What are critical measures of assessing good governance in the bioeconomy?

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Before one can assess good governance of BE, governance needs sufficient info on performance of BE

Monitoring and assessment is developing

Critical elements are key objectives and indicators
- Starting with SDGs
- Addressing both production and consumption
- Accounting for domestic and transnational impacts
Key objectives of the bioeconomy

- **Social sustainability**
  - Work safety
  - Social integration
  - Workers rights
  - Cooperative focus
  - Legal certainty

- **Development of rural areas**
  - Food security
    - Sustainable final consumption
  - Sustainable production
  - Sustainable infrastructures

- **Contribution to climate protection**
  - Land degradation neutrality
  - Preservation and improvement of air quality
  - Preservation of soil quality and function
  - Preservation and strengthening of biodiversity
  - Preservation of water balance and quality

- **Economic sustainability**
  - Employment
  - Added value
    - Competitiveness
    - Innovation

- **Environment sustainability**

Information in the multi-level system
## Systematics of the information

<table>
<thead>
<tr>
<th>Key objectives</th>
<th>Criteria</th>
<th>SDG</th>
<th>Indicators</th>
<th>Scale level / Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to climate protection</td>
<td>Emission of greenhouse gases</td>
<td>13, 9.4</td>
<td>Amount and type of ghg emissions</td>
<td>national/ Destatis EU/ Eurostat international/ IPCC, IIASA</td>
</tr>
<tr>
<td></td>
<td>Carbon storage</td>
<td></td>
<td>Amount of carbon stored in grassland ad forest area</td>
<td>national/ Umweltbudesamt international/ IIASA</td>
</tr>
<tr>
<td>Preservation and improvement of air quality</td>
<td>Gaseous pollutant emissions to atmosphere (beside ghg)</td>
<td></td>
<td>Total emission by type of pollutant</td>
<td>international/ OECD</td>
</tr>
<tr>
<td></td>
<td>Particulate matter</td>
<td>11.6</td>
<td>Particulate matter emissions PM$_{2.5}$</td>
<td>national/ Destatis EU/ Eurostat international/ WHO</td>
</tr>
<tr>
<td>Preservation of waterbalance and -quality</td>
<td>Water quality</td>
<td>6.3</td>
<td>Phosphorus load [and nitrate influx] in ground- and surfacewater</td>
<td>national/ WaterGAP EU/WaterGAP international/ WaterGAP</td>
</tr>
<tr>
<td></td>
<td>Water quantity</td>
<td>6.4</td>
<td>Extraction of ground- and surfacewater</td>
<td>national/ WaterGAP EU/ WaterGAP international/ WaterGAP</td>
</tr>
<tr>
<td></td>
<td>Water scarcity index (WSI)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cause-effect relationships of central importance

Impacts
- Landscape changes
- Hydrology changes
- Biodiversity changes
- Soil degradation
  etc.

Pressures
- Input
  Extraction from environment
  - (Industry)-Minerals
  - Fossil fuels
  - Metal ores
  - Construction minerals
- Biomass
- Water

Drivers
- Production
- Infrastructures
- Consumption

Pressures
- Output
  Release to environment
  - Emission to air and water
  - Waste deposition
  - Dissipative losses

Impacts
- Climate change
- Eutrophication
- Acidification
- Landscape changes
- Hydrology changes
- Biodiversity losses

Conflicts
Risks

Policies
Society
Response

Hazards
Risks
Resource and climate footprints of domestic consumption

- Use of biotic commodities in a country for production, consumption and infrastructures
- Environmental burden in foreign countries
- Environmental burden on national territory
Resource and climate footprints of product consumption

Agriculture FP
Forest FP
Water FP
Material FP
GHG FP
First reference values for the evaluation

Resource input → Final consumption → Environmental pressures

Final consumption:
- Production
- Infrastructures

Derivation headline indicators

Reference values for sustainable resource use

<table>
<thead>
<tr>
<th>Resource and climate footprints</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Crop-) Land</td>
<td>0.20 ha/(Person*a)</td>
</tr>
<tr>
<td>Forest</td>
<td>0.4 m³/(Person*a)</td>
</tr>
<tr>
<td>Water</td>
<td>EU: 1.25 m³/(Person*a)</td>
</tr>
<tr>
<td>Water</td>
<td>110 – 450 m³/(Person*a)</td>
</tr>
<tr>
<td>Greenhouse gases</td>
<td>1.05 t/(Person*a)</td>
</tr>
<tr>
<td>Material</td>
<td>10 t TMC_{abiotic}/(Person*a)</td>
</tr>
</tbody>
</table>

Reference values for the evaluation

- Bringezu et al. (2012)
- Roelich et al. (2011)
- O’Brien (2016)
- O’Brien et al. (2017)
Example: Cropland used for domestic consumption of agricultural goods

- EU-27 used 22% more cropland than domestic cropland area in 2011
- EU-27 used 30% more cropland than the globally available per person cropland of the world population in 2011
- Consumption exceeded 0.20 ha/person which is proxy target for SOS in 2030 (goal: stop loss of biodiv by LUC)

Use of global cropland by the EU-27 for the consumption of agricultural goods

Source: H. Schütz – Wuppertal Institute, based on Bringezu et al. 2012
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Thank you very much!

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Further Info:

www.symobio.de