



K. N. Toosi University of Technology, Tehran

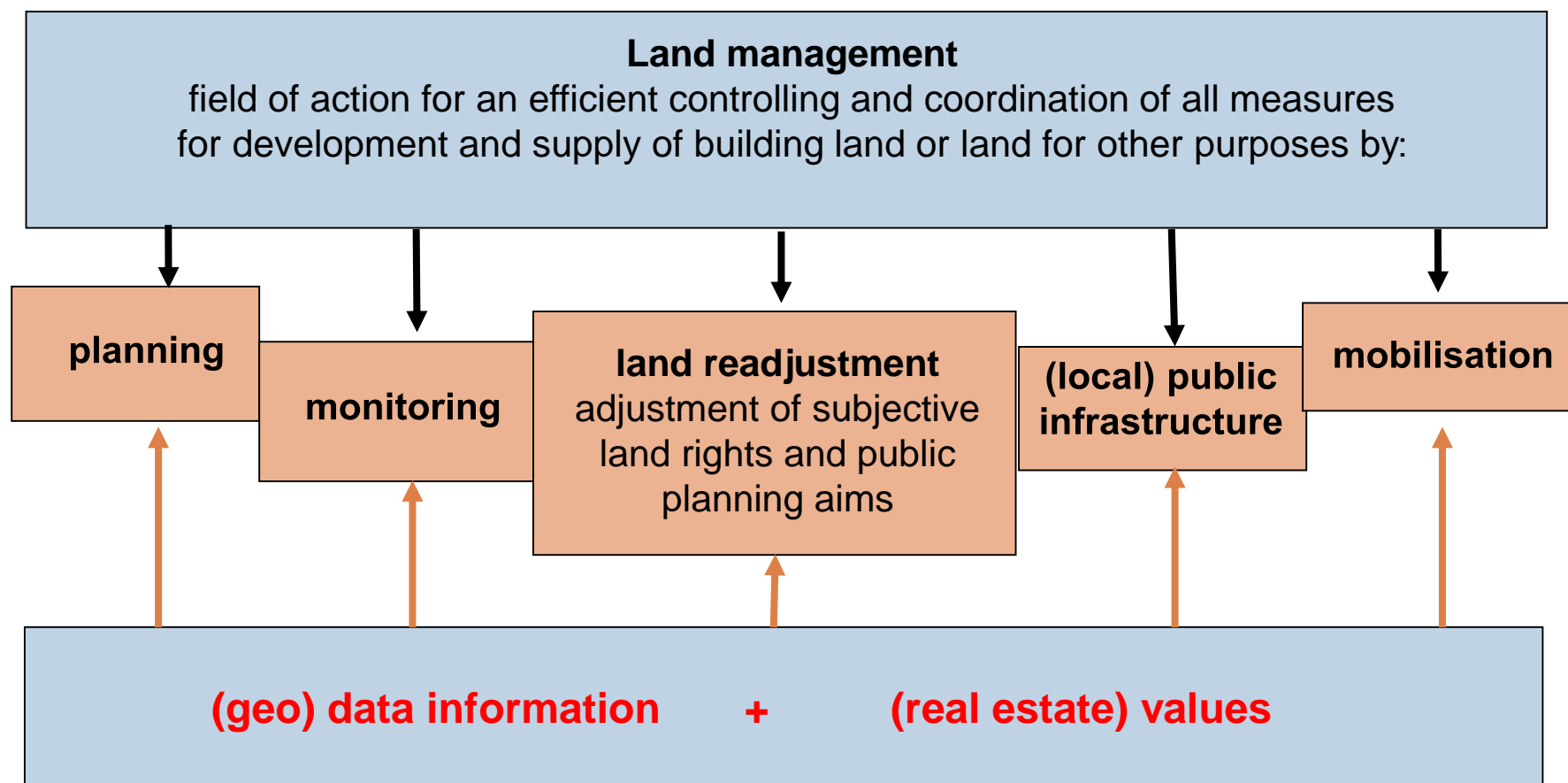
Workshop Toosi – LUH on  
Environmental Data Science

04.– 05. May 2019, Tehran, Iran

## **Challenges of Data Analysis in Land Management**

Prof. Dr.-Ing. Winrich Voß  
Land and Real Estate Management  
Geodetic Institute Leibniz University Hannover

- Subject of land management
  - Sustainable development of the environment
    - Focus on → built-up - non built-up; → urban – rural
    - Focus on → single plots; → locations/neighborhoods/districts; → regions
- Aims of land management
  - Documenting the existing situation (e.g. cadastre, land-use)
  - Monitoring of changes / developments (e.g. property prices)
  - Managing/ implementing a new structure (e.g. coordinating, balancing, evaluating)

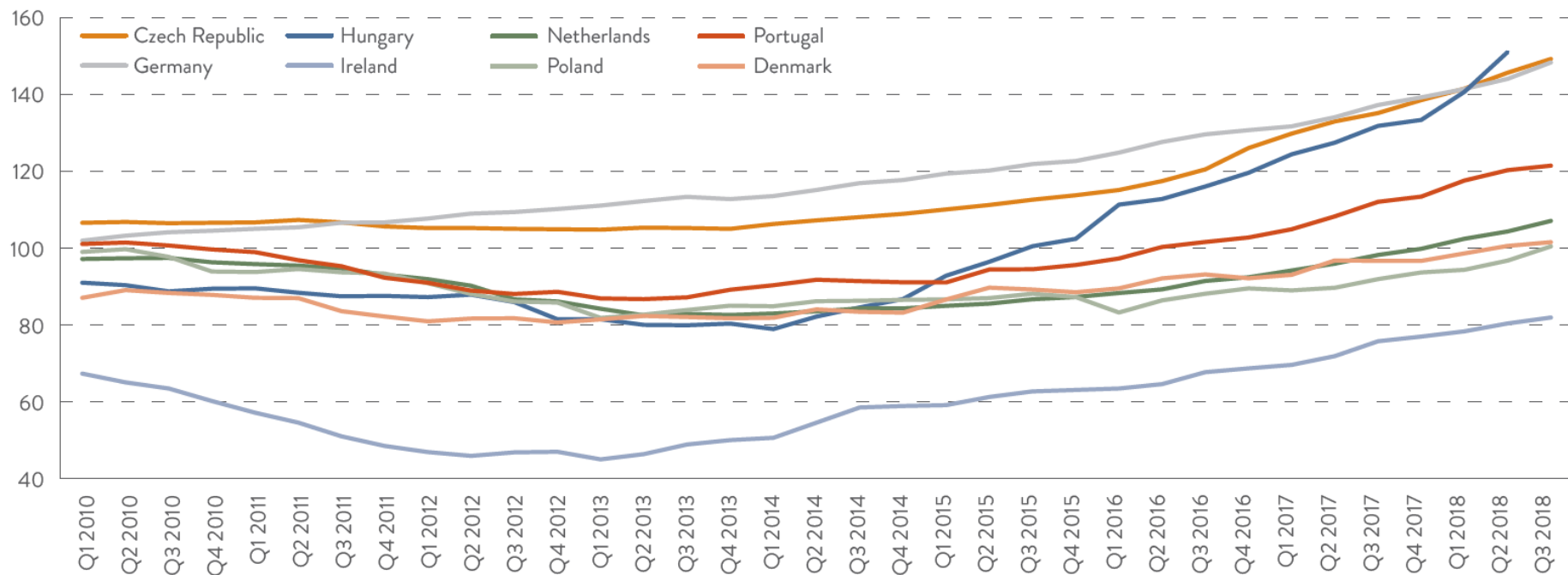


- Methods and data in Land and Real Estate Management
  - Quantitative methods
    - Hedonic methods incl. regression analysis (e. g. valuation)
    - Bayes statistics, Fuzzy methods
  - Qualitative methods
    - Expert knowledge
    - Stakeholder interviews, different types
  - Decision Support methods
    - Multi-criteria decision making (e. g. Value-benefit-analysis)
    - Mixture of tangible and in-tangible aspects
    - GIS-based szenario technics
    - (International) comparison
- Different types of data are necessary

- Current hot topics in Land Management in Germany
  - Hype at German Real estate market since 10 years  
How can public authorities promote affordable housing ?  
Governmental commission works on new strategies and legal tools
  - Equivalent living conditions in urban and rural regions  
Government commission works on new standards and financial tools
  - National sustainable development goals
    - Climate change and renewable energies (e. g. mobility, buildings)
    - Land use monitoring / land consumption
    - In-fill development (incl. brownfields) before greenfield development
  - New property tax in Germany  
New law has to be passed in 2019

## EU: Nominal House Prices (2007 = 100)

**CHART 2C** | COUNTRIES WHERE HOUSE PRICES\* HAVE RISEN BY AT LEAST 5% Y-O-Y

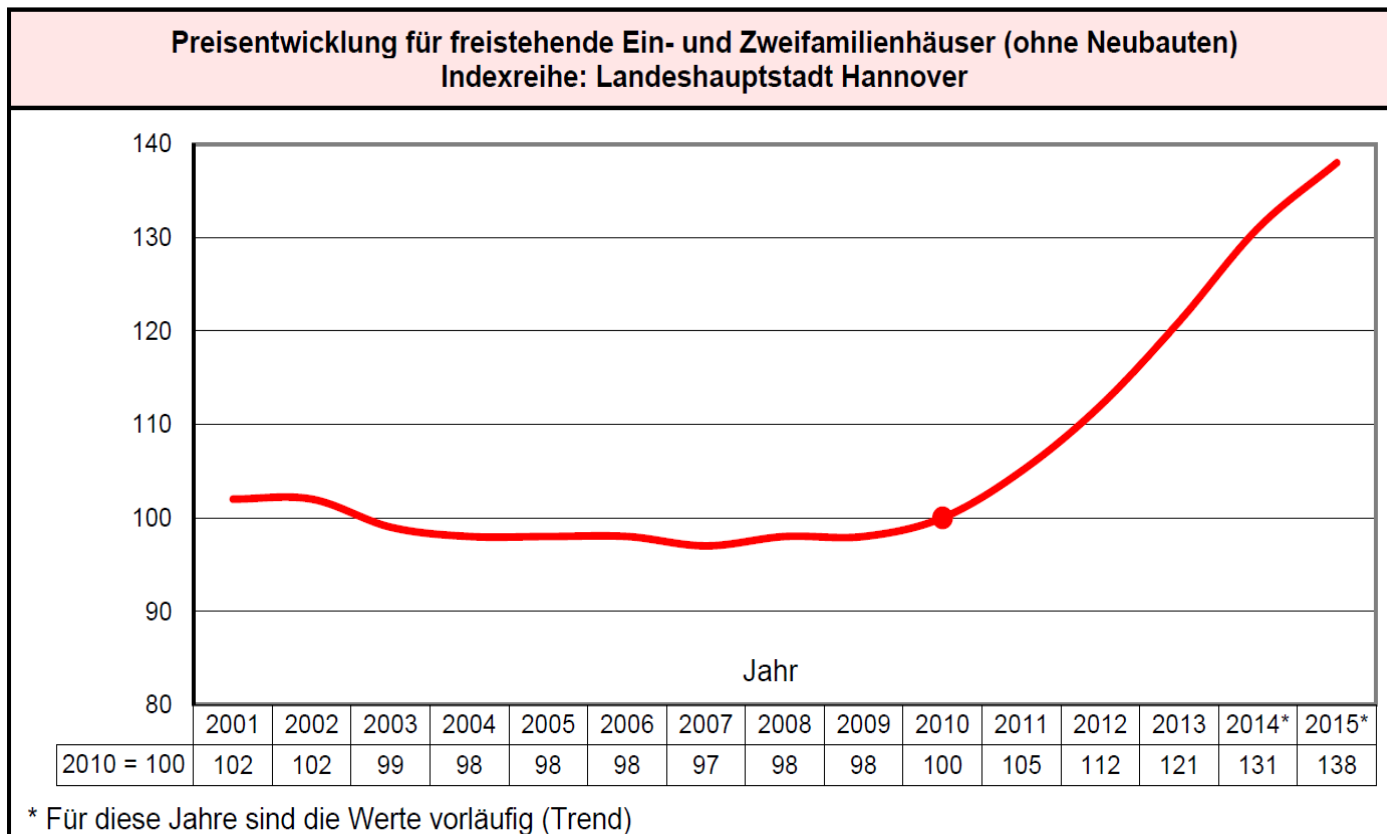


\* Average Q1-Q4 2007=100

Source: European Mortgage Federation

Germany: 3/2018 → Index 150  
 3/2010 → Index 105  
 → 43% (8J.) → 5,3% p.a.

## Price development (index) of detached houses in Hannover (2001 – 2015)



Source: Gutachterausschuss für Grundstückswerte Hameln-Hannover 2016: Market Report 2016 of Region Hannover and counties Hameln-Pyrmont, Hildesheim and Schaumburg, p. 126.

## Space / land used for settlement and traffic (ha per day, Germany)

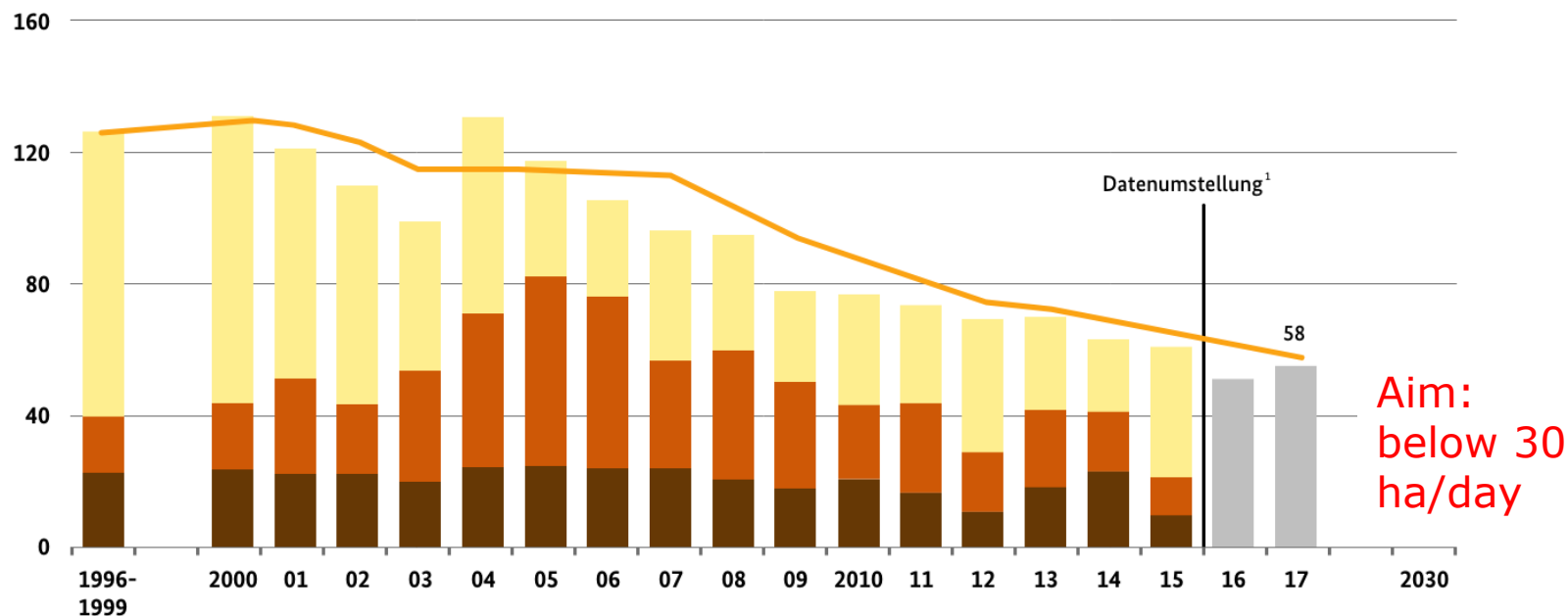
Settlement area:

Space for built-up areas  
(diff. land-use)

Space for recreation, sports, cemeteries

Space for traffic

Sliding 4-years average



Quelle: Statistisches Bundesamt, Januar 2019

→ Success of in-fill development (Innenentwicklung) becomes apparent !

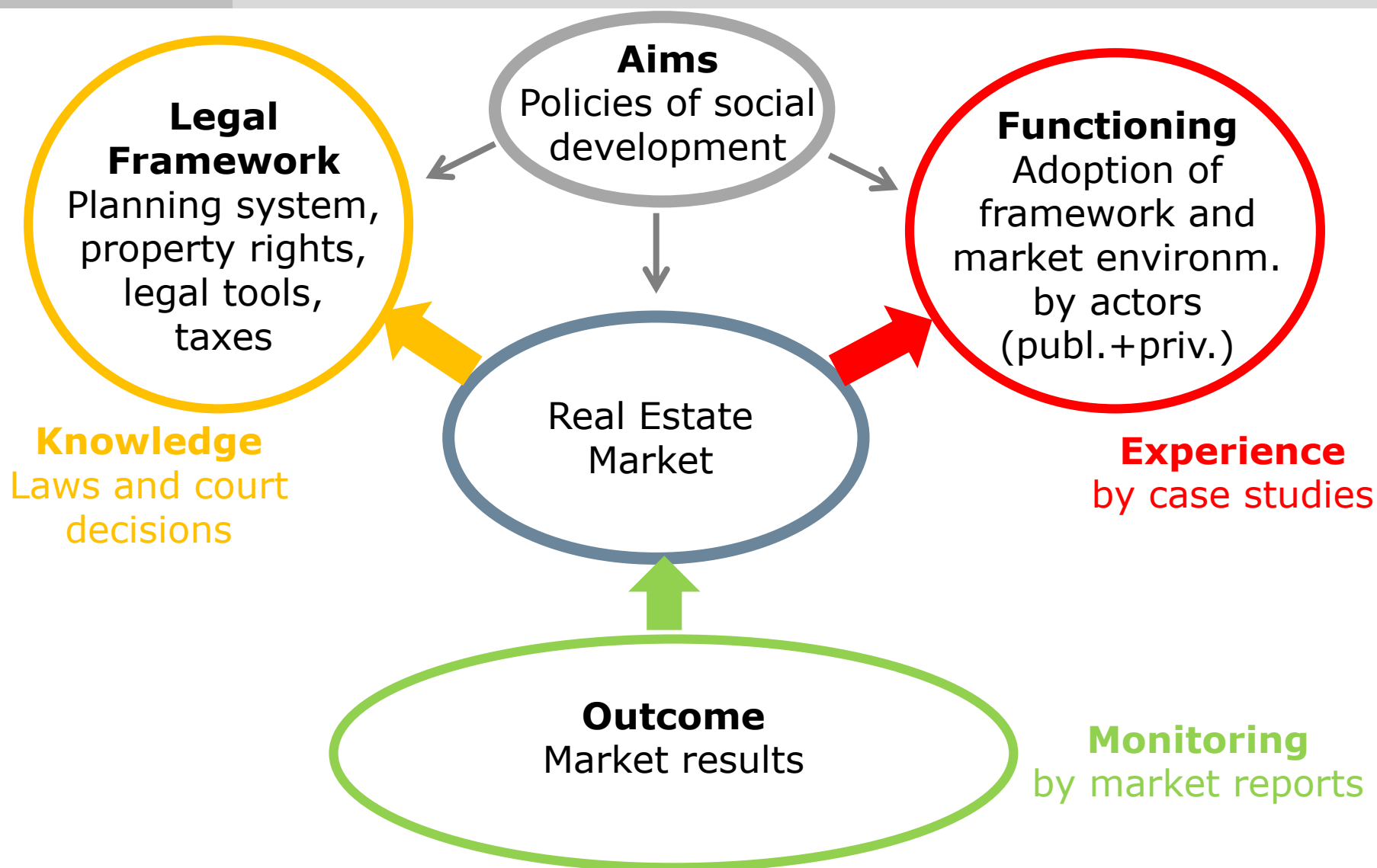


## 2. Challenges of data analysis in Land Management

- „Data“ is „information“ (different types of information)
- Inhomogeneous data
  - different sources (e. g. private or public)
  - different spatial or administrative levels (local or regional)
  - different quality (tangible or intangible)
- Not enough relevant data
- Availability of (geo)data increases (e. g. VGI, Open data initiatives, INSPIRE initiative of EU)

### 3. Research approaches at Chair of L & RE-M of LUH

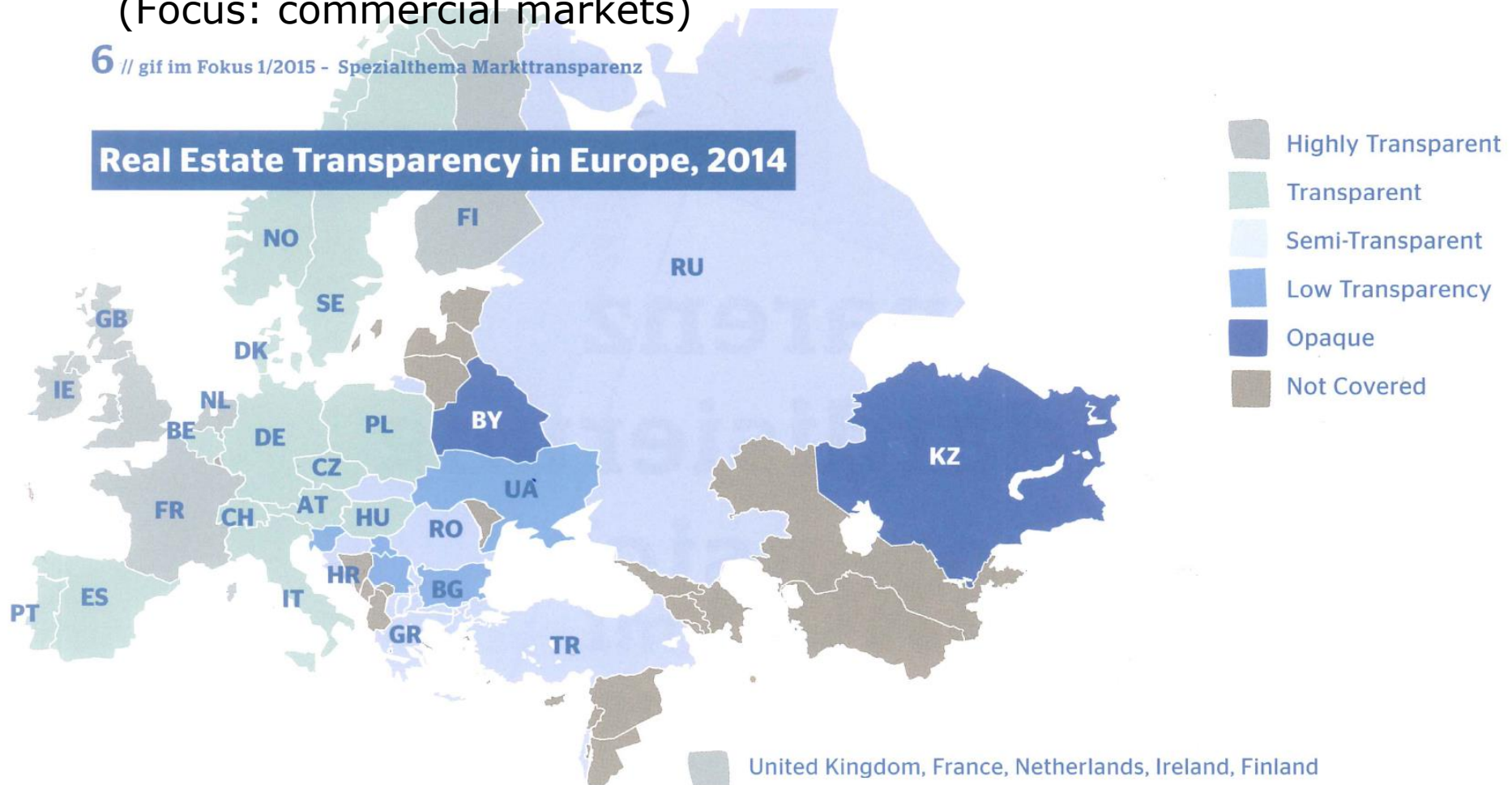
- Real estate market analysis / Market transparency
- Fuzzy-Bayes-Approaches in market analysis and valuation
- Geodata-Support tool in market analysis and valuation
- Village development under current national and global trends
- Research Center TRUST – Transdisciplinary rural and urban spatial transformation



## Europe: Differences in market transparency (Index JLL) (Focus: commercial markets)

6 // gif im Fokus 1/2015 - Spezialthema Markttransparenz

### Real Estate Transparency in Europe, 2014



Source: Jones Lang Lasalle 2015: Transparency Index

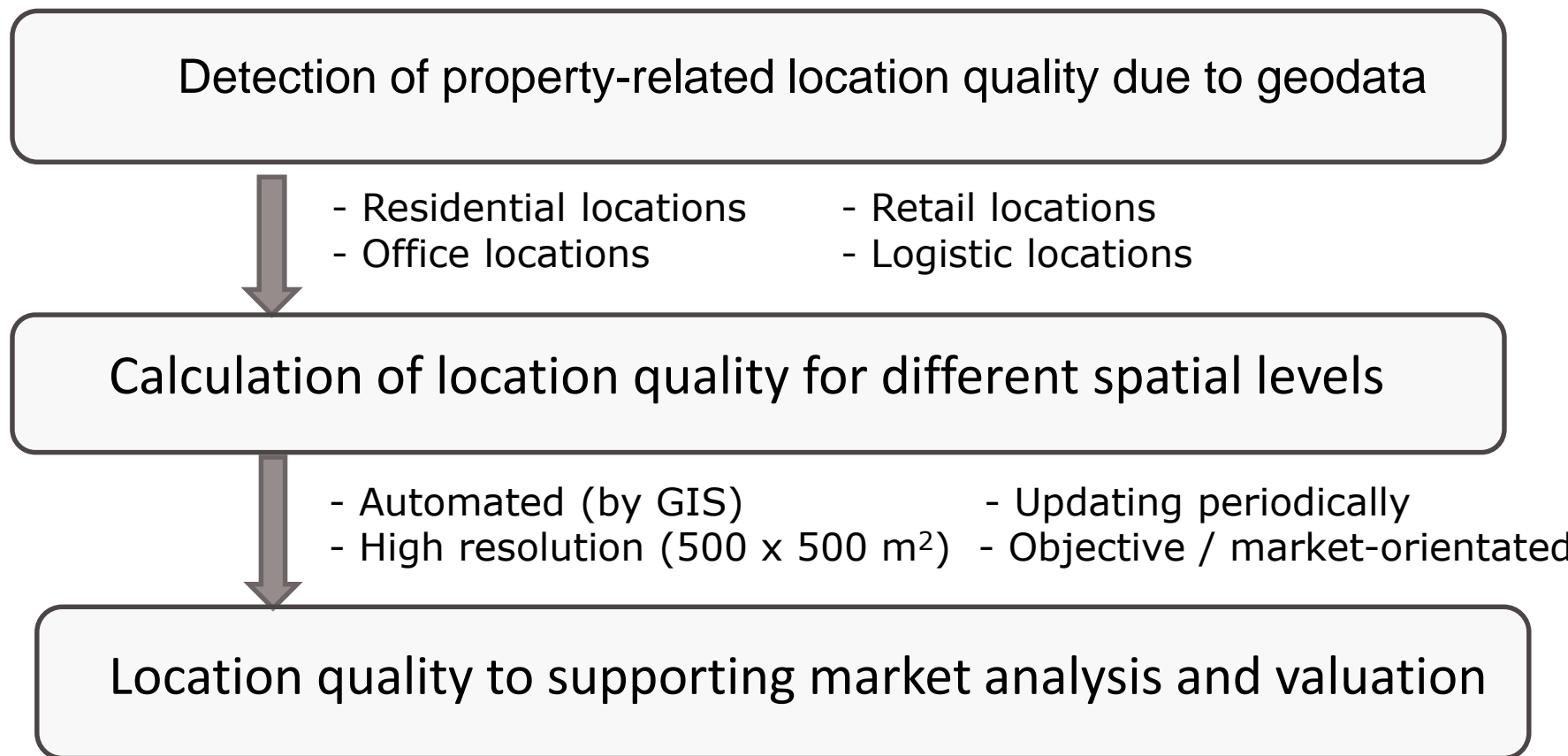
## Background

- Scarceness of / demand for more reliable land market data
- Availability of geodata (e. g. open data initiatives, INSPIRE initiative of EU)

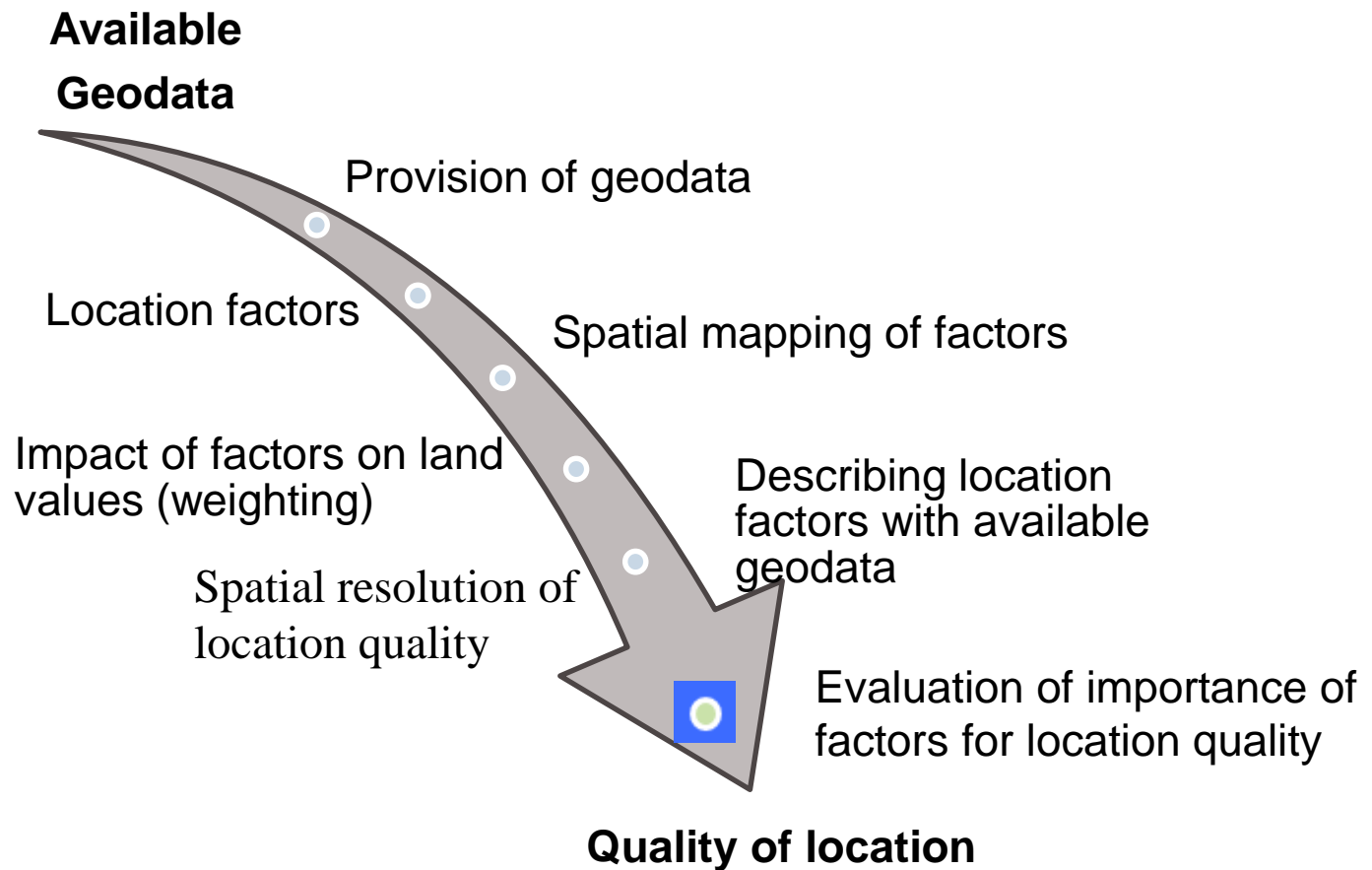
## Aim

- **Automated detection of site quality / location quality by using free available geodata**
- **Comparability of locations at cross-regional level**

## Geodata-Support tool in market analysis and valuation



## Steps to detect location quality



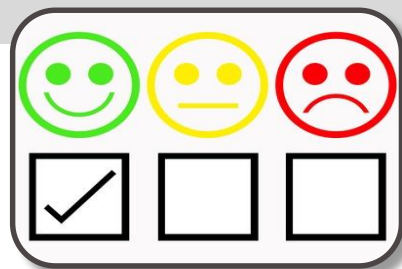
## Impact of location factors on land values (selection and weighting):

- Method: Expert questioning by priority analysis (factor by factor)
- Summarized expert opinions

		...hat im Vergleich zu diesem							Weighting (total)	Weighting (%)
		A	B	C	D	E	F	G		
Dieser Indikator...	A		0	0	1	2	0	1	4	10%
	B	2		2	2	1	0	0	7	17%
	C	2	0		1	1	2	0	6	14%
	D	1	0	1		0	0	1	3	7%
	E	0	1	1	2		0	0	4	10%
	F	2	2	0	2	2		2	10	24%
	G	1	2	2	1	2	0		8	19%
									42	100%



Evaluation of importance



due to location quality:

Macro-location

Micro-location

		Distance classification (m)		
Location factors	POI	1	2	3
Distance to high-voltage lines	Pylon	< 500	500 - 2.000	> 2.000
Distance to educational institutions	Primary school	> 2.000	1.000 - 2.000	< 1.000
	Secondary school	> 5.000	2.000 - 5.000	< 2.000
Distance to medical institutions	Medical specialist	> 5.000	2.000 - 5.000	< 2.000
	Hospital	> 10.000	5.000 - 10.000	< 5.000

## Summation of importance of location factors :

- Using the evaluation and weighting of location factors
- Summation represents location quality of area relatively to all others

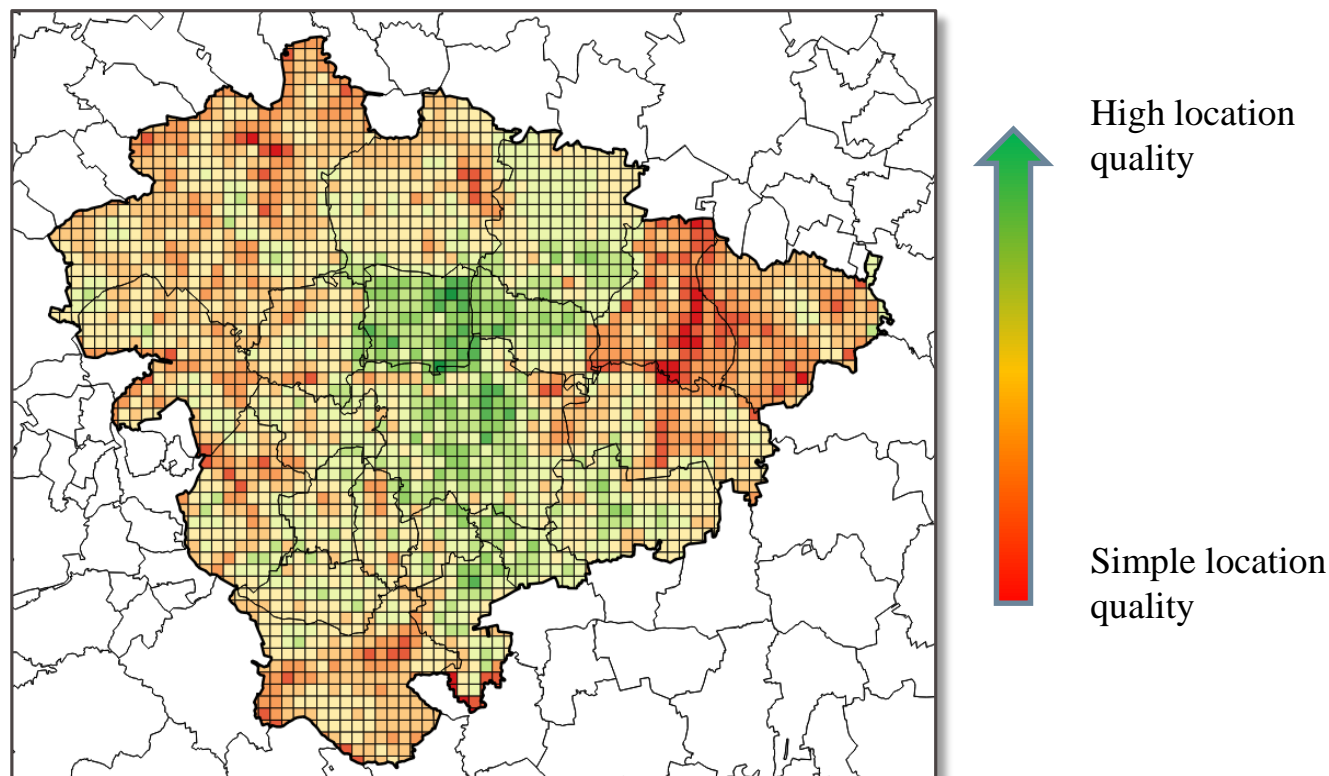
Macro-location:

Calculation of location quality

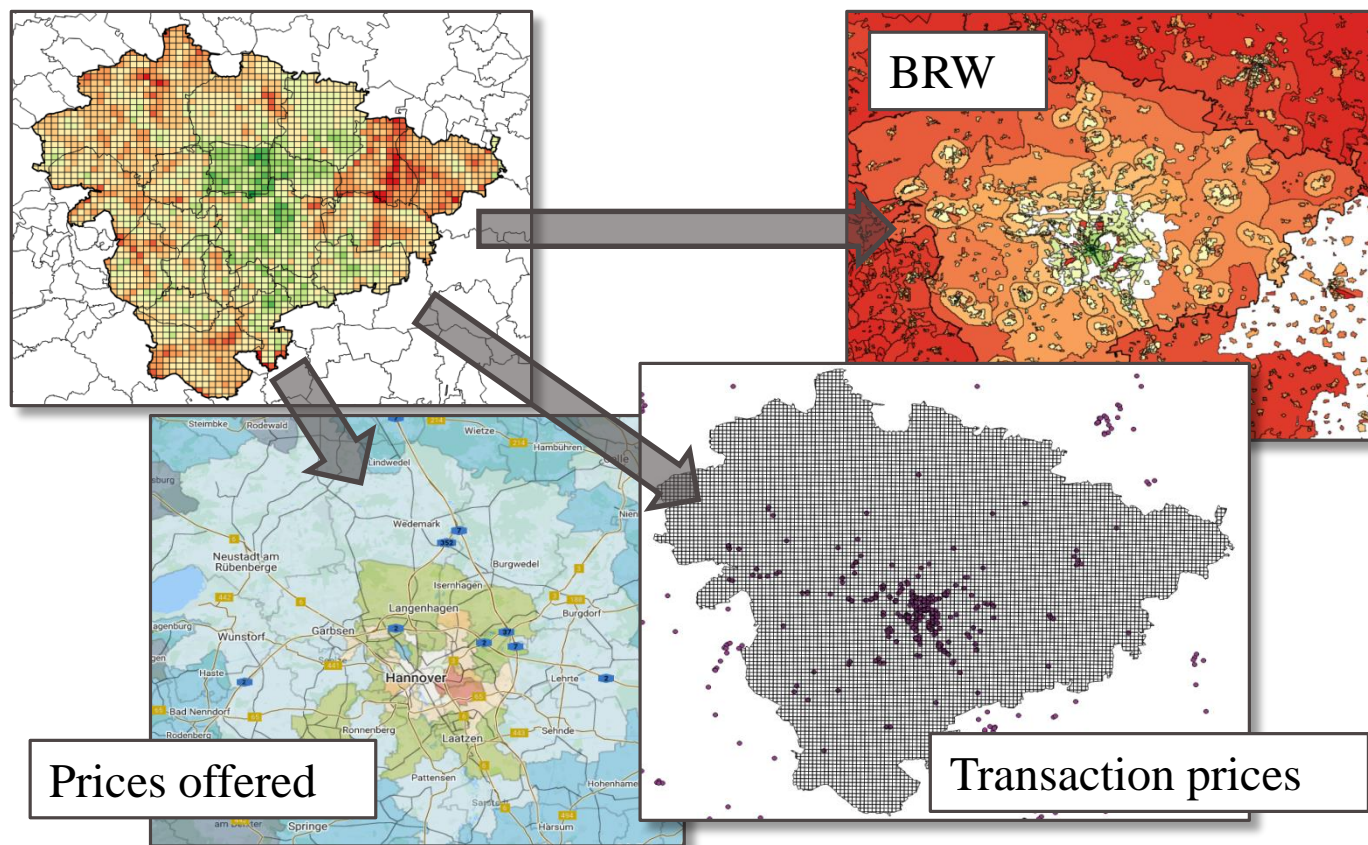
Weighting	Faktor 1 10%		Faktor 2 17%		Faktor 3 14%		...		Location quality
	Evalua	Sum	Evalua	Sum	Evalua	Sum			
Municipality 1	1	10	3	51	3	42			103
Municipality 2	3	30	2	34	1	14			78
Municipality 3	2	20	2	34	1	14			68
...									

## Example : Results for 21 Municipalities of Hannover region

Combination of macro-location (20 %) and micro-location (80 %):

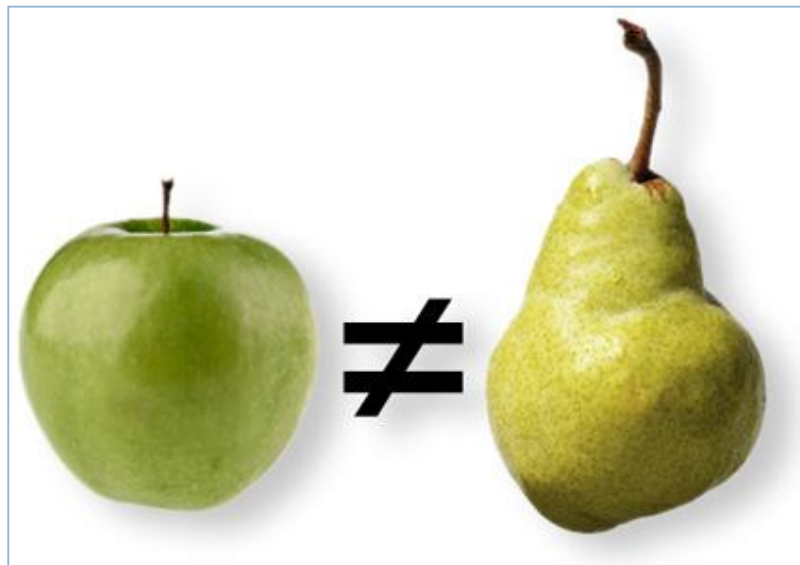


## Validation of the model due to market results (different approaches)



## Challenges of data analysis in Land Management

- ... tried to show the needs and requirements in land management data
- ... more available data (big data?) are helpful, but ...
- ... research is necessary how „volume“ can contribute to „quality“ or substitute it
- ... research is necessary including economically relevant data



**Thank you !**

## CONTACT

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