

Systems Thinking for Sustainable Land-Use Data Governance: A Soft Systems Enquiry into South Africa's National Geospatial System

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Key words: Capacity building; Geoinformation/GI; GIM; Land management; Legislation; Professional practice; Spatial planning; Standards; Systems Thinking; Soft Systems Methodology; Spatial Data Infrastructure

SUMMARY

Mapping land use at a national scale in South Africa remains a complex and unresolved challenge due to both technical and institutional constraints. Despite these difficulties, the pursuit of a coherent national land-use dataset offers valuable opportunities for learning, innovation, and capacity building aligned with the Sustainable Development Goals (SDGs).

This paper adopts Soft Systems Methodology (SSM) to explore the interaction of diverse stakeholders such as, government agencies, technical experts, and policy decision makers within South Africa's evolving geospatial governance landscape. Differing worldviews, mandates, and information practices highlight the need for shared understanding and adaptive learning across institutional boundaries.

Drawing on qualitative evidence from stakeholder interviews and policy analysis, the study employs systems thinking approach such as rich pictures, (Customers, Actors, Transformation, Worldview, Owner, and Environmental) CATWOE analysis, and causal loop diagram to map institutional interdependencies under the Spatial Data Infrastructure (SDI) Act and the Spatial Planning and Land Use Management Act (SPLUMA).

The findings highlight the critical role of both technical and institutional interoperability, emphasizing that South Africa's National Land-Cover (NLC) Standard SANS 19144-2, aligned with ISO 19144-2, and the ISO 19144-3 Land Use Meta Language (LUML), provide a harmonised framework for integrating land cover and land-use classifications. This alignment enhances semantic interoperability, enabling land-cover inventories to evolve into actionable, policy-relevant land-use information that supports land administration, resource management, and sustainable development. Importantly, the paper recognises the South African NLC classification Standard as a

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foundational enabler of National land-use data coherence.

The view from system thinking perspective, this alignment serves as a boundary spanning mechanism, connecting institutions operating under distinct mandates such as those of the SDI Act and SPLUMA. The connection fosters shared learning and coherence within South Africa's evolving geospatial-governance framework. This study is grounded on broader discussion on knowledge infrastructures and spatial data ecosystems. It argues that systemic thinking can enhance resilience, accountability, and innovation in national geospatial initiatives.

Keywords

Soft Systems Methodology (SSM); Systems Thinking; Spatial Data Infrastructure (SDI); Land-Use Data Governance; Spatial Planning; Organizational Adaptive Learning.

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