National Academy of Sciences

Challenges and Opportunities towards a Just Transition and Sustainable Development: A Workshop

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Panel I:

Key Measurement Frameworks for Just Transitions and Sustainable Development

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SUSTAINABILITY

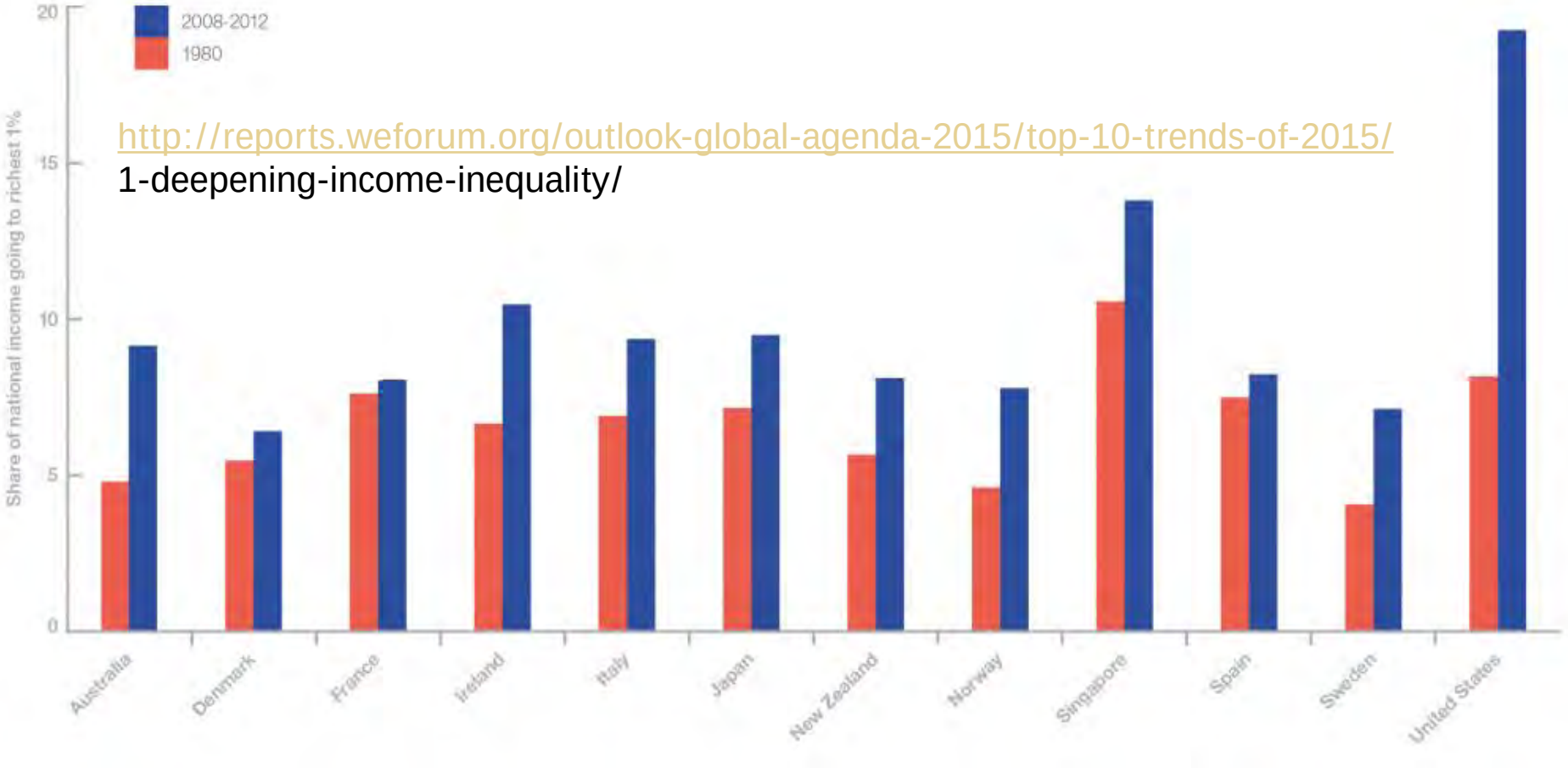
- Very qualitatively "Meet the current needs without destroying the ability of future generations to meet theirs", and:
- Balance economic, social and environmental needs; The needed massive environmental transition cannot be at the expense of adequate social (including JUST) and economic pillars

HUMAN VALUES

*Some fundamental definitions of sustainability are based on more or other pillars

Rising income inequality even within developed countries
Share of national income going to the richest 1%

Inequality is rising globally – and soaring in the US (2017)

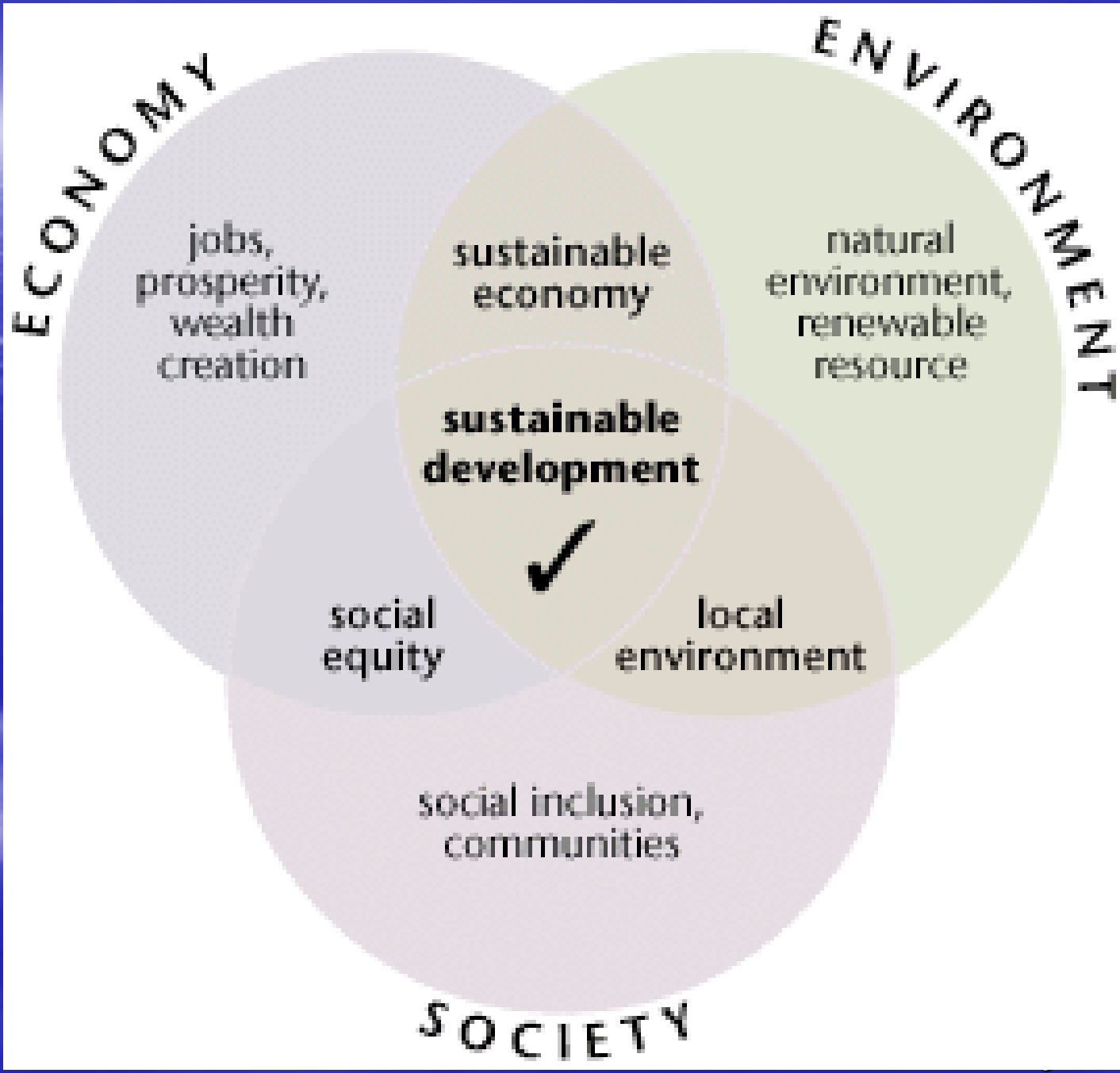


http://reports.weforum.org/outlook-global-agenda-2015/top-10-trends-of-2015/1-deepening-income-inequality/

Measurement Frameworks for Just Transitions and Sustainable Development: a simple example outline for finding a sustainably optimal transition process

1. Define a desired **objective function for sustainable Just Transitions, such as minimal cost or maximal happiness, or…**
2. **Define "Just Transition"**
   - 2.1 "T**ransition"**
     - 2.1.1 **To what? How fast? Where?**
     - 2.1.2 **How**: eg stop using fossil fuels or CO_2 capture and sequestration?
   - 2.2 **"Just"**
     - 2.2.1 t**o whom and to how many**
     - 2.2.2 **How**: policing, monitoring…
3. **Quantitative definitions and analysis**
4. **Analysis methodology**
   - 4.1 Develop one or more wanted **composite Just Transition criteria**
   - 4.2 Use minimally sufficient **indicators**; such as quality of life, happiness, money?
   - 4.3 Address the complexity of choosing associated **weights**, eg polling…
   - 4.4 **Validation (!!!)**
   - 4.5 Must be conducted by **Iterative** process
   - 4.6 Foresee and prepare for **hurdles**, eg the **Rebound Effect,** shocks (pandemics, wars…), inflation, bad or inadequate data, corruption…
5. Establish and analyze **scenarios** to calculate the effects of driving forces on socio-economic consequences

The 3 pillars of sustainability illustrated as overlapping circles indicating that the three pillars are most usually **inter-related**, and affect each other



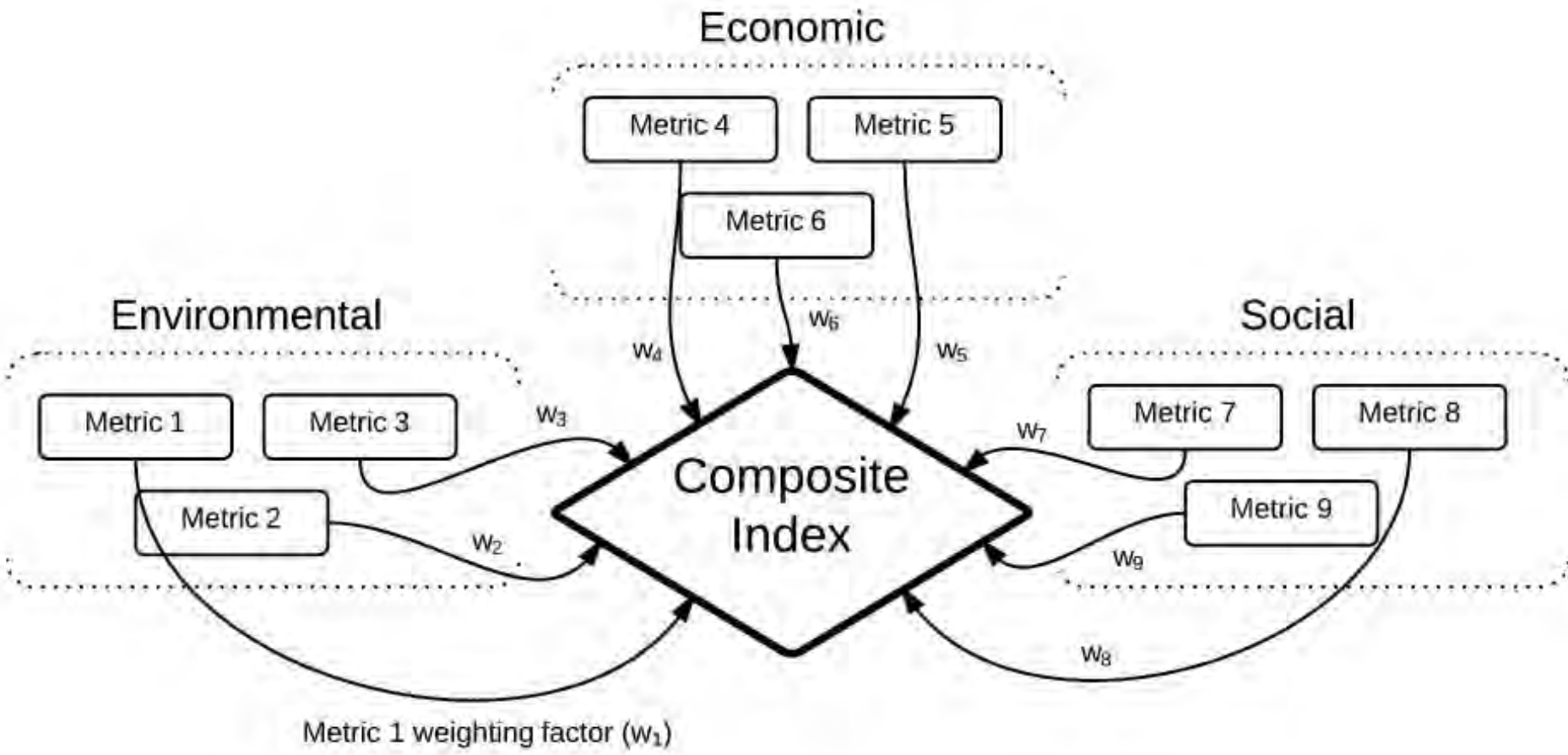
Resilience

- Resilience is the ability of a system to prepare for threats, absorb impacts, recover and adapt following persistent stress or a disruptive event
- Sustainability is defined through the triple bottom line (pillars) of environmental, social and economic system considerations
- In recent years there have been many disparate uses of the terms sustainability and resilience, with some framing sustainability and resilience as the same concept, and others claiming them to be entirely different and unrelated.
- In response to increasing environmental threats, such as high-impact storms, intense drought, food shortages and climate change, as well as the recently rapidly woken epidemics and pandemics, there has been an effort to secure a future with **both a high quality of life and a resistance to the impacts of adverse events**. These efforts have led to ever-growing interests in sustainability and resilience.
- **Resilience must be integrally included in the definition of sustainability**, probably as one of the sustainability indicators, which also explicitly takes into consideration the time parameter, especially to address the suddenness and precipitousness of many resilience-challenging drivers.
- The Coronavirus pandemic is an outstanding example of unsustainable development, which has invested the national and global efforts and resources mostly into short term economic and socio-political targets and manifestly failed to invest in effective dealing with major future challenges including shocks.

"We, the Heads of State and Government (193) and High Representatives, meeting at the United Nations Headquarters in New York from 25-27 September 2015 as the Organization celebrates its seventieth anniversary, have decided today on new global Sustainable Development Goals": Transforming our world: the 2030 Agenda for Sustainable Development.

Composite Sustainability Index (CSI)

composed by *metrics* (*indicators*) and *weighting factors*



Regardless of the specific definition, and their complexity, the sustainability **indicators** must satisfy some common sense criteria.

- Inclusive of economical, environmental and social concerns (the three pillars of sustainability)
- Relatively simple, and widely understandable,
- Normalized to allow easier comparisons,
- Reproducible,
- Satisfy the laws of nature.

Aggregation of Indices

- The values of the used individual metrics ("indicators") M_i can be aggregated into a single composite metric, the Composite Sustainability Indicator (*CSI*) using weights (w_i) for each, as

$$CSI = \sum_i M_i\left(\vec{x}_{ij}\right) w_i\left(\vec{y}_{ik}\right) \quad \text{or} = \prod_i M_i\left(\vec{x}_{ij}\right) w_i\left(\vec{y}_{ik}\right) \quad (1)$$

or some other aggregation, where

$\vec{x}_{ij}$ the j system parameters that affect the metric M_i;

Example: if a metric is environmental, the "system parameters" may be impact on biota, gaseous emissions, etc.

$\vec{y}_{ik}$ the k system parameters that affect the weight w_i;

Example: if a weight is related to an environmental metric, the system parameters" may be the relative importance of the impact on biota, gaseous emissions, etc.

i index of a metric-weight pair (M_i-w_i)

j index of a metric (M_i) - dependence parameter $\vec{x}_{ij}$

k index of a weight (w_i) - dependence parameter $\vec{y}_{ik}$

Use of the aggregated indices for optimization

- Now determine the functional dependence of the indicators, and sometimes of the weighting factors, on the process parameters.
- Then determine the *CM* with its dependence on the system parameters
  - Can serve as the optimization objective function or be part of it,
  - Can serve for sensitivity analysis,
  - The objective function can then be used to seek the optimal system solution.

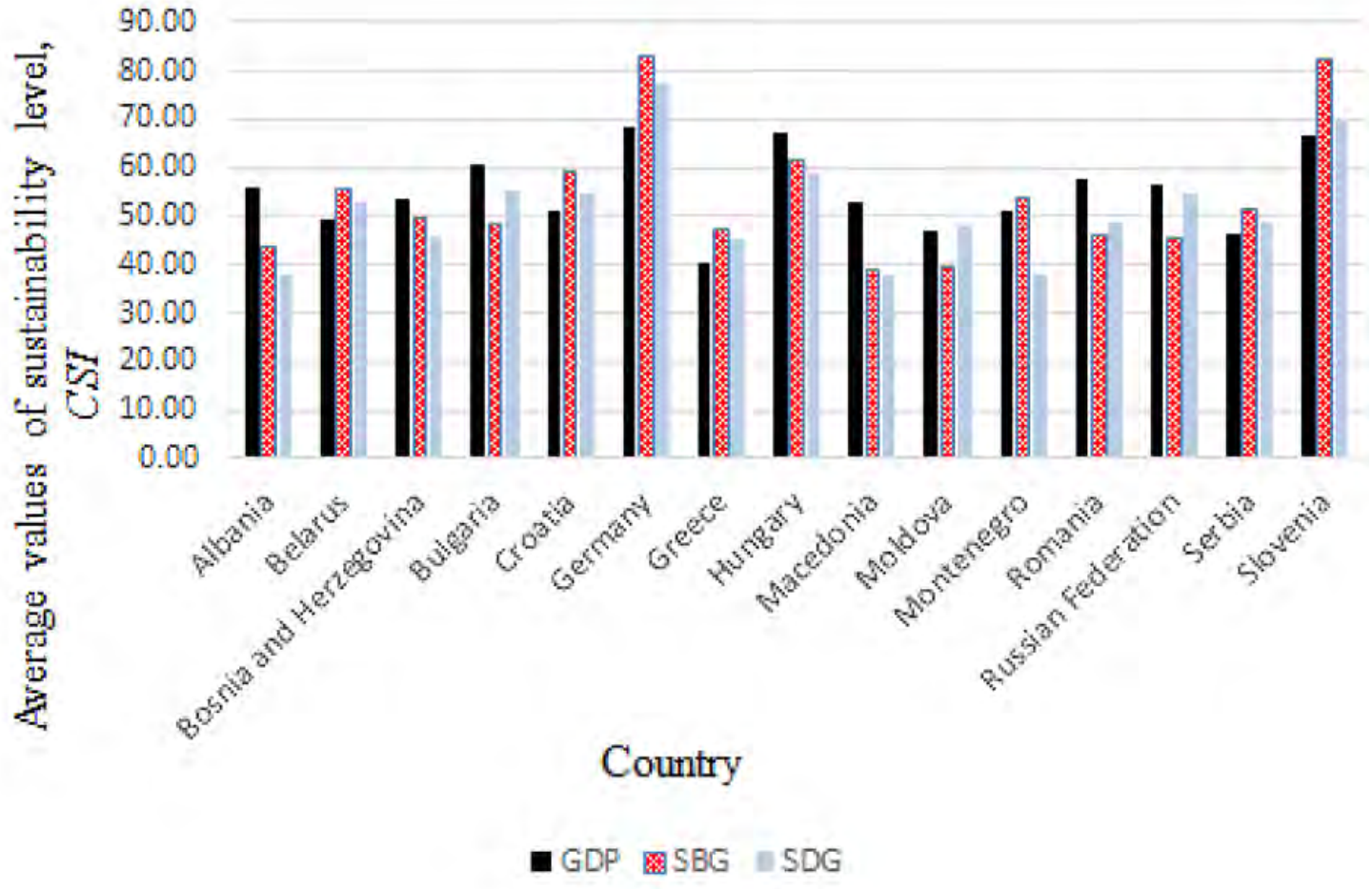
The quantitative sustainability analysis process steps, typically iterative

1. Definition of the system and its spatial and temporal extent
2. Preliminary definition of the sustainability objective function and its units
3. Definition of all sustainability indicators and their system-variable dependence quantification (considering spatial effects and temporal evolution)
4. Reduction of their number to a necessary minimum
5. Normalization of the indices and unification of their units
6. Final definition of the sustainability objective function and its units
7. Definition of the indices' relative weights
8. Decision on the method of the aggregation of the indices, considering space and time
9. Aggregation
10. Error analysis
11. Sensitivity analysis
12. Optimization
13. Testing under practical conditions
14. Repeat of the procedure for an established alternative process for the same water supply objective: this allows generation of relative rather than absolute quantitative results and is very important for comparison and further validation.
15. Iteration and development of learning experience for this and future projects

An example of sustainability analysis:

Average values of the degree of sustainable development (CSI) obtained by application of the GDP-based (GDP), the Beyond -GDP (SBG), and the SDG-based (SDG) approaches in SEE, the Russian Federation, and Germany

Noam Lior, Mirjana Radovanović, Sanja Filipović, Comparing sustainable development measurement based on different priorities: sustainable development goals, economics, and human well-being—Southeast Europe case. Sustainability Science, (2018) 13:973–1000 https://doi.org/10.1007/s11625-018-0557-2



Watch out for malicious rebound: All good causes immediately spawn abusers

"linguistic detoxification"

Sustainability ethics: a call for damage control and prevention*

- In a free society people can use any terminology they choose, but sustainability is of vital importance to our survival and using its terminology in vain diminishes its vitally important value by desensitizing society and sowing distrust.
- Legally speaking, it is a form of actionable false advertising
- Path towards damage control must be found and action implemented rapidly, maybe:
  - Development of internationally acceptable standards for that vital concept
  - Compliance enforcement legislation,
  - Public embarrassment that thereby denies the publicity benefits of false advertising,
  - and other methods

*Noam Lior, Sustainability Ethics and Metrics: Strategies for Damage Control and Prevention, Journal of Environmental Accounting and Management 1(1) (2013) 15-24. (on "Handouts")

Some of our related published examples

a. Noam Lior, Mirjana Radovanović, Sanja Filipović, Comparing sustainable development measurement based on different priorities: sustainable development goals, economics, and human well-being—Southeast Europe case. Sustainability Science, (2018) 13:973–1000 https://doi.org/10.1007/s11625-018-0557-2
b. Sanja Filipović, Noam Lior, Mirjana Radovanović, The Green Deal – just transition and sustainable development goals *Nexus* (An invited perspective), Renewable and Sustainable Energy Reviews 168 (2022) 112759 https://doi.org/10.1016/j.rser.2022.112759
c. N. Lior, "Sustainable and resilient energy development status (2021/2022) revealed by the pandemic, and a brief review of the U.S. Inflation Reduction Act 16 August 2022". Invited Keynote paper of the EU international conference program CIRECON Erasmus+: "The Circular Economy, the number one priority for the EU Green Deal". Novi Sad, Serbia, 19-21 September 2022. https://cirecon.wordpress.com/international-conference/