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Indicator-based evaluation of interlinkages between different sustainable development objectives

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Consortium



CORE PARTNERS

	Acronym	Country
1. Charles University Environment Center	CUEC	Czech Republic
2. Sustainable Europe Research Institute	SERI	Austria
3. Vrije Universiteit Amsterdam / Institute for Environmental Studies	IVM	Netherlands
4. Policy Studies Institute	PSI	UK

PARTNERS

5. National Statistical Institute of Italy	ISTAT	Italy
6. Institute of Economic Structures Research	GWS	Germany
7. Environmental Network Limited	ENL	UK
8. Middle East Technical University / Department of Sociology	METU	Turkey
9. Wuppertal Institute for Climate, Energy, Environment	WI	Germany



Motivation / starting point

1. European indicator sets require constant revision and improvements
 - “Indicators to be developed”: regarding methodology and / or data
 - Knowledge on important new policy areas in the future
2. Lack of methodological approaches to assess interlinkages between different objectives of EU SDS / of SD policies
 - where are synergies and trade-offs in SD policy making?



3 main objectives

1. Further improvement of selected sustainable development **indicators** and identification of emerging policy fields
2. Assessment of **interlinkages** between different priorities of EU sustainable development policies (past & future)
3. Deriving conclusions for EU **SD policies** and the implementation of the EU SDS

Several current policy initiatives & processes with high need for indicator-based monitoring and for implementing knowledge on interlinkages



Policy relevance

Planned revision of Lisbon Strategy and EU SDS

- Revision of (a) Lisbon strategy & (b) European Sustainable Development Strategy beyond 2010
 - 2 related sets of indicators for monitoring at Eurostat:
 - a) Structural Indicators** on 6 domains, including the environment
 - b) Sustainable Development Indicators** (themes covering economic, social, environmental and institutional dimensions)
- INDI-LINK results could support the revision of both strategies as well as the possibility of a joint strategy (synergies & trade-offs)



Policy relevance

Stiglitz Report

<http://www.stiglitz-sen-fitoussi.fr>

- Published by the French Commission on the measurement of economic performance and social progress (created in 2008)
- Recommends that the environmental aspects of sustainability should be followed-up based on a **well-chosen set of physical indicators**
- Suggest a dashboard which combines
 1. An indicator from the extended wealth approach that sends warning messages about economic non-sustainability
 2. A set of well-chosen *physical* indicators, which would focus on dimensions of environmental sustainability that are either already important or could become so in the future, and that remain difficult to capture in monetary terms

Beyond GDP (European Commission)

<http://www.beyond-gdp.eu>

- ***GDP and beyond - Measuring progress in a changing world***
 - New Communication by the European Commission to the Council and the European Parliament, August 2009
 - Calling for the development of more inclusive indicators that provide a more reliable knowledge base for better public debate and policy-making

“The Commission intends to cooperate with stakeholders and partners to develop indicators that are internationally recognised and implemented”

→ Understanding interlinkages between growth and social / ecological developments for higher well-being in Europe

3 main work packages

WP 1: Development of SD indicators (CUEC)

- Task 1.1: Review of state of the art
- Task 1.2: Development of indicators
- Task 1.3: Emerging policy fields
- Task 1.4: Recommendations for future indicator development



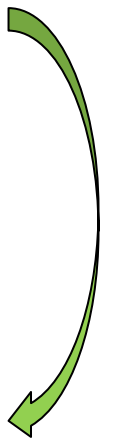
WP 2: Assessment of interlinkages (IVM)

- Task 2.1: Evaluation of methodologies
- Task 2.2: Analysis of past interlinkages
- Task 2.3: Forecasts and modelling
- Task 2.4: Trade-offs and synergies
- Task 2.5: Methodological recommendations



WP 3: Policy conclusions (PSI)

- Task 3.1: Review of state of the art in sustainability policy assessment
- Task 3.2: Identification of most synergistic sets of integrated policy instruments
- Task 3.3: Recommendations for implementation of EU SDS





WP 1 - Development of SDIs

1. Biodiversity index
2. Child wellbeing
3. Environmentally weighted indicator of material consumption
4. Green public procurement
5. Unmet needs for healthcare
6. External costs of energy consumption
7. Vehicle-km
8. Total material consumption and GDP at constant prices
9. Administrative cost imposed by legislation

Environmentally weighted indicator of material consumption (SERI, Austria)



1. The Thematic Strategy on the Sustainable Use of Natural Resources (Resource Strategy), launched in 2005 has a goal “to reduce the negative environmental impacts generated by the use of natural resources in a growing economy”
2. This concept - referred to as decoupling - suggests that, by separating the links between resource use and environmental impacts, sustainable development will be more achievable
3. In order to work towards this aim, it is essential to be able to quantify the environmental impacts of resource use – the objective of indicators as the Environmentally-weighted Material Consumption (EMC).

Environmentally weighted indicator of material consumption



The approach proposed by INDI-LINK presents a new framework for the calculation of an EU-wide indicator for environmental impacts related to the use of natural resources and products

It suggests integrating the most suitable methodological elements of different existing tools, models and projects and, where necessary, further develops these

Environmentally weighted indicator of material consumption



The main components of the accounting framework should include:

1. monetary input-output tables of all EU-countries plus a maximum number of EU trading partners in a deep sectoral resolution;
2. physical input-output tables in a comparative classification detail for EU countries and a maximum number of EU trading partners;
3. detailed, bilateral trade datasets for products and services, to combine the IO-data in a MRIO framework;
4. comprehensive process-based LCA data, which assist in detailing existing input-output tables and filling gaps in current NAMEA tables;
5. matrices of NAMEA-type extensions of the input-output tables derived from existing NAMEA data and enriched by LCA-type data.

Environmentally weighted indicator of material consumption



A three-step approach:

- elaboration of a method to calculate raw material equivalents of traded products, in order to relate all national material flows to the extraction stage, allowing for a consistent comparison of resource use levels between countries. Based on the procedures for producing the DMCRME
- step 2 elaborates a methodology for the calculation of indicators integrating material consumption and its environmental impacts in the EU
- In a last step, this methodology should be extended towards an indicator of all embodied impacts, methodologically departing from Environmentally Extended Input-Output Analysis (EE-IOA).

Environmentally weighted indicator of material consumption - recommendations



In order to be able to effectively use the proposed accounting framework, an indispensable necessity is the provision of consistent, detailed and complete data sets of a maximum number of countries.

Without a doubt, this need implies considerable work among the statistical offices and other institutions producing and handling data.

However, the advantage of setting up such a framework certainly is the standardisation and integration of different methodologies, and thus a unification of data collection.

WP 1 - Indicators for the emerging policy fields



The aim of the Task 1.3 is to deliver suggestions for new SD indicators on emerging policy fields, which are currently not covered by the EU SDI set.

Scope of the study:

1. Issues that have been only rarely discussed by the scientific community (knowledge on the issue is little, evidence is not sufficient, information is bound to scientific sources, etc.) and therefore could not be addressed by policies so far
2. Issues that have been known (discussed by the scientific community or even known to the public at large) for some time but they have not been addressed by policies and policies measures for some reasons (this group comprises neglected issues, unfinished business, etc.).

A list of indicators for the emerging policy fields



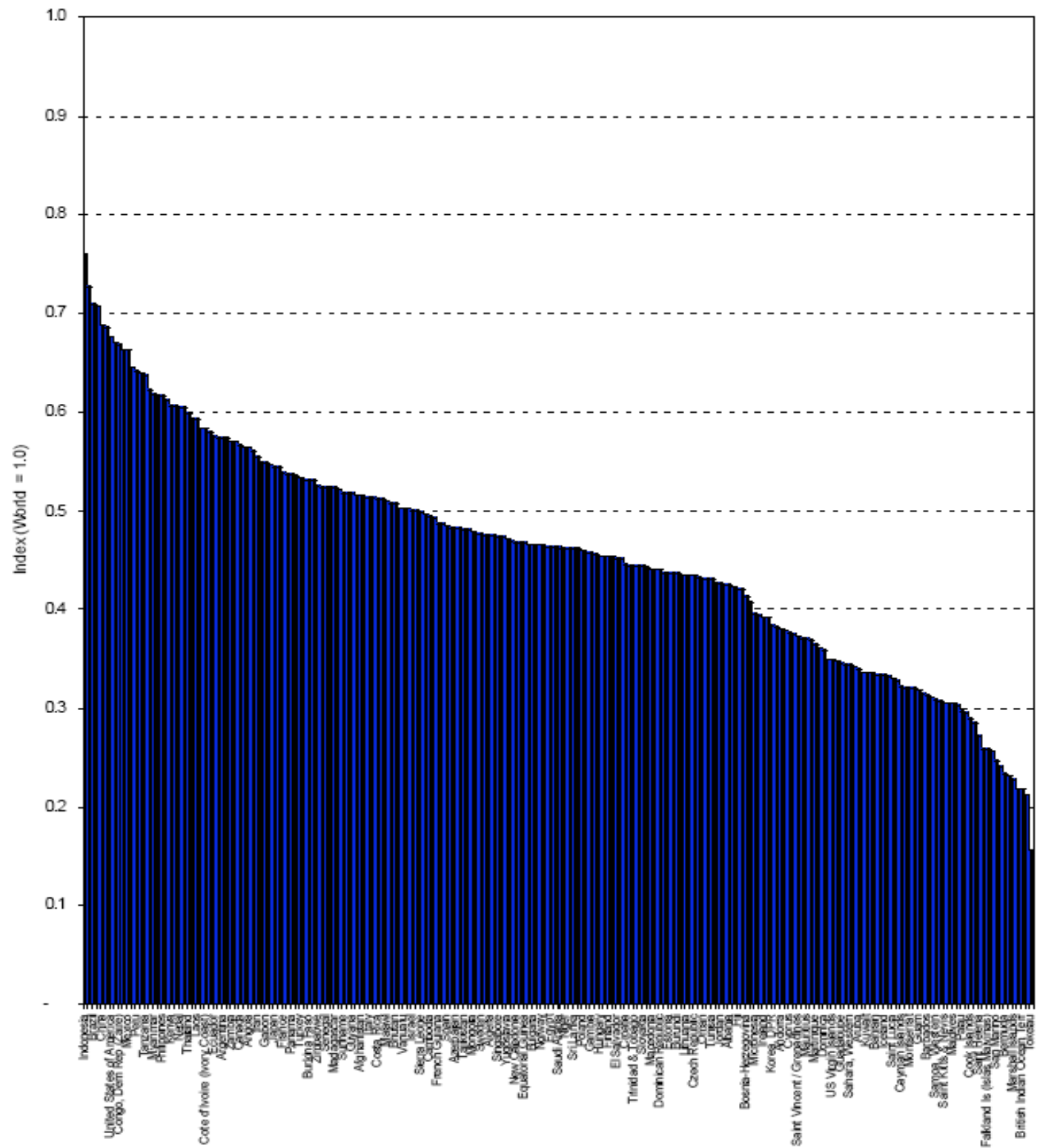
1. Appropriation of ecosystem services
2. Biocultural diversity
3. Infectious diseases spread through global travel and trade
4. Fossil energy embodied in national consumption
5. Global land use of domestic consumption
6. Security of energy supply
7. Security of phosphorus supply and consequential food supply in connection to intensified agriculture
8. Non-Ionizing Electro-Magnetic Radiation
9. Public participation of EU citizens and civil society organizations
10. Contribution of wellbeing and happiness to SCP
11. Dislocation of environmental impacts through international trade
12. Eco-Innovation
13. Food sovereignty in developing countries
14. Resource scarcity
15. Sustainable De-growth
16. Taxes on international financial transactions
17. International Labor Migration: Return Migration

Biocultural diversity

Biocultural diversity (BCD) is the **total variety exhibited by the world's natural and cultural systems.**

The BCD concept draws from the anthropological and ethnoecological insights about the relations of the human language, knowledge and practices with the environment which have significant implications for promoting SD. BCD is based on 5 indicators:

- ⑩ languages, religions, and ethnic groups
- ⑩ and bird/mammal species and plant species



WP 2: Assessment of interlinkages (IVM)



1. Presentation of a methodological framework for interlinkage assessment, based on a review and comparative analysis of advantages and limits of different analytical frameworks for analysing interlinkages between the different SD dimensions
2. Recommendations for application of these different methods in SD policy making
3. Quantitative analyses of these interrelations applying selected analytical tools and selected indicators from the EU SDI set
4. Tested set of tools and models to provide forecasts of selected SD indicators and an ex-ante assessment of future interlinkages

WP 2: Interlinkages (IVM)



Van Herwijnen (2007) defined „interlinkages“ for the evaluation of the different methods and indicators:

„An interlinkage is a qualitative or quantitative relationship between two or more SD indicators that can be based on statistical analysis or on the results of formal or applied methods or models of political, socio-economic and environmental interactions.“

Hence, interlinkages exist if a change in one indicator causes changes in one or more other indicators, either directly or indirectly through third variables. Interlinkages also exist if two or more indicators are positively or negatively influenced by the same policy actions.

Synergies and trade-offs

Van Drunen *et al.* (2008) defined **synergy**, or positive feedback, as a development favouring sustainable development in one dimension (or key challenge) that also leads to positive outcomes in terms of sustainability with regard to another dimension (or key challenge). A **trade-off** or negative feedback means that the opposite is true. Synergies and trade-offs can be identified within the pillars or between the pillars of SD, or the key challenges of the EU SDS.

WP 2: Potential interlinkages



Potential interlinkages were identified by Eurostat (2007) and discussed/supported by evidence that was collected within the INDI-LINK project

1. Socio-economic development
2. Sustainable consumption and production
3. Social inclusion
4. Demographic changes
5. Public health
6. Climate change and energy
7. Sustainable transport
8. Natural resources
9. Global partnership
10. Good governance

Eurostat says that a majority of indicators (86 %) address more than one dimension, and 33 % can be considered as three-dimensional, addressing economic, social and environmental aspects of the issue simultaneously.

WP 2: Potential interlinkages – soc.welfare and environment



Eurostat identified potential linkages between health and contamination in food, air pollution, and climate change; poverty and environmental degradation (e.g. *“poorer people are often more affected by environmental degradation”*); *poverty, long-term unemployment and climate change and linkages between demographic changes and the environment*

In general, Eurostat seems to observe *synergies between improvements in social welfare and the environment*, although it can of course not be denied that wealthier people consume more than poorer people and ecological pressure indices such as the Carbon Footprint tend to be higher for wealthier people and regions.

EW-MFA assumes interlinkages based on “material transformation chains”. In particular, the further down the production chain one country’s economy is, the lower its material intensity. Simulations with the DEAN model show that e.g. *the Netherlands has been able to decouple environmental pressure and economic growth in part by “transferring environmental problems abroad through international trade”* (importing more “dirty” goods and exporting more “clean” goods).

WP 2: Future interlinkages



Project selected five methods, methodologies and tools (MMTs) to investigate likely interlinkages among sustainability indicators in the future: *Multi-criteria analysis (MCA)*, *GVAR* (Global Vector Autoregression), *GINFORS* (Global INterindustry FORecasting System), *DEAN* (Dynamic applied general Equilibrium model with pollution and Abatement for the Netherlands) and *ASA*

Testing was different: a simple correlation between two SDIs (MCA) – or complex – embodied in a large simulation model (GINFORS). Some ideas can be tested on historic data (GVAR)

Interlinkages that held in the past, may not automatically hold in the future (future interlinkages are dependent on future policy scenarios (including no-policy sce-narios))

WP 2: Assessment of interlinkages – GVAR



The GVAR model can be used to explore statistical relationships among sets of sustainability indicators.

In the case study, GVAR examined interlinkages between:

- (the growth rates of) GDP per capita, CO2 emissions per capita, energy use per capita, life expectancy at birth, and the unemployment rate.

The analysis was first done with the UN World Development Indicators for EU15 for the period 1980-2005. The case study briefly presented statistical relationships between the variables for Germany. It should be noted, however, that these relationships describe short-term (1 year) rather than long-term interlinkages. The case study discusses what steps need to be taken to identify long-run relationships.

WP 2: GINFORS: energy-emission models



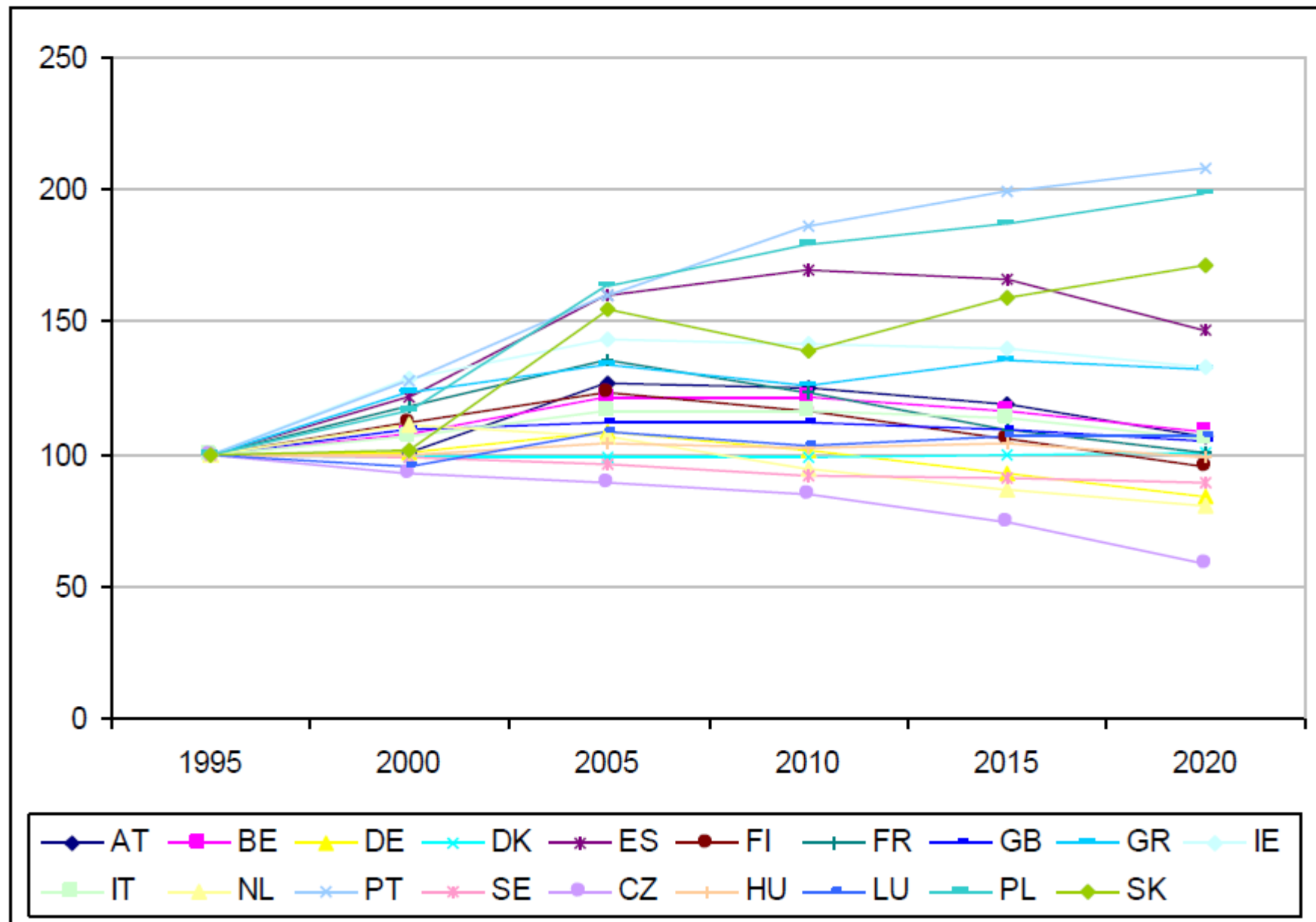
The energy emission models show the interrelations between economic development, energy consumption and emissions.

The variables of the respective IO models and/or macro models are used as drivers for energy consumption.

Energy consumption expenditure in turn has a direct influence on economic variables

		Fossil fuels 1-4	Nuclear 5	Renewable 6-9	Electricity&Heat 10-12	Total 13
Production and trade (1-5)	1 ⋮ 5					
Total Primary Energy Supply (TPES, 6)	6	25 + Σ 7-24				
Transformation (7-24)						
Total Final Consumption (TFC, 25)	25	Σ 26,40,48,53				
Total Industry Sector 27-39	26					
Total Transport Sector (41-47)	40					
Total Other Sectors (49-52)	48					
Non-Energy Use (55-58)	54					

Electricity consumption by households (L210) does not increase as much as in the past in almost all countries after 2005. Many countries will even be able decrease their electricity consumption by private households (see Figure 4.11).





INDI-LINK

*Indicator-based evaluation of interlinkages between
different sustainable development objectives*

Modelling Future Interlinkages

DELIVERABLE

Deliverable number: D2.5

Workpackage: WP2

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WP 2: Some findings



Our case studies suggest that **coupled environment-economy models** (specifically GINFORS and DEAN) are most suitable for assessing trade-offs and synergies between sustainability indicators as a result of (proposed) national or international policies.

For project level decisions **multi-criteria analysis** and **cost-benefit analysis** seems most appropriate. In most cases, these methods would require additional models to enable them to assess future linkages.

GVAR may be further developed to assess (short term) linkages between sustainable development indicators.

ASA was considered not very suitable for making future assessments.



Area	Finding	Recommendation
Theory	A solid theory on the interlinkages between the different SD indicators and trends has not been developed so far. Also a theory for a multi-level SD indicator framework is lacking.	Commission research devoted to the elaboration of a theoretical framework of interlinkage assessment. This should include a multi-level application (macro-meso-micro) of SD indicators and their interlinkages.
Data	Statistical and decomposition methods as well as econometric simulation models require sufficient historical data sets. In the cases investigated these data sets were not always available.	To extend the time series of SDI to the past, if possible. To ensure that all data underlying SDIs are collected on a yearly basis in the future.
	Statistical and simulation models often need data in different dimensions than those of the SDI data set (e.g. levels instead of percentage changes)	Allow the user to select alternative dimensions of the data, including the original dimensions and the absolute numbers.
	For certain applications (e.g. decomposition) important (intermediate) indicators were missing from the SDI set.	Consider whether it is possible to define and select related indicators within one theme through the use of the driver-pressure-state-impact-response (DPSIR) framework.
	For many SDIs, there is a significant time lag in the publication of statistical data. Recent trends can often not be analysed due to the lack of timely data.	Develop methodologies to provide solid estimates for the current values of data underlying the SDIs.
	Robust social data is in many cases not available for interlinkage assessment. Important analyses, such as distributional impacts of SD policies, can therefore not be performed.	Increase the availability of social data for statistical and modelling purposes.
	Models	There are few empirical models that allow quantifying future interlinkages among sustainability indicators.
	The models that quantify future linkages typically focus on synergies and trade-offs between economic and environmental indicators. Indicators from the social pillar are under-represented.	Support the inclusion of social SDI in applied modelling.



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