Digital Twin for the Next Generation of Urban Land Administration and 3D Spatial Planning

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SUMMARY

Traditional land administration and spatial planning methods are challenged with the increasing complexity of urban land management due to urbanisation. Compact city development with high-rise buildings, developing complex infrastructures above and underground, and decreasing natural resources are some examples that need urgent attention. On the other hand, the advancements in digital technologies, multi-dimensional data models (CityGML, BIM, 3D Cadastre), and spatial data infrastructures created an opportunity for the next generation of urban land administration and 3D spatial planning. This study aims at introducing a novel system architecture and a web-based platform for spatially enabled digital twins.

A composable system architecture proposed integrating 2D, 3D, and 4D (time) data for visualisation, query, and analytics. The system provides data harmonisation, web-based data access, and 3D data conversion capabilities. The system was also developed through customisation of open-source libraries. To understand the opportunity and challenges of such a digital platform, we examined its application in 3D Cadastre visualisation, 3D searches and query, 3D development assessment, and development envelope controls. Then we engaged with the stakeholders through a series of workshops and collected and analysed their feedback.

Using the 3D data conversion and data integration workflow, more than 1400 open and proprietary data were integrated into the digital twin. Furthermore, 3D cadastre visualisation, search and query capabilities were implemented and demonstrated to the stakeholders. The 3D cadastre was also used for further applications, including high-rise building development assessment and line of site analysis. Other potential usages of data integration for 3D spatial analysis were examined through populating the 3D development enveloped adopting land development framework. In addition, integrating real-time data such as closed-circuit television (CCTV) cameras, public transport

movements, and traffic conditions in Metropolitan Melbourne, Australia, could improve our capability for other analytics for implications of compact city development and land management. The platform was also capable of integrating the utility data for underground visualisation.

The spatially enabled digital twin can potentially offer an opportunity for the next generation of land administration and 3D spatial planning. In addition, the 3D cadastre visualisation, search and query capabilities in the digital twin highlighted the added value and potential application of data in other disciplines, including 3D property valuation, asset management, and building compliance and maintenance.

However, the technology alone is not a solution for moving towards the next generation of land administration and spatial planning. Standard, organisational, and business challenges need to be considered and addressed for a successful digital modernisation in land administration and spatial planning.