

NECTAR Joint Cluster 1 and Cluster 2 International Workshop
Transport infrastructures: Investments, Evaluation and Regional Economic Growth
 22-23 March 2019, Rome, Italy

Potential accessibility and multimodal approach to evaluation and monitoring of road, railway, air and water inland development in Poland

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Accessibility and mobility studies – team experience

- Long-term cooperation with **Ministry of Development** (more than 20 projects and expertises)
- **National Science Centre** grants (more than 10 projects)
- **ESPON** projects (TRACC, SeGI and other)





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Purpose and content of the presentation

- Purpose – presentation of the **results of a monitoring study of the changes in road, railway, air and water inland accessibility** in Poland over time, in the years **2004-2023**.
- Monitoring is in the form of:
 - **ex post** and **ex ante** evaluation
 - **road and railway infrastructure** development
 - **airports** capacity
 - **water inland** investments
 - three long-term budget periods after the accession of Poland to the EU:
 - 2004-2006;
 - 2007-2013;
 - 2014-2020 (+3).
- Research takes into account both:
 - **changes in accessibility** (since 2004) as a proxy of **efficiency**,
 - **changes in the spatial differentiation** as a proxy of **equity** (cohesion) over time, both indicators updated at **two-year intervals**.

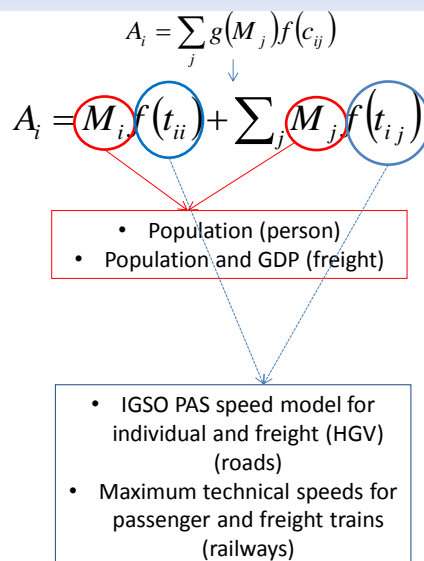
Additional few slides - Results of a new project **EU-ROAD-ACC** (**EUropean ROAD ACCessibility**)



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Methodology

- Both **person and freight transport** get attention.
- The monitoring is based on the:
 - **potential accessibility model** (Spiekermann *et al.* 2015, Geurs and van Eck 2001),
 - integrated infrastructure **investments database** (transport component),
 - **population and GDP data** as proxies of destination attractiveness (land-use component).



Methodology

- Database of thousands of infrastructure projects including EU-funded investments.
- Population and disaggregated estimated GDP data from subregional to municipal level (2321 transport units)

$$A_i = \sum_j g(M_j) f(c_{ij})$$

$$A_i = M_i f(t_{ii}) + \sum_j M_j f(t_{ij})$$

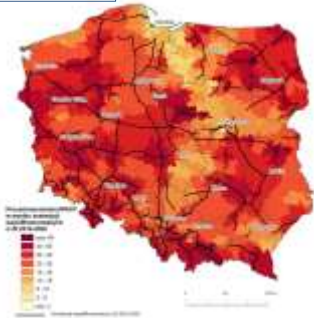
$$f(c_{ij}) = \exp(-\beta t_{ij}), \beta = 0,023105$$

2321 transport nodes (municipal level)

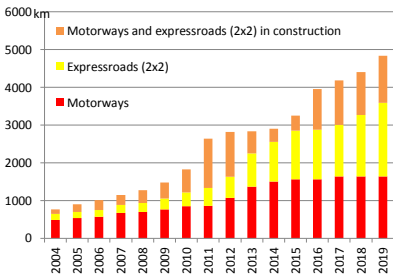
Potential accessibility MAI indicators for passenger and freight transport and synthetic indicators (modal and multimodal ones) calculated

Transport mode	Passenger transport	Freight transport	Modal synthetic indicator	Multimodal synthetic indicator
Road	Passenger RoAI	Freight RoAI	RoAI	
Railway	Passenger RaAI	Freight RaAI	RaAI	
Air	AAI			
Inland shipping		WAI		
Synthetic indicator	Passenger MAI	Freight MAI		Synthetic MAI

Project database: Railway investments in Poland (EU co-funded) 2014-2020



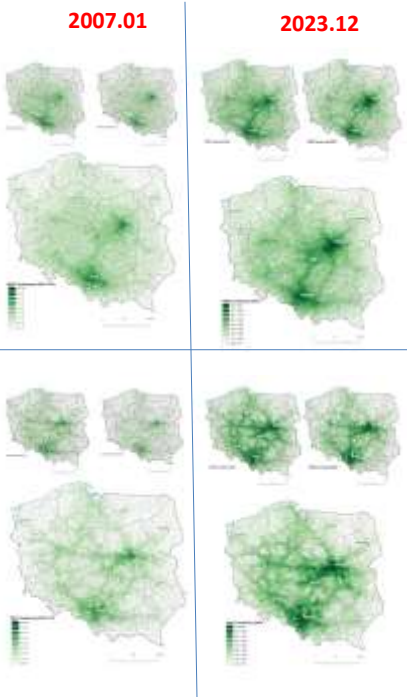
Accessibility level (2007.01 vs 2023.12)



- Infrastructure development = big push to roads, railways and accessibility

Road acc.

Railway acc.





<http://ssc.siskom.waw.pl/>



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Potential Accessibility Dispersion index

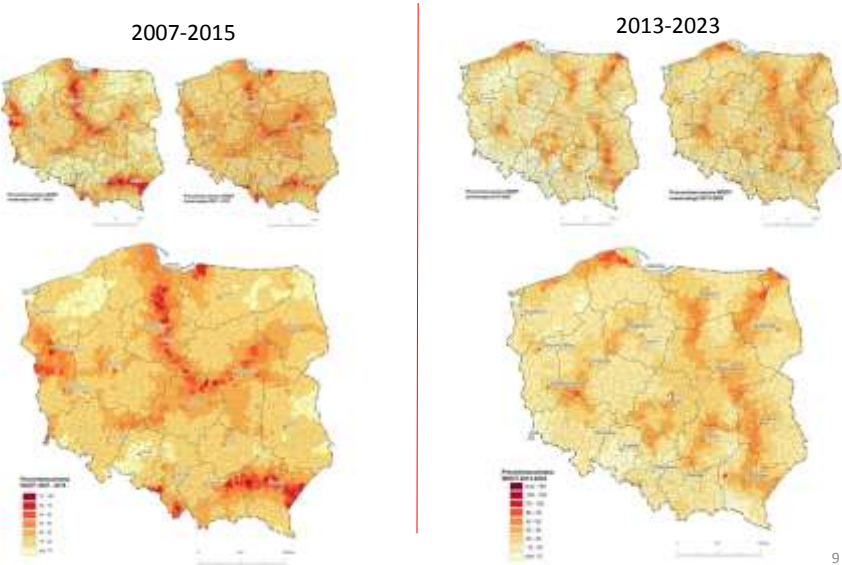
- Consequences of changes in accessibility for territorial cohesion - **Potential Accessibility Dispersion (PAD)** index.
- **PAD** takes into account the **standard deviation of potential accessibility values** across municipalities using population as the weighting variable (López *et al.*, 2008; Ortega *et al.*, 2012; Stępnia and Rosik, 2013; Rosik *et al.*, 2015).

$$PAD = \frac{SD_{A_i}}{\frac{\sum A_i * P_i}{\sum P_i}}$$

A_i is the value of the potential accessibility indicator calculated for unit i ,
 P_i is the population of unit i ,
 SD_{A_i} is the standard deviation of A_i values weighted by population.

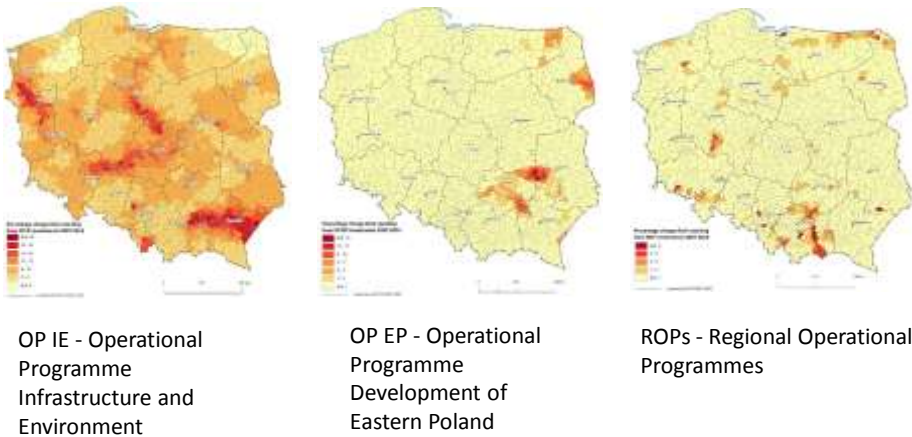
The higher the PAD values, the greater the diversity of accessibility within the country

Relative road accessibility changes at the municipal level



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Net effects of accessibility changes resulting from the implementation of investments co-financed under the individual operational programmes, i.e. OP IE, OP EP and ROPs (2007-2013)

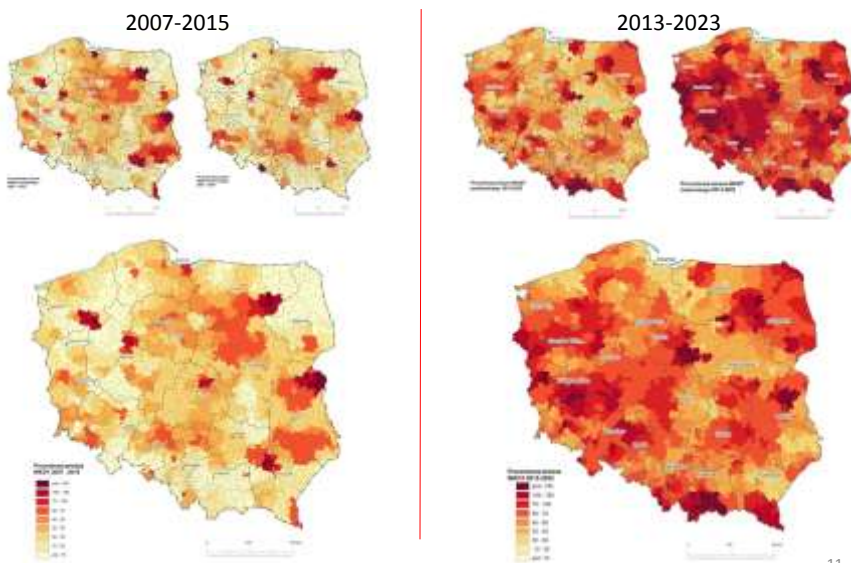


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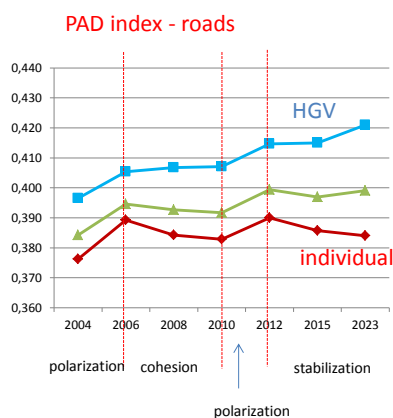
Relative rail accessibility changes at the municipal level



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Results – road accessibility and cohesion until 2023

- After the accession to the EU the regional disparities in accessibility have increased.
- Trend break and the situation started to slightly improve after 2012.
- Freight accessibility is getting more polarized pattern due to:
 - GDP concentration,
 - Lower HGV speeds (relative to individual) on motorways (smaller impact on periphery)



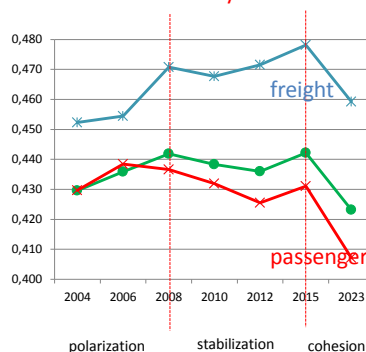


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Results – railway accessibility and cohesion until 2023

- Railway network **at the moment of accession to the EU** was heavily degraded and outdated.
- **Differences in accessibility level** between central and peripheral regions **grew**, in particular for freight transport.
 - degradation of **freight lines located peripherally** progressed much faster than degradation of lines connecting major conurbations dedicated primarily to passenger transport.
- **Disparities** should be reduced within the programming period 2014-2023
 - planned improvement and reactivation of many regional railway lines in remote areas.

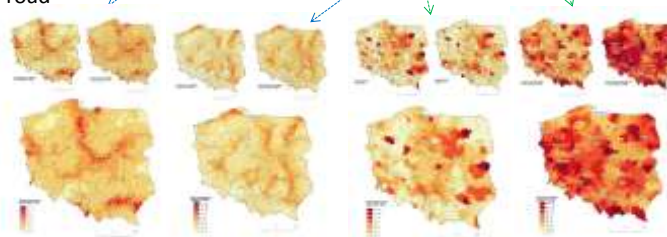
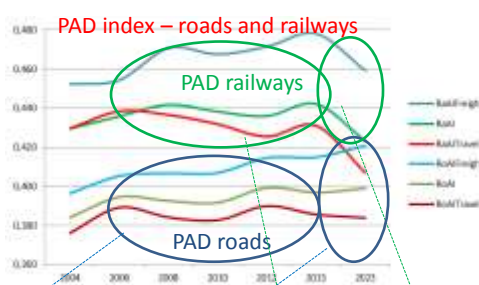
PAD index - railways

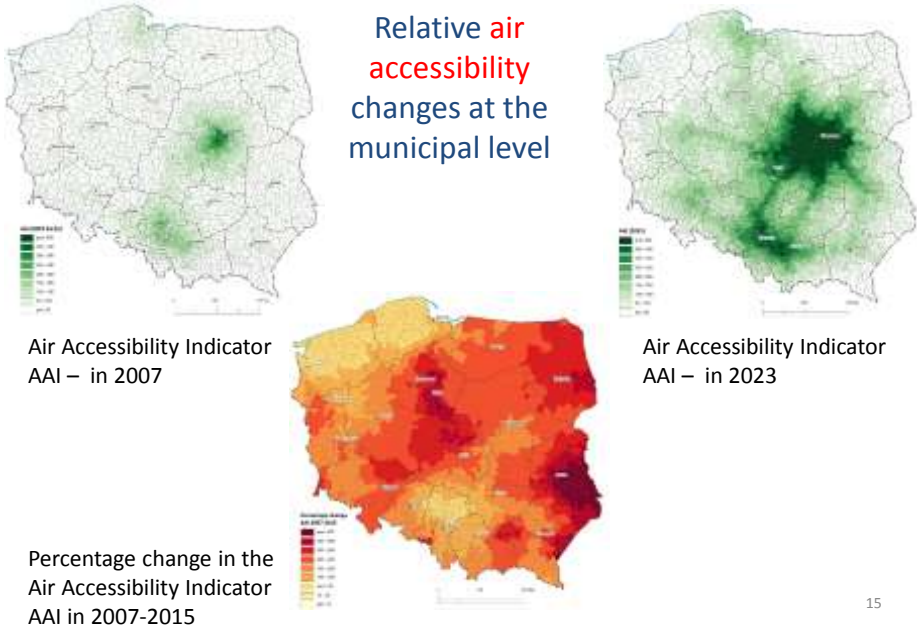


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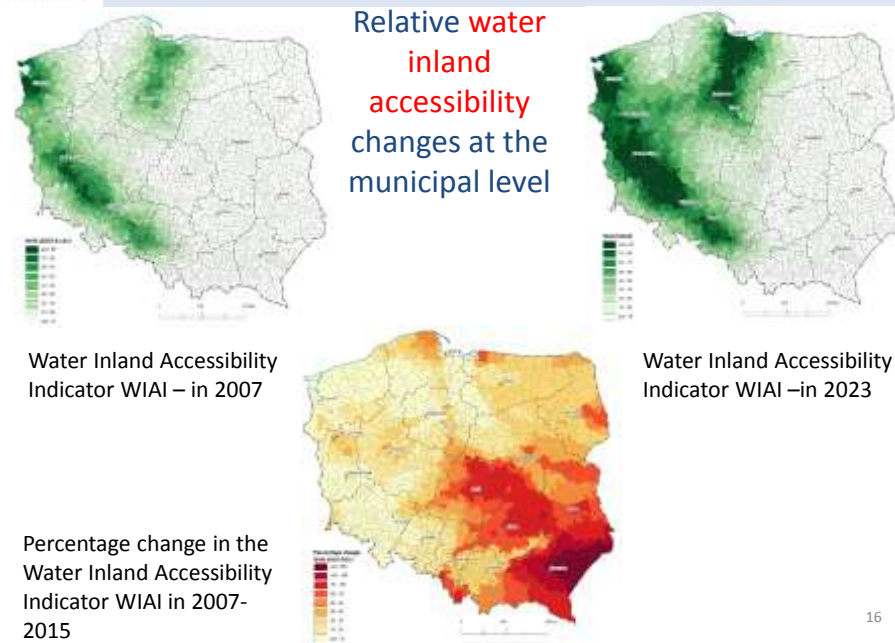
Conclusions and results – road and railway accessibility and cohesion

- Railway network density is not as high as road network - **accessibility disparities are higher for railways.**
- Spatial distribution of investments until **2023** gives **hope for further improvement** in terms of **territorial cohesion**
- **Cohesion impact of railway development is likely to be more positive** than the road development





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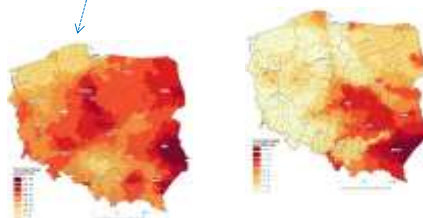
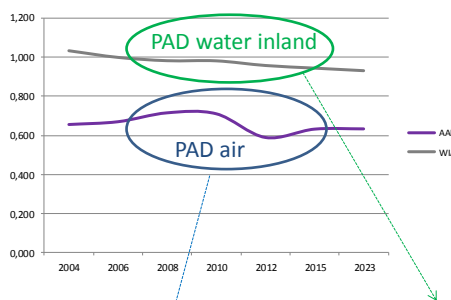


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Conclusions and results – air and water inland accessibility and cohesion

- Air and inland water transport exhibit much higher differences than road and railway transport.
- Thanks to the development of regional airports (in particular 2010-2012) and improving road access to them, a decrease of disproportions occurred.
- However, large investments in airports in Warsaw and Cracow in 2012-2015 result in a reversal of this positive in terms of cohesion trend.
- Until 2023, the lack of larger investments results in maintaining relatively high regional accessibility differences in air transport
- Situation improves in inland water. However, only a very small section of the country may realistically benefit from services provided by this transport mode

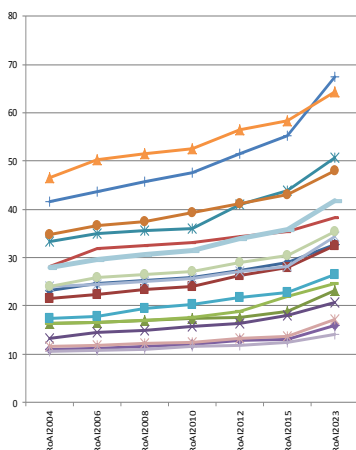
PAD index – air and water inland



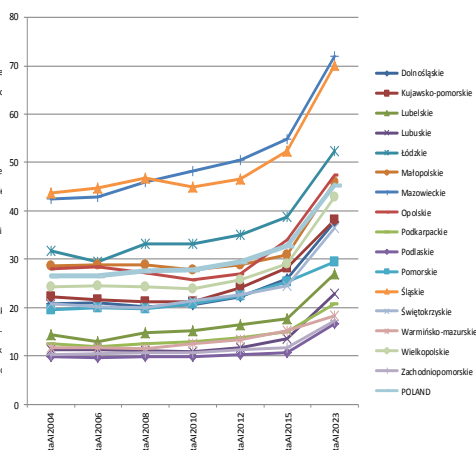
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Road and railway accessibility monitoring (NUTS2; 2004-2023)

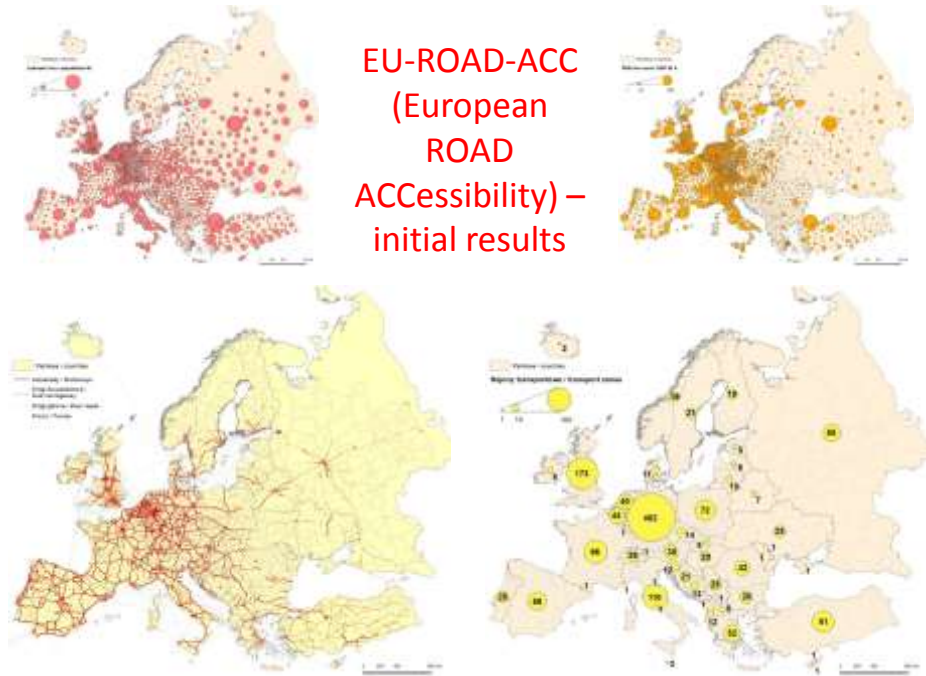
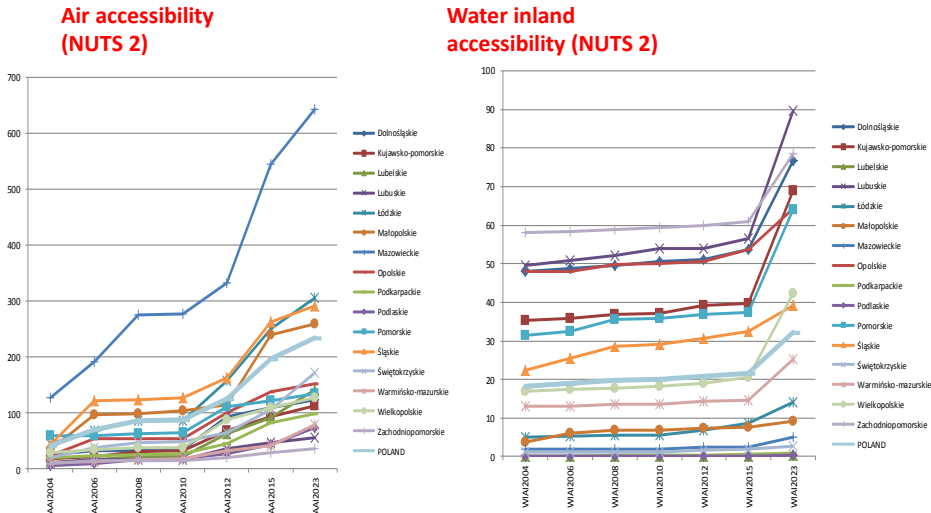
Road accessibility (NUTS 2)

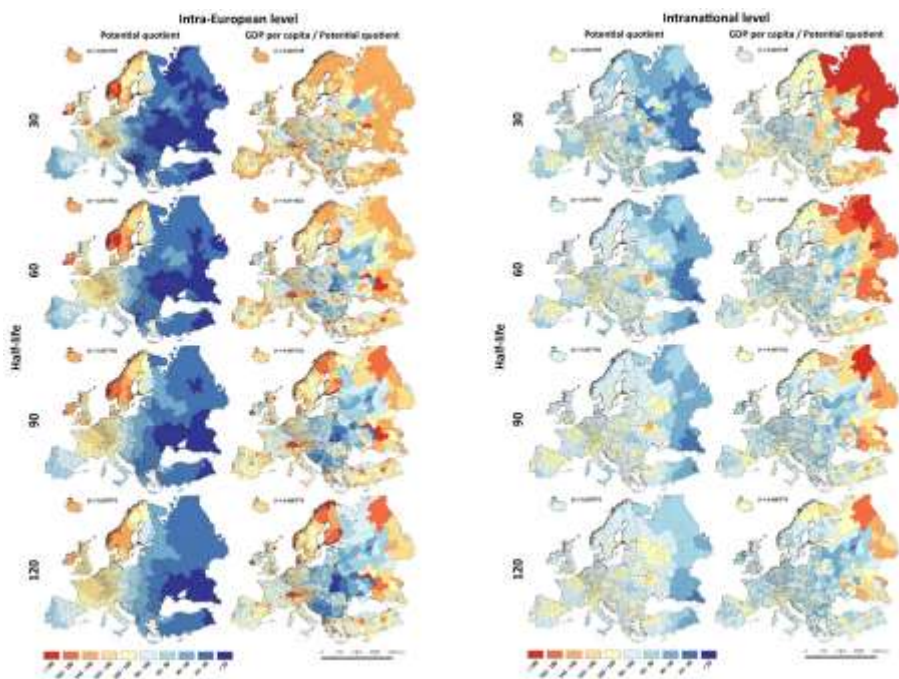


Railway accessibility (NUTS 2)

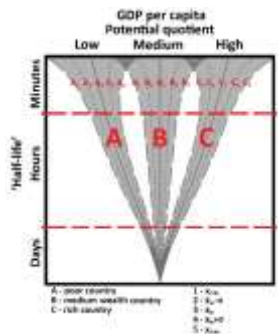


Air and water inland accessibility monitoring (NUTS2; 2004-2023)

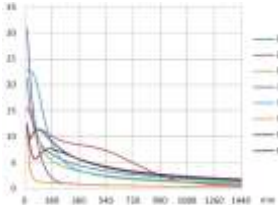




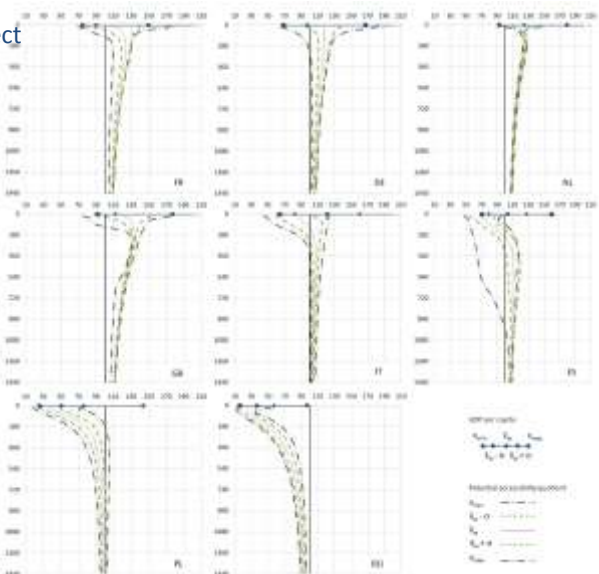
Distance-Decay tornado effect



Distance-decay tornado effect. Bundles of the potential quotient for regions in the poor country (A), medium income country (B) and rich country (C) resulting from the lengthening the CATCH-time (half-life)

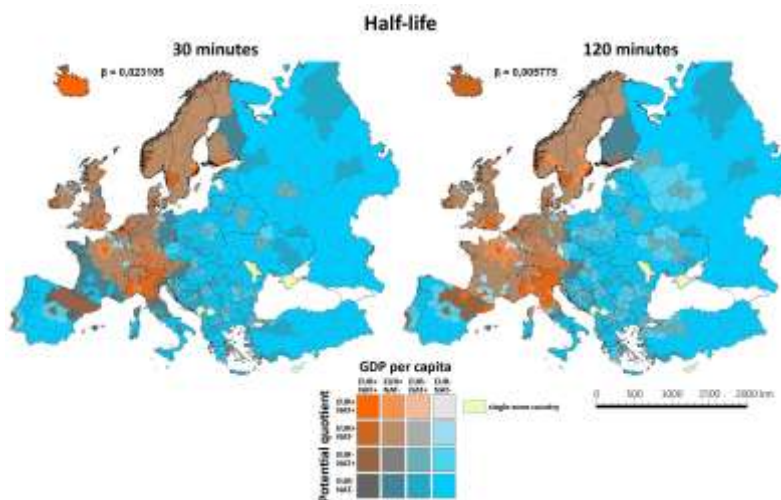


Population-weighted standard deviation of potential quotient depending on the CATCH-time (half-life) values for eight most populous EU member states. Intra-European dimension



Distance-decay 'tornado effect' on reducing regional disparities in intra-European potential accessibility quotient for eight most populous EU member states (CATCH-time (half-life) ranging from 0 to 24h)

Typology – where is Rome?



Typology of regions in Europe depending on the relations* between GDP *per capita* and potential quotient at the intra-European (EUR) and intranational (NAT) level for the CATCH-time (half-life) values of 30 and 120 minutes in 2015

*For GDP *per capita* EUR +/- and NAT +/- means the value above/below respectively intra-European and intranational average; for potential quotient EUR +/- and NAT +/- means the surplus/shortage of economic potential relative to population potential respectively at the intra-European and intranational level



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Thank you for your attention

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