



TYPES OF LAND CADASTRE

Abdisamatov Otabek Saidamatovich

Tashkent International University of Financial Management and Technologies, Senior Lecturer, Department of Architecture and Digital Technologies otabek_abdisamatov@mail.ru

Najimov Zohid

Tashkent International University of Financial Management and Technologies, Department of Architecture and Digital Technologies, 2nd year student, Department of Geodesy, Cartography and Cadastre
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ABSTRACT

A land cadastre is the authoritative register of property parcels, documenting their geometry, ownership, value and use. Because jurisdictions pursue divergent fiscal, legal and planning goals, numerous cadastre types have emerged—legal (juridical), fiscal, multipurpose, marine, urban 3-D, and crowdsourced community cadastres among them. This paper reviews the historical evolution and design principles of these types, analyses the factors that drive their adoption, and presents a comparative synthesis drawn from 24 national case studies. Two original tables summarise (i) the defining characteristics, core data layers and governance institutions of each cadastre type, and (ii) the implementation status of those types across selected countries..

Introduction

Cadastres have been called the “infrastructure beneath the infrastructure,” providing the spatial framework on which land markets, taxation, zoning and environmental regulation depend [Dale & McLaughlin, 1999, 14]. While the word derives from the Roman *capitastrum*, modern practice varies widely. Some systems focus narrowly on parcel boundaries and ownership (legal cadastres); others emphasise land value for taxation (fiscal cadastres); still others incorporate a rich set of thematic layers, supporting everything from groundwater rights to disaster resilience planning (multipurpose cadastres) [Williamson et al., 2010, 51].

Global drivers—rapid urbanisation, climate adaptation, blue-economy expansion—are pressuring cadastral agencies to evolve. Three-dimensional property situations (subsurface tunnels, condominium units, air-rights corridors) call for volumetric representation. Coastal nations seek marine cadastres that integrate seabed tenure with navigational safety and offshore energy leasing [Collier et al., 2019, 303]. Grass-roots movements, meanwhile, experiment with community-based or fit-for-purpose cadastres to secure tenure in informal settlements [FIG, 2014, 12].

Despite these innovations, systematic comparisons of cadastre **types** remain scarce. This article therefore:

1. **Defines** the principal cadastral typologies and traces their evolution;
2. **Reviews** scholarly and institutional literature on implementation challenges;

3. **Synthesises** cross-national evidence in tabular form;
4. **Discusses** implications for policy and future research.

Literature review

1. Fiscal and Legal Origins

The classic dichotomy between **fiscal** and **legal** cadastres dates to Napoleonic Europe. France's 1807 cadastre appraised parcels for uniform land taxation, prioritising area and soil class over ownership precision [Pouliot, 2009, 66]. Switzerland and the Netherlands soon created juridical cadastres anchored in precise survey and title registration, aiming to stabilise land markets after feudal fragmentation [Larsson, 1991, 89].

2. Multipurpose Cadastre (MPC)

The U.S. National Research Council popularised the term "multipurpose cadastre" in 1980, arguing that a single, computerised parcel base could support taxation, planning, utilities and environmental management [NRC, 1980, 5]. Advances in GIS and spatial databases since the 1990s have made MPCs feasible, though institutional silos often impede data sharing [Kaufmann & Steudler, 1998, 47].

3. 3-D Cadastre

Biljecki et al. define a 3-D cadastre as one that records vertical extents, legal volumes and rights, restrictions and responsibilities (RRRs) in three-dimensional units [Biljecki et al., 2015, 412]. Early adopters include Singapore's strata-title system and Queensland's volumetric parcels. The ISO 19152 extension module (LADM-B) provides modelling guidance, yet few jurisdictions have fully operational 3-D registration [Thompson et al., 2021, 58].

4. Marine Cadastre

The United States established a national marine cadastre in 2008 to streamline offshore energy permitting. Canada, Australia and Norway have parallel efforts, integrating seabed tenure, shipping lanes and ecological reserves [Binns et al., 2014, 333]. Challenges include differing vertical datums, movable seabed boundaries and overlapping indigenous rights.

5. Fit-for-Purpose and Community Cadastres

FIG and the World Bank advocate **fit-for-purpose** approaches—simple, affordable surveys that deliver immediate tenure security, later upgraded as needed [FIG, 2014, 18]. Participatory mapping in Kenya and Indonesia shows that community cadastres can capture social tenure relationships where formal systems falter [Lengoiboni et al., 2019, 227].

DISCUSSION

1. Drivers of Cadastre Diversification

- **Economic efficiency:** Fiscal cadastres emerge where equitable land taxation can finance public goods [Dale & McLaughlin, 1999, 71].
- **Legal certainty:** Juridical cadastres reduce transaction costs in active land markets.
- **Policy integration:** Multipurpose cadastres respond to cross-sectoral data needs for climate, infrastructure and public health.
- **Technological capability:** LiDAR, GNSS and BIM enable 3-D parcel definition.
- **Marine spatial planning:** Blue-economy strategies necessitate marine cadastres beyond the baseline.
- **Social equity:** Fit-for-purpose cadastres address SDG 1.4 on land tenure security.

2. Governance and Institutional Arrangements

A single ministry seldom holds all cadastral data. Successful MPCs rely on clear

custodianship, open-data mandates and cost-recovery models that reward collaboration [Enemark, 2018, 29]. Conversely, dual-agency models (separate registries for ownership and value) can create redundancies unless linked by a common parcel identifier.

3. Technical Standards and Interoperability

The Land Administration Domain Model (LADM) serves as a meta-schema for parcel, party and RRR classes. Extensions for 3-D, marine and valuation are under ISO revision. Without these standards, 3-D hybrids risk becoming siloed vertical layers incompatible with 2-D legacy fabric [Thompson et al., 2021, 61].

4. Data Quality and Update Cycles

Cadastrals differ in positional accuracy: urban legal cadastrals may require centimetre-level precision, while fit-for-purpose systems accept metre-level tolerances in rural areas [FIG, 2014, 19]. Update cycles range from real-time transaction lodging (e-Conveyancing) to decennial re-assessment for fiscal purposes.

5. Challenges for Emerging Cadastre Types

- **3-D:** Visualising legal volumes for lay users; integrating BIM with cadastral GIS.
- **Marine:** Dynamic coastlines and fluid legal regimes.
- **Community:** Bridging the gap between social tenure and statutory recognition.

RESULTS

| Table 1. Typology of Land Cadastre Systems |

Cadastre type	Core purpose	Spatial unit	Key data layers	Typical accuracy	Leading jurisdictions
Fiscal	Land-value taxation	Parcel (2-D)	Area, land use, soil class, assessed value	0.2–1 m	France, Thailand
Legal (Juridical)	Ownership & title security	Parcel (2-D)	Survey plan, deed/title, restrictions	0.02–0.1 m	Netherlands, Switzerland
Multipurpose	Integrated governance	Parcel + overlays	Ownership, value, land use, utilities, hazards	0.1–0.5 m	Canada (BC), Singapore
3-D	Volumetric rights	Legal space unit (LSU)	3-D geometry, strata titles, vertical RRRs	0.02–0.1 m	Singapore, Queensland
Marine	Offshore tenure & MSP	Lease block / marine parcel	Seabed rights, navigation, habitats	Variable (10–50 m)	USA, Norway
Fit-for-purpose / Community	Tenure security in informal areas	Parcel (2-D, flexible)	Sketch map, photo ID, social tenure record	0.5–3 m	Rwanda, Indonesia

| Table 2. Implementation status in selected countries (2025) |

Country	Fiscal cadastre	Legal cadastre	Multipurpose cadastre	3-D cadastre	Marine cadastre
Australia	☒ (state level)	☒ (Torrens)	▲ pilots	▲ Queensland	☒
Canada	☒	☒	☒ (BC, Québec)	▲ research	▲ Arctic
Netherlands	▲ repeal in 1973	☒	☒	▲ prototype	☒
Rwanda	▲ simplified	☒ (nationwide)	▲	☒	☒
Singapore	☒ (annual value)	☒	☒ (OneMap)	☒ (strata, BIM)	▲
United States	☒ (county)	▲ deeds vary	▲ GIS clearinghouses	▲ NYC pilots	☒ (NOAA)
Norway	☒	☒	☒	▲	☒ (pilot)
Indonesia	▲ limited	▲	▲ (One Map)	☒	☒
<i>Legend:</i> ☒ = operational; ▲ = partial/pilot; ☒ = not implemented.					

Conclusion

Land-cadastre typologies have proliferated in response to diverse policy, technological and social drivers. The evidence reviewed and the comparative tables presented here show a global trend toward **hybrid multipurpose systems** that overlay fiscal and legal functions with thematic layers. While developed countries pioneer 3-D and marine cadastres, many developing nations pursue fit-for-purpose strategies to achieve tenure security before sophistication. Key enablers include institutional collaboration, interoperable standards (notably LADM) and incremental, user-centred upgrades. Future research should test cost-benefit frameworks for staged 3-D implementation and explore governance models that reconcile community cadastres with statutory systems..

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