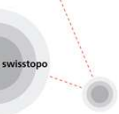
 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Topography swisstopo
Federal Directorate of Cadastral Surveying

wissen wohin
savoir où
sapere dove
knowing where





Cadastral Dimensions – Crossing Boundaries

Dr. Daniel Steudler

The World Cadastre Summit

20-24 April 2015, Istanbul, Turkey




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- **Evolution in Switzerland and experiences**
- **Crossing the boundaries: latest developments and future trends**




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Trends – Social

- huge urbanization process
- environmental sustainability
- disaster management
- land management issues






World urban/rural population 1950-2050
(esa.un.org)

Year	Population (billion)	Urban (%)	Rural (%)
1950	2.5	29%	71%
1970	3.7	36%	64%
1990	5.3	43%	57%
2010	6.9	51%	49%
2030	8.3	60%	40%
2050	9.2	70%	30%


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Trends – Technical

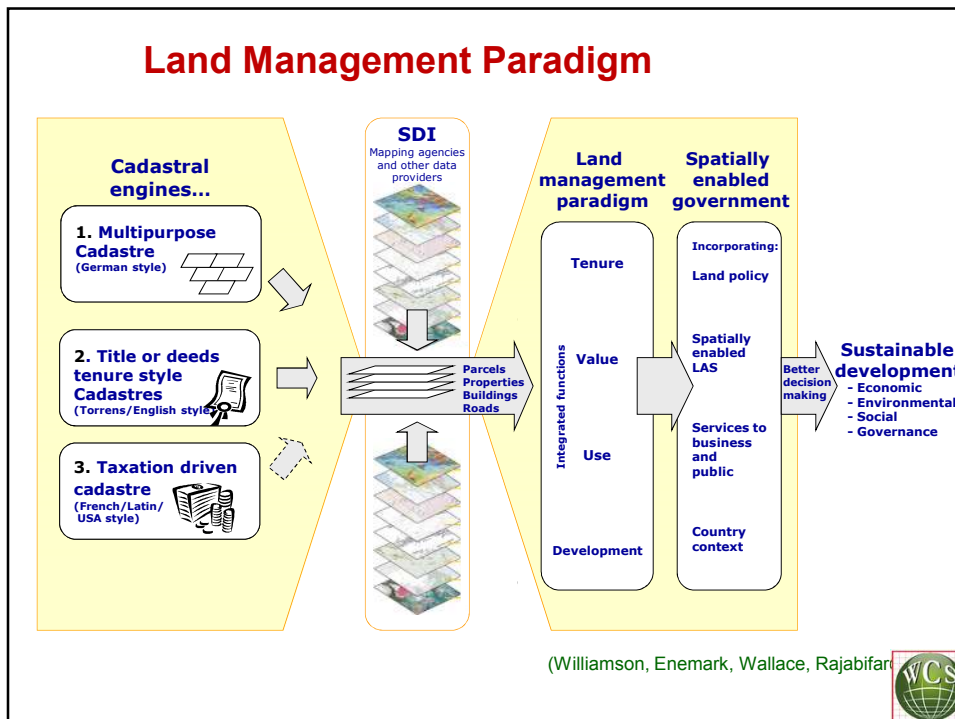
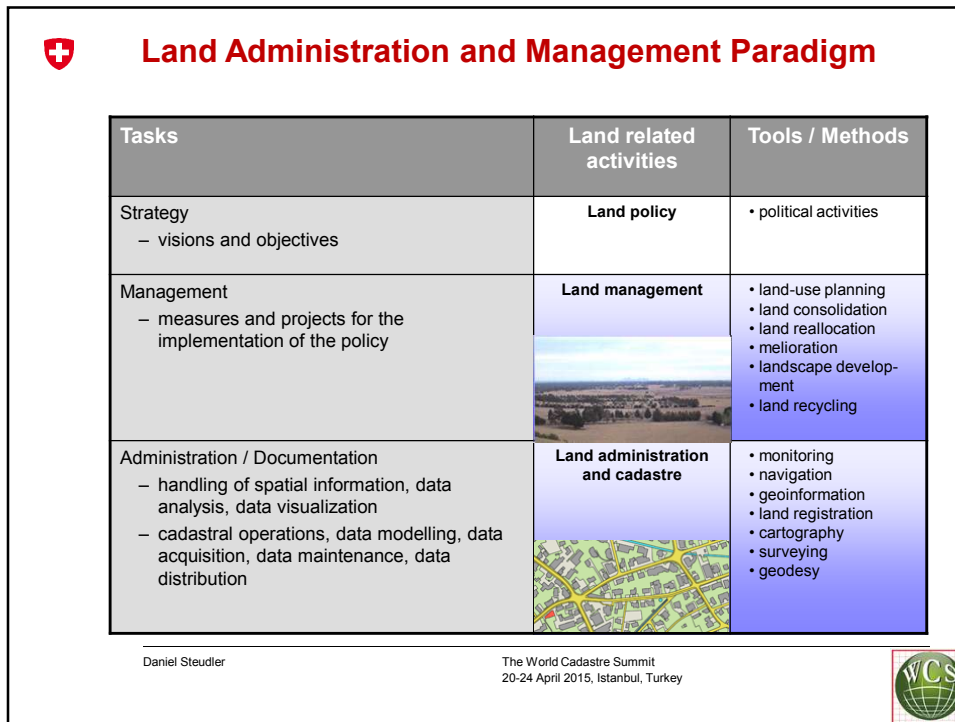
- digital data → information age
- cadastral data (land ownership) as part and basis for GDI
- synergies with topographic data
- cadastral systems are documentation systems
→ increasing content



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CH: Reform of cadastral surveying (1980's)

Principles of Reform Project RAV:

- Minimum of regulations on the Federal level
- avoidance of double data acquisition
- increase of data actuality
- freedom of data acquisition method
- **data as basis for LIS as well (not only registry)**

1992

Legal basis for AV93:

- Ordnance for Official Surveying (**VAV, 1.1.1993**)
- Technical Ordnance for Official Surveying (**TVAV, 1.7.1994**)

RAV = Reform der amtlichen Vermessung
VAV = Verordnung über die amtliche Vermessung
TVAV = Technische Verordnung über die amtliche Vermessung

Two very relevant achievements:

- extension of purpose (not only for land registry, also for land information in general)
- need of flexible data exchange mechanism

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Data Modelling

Standardized data modelling and cadastral data definition (introduced in Switzerland in 1993)

8 Information Layers
(Possibility to realise the layers separately)

Data Model (UML)
(Entity-Relationship-Diagram)

```

TRANSFER Data_Catalogue;
MODEL Basic_Data_Set
DOMAIN
  LKoord = COORD2 480000.000 70000.000
  MKoord = COORD3 480000.000 70000.000 0.000
  Height = DIM1 0.000 5000.000 5000.000;
  Precision = {0 .. 300};
  Reliability = {yes, no};
  LetterOrientation = GBAS 0.0 400.0;
  Status = {planned, valid};

TOPIC Control_Points =
  .....
END Control_Points;
TOPIC Land_Cover =
  .....
END Land_Cover;
Ownership =
  MONUMENTATION = {border_stone, plastic_peg, cross,
    not_monumented};
  OWNERSHIPType = {space, distinct_right,
    construction_right, water_source_right};

TABLE LimitPoint =
  OSKey: OPTIONAL -> OwnershipMaintenance;
  Identifiers: OPTIONAL TEXT*1;
  Geometry: LKoord;
  PositionPrecision: Precision;
  PositionReliability: Reliability;
  Origin: OPTIONAL TEXT*10;
  SymbolOrientation: OPTIONAL LetterOrientation;
  !! Default: 0.0
  IDENT
  Geometry;
END LimitPoint;
END Ownership;
END Basic_Data_Set.
                
```

Data Description Language INTERLIS
(system independent)

→ with this standardized way of data modelling, the use and exchange of digital cadastral data is independent from the GIS or software system.

Publication «Spatially Enabled Society»

Steudler, D. and A. Rajabifard, editors,
72 pages, FIG Publication no. 58

→ <http://www.fig.net/pub/figpub/pub58/figpub58.pdf>

A spatially enabled society – including its government – is one that makes use and benefits from a wide array of spatial data, information, and services as a mean to organize its land related activities. Spatial enablement is a concept that adds location to existing information and thereby unlocks the wealth of existing knowledge about the land, its legal and economical situation, its resources, potential use and hazards. Information on landownership is thereby a basic and crucial component to allow for correct decision-making. Such data and information must be available in a free, efficient, and comprehensive way in order to support the sustainable development of society. It therefore needs to be organized in such a way that it can easily be shared, integrated, and analysed to provide the basis for value-added services.



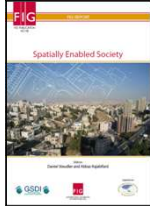
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Six Key Elements for a SES


- **Legal framework** for basic geoinformation;
- **Common data integration concept**
 - legal and institutional independence of information (to allow for independent responsibilities);
 - common geodetic reference framework;
 - standardized data modelling concept;
- **Positioning infrastructure** for the common reference framework;
- **Network infrastructure** to enable integration and sharing of spatial data through the spatial data infrastructure SDI;
- **Landownership information** as one of the basic information topics;
- **Data and information principles**
 - official, authentic, complete, comprehensive, updated;
 - accessibility of data i.e. public sector information initiatives;
 - volunteered geographic information (VGI), web 2.0 possibilities.



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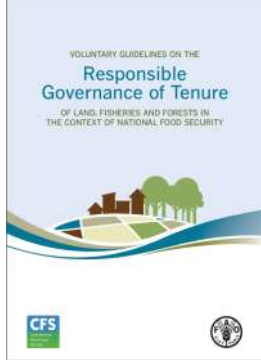


Land Ownership Information

FSC and FAO

Voluntary Guidelines on the Responsible Governance of Tenure (2012):


- Legal recognition and allocation of tenure rights and duties
- Transfers and other changes to tenure rights and duties
- Administration of tenure
- Responses to climate change and emergencies
- Promotion, implementation, monitoring and evaluation




Examples on a European level are INSPIRE (where cadastral parcel is a core data set); the six Dutch official and authentic registries (one of them "parcel and land registration"); or the Danish basic data program (person, business, real property, address, geographic, and incomes data).


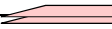
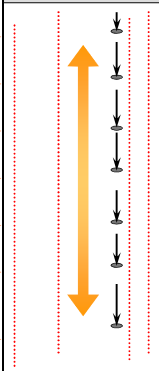












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Common Data Integration Concept

Legal topic	Institution, stakeholder	textual information	spatial data, geoinformation	
Water/noise protection	Local government			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Spatial Data Infrastructure (SDI) </div> 
Environ. protection	Environ. dept.			
Land-use planning	Planning dept.			
Collective land rights	Corporations, tribes, clan			
Land valuation	Government			
Public-law restrictions	Government			
Land registry, cadastre	National government State government Local government			

Four basic principles for a common data integration concept:

- 1) to respect the legal / institutional independence of stakeholders
- 2) to use a standardized data modelling concept
- 3) to use a common geodetic reference framework
- 4) no logic relations to objects in different topic except through geographic location



Independent information layers

Advantages:

- stakeholders can look after their own data sets, they only have to respect the defined basic principles
- the fear of stakeholders – losing control over their data – can be overcome
- responsibility, work flow and data flow can clearly be defined and managed by each stakeholder independent from the others

Legal topic	Institution, stakeholder	textual information	spatial data, geoinformation
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17 Public-Law Restriction in Swiss Cadastre

PL-Restriction	Institution, stakeholder	textual information	spatial data, geoinformation	Spatial Data Infrastructure
Cantonal and municipal use planning	Land-use planning Dept.			
Project zones	National Highway			
Construction lines	Railways			
Project zones	Airport authority			
Construction lines				
Aerial obstacles				
Hazardous waste	Environment			
Ground water protection zones	Water Man.			
Ground water protection perimeters				
Noise levels	Environment			
Forest delimitation (in constr. zones)	Forest Dept.			
Forest distance lines				
Land registry, cadastre	National government State government Local government			

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Considerations

- seemingly these are technicalities
 - but with strong conceptual implications
 - we as professionals need to be able to handle those technicalities in order to be able to provide the appropriate services and expertise
- all partnering stakeholders would have to respect those basic principles and maintain and update their data sets accordingly
- setting-up of an SDI is less of a technical problem, it is much more about inter-governmental communication (to overcome stakeholder's silo-type of thinking and the fear of losing control over its own data and information)

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Background

- Think Tank active since 2012;
- aim is to identify the current trends in the geoinformation field and to develop a strategy for the cadastre;
- Swiss cadastral system is well advanced: digital, well conceptualized, close to full coverage, legally comprehensive;
- issues in Switzerland are mainly organizational (federalist environment) and structural;
- a first result of the Think Tank is a Discussion Paper published in May 2014
 - identify trends and developments
 - open eyes and minds of professionals



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Changing World

- from drawing board and pencil to computer technology
- from terrestrial measurements to photogrammetry and GNSS
- from analogue to digital
- from paper maps to databases to knowledge bases

- technology push vs. citizen pull
- trend from written word to imagery
- social media



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Objects of the Cadastre

- traditionally, the cadastre provides legal security of landownership and represents objects such as parcels, buildings, and structures;
- new categories come into being, e.g. polluted sites, land-use zoning, zones exposed to noise, etc.
- the Internet brings along social change, increasing involvement of the public (open data, apps, open source software, social networks);
- rise of radical new approaches, namely a society driven more by legitimate than legal impetus.

**The legitimate
often prevails
over the legal**

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Internet of Things and Linked Data

The diagram illustrates the Internet of Things (IoT) and Linked Data ecosystem. A central cloud labeled 'Cloud & Services' is connected to various smart city and industrial applications. On the left, 'INTELLIGENT CITY' includes Responsive Sire, Municipal Command & Control Center, Smart Grid, Hospital Optimization, Connected Ambulances, and Intelligent Medical Devices. In the center, 'INTELLIGENT HOSPITAL' includes Hospital Optimization, Smart Grid, and Intelligent Digital Signage. On the right, 'INTELLIGENT' includes Factory Optimization, Home Energy Mgmt., Traffic Flow Optimizations, and Logistics Optimization. A large circular network of nodes represents linked data. A legend on the right side of the circular network lists various categories: Smart City, Smart Grid, Smart Home, Smart Hospital, Smart Industry, Smart Agriculture, Smart Transportation, Smart Energy, Smart Environment, Smart Security, Smart Health, Smart Education, Smart Retail, Smart Government, Smart Infrastructure, Smart Mobility, Smart Logistics, Smart Manufacturing, Smart Agriculture, Smart Energy, Smart Environment, Smart Security, Smart Health, Smart Education, Smart Retail, Smart Government, Smart Infrastructure, Smart Mobility, Smart Logistics, Smart Manufacturing.

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Big Data and Data Mining

The collage features three images: a modern house with a swimming pool, a rural landscape with sheep, and a tunnel of binary code. Green dots are overlaid on the house and landscape images.


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Data mining is going to speed up the mass exploitation of "big data"

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Ubiquitous Mobility



© <http://cosstech.com>

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Making the invisible visible...



From:
Cadastre 2034 – A 10-20 Year Strategy
for developing the cadastral system



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Crowd-sourcing, Augmented Citizen



© <http://www.geoawesomeness.com>

**Citizens as the nation's
number one
geomaticians!**

© <http://www.openstreetmap.org>

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The new "Common Property"

- public sector information was so far the standard for knowledge on land and its legal status;
- private initiatives are producing new data collections, such as e.g. footpaths, OpenStreetMap, GoogleStreetView, eBird.org, virtual visits to tourist destinations, etc. → all eventually becoming a knowledge base used by society at large;
- the combination of both – public and private – information sets will yield additional value to the knowledge base of the land and territory.

→ the new "Common Property" of shared knowledge, i.e. public and open know-how

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Conclusions

- there are trends and developments, which cannot be ignored;
- increasingly dynamic world;
- drivers are the technology-push, as well as the pull by citizen involvement (crowd-sourcing, augmented citizen);
- the public sector – responsible for a public good, called the cadastre – needs to consider, how to deal with citizen-driven input (which, in some cases, is more efficient);
- the public sector needs to re-focus its role.



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**İlginiz için
teşekkür ederiz!**

