Generic concepts to support country profiles, LADM implementation and indexing within formal Land Registers.

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Key words: Land Administration, Land Registration, LADM, Concepts, Country Profile

NOTE TO EDITOR

We have used the template provided. Please note that whilst the sections have the appropriate style the associated numbering has malfunctioned. We can not resolve this.

In addition some of the text in the illustration may be too small at print. If you agree I'd appreciate your steer on any change.

SUMMARY

The Land Administration Domain Model is a conceptual reference to support the implementation of, and interoperability between, land administration systems. LADM is generic in scope: different operational domains can each produce fit-for-purpose implementations using LADM as a template. One such domain is Land Registration where Land Registrars register land based on the legislated mandates of a specific jurisdiction. This represents a highly formalised registration process. Whilst the specific requirements of each jurisdiction differ there are generic concepts which are applicable within the Legal Land Registration domain.

This paper will introduce and ground a number of concepts. Initially generic foundational concepts are introduced that are matched to LADM party, rights and land concepts. By defining different ownership and non-ownership rights conceptual relationships can be defined between owning and non-owning parties. These concepts can be resolved in data and clearly identify the nature of indexing which is required in order to efficiently structure the register and support any product derivation.

These concepts support an exemplar registration process. The exemplar is framed around concepts within a 'Register of Deeds' that support a 'dealing with whole' application - a simple disposition (sale of ownership) from one party to another. This example describes how the concepts can be used to structure registration and support indexing that allows the flexible derivation of products from the data. The derived product in the exemplar is a Title Certificate.

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Generic concepts to support country profiles, LADM implementation and indexing within formal Land Registers.

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1. INTRODUCTION

The Land Administration Domain Model (LADM, (ISO TC/211, 2012)) is a conceptual reference to support the implementation of, and interoperability between, land administration systems. LADM is generic in scope: different operational domains can each produce fit-for-purpose implementations using LADM as a template. One such domain is Land Registration where Land Registrars register land based on the legislated mandates of a specific jurisdiction. Land registration is effectively summarised by Wikipedia as follows:

> *Land registration generally describes systems by which matters concerning ownership, possession, or other rights in land are formally recorded (usually with a government agency or department) to provide evidence of title, facilitate transactions, and prevent unlawful disposal.*

Land Registers operate under a legal mandate and therefore tend to be formalised. The legal concepts represented in a Land Register reflect the changing relationship between citizenry and the state that have evolved over time. Registration is the process of adding, varying or removing parties, rights, and land within the Land Register.
The structure of the register defines registration and re-use capabilities.

> *The operation of a land registry is basically an exercise in filing - the indexing and storing of particulars in respect of each land parcel in such a way that they can be amended, retrieved, and presented without delay or mistake. (Simpson, 1978, s20.4)*

Viewing the register, and the associated registration process, as a data storage, indexing, and retrieval problem is crucial. The data in Land Registers needs to be structured and managed effectively so that services can be efficiently delivered. The highly effective indexing within the Scottish Register of Sasines (a record of deeds) simplified retrieval which partially explains why the register is still in existance after 400 years (Simpson, 1978, s6.5.1). Ineffective indexing leads to costly retrieval and, it can be argued, is the reasoning behind the implementation of the *Torrens'* (Title by registration) legislation in 1858 in South Australia. Indexing and retrieval is therefore key to the functioning of a modern Land Register. As described by Mapp (1978, s3.3):

> *'The administrative efficiency of an instrument registration system, and its indexing in particular is of enormous consequence to lawyers, other professional title searchers, and the public.'*

Technology and standards support efficient indexing:

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- Databases:
  - Structured and unstructured information retrieval is core to modern database design.
- Spatial indexing:
  - Spatial information theory has provide highly efficient multi-dimensional spatial indexing techniques.
- Standards:
  - LADM (ISO19152) and other associated standards support effective data modelling.

The technology allows a model to be materialised and the data indexed. The model itself reflects the legal and operational concepts of Land Administration. Within a small number of paragraphs we have already introduced a large number of Land Administration terms. This terminology can be used within each jurisdiction but may have a subtly different meaning: this leads to semantic fragmentation. To reduce fragmentation these concepts and their relationships should be formally defined and modelled. The LADM allows the formal modelling of legal, social and operational concepts as data and related process operations. However, LADM is a general model: this means that the model is universally applicable. This paper will consider this problem from the specific context of Land Registration. Whilst the specific requirements of each jurisdiction differ there are generic concepts which are applicable within the Land Registration domain. A thorough understanding of the concepts supports the development of effective country profiles.

2. TENTATIVE CONCEPT DEFINITIONS

This paper will introduce and ground a number of concepts. No supporting formal ontology (first-order logic) model has been created at this stage as there is no consensus around the definition of the concepts. Formal ontology modelling should occur once the concepts are robust and accepted by the community.

This paper is introductory and will be framed around concepts within a 'Register of Deeds' that support a 'dealing with whole' application - a simple disposition (sale of ownership) from one party to another. It does not consider the subdivision of ownership rights: either spatially (a 'split') or as a rights subdivision (for example, a strata for a flat). Likewise non-ownership rights (including leases) will not be discussed in detail. These activities are beyond the remit of this illustrative paper.

Generic, foundational, concepts are introduced that are matched to LADM party, rights and land concepts. By defining different ownership and non-ownership rights compounded conceptual relationships can be defined between owning and non-owning parties. These concepts can be resolved in data and clearly identify the nature of indexing which is required in order to efficiently structure the register and support any product derivation.

The conceptual definitions (below) are described briefly. The definitions are compounded: this helps demonstrate how complex concepts can evolve from simple primitives.

2.2 Foundational concepts - Parties, Rights and Land

Parties, Rights and Land are core concepts in the LADM (ISO TC/211, 2012) approach.

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<u>Land</u>

In terms of a Land Register *land* describes:

- a **thing** which has a spatial extent
- that defines a **right(s)**
- that is held by a **party(s)**.

<u>Rights</u>

A **right** describes the:

- **nature of the things**
- that **parties (persons)** can do.

<u>Real Rights in Land</u>

A **real right** describes the:

- **nature of the things**
- that **parties (persons)** can do
- with **property**
  - *movable property* (possessions such as clothes, cars, keys, televisions) or
  - *immovable property* (land).

A **real right in land** describes the:

- **nature of the things**
- that **parties (persons)** can do
- with **land** (immovable property).

It is the registration of **real rights in land** which is of interest to a Land Register (Gretton & Steven, 2017, pp. 8-10).

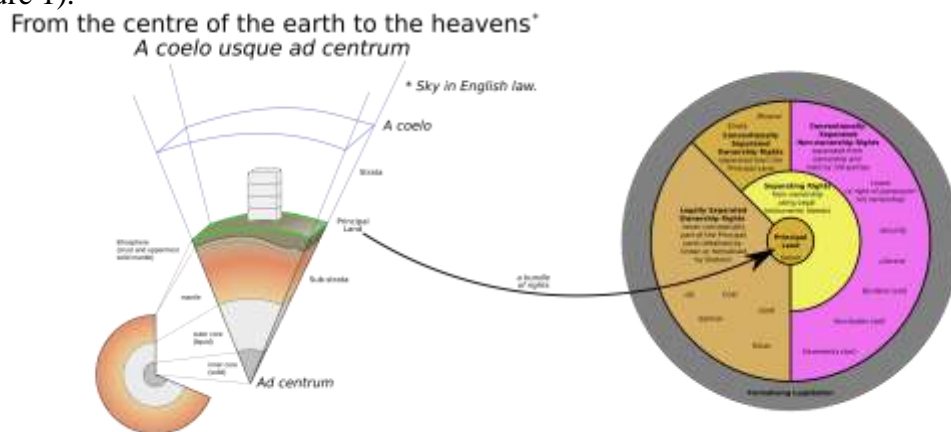As every registrable **real right in land** has a land component these are *spatio-rights* (see Figure 1).

Figure 1 Dominium (e.g. freehold, solum etc.) represents ownership of land: a spatio-right. Whilst these rights may be represented in two dimensions many have a three dimensional legal implication. Ownership itself represents a bundle of rights. Some of these rights can be separated from the bundle by statute or conveyancing methods.

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Parties

In terms of the Land Register parties describe the:

- **things**
- that can hold **real rights in land**.

LADM extends parties to include ALL parties who are actors in the registration and re-use process.

Parties can hold **real rights in land** on the Land Register (see Figure 1). Owning parties are parties that hold (or benefit from) an *ownership* right. *Ownership* rights can be held as fractional shares by more than one party. The total of all fractional ownership for a single piece of land should always equal 1 (or, as a fraction, 1/1).
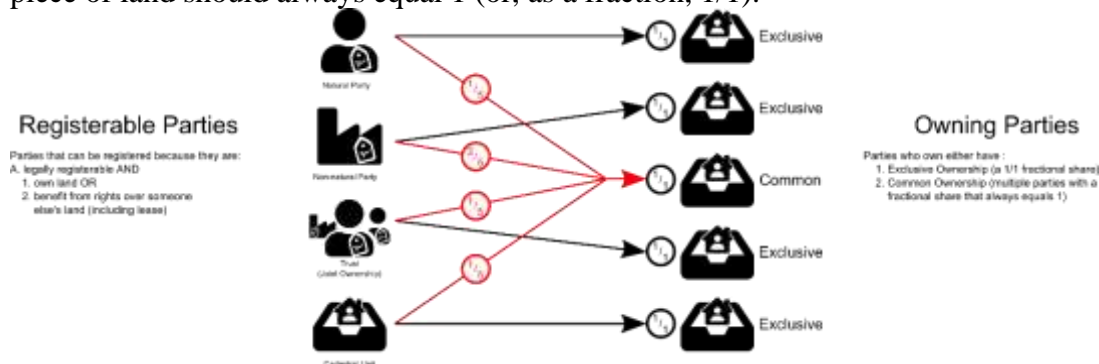

*Figure 2 Registrable parties - are parties that **can hold** a real right in land on the Land Register. Owning parties are parties that **do hold** an ownership right. Ownership rights can be held as fractional shares.*

Real Rights in Land relationships

Rights relationships can become quite complicated. Only those relationships which are required for the purposes of this paper have been included.

- A **real right in land** can represent
  - **ownership rights** or
  - **non-ownership rights** (see Figure 1).
- A **benefiting** party
  - **holds** a **real right in land**.
- A party who **holds** a **real right in land**
  - has a **benefit**.
- A **benefiting** party who **holds** an **ownership right**
  - is an **owner** (see Figure 2).
- A **cadastral unit**
  - is the spatial extent of an **ownership right**.
- Each **cadastral unit**
  - has a **unique identifier**.
- **Encumbered** land
  - is land where a **third party** (i.e. someone who is not the owner) **holds** a **real right in land**.
- An **encumbering real right in land**

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- is a **real right in land** held by a party **over land that they do not own**.

Third parties (i.e. someone who is not the owner) who **benefit** from an **encumbering real right in land** can have:

- **Praedial Benefits**
  - The right is granted to the party in their capacity as **owner of land**. When the land is sold, the right travels with the land (Simpson, 1978, s1.4.3).
    - When modelled a **cadastral unit** is the **owning party**.
    - The owning **cadastral unit** is a proxy for the party who, in turn, **owns the cadastral unit**.
- **Personal Benefits**
  - The right is granted to a party in a **personal capacity**. When the land is sold, the right remains with the party.

Encumbrances represent a spatio-right relationships between an owner of land and a third party. **Encumbrances** are indexed spatially (see Figure 3).

Praedial Benefits represent a party-right-land relationship where the benefiting party is land. **Praedial Benefits** are indexed by party (see Figure 3).

3.2 Transactional changes to a Land Register

A Land Register is changed through formal transactional processes that are normally defined within the legal framework of the jurisdiction. Different actors play different roles within the transactional sequence. Common roles include parties who:

- have a relationship with a **registrable real right**:
  - a **granter** (the party who **holds** a **real right in land** (normally the **owner**)) and
  - a **grantee** (the party who will **benefit** from a **real right in land**).
- provide a formally accredited **credence based service**:
  - solicitor or notary,
  - cadastral surveyor or national cadastral agency,
  - registrar

As described in Figure 3 the transactional sequence can be broadly broken down in to three stages:

1. Application stage - where the Legal Instrument (deed) is drafted and submitted for consideration as part of an application.
2. Registration stage - where, if the application is accepted, the deed is recorded and rights are registered based upon the jurisdictional mandate. The data is structured and indexed to improve retrieval and access.
3. Product stage - where the data is combined to generate user outputs (e.g. Title Certificate).

It is within this framework that clarity concerning concepts and the relationship between concepts is important. This informs how the data is indexed and what products can be efficiently delivered.

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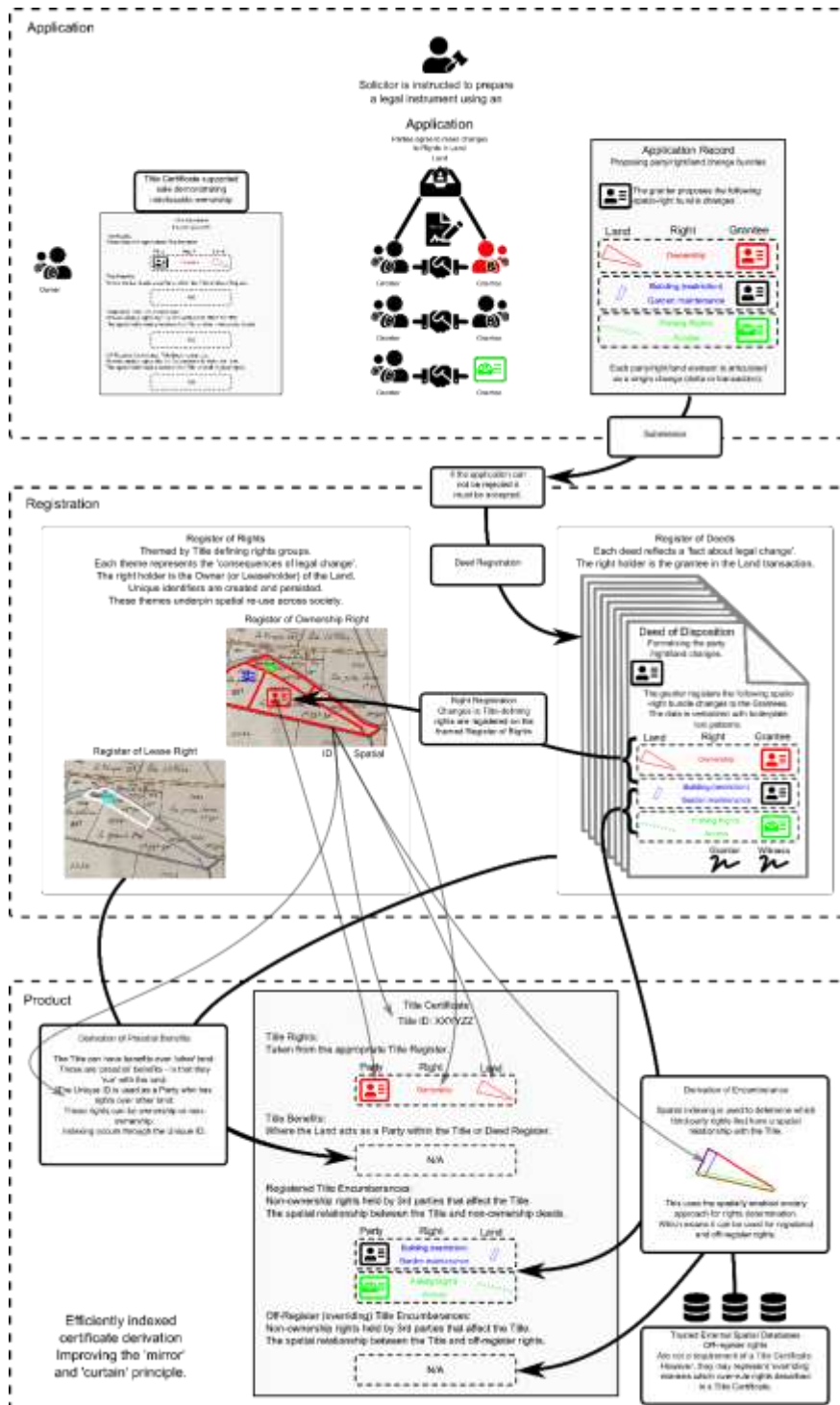Virtually in the Netherlands, 21–25 June 2021

Figure 3 The transactional process that changes a Land Register. A solicitor or notary working with the right holder and benefiting party drafts a deed to reflect the required changes to the real rights in land in the register. This is submitted to the registrar in an application. If the registrar accepts the application the deed and rights changes are recorded and registered based on the legal framework in the jurisdiction. The data is indexed to support the efficient derivation of products required by the jurisdiction (notably Title derivation).

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Legal Instruments

Legal instruments are *jurisdiction dependent* and used to legally instruct the registrar to make changes to the Land Register. Legal instruments are the family of legal tools that include *deeds* and *contracts*. In terms of the Land Register a legal instrument:

- describes **changes** to specific **real rights in land** between:
    - a **granter**
    - a **grantee**
        - the granter and grantee can be the same party (see, for example, the allocation of a 'building restriction' in Figure 3).
- can represent **multiple rights** granted to **multiple parties** over **multiple areas of land**.
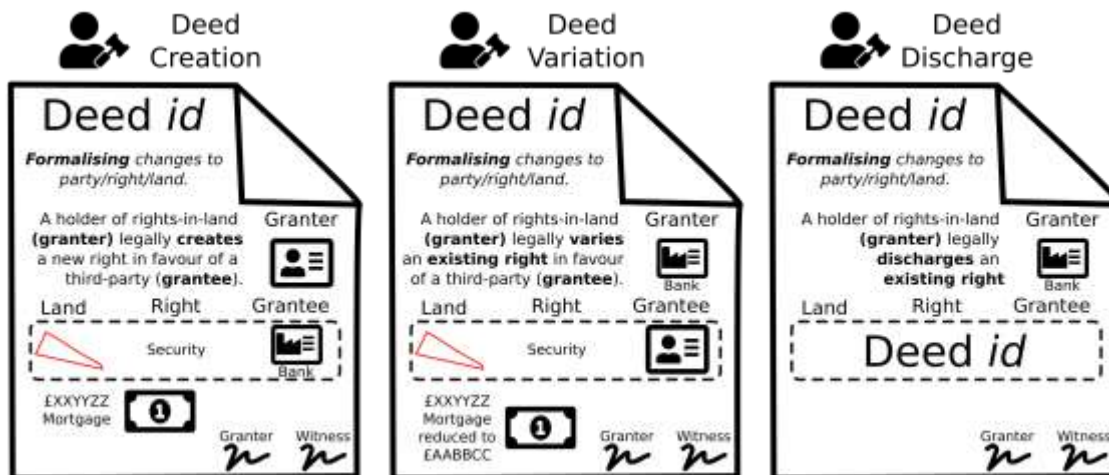

Figure 4 Deeds acting as a carrier for a spatio-right bundle from a granter to a grantee that create, vary or discharge rights.

Essentially a legal instrument is the carrier for a spatio-right bundle from a granter to a grantee. Legal instruments can (see Figure 4):

- **create** new **real rights in land**
    - a new party/right/land relationship.
- **vary** existing **real rights in land**
    - the variation does not need to affect all rights.
    - individual **real rights in land** can be **discharged** through this process.
    - variation allows nuanced change to an instrument.
- **discharge** existing **legal instruments**
    - all **real rights in land** are **discharged** with the **legal instruments**.
    - A **grantee** is not required for a **discharge**.

4.2 Registration

The legislation in each jurisdiction describes how accepted applications are registered. It should be noted that whilst there is a general requirement to submit a legal instrument that represents change against the Land Register, there may not be a legal requirement to **register**

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the deed itself. Instead there can be a requirement to **register the consequences of the right changes represented in the deed**. This represents the broad difference between a Land Register represented as:

- a **Register of Deeds** through the recording of facts in deeds or
- a **Register of Title** through the registration of rights consequences against a Title record.

In the main there should be no difference between how rights are resolved between the two types of register. Structuring and indexing will determine how easy it is to derive products and services. The issue with a title register is what happens with an inaccuracy. If it is resolved under the 'common law' then equality is maintained. If, however, it is resolved under the registration law and that leads to a different response to the common law then a bijural inaccuracy ensues (Lord Eassie et al., 2004, s1.11; O'Connor, 2010).

In Figure 3 a **Register of Deeds** approach has been taken which includes an optional materialisation of a **Register of Rights**. This **Register of Rights** is similar to the **Register of Plots of Land** referred to by Reid & Gretton (2017, s4.4). The **Register of Rights** is a materialised derivative from the **Register of Deeds** based upon right themes which are used to frame the derivation of products (most notably **ownership** and **leasehold** rights to support the derivation of Title). The theme that relates to ownership rights is a *map that shows the boundaries and ownership of land parcels*: this, in turn, is equivalent to a **cadastral map**. The **cadastral map** supports a *Spatially Enabled Society* approach to re-use (Steudler & Rajabifard, 2012). The direct materialisation of this theme means that **unique identifiers** can be minted and persisted for individual **cadastral units**. Persistent unique identifiers for cadastral units support management, discovery, cross-referencing, search and indexing. In addition the **cadastral map** shows the most recent party, right, land relationship for each **cadastral unit** as processed through the **Register of Deeds**. As such it can be used as evidence of **chain of title**.

5.2 Products: A Title Certificate example

During registration data is structured and indexed to support the efficient derivation of products required by the jurisdiction (notably Title derivation). In Figure 3 we have articulated this through the production of a **Title Certificate**. The **Title Certificate** is a Title summary describing the rights associated with owned land. Wikipedia has a succinct summary of title:

> *In property law, a title is a bundle of rights in a piece of property in which a party may own either a legal interest or equitable interest. The rights in the bundle may be separated and held by different parties. It may also refer to a formal document, such as a deed, that serves as evidence of ownership. Conveyance of the document may be required in order to transfer ownership in the property to another person.*

At a simple level a *buyer* of land (the *grantee* on a deed) will want to determine if the *seller* (the *granter* on the deed) does actually own the land they purport to sell. The buyer will also want to know of any rights that benefit or encumber the owned land. The **Title Certificate** will provide all this information in one place, thereby supporting the buying and selling of land. If the Land Register is a *Register of Deeds* then a title is derived by determining which

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legal facts affect a piece of owned land. The generation of the **Title Certificate** will involve the following activities:

- identification all the deeds that affect the owned land.
- determine the relationships between these deeds to:
  - validate that the seller has valid ownership: producing a chain of title or title deed.
  - identify what (praedial) beneficial rights **the owned land has over other land**.
    - **Praedial Benefits** are indexed by party.
  - identify what beneficial rights **3rd parties have over the owned land (encumbrances)**.
    - **Encumbrances** are indexed spatially.

Clearly effective indexing is required to support efficient searches.

Indefeasibility

Indefeasibility is a useful legal concept associated with ownership and Title determination. Two different definitions of *indefeasible* ownership have been identified:

An "indefeasible" title, for present purposes, is one that cannot be set aside on the ground of any defect in the way that it was acquired. (O'Connor, 2010, p. 196)

A title is 'indefeasible' if there are no competing claims either from a competing owner or from the holder of some derivative right (such as a mortgage) (Reid, 2020, p. 116).

Both definitions require determining the validity of ownership (based on ownership provenance). Reid (2020, p. 116) additionally identifies freedom from encumbering rights held by third parties. The key issue here is what encumbering rights are relevant? This will be jurisdiction dependent but is likely to include rights which have a direct impact on possession (such as security (mortgage)). An indefeasible title can, therefore, be transacted with confidence. Title indefeasibility is a core concept within a conveyancing system.

Chain of title: demonstrating 'true' ownership

The 'true' owner is the person who ought to be owner, based upon the legal deeds, the registration system and accounting for void and other deed errors (Lord Eassie et al., 2004, s5.29). In common law, ownership can be demonstrated by tracing the chain of ownership back to the earliest grant of land. These transaction documents (nominally deeds or other legal instruments) are collectively known as the *title deeds* or the *chain of title*. In Figure 3 this is articulated in the *Register of Ownership Rights* which is a materialisation of the most up-to-date deed information. This provides the details concerning the *spatial extent of ownership* and the *party who holds the ownership right* which are used to frame the other elements of the Title Certificate.

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Spatial indexing is used to determine which third-party rights have a spatial relationship with the extent of the ownership right. This uses the spatially enabled society approach for rights determination. When used within the Land Register the Register of Deeds is queried and there is confidence in the quality of the results. When used off-register (for overriding interest) trust and quality rules will need determining.

<div align="center">Identification of Praedial Beneficial Rights</div>

A **praedial benefit** is when a real right in land is held by a party in their capacity as **owner of land**. The right is registered against the dominant **cadastral unit** as a proxy party. When the dominant cadastral unit is sold the praedial benefit automatically travels with the land and becomes a benefit to the new owner. Identification of praedial benefits is a simple matter of indexing over the unique identifer.

3. A RIGHTS REGISTRATION EXEMPLAR

Figure 3 describes a sale transaction as follows:
- The **man in black** owns land which is evidenced through the **Title Certificate**.
- Application Stage.
  - The **man in black** (*granter*)
    - informs a solicitor that he would like to sell the land to the **lady in red** (*grantee*).
    - informs the same solicitor that he would like to grant other (non ownership) rights to other nominated parties (*grantees*).
  - The solicitor
    - confirms that the **Title Certificate** is up-to-date and accurate.
    - confirms the identify of the **man in black**.
    - confirms the identify of the **lady in red**.
    - confirms the identify of the other *grantees*.
    - drafts the deed.
    - completes and submits the application.
- Submission Stage.
  - If there is no basis to reject the application it must be accepted.
- Registration Stage.
  - The Registrar
    - records (registers) the deed.
      - indexes the data in the deed.
    - registers the **ownership right** in the deed in the **Register of Ownership Rights**.
      - The ownership right held by the **man in black** is versioned.
      - The party who owns the **cadastral unit 1019** is updated to be the **lady in red** in the **Register of Ownership Rights**.
      - The **Register of Ownership Rights** is re-indexed.

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- Product Stage (creating a new **Title Certificate**)
  - The Registrar extracts
    - **Title details** for **cadastral unit 1019** from the **Register of Ownership Rights**.
    - **Title (praedial) benefits** using a party index search over the Registers for **cadastral unit 1019**.
    - **Registered Title encumbrances** using a spatial index search over the Registers for **cadastral unit 1019**.
    - **Off-register Title encumbrances** using a spatial index search over external Registers for **cadastral unit 1019**.
- The **lady in red** owns land which is evidenced through the **Title Certificate**.

4. DISCUSSION AND CONCLUSION

'One might logically assume that the fundamental objectives and elements of a system created by statute could be determined through inductive reasoning from the statute itself.' Mapp (1978, s4.2)

This paper has described a number of potentially generic concepts that apply to the *formal Land Registration domain* (a sub domain of the LADM community). This work supports the *fit-for-purpose* approaches to Land Administration which are designed to support developing countries (Enemark et al., 2016; Unger & Bennett, 2020). We have framed concepts in a manner that demonstrates how they can affect the storage, indexing, and retrieval of land registration data in a flexible, effective and efficient manner. We have demonstrated how *Title* like products can be efficiently derived from the registered data. The structuring of knowledge in this manner allows the land registration products to be *determined through inductive reasoning* as described by Mapp (1978, s4.2).

These modern approaches to indexing can function as part of a *Spatially Enabled Society* (Steudler & Rajabifard, 2012). A *Spatially Enabled Society* makes use, and benefits from, a wide array of spatial data, information, and services as a means to organise its land and water related activities and to make better decisions. In a *Spatially Enabled Society* products and services derived from Land Administration will be woven into the fabric of the government, research, business, and other citizen ecosystems. Such an approach is critical for resolving overriding interests - that is interests held outwith the Land Register which take precedence over information held on the register. This has been a persistent problem in Titling systems. Clearly, there is more to do. This conceptual grounding once embraced by the community can be articulated in a first-order-logic Ontology. Such an ontology will assist in knowledge representation and reasoning. This is turn will support the development and enhancement of LADM country profiles and any agent based transactional (conveyancing) workflows supporting (semi) automated approaches to registration. This moves toward the the vision of instantaneous, hands-free, automated registration embraced by such legal architects as Reid & Gretton (2017, s4.32). Hands-free, automated registration increases resiliance within the registration sector. The COVID-19 pandemic has demonstrated the need for increased resilience.

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BIOGRAPHICAL NOTES

Ordnance Survey is the national mapping agency for Britain, and a world-leading geospatial data and technology organisation. Accurate location data is used for smarter solutions to the world's most complex problems including resource management, urbanisation and population growth. As a trusted partner to government, business and citizens across Britain and the world, our expertise and technology helps customers in government, business and infrastructure deliver efficient services.

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Dr Anthony BECK
A geospatial and analytics professional with a unique mix of technical, commercial, academic and policy skills. Anthony has experience of delivering repeatable solutions using an inclusive

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and interdisciplinary approach, involving GI-Science, Knowledge Engineering, and Data Modelling.

One of Anthony's key skills includes demonstrating the link between data, policy and practice and ensuring that processes have appropriate assurance and governance. He is a Concept and Data architect and an acknowledged expert in advising specialist, policy and standards bodies on: land registration, utilities, heritage, smart cities and addressing.

Anthony is fully conversant with the strategic and architectural issues for title, deed and right-based Land Registration and Cadastral Mapping and is fluent with ISO19152 (Land Administration Domain Model (LADM)). He is contributing to the ISO19152 version 2 revision.

Mr Dave STOW
Currently Lead Enterprise Architect at Ordnance Survey where he is helping the business implement its strategy of delivering managed digital services. He has experience spanning over thirty years and ranging across utilities, finance, a technology start-up, not-for-profit and public sector, and has lived and operated internationally. Dave has a proven track record of developing strategy to maximise business performance, and putting in place the teams and governance to ensure delivery against that strategy.

In his current role Dave has a special interest in how land administration can be improved as part of enabling macroeconomic growth, using both technology and professional services to increase capacity and capability of land authorities (taking into account cultural and legal factors). He's spoken at a number of conferences on transforming land services to sustain an economy by improving land registration, taxation collection and enforcing land legislation.

With a reputation for creating teams that deliver tangible benefit, Dave is a recognised decision maker and leader possessing extensive knowledge and expertise in digital and its relationship to the technology led businesses of today.

Mr Michael HILL
Michael is an experienced Lead Engineer and Certified Scrum Master with a demonstrated history of working in the information technology and services industry. Experienced in all stages of the secure software development lifecycle and testing methods/ frameworks from project inception through to completion, he has a proven ability of combining technical knowledge with business requirements to show technology can be applied in the real world using various technologies and platforms.

Michael has developed various delivery approaches and road maps for international customers, across South Africa, America, India and the UK, considering various support models and deployment mechanisms that could be used within land information systems.

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