20 lessons from 20 years

The power and charm of
composite indicators and scoreboards

Michaela Saisana
Joint Research Centre

> " We are drowning in information, while starving for wisdom…
> E. O. Wilson

Human Capital Index (World Bank) World Happiness Ranking (UN SDSN)

Education for all Development Index (UNESCO)

Global Slavery Index (Walk Free Foundation)

Human Development Index (UNDP)

World Press Freedom Index (Reporters Without Borders)

Better Life Index (OECD)   Living Planet Index (WWF)

Global Innovation Index (WIPO, INSEAD, Cornell)

Best Countries for Business (Forbes)

World Health Report (WHO)

A polarised audience for Composite Indicators

Enthusiastic supporters

mostly from advocacy groups developing their own indices to advance a cause

Skeptical economists and official statisticians

concerned by the subjective nature of the selection of variables, weights and aggregation

European Commission

WALK FREE | GLOBAL SLAVERY INDEX
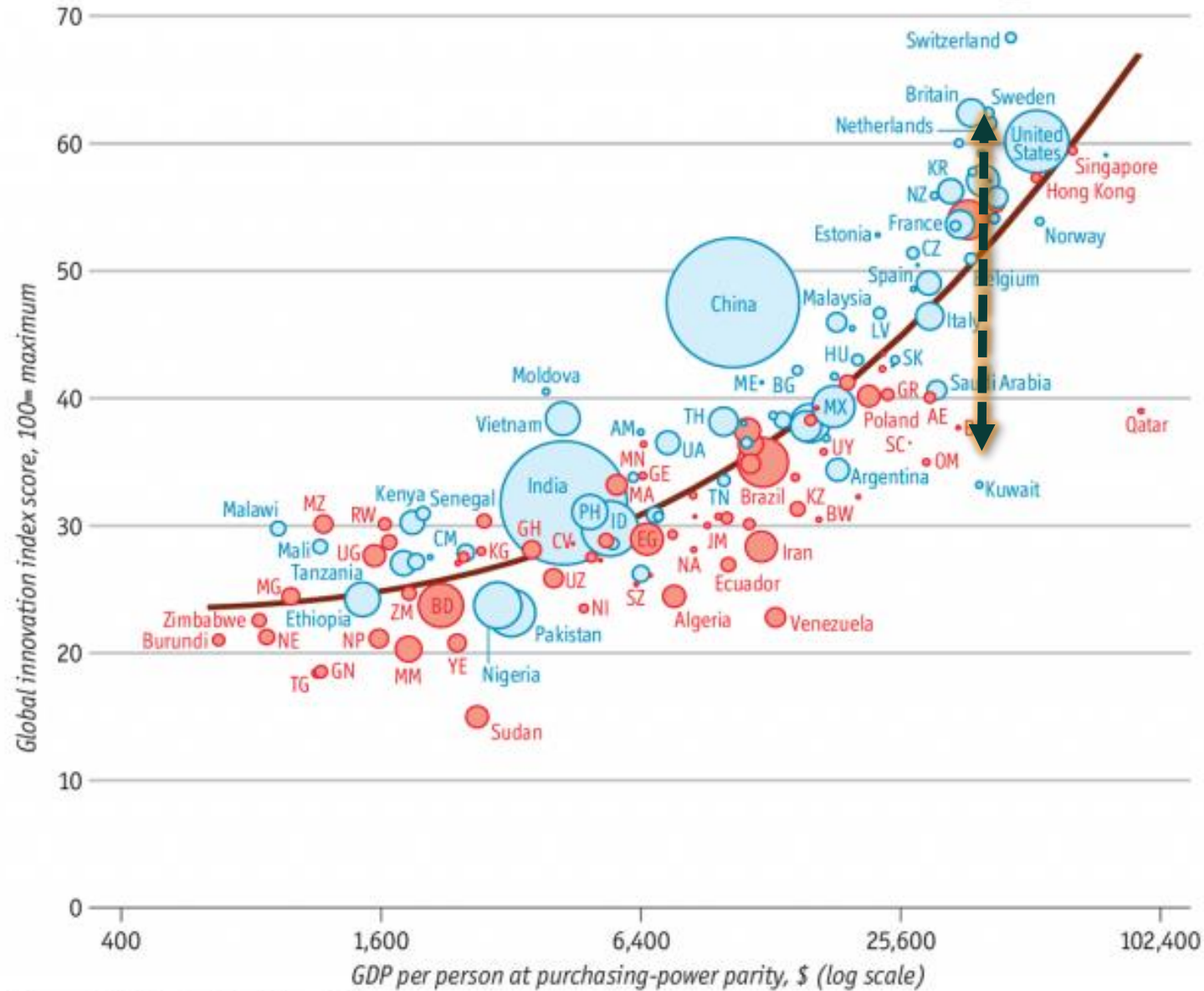
GLOBAL SLAVERY INDEX

MODERN SLAVERY: A HIDDEN, EVERY DAY PROBLEM.

It is a confronting reality that even in the present day, men, women and children all over the world remain victims of modern slavery.

European Commission

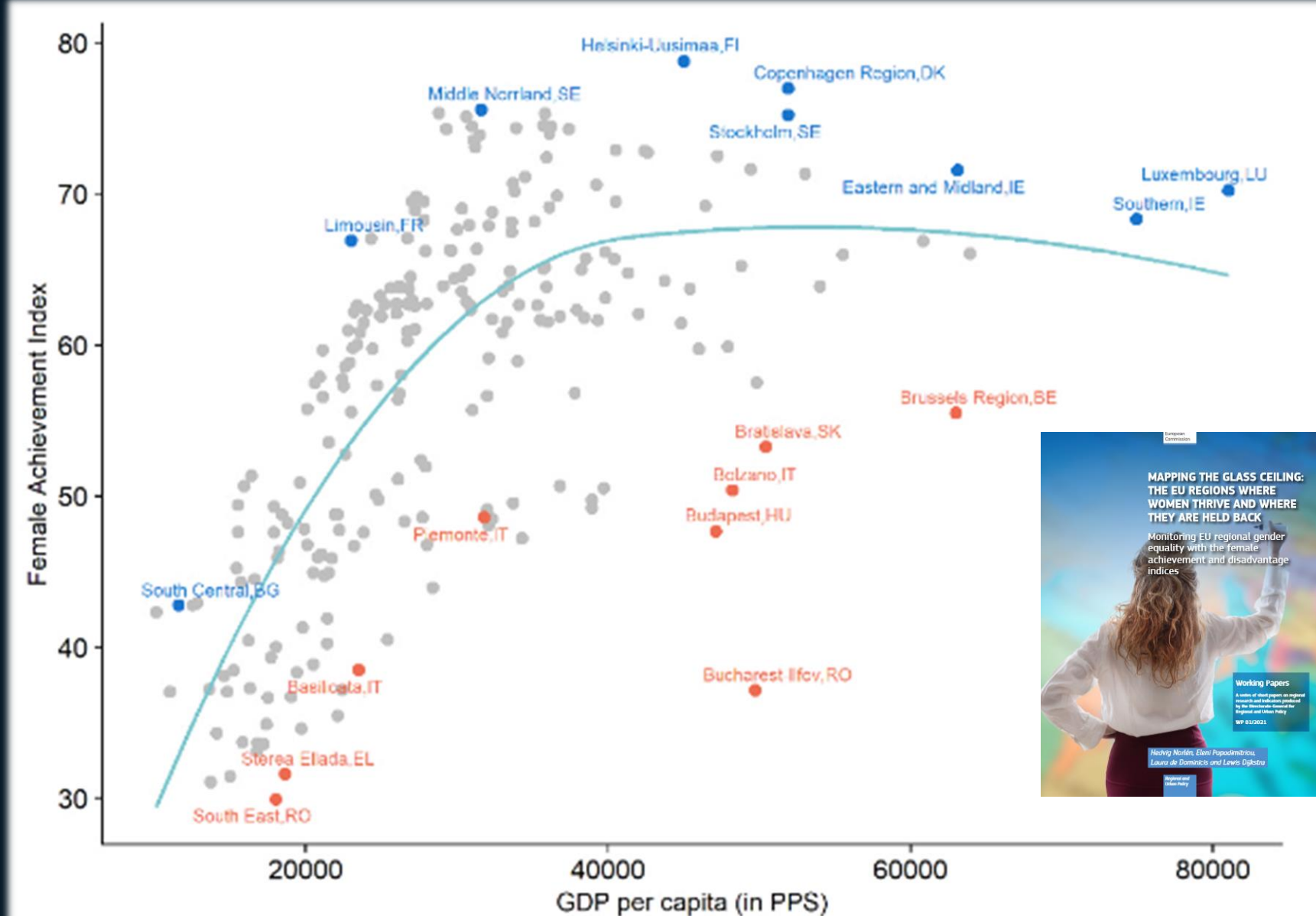Global Innovation Index
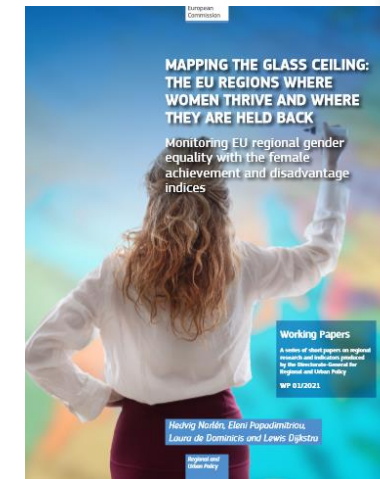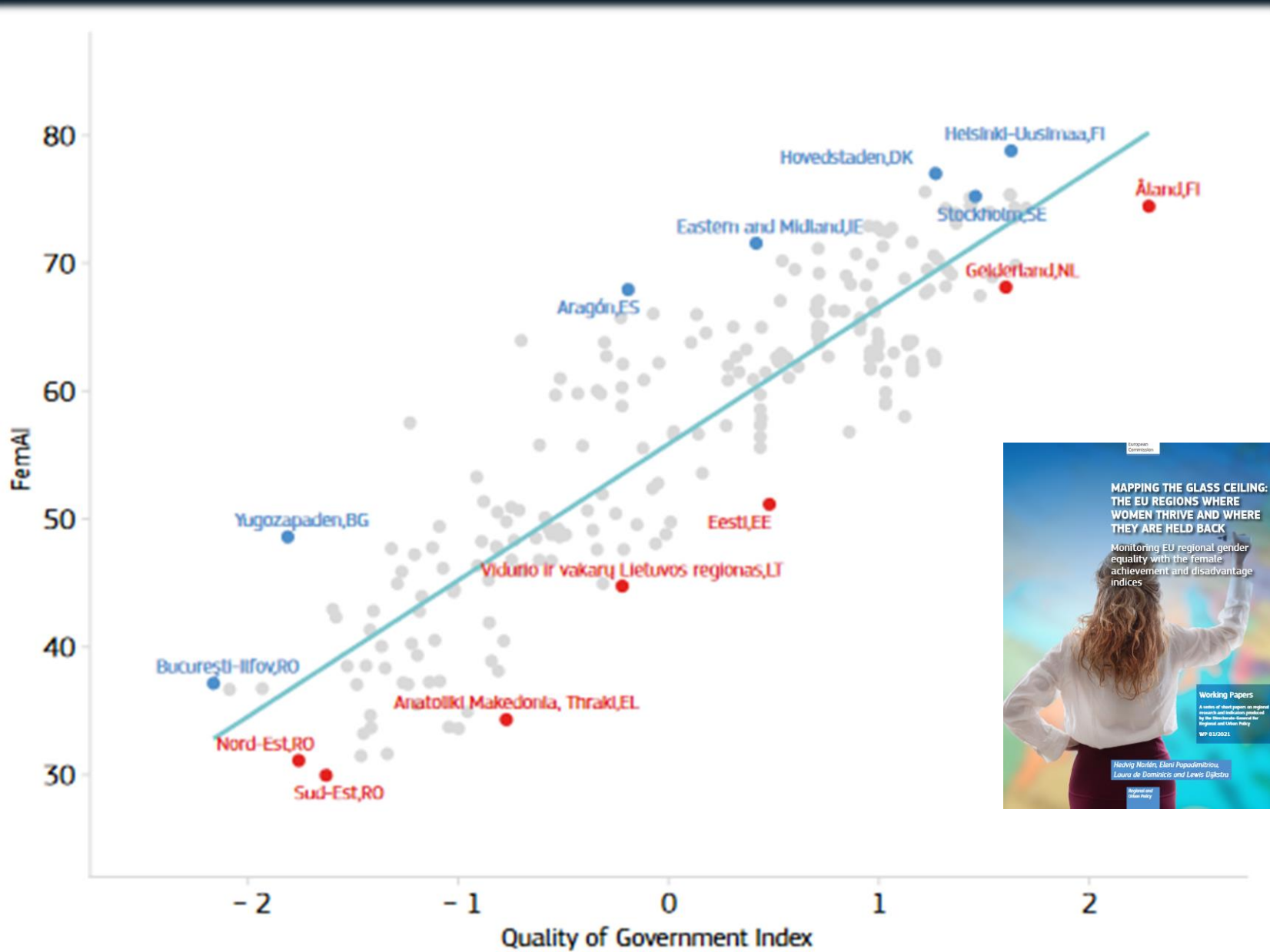2014 or latest available year

Source: Global Innovation Index, 2015
Economist.com

6

Regional Gender Equality Monitor

Regional Gender Equality Monitor

A polarised audience for Composite Indicators

Enthusiastic supporters

mostly from advocacy groups developing their own indices to advance a cause

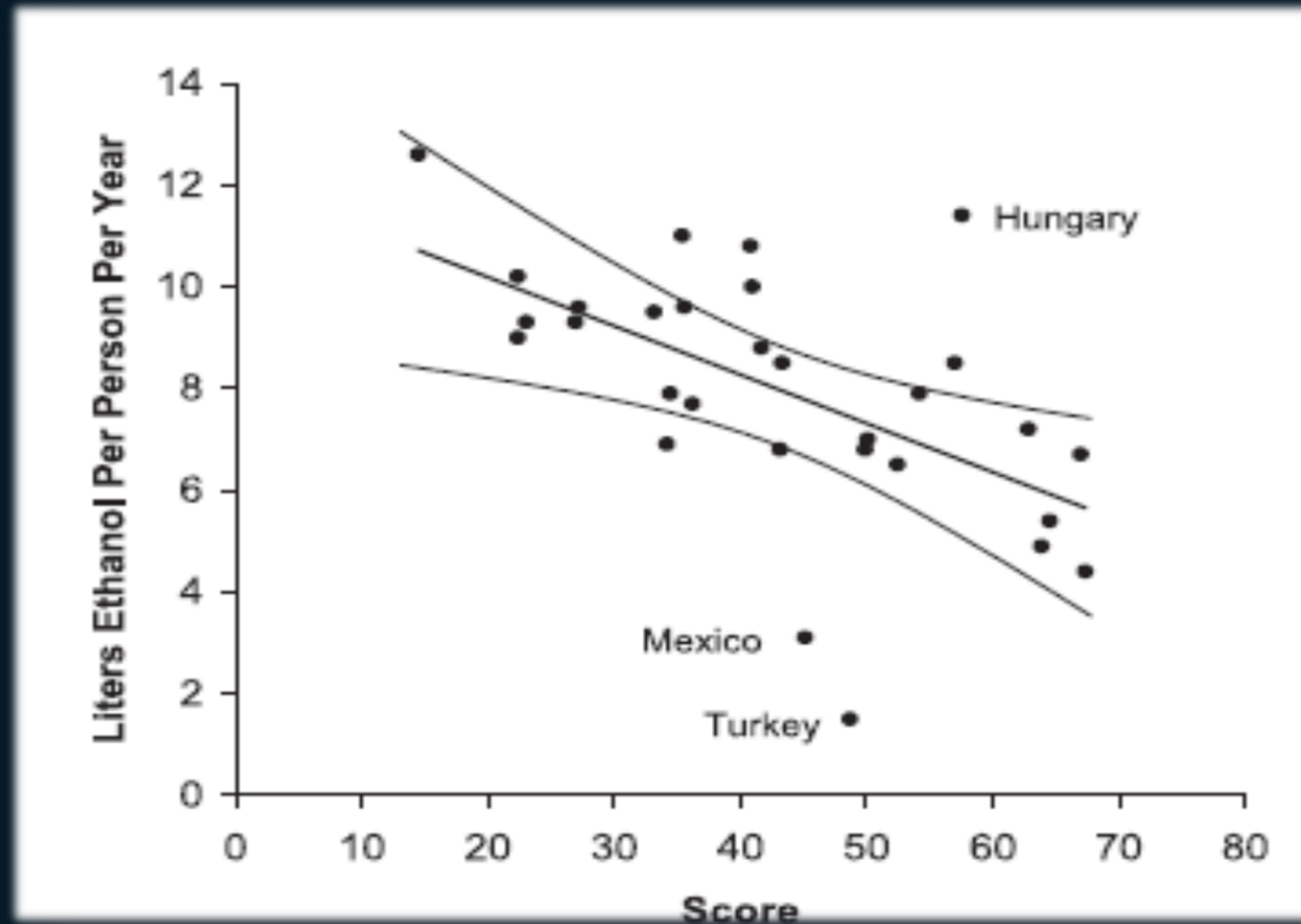**Skeptical economists and official statisticians**

concerned by the subjective nature of the selection of variables, weights and aggregation

European Commission

Indices … are they measurements without theory?

Domains	Ratings	Topics	Policies
Physical availability (32 points)	☆☆☆	Legal alcohol purchase age (y)	16, 17, 18, 19, 20+
	☆☆☆	Alcohol server liability for damages caused by actions of patrons	No, Yes
	☆☆	Restrictions on types of alcoholic beverages sold in retail stores	None; Partial government monopoly; Full government monopoly
	☆☆	Restrictions on density of stores selling alcoholic beverages in a given locale	None; On wine only; On wine and spirits; On wine, spirits, and beer
	☆☆	Restrictions on business hours for selling alcohol	None; On hours or days; On both hours and days
Drinking context (8 points)	☆☆	Community mobilization programs to increase public awareness of, and prevent alcohol problems	No, Yes
	☆	Mandatory training of alcohol servers to prevent and manage aggression	No, Yes
Alcohol prices[a] (24 points)	☆☆☆	Beer price index	0–0.29, 0.30–0.59, 0.60–0.89, 0.90+
	☆☆☆	Wine price index	0–0.9, 1.0–1.9, 2.0–2.9, 3.0+
	☆☆☆	Spirit price index	0–2.9, 3.0–5.9, 6.0–8.9, 9.0+
Alcohol advertising (3 points)	☆	Number of different media (print, broadcast, billboards) with advertising restrictions	0, 1, 2, 3
Motor vehicles (34 points)	☆☆☆	Random breath testing	None,[b] Rare, Occasional, Often, Very often
	☆☆☆	Legal blood alcohol limit—adult (mg/dl)	0.08+, 0.03–0.07, 0–0.02
	☆☆☆	Legal blood alcohol limit—youth (mg/dl)	0.04+, 0.02–0.03, 0–0.01
	☆☆	Mandatory penalty for exceeding legal limit	Fine, License suspension
	☆☆	Graduated licensing for young drivers	No, Yes

[Source: Alcohol Policy Index, 2007, *PLoS Medicine,* 4(4):752-759]

European Commission

Indices … are they measurements without theory?

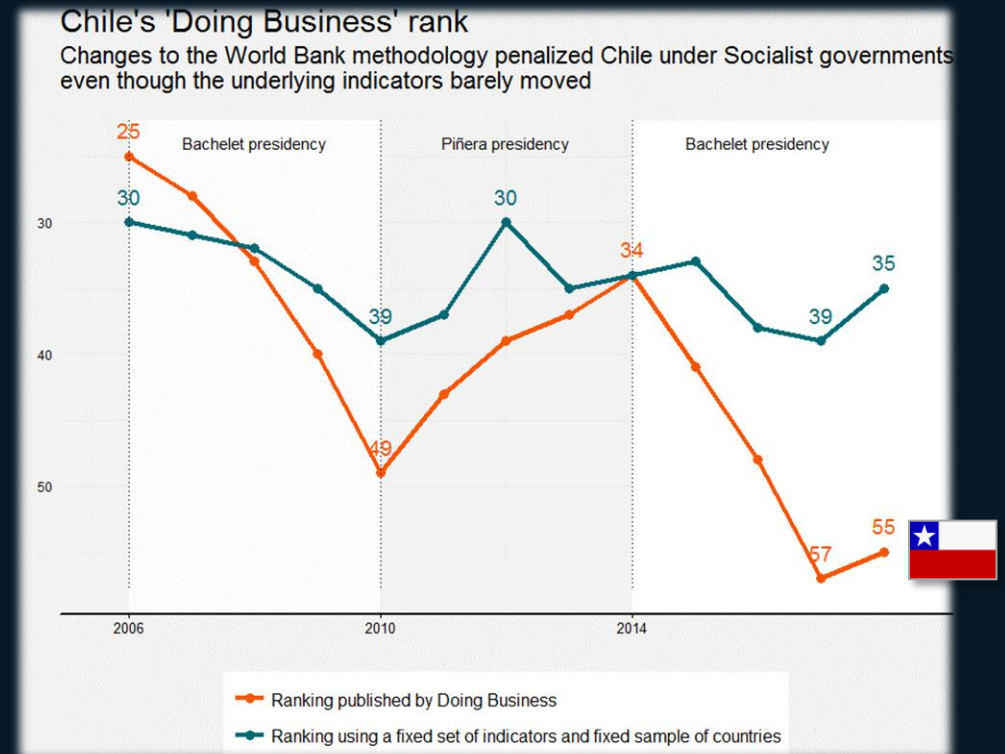[Source: Alcohol Policy Index, 2007, *PLoS Medicine,* 4(4):752-759]

Indices have strong political and policy implications

BUSINESS NEWS   JANUARY 25, 2018 / 12:25 AM / 8 MONTHS AGO

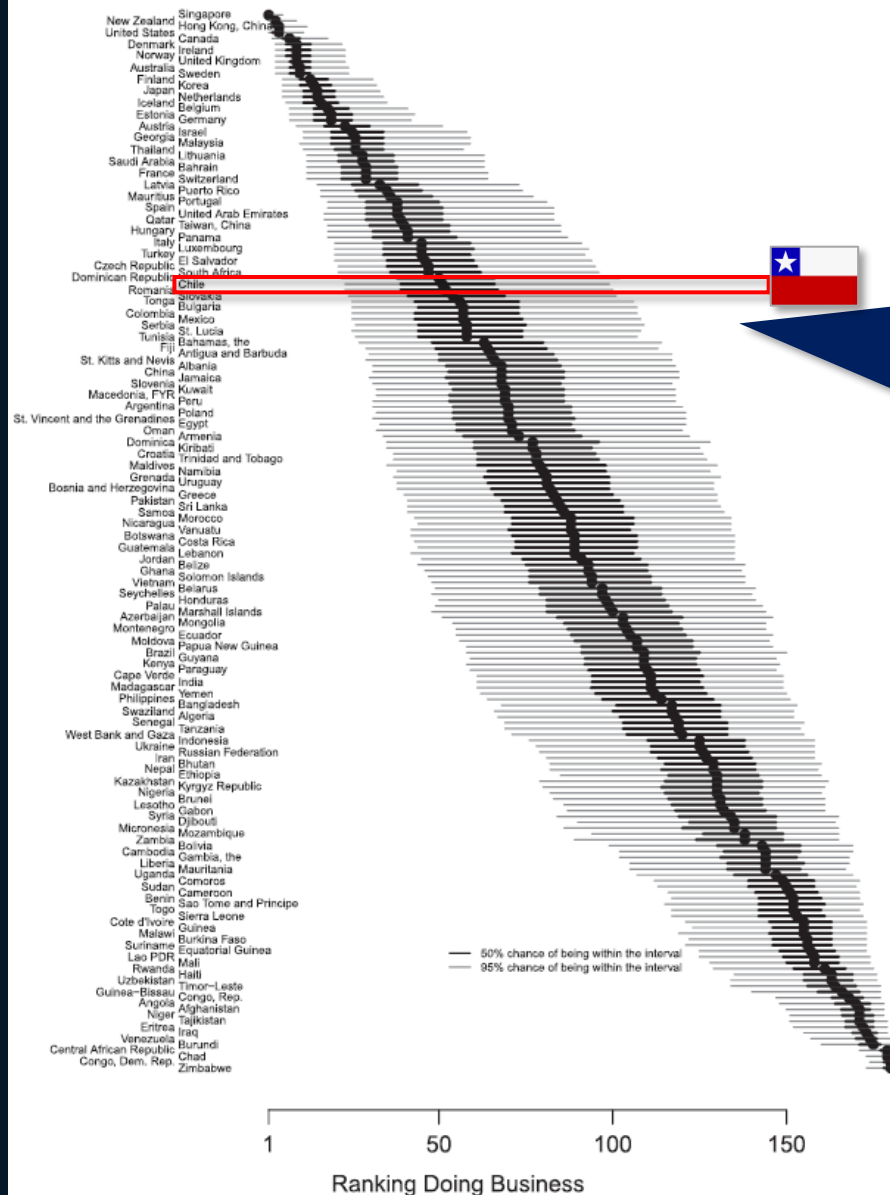## World Bank economist Paul Romer quits after Chile comments

WASHINGTON (Reuters) - Paul Romer stepped down as the World Bank's chief economist on Wednesday after he came under fire for saying that Chile's rankings in a closely watched "Doing Business" report may have been deliberately skewed under socialist President Michelle Bachelet.

Chile's 'Doing Business' rank
Changes to the World Bank methodology penalized Chile under Socialist governments even though the underlying indicators barely moved

Bachelet presidency   Piñera presidency   Bachelet presidency

— Ranking published by Doing Business
— Ranking using a fixed set of indicators and fixed sample of countries

Source: Justin Sandefur and Divyanshi Wadhwa, based on data from www.doingbusiness.org and World Bank "Doing Business" reports, 2006-2018.
URL (3 Oct 2018): https://www.cgdev.org/blog/chart-week-3-why-world-bank-should-ditch-doing-business-rankings-one-embarrassing-chart

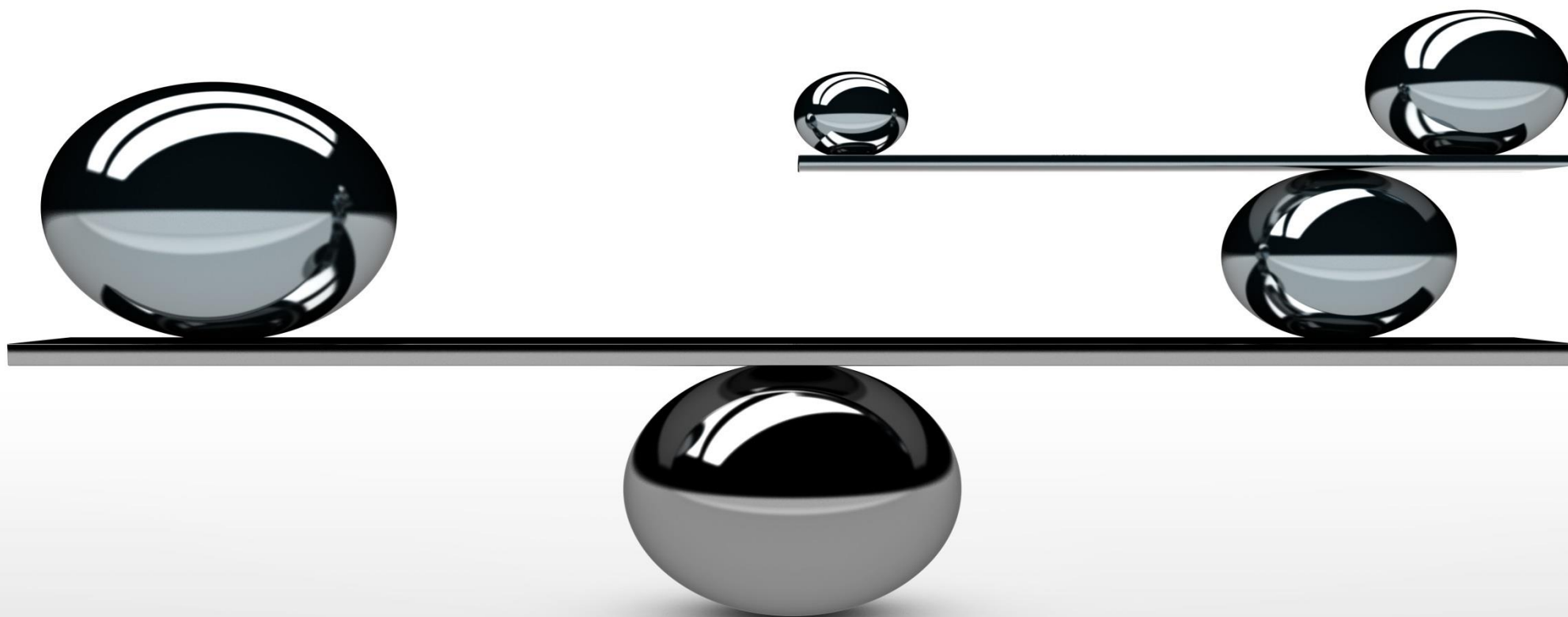European Commission

Uncertainty in Doing Business ranking

"Whether or not there was deliberate manipulation of its Doing Business Indicators, the Bank should better acknowledge the huge uncertainty about this index especially in the middle 80% of country rankings. Only top and bottom seem reliable." (Ravallion, 2018)
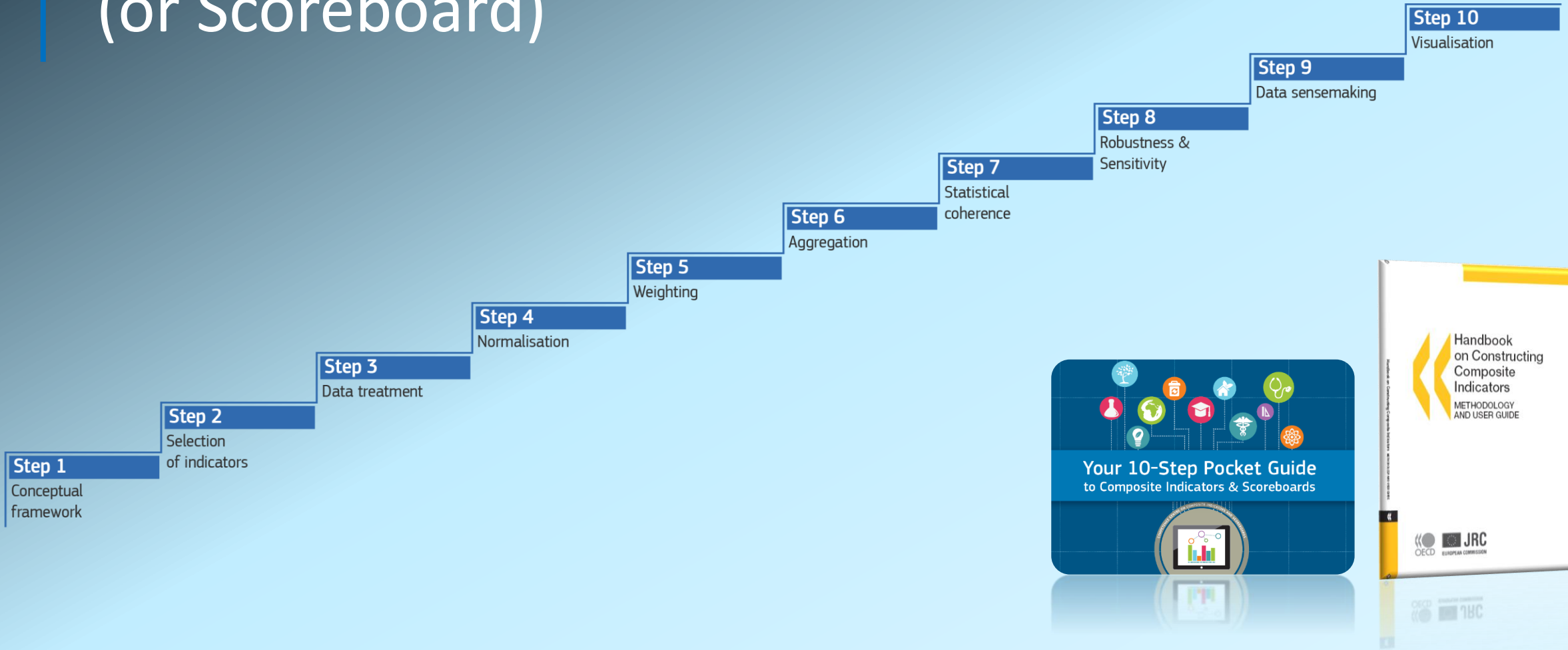
Building a composite indicator:
a delicate balance between Science and Art

10 STEPS to build a Composite Indicator (or Scoreboard)

Step 10
Visualisation

Step 9
Data sensemaking

Step 8
Robustness & Sensitivity

Step 7
Statistical coherence

Step 6
Aggregation

Step 5
Weighting

Step 4
Normalisation

Step 3
Data treatment

Step 2
Selection of indicators

Step 1
Conceptual framework

Your 10-Step Pocket Guide
to Composite Indicators & Scoreboards

Handbook on Constructing Composite Indicators
METHODOLOGY AND USER GUIDE

OECD JRC EUROPEAN COMMISSION

Define the concept to be measured

▶▶ Clearly define the **objectives** and the **end-users** of the index

▶▶ Map **existing literature**, indicator frameworks and definitions and assess the added-value of your index

▶▶ Involve **stakeholders**, e.g. via workshops
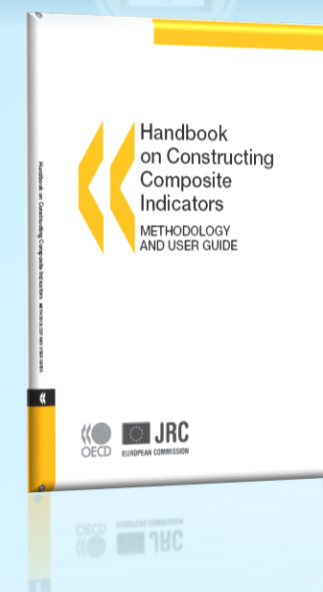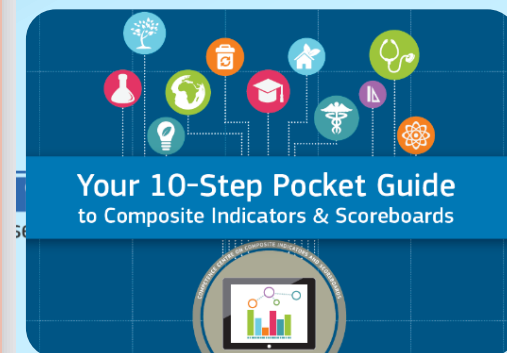
▶▶ Structure the concept into **framework** of dimensions

▶▶ *Valid both for composite indicators and scoreboards*

COIN Tips

You may need to spend up to 2/3 of the overall time in defining the conceptual framework and the indicators.

5-7 indicators per dimension is a good practice. A minimum of 3 indicators by dimension is acceptable.

Your 10-Step Pocket Guide
to Composite Indicators & Scoreboards

Handbook
on Constructing
Composite
Indicators
METHODOLOGY
AND USER GUIDE

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COIN Tips

Aim for at least 65% of data coverage across each indicator and each country.

▶▶ Assemble a pool of candidate indicators from the **literature review**

▶▶ Choose indicators based on **criteria** such as: relevance, data availability/reliability and credibility

▶▶ Keep track of all indicator decisions and characteristics in a **summary table**, e.g. coverage, type, descriptive statistics, source and year

▶▶ **Scale indicators** by an appropriate size measure to have an objective comparison across countries, e.g. population, GDP, etc.

▶▶ *Valid both for composite indicators and scoreboards*

Handbook on Constructing Composite Indicators
METHODOLOGY AND USER GUIDE

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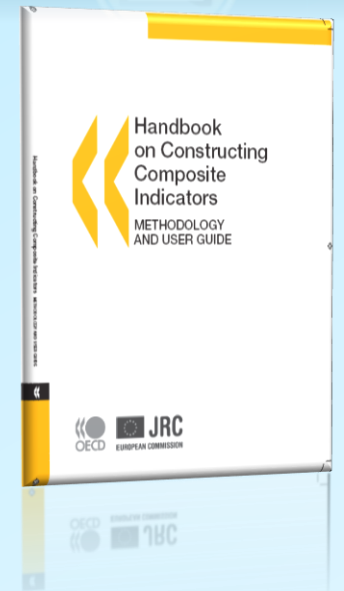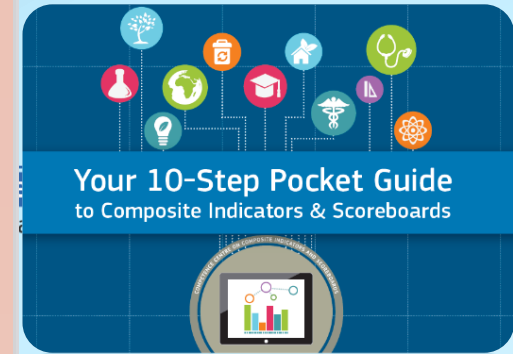
STEP 03

Analyse and treat the data, where necessary

▶▶ **Visualise the distribution** of each indicator using histograms and scatter-plots

▶▶ Check for **missing data** and carefully decide whether or not to impute the data, and which method to use

▶▶ Discuss and treat **outliers**, if needed, to avoid that they become unintended benchmarks
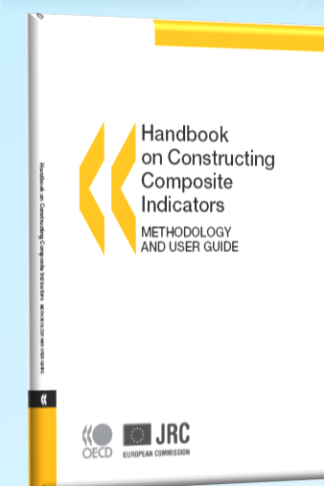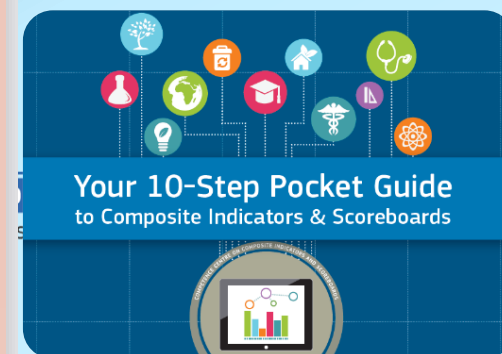
▶▶ *Valid both for composite indicators and scoreboards*

COIN Tips

Plot first and consider indicators for outlier treatment if:
1) absolute skewness > 2.0 and kurtosis > 3.5 or,
2) kurtosis is very high > 10

Winsorisation is one way to treat data, in which outliers are assigned the next highest/lowest score.

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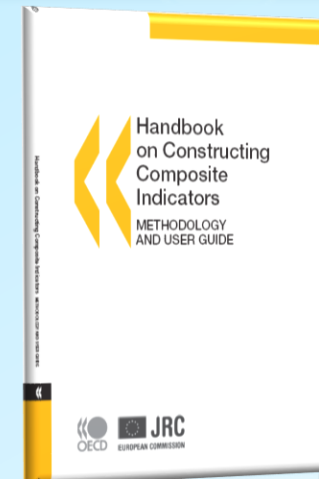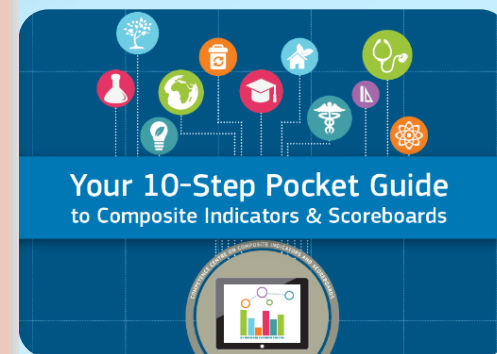OECD JRC EUROPEAN COMMISSION

Bring all indicators onto a common scale

COIN Tips

A commonly-adopted normalisation method is the Min-Max approach, which rescales indicators onto an identical range (0-100) by subtracting the minimum value and dividing by the range of the indicator values.

▶▶ Make **directional adjustments**, so that higher indicator scores correspond to better performance in the concept being measured

▶▶ Select a suitable **normalisation** method that respects the conceptual framework and the data properties

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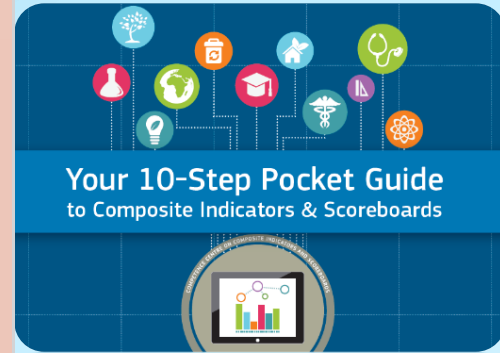METHODOLOGY AND USER GUIDE

OECD EUROPEAN COMMISSION JRC

Weight the indicators and dimensions

▶▶ Select a suitable **weighting method** which aligns with the goals of the index

▶▶ If appropriate, use **expert elicitation** to understand the relative importance of indicators and dimensions

▶▶ Consider whether **correlations** between indicators should be accounted for **in the weights**

▶▶ Keep in mind the ability to **communicate the weighting scheme** to your audience

" **COIN Tips**

Popular weigthing methods include equal weighting, factor analysis, derived weights, data envelopment analysis, expert opinion and the budget allocation method. "

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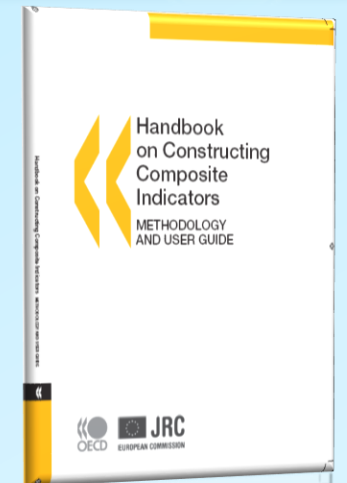
Aggregate the indicators and dimensions

COIN Tips

Popular aggregation methods include the arithmetic average, geometric average, Borda and Copeland.

▶▶ Consider whether **compensability among indicators** should be allowed, i.e. a deficit in one indicator can be compensated by a surplus in another

▶▶ Consider **up to which level to aggregate**

▶▶ Select a **suitable aggregation** method that respects the goals of the index

▶▶ Keep in mind the **ability to communicate the aggregation method** to your audience

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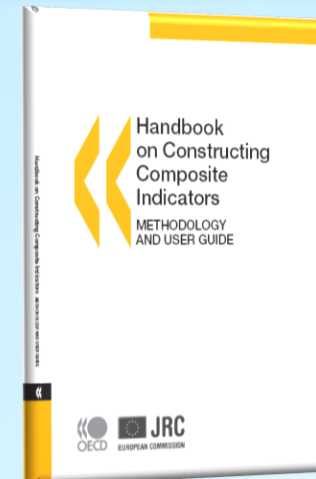
Assess the statistical and conceptual coherence

▶▶ Check **correlations between aggregations and the underlying indicators** – are some over or under-represented in the aggregate scores?

▶▶ Assess whether **statistical properties can be improved** by moving indicators under different dimensions or merging/splitting dimensions

▶▶ Check whether a **bias** has been introduced in the composite indicator, e.g. a strong correlation with population (>0.6) or GDP
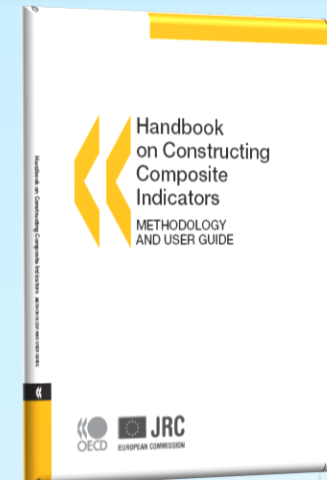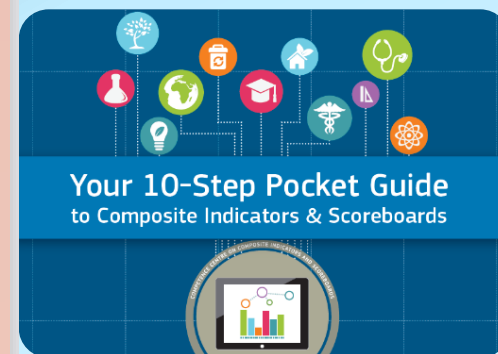
▶▶ *Valid both for composite indicators and scoreboards*

COIN Tips

Check whether indicators:

• *Dominate the framework: correlation > 0.95*

• *Are under-represented: –0.3 < correlation <0.3*

• *Are negatively related to the composite indicator: correlation < –0.3*

Assess the impact of uncertainties

COIN Tips

Provide the full ranks and index scores with confidence intervals in order to better appreciate the robustness of the ranks/scores to the modelling choices.

▶▶ Identify the **main uncertainties** underlying the index, e.g. methodological choices, indicator selection, etc.

▶▶ Assess the **impact of the uncertainties** on the scores or ranks. Use sensitivity analysis to see which assumptions cause the most uncertainty

▶▶ Explain why certain **countries notably improve or deteriorate their relative position** given changes in the assumptions

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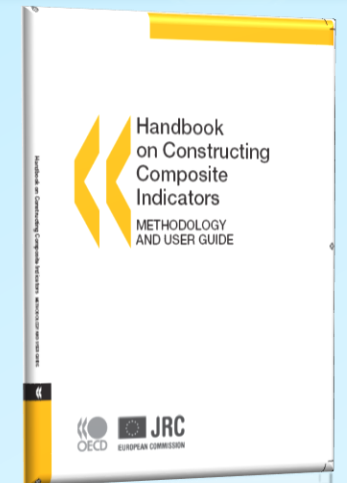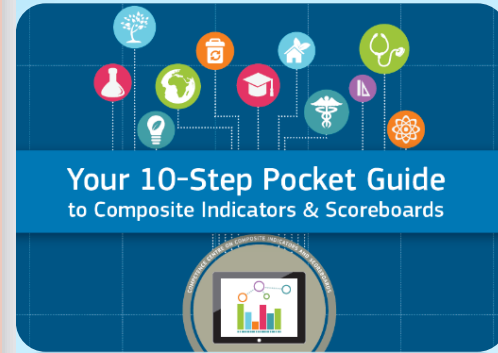
Make sense of the data

▶▶ Dig into the data to reveal **narratives and stories** for your audience. What question did you set out to answer?

▶▶ **Decompose performance** at the dimension or indicator level to reveal strengths and limitations for each country or groups of countries

▶▶ **Correlate the index with relevant measurable phenomena** and explain similarities or differences

▶▶ Don't assume causality from correlation. Perform **causality tests** (if time series data is available)

▶▶ *Valid both for composite indicators and scoreboards*

COIN Tips

It is your role to find stories in the numbers. The tools don't know what those stories are. Your data visualisation tools will be more effective if combined with powerful narratives.
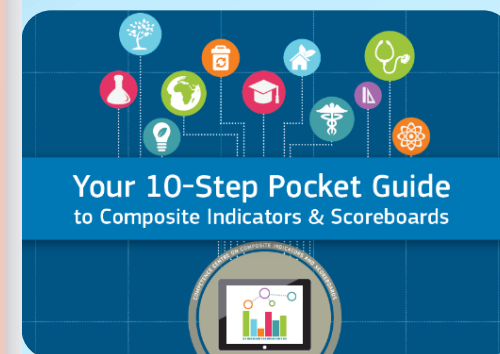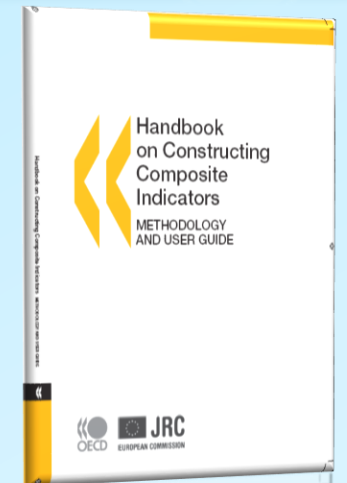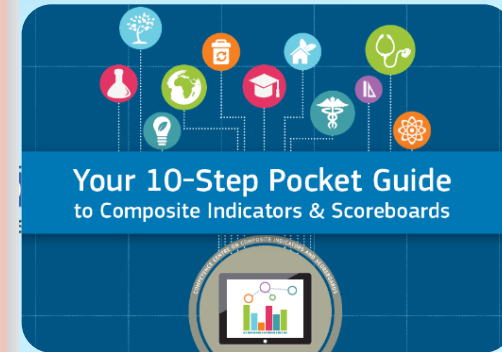
Present the data visually

COIN Tips

The best data graphics are usually the simplest. Well-designed graphics should focus on showing the findings clearly, be easy to read and decode the data.
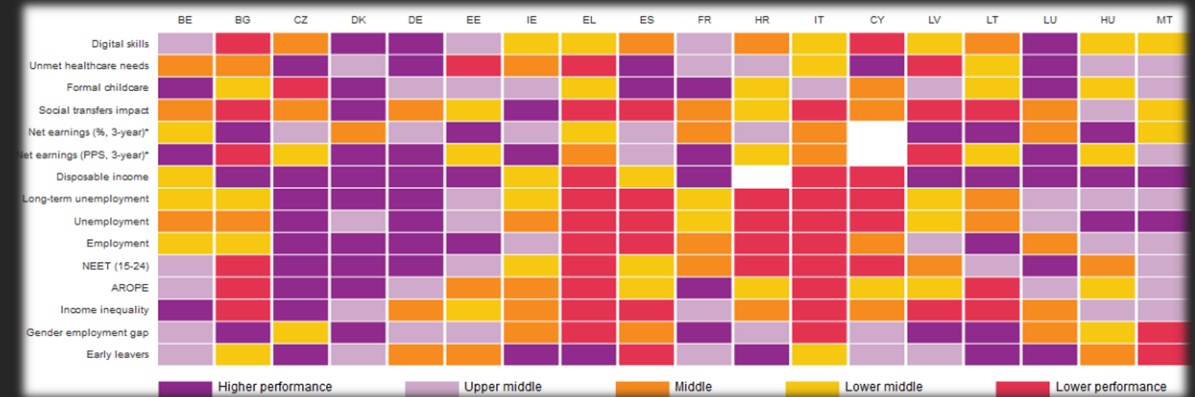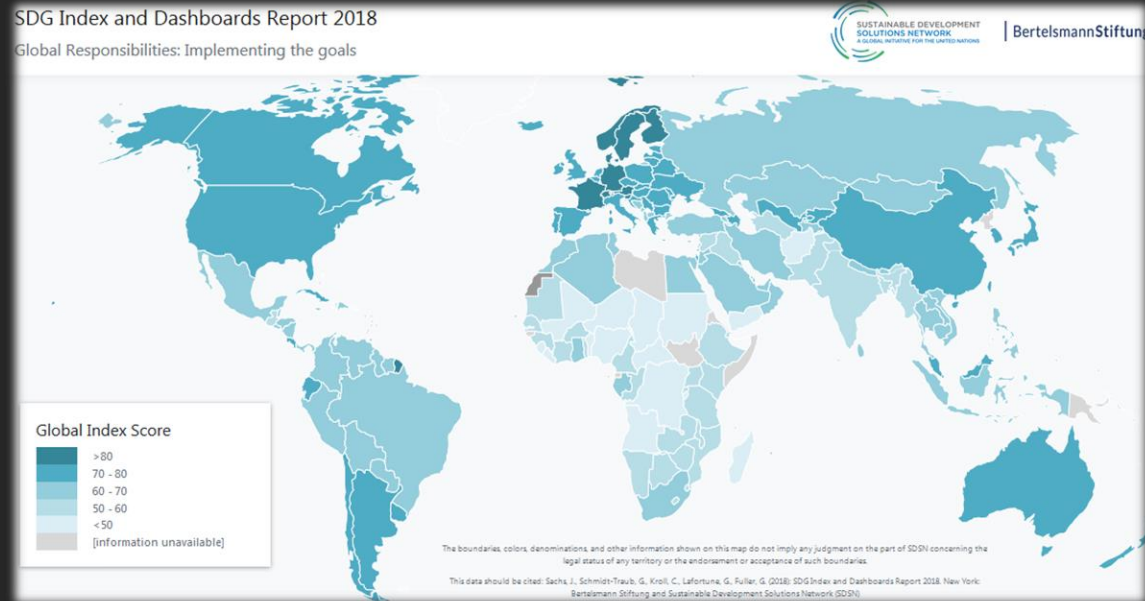
A picture is worth a thousand words!

▶▶ Focus first on what your **key messages** are and to whom you are aiming to communicate them

▶▶ Select the **visualisation tools** which clearly communicate the messages without hiding vital information

▶▶ **Avoid over-complicated visuals** and excessive cognitive load
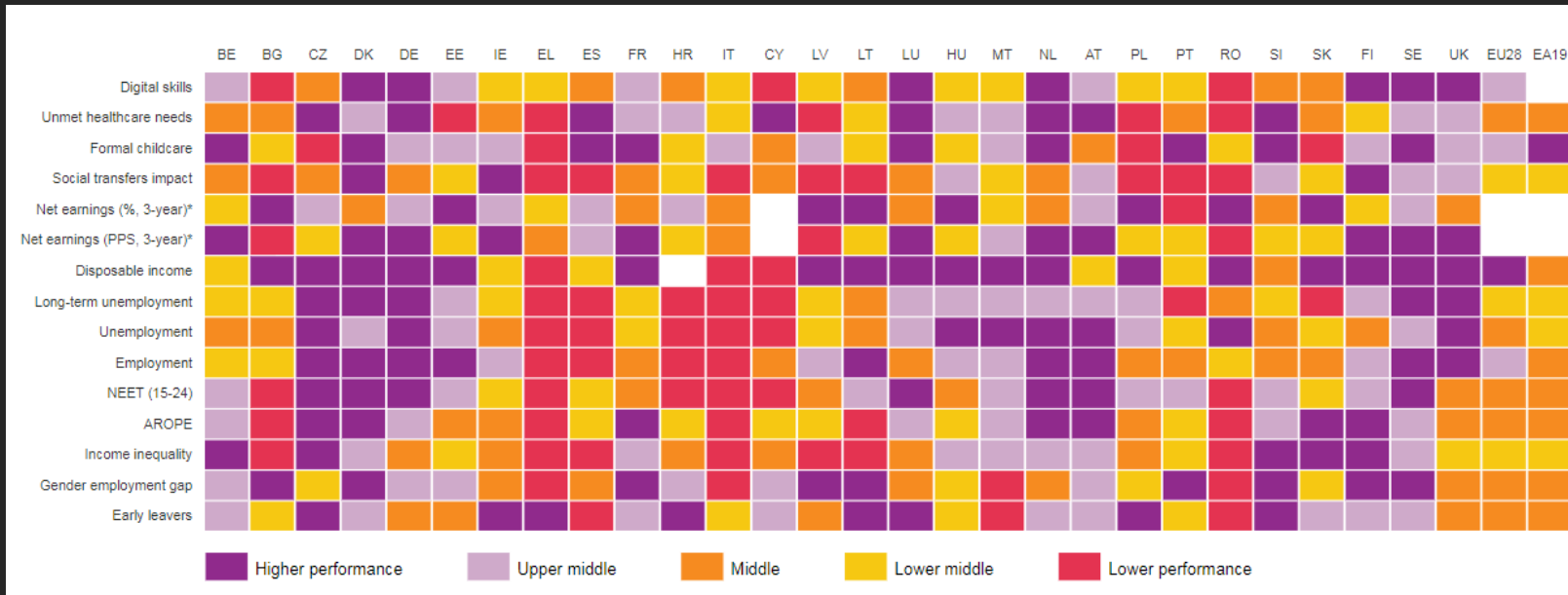
▶▶ *Valid both for composite indicators and scoreboards*

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Dilemma: Index or Scoreboard?

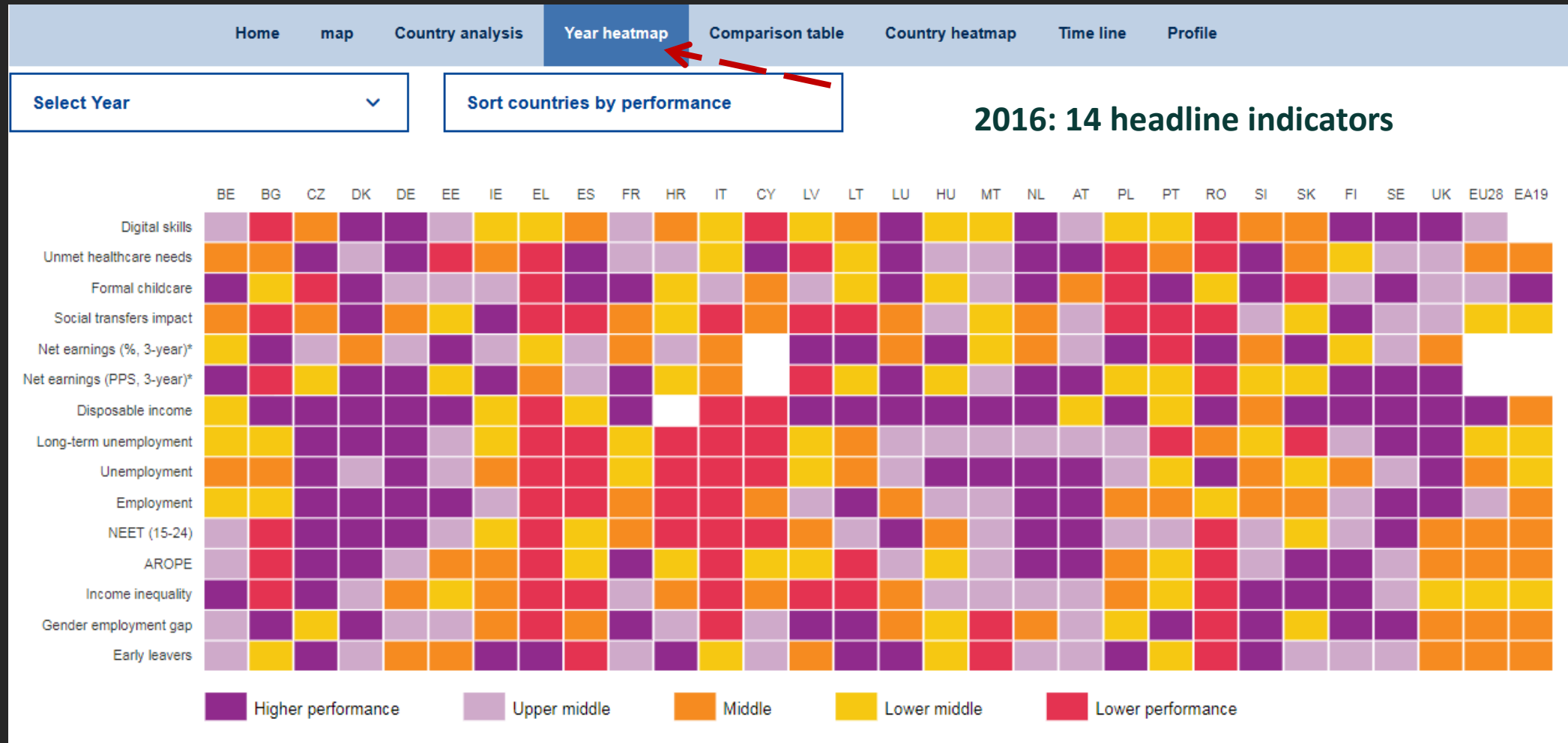**Composite Indicators** are aggregations of individual indicators compiled into a single score.

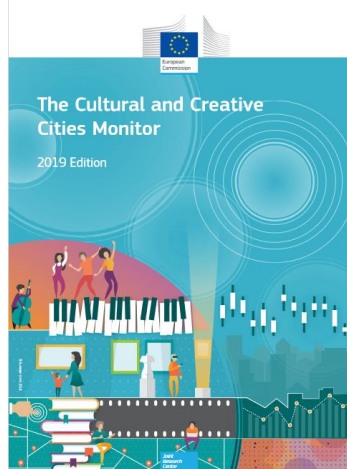**Scoreboards** are collections of individual indicators that are related to a common concept.
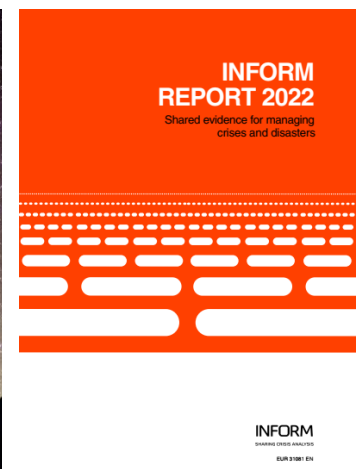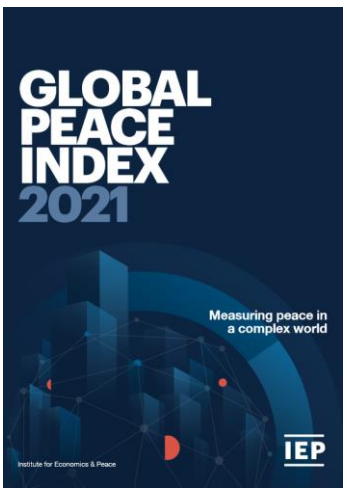
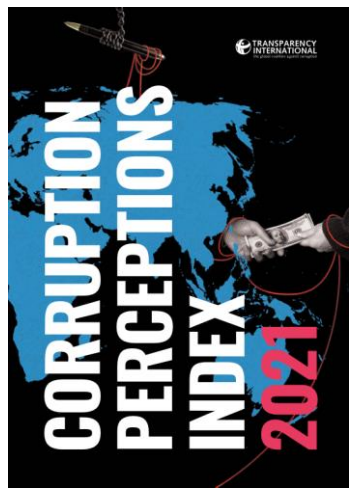# Social Scoreboard

Social Scoreboard

Social Scoreboard

Environmental Performance Index 2022
Ranking country performance on sustainability issues

Yale Center for Environmental Law & Policy, Yale University — Center for International Earth Science Information Network, Columbia University — With support from the McCall MacBain Foundation
EPI

Global Innovation Index 2022
What is the future of innovation-driven growth?
WIPO

THE 2021 EU JUSTICE SCOREBOARD
Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions COM(2021) 389
Justice and Consumers

SUSTAINABLE DEVELOPMENT REPORT 2022
From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond
Includes the SDG Index and Dashboards
CAMBRIDGE

BACK TO NORMAL IS NOT ENOUGH
2022 SDG Gender Index
EQUAL MEASURES 2030

European Innovation Scoreboard 2021
Innovation

HUMAN DEVELOPMENT REPORT 2021/2022
Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World
UNDP

MIT Technology Review Insights
2nd Edition
The Green Future Index 2022
A ranking of 76 economies on their progress and commitment toward building a low-carbon future.
Gold partner: Morgan Stanley — Silver partners: citrix, HED CERAMICA GROUP

TRANSITIONS PERFORMANCE INDEX 2021
Towards fair and prosperous sustainability
European Commission
Research and Innovation

World Justice Project
Rule of Law Index® 2021

CORRUPTION PERCEPTIONS INDEX 2021
TRANSPARENCY INTERNATIONAL

GLOBAL PEACE INDEX 2021
Measuring peace in a complex world
Institute for Economics & Peace
IEP

Gender Equality Index 2021
Health
EIGE

The Human Capital Index 2020 UPDATE
Human Capital in the Time of COVID-19
WORLD BANK GROUP

The Global Talent Competitiveness Index 2022
The Tectonics of Talent: Is the World Drifting Towards Increased Talent Inequalities?
INSEAD The Business School for the World — human capital leadership institute — PORTULANS INSTITUTE

2021 Social Progress Index
Executive Summary
SOCIAL PROGRESS

INFORM REPORT 2022
Shared evidence for managing crises and disasters
INFORM
SHARING ORDS ANALYSIS
EUR 31081 EN

Global ICT Regulatory Outlook 2020
Studies & research
ITU Publications
ITU

2021 Resource Governance Index
Natural Resource Governance Institute

The Cultural and Creative Cities Monitor
2019 Edition
European Commission

Global Attractiveness Index
The thermometer of a Country's attractiveness
The European House Ambrosetti
TOYOTA AVIVA

European Commission
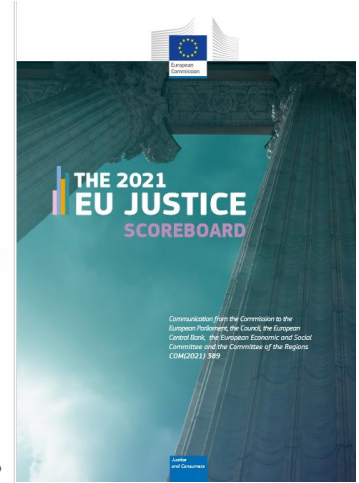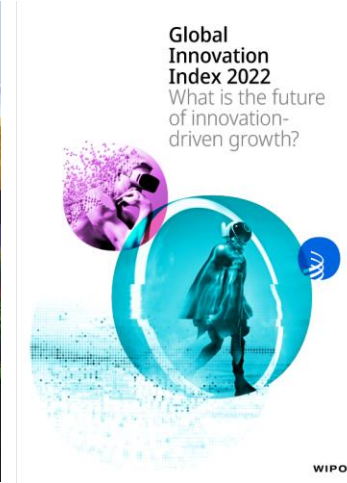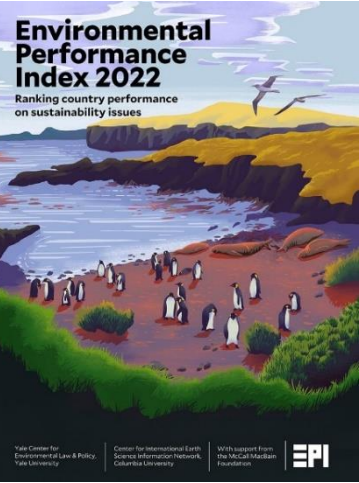
MEASURE, EXPLORE, AND COMPARE FOR INFORMED DECISIONS

Composite Indicators & Scoreboards Explorer

Your gateway for numbers that matter

Start Exploring >   European Green Deal   🔍

145	34	244	1438	443	653K
Indices	Scoreboards	Countries	Regions	Cities	Data points

Indices and scoreboards

Countries and territories

Synergies and trade-offs

https://ec.europa.eu/scoreboards-explorer

Composite Indicators & Scoreboards Explorer

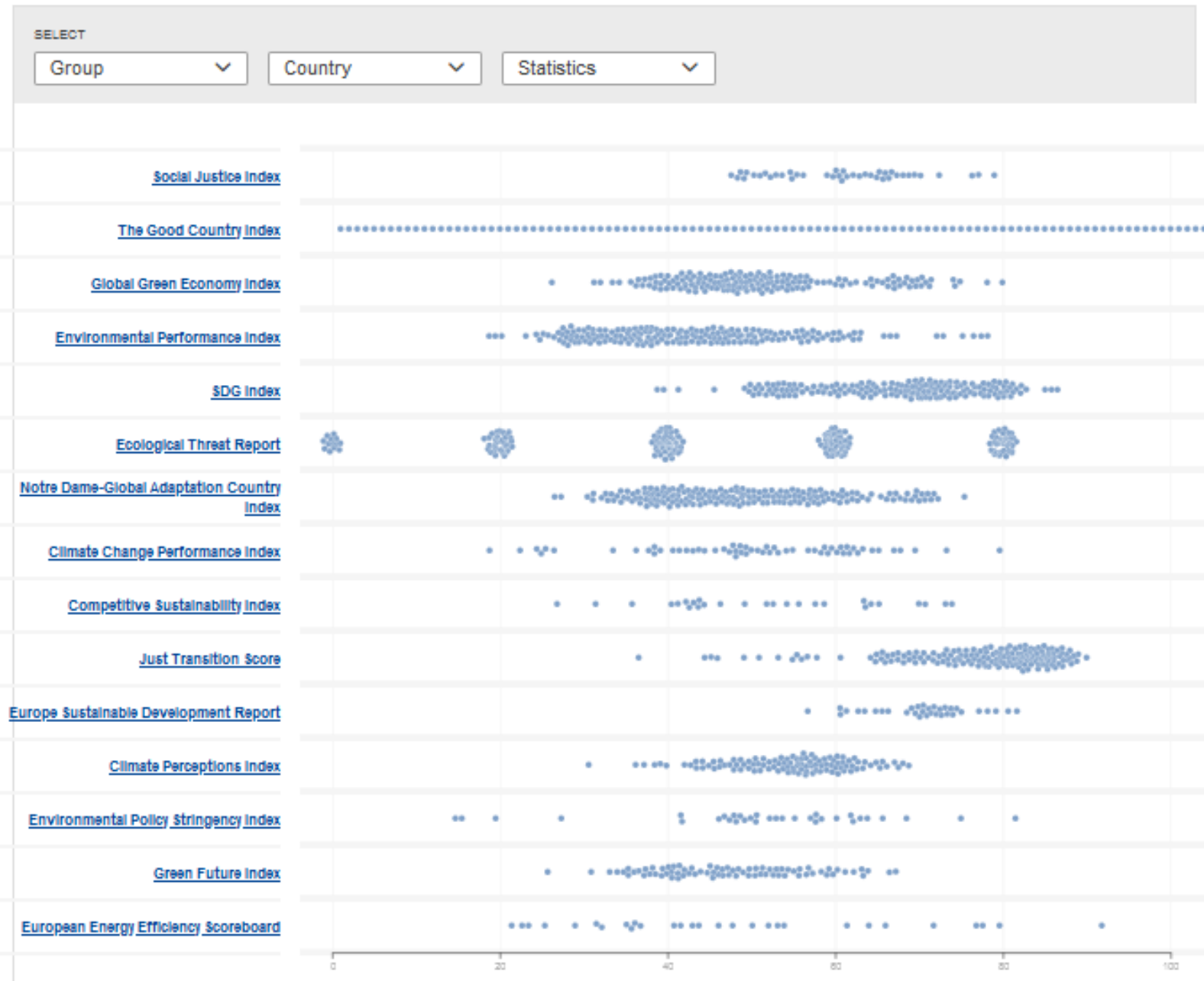## UN Sustainable Development Goals

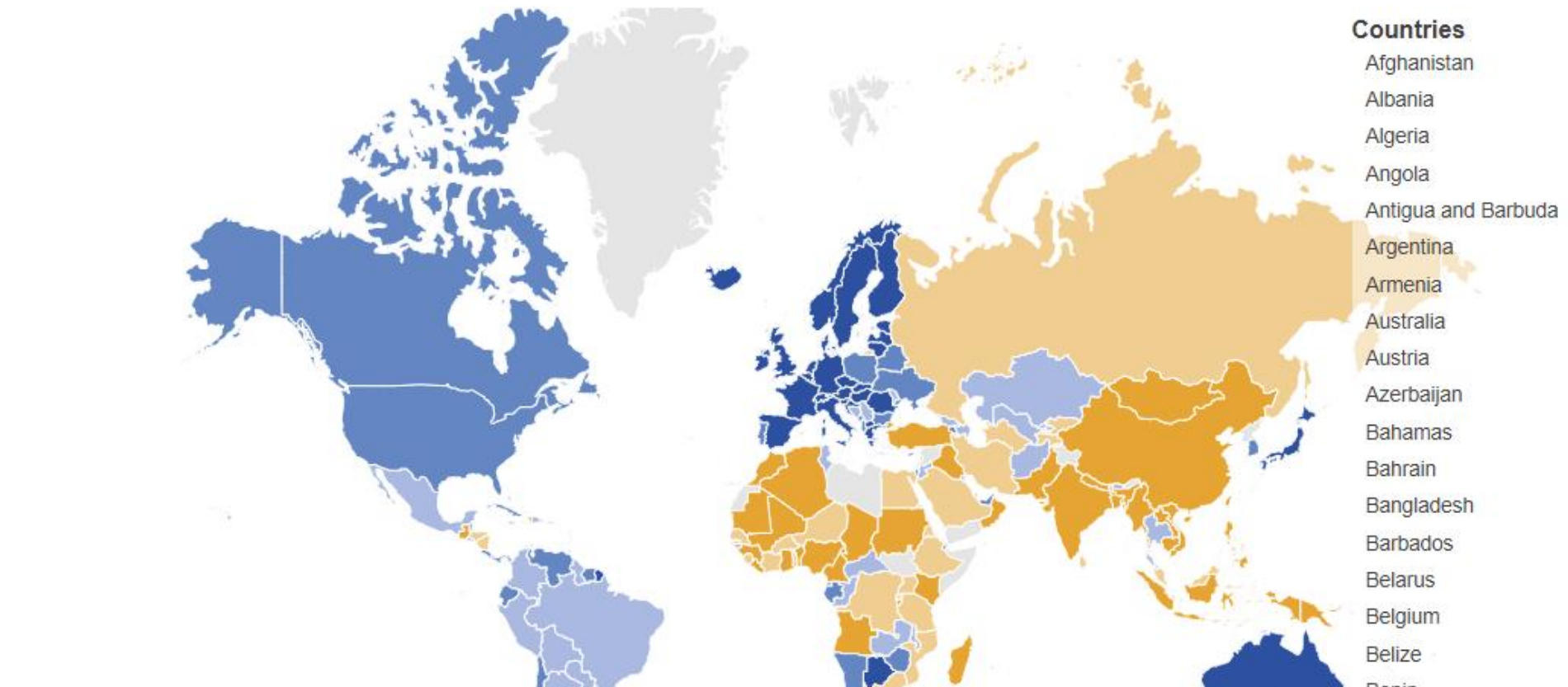|		
GOAL 1: No Poverty	10	
GOAL 2: Zero Hunger	7	
GOAL 3: Good Health and Well-being	39	
GOAL 4: Quality Education	26	
GOAL 5: Gender Equality	13	
GOAL 6: Clean Water and Sanitation	3	
GOAL 7: Affordable and Clean Energy	14	
GOAL 8: Decent Work and Economic Growth	41	
GOAL 9: Industry Innovation and Infrastructure	35	
GOAL 10: Reduced Inequality	23	
GOAL 11: Sustainable Cities and Communities	12	
GOAL 12: Responsible Consumption and Production	13	
GOAL 13: Climate Action	19	
GOAL 14: Life Below Water	5	
GOAL 15: Life on Land	8	
GOAL 16: Peace and Justice Strong Institutions	57	
GOAL 17: Partnerships to achieve the Goal	4	

Number of monitoring frameworks that were mapped by the JRC for the 17 UN SDG.

Example: there are mapped **39 monitoring frameworks** (with over 3000 indicators!) under **SDG 3: Good Health and Wellbeing**

European Commission

GOAL 13: Climate Action

SELECT

| Group ▼ | Country ▼ | Statistics ▼ |

Social Justice Index

The Good Country Index

Global Green Economy Index

Environmental Performance Index

SDG Index

Ecological Threat Report

Notre Dame-Global Adaptation Country Index

Climate Change Performance Index

Competitive Sustainability Index

Just Transition Score

Europe Sustainable Development Report

Climate Perceptions Index

Environmental Policy Stringency Index

Green Future Index

European Energy Efficiency Scoreboard

European Commission

Environmental Performance Index

Countries
- Afghanistan
- Albania
- Algeria
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Australia
- Austria
- Azerbaijan
- Bahamas
- Bahrain
- Bangladesh
- Barbados
- Belarus
- Belgium
- Belize

Legend: 77.9 | 53.2 | 45.5 | 38 | 31.7 | 18.9

Top performers by Income peer group ⓘ ⌄

High income	Upper middle income	Lower middle income	Low income
Denmark	Romania	São Tomé and Príncipe	Central African Republic
United Kingdom	North Macedonia	Belize	Afghanistan
Finland	Botswana	Ukraine	Malawi
Malta	Saint Vincent and The	Kiribati	Guinea-Bissau
Sweden	Grenadines	Djibouti	
	Bulgaria		

Environmental Performance Index

Countries

Afghanistan
Albania
Algeria
Angola
Antigua and Barbuda
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize

Legend scale: 77.9 | 53.2 | 45.5 | 38 | 31.7 | 18.9

Top performers by **HDI peer group** ⓘ ˅

Very high human development	High human development	Medium human development	Low human development
Denmark	Seychelles	São Tomé and Príncipe	Djibouti
United Kingdom	North Macedonia	Namibia	Central African Republic
Finland	Botswana	Kiribati	Afghanistan
Malta	Saint Vincent and The Grenadines	Zimbabwe	Malawi
Sweden	Antigua and Barbuda	Eswatini	Guinea-Bissau

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Environmental Performance Index

1-Environmental Performance Index   2-Environmental Health   3-Ecosystem Vitality   4-Climate Change   5-Air quality

6-Sanitation & Drinking Water   7-Heavy metals   8-Waste Management   9-Biodiversity & habitat   10-Ecosystem Services   11-Fisheries

12-Acid Rain   13-Agriculture   14-Water Resources   15-Climate Change Mitigation

European Commission

Composite Indicators & Scoreboards Explorer
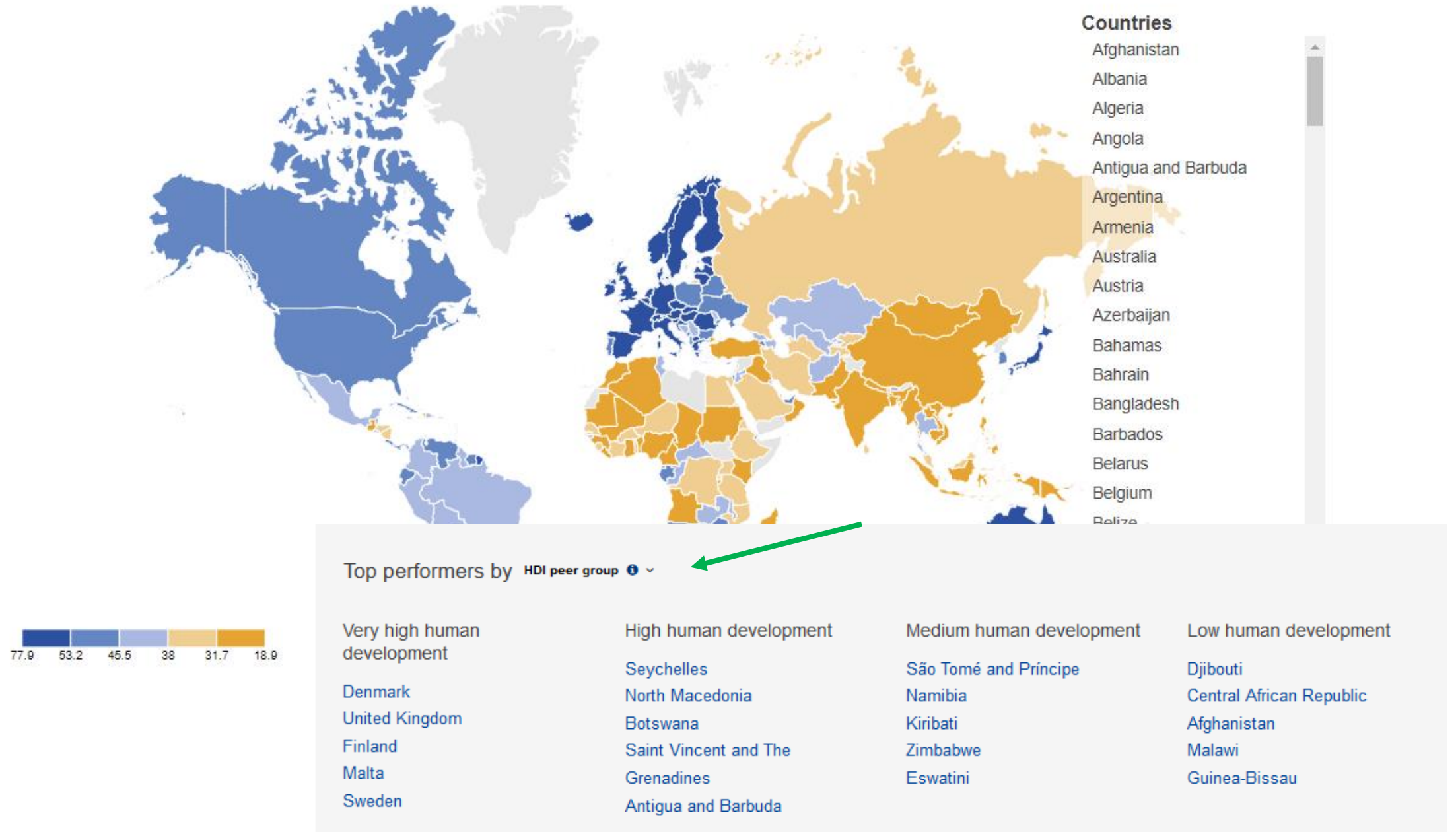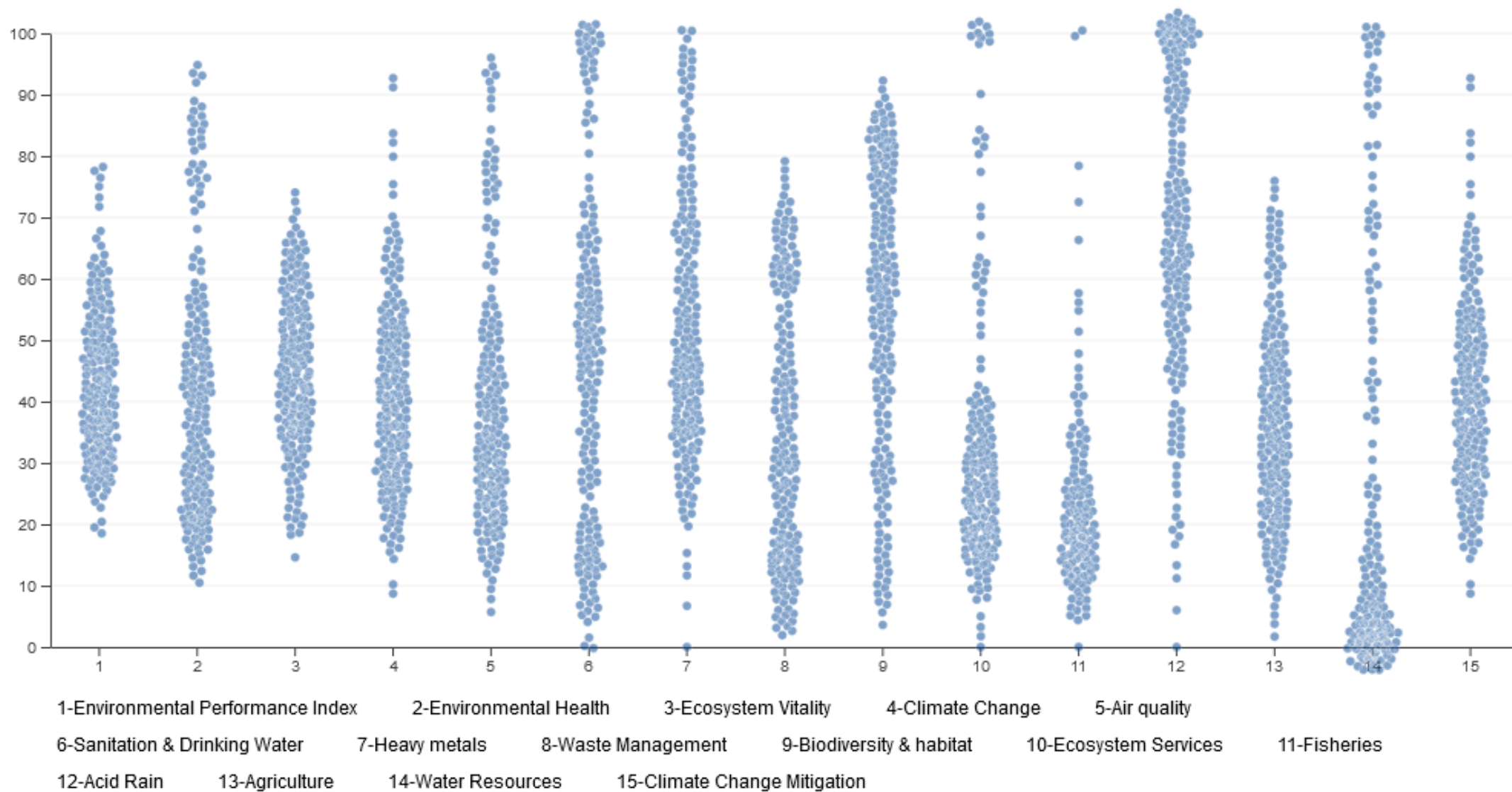
Stories (4)

13 June 2023

Beyond GDP: Measuring what 'makes life worthwhile'

By A. R. Neves

🕐 9 Minutes
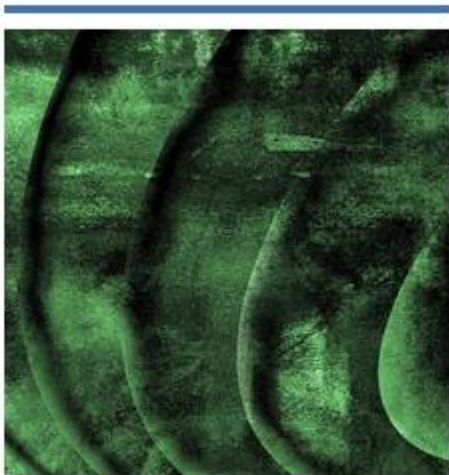
16 March 2023

Riding the green-social transition tandem with the right data

By S. Prevost, J. Harmacek

14 November 2022

How are indices and scoreboards used in EU policymaking?

By M. Saisana, A.R. Neves, M. Nurminen, E. Starnoni, V. Alberti, C. Moura

14 November 2022

Why Regions Matter for Gender Equality?

By M. Nurminen and E. Papadimitriou

🕐 5 Minutes
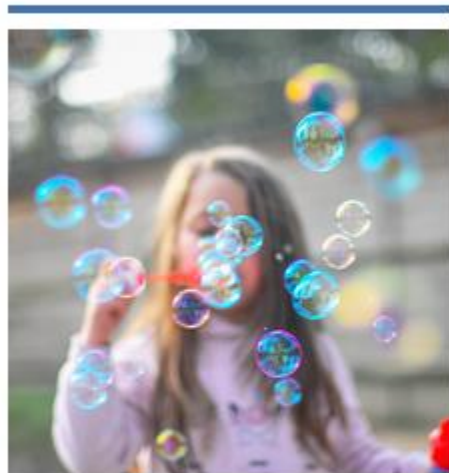
European Commission

Composite Indicators & Scoreboards Explorer

Home   Explorer   Indices and scoreboards   Countries   Synergies and trade-offs   Policy areas   Stories   FAQs   About

Stories (4)

" Every day of continued exponential growth brings the world system closer to the ultimate limits of that growth. A decision to do nothing is a decision to increase the risk of collapse. "

Donella H. Meadows, Limits to Growth, 1972

13 June 2023
Beyond GDP: Measuring what 'makes life worthwhile'
By A. R. Neves

🕐 9 Minutes

https://composite-indicators.jrc.ec.europa.eu/explorer/stories/beyond-gdp

European
Commission

Beyond GDP: Measuring what 'makes life worthwhile'

👤 A. R. Neves   📅 Published 13 June 2023   ⊞ 9 Minutes

Overview of 11 wellbeing and sustainability-related indices

| Index	Organisation	Countries	Indicators	Sustainability pillars covered		
				Economic	Social	Environment
Competitive Sustainability Index ⊙	University of Cambridge	27	84	■	■	■
Ecological Footprint	Global Footprint Network	184	5			■
Environmental Performance Index ⊙	Yale University, Columbia University	180	40			■
Global Sustainable Competitiveness Index ⊙	SolAbility	180	131	■	■	■
Human Development Index	UNDP	189	4	■	■	
Planetary-adjusted Human Development Index	UNDP	189	6		■	■
Legatum Prosperity Index	Legatum Institute	167	300	■	■	■
Social Progress index ⊙	Social Imperative	169	60		■	■
SDG Index and Dashboards ⊙	SDSN	193	92	■	■	■
Transitions Performance Index ⊙	European Commission	73	28	■	■	■
World Happiness Report	SDSN	146	6	■	■	

One or more editions of the index were audited by the JRC
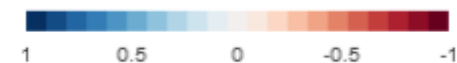
European Commission

Beyond GDP: Measuring what 'makes life worthwhile'

A. R. Neves   Published 13 June 2023   9 Minutes

## Synergies & trade-offs between 11 pairs of indices
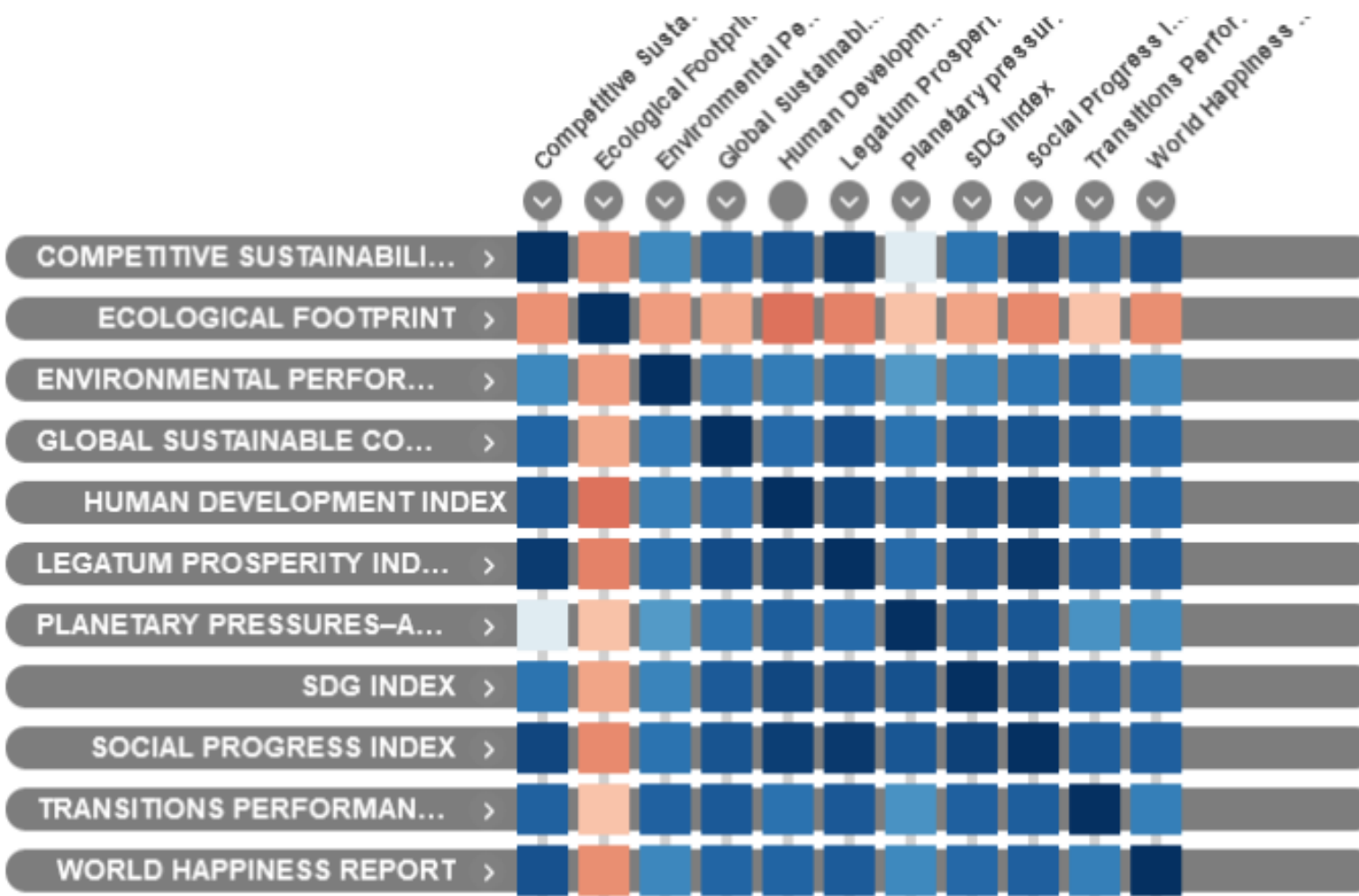
The correlation matrix illustrates that most of the indices measuring aspects of human wellbeing and sustainability show strong links between them. Darker blue represents greater positive correlation. The only exception goes for the Ecological Footprint.
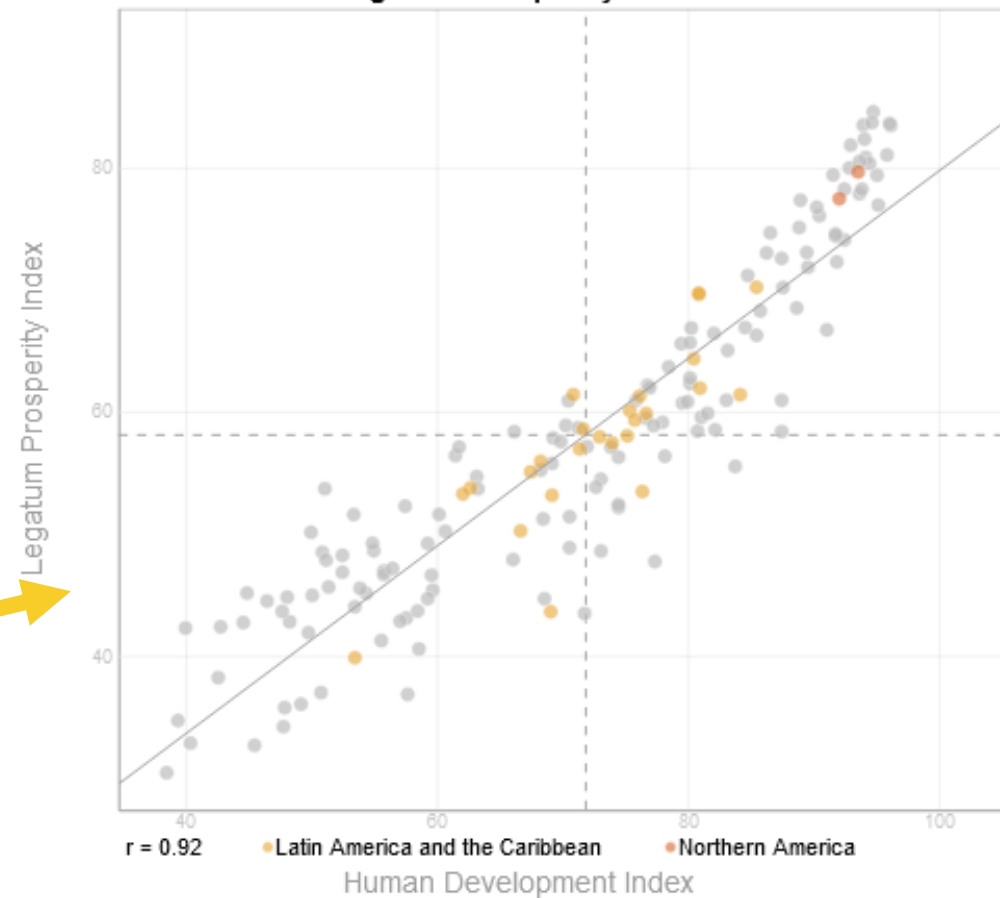
Beyond GDP: Measuring what 'makes life worthwhile'

A. R. Neves   Published 13 June 2023

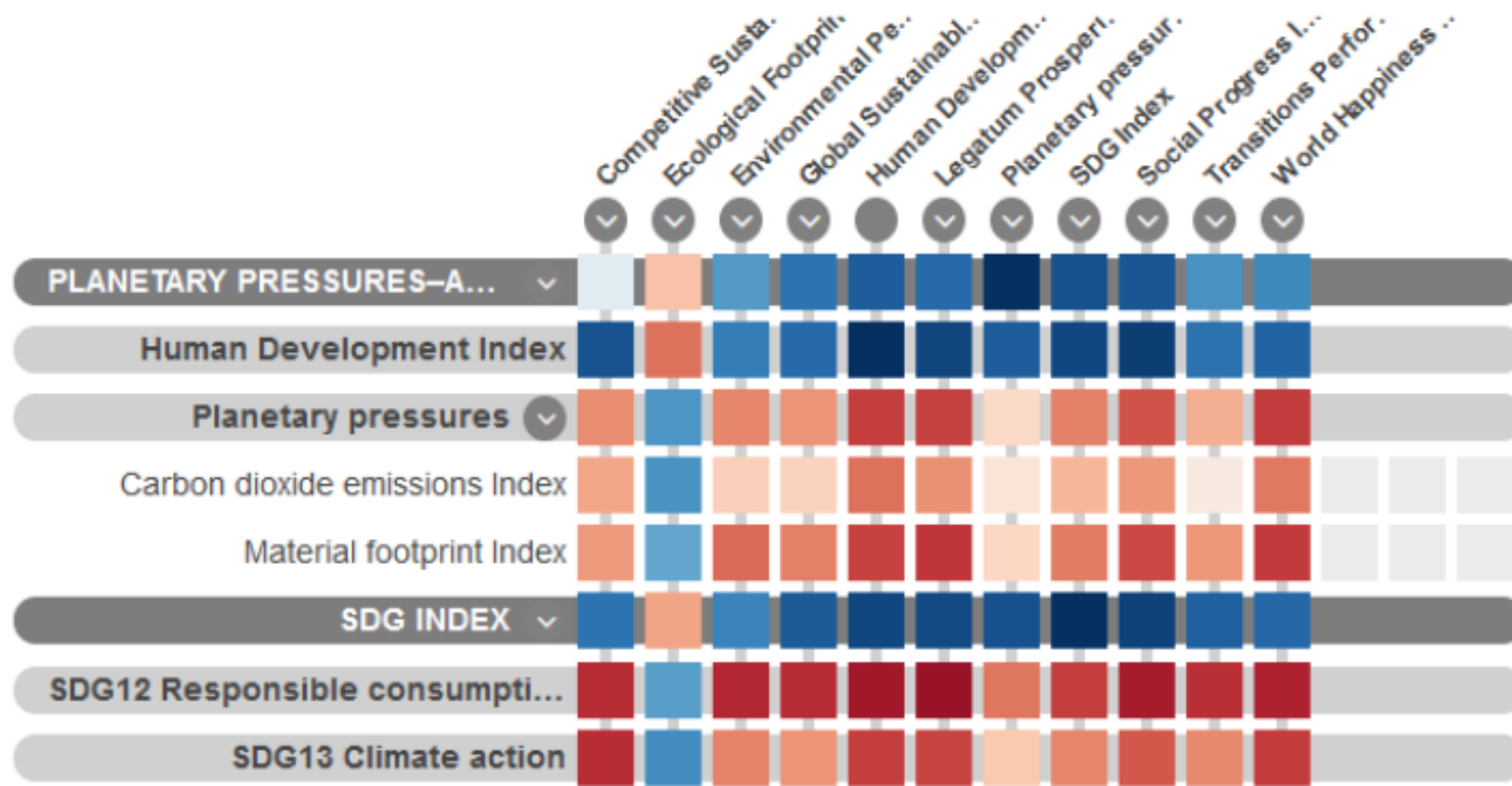## Synergies & trade-offs between 11 pairs of indices
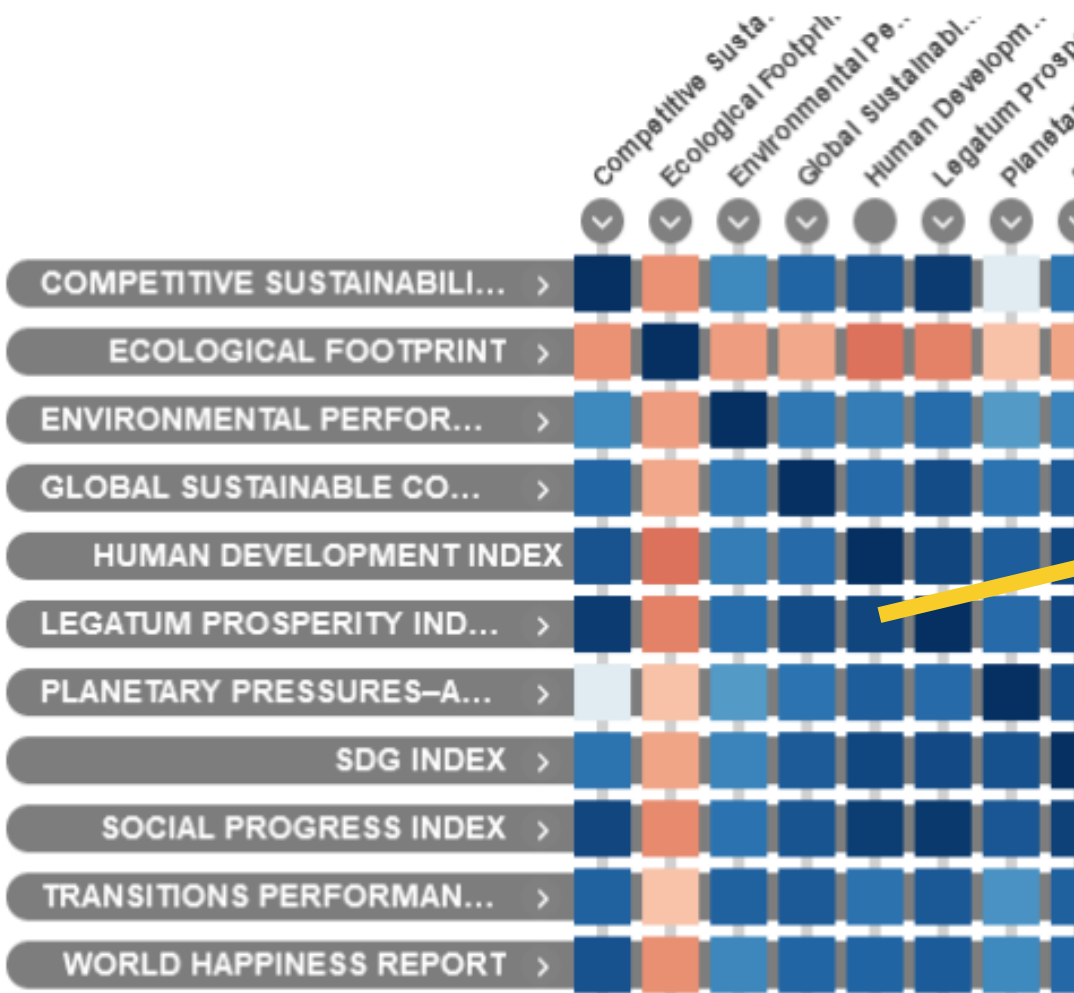
### Association between Human Development Index and Legatum Prosperity Index

A closer look at trade-offs

The correlation matrix shows the trade-off between the 'Planetary pressures' dimension of the Planetary pressures-adjusted Human Development Index, the 'SDG 12' and the 'SDG 13' dimensions of the SDG Index and all the indices, with the exception of the Ecological Footprint. Red represents strong negative correlation.
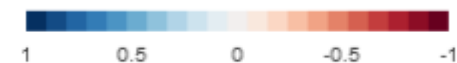
Competence Centre on Composite Indicators and Scoreboards

Support to EU Services in any policy area
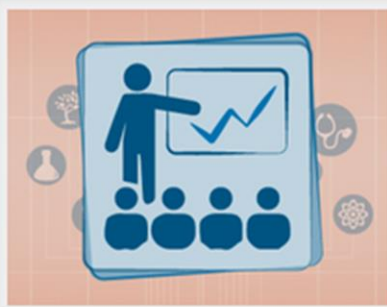
✓ **20+ years of expertise** *(since 2002)*

Support to international organisations

Methodology and guidelines

Handbook
on Constructing
Composite
Indicators

METHODOLOGY
AND USER GUIDE

COMPETENCE CENTRE ON COMPOSITE INDICATORS AND SCOREBOARDS

Training and Community of Practice
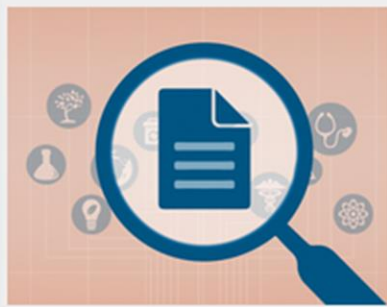
European Commission

Get in touch jrc-coin@ec.europa.eu & michaela.saisana@ec.europa.eu

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