

# Multicriteria and Lifecycle-based integrated sustainability assessments: common challenges and points of divergence



*Carlos Tapia, Aritz Alonso  
(Tecnalia), Hanna Pihkola, Tiina  
Pajula (VTT), Michael Ritthoff (WI),  
Peter Saling (BASF), Ywann Penru  
(SUEZ), Alexander Röder (CEMEX)*

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*SAMT - Sustainability assessment methods and tools  
to support decision-making in the process industries*

# Materials & methods

- Selected findings from the **SAMT project** (Sustainability Assessment Methods and Tools to support decision-making in the process industries) (2015-2016)
- Within SAMT, **experiences and good practices** from the **cement, oil, metal, water, waste and chemical industry** were collected
- **Applied methods** included reviews, interviews, workshops and practical case studies

See: [www.spire2030.eu/samt](http://www.spire2030.eu/samt)



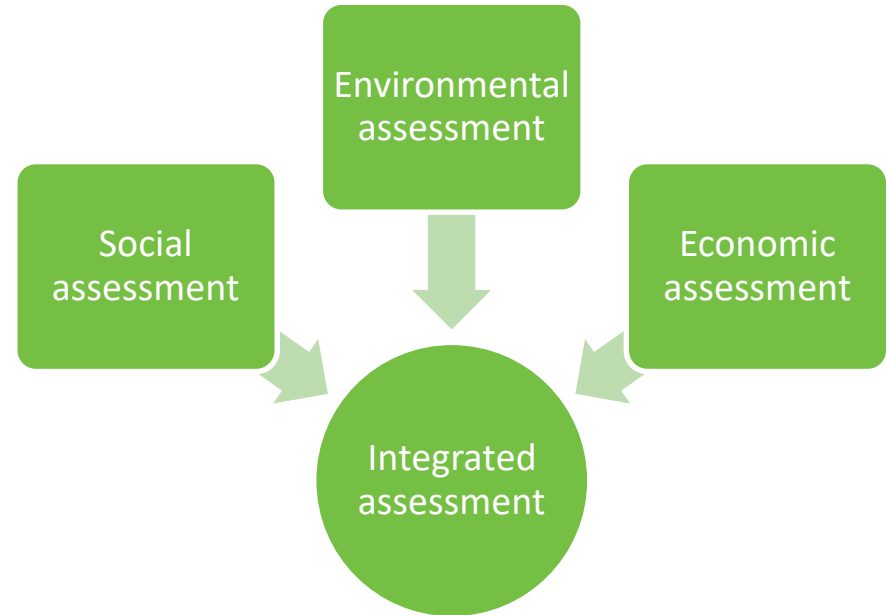
# Aim of the presentation

- To pinpoint some of the **similarities** between multi-criteria methods and integrated sustainability methods
- To identify some **methodological challenges** linked to the integration of different sustainability dimensions
- To exemplify some of the **good practices** identified in SAMT
- To propose topics for **future research and development**

# What are 'integrated' methods

**Integrated sustainability assessment methods** can be described as a "*juxtaposition of well-delimited methods ('**Russian dolls' construct**)...*

*Integrated methods usually include a **weighting scheme** to aggregate sub-indicators into one or a small number of indicators"*



Source: Saurat, M., Ritthoff, M., Smith, L., 2015. SAMT Project, Deliverable 1.1.

# Some examples of integrated methods



- BASF Eco-Efficiency Analysis (**EEA**)
- BASF Socio-Eco-Efficiency Analysis (**SEEBALANCE**)
- Product Sustainability Assessment (**PROSA**)
- Integrated method for calculation / measurement of resource efficiency (**ESSENZ**),
- Sustainable Value (**SustV**)
- Ecodesign (**EcoD**)
- Product Oriented Environmental Management System (**POEMS**)
- Life cycle iNdeX (**LInX**)
- Composite Sustainable Development Index (**CSDI**)
- COMbining environmental Performance indicators, LIfecycle approach and Multi-criteria to assess the overall ENvironmental impact (**COMPLIMENT**)
- ...



# The advantages of integration

- Provides a **simultaneous (but static) snapshot** on the environmental and/or economic and/or social impacts of products/processes
- Allows to **organise complex multi-dimensional information** and data **in a structured way**
- Ideally, may also contribute to **clarify the structural relations** between the sustainability aspects considered in the analysis.



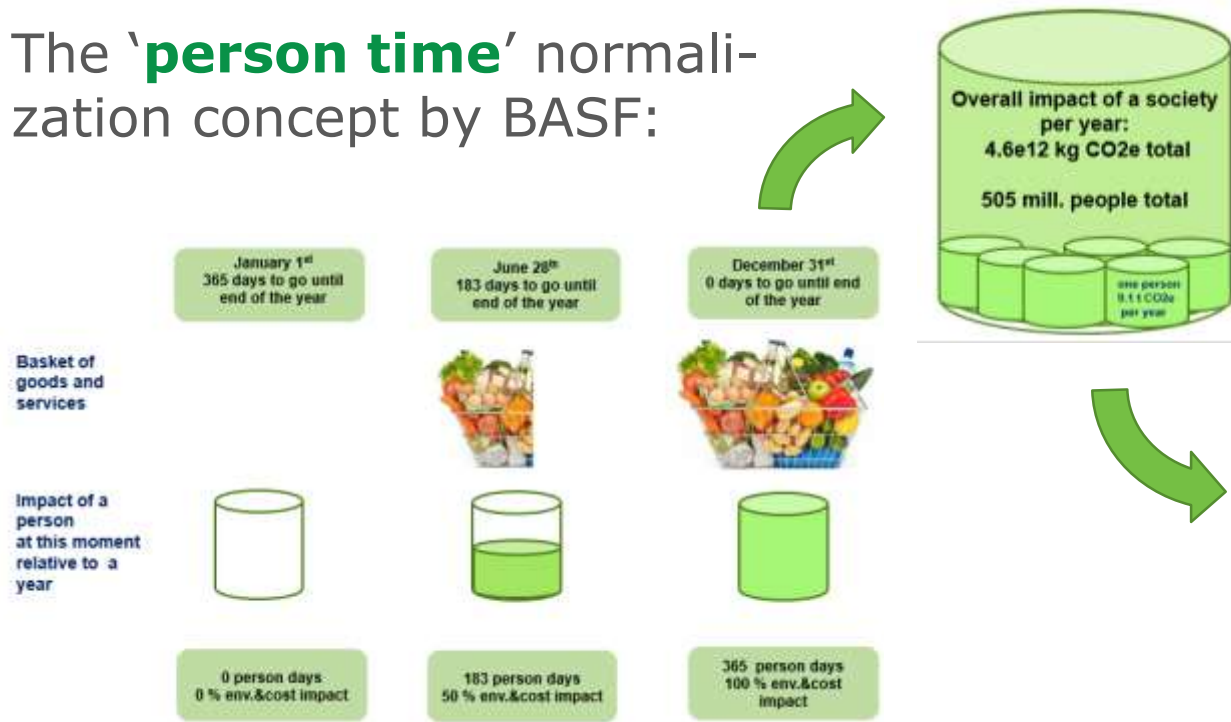
# Identified challenges (1): normalization

## Avoid adding up apples and oranges...

- In this step indicators are transformed into a-dimensional units.
- Usually, a **benchmark** or **reference value** is used for normalization purposes.
- There are **two approaches** to benchmark setting:
  - **Compliance-oriented**: the reference value is chosen to meet a normative or legal requirement.
  - **Performance-oriented**: the reference value is chosen to meet a business target.

# An example of good practice on normalization

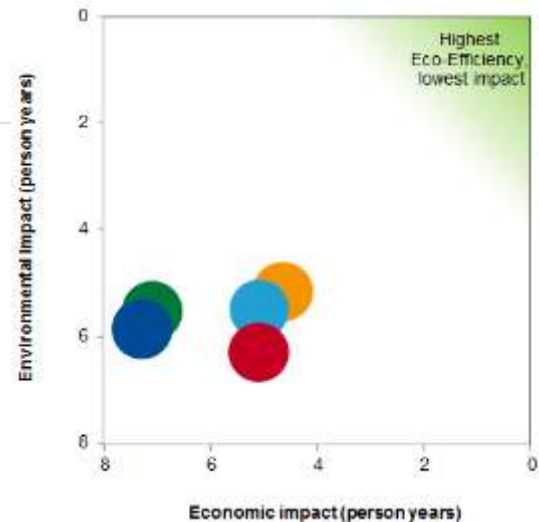
The '**person time**' normalization concept by BASF:



**Example:**  
A product results in 1000 kg CO2e.

$$\frac{1000 \text{ kg CO2e}}{9100 \text{ kg CO2e/person}} = 0.1 \text{ person year}$$

$$= 40 \text{ person days}$$





# Identified challenges (2): weighting

**Should all dimensions contribute equally to the aggregated score?**

- **'Supervised' approach**: weights are defined **based on the perceived relevance** of the individual dimensions/indicators grouped. Examples include Surveys, polls, AHP, CA, BA. Easy to communicate but subject to **mutable value choices**.
- **'Unsupervised' approach**: weights are set by means of statistical methods. Examples include FA, DEA, BOD, bipartite networks, etc. Free of value choices but **weights are study-specific**.

# Identified challenges (3): aggregation



## Should 'compensability' be allowed?

- **Compensatory methods**: decline in one dimension can be offset by progress in another one. Here **weights indicate substitution rates (trade-offs)**. E.g. additive aggregation, the Borda rule.
- **Non-compensatory methods**: decline in one dimension cannot be offset by progress in another one. Here **weights can be understood as 'importance coefficients'**. E.g. outranking methods like the Condorcet approach, or non-compensatory MCA.

# The consequences

- **Lack of stability** of the outcomes, undermining **comparability** and **replicability** of impact assessments:
  - **Vertically**: frequently, integrated analysis performed under 'similar' but not identical research designs are not fully comparable due methodological aspects.
  - **Longitudinally**: studies that focus on evolutionary aspects are not comparable if e.g. benchmarks or value choices vary overtime.
- Results become **difficult to interpret and communicate**, which undermines **usability**

# Conclusions

## Comprehensiveness $\neq$ Integrativeness

Being comprehensive, 'integrated methods' are not necessarily **integrated**, if e.g. interrelations within and across dimensions are not explicitly acknowledged

## Systematic $\neq$ Systemic

Being systematic, integrated methods are not necessarily **systemic**, if e.g. complex internal network relations are not explored in a dynamic way

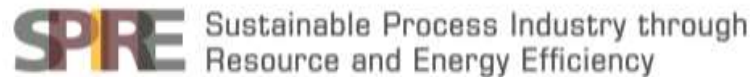
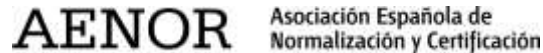
# The way forward

Integrated methods need to advance towards:

- The definition of **stable normalization, weighting and aggregation methods** and their implementation in **practical tools**.
- An **explicit recognition of the structural relations** between the sustainability spheres, dimensions and indicators considered.
- A **systemic view on sustainability** based on a functional integration of the different components of a system in a holistic and dynamic way.

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Thank you for your attention!

**[www.spire2030.eu/samt](http://www.spire2030.eu/samt)**

Contact:

carlos.tapia@tecnalia.com