Regional Indicators

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- Projects:
  - "Potentials and barriers of knowledge and technology transfer using the example of the innovation system Thuringia"
  - "Building African capacities for the development of clusters"

- Teaching:
  - Basics of Microeconomics
  - Basics of Innovation Economics
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- Research Interests:
  - Economics of Innovation
  - Knowledge and Technology Transfer
  - Regional Economics

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Learning objectives of this course

After this course you will know, …

- how to define regions and how to distinguish them from each other

- what indicators are, how they are created and which critical appraisal they require

- which are the most important regional indicators and how they are represented on different spatial perspectives

- what evidence can be found in the literature regarding the role of regional indicators and their impact on regional growth

Outline

Part I	What is a region and how can we characterize them?
Part II	What is an indicator and why do we need it?
Part III	Regional indicators and their impact on regional growth

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Part I	What is a region and how can we characterize them?
Part II	What is an indicator and why do we need it?
Part III	Regional indicators and their impact on regional growth

1. Why is the spatial perspective important
2. Defining regions
3. Characterizing regions

Why is the spatial perspective important?

- All our actions have a spatial dimension
- The importance of space or the region-specific conditions are reflected in regional differences in living conditions and economic activities

  → regional disparities

Empirical regional research

- Basis for regional forecasting as well as measures of spatial planning policy

Defining regions

- Sub-area of an overall space, the demarcation of which is based on the administrative, homogeneity or functional principle

- Choice of the principle depends on the question and the objective of the regional study

→ Region is a varying concept, which defines regions depending on the question of an investigation
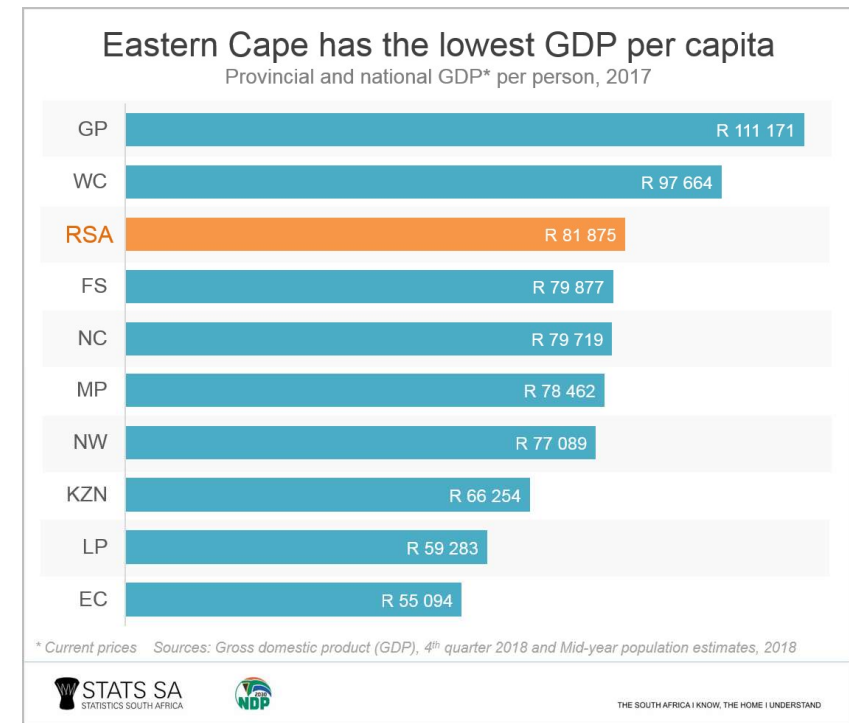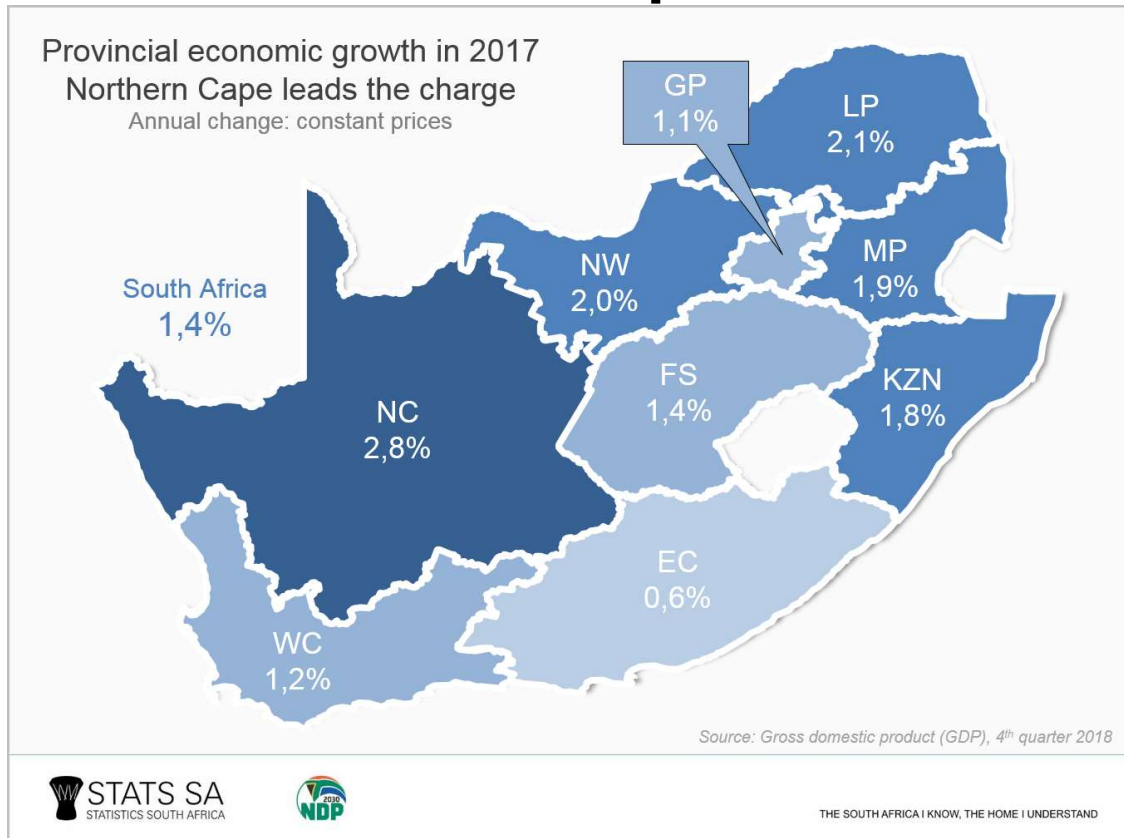
Administrative principle

- Region is an administrative unit:
  - Advantage: data availability
  - Disadvantage: separation of contiguous economic areas

- Examples:
  - Provinces of South Africa
  - NUTS classification by the European Union

NUTS classification by the European Union

- NUTS (Nomenclature of territorial units for statistics) is a system for dividing up the economic territory of the EU and the UK

- Purpose:
  - Collection, development and harmonisation of European regional statistics
  - Socio-economic analyses of the regions
  - Framing of EU regional policies

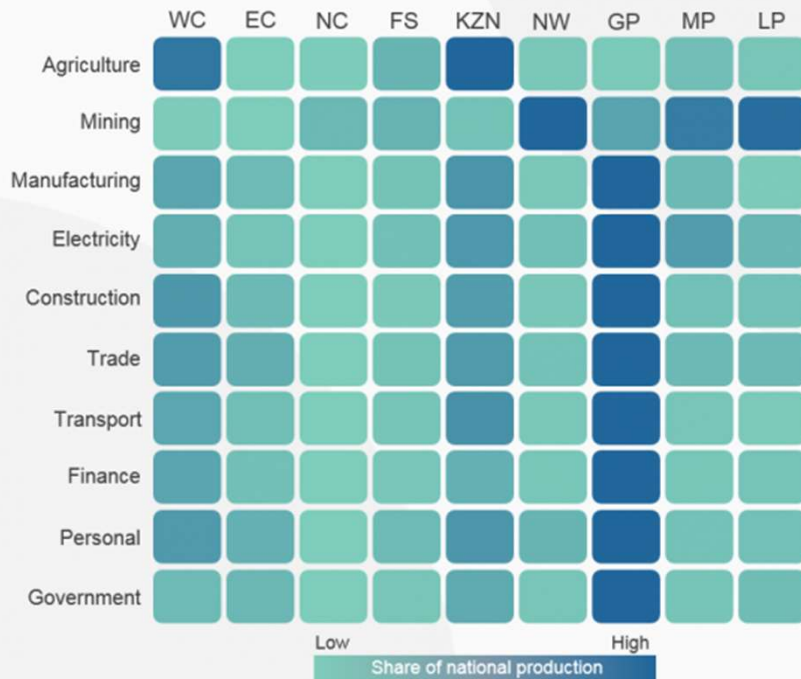|			
NUTS 1	92 regions	3 million - 7 million	major socio-economic regions
NUTS 2	242 regions	800.000 - 3 million	basic regions for the application of regional policies
NUTS 3	1.166 regions	150.000 - 800.000	small regions for specific diagnoses

GDP growth rate and GDP per Person South African provinces in 2017

Provincial economic growth in 2017
Northern Cape leads the charge
Annual change: constant prices

GP 1,1%
LP 2,1%
NW 2,0%
MP 1,9%
South Africa 1,4%
FS 1,4%
KZN 1,8%
NC 2,8%
EC 0,6%
WC 1,2%

Source: Gross domestic product (GDP), 4th quarter 2018

THE SOUTH AFRICA I KNOW, THE HOME I UNDERSTAND

Eastern Cape has the lowest GDP per capita
Provincial and national GDP* per person, 2017

GP	R 111 171
WC	R 97 664
RSA	R 81 875
FS	R 79 877
NC	R 79 719
MP	R 78 462
NW	R 77 089
KZN	R 66 254
LP	R 59 283
EC	R 55 094

* Current prices   Sources: Gross domestic product (GDP), 4th quarter 2018 and Mid-year population estimates, 2018

THE SOUTH AFRICA I KNOW, THE HOME I UNDERSTAND

Source: Department Statistics South Africa
Link

Source: Department Statistics South Africa
Link

Homogeneity principle

- Region is a grouping of sub-areas with largely similar structure
- Based on one indicator
    - GDP per inhabitant
    - Population density (inhabitants per square kilometer)
    - Industry density (employees of an industry per square kilometer)
    - …
- Based on a bunch of indicators
    - Cluster analysis: Analysis method that groups objects based on selected characteristics in such a way that the group members are as homogeneous as possible and the groups among themselves are as heterogeneous as possible

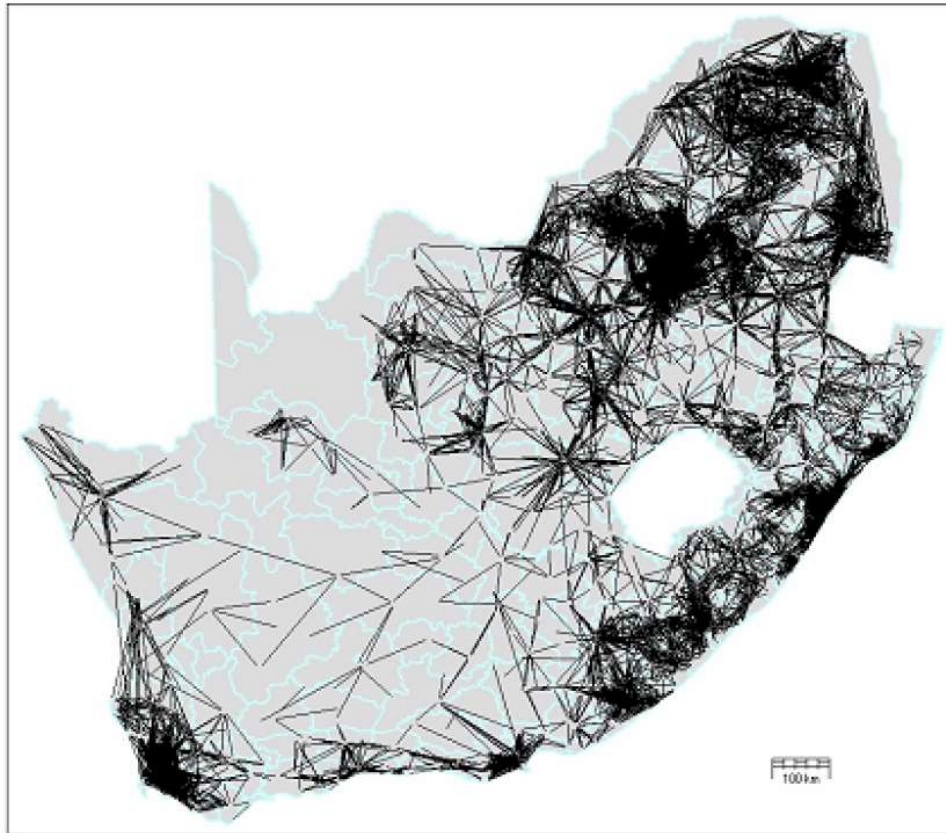# GDP per inhabitant
by NUTS-2 regions of European Union in 2019
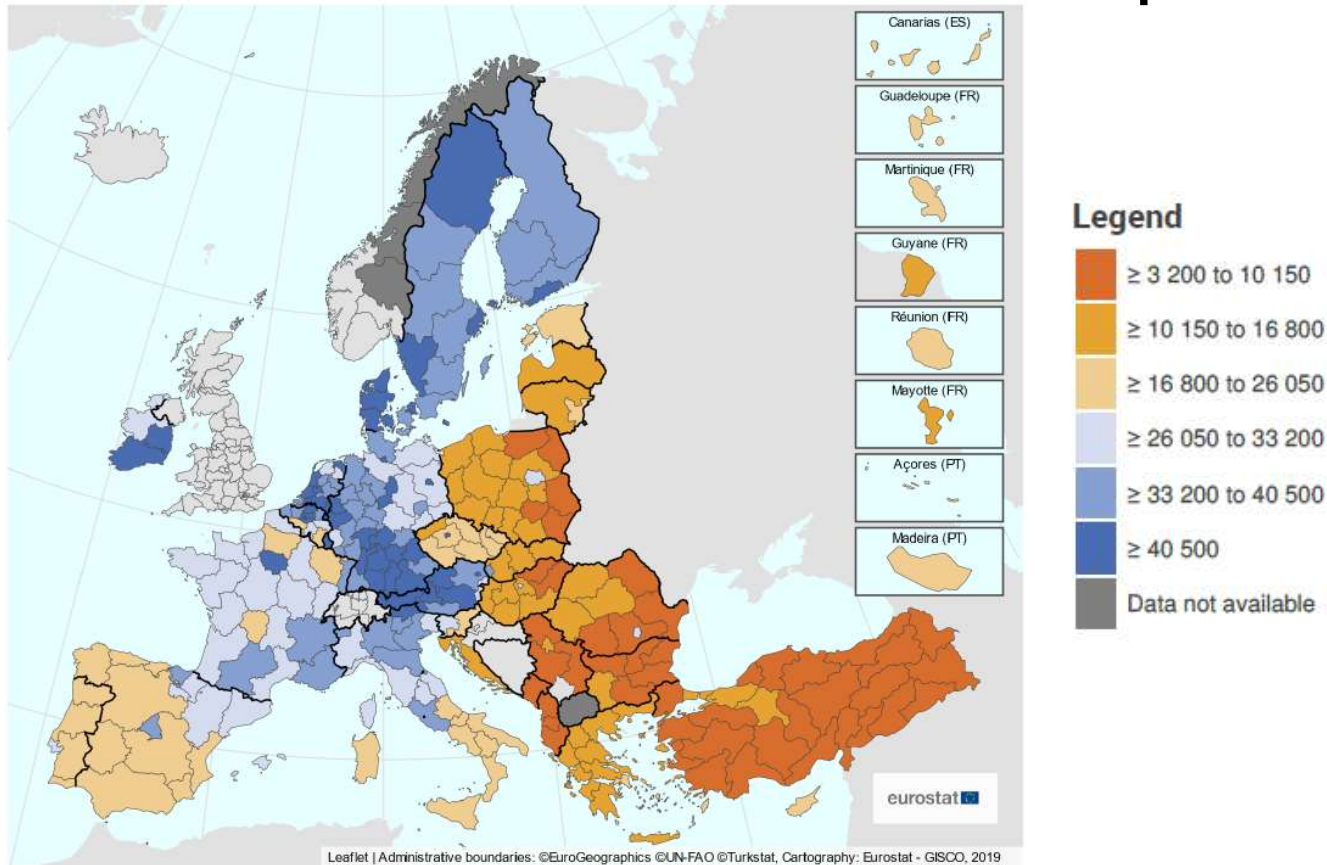
Source: Eurostat
Link

Functional principle

- Regions are delimited on the basis of interactions and interdependencies

- To capture center-periphery relationships
  - Commuting linkages

- Examples:
  - Labor market regions
  - Functional urban areas

Functional transport regions in South Africa

- Usage of national commuter data (journey-to-work data) from 2008
- Derivation functional transport areas based on passenger movements
- Reflects interdependencies between municipalities, indicating labour markets

Source: Krygsman et al. (2009)
Link

Functional urban areas of Germany

OECD defines functional urban areas across countries by key variables:

- Population density

- Travel-to-work flows

Characterizing Regions (1)

Hard and soft factors

- Hard: direct influence on cost and returns (natural resource endowments, percentage of people with higher education, etc.)

- Soft: non-economic nature (geographical landscape, culture, language/dialect, etc.)

Position of localized factors in the value chain

- Procurement-related: raw material endowments, energy, suppliers

- Production-related: work force, tax burden

- Sales-related: proximity to customers/competitors, quality of infrastructure

Characterizing Regions (2)

Localized and ubiquitous factors

- Localized: only in few areas (international airport, habors)

- Ubiquitous: available in (mostly) all areas (internet, housing, roads)

General and particular location factors

- General: tax rates, availability of building space and housing, cost and quality of work force

- Particular: geographical proximity to research organizations, international airports, natural resource deposits

What type of region is the Free State?

How would you characterize the Free State?

What are advantageous locational factors in the Free State?

Tips

- Identifiying groups (clusters) of homogeneous regions

→ Cluster Analysis

→ in R: [How to do cluster analysis in R](#)

→ in Stata: [How to do cluster analysis in Stata](#)

- Identifiying functional regions

References and further reading

- European Commission (2021): Statistical regions in the European Union and partner countries. Luxembourg: Publications Office of the European Union.

- Krygsman, S.; De Jong, T.; & Nel, J. (2009): Functional transport regions in South Africa : an examination of national commuter data. 28th Annual Southern African Transport Conference 2009.

- McCann, P. (2013): Modern Urban and Regional Economics. Oxford: Oxford University Press.

- OECD (2020): Delineating Functional Areas in All Territories, Paris: OECD Publishing.

- Paasi, A.; Harrison, J. & Jones, M. (2018): Handbook on the geographies of regions and territories. Cheltenham: Edward Elgar Publishing.

Outline

Part I	What is a region and how can we characterize them?
Part II	**What is an indicator and why do we need it?**
Part III	Regional indicators and their impact on regional growth

1. Function of indicators
2. Types of indicators
3. Critical appraisal

What is an indicator and why do we need it?

Scientific questions often are not subject to the concepts of statistics and therefore have to be put into a suitable form for empirical-statistical procedures

→ How to measure the issue of interest?

Measurement problem

- Constructs or concepts are often used to explain issues theoretically, but they are difficult to measure quantitatively
- e.g. human capital, entrepreneurial ecosystem

Purpose of the measurement

- To overcome these measurement problems we use indicators, which approximate the issue by assigning numbers
- → Operationalization of the issue of interest by latent variables (not directly observable)

Operationalization

- Quantitative access to the object of investigation
- For this, the questioner must find / develop a measurement method
- Requires the construction of indicators (numerical representation of empirical phenomena) for the actual measurement of the underlying issue

Types of indicator

- Individual indicator
  - Only one indicator is used to illustrate a phenomena
  - Each observation has one numerical value
  - Example: GDP, population

- Composite indicator
  - Mathematical combinations/aggregations of a set of sub-indicators
  - Individual indicators are compiled into a single index
  - measures multi-dimensional concepts (e.g. competitiveness, environmental quality) which cannot be captured by a single indicator
  - Based on theoretical framework
  - Selected, combined and weighted in a manner which reflects the dimensions or structure of the phenomena being measured

Composite indicator: Pros and Cons

Pros	Cons
Summarise complex or multi-dimensional issue	May send misleading, non-robust policy messages → Sensitivity analysis for robustness assessment
Can offer a rounded assessment of countries` or regions` perfomance	May invite stakeholders to draw simplistic conclusions → Consideration of sub-indicators
Enables judgments to be made on countries` or regions` efficiency	Increases the quantity of data needed
Can be used for benchmarking countries or regions of best performance	May ignore dimensions of performance that are not measurable

Composite indicator: Examples

- Environment
  - Environmental Sustainability Index (ESI) by the World Economic Forum
- Society
  - Human Development Index (HDI) by the United Nations
- Economy
  - Index of Economic Freedom by the Heritage Foundation
- Innovation and Technology
  - European/Regional Innovation Scoreboard (EIS/RIS) by the European Commission
- Globalization
  - Global Competitive Index (GCR) by the World Economic Forum

Critical appraisal

- Different single indicators to evaluate the same underlying question

GDP or GDP per person?

→ Can cause different evaluations regarding the health of the economy

- Implementation of different indicators to capture the same phenomena via a composite indicator

Which indicators are necessary to capture an innovative region?

→ Can cause different approaches of measurement

- Application of different weights to the selected sub-indices

→ Already slight changes can cause a new representation of the phenomenon and   might change the assignment of observation units to performance groups

Always be cautious with indicators and question them critically!

Which other composite indicators do you know?

Are there any often used composite indicators in your field of study/research?

References and further reading

- Saisana, M. & Tarantola, S. (2009): State-of-the-art report on current methodologies and practices for composite indicator development. Institute for the Protection and Security of the Citizen (Joint Research Centre) [Link](#)

Outline

Part I	What is a region and how can we characterize them?
Part II	What is an indicator and why do we need it?
Part III	**Regional indicators and their impact on regional growth**

1. Infrastructure and regional growth
2. Institutions and regional growth
3. Human capital and regional growth
4. Innovations and regions
5. Entrepreneurship and regions

Infrastructure and regional growth

Infrastructure: Meaning

- Expression comes from military terminology which refers to all important facilities, resources and related logistics to be able to be militarily active

- Economic understanding: All basic facilities necessary for economic and social activity

- Main characteristics of infrastructure:
  - Capital-intensive
  - Often provided by state
 - Mostly immobile

Infrastructure spending gap among countries

Economic infrastructure, % of GDP

	Actual infrastructure spending, 2010–15	Gap between spending and estimated infrastructure needs, 2017–35
China	8.3	−2.5
India	5.6	0.7
Saudi Arabia	5.1	−0.2
South Africa	4.7	0.6
Australia	4.4	−1.0
Russia	4.0	−0.3
Turkey	3.7	0.3
Canada	3.4	−0.2
Indonesia	3.4	1.2
Japan	3.2	−1.0
Mexico	2.5	1.3
United States	2.3	0.5
Brazil	2.3	1.1
Italy	2.3	0.2
France	2.2	−0.1
United Kingdom	2.1	0.5
Germany	2.1	0.5

Source: McKinsey
Link

Infrastructure: Classification I

- Core infrastructure
  - Public capital which is particularly important for economic activity

- Social infrastructure
  - Public capital which constitutes social services
  - Health, education, social welfare, fire protection, public safety, recreation, culture

Infrastructure: Classification II

Water, energy, solid waste	Development
Supply electricity and gas	Provision of industrial real estate
Water management	Pest control
Solid waste management	Erosion protection
…	…
Transport	**Communication**
Streets, bridges, tunnels	Telephone network
Railway network	Postal services
Airports	Television and radio transimission
Channels and harbours	Broadband supply
…	…

Motorway network
by NUTS 2 regions in 2018 (km per 1.000 km²)
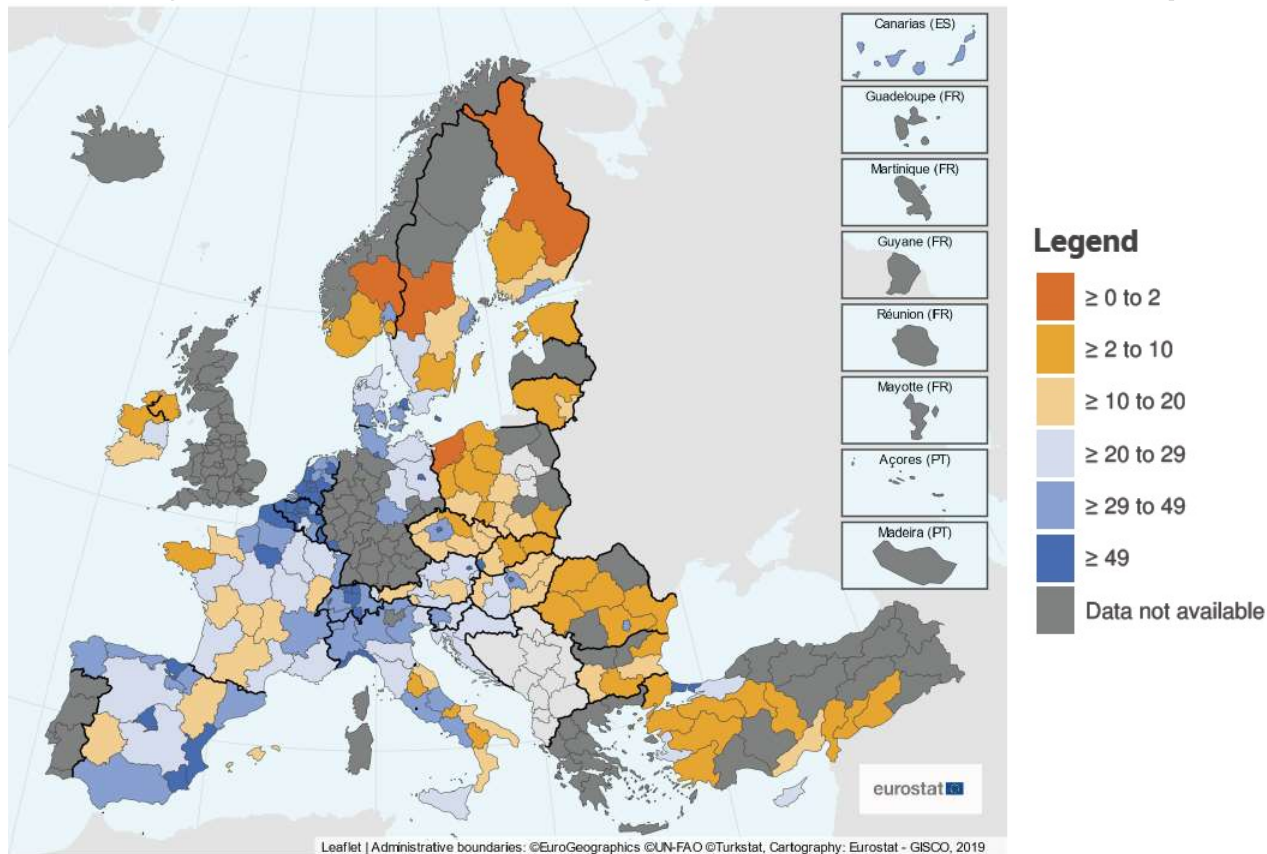
Source:
Eurostat
Link

Infrastructure: Impact on growth

- Lack of physical infrastructure can be a barrier to regional development

- However, oversupply of physical infrastructure in weak regions does not necessarily lead to regional growth ("traffic lights do not produce traffic")

- No clear evidence regarding relationship between public infrastructure investments and economic growth, but with majority finding a positive relationship (Timilsina et al. 2020)

- Still open question, whether infrastructure induces growth or does growth induce investments in infrastructure

References and further reading

- Timilsina, G. R.; Hochman, G. & Song, Z. (2020): Infrastructure, Economic Growth, and Poverty: A Review. World Bank Policy Research Working Paper No. 9258

Institutions and regional growth

Institutions: Meaning

- In simplified terms: The rules of the game
- Formal institutions: codified rules (e.g. laws, financial regulations, system of property rights, formal relationships)
- Informal institutions: non-codified, socially shared rules (e.g. codes of conduct, informal relationships in social networks, values, social trust)

- Persistence of institutions:
  - Formal institutions can change fast (new law is passed)
  - Informal institutions more persistent over time

European Quality of Government Index I

- Developed by Quality of Government Institute of Gothenburg University

- Only measure of institutional quality available at regional level in European Union

- Captures average citizens' perceptions and experiences with corruption and public services in their region of residence

Link

European Quality of Government Index II

<u>Dimension: Rule of law</u>

- How would you rate the quality of the police force in your area? (Low/High, 0-10)
- Corruption is prevelant in the police force in my area? (Agree/Disagree, 0-10)

…

<u>Dimension: Government effectiveness</u>

- How would you rate the quality of public education in your area? (Low/High, 0-10)

…

<u>Dimension: Voice and accountablity</u>

- Elections in my area are honest and clean from corruption? (Agree/Disagree, 0-10)

…

European Quality of Government Index III

<u>Dimension: Corruption</u>

- In the past 12 months have you or anyone living in your household paid a bribe in any form to health or medical services? (Yes/No)

- How often do you think other citizens in your area use bribery to obtain public services? (Never/Very often, 0-10)

…

<u>Dimension: Political decentralization</u>

- Policy scope: extent to which regions have authority over policies such as education, welfare, police, economic policy and control over governments

- Law-making: extent of regional law-making influence at the national level (from no representation to the ability for a majority of regions to veto national legislation)

…

European Quality of Government Index 2017
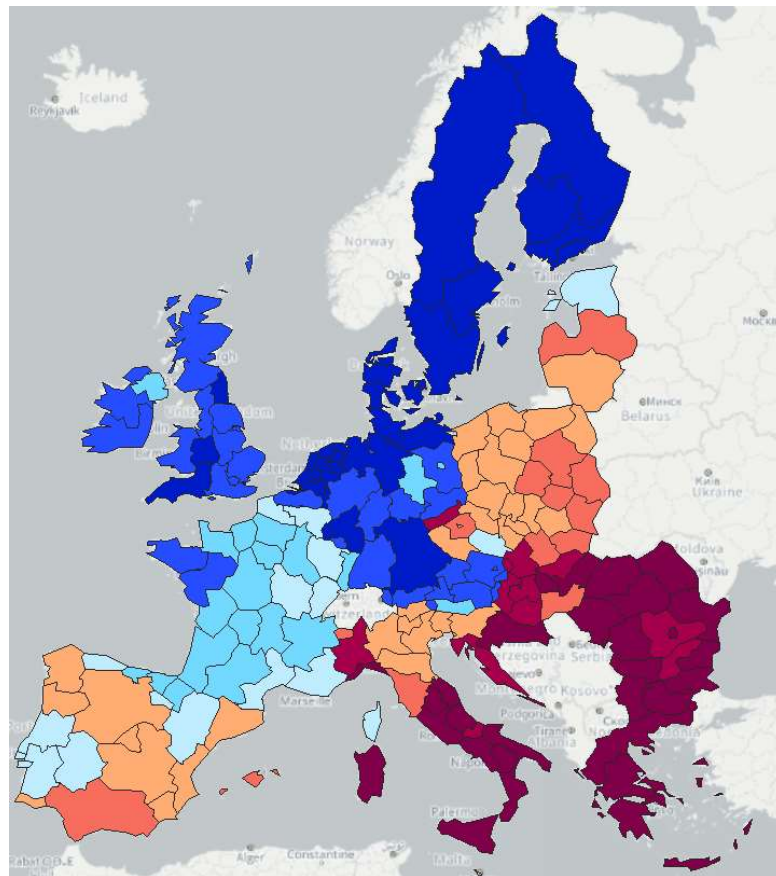
EU average is 0;
negative values are
below the EU average;
positive values are
above the EU average

- < -1.2
- -1.2 - -0.9
- -0.9 - -0.5
- -0.5 - 0
- 0 - 0.3
- 0.3 - 0.7
- 0.7 - 1.1
- > 1.1
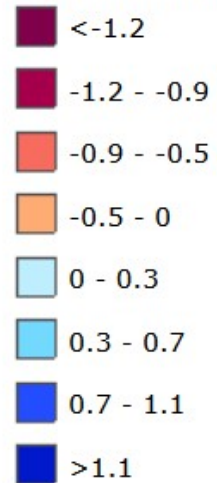
Source: European Commission, DG Regional and Urban Policy
Link

European Quality of Government Index 2017
## Rank order and regional variation
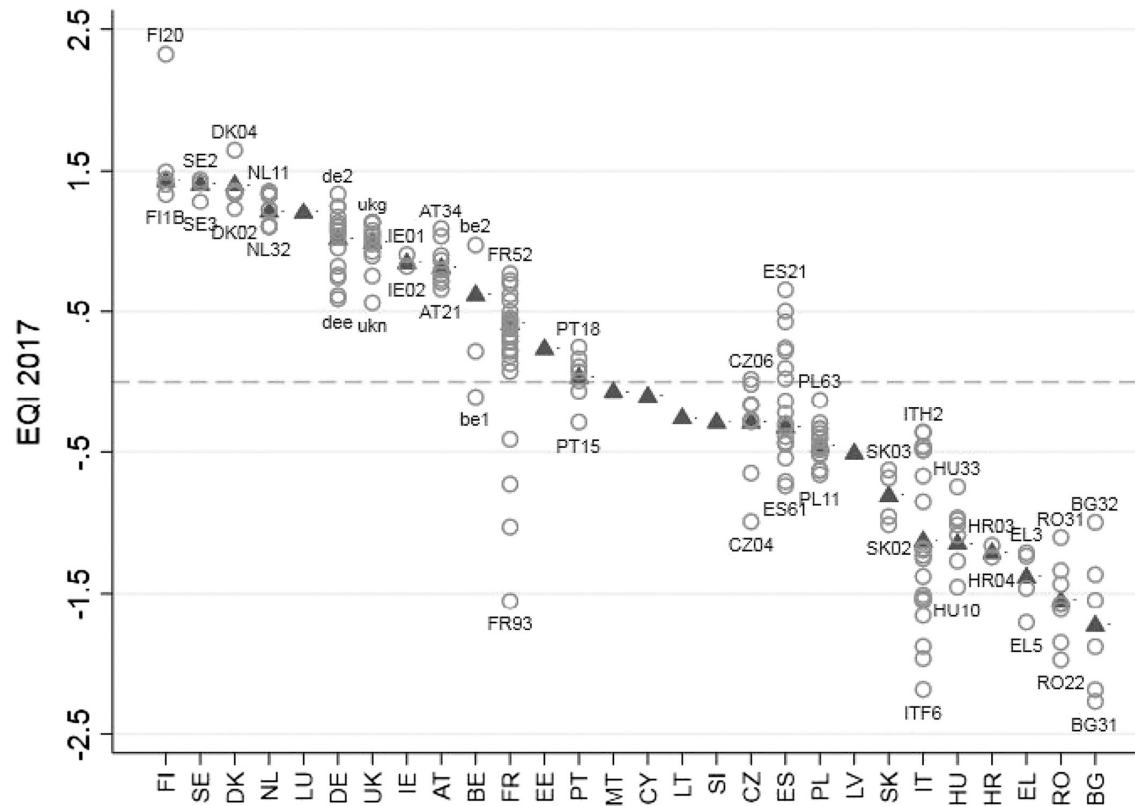
Source: Charron et al. (2019)
Link

Alternative on country-level

- Worldwide Governance Indicators (WGI) project by the World Bank
  - Reports composite and single indicators for over 200 countries from 1996-2020
  - Inculling dimensions like
    - Voice and Accountability
    - Regulatory Quality
    - Control of Corruption
    - ...
  - Free access to data as well as interactive data access

Link

Institutions: Impact on growth

Patents and QoG - 1997-2009 averages
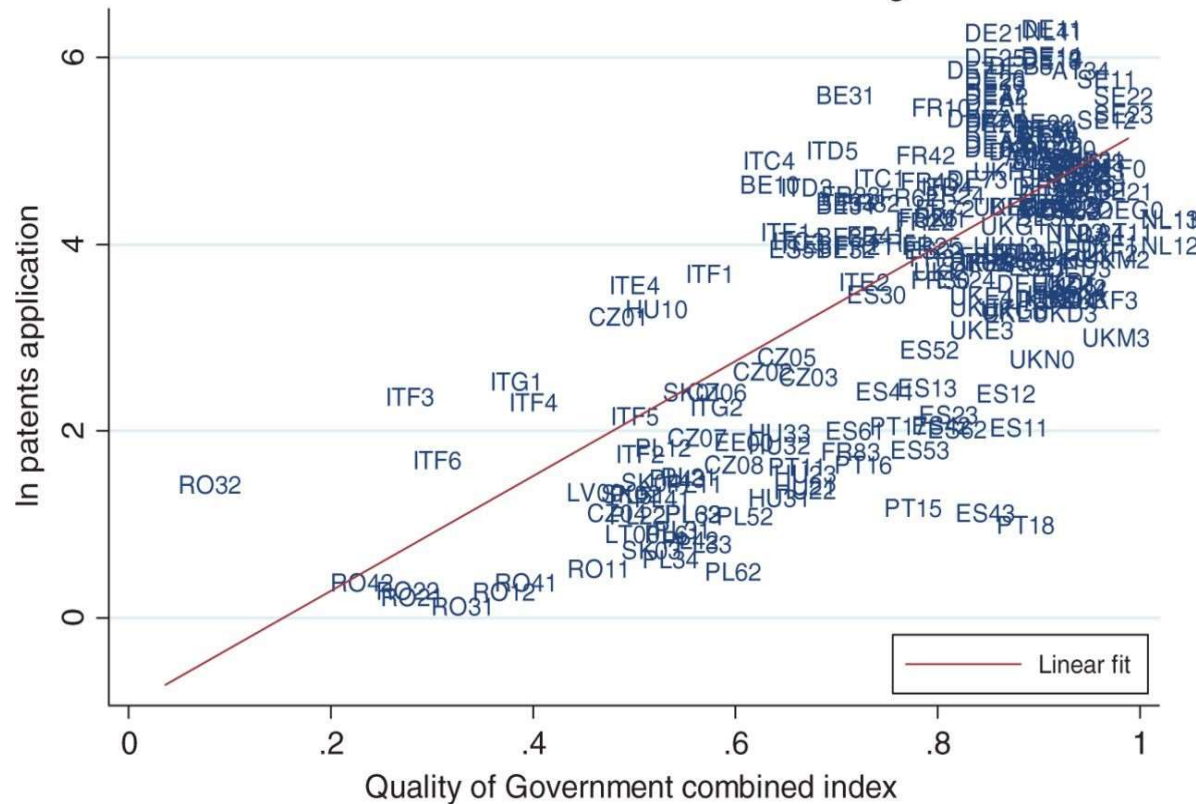
→ Positive relationship between the quality of government and regional innovation performance (measured by patent applications)

References and further reading

- Charron, N.; Lapuente, V. & Annoni, P. (2019): Measuring Quality of Government in EU Regions Across Space and Time. Papers in Regional Science, 98 (5), 1925-1953.

- North, D. C. (1994): Economic performance trough time. American Economic Review, 84, 359-368.

- Rodriguez-Pose & Di Cataldo, M. (2015): Quality of government and innovative performance in the regions of Europe. Journal of Economic Geography, 15 (4), 673-706.

- Williamson, O. (2000): The New Institutional Economics: Taking Stock, Looking Ahead. Journal of Economic Literature, 38, 595-613.

Human capital and regional growth

Human capital: Meaning

- Individuals' skills, competencies and knowledge due to their investment in education and training

- Intangible asset which improves productivity

- Investment decision: current income opportunities are renounced in exchange for better income prospects in the future

- Aggregation:
  - Firm-level: investments in employees to increase firm's productivity and profit
  - Regional/country-level: public spending into educational system

Human capital: Impacts on growth

- Worldwide trend of many countries to push education, especially at the tertiary level
- Aim is to improve the economic position of both individuals and regions/nations
- Higher education is seen as a source of innovation and thus productivity improvements and economic growth
- Evidence, e.g.:
  - Positive and significant correlation between average share of employees with tertiary degree and GDP per inhabitant for German NUTS 3 regions (Falck et al. 2011)
  - Positive and significant correlation between education quality (test scores) and GDP growth rate over period from 1960-2000 among 50 countries (Hanushek & Woessmann 2008)

Creativity as an extended concept of human capital

- „Creative class" by Richard Florida (2004, 2012):
  - One of the main driver of regional growth
    - Cultural creativity
    - Technological creativity (innovations)
    - Economic creativity (entrepreneurship)
  - Creative people are interested in a broad cultural offer, tolerance towards other cultures and lifestyles and an a high-quality supply of education and public services
- „Jobs follow people" instead of „people follow jobs"

The Global Creativity Index

- Index developed by the Martin Prosperity Institute (University of Toronto) with the participation of Richard Florida
- Division of Index into three dimensions („the 3Ts"):
  - Technology
    - R&D investment
    - Innovations
  - Talent
    - Creative class
    - Educational attainment
  - Tolerance
    - Racial and ethnic tolerance
    - Gay and lesbian tolerance

Global Creativity Index 2015
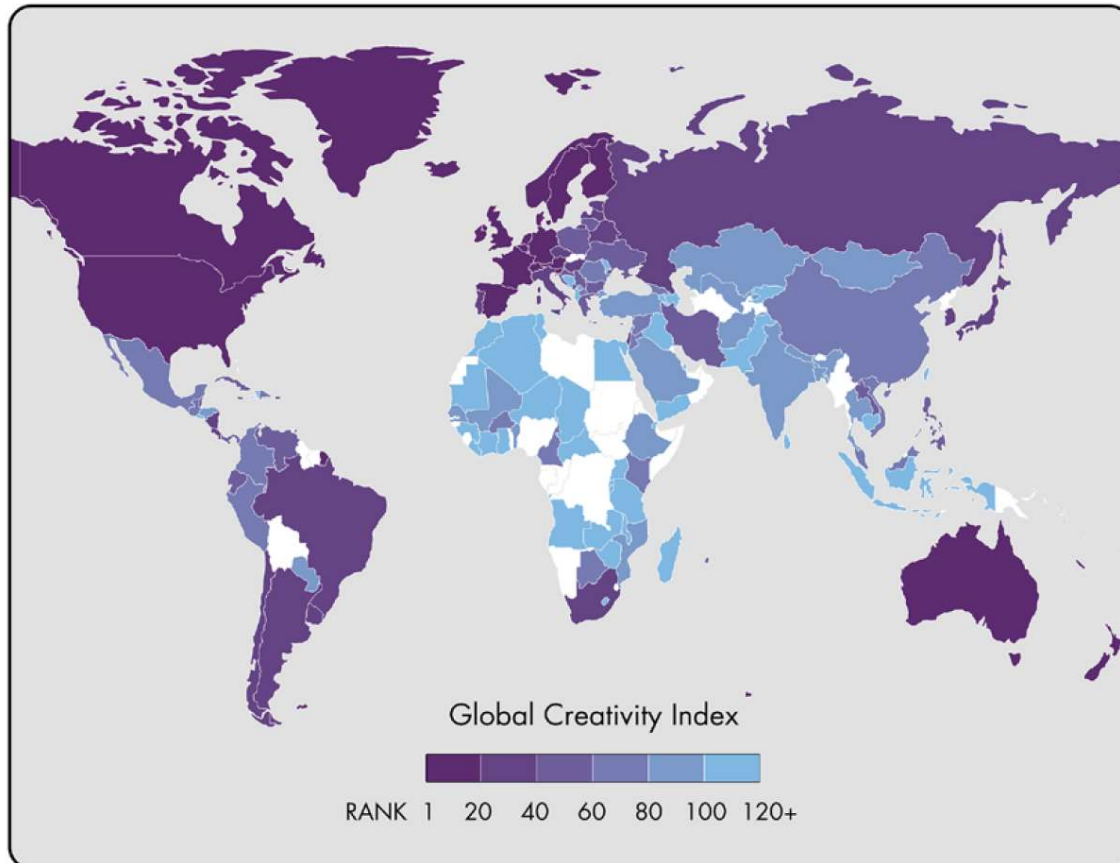
Source: Florida et al. (2015)
Link

Creativity and growth
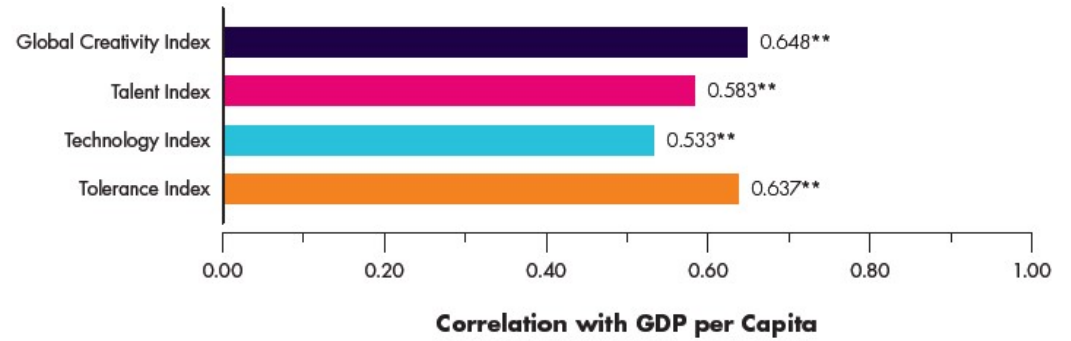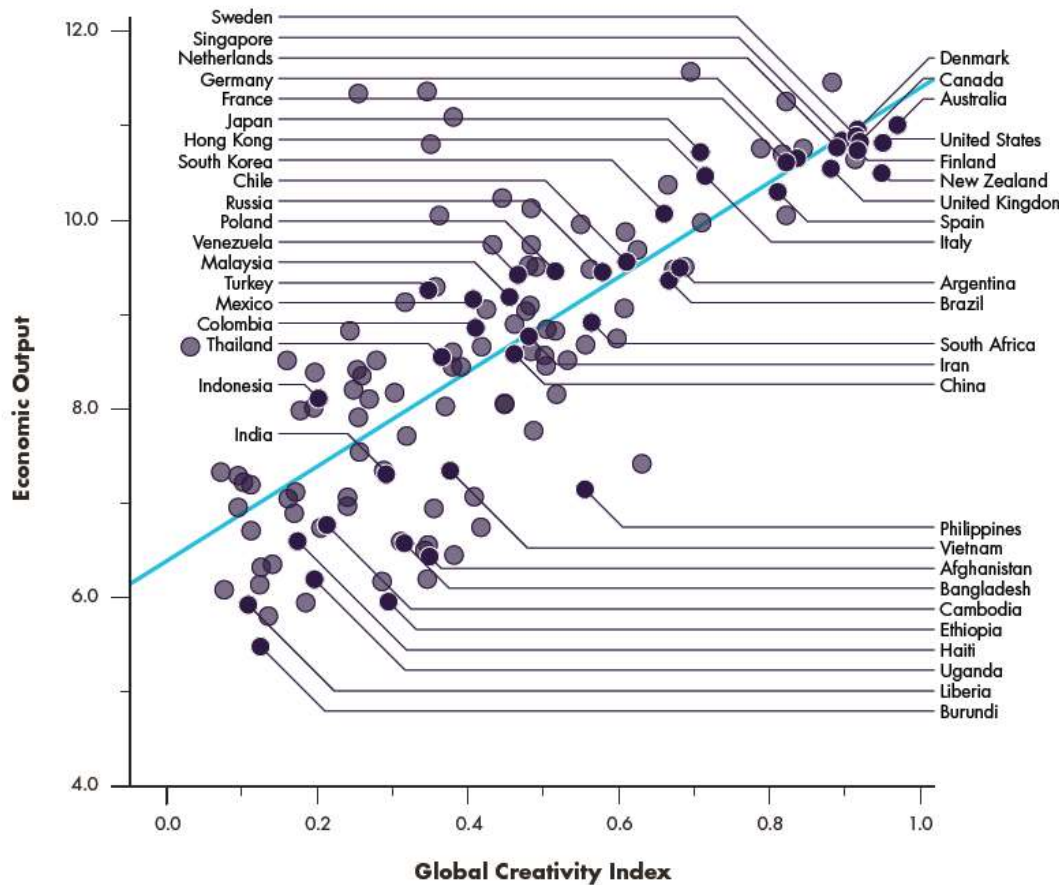
Source: Florida et al. (2015)
Link

References and further reading

- Becker, G. (1993): Human Capital, Chicago: University of Chicago Press.
- Falck, O.; Fritsch, M. & Heblich, S. (2011): The Phantom of the Opera, Cultural Amenities, Human Capital, and Regional Economic Growth. Labour Economics, 18, 755-766.
- Florida, R. (2004): Cities and the Creative Class, New York: Routledge.
- Florida, R. (2012): The Rise of the Creative Class: revisited, New York: Routledge.
- Florida, R., Mellander, C. & King, K. (2015): The Global Creativity Index 2015, Toronto: Rotman School of Management.
- Hanushek E. A. & Woessmann, L. (2008): The Role of Cognitive Skills in Economic Development, Journal of Economic Literature, 46, 607-668.

Innovations and regions
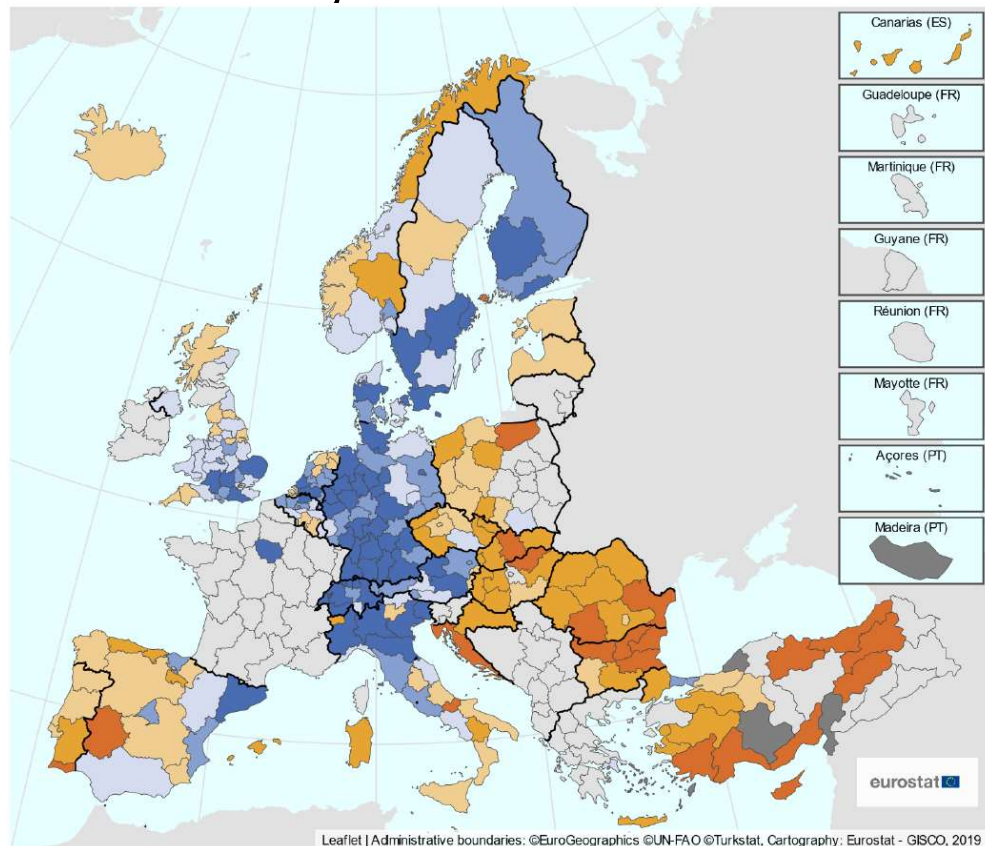
Innovations and Regions

- Different regional preconditions for innovation activities
  - Availability of human capital (qualified labour)
  - Existence of universities and research institutes
  - Proximity to competitors, customers and suppliers
  - Intensity of knowledge spillovers
- Different regional involvement in innovative activities
  - Innovation input
  - Innovation output
  - Diffusion of knowledge and technology (knowledge spillovers)

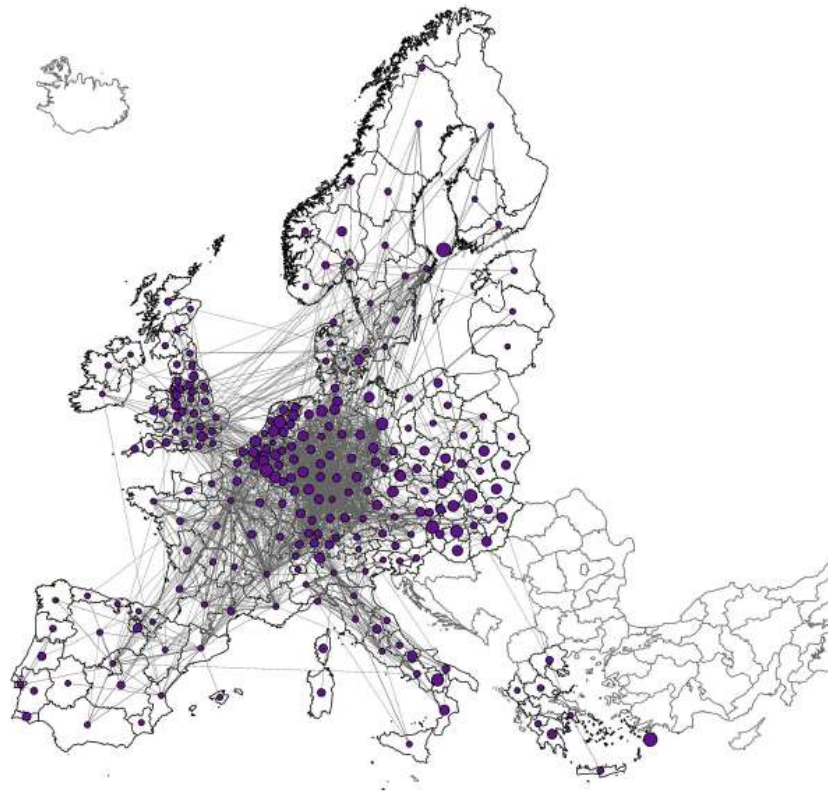# Innovation input: R&D expenditures in 2017
(% of GDP)

South Africa: 0,832

	< 0.37
	0.37 – 0.90
	0.90 – 1.37
	1.37 – 2.20
	> 2.20
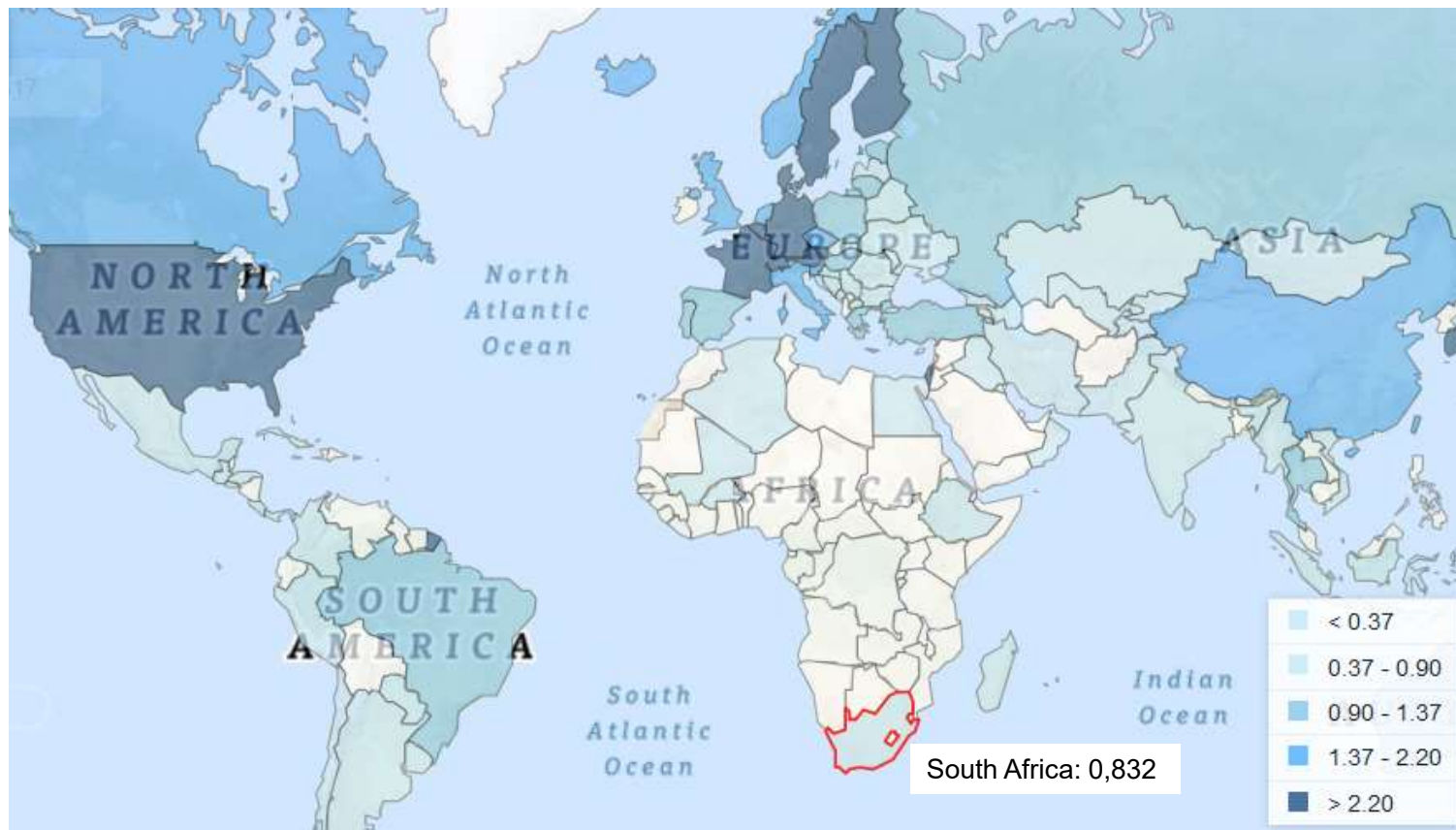
<u>Source:</u> World Bank
<u>Link</u>

Innovation output: Patent applications EU
NUTS 2, 2012

Source: Eurostat
Link

Knowledge spillovers:
European co-patenting network

Source: Bergé et al. (2017)
Link

Regional Innovation Scoreboard for European Regions I

- European Innovation Scoreboard uses 32 indicators among 4 dimensions for EU countries:
  - Framework conditions
  - Investments
  - Innovation activities
  - Impacts
- Regional Innovation Scoreboard uses 21 indicators to create index on NUTS 2 level
- Index used to divide regions into 4 performance groups
  - Innovation leader
  - Strong innovator
  - Moderate innovator
  - Emerging innovator

Regional Innovation Scoreboard for European Regions II

Framework conditions

- Human resources (e.g. percentage of population aged 25-34 having completed tertiary education)
- Attractive research systems (e.g. International scientific co-publications per million population)
- Digitalisation (Individuals who have above basic overall digital skills)

Investments

- Finance and support (e.g. R&D expenditure in the public sector as percentage of GDP)
- Firm investments /e.g. R&D expenditure in the business sector as percentage of GDP)
- Use of information technologies (e.g. Employed ICT specialists)

# Regional Innovation Scoreboard for European Regions III

<u>Innovation activities</u>

- Innovators (e.g. SMEs introducing product innovations as percentage of SMEs)
- Linkages (e.g. Innovative SMEs collaborating with others as percentage of SMEs)
- Intellectual assets (e.g. Patent applications)

<u>Impacts</u>

- Employment impacts (e.g. Employment in knowledge-intensive activities as percentage of total employment)
- Sales impacts (e.g. Sales of new-to-market and new-to-enterprise product innovations as percentage of total turnover)
- Environmental sustainability (Air emissions in fine particulates in Industry)

Regional Innovation Scoreboard in 2021
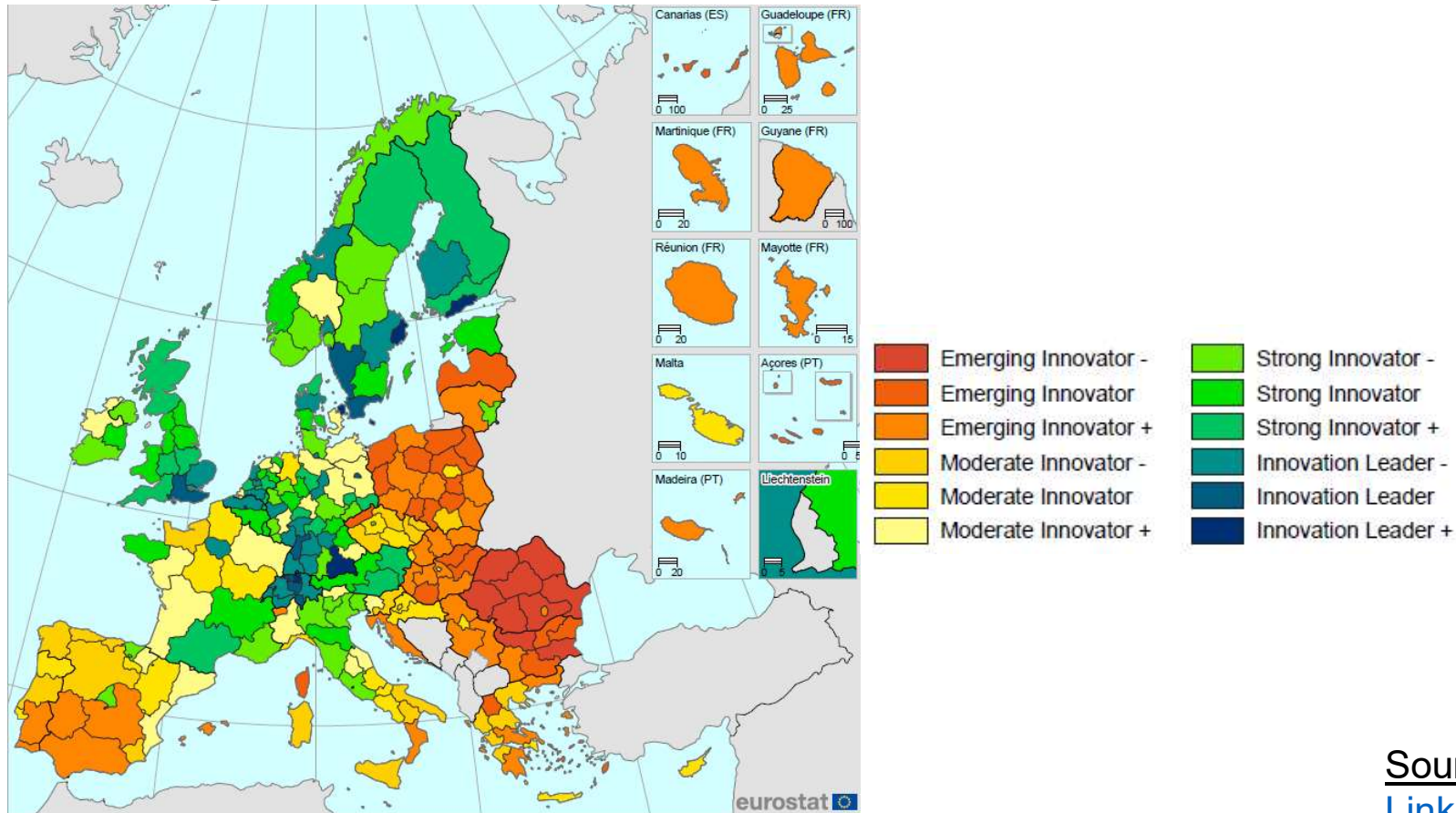
Source: European Commission
Link

References and further reading

- Bergé, L. R.; Wanzenboeck, I. & Scherngell, T. (2017). Centrality of regions in R&D networks: a new measurement approach using the concept of bridging paths, Regional Studies, 1–14.

- European Commission (2021): Regional Innovation Scoreboard 2021 – Main Report.

- European Commission (2021): Regional Innovation Scoreboard 2021 – Methodology Report.

Entrepreneurship and regions

Regional Entrepreneurial Ecosystem
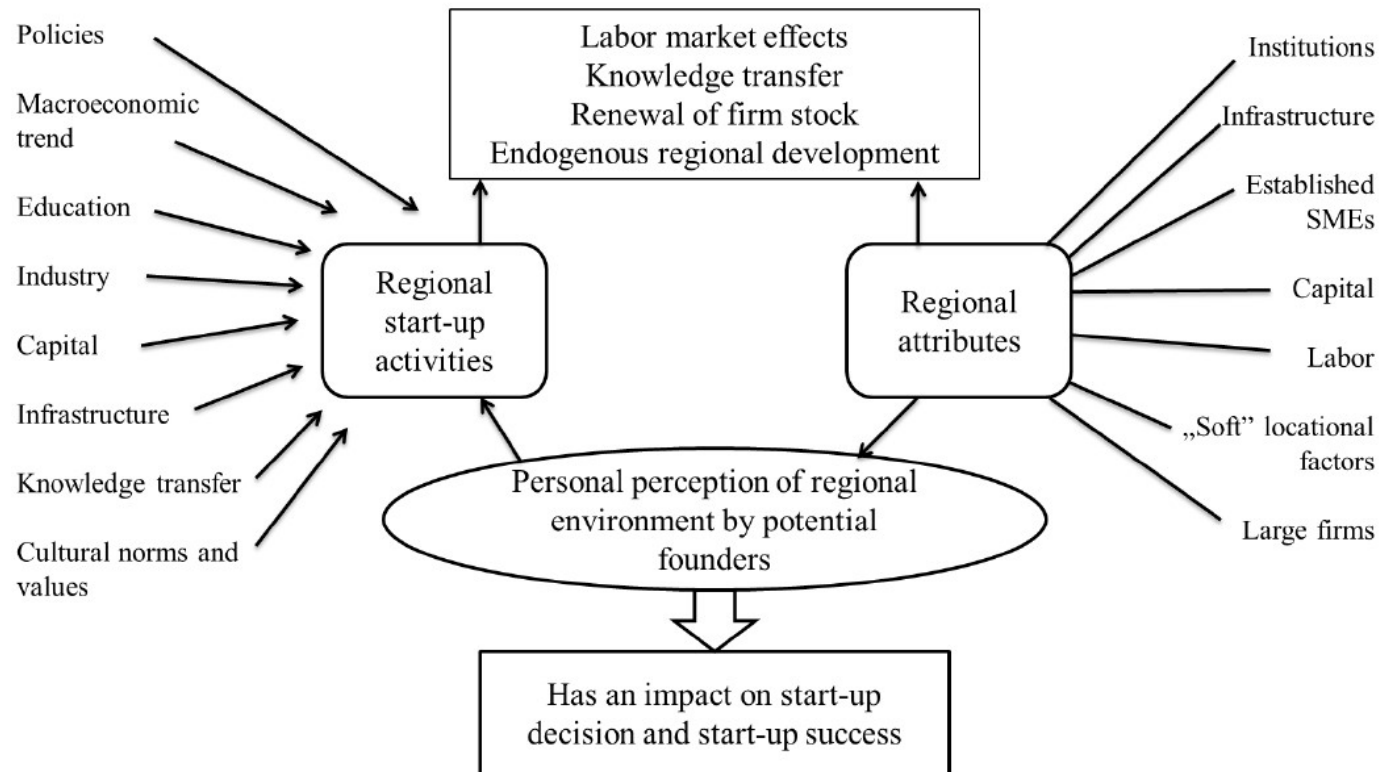
Source: Sternberg (2009)

Composite indicators

- Regional level
  - Regional Entrepreneurship and Development Index (REDI)
  - [Link](#)
- Country level
  - Global Entrepreneurship and Development Index (GEDI)
  - [Link](#)

References and further reading

- Sternberg, R. (2009): Regional dimensions of entrepreneurship. Foundations and Trends in Entrepreneurship 5, Now Publishers.

Are there any economically relevant indicators that have not been mentioned today, but which in your opinion also play an important role in regional development?

Can you describe the Free State in terms of economic indicators that you know?