3D Cadastres and Beyond

4th International FIG 3D Cadastre Workshop 2014

THE UNIVERSITY OF MELBOURNE

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The University of Melbourne

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Key Drivers

- Increasing urban complexity;
- Needs and opportunities in the context of **future cities** and future institutional sustainability;
- 3D land and property info to support future planning and management of urban environment (e.g. leveraging BIM, PIM);
- **Future users** vs **current users**, including wider array of stakeholders;
- Making sense of smart data in cities eg. smart utilities, 4D data.

Future Cadastre needs to find new ways of representing vertical developments.

Enhanced Evidence-based Decision-making

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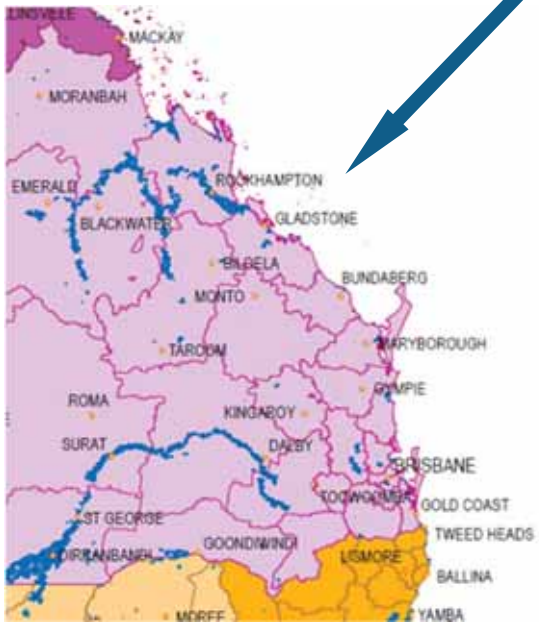
25 Smith Street = -35.5676, 135.6587

Address	25 Smith Street
Purpose	Residential
Damage	75%
Date	10/01/2011
Event	Flood
Floor Height	0.8 metres
Value	$210,000
Population	4
Assistance	Required

Detailed evidence base to inform decision making



Targeted Government assistance

Flood extents

Imagery

Base data

Fundamental location data

Land and Property Information in 3D

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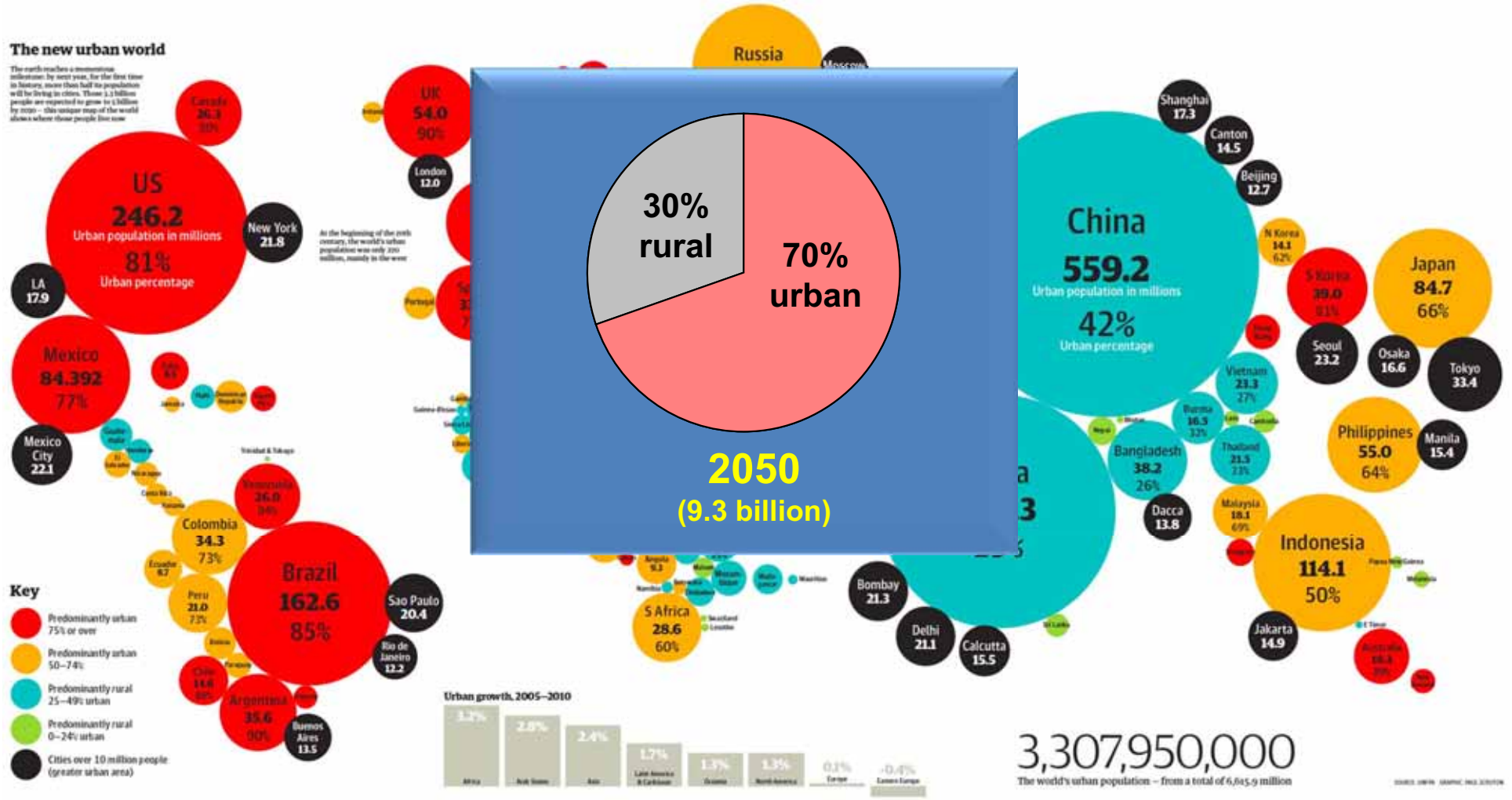
Key Massages…

- Future cadastre needs to take into account the **expectations** of all stakeholders.
- Future cadastre needs to find new ways of representing vertical developments.
- Future cadastre requires the consideration of how **the needs of current users** should be balanced against the potential needs of **future users**.
- **3D cadastre** offers new engagement opportunities and is **fundamental for the future**.

Increasing Urbanisation

By 2050, %70 will live in urban areas…



Complex Urban Environment

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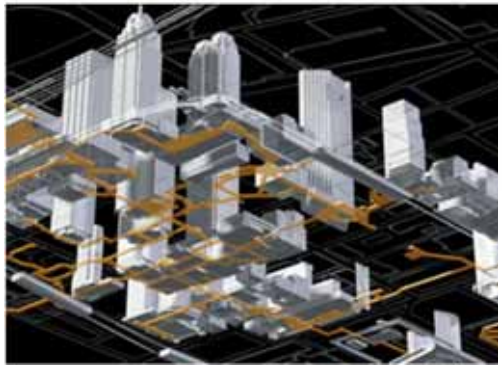

Complex Structures

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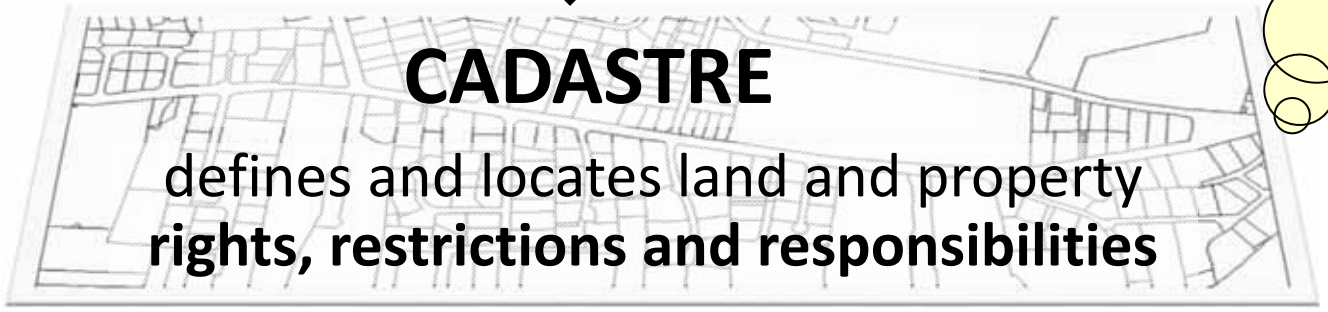
Land and Property Management

AUD$4.7 trillion

This facilitates the operation of **property markets**, which underpin **national economies**.



CADASTRE

defines and locates land and property
rights, restrictions and responsibilities

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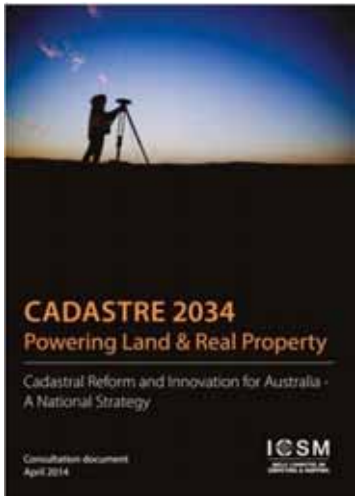
Increasing Vertical Development

How can the cadastre accurately and readily identify <u>all</u> property rights, restrictions and responsibilities?

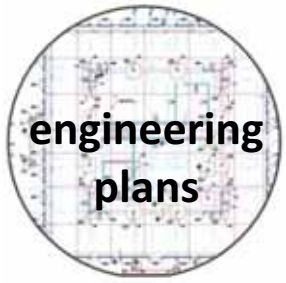
Cadastre 2014 to Cadastre 2034

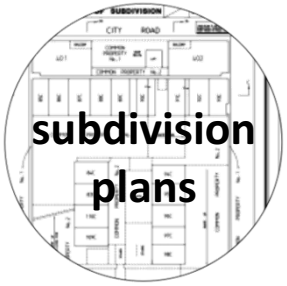


…Cadastre 2014 provided a **simple** yet **effective framework** for supporting the evolution of cadastral systems. It established a set of universal principles that all countries could work towards.

…Cadastre 2014 emphasised **information integration** and shifts in **collaboration dynamics** across stakeholders.

Limitations of 2D information





planning

development

management

community knowledge

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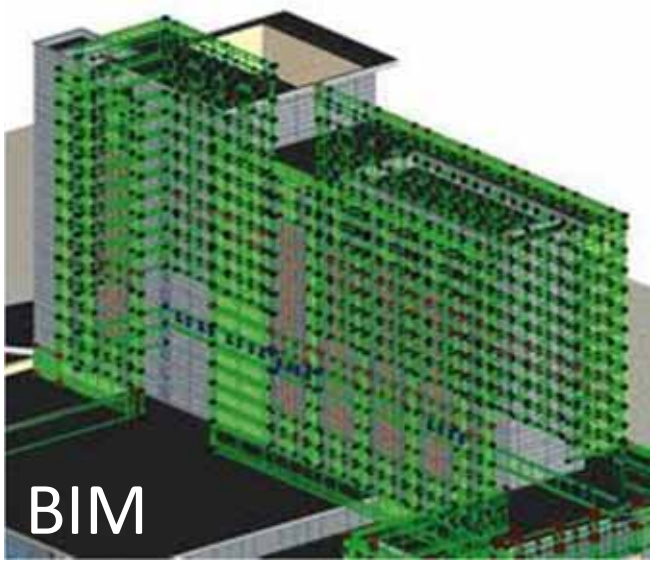
New Technological Opportunities



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Multi-scale Simulation Tool

GIS

This requires spatially accurate map-base and cadastre as a foundation.

City

BIM+GIS

BIM

Precinct

Building

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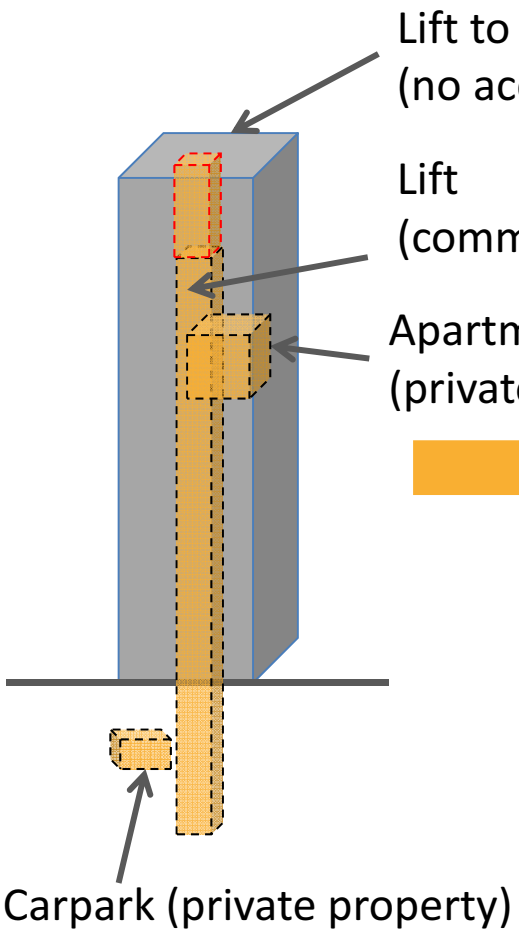
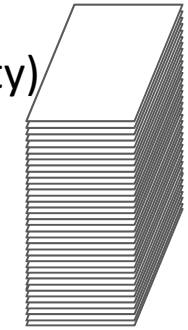
FIG Working Group on 3D Cadastres

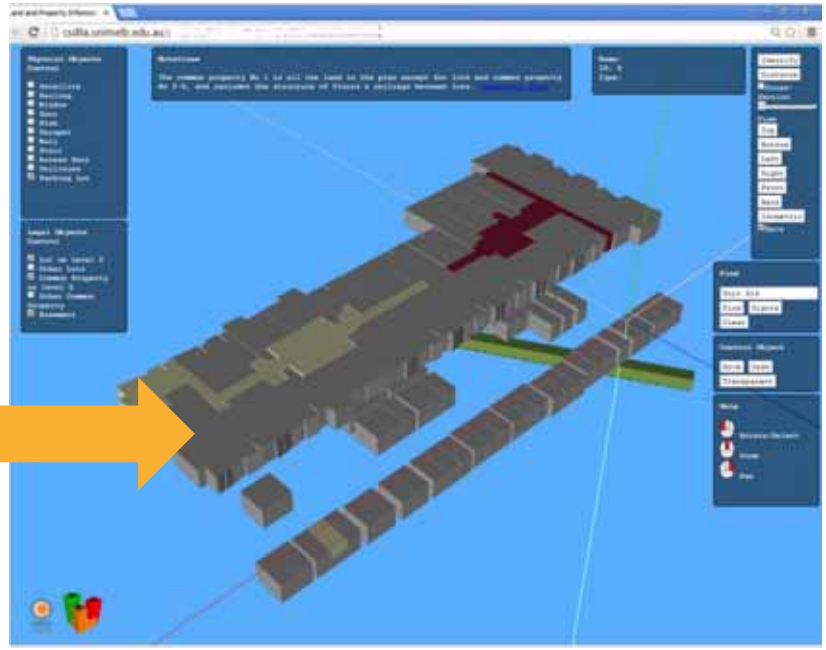
"In all cases for the establishment of such a cadastre **legal**, **institutional** and **technical** issues have to be addressed."

3D land and Property Project (2010-2014)





Multiple pages of 2D plans/info per building



3D model of property RRR information

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ARC-Linkage Project Partners

ICSM
ANZLIC COMMITTEE ON SURVEYING & MAPPING

Australian Government
Australian Research Council

PSMA AUSTRALIA LIMITED

State Government Victoria
Department of Transport, Planning and Local Infrastructure

NSW GOVERNMENT
Land & Property Information

CITY OF MELBOURNE

strata community australia VIC

AAM

Alexander Symonds Surveying Consultants

FKA

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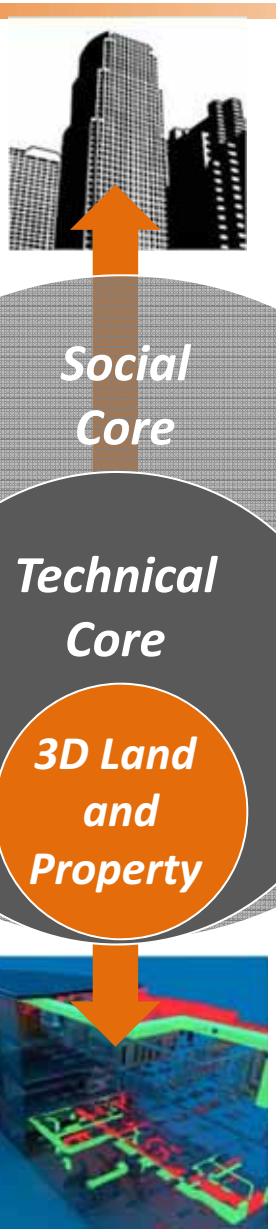
Scope

Future Cadastre needs to take into account the expectations of all these stakeholders.

Project Focus



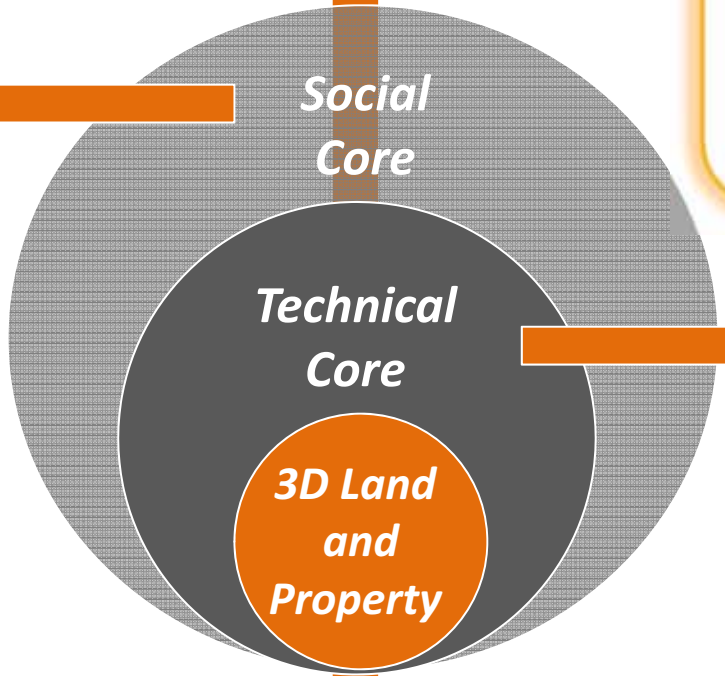
INSTITUTIONAL CHALLENGES

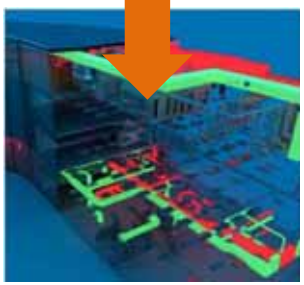
- Regulatory
- Social
- Cultural

TECHNICAL CHALLENGES

- Data source
- Data model
- Data visualisation
- BIM

Project Outcomes





STRATEGY DEVELOPMENT

- Cultural change
- Collaboration
- Adoption
- Implementation

4 prototypes
2 data models
26 publications
10 new expert resources into the market

TECHNICAL TOOLS

- Data model
- Web-based visualisation platform
- Specifications

Project Outcomes

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Project outcomes

3D printing

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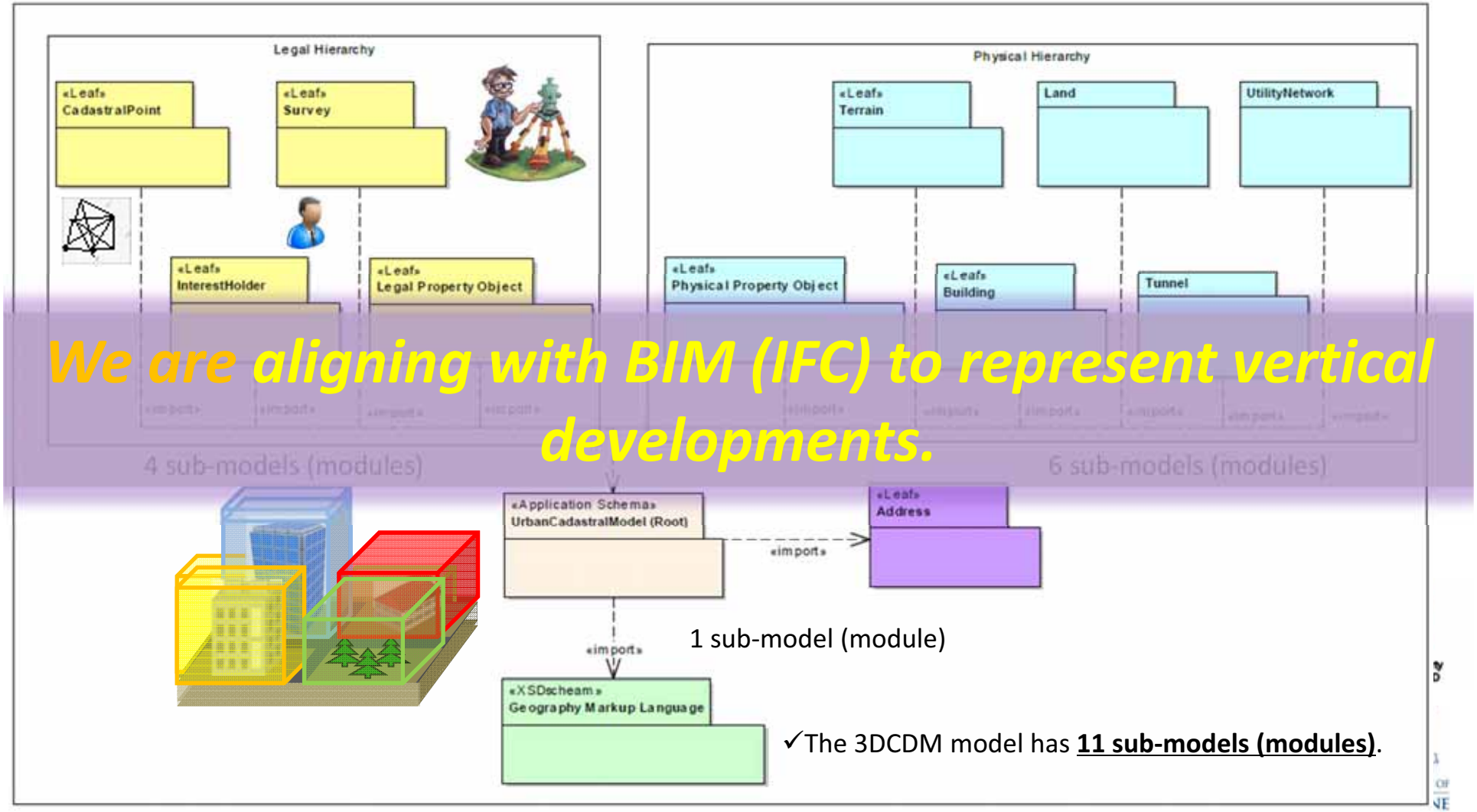
3D Cadastral Data Model

Organising 3D physical and legal information

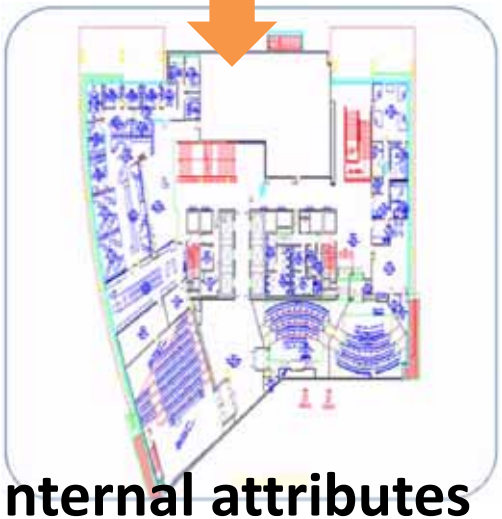


Aien, 2013

3D Data Sourcing

External attributes

- Facade
- Roof
- Texture



Internal attributes

- indoor mapping
- building exits
- utilities

3D building reconstruction

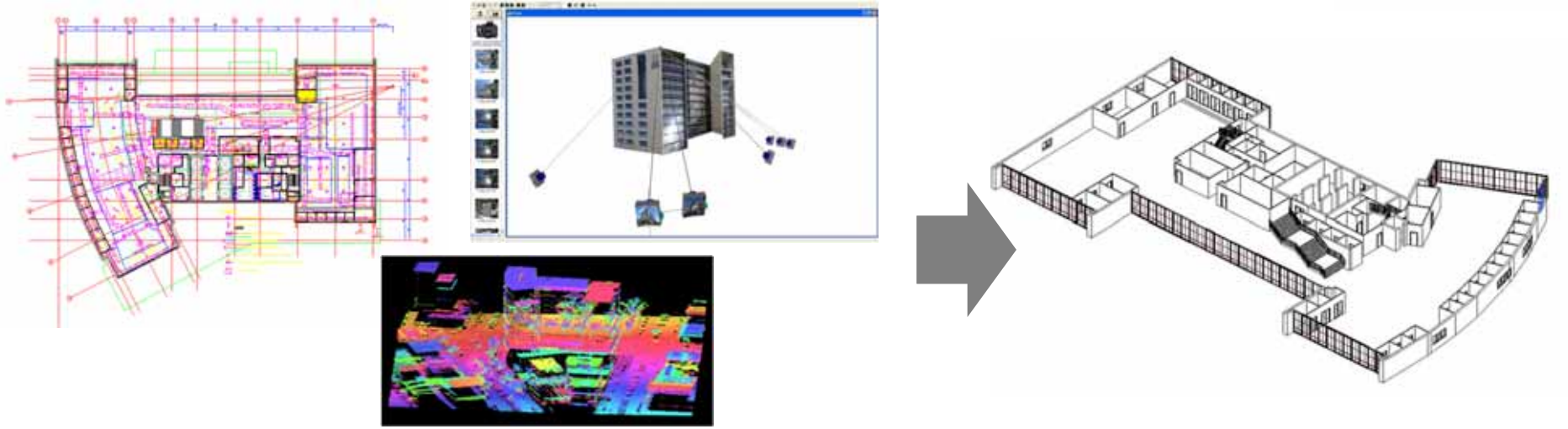
Jazayeri et al, 2014

3D Data Sourcing

Integration of:

- Close-Range Photogrammetry
- Aerial imagery
- LiDAR
- 3D ground plans

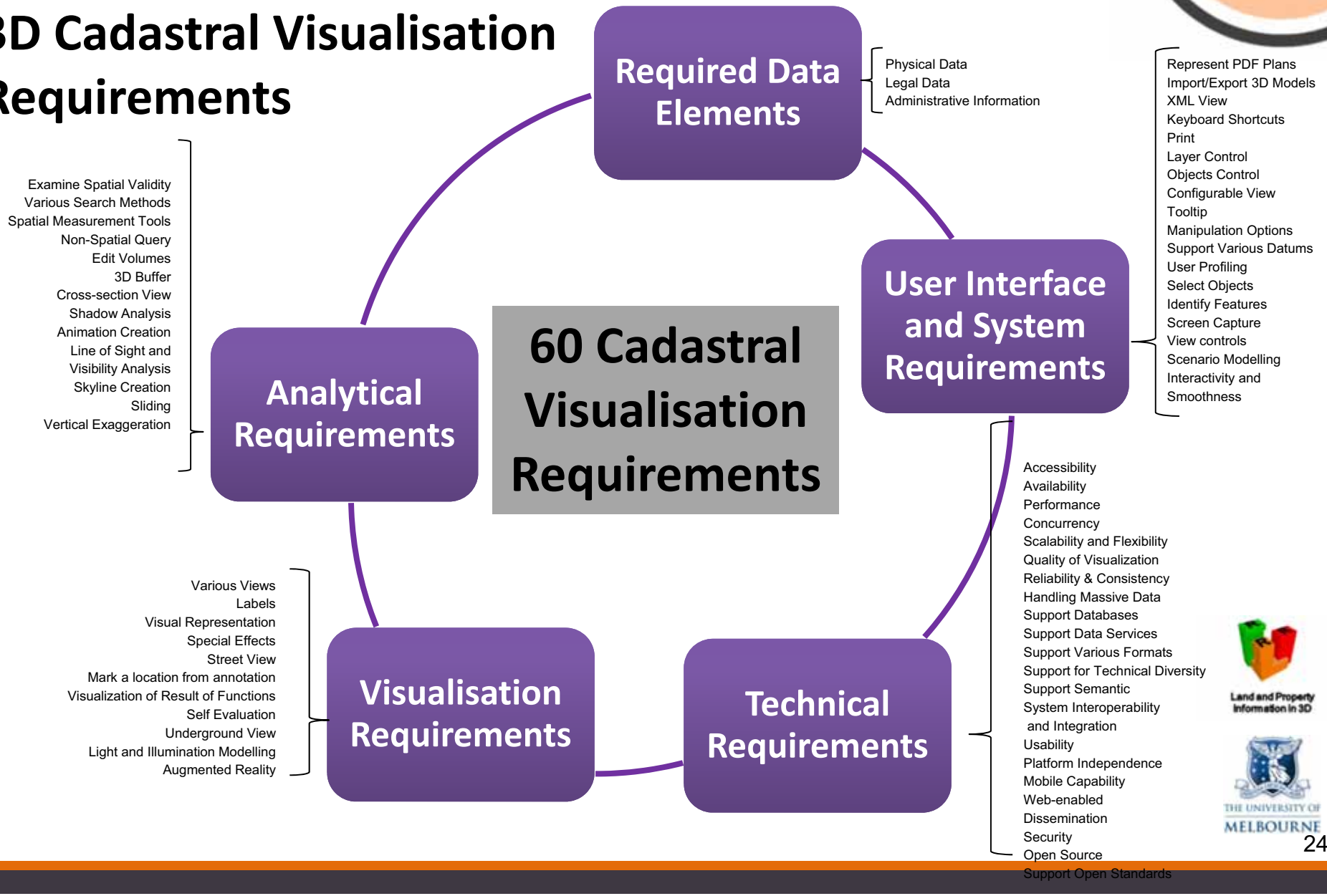
Generating 3D objects from 2D plans



Jazayeri et al, 2014

Visualisation Challenges and Prototype

3D Cadastral Visualisation Requirements



Visualisation Challenges and Prototype

Validation of Requirements

Over 160 responses from 37 countries

(supported by FIG)

Argentina	Brazil	Costa Rica	Denmark	Germany	Indonesia	Korea, Republic of	Mexico	New Zealand	Romania	Slovenia	Switzerland	
Australia	Canada	Croatia	Ethiopia	Greece	Iran, Islamic Republic of	Latvia	Nepal	Poland	Serbia	Spain	Turkey	United States
Austria	China	Czech Republic	France	India	Ireland	Malaysia	Netherlands	Portugal	Singapore	Sweden	Ukraine	

BIM Model

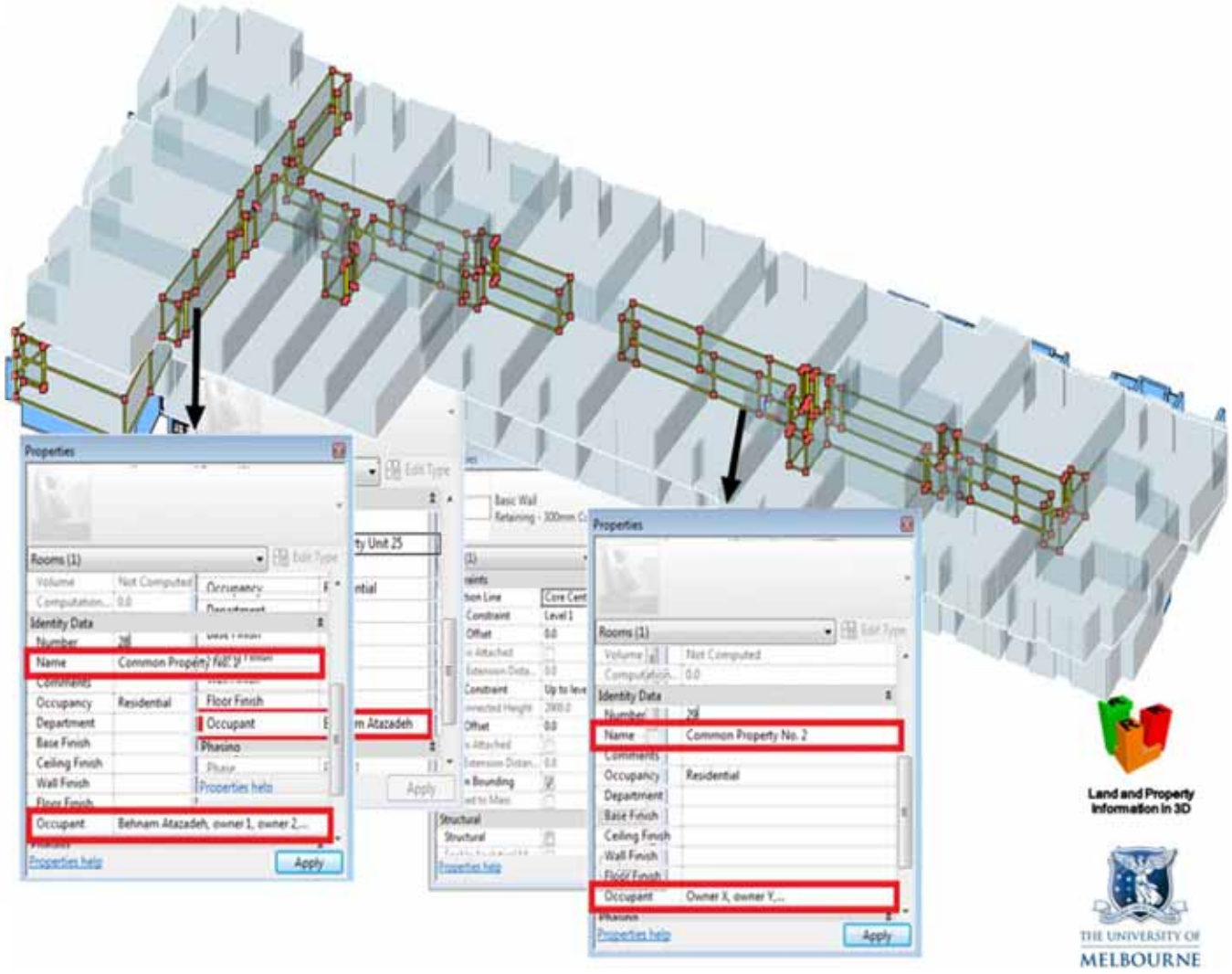
BIM and cadastral information

Physical Information

- interior walls
- exterior walls
- sliding doors
- single-flush doors
- awning windows
- fixed windows
- stairs
- slabs

Legal Information

- ownership information
- common properties
- easements



3D Land and Property Prototype

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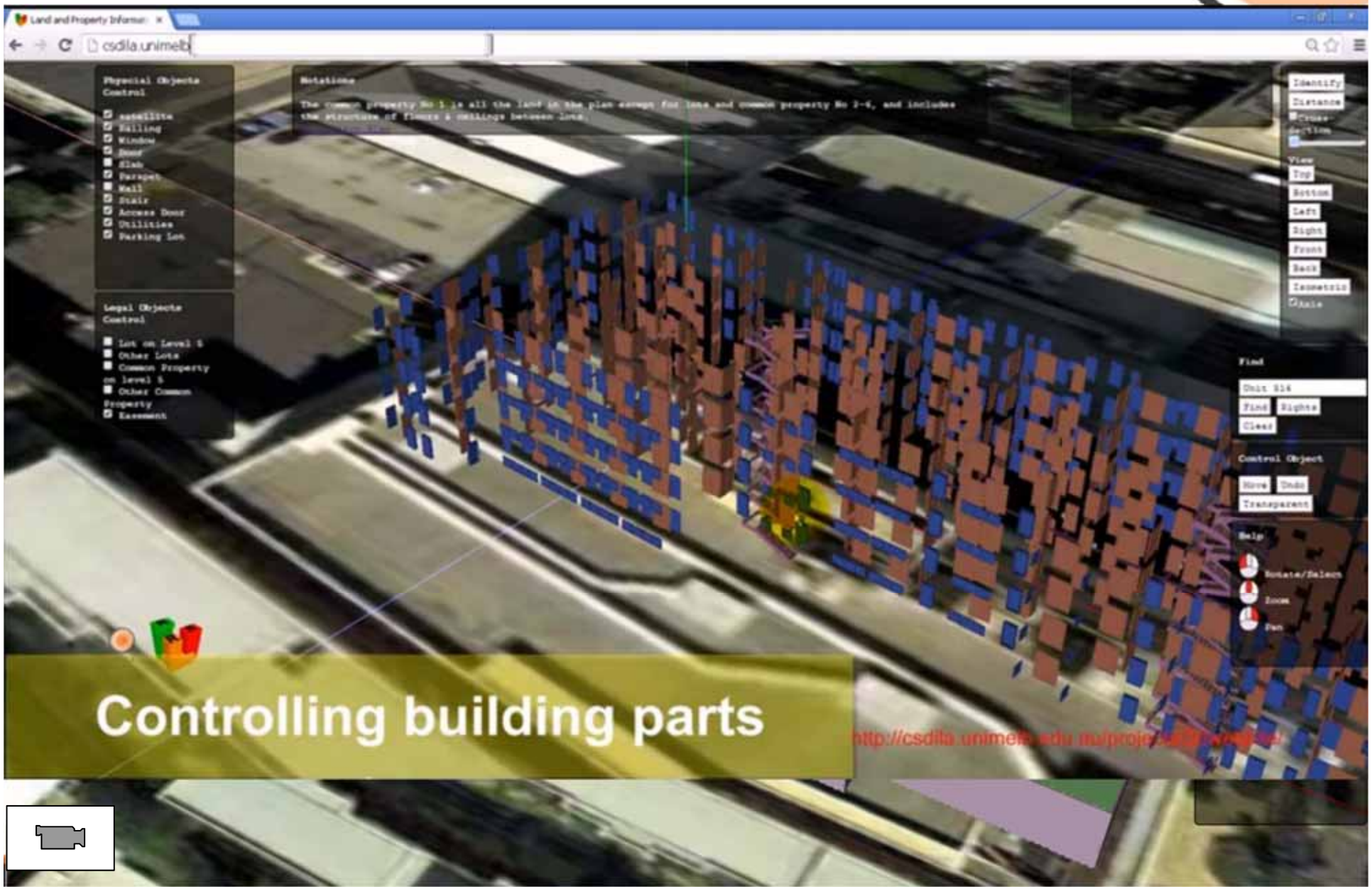

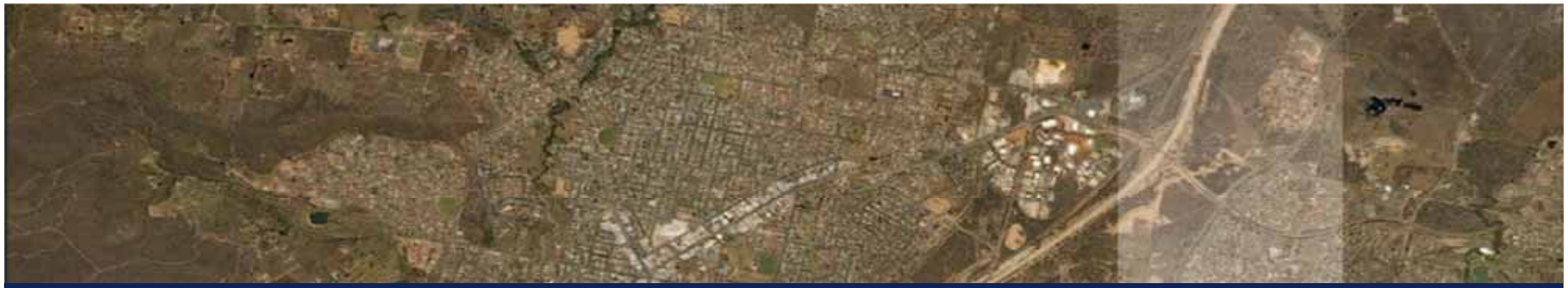

Current Institutional Challenges

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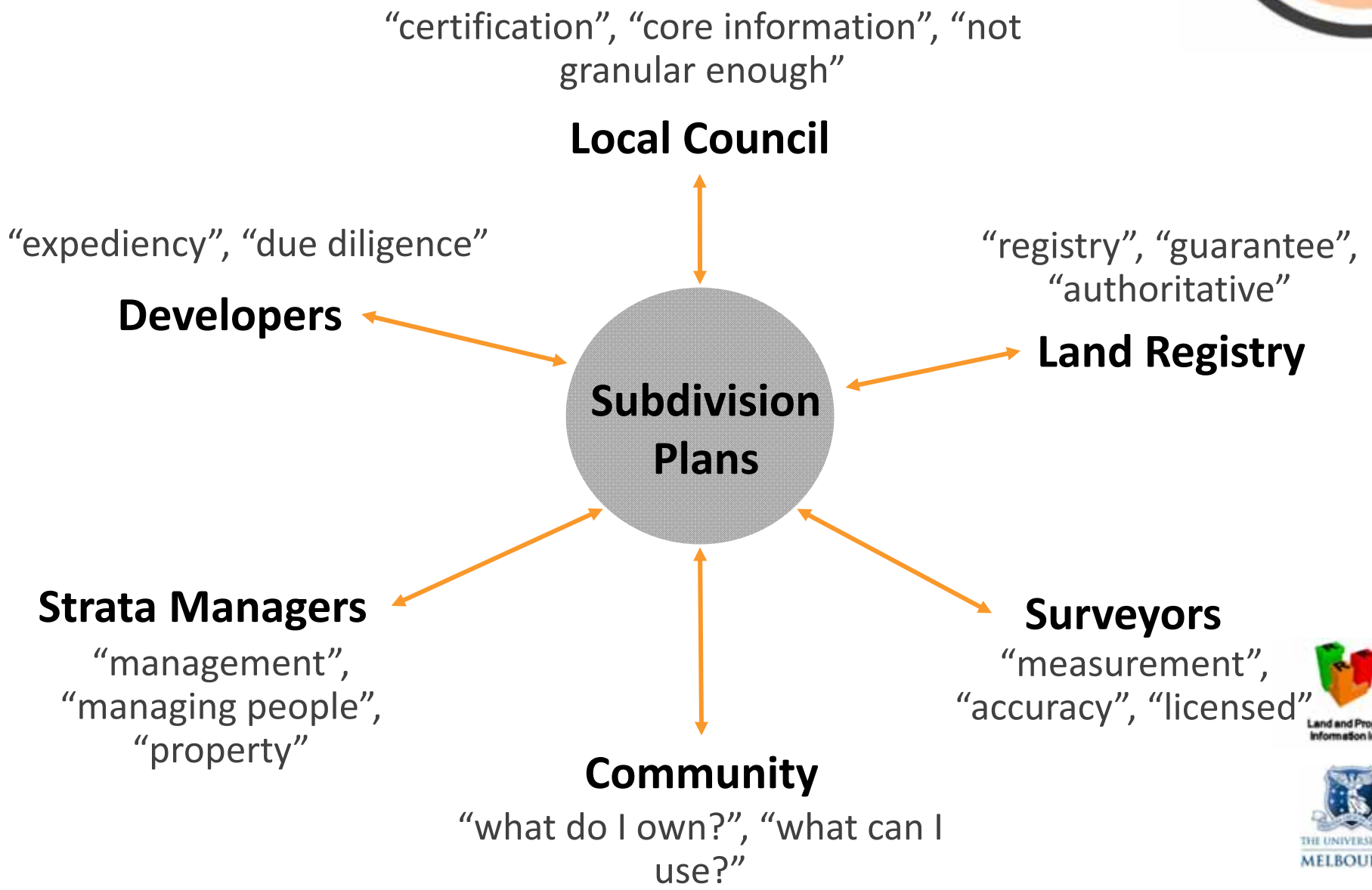
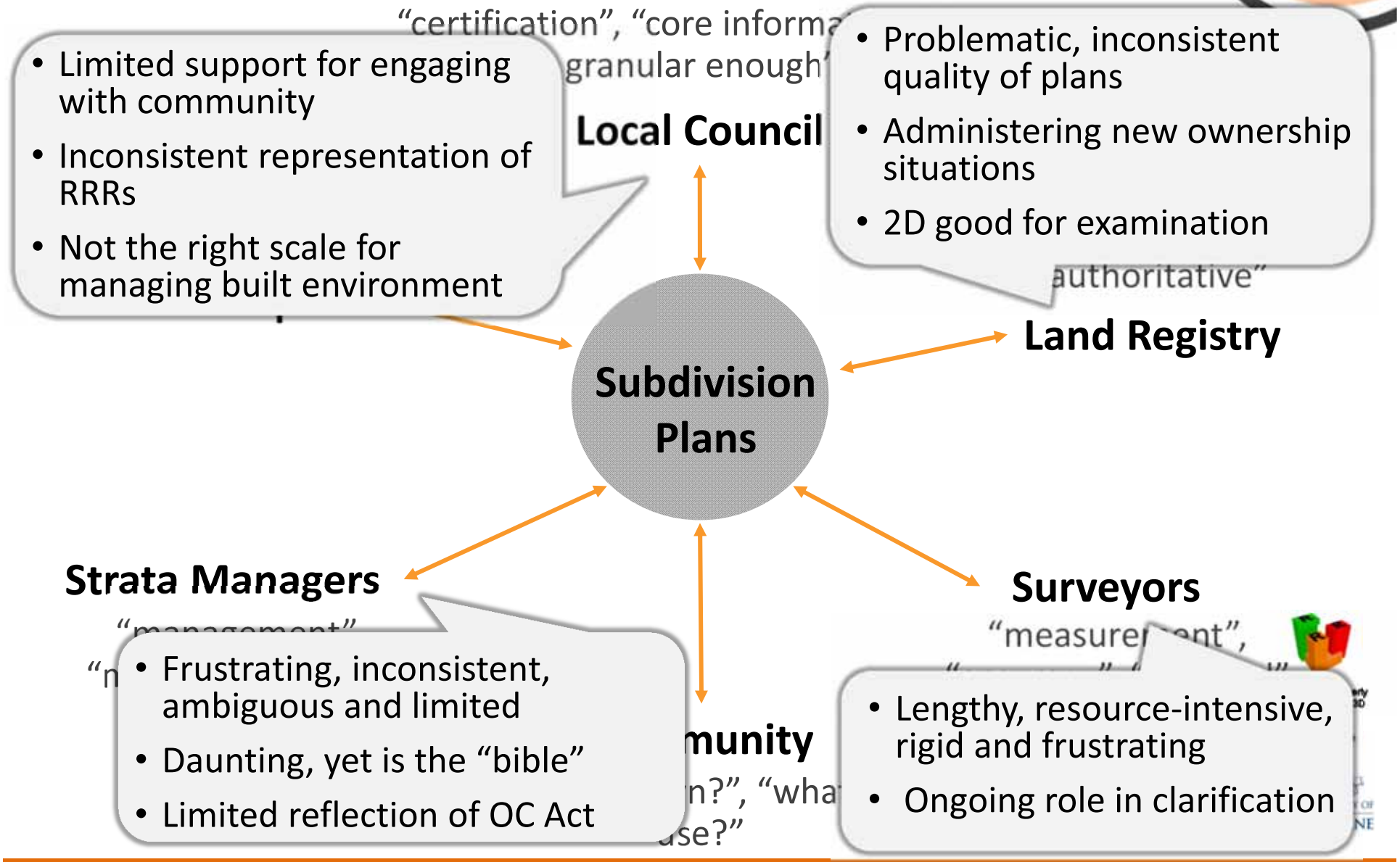
One Plan, many Purposes



One Plan, different Perceptions



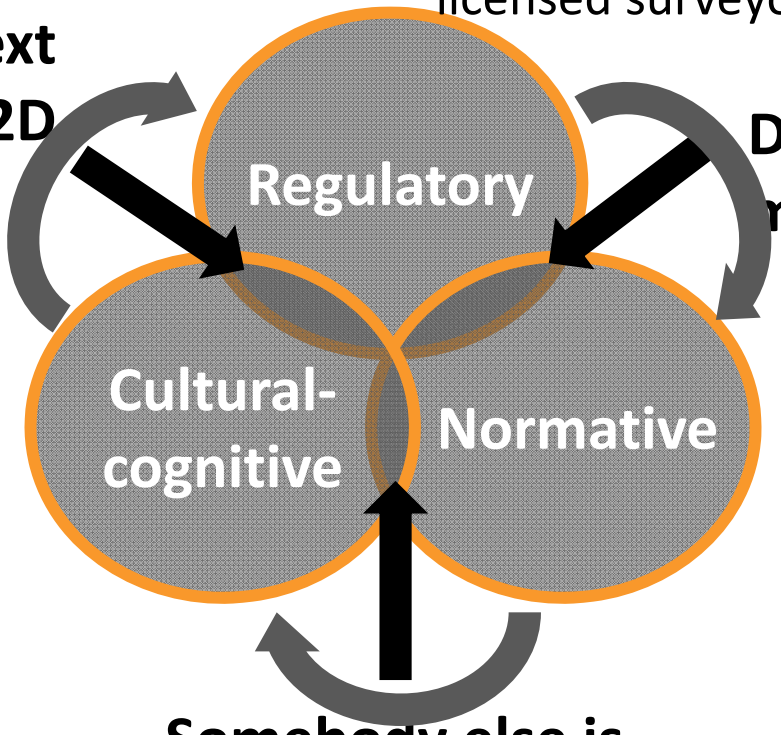
2D to 3D: Key Institutional Challenges

Current 2D environment based on…

Longstanding Subdivision Act and registration process

Rigorous information standards due to licensed surveyors

Historic context and tradition of 2D



Development vs. management

Vertical subdivision less common

Process mostly works but is getting harder for more complex buildings

2D plan is ***the*** source of information

Process works for horizontal (land) subdivisions

Somebody else is the problem

2D to 3D: Key Institutional Challenges

Perception that law MUST first change
Who OWNS the problem?

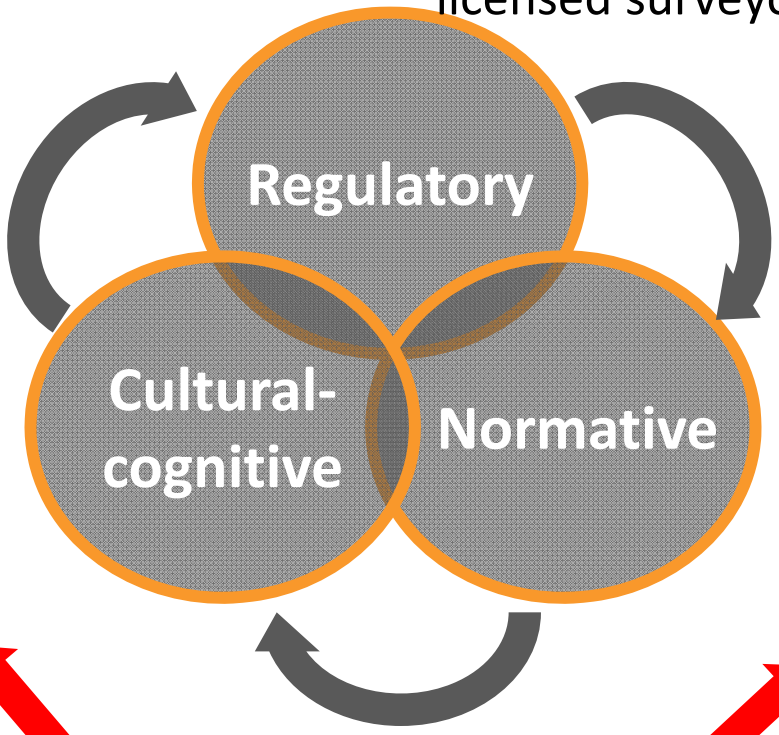
Longstanding Subdivision Act and registration process

Rigorous information standards due to licensed surveyors

Building subdivisions as a unilateral issue

Vertical subdivision less common

Process mostly works but is getting harder for more complex buildings



Development process highly routinised

2D plan is ***the*** source of information

Process works for horizontal (land) subdivisions

Perceived difficulty of building an argument for change; Lack of awareness

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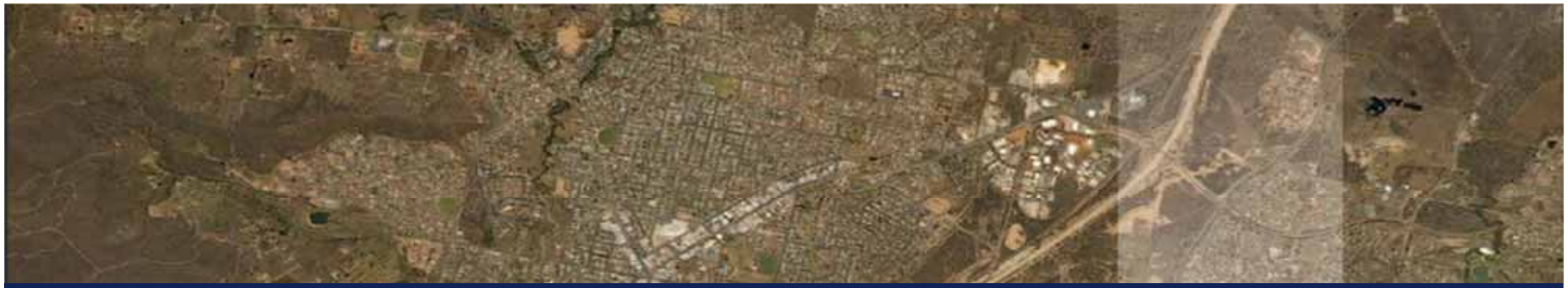

Roadmap and Potential Strategies

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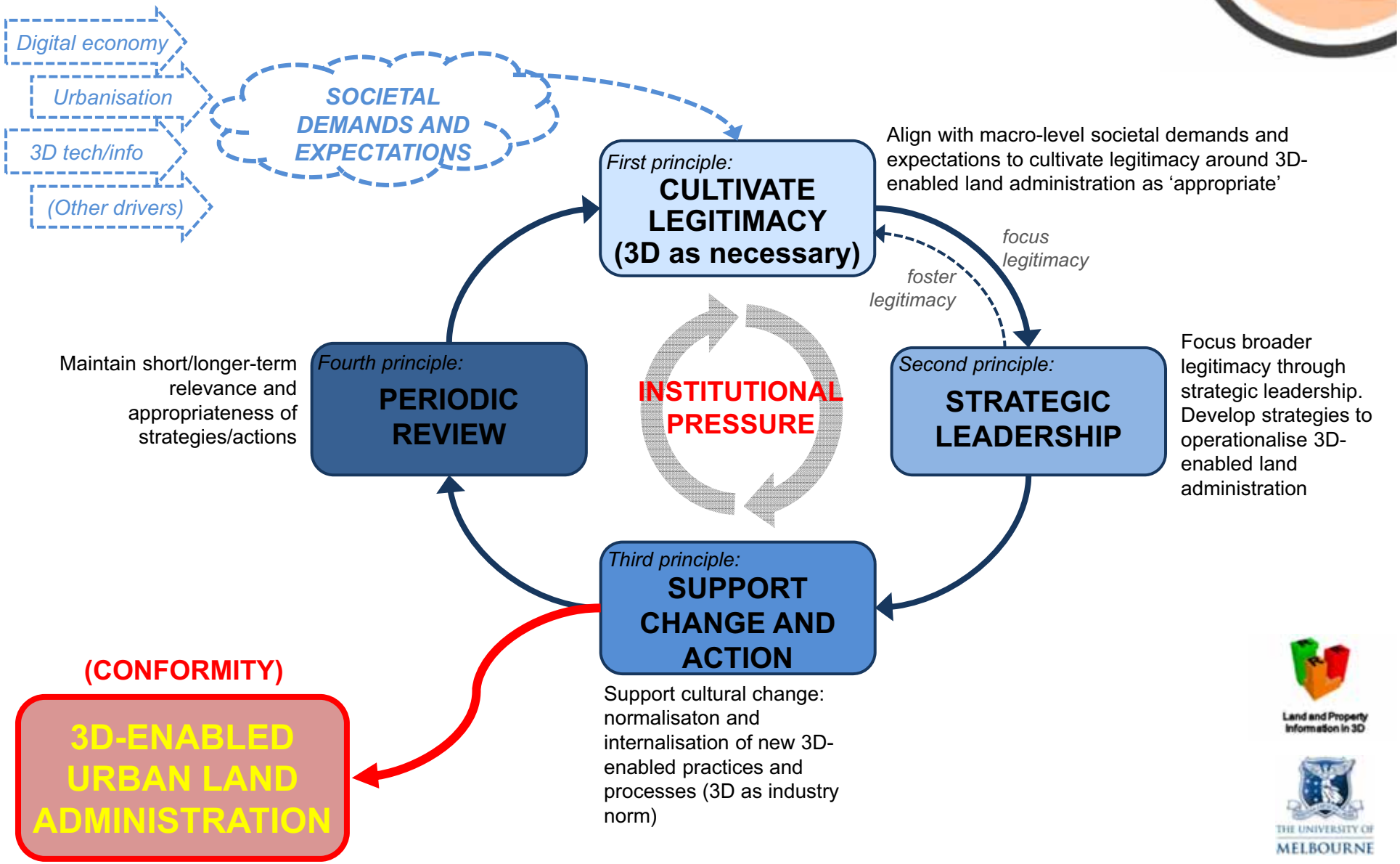
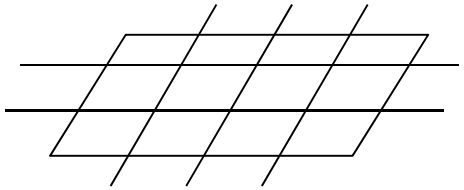
Framework for Change: 2D to 3D

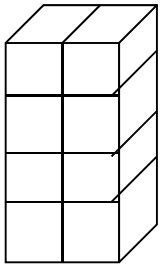


Potential Strategies

Concepts developed for 'land' not necessarily appropriate for buildings



subdivision paradigm



LAND

- More static entity – not much changes after registration
- Typically only development, not necessarily management
- Discrete, separate institutional arrangements
- Concept of ownership

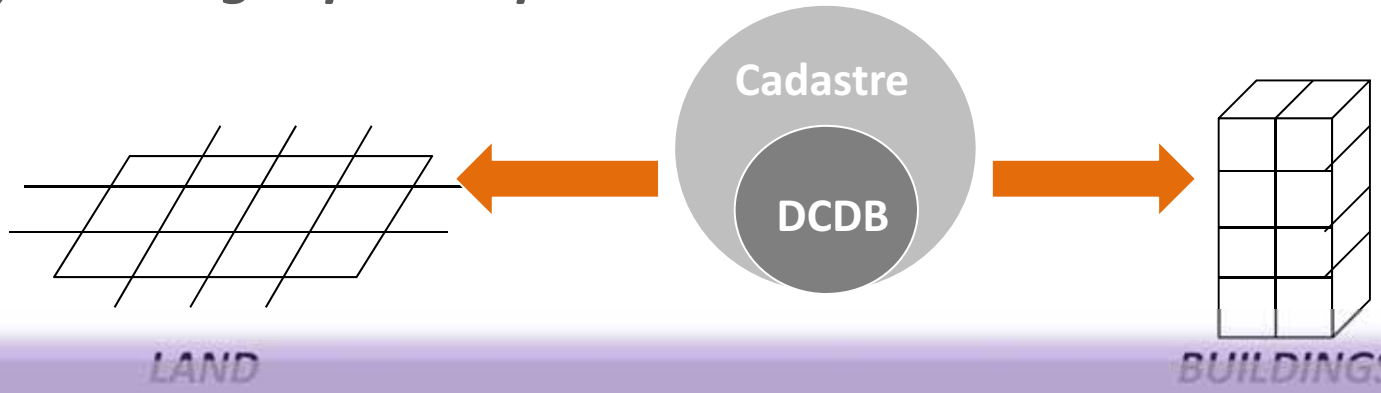
BUILDINGS

- Continually changing e.g. continuous resubdivision/ amalgamation, swapping lots, etc.
- Requires a collaborative approach to both development and management
- Requires integrated institutional arrangements
- Larger number of stakeholders per development process

Separate processes for land and buildings.

Potential Strategies

By creating separate processes:



- ***Structural changes in industry (education, training, roles and responsibilities)***
- ***Legislative and process review***
- ***Develop new terminology***

- Leverage other visualisation/web technologies

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Potential Strategies

Supporting institutional changes

- Development and management of buildings are supported by different legislation, organisations, processes, etc
- Move towards a building lifecycle approach: productivity and sustainability arguments for change

Institutional structure and organisational culture needs to change to support greater collaboration

e.g. governments legislating the use of BIM to force cultural shift

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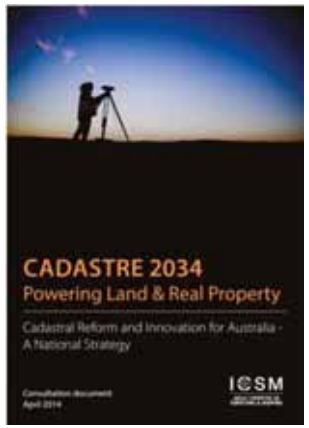
Fundamental Role of Cadastres

- **Future cadastres** need to deal with increasing urban complexity and identify the **RRRs** existing within the community.
- Future users vs current users. Needs and opportunities in the context of **future cities** and **future institutional sustainability.**
- **Integrated land and property information.** 3D info to support **urban management** (e.g. leveraging BIM). Making **sense of smart data** in cities eg. smart utilities, 4D data.
- **New connections** between land admin/land registries, the wider society, across disciplines, and with a supporting focus of cadastre's role in delivering other national visions, digital economy, foundation dataset, smart cities.

Future Cadastres: New Connections



Government

Industry

International

Aus

States

Location/ Spatial Strategies

Cadastre 2034

Smart

Community

Cities

apps

Private sector DB

3D Data

VA

ANZLIC

ONE ANZ FOUNDATION SPATIAL DATA FRAMEWORK

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Collaborate. Leverage. Community-focused.

Integrated Knowledge Systems

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3D cadastres and smart future cities

Thank you

abbas.r@unimelb.edu.au

www.csdila.unimelb.edu.au/projects/3dwebsite

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