define the project requirements.

• Even when it falls outside the scope of the project, technical assistance given in response to government needs can generate insights that can help development partners to refine their investment. In this instance, GSCP support led to the above mentioned pilot project that resolved some of the client's challenges.

• Companies in the smart technology industry can collaborate rather than competing through effective coordination to maximize the private sector innovation. The project's international benchmarking exercise by GSCP experts facilitated coordination among a group of private companies and experts in the field.

MOVING FORWARD

ATR/ BPN plans to demonstrate Jakarta's cadaster-based indoor/outdoor map services covering an area of 10 square kilometers. It is also considering public-private partnership models suggested by the project experts. A follow-on World Bank project—tentatively called Multipurpose Cadaster for Sustainable Development—aims to support the Government of Indonesia with integrated land and geospatial information with 3D cadaster as one of main components.