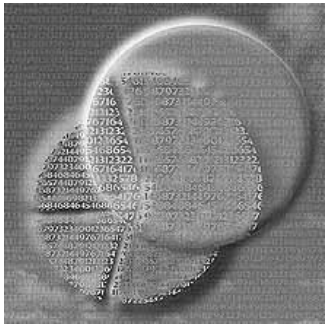
Composite Indicators – A review

Second Workshop on Composite Indicators of Country Performance,
Feb. 26-27th 2004

OECD, Paris



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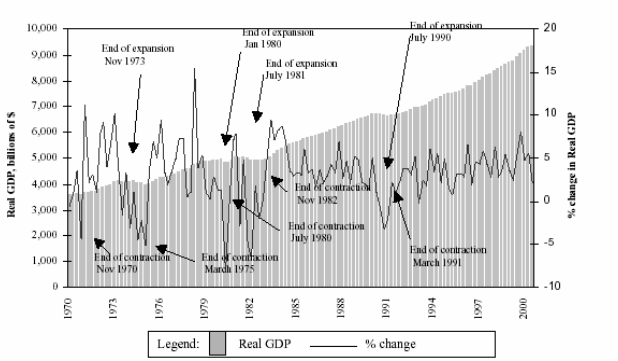
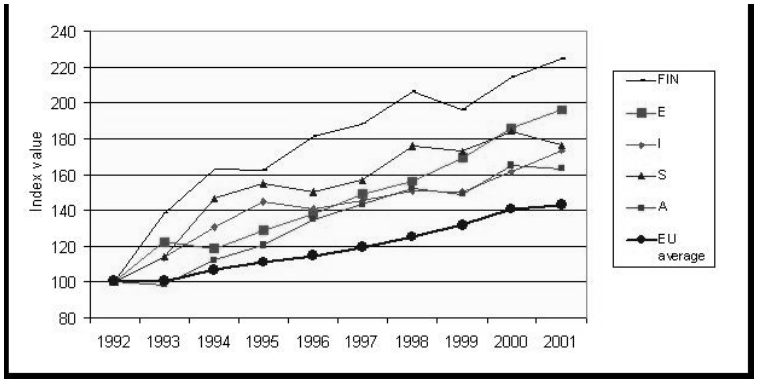
A first look

GDP

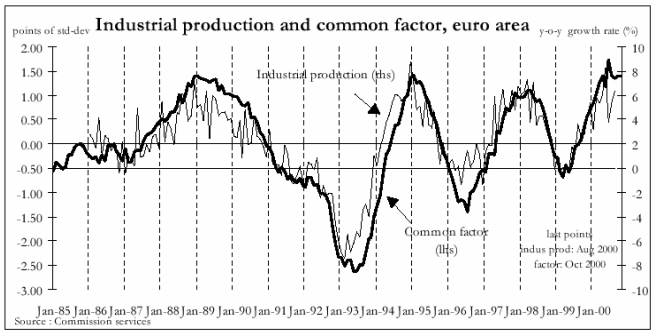


Source: U.S. Department of Commerce, Bureau of Economic Analysis, and National Bureau of Economic Research.
Compiled by: CEDBR, W. Frank Barton School of Business, Wichita State University

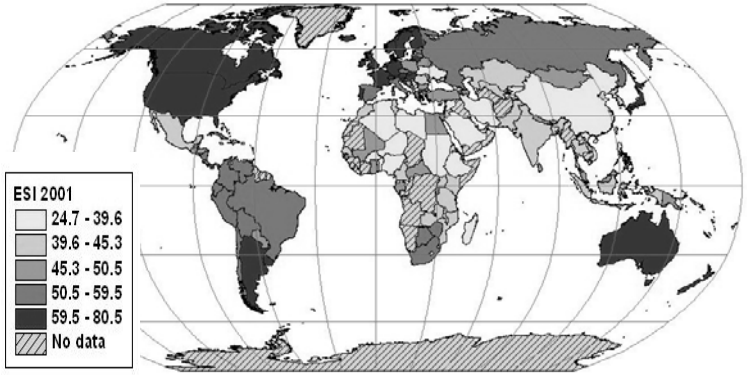
Internal Market Index



Business climate indicator



Environmental Sustainability Index



http://www.jrc.cec.eu.int/uasa

Definition

Technical:

Composite indicators are mathematical combinations (or aggregations) of a set of indicators.

Conceptual:

“Composite indicators are based on sub-indicators that have no common meaningful unit of measurement and there is no obvious way of weighting these sub-indicators”

(Source: Note on composite indicators, EC, Brussels, March 2002)

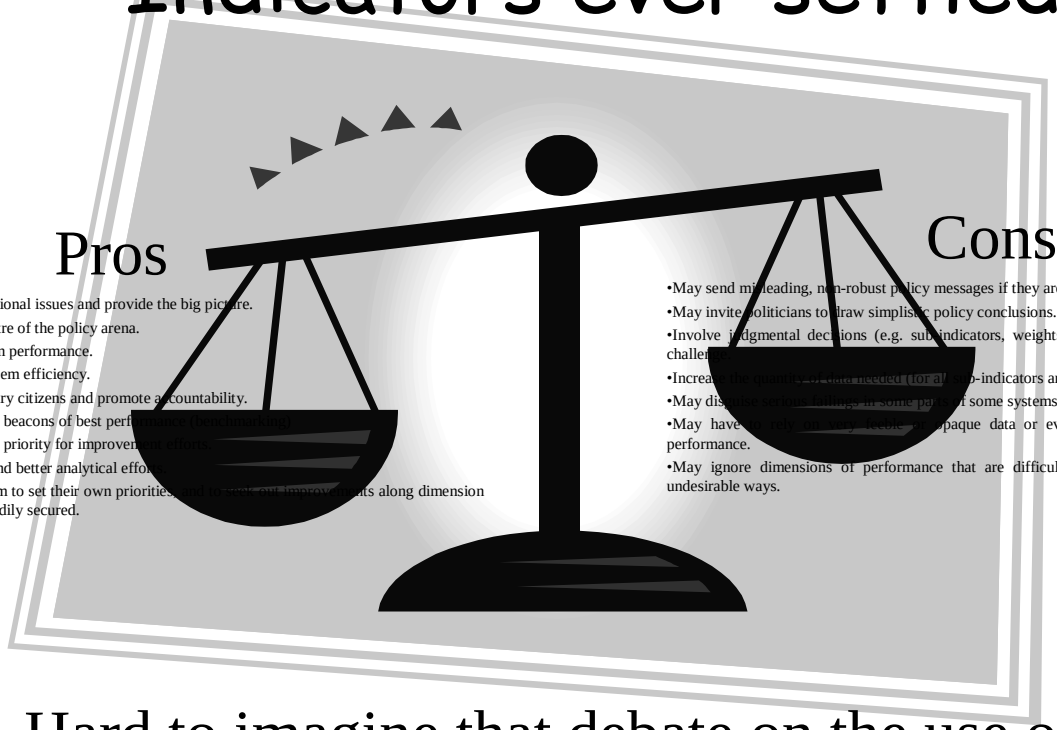
Pros of Composite Indicators

- To summarise complex or multi-dimensional issues.
- To place countries' performance at the centre of the policy arena.
- To offer a rounded assessment of countries' performance.
- To enable judgments to be made on countries' efficiency.
- To facilitate communication with ordinary citizens.
- To be used for benchmarking countries of best performance.
- To indicate which countries represent the priority for improvement efforts.
- To stimulate the search for better data and better analytical efforts.
- To set locql priorities, and to seek out improvements along dimension of performance where gains are most readily secured.

Cons of Composite Indicators

- May send misleading, non-robust policy messages.
  → Sensitivity analysis for robustness assessment
- May invite stakeholders to draw simplistic conclusions.
  → Consideration of subindicators
- Involve judgmental decisions
  → Transparency in judgement
- Increase the quantity of data needed.
- May disguise serious failings in some parts of some systems.
  → Consideration of subindicators
- May rely on very feeble data in some dimensions.
- May ignore dimensions of performance thqt qre not measurable.

Debate on Composite Indicators ever settled?



Pros

•To summarise complex or multi-dimensional issues and provide the big picture.
•To place system performance at the centre of the policy arena.
•To offer a rounded assessment of system performance.
•To enable judgments to be made on system efficiency.
•To facilitate communication with ordinary citizens and promote accountability.
•To indicate which systems represent the beacons of best performance (benchmarking).
•To indicate which systems represent the priority for improvement efforts.
•To stimulate the search for better data and better analytical effort.
•To offer local policy makers the freedom to set their own priorities, and the scope for improvements along dimension of performance where gains are most readily secured.

Cons

•May send misleading, non-robust policy messages if they are poorly constructed or misinterpreted.
•May invite politicians to draw simplistic policy conclusions.
•Involve judgmental decisions (e.g. sub-indicators, weights) that could be the target of political challenge.
•Increase the quantity of data needed (for all sub-indicators and countries).
•May disadvantage some countries in some parts of some systems.
•May have to rely on soft (subjective) or opaque data or even contentious in some dimension of performance.
•May ignore dimensions of performance that are difficult to measure may distort behavior in undesirable ways.

Hard to imagine that debate on the use of composite indicators will ever be settled.

Statisticians may resent that work in data collection and editing is “wasted” or “hidden” behind a single number of dubious significance.

Stakeholders tempted to summarise complex (elusive) processes into a single figure to benchmark country performance for policy consumption.

Debate on Composite Indicators ever settled?

All things considered, composite indicators should be identified for what they are:

simplistic presentations and comparisons of performance in given areas to be used as starting points for further analysis and discussion

Thematic categories of Composite Indicators

- Environment
- Society
- Economy
- Innovation/Technology/Information
- Globalisation

Examples of composite indicators

Environment

- Environmental Sustainability Index (WEF)
- Air Quality Index (WEF)
- Environment Index (World Travel and Tourism Council)
- Environmental Performance Index (WEF, Yale & Columbia Universities)
- Living Planet Index (UNEP & WCMC)
- National Biodiversity Index (Secretariat of the Convention on Biological Diversity)
- Natural Capital Index (RIVM, The Netherlands)

A more complete list available on web:
http://farmweb.jrc.cec.eu.int/ci/

Examples of composite indicators

Society

- Human Development Index (United Nations)
- Health System Achievement Index (WHO)
- Corruption Perceptions Index (Transparency International)
- World Income Inequality Database:Gini Index (United Nations)
- Wellbeing Index (Prescott-Allen)
- Genuine Progress Indicator (Redefining Progress)

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Examples of composite indicators

Economy

- Economic Sentiment Indicator (EC)
- Composite Leading Indicators (OECD)
- Internal Market Index (EC)
- Doing Business Indicators (World Bank)
- Index of Economic Freedom (Heritage Foundation)
- Economic Competitiveness Index (Institute for Management Development)
- Human Tourism Index (World Travel and Tourism Council)

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Examples of composite indicators

Innovation/Technology/Information

- Summary Innovation Index (EC)
- Innovative Capacity Index (Porter and Stern)
- Investment/Performance in the knowledge based economy (EC)
- Technology Achievement Index (United Nations)
- The Networked Readiness Index (Harvard University - Centre for International Development)
- E-Government Rankings (World Markets Research Centre)

A more complete list available on web:
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Examples of composite indicators

Globalisation

- Globalization Index (Foreign Policy Magazine)
- World Competitiveness Index (IMD)
- Growth Competitiveness Index (WEF)
- Current Competitiveness Index (WEF)
- The Globalisation Index (G-Index) (World Markets Research Centre)

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General Building Scheme

1. Theoretical framework
2. Data selection
3. Correlation analysis
4. Preliminary data treatment
5. Data normalisation
6. Data weighting
7. Data aggregation
8. Robustness/ sensitivity tests
9. Visualisation

1. Theoretical Framework

Ideally, a theoretical framework will allow indicators to be selected, combined and weighted in a manner which reflects the dimensions or structure of the phenomenon being measured.

Environmental example

What is biodiversity?

Biological diversity - or biodiversity – is usually referred to as the variety of life on earth. This variety is reflected at three levels: in the diversity within species and their genetic composition (genetic diversity), the number of species (species diversity) and the state and function of ecosystems.

2. Data selection

- **Policy relevance**
- **Simplicity**
- **Validity**
- **Time series data**
- **Availability of affordable data**
- **Sensitivity**
- **Reliability**

An inventory of biodiversity indicators in Europe

Nature protection (387)
Forestry (78)
Energy (1)
Tourism recreation (4)
Climate change (12)
Urban development (4)
Water (43)
Transport Infrastructure (11)
Trade (2)
Fisheries (22)
Agriculture (91)

(European Centre on Nature Conservation, February 2002)

3. Correlation analysis

Indicators are often chosen with little attention paid to the interrelationships between them.

Correlation analysis:
- Identify statistical dimensions in data set
- Eliminate highly correlated indicators

Method	Composite Indicators
Principal Components Analysis	Environmental Sustainability Index General Indicator of Science & Technology Internal Market Index Business Climate Indicator Success of software process implementation
Cronbach Coefficient Alpha	Success of software process implementation

4. Preliminary data treatment

- Making variables comparable

  (e.g. dividing by population /income/ populated land area)

- Missing data imputation

  (e.g. data deletion, mean substitution, regression, multiple imputation, nearest neighbour, ignore).

- Logarithms of highly skewed variables

  (e.g. skewness measure greater than 5).

- Truncating distributions

  (e.g. to account for inaccuracy of data at the extremes, to avoid extreme cases becoming benchmarks for entire population.

5. Data normalisation

Method	Composite Indicators
Standard deviation from the mean	Environmental Sustainability Index Mother's Index Internal Market Index General Indicator of Science and Technology
Distance from the group leader	
Distance from the mean	Economic Sentiment Indicator
Distance from the best and worst performers	Human Development Index Health System Achievement Index Commitment to Development Index Human Tourism Index The Networked Readiness Index
Categorical scale	Environmental Performance Index National Health Care Systems Performance Business climate indicator Index of Economic Freedom Summary Innovation Index

6. Data weighting

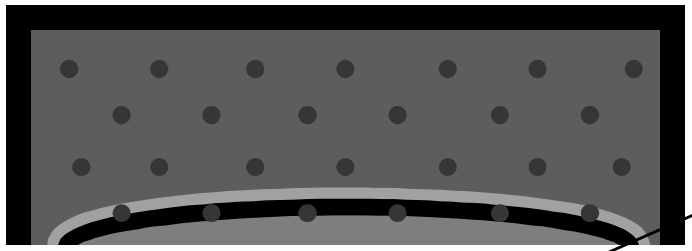
Method	Composite Indicators
Equal weights	Summary Innovation Index Environmental Sustainability Index Composite Leading Indicators
Correlation analysis	Relative intensity of regional problems in the Community
Unobserved Components Models (including PCA/ FA)	Internal Market Index General Indicator of Science and Technology Business climate indicator Governance indicators (Kaufmann, Kraay and Zoid-lobatón, 1999 and 2003)
Regression analysis	
Data envelopment analysis (DEA)	Human Development Index (Mahlberg and Obersteiner, 2001) Social Inclusion (Cherchye, Mosen, Van Puyenbroeck, 2003) Unemployment (Storrie and Bjurek, 1999, 2000)

6. Data weighting

Method	Composite Indicators
Distance to targets	Human Development Index
Public opinion	Health System Achievement Index Commitment to Development Index
Budget allocation	e-Business readiness index Internal Market Index
Analytic Hierarchy Process	EU New Economy Policy Indicators (NESIS) Technology Achievement Index (JRC)
Conjoint Analysis	Indicator of quality of life in the city of Istanbul (Ülengin et al. 2001) Environemntal indicators (advocated by Kahn, 1998; Kahn and Maynard 1996)
Weighting according to missing data	

7. Data aggregation

General formula



Composite Indicator value

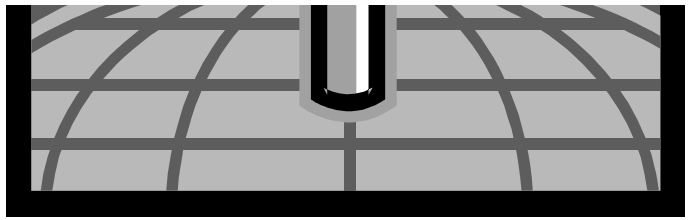
for country *c*

Normalised indicator value

$$Y_c = \sum_{q=1}^{Q} \left(I_{q,c}^{p} \cdot w_q \right)^{1/p}$$

compensation effects included

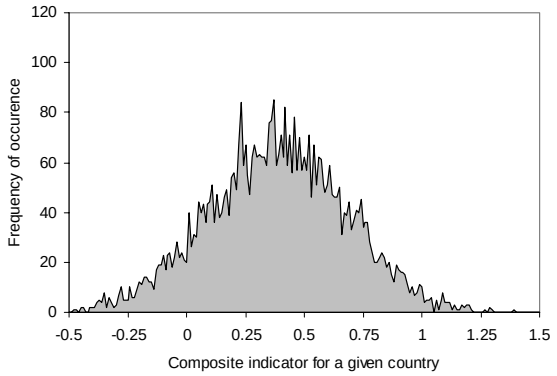
Weight value



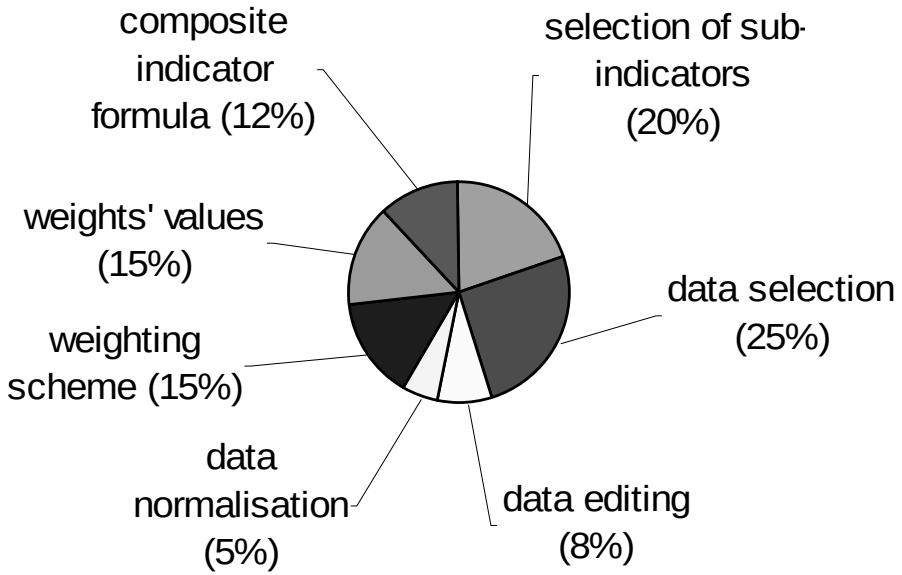
8. Robustness/sensitivity tests

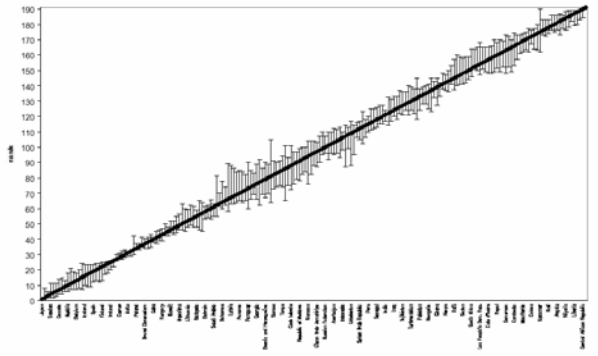
1. selection of sub-indicators
2. data selection
3. data editing
4. data normalisation
5. weighting scheme
6. weights' values
7. composite indicator formula

→ Uncertainty analysis results



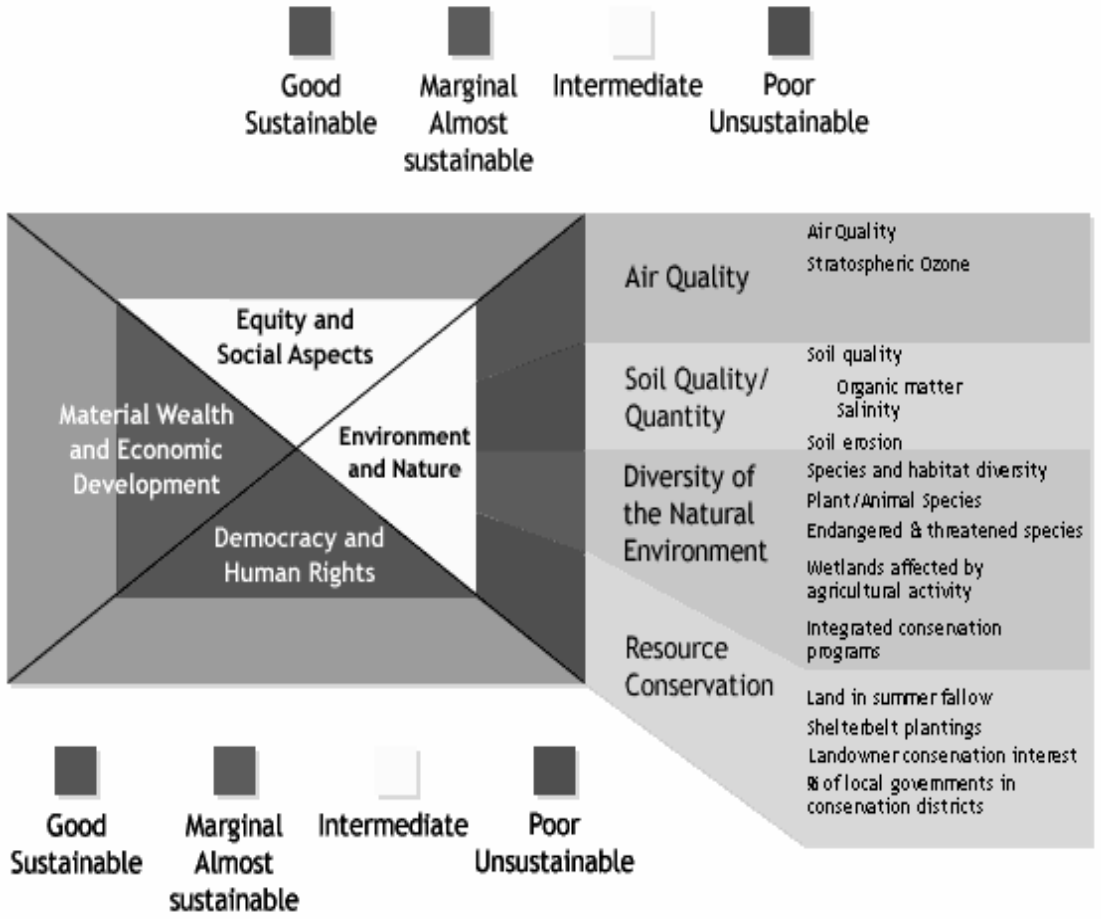
↓ Sensitivity analysis results





9. Visualisation

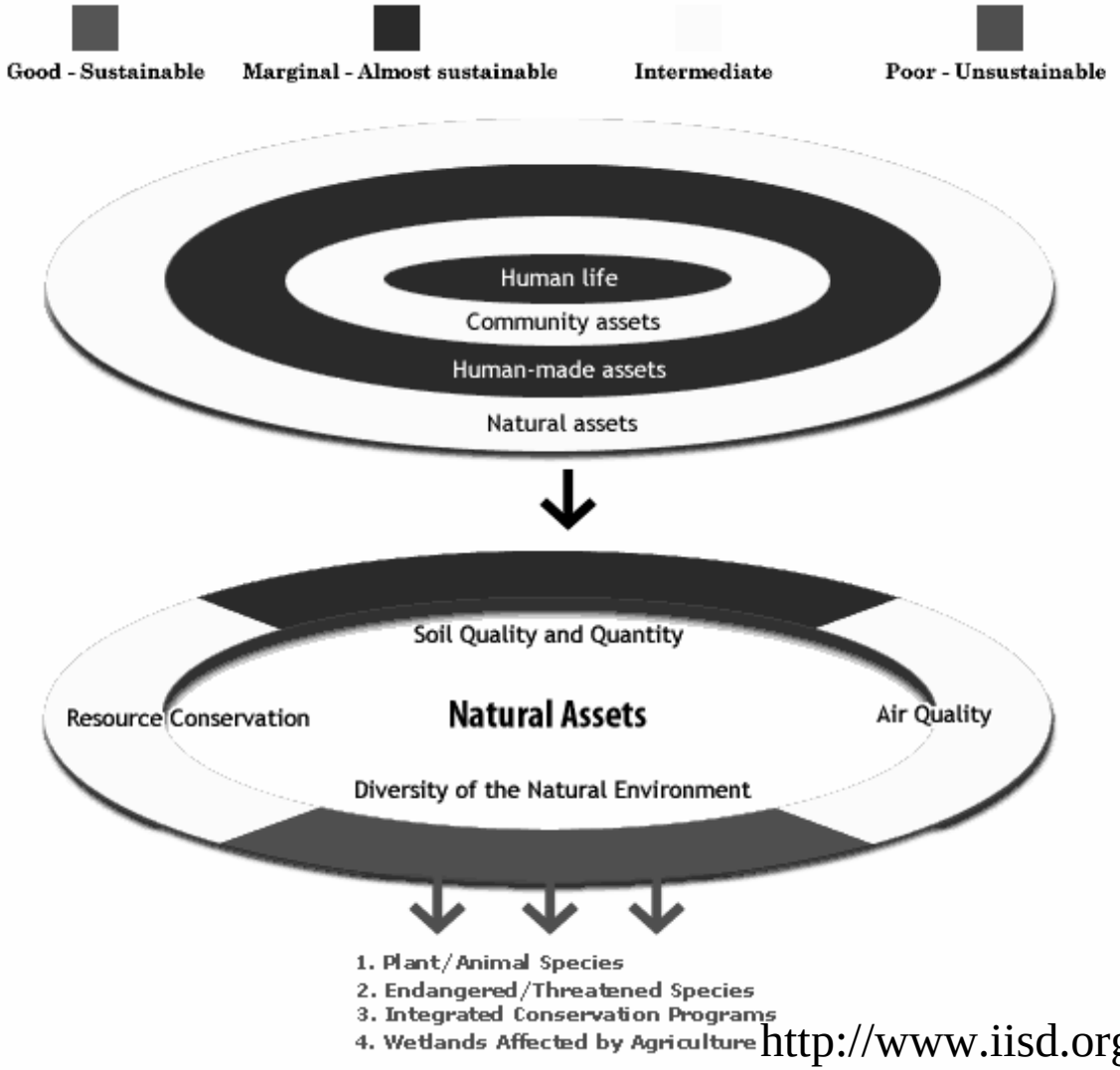
Four-sided pyramid (IISD)



http://www.iisd.org/cgsdi/visuals.htm

9. Visualisation

Elliptical indicator cluster (IISD)



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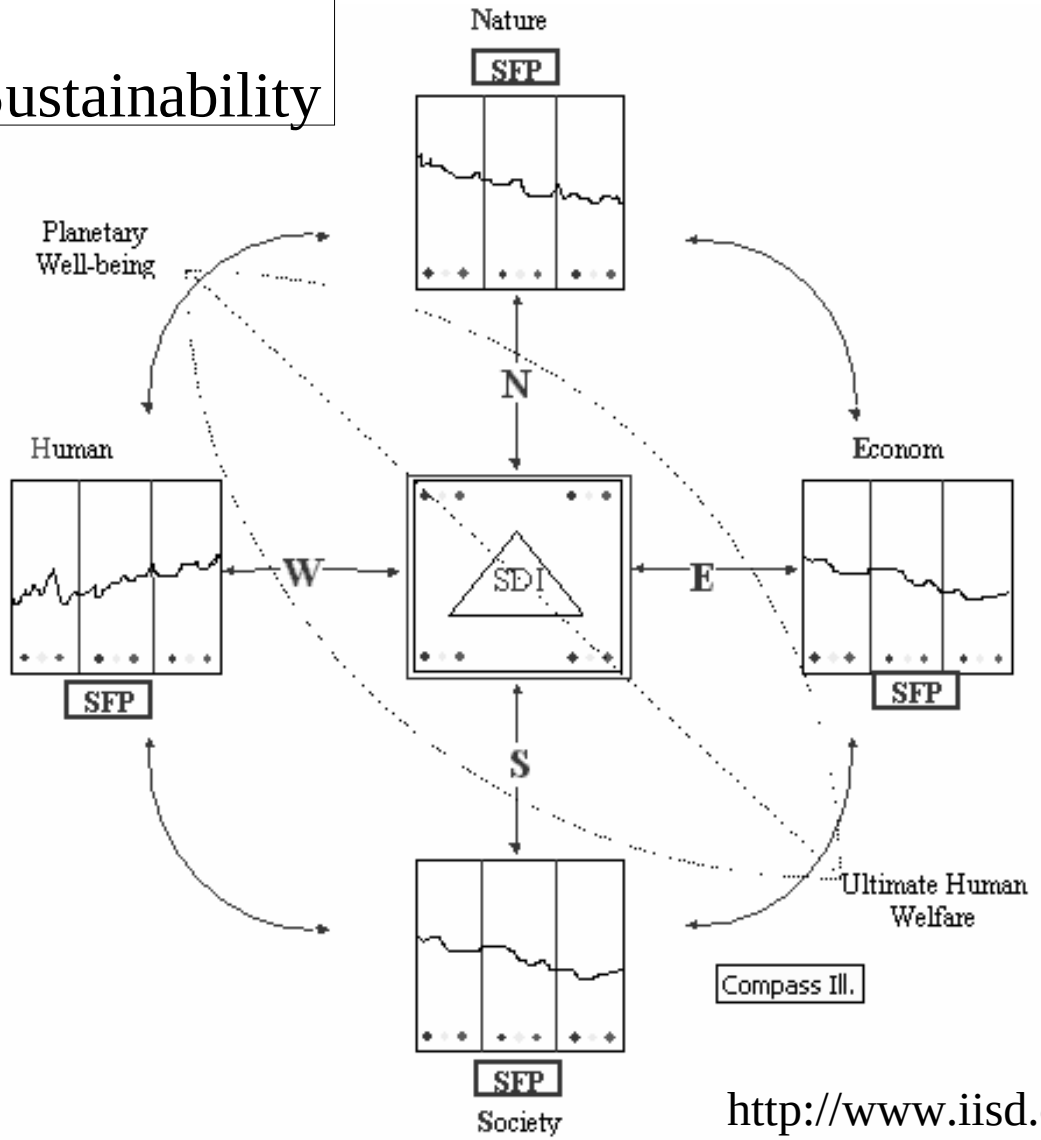
9. Visualisation

Compass of Sustainability



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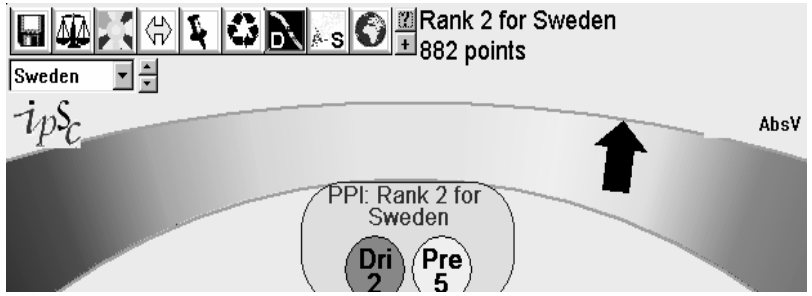
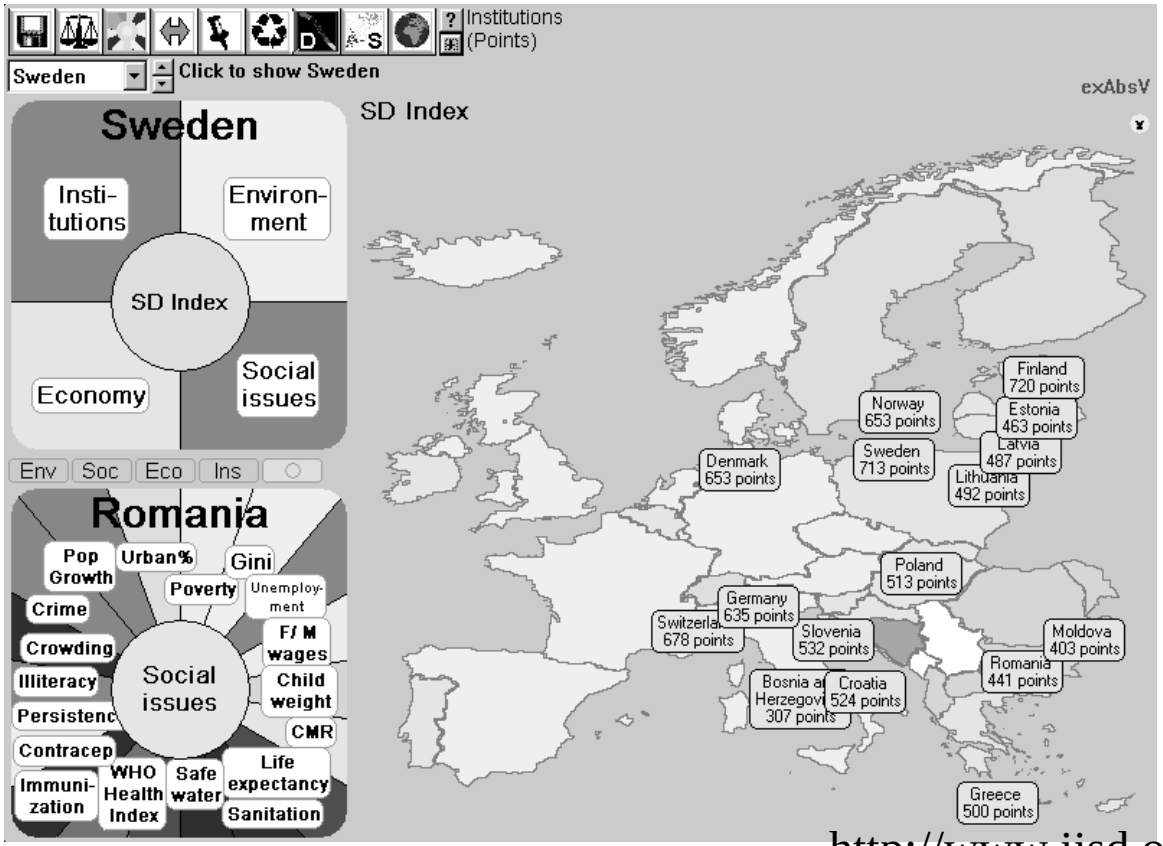
9. Visualisation

Dashboard Sustainability





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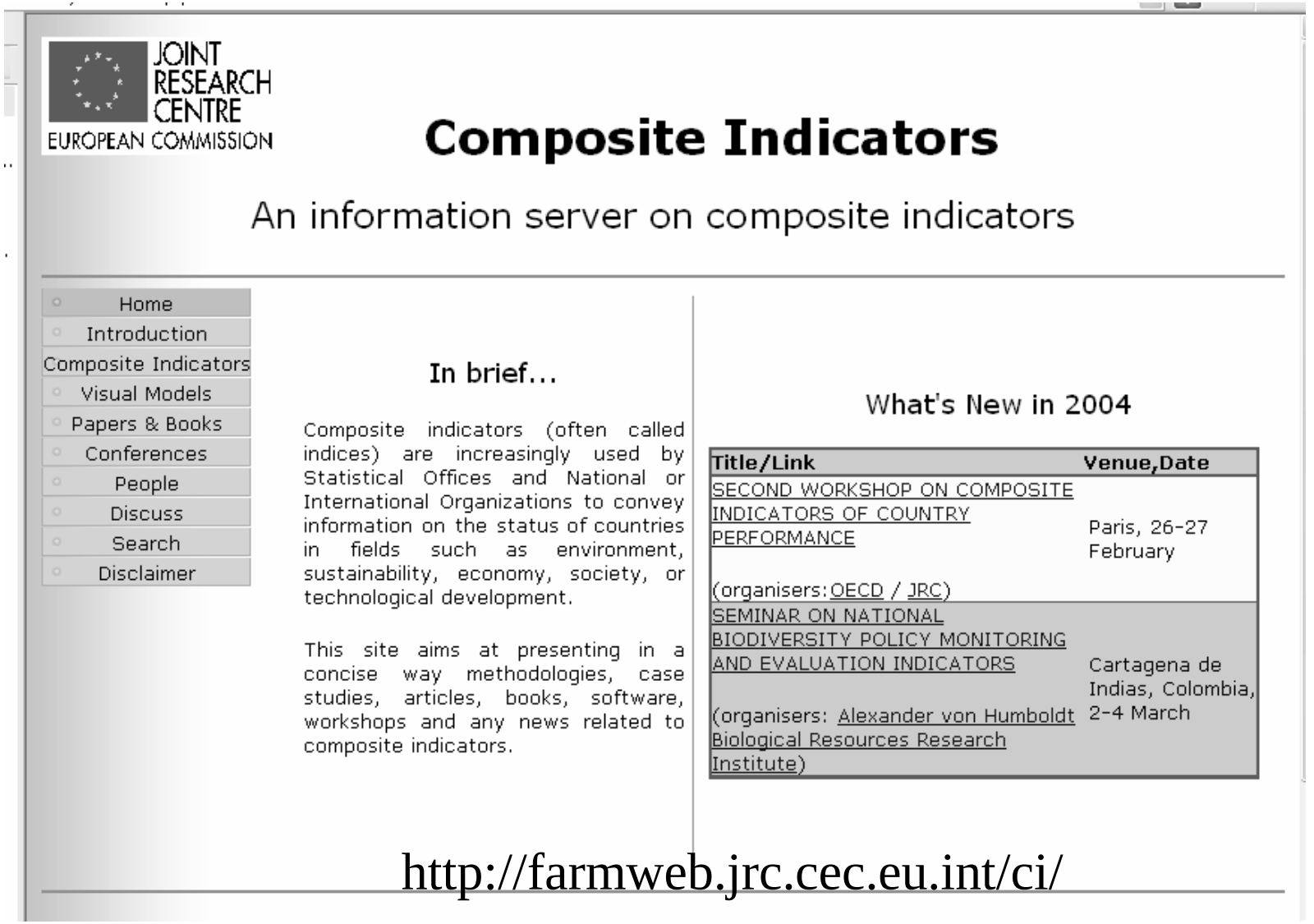
Conclusions

- Review available indicators within a domain before data selection
- Apply correlations analysis on data
- Apply different data normalisation methods
- Apply different data weighting methods (+ participatory approaches)
- Test robustness of composite indicator values (rankings) to methodological changes
- Communicate composite indicator values (+ indicators' values)

Information Server on Composite Indicators



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