Accessibility: How Can We Measure It?

Concept, Key Indicators, Measurements, Base Data

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Presentation Contents

Part 1. Concept and Key Indicators

Part 2. Examples of Accessibility Indicators
Discussion of Indicator Dimensions

Part 3. Fields of Application
Some Theoretical Considerations

Part 4. Examples – Indicator Discussion

Part 5. Needed Base Data
Conclusions
Projects Applying Accessibility Indicators

Part 1.

Concept and Key Indicators

What is Accessibility?

Accessibility is the main product of a transport system. It determines the ***locational advantage*** of a region relative to all regions.

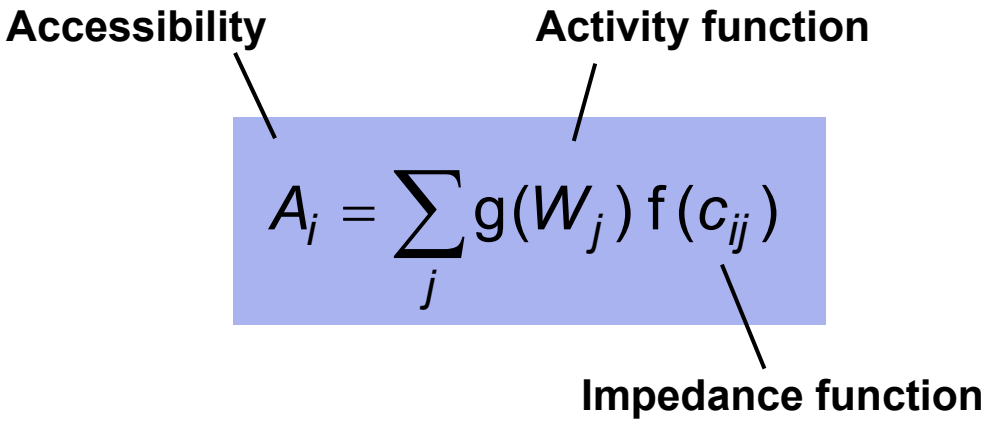
Accessibility indicators can be defined to reflect both ***within-region infrastructure*** and ***infrastructure outside*** the region which affect the region.

Accessibility indicators range from ***simple infrastructure measures*** (***endowment indicators***) towards ***complex*** indicators taking account of ***connectivity*** and ***opportunities***.

Accessibility Indicators: A Definition

„Accessibility indicators describe the location of an area with respect to opportunities, activities or assets existing in other areas and in the area itself, where ‚area' may be a region, a city or a corridor [or any other spatial entity, CS] in relation to the ease/efforts of getting there."

(Wegener et al., 2002)



In Contrast: Endowment Indicators

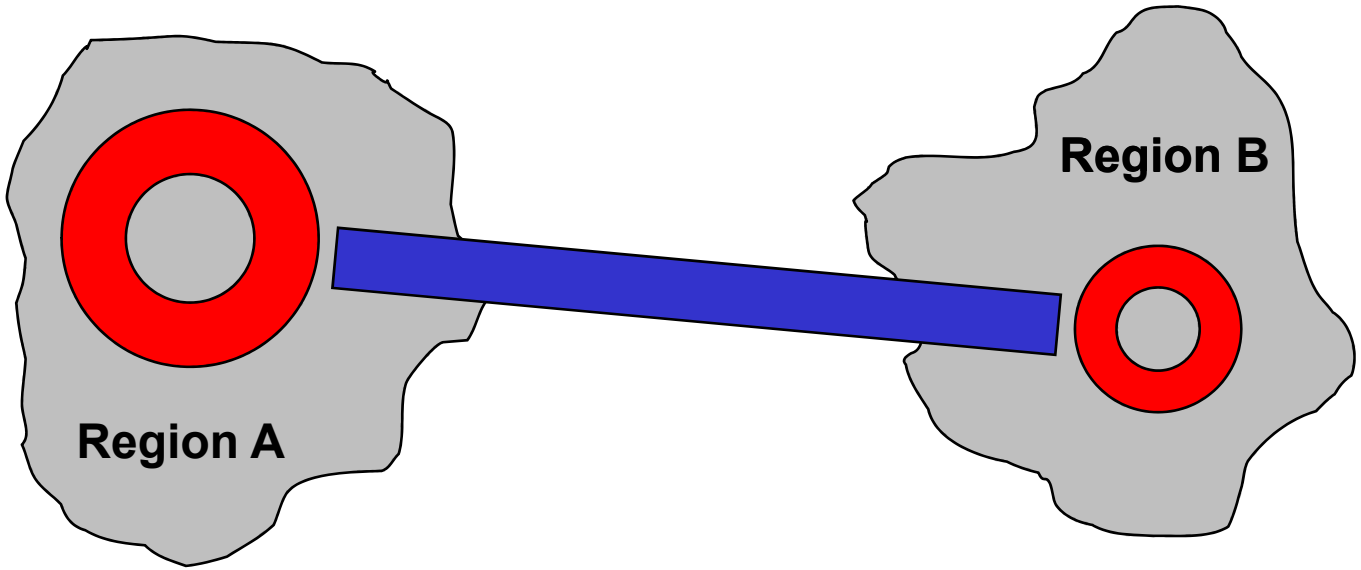
Endowment indicators are measures for ***quantifying*** existing ***assets*** within a country, region, city or corridor (or any other spatial entity), neglecting the assets of all other regions and the connections to them.

Such indicators include, for example,

- Number of railway stations, airports, hospitals, or schools
- Length or density of motorways or shipping networks
- Percent of broadband access in a region
- …

Endowment Indicators and Accessibility Indicators

Endowment indicators vs. ***Accessibility indicators***

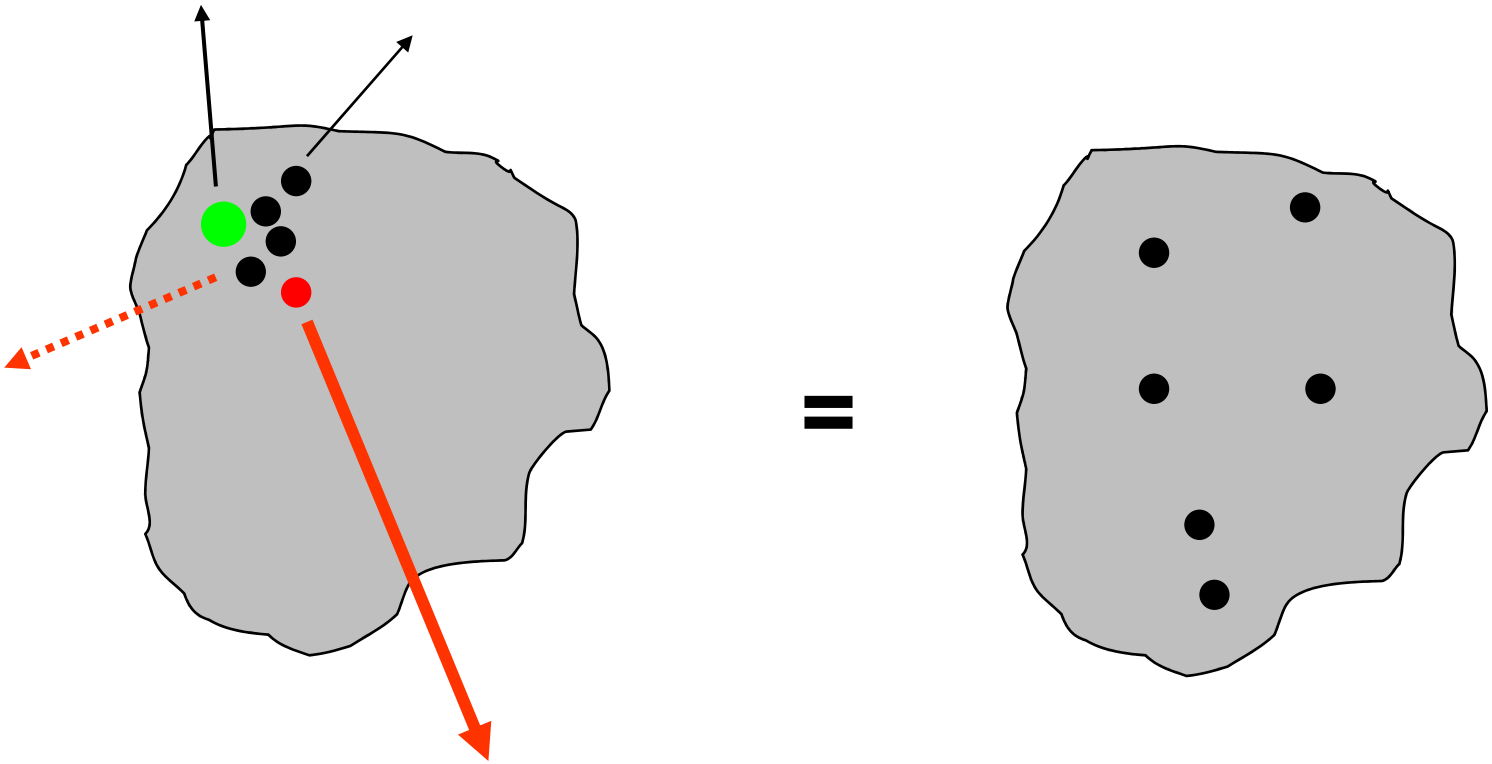


Assets of each ***individual*** region vs.

Assets and ***connectivity*** between ***all*** regions

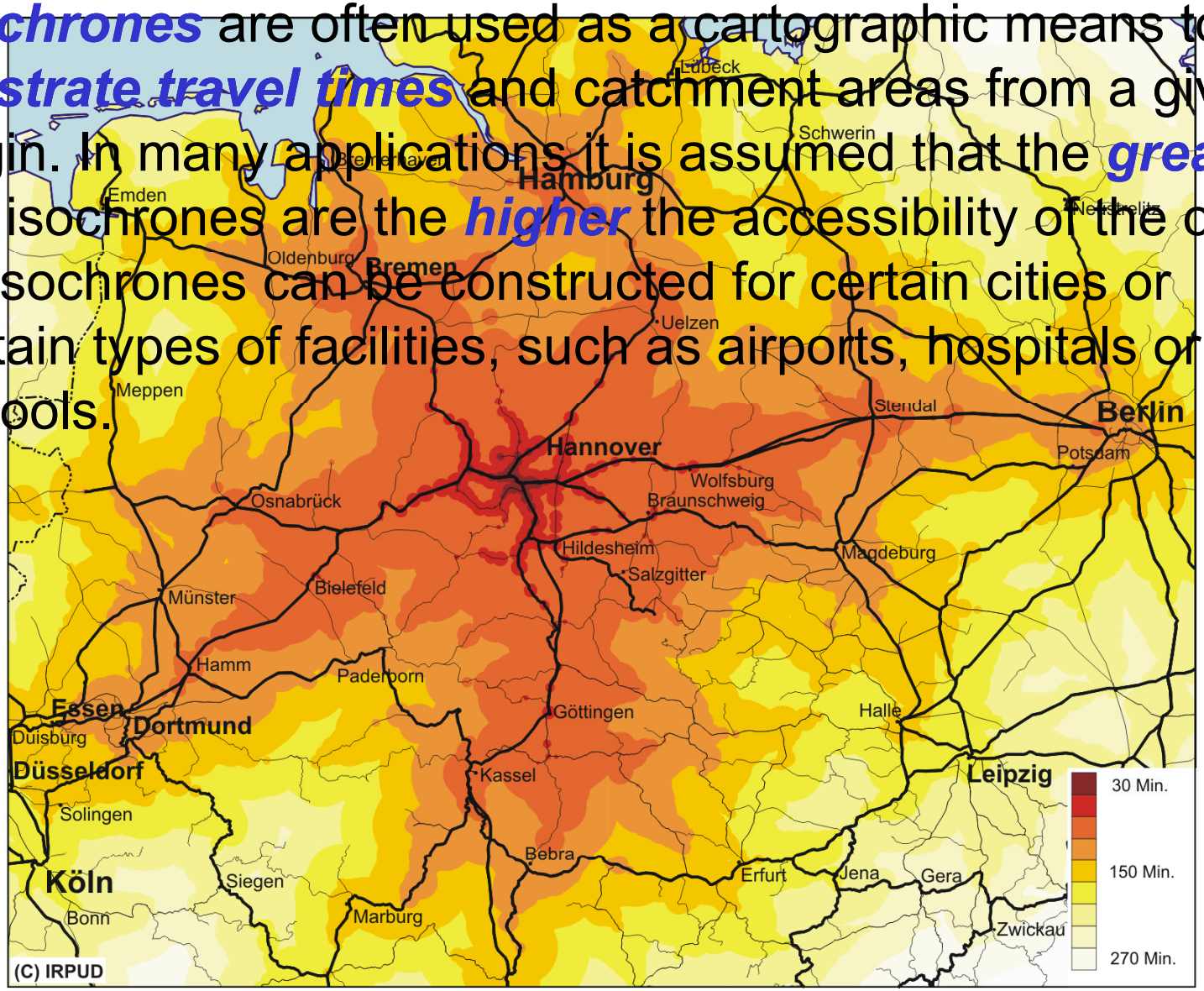
Main Drawbacks of Endowment Indicators

- only ***little differences*** over time (and what do they mean?)
- ***qualitative aspects not considered***
- ***neglecting internal variances***



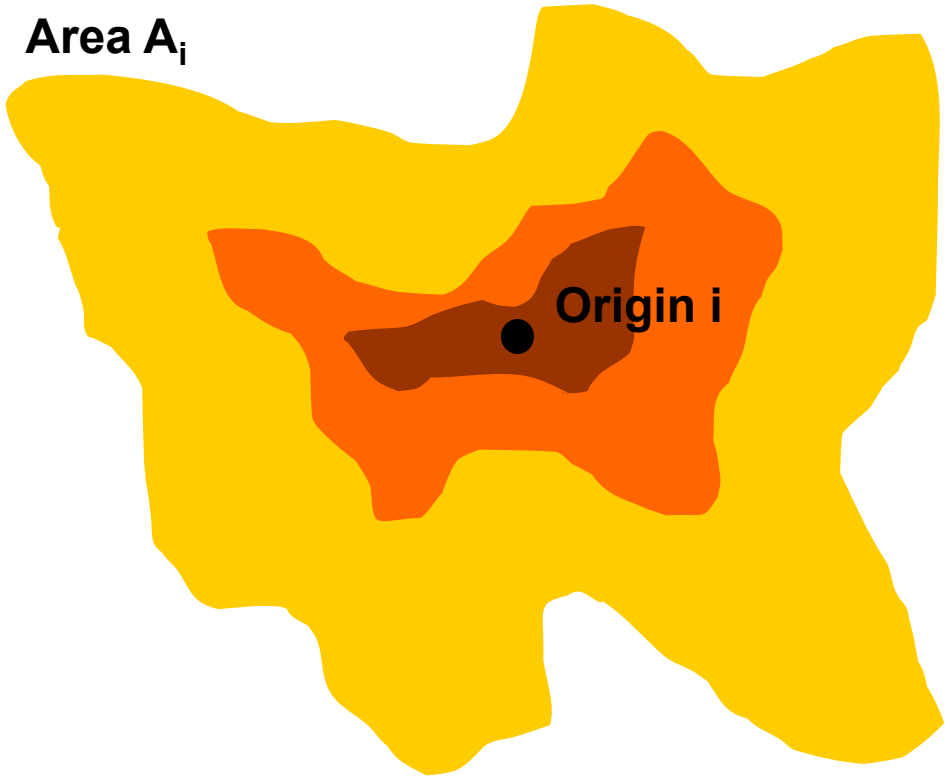
In Contrast: Isochrones

Isochrones are often used as a cartographic means to ***illustrate travel times*** and catchment areas from a given origin. In many applications it is assumed that the ***greater*** the isochrones are the ***higher*** the accessibility of the origin is. Isochrones can be constructed for certain cities or certain types of facilities, such as airports, hospitals or schools.



Main Drawbacks of Isochrones

- considering only one origin at a time
- results can hardly be compared to any standards
- difficult to derive quantitative numbers (except for area)



Area A_i > Area A_j
Area A_j < Area A_{j+1}

What does this mean?
Standards?

Common Accessibility Indicators

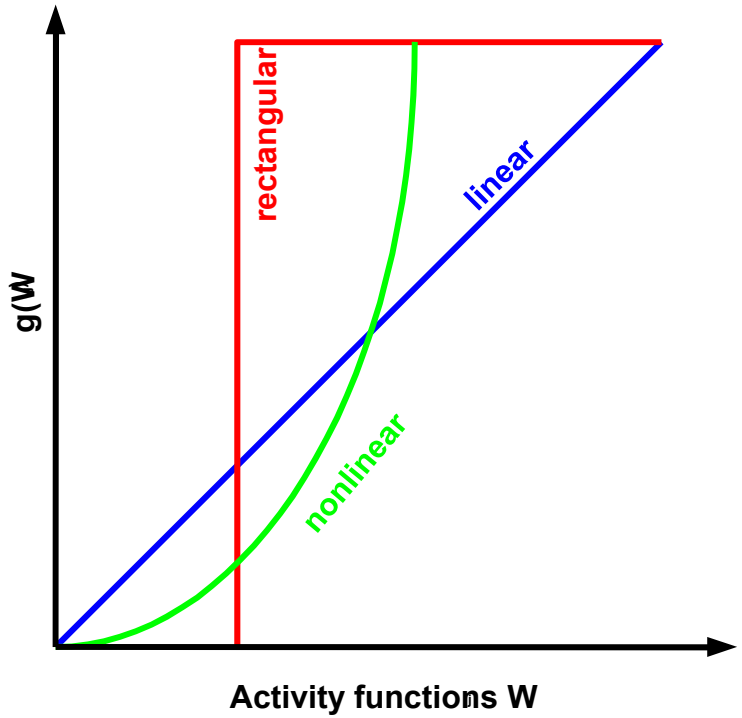
Three basic types of accessibility indicators are widely used in various studies, which are:

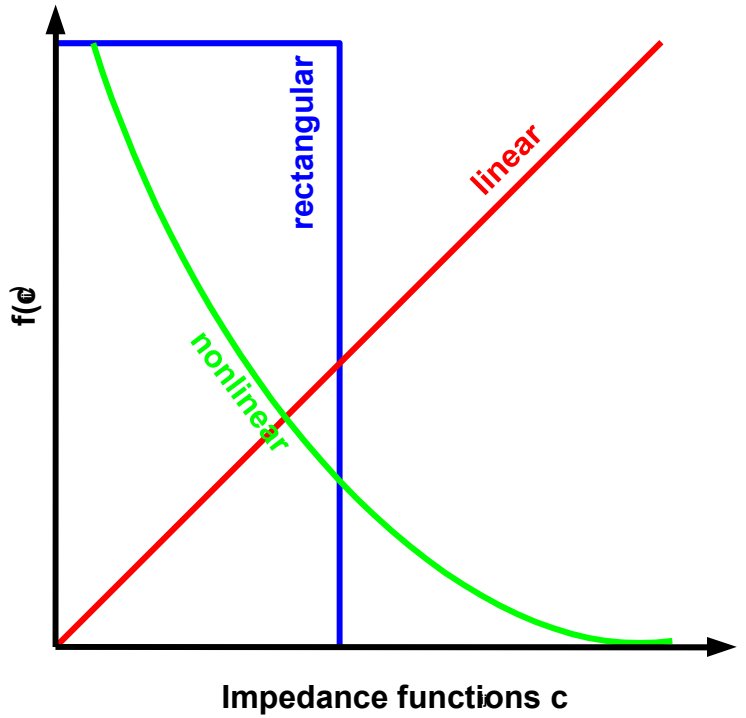
- Travel time, ***travel cost***, or travel distance indicators
- ***Daily accessibility***
- ***Potential*** accessibility

The three basic types ***differ*** from each other in the way they implement the ***activity*** and ***impedance functions***.

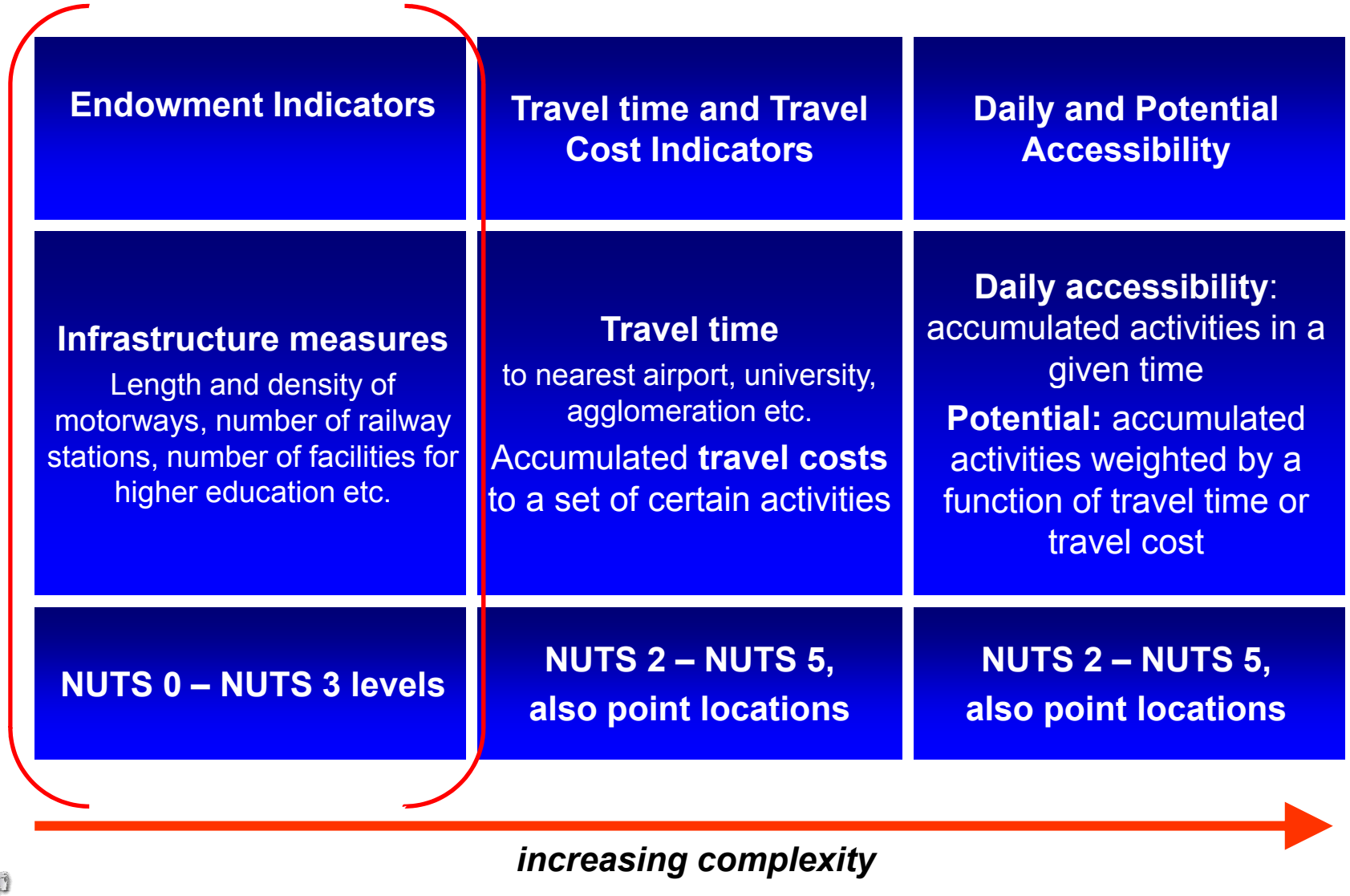
Indicator Characteristics

Travel cost	Accumulated travel cost/travel time to a set of activities
Daily accessibility	Accumulated activities in a given travel time
Potential	Accumulated activities weighted by a function of travel cost





Framework of Accessibility Indicators



Indicator Dimensions

Type of indicators	Travel cost, daily accessibility, potential
Spatial scale	Continental, trans-national, national, regional, local (NUTS 0 – NUTS 5)
Destination activities	Diff. groups, occupations, opportunities (population, GDP, jobs etc.)
Modes	Road, rail, air, waterways, multimodal
Standardisation	Type of standardisation (averaging, min/max), class breaks
Spatial impedances	Distance, travel time, travel cost
Constraints	Speed limits, access restrictions, maximum driving hours, capacity, check-in times
Barriers	Political, economic, legal, cultural barriers
Types of transport	Personal travel, goods transport
Dynamics	Single year, different points in time, time series

Part 2.

Examples of Accessibility Indicators

Discussion of Indicator Dimensions

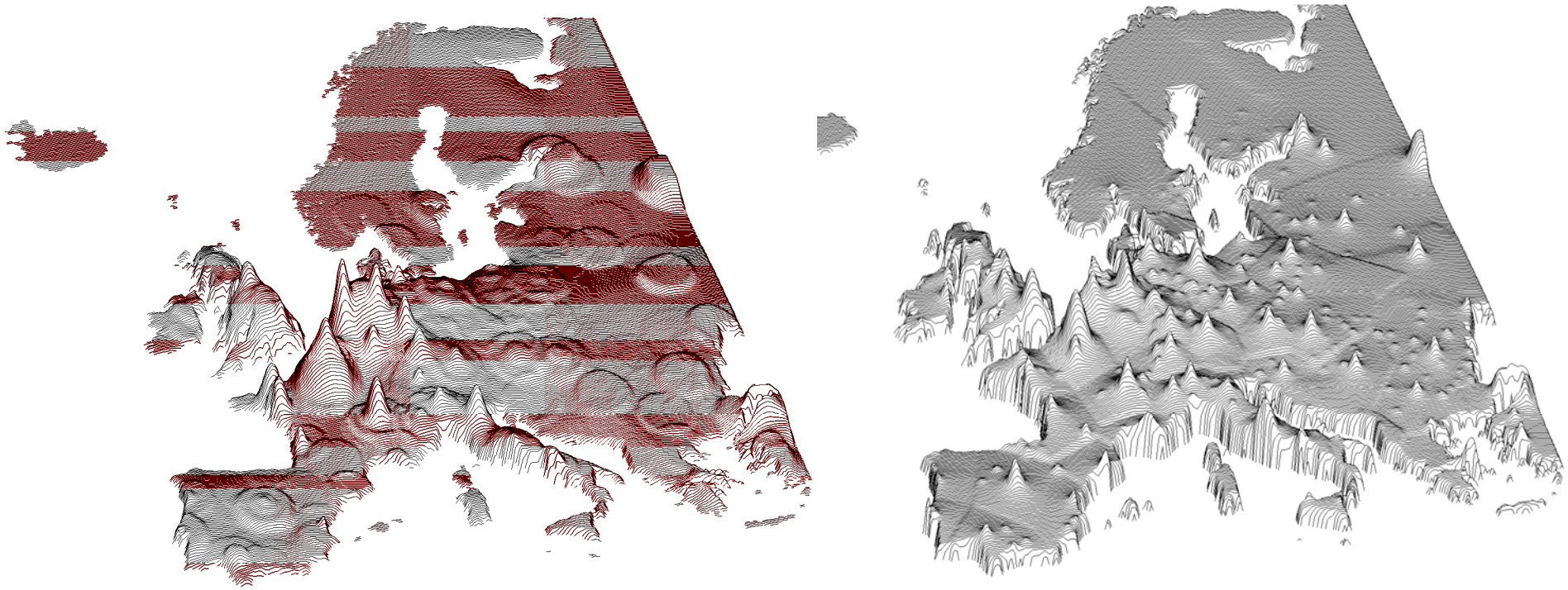
Accessibility Indicators: Examples and Discussion

A number of indicators should be ***exemplified*** and ***discussed*** now against the background of

- Types of indicators
- Spatial scale
- Destination activities
- Modes
- Standardisation

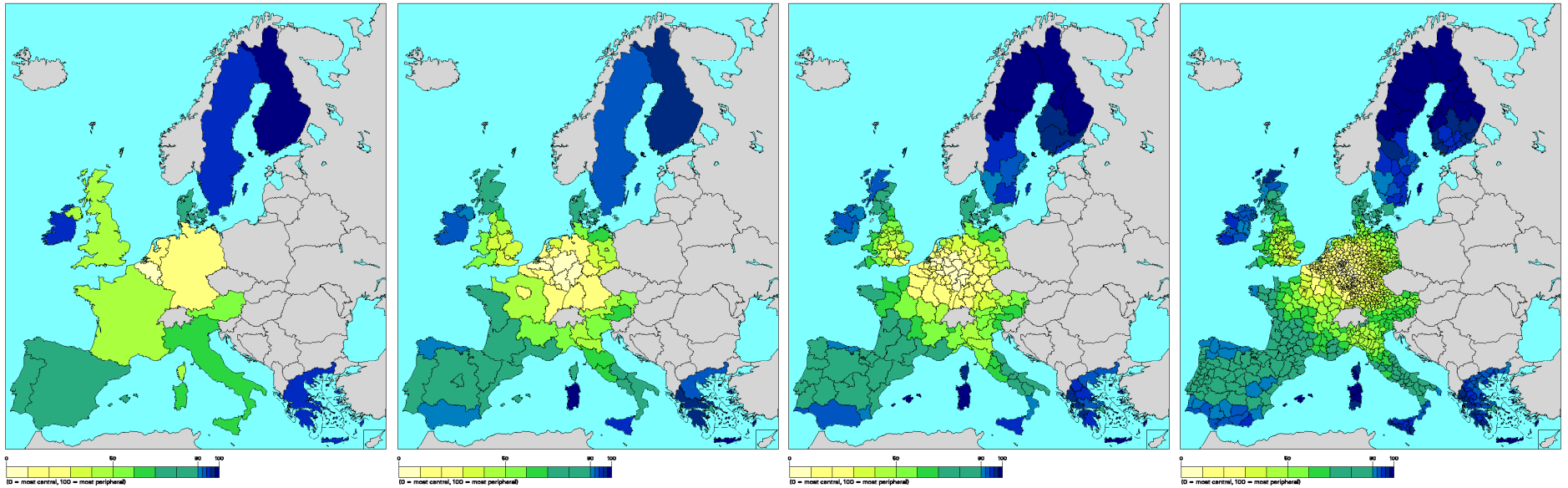
Type of Indicator

Daily accessibility (left), ***Potential accessibility*** (right)



Spatial Scale (I)

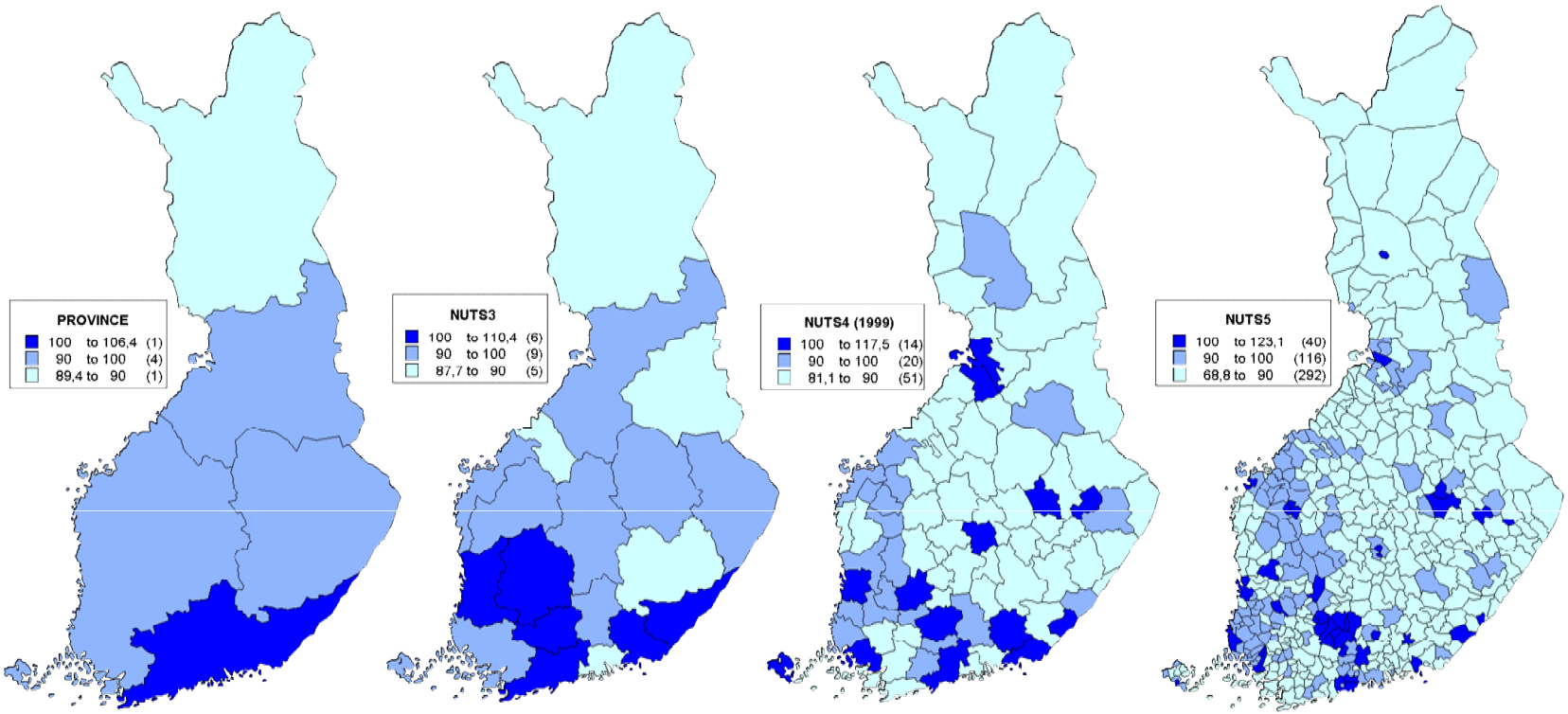
Potential accessibility (Peripherality Study)



NUTS 0 ***NUTS 1*** ***NUTS 2*** ***NUTS 3***

Spatial Scale (II)

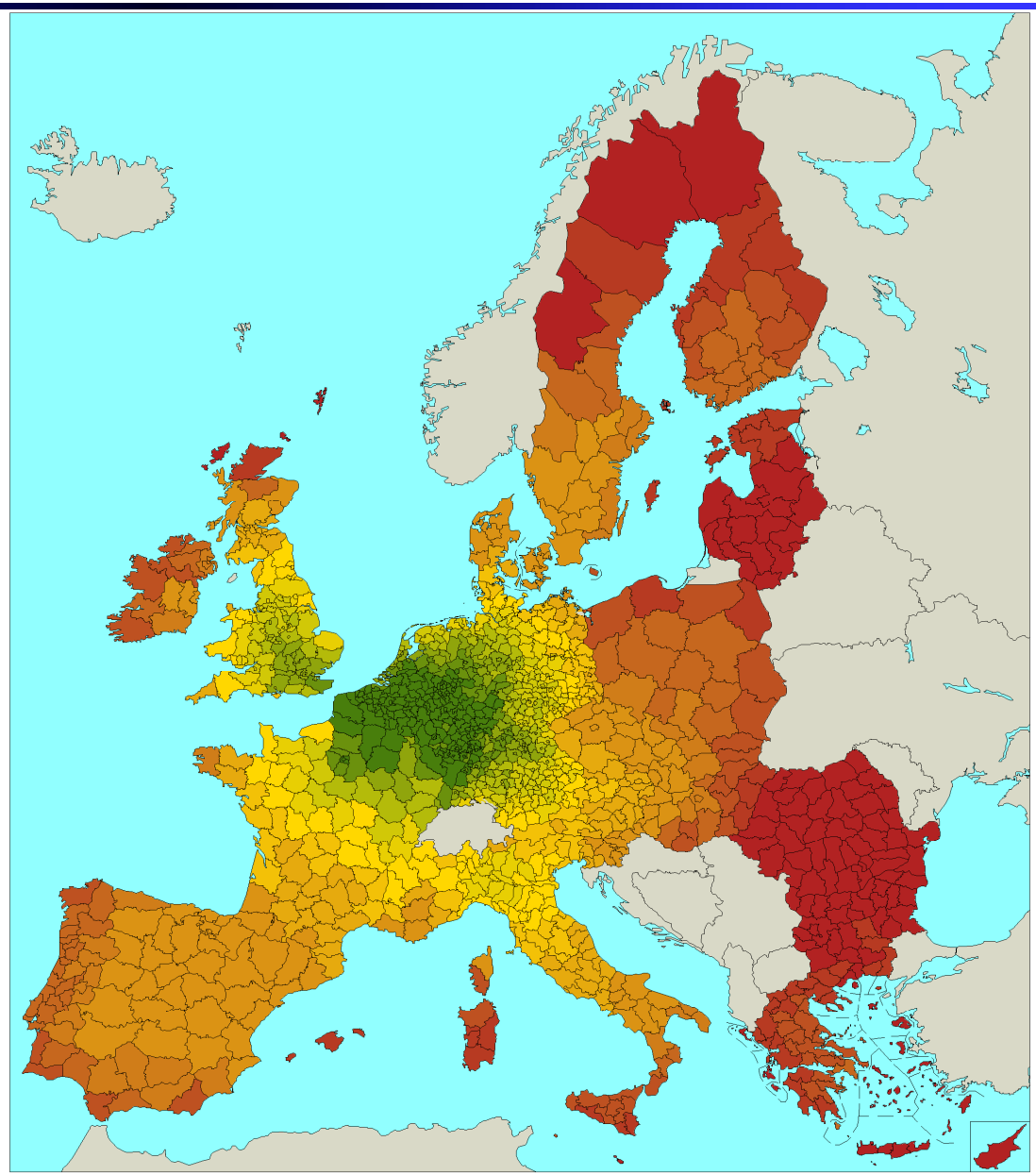
Broadband availability in Finland (ESPON 1.2.2)



This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

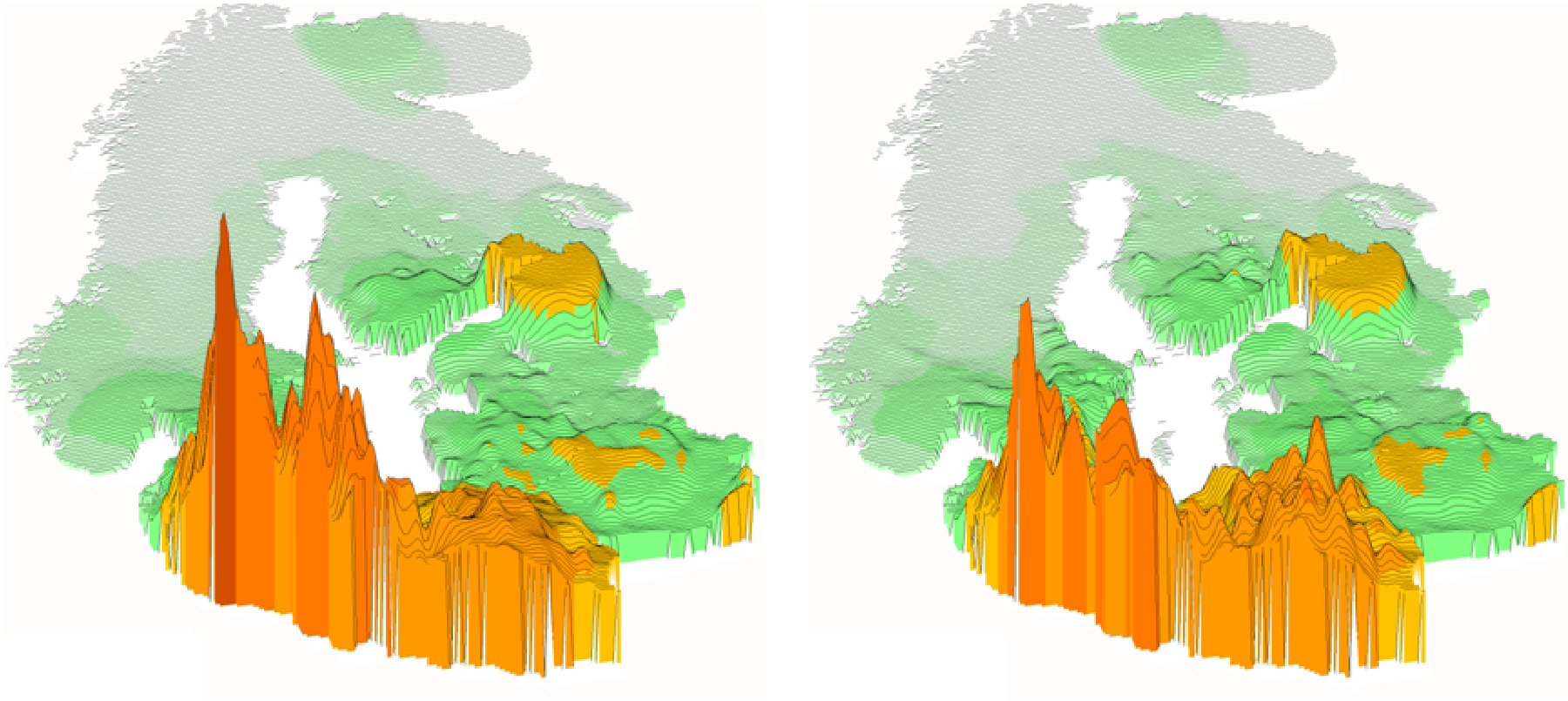
Destination Activities

Accessibility to
GDP
(Peripherality Study)



Modes

Daily accessibility for ***road*** (left), ***rail*** (right) (VASAB2010+)



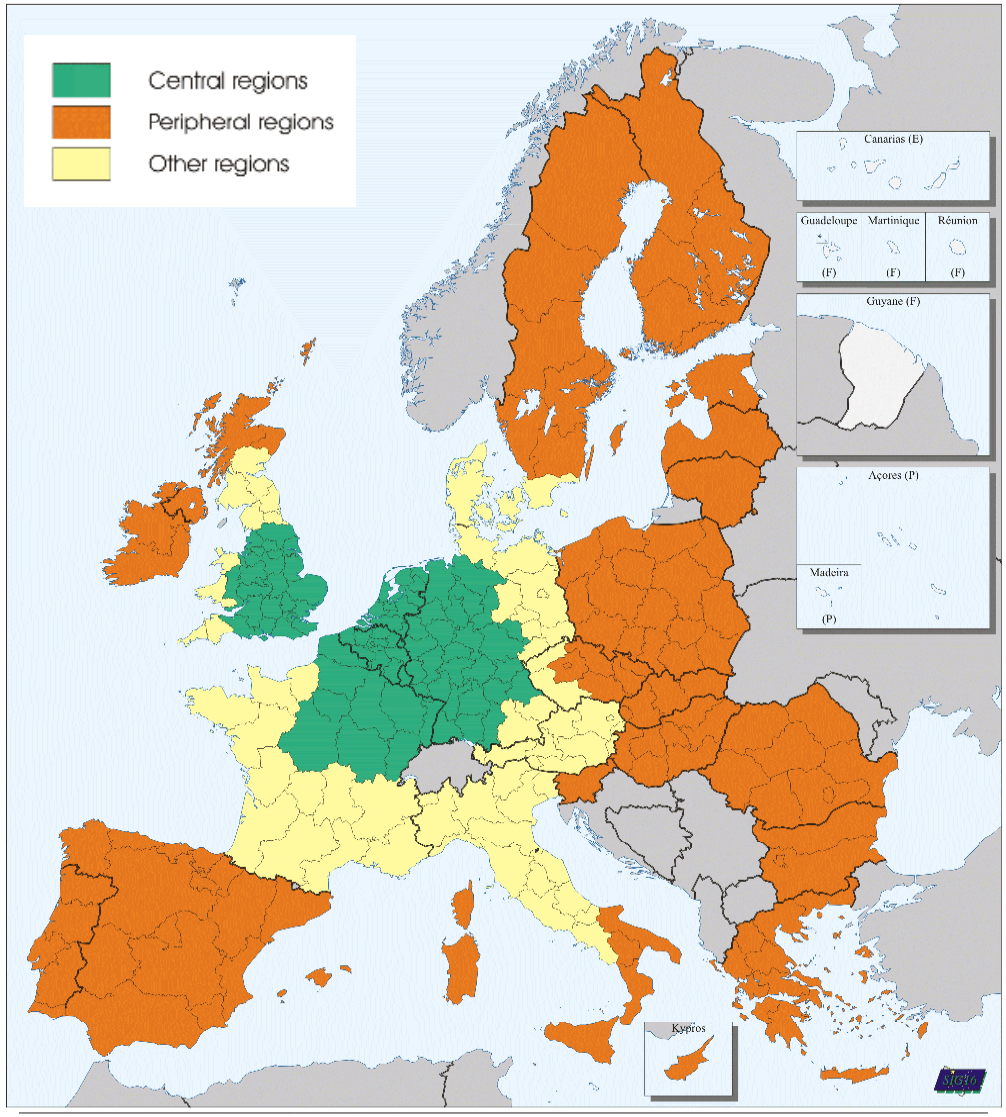
Standardisation

Potential accessibility by car ***detailed*** illustrated with some ***15 classes*** (Peripherality)

…..

and its ***use in policy*** analysis

(2nd Cohesion Report of the European Commission)



A.4 Central and peripheral regions

Part 3.

Fields of Applications

Some Theoretical Considerations

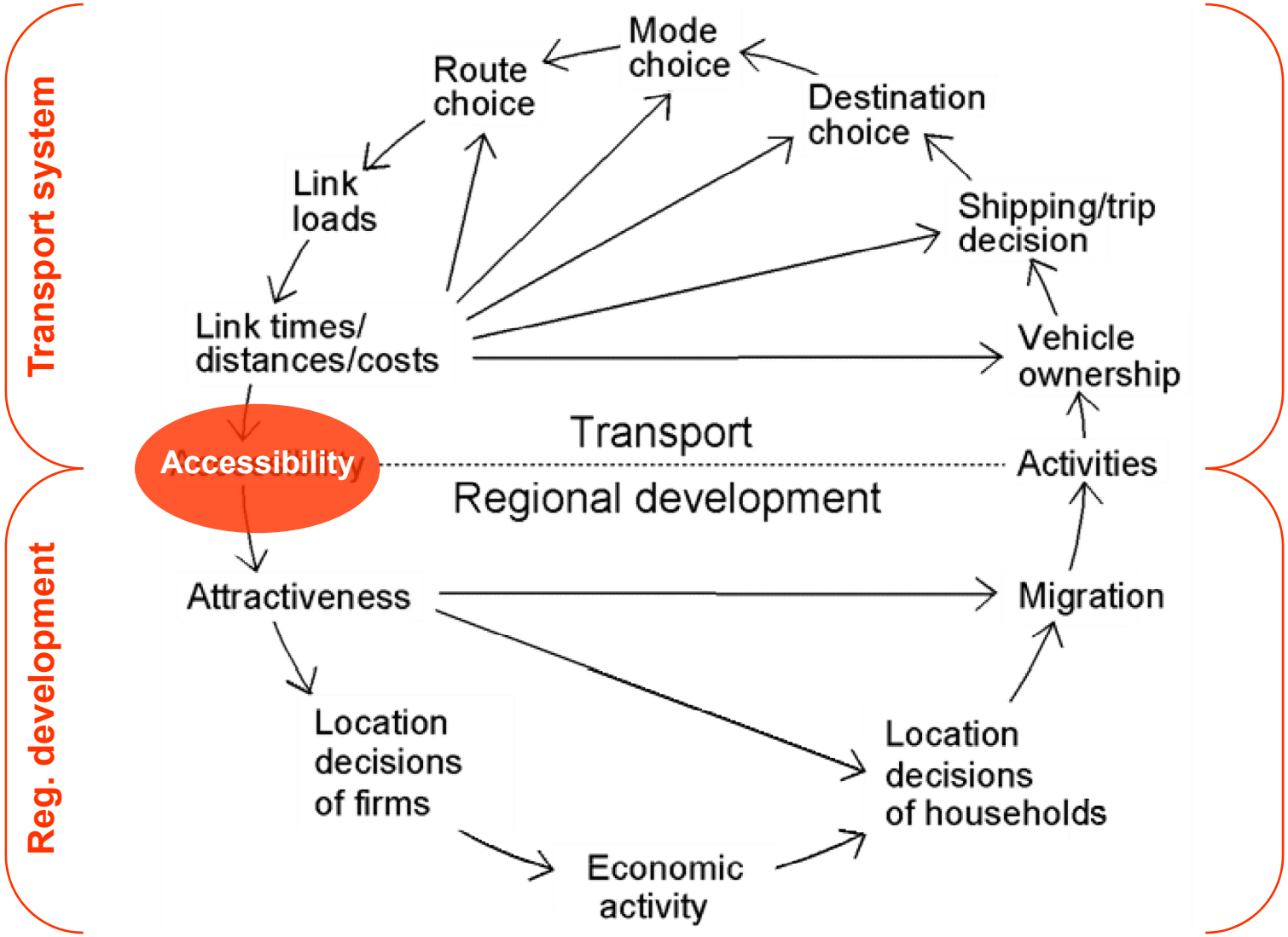
Usage of Accessibility Indicators

Accessibility indicators are used in a variety of applications and assessments as important indicators. They can be used

- to describe the ***current situation of regions***
- to monitor regional ***developments over time***
- to ***assess policy measures***, programmes, investments and projects (both ex-ante, ex-post)
- to ***feed case studies*** or specific model applications
- as ***benchmarks*** (both over time or between regions)

They gained particular importance in ***assessing territorial cohesion*** and ***individual project appraisals***.

Theory: Accessibility and Regional Development

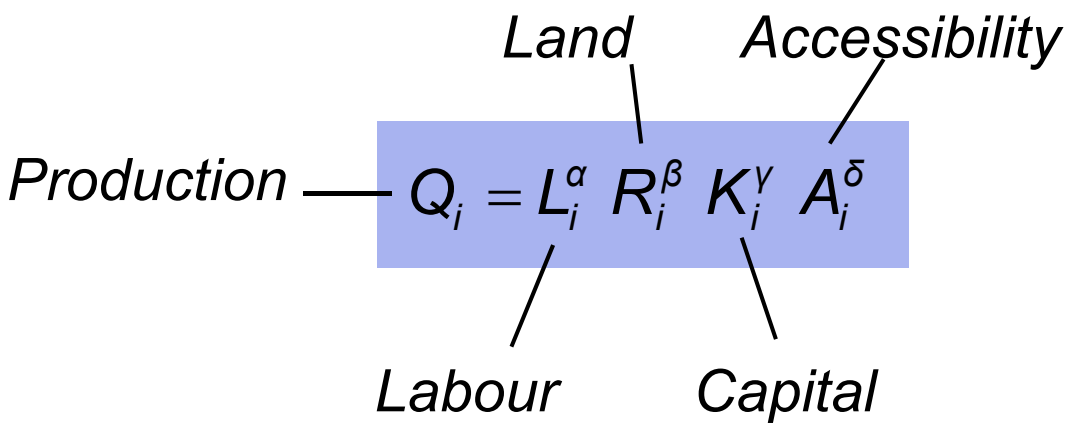


Theory: Accessibility and Economic Development

The ***important role of transport infrastructure*** for regional development is one of the fundamental principles of regional economics.

Hypothesis:

Regions with ***better access*** (i.e. higher accessibility) to input materials and markets will be ***more productive, competitive*** and hence ***more successful*** than remote regions.



Theory: Accessibility and Cohesion

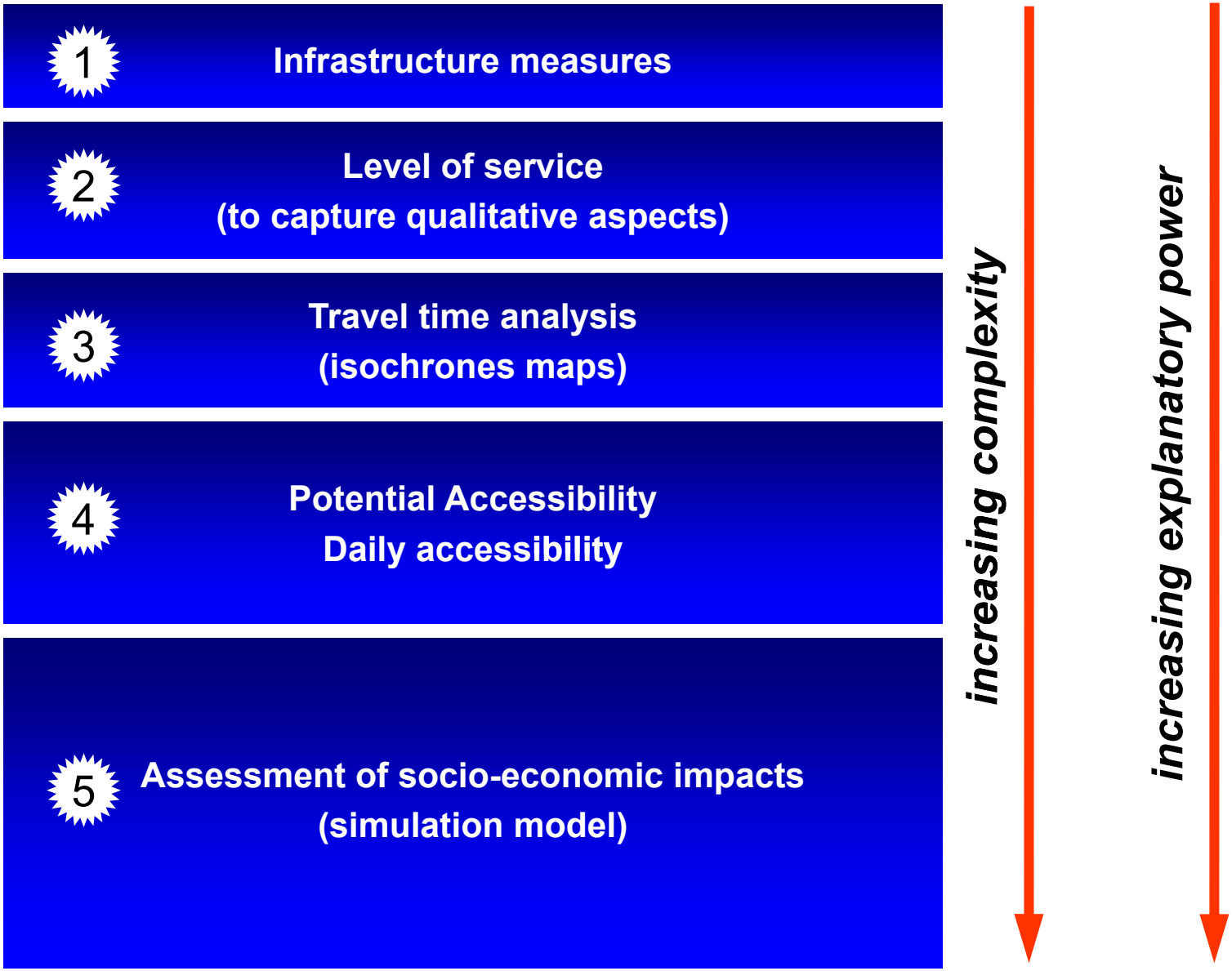
European Spatial Development Perspective (1999) stated:

*"**Good accessibility** of European regions **improve their competitive position** but also the competitiveness of Europe as a whole."* (69)

*"The creation of several dynamic zones of global economic integration, well distributed throughout the EU territory and comprising a **network of internationally accessible** metropolitan regions and their linked hinterland (…), will play a **key role in improving spatial balance** in Europe."* (20)

Accessibility indicators needed to assess policy success.

Approach to Assess Locational (Dis-)Advantages



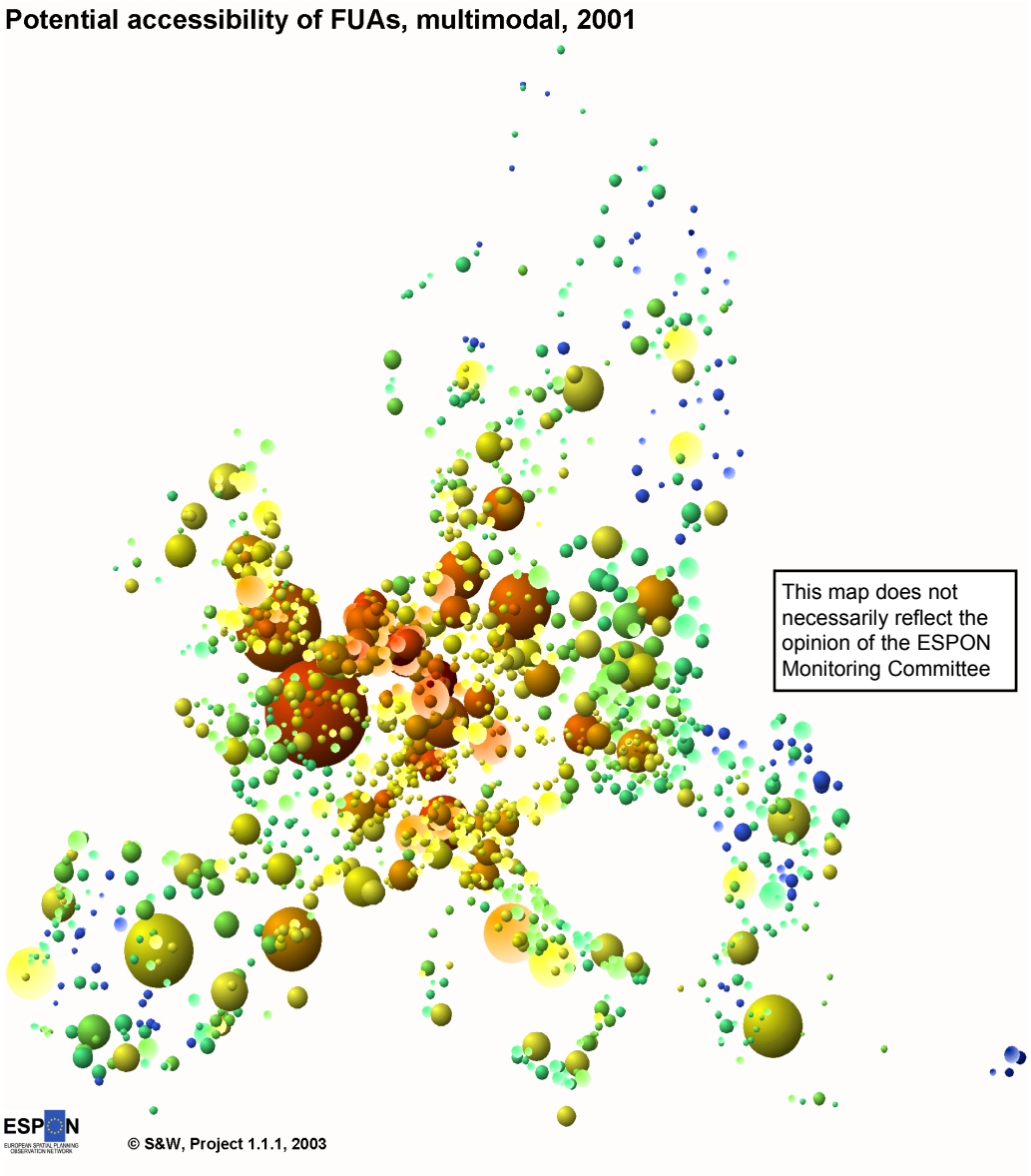
Part 4.

Examples - Indicator Discussions

Ex. 1: Potential, FUAs, multimodal

Q1: Selection of origins

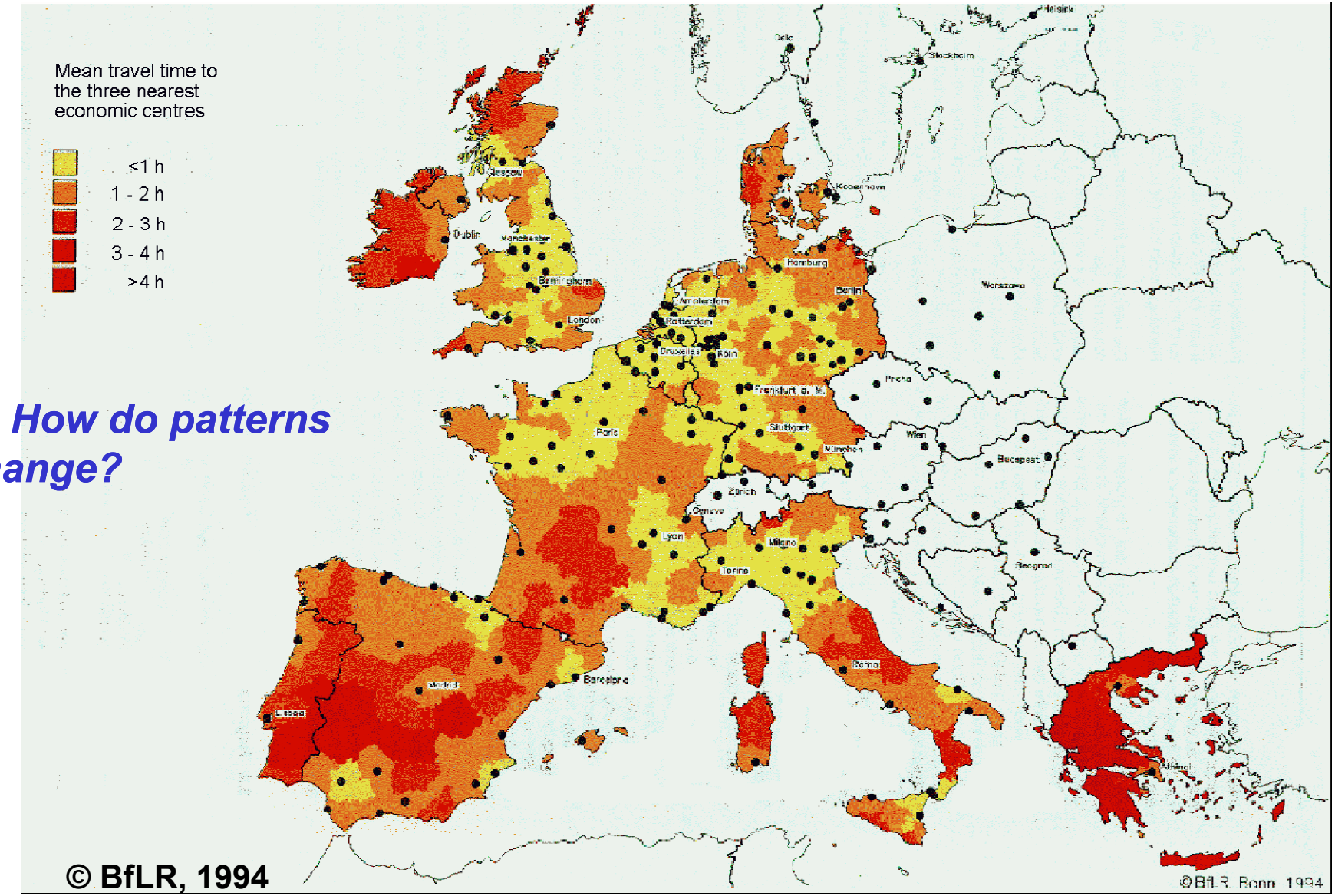
Q2: Presentation



Accessibility (ESPON Space = 100)

	0 < 20
	20 < 40
	40 < 60
	60 < 80
	80 < 100
	100 < 120
	120 < 140
	140 < 160
	160 < 180
	180 < ...

Ex. 2: Mean Travel Times to Nearest Centres



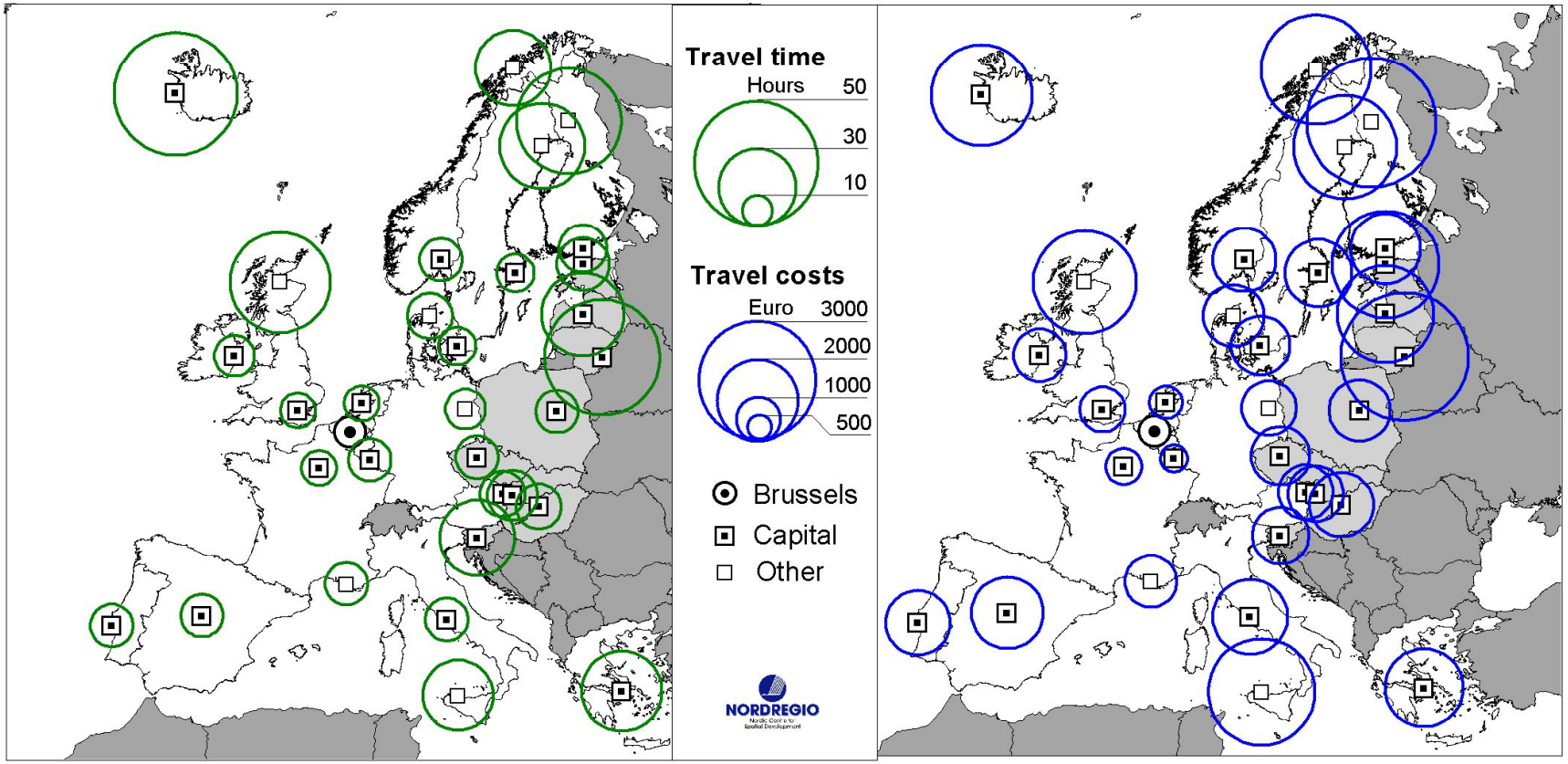
Q: How do patterns change?

© BfLR, 1994

Ex. 3: Travel Time and Costs for a Trip to Brussels

Q1: Type of Indicator

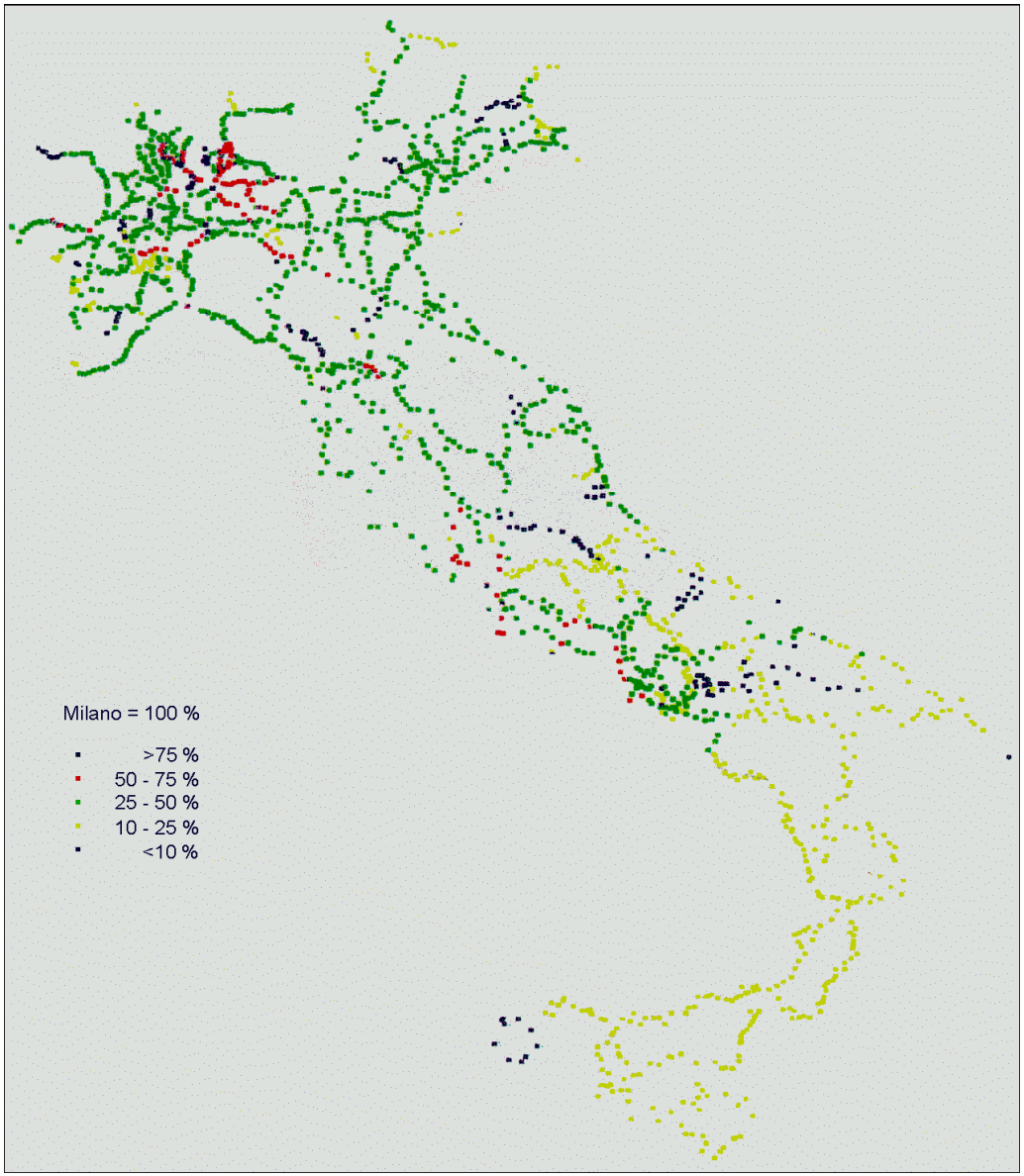
Q2: How are the indicators presented?



Ex. 4: Population Potential at Train Stations

Q1: Selection of origins

Q2: Standardisation

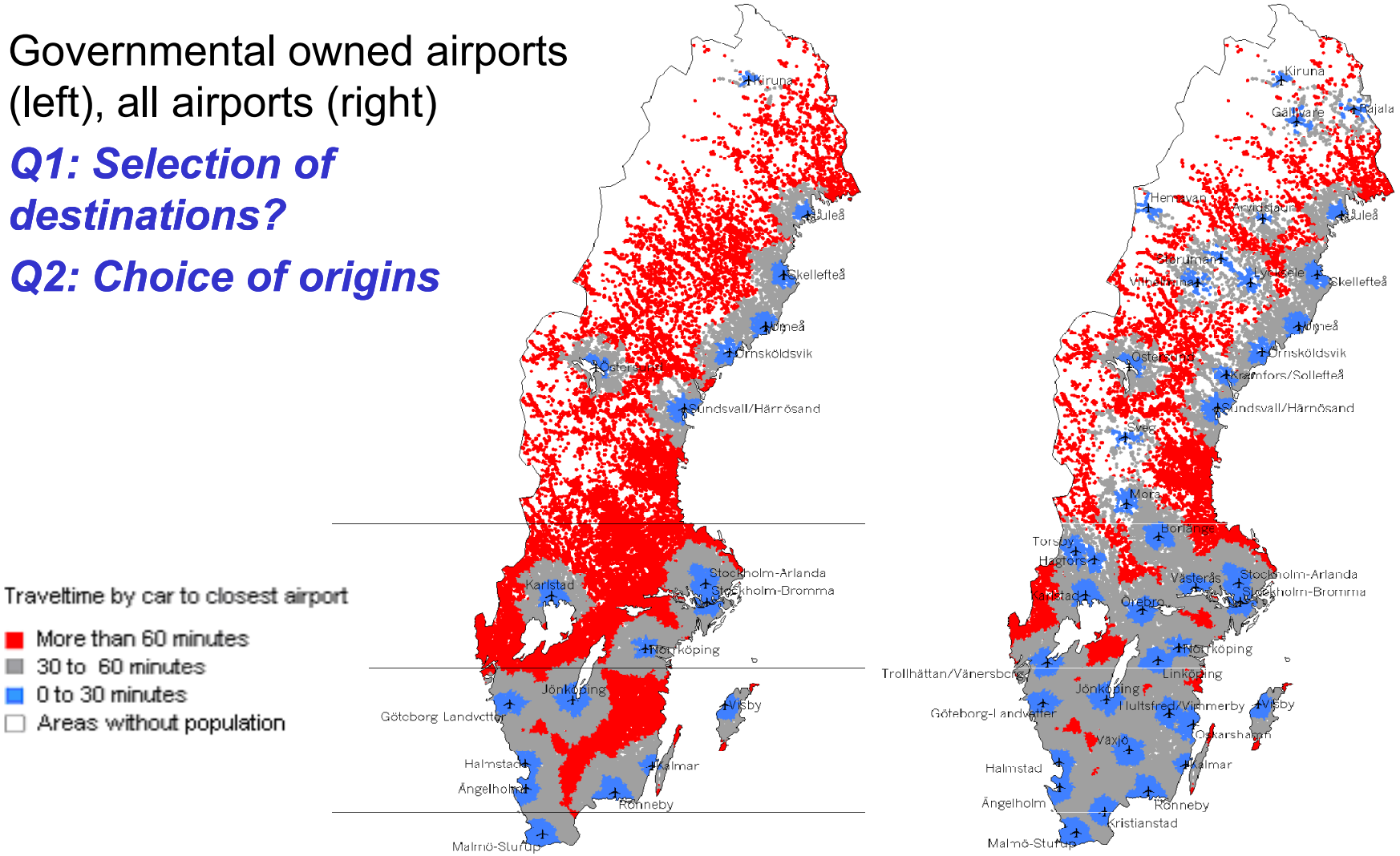


Ex. 5: Travel Time by Car to Swedish Airports

Governmental owned airports (left), all airports (right)

Q1: Selection of destinations?

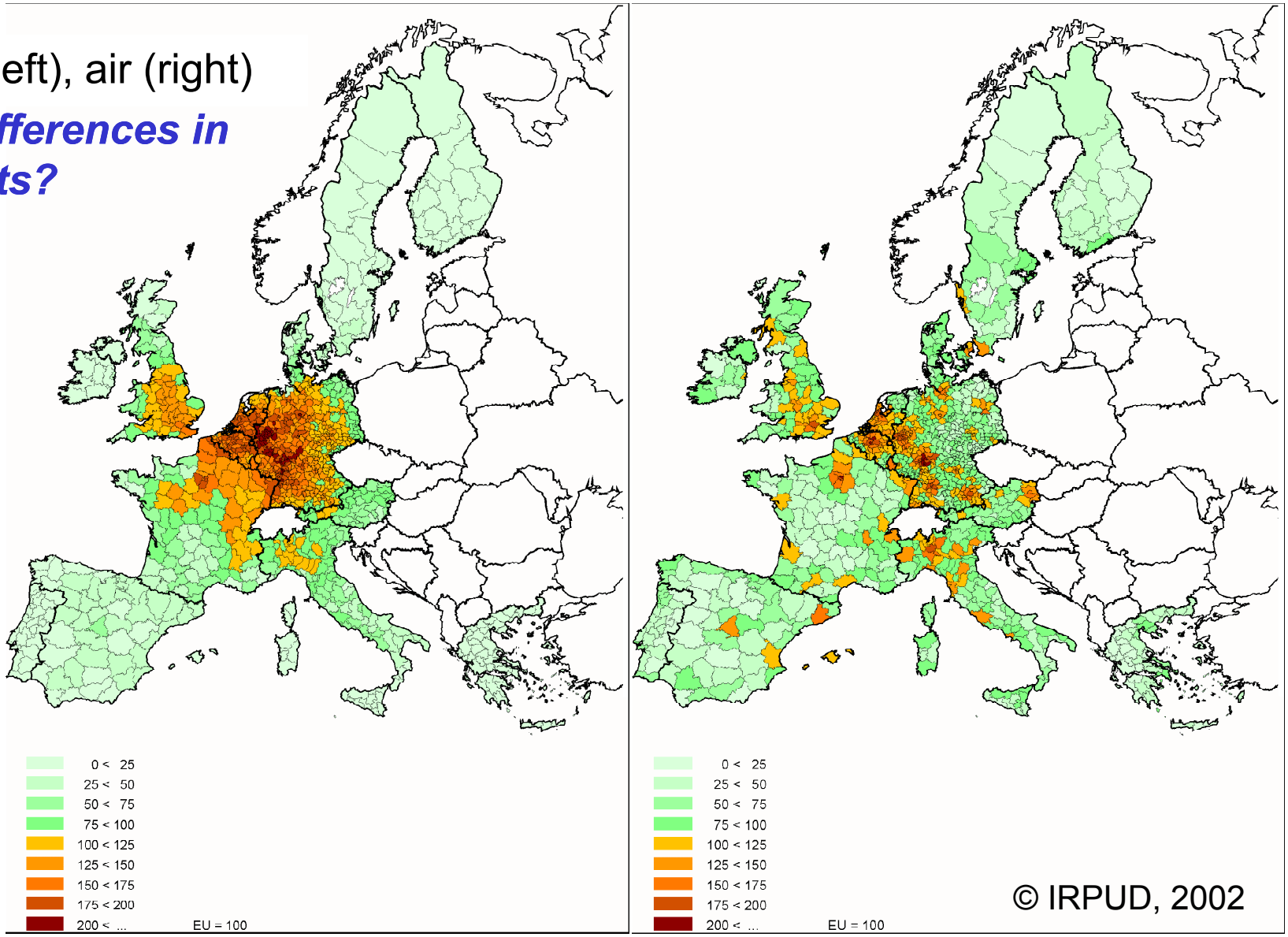
Q2: Choice of origins



Ex. 6: Potential Accessibility by Different Modes

Rail (left), air (right)

Q: Differences in results?

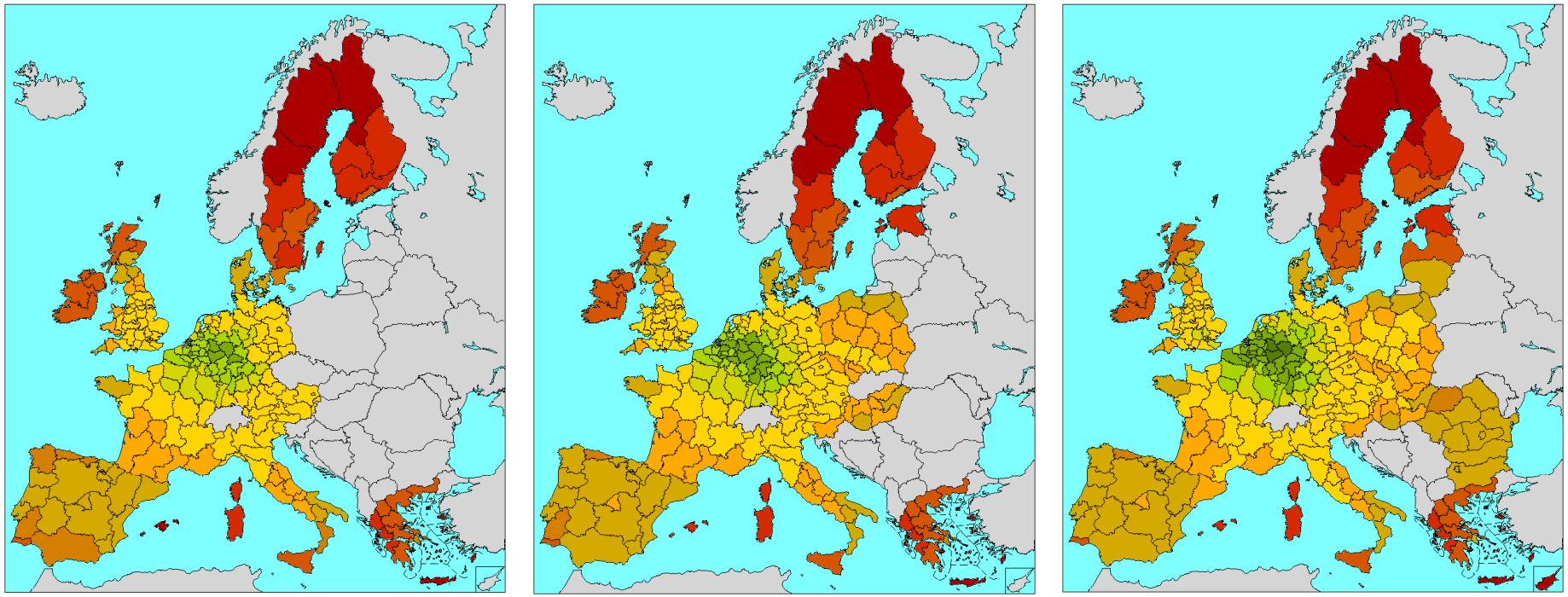


Ex. 7: Potential Accessibility to Population (Car)

EU 15 (left), EU15+5 (middle), EU15+12

Q1: What is the spatial scope of the maps?

Q2: How do the average numbers change?



Ex. 8: Daily Accessibility by Rail

Absolute numbers 1993 (left), absolute change 1993-2010 (right)

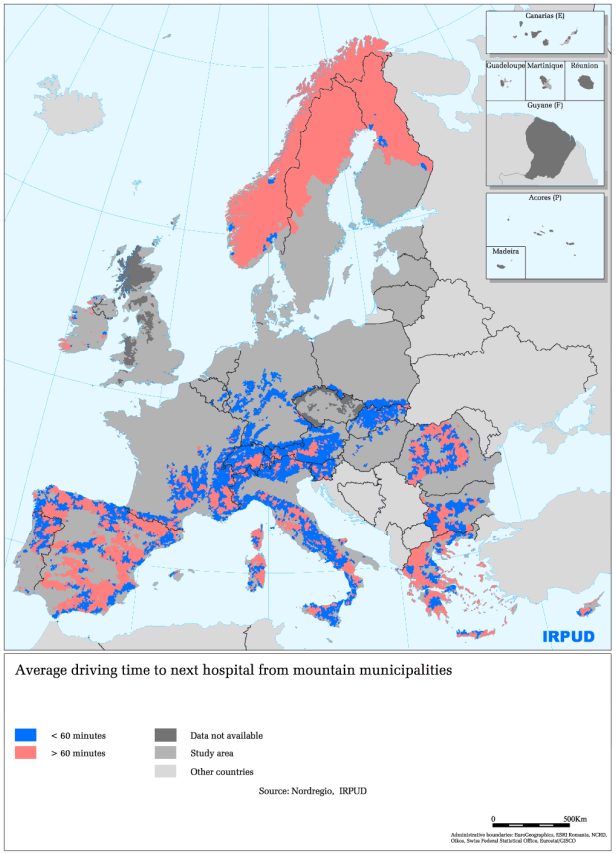
Q1: What are the (dis-)advantages of this type of illustrations?

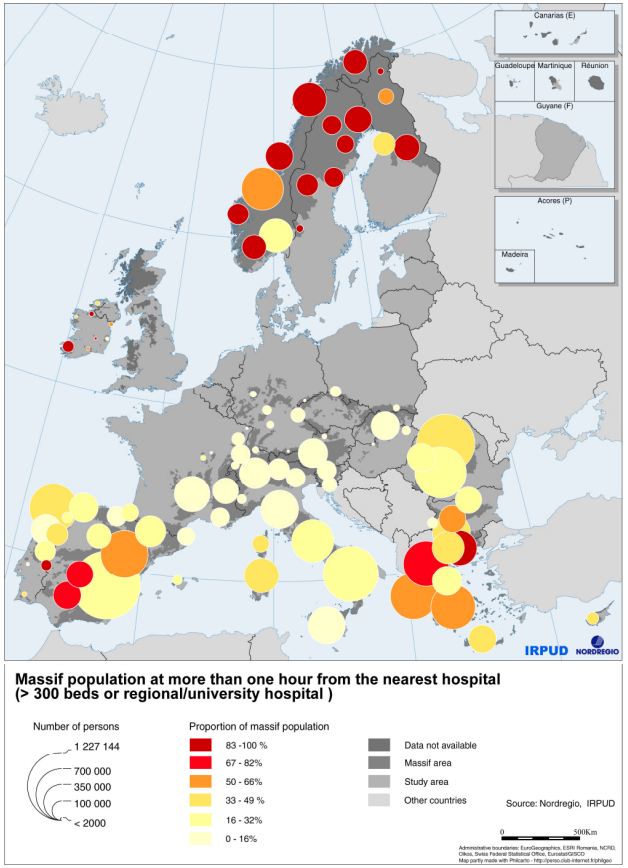
Q2: How are the changes visualised and how are they to be interpreted?

Ex. 9: From Travel Time to Indicator

Driving time to hospitals (left), proportion of massif population >60 min from hospital (right)

Q1: What is an indicator, what is just an illustration?





Part 5.

Needed Base Data

Conclusions

Projects Applying Accessibility Indicators

Data Needs

- ***Transport networks*** (road, rail, air, waterways, public transport)
- ***Region boundaries***, boundaries of other spatial entities
- ***Public infrastructure*** (ITC, universities, hospitals, …) including relevant statistical data
- ***Regional data*** (population, GDP), or similar data for other spatial entities.
- ***Additional data*** used for model refinements (e.g. barriers, border waiting times, check-in times, speed limits, capacity restrictions)

The level of detail for all these data depend on the particular application/project.

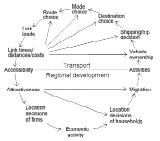
Conclusions (I)

- ***No common definition*** of accessibility indicators
- Not only one accessibility indicator, but there is a ***variety of accessibility indicators*** used
- ***Different indicators*** are used for ***different questions***
- Indicators can be ***adjusted*** to specific questions

- ***Choice*** of indicator becomes a ***matter of concern***
- Danger to use ‚***wrong indicator***‘ (by chance, by intention)
- Indicator results must be ***interpreted carefully***
- Need to ***embed*** indicators in overall ***analysis framework***

Conclusions (II)

- Can be used in a ***variety of applications***, from ***local scale to European scale***
- Are ***widely used*** in many publications



- Represent ***important interface*** between the ***transport system*** and ***regional development***
- Deserve ***growing importance*** in the EU in the discussion of territorial cohesion
- Sometimes ***analysis framework poorly developed***
- ***Convergence in accessibility*** often ***misunderstood*** as ***convergence in economic*** situation

Relevant Projects – Interesting Links (Examples) (I)

- ***ESPON*** 1.1.1, 1.2.1, 1.2.2 and 2.1.1
  www.espon.lu
- ***Study Programme on European Spatial Planning***
- ***SASI***, ***IASON*** (EC R&D Programs)
  www.raumplanung.uni-dortmund.de/irpud/pro/sasi/sasi.htm
  www.wt.tno.nl/iason/
- ***Peripherality Study*** (DG Regio)
  europa.eu.int/comm/regional_policy/sources/docgener/studies/study_de.htm
- ***Mountain Areas in Europe*** (DG Regio)
  www.nordregio.se
- ***Study on the Islands and Outermost Regions*** (DG Regio)
- ***VASAB 2010+*** (Interreg II C Project)
  www.vasab.org.pl

Relevant Projects – Interesting Links (Examples) (II)

- ***Urban Audit*** (DG Regio)
  europa.eu.int/comm/regional_policy/urban2/urban/audit/src/intro.html
- ***GEMACA II*** (Interreg II C Project)
  www.iaurif.org/en/projects/networking/gemaca/gemaca.htm
- ***TEN_STAC*** (DG TREN)
  www.nea.nl/ten-stac/
- ***Northern Peripheral, Sparsely Populated Regions in the EU*** (Nordregio)
  www.nordregio.se
- ***AsPIRE – Aspatial Peripherality*** (EC FP5 Program)
  www1.sac.ac.uk/management/External/Projects/AspireExternal/Default.asp
- ***Las regiones ultraperiféricas de la Unión Europea: Análisis de ultraperificidad*** (MCRIT)
  www.mcrit.com/rup/

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