From Planning to Spatial Governance, Implementing a BIM-GIS Integration for Transparent Land Administration and Sustainable Settlement Development

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SUMMARY

Overtime I have noticed Inefficient and non transparent land development practices create significant barriers to securing land management and realizing sustainable urban growth in the local communities I was brought up, thereby directly challenging SDG 11 (Sustainable Cities) and SDG 16 (Strong Institutions) one of the core issue is the persistent disconnect between high-precision 3D design models (BIM) and the legal requirements of land administration (Cadastre/GIS). This project seeks to fill this gap by establishing a reliable, comprehensive digital workflow to create a Digital Land Development Twin, that enhanced transparency and efficiency in spatial governance for a new settlement area.

My methodology employs a multi-disciplinary approach to build a Fit for Purpose Cadastre using advanced geospatial and design technologies from CAD to BIM and GIS integration

High Resolution Data Acquisition: The project begins with data capture using a UAV LiDAR point cloud of the site. This data establishes the precise ground truth, providing the high-accuracy terrain context necessary for informed design and subsequent as-built validation, monitoring and mainatainance of the project.

Design and BIM Modeling: I used Civil 3D to create the initial parcel layout and engineering designs for the basic residential road network. Proposed structures and key infrastructure were modeled in InfraWorks and Revit, creating the detailed 3D design documentation (BIM) for the planned environment.

BIM-GIS Integration and Legalization: I implemented a workflow to translate the 3D design and cadastral geometry into a unified spatial database within ArcGIS Pro. This process formally

instantiated the final digital cadastral layer, adhering to 3D Cadastre principles, and facilitated the attachment of essential legal and administrative attributes such as planning zone, allocation status,size and owner .

Spatial Governance Tool: The integrated data, representing the Digital Twin, was deployed to a web GIS platform. I developed a Dashboard to serve as a model for Spatial Governance, allowing stakeholders and authorities to visualize the entire development in 3D and query plot attributes in real time, thereby promoting transparency and informed land management.

This project successfully demonstrates a seamless proof ofconcept for migrating from 3D design to an operational spatial data infrastructure for land development. The resulting integrated Digital Twin provides a unified, accurate source of truth for the new land area.

My work makes a significant contribution to the FIG Congress themes by:

Advancing Land Administration commission 7 a replicable model for 3D/4D Land Administration and accelerating the path to secure tenure in newly developed regions.

Spatial Governance (SDG 16) The data driven dashboard dramatically increases public and institutional transparency, linking planning decisions directly to verifiable spatial by spatially connecting legal and engineering data, the framework establishes a robust foundation for resilient and efficiently managed urban growth.