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School of Engineering

Regulative frameworks and life cycle thinking in sustainability management

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4.11.2020

Agenda for today

13-14.30: Lecture

Regulative/voluntary frameworks around sustainability

Indicators

Life cycle thinking -based sustainability management

Activities, footprints, handprint and compensation

14.30-16: Independent online session:

Environmental legislation (37 min)

Industrial Emissions Directive (IED) and related BAT (best available technique) as a case example (25 min)

	Never heard	I know the basics	I know very well	Have applied the measure/concept in practice (in work / course), please specify in the textbox, which measure and how you have applied it.	Keskiarvo	Mediaani
Life cycle thinking in companies	0%	86,67%	6,66%	6,67%	2,2	2
Environmental management systems	26,67%	53,33%	13,33%	6,67%	2	2
Environmental certificates and ISO standards	6,67%	53,33%	26,67%	13,33%	2,47	2
Sustainability indicators	40%	60%	0%	0%	1,6	2
Eco-labels	20%	73,33%	6,67%	0%	1,87	2
Footprints	0%	73,33%	20%	6,67%	2,33	2
Handprints	60%	26,66%	6,67%	6,67%	1,6	1
Industrial emissions directive IED	73,33%	20%	0%	6,67%	1,4	1
Best available technique BAT and reference documents BREFs	60%	33,33%	0%	6,67%	1,53	1

Today

Company task
Lectures next week

Independently

Regulative and voluntary frameworks & drivers in sustainability management

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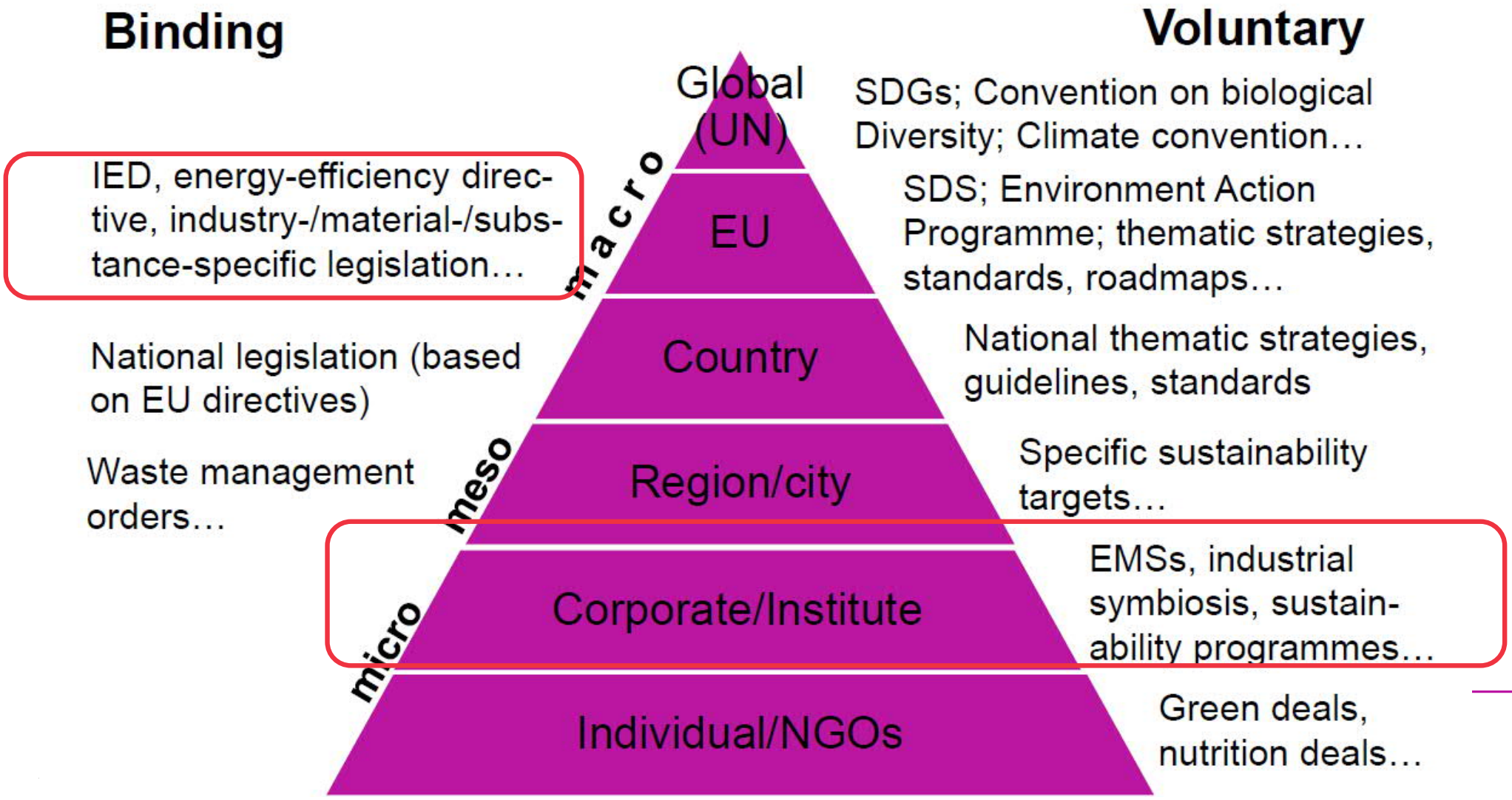
Different levels of policy instruments



Some policy instruments during life cycle

Objectives:

SDGs
Circular economy
Resource-efficiency
Minimization of risks*…

Minimization of emissions & wastes
Safety
Energy-efficiency…

Main regulations:

DfE
EIA
REACH
Material-/ Substance-specific regulations

Procurement regulations, NOTE! Only for public actors

IED
OSH Directive

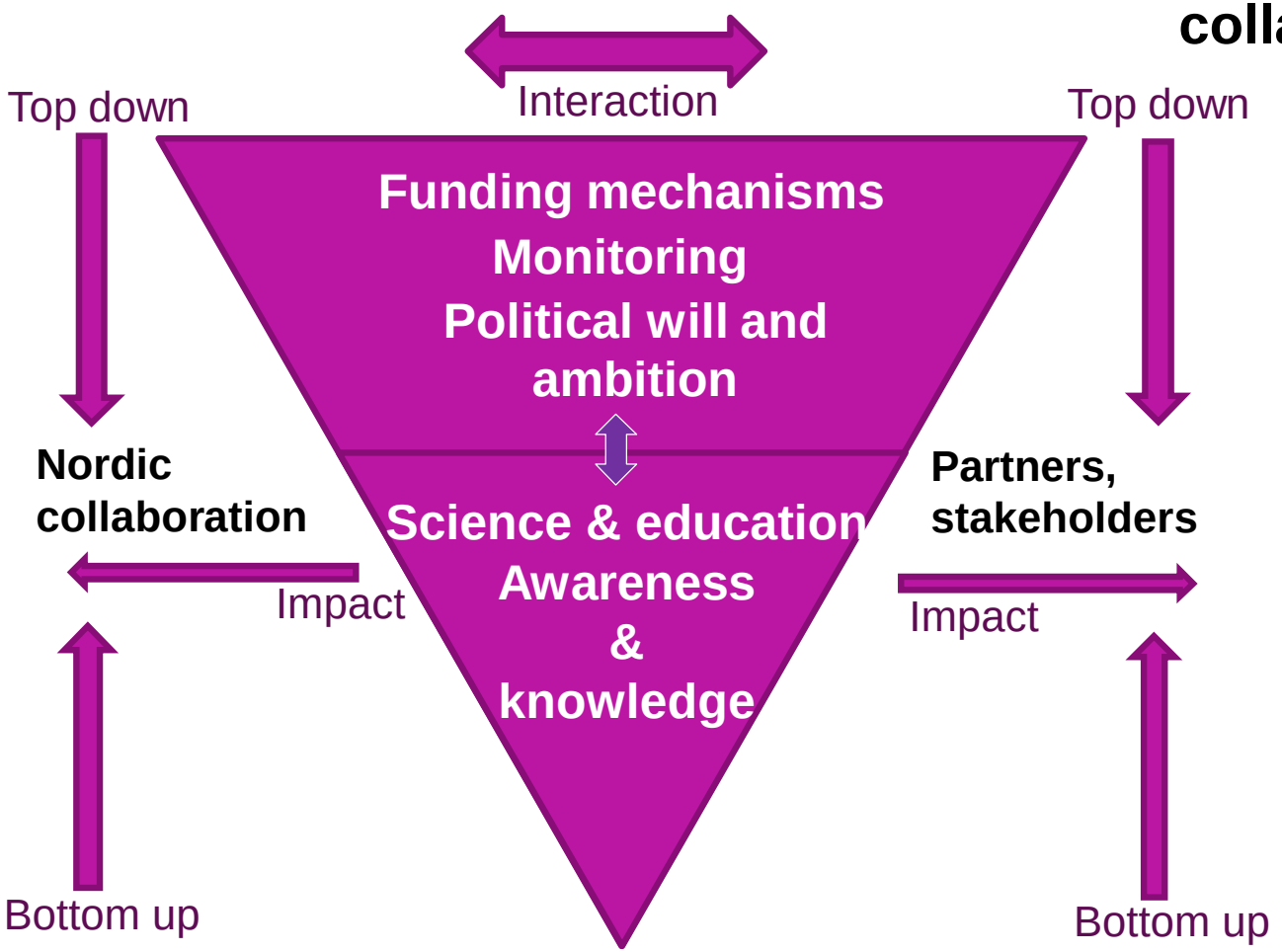
Waste management regulations

*related to hazardous substances human health and the environment

Drivers of Agenda 2030 (SDGs) in Finnish universities

Global agreements, the UN

Global university collaboration



EU strategy and directives

Finnish legislation

Finnish strategy

University strategy and values

University administration

National Implementation + municipalities

Implementation in all operations
(campus, research, teaching, outreach)

Finnish authorities **Finnish civil society** **Students, campus residents** **Staff**

More about environmental legislation and IED (BAT/BREF) as a case example:

study the video lecures in MyCourses with the given guiding questions:

https://mycourses.aalto.fi/mod/page/view.php?id=651828

Life cycle thinking in sustainability management

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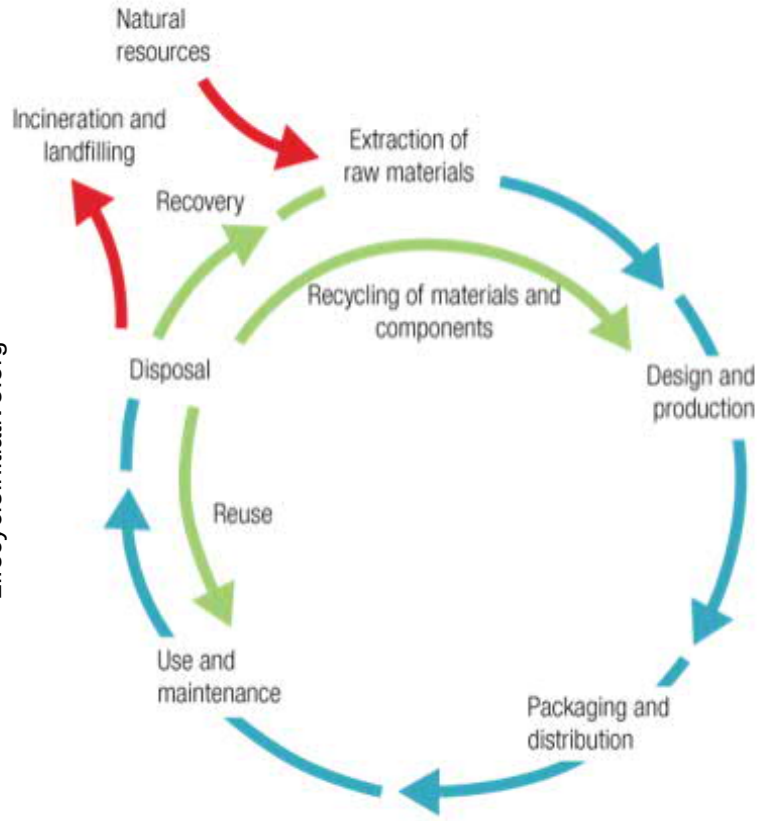
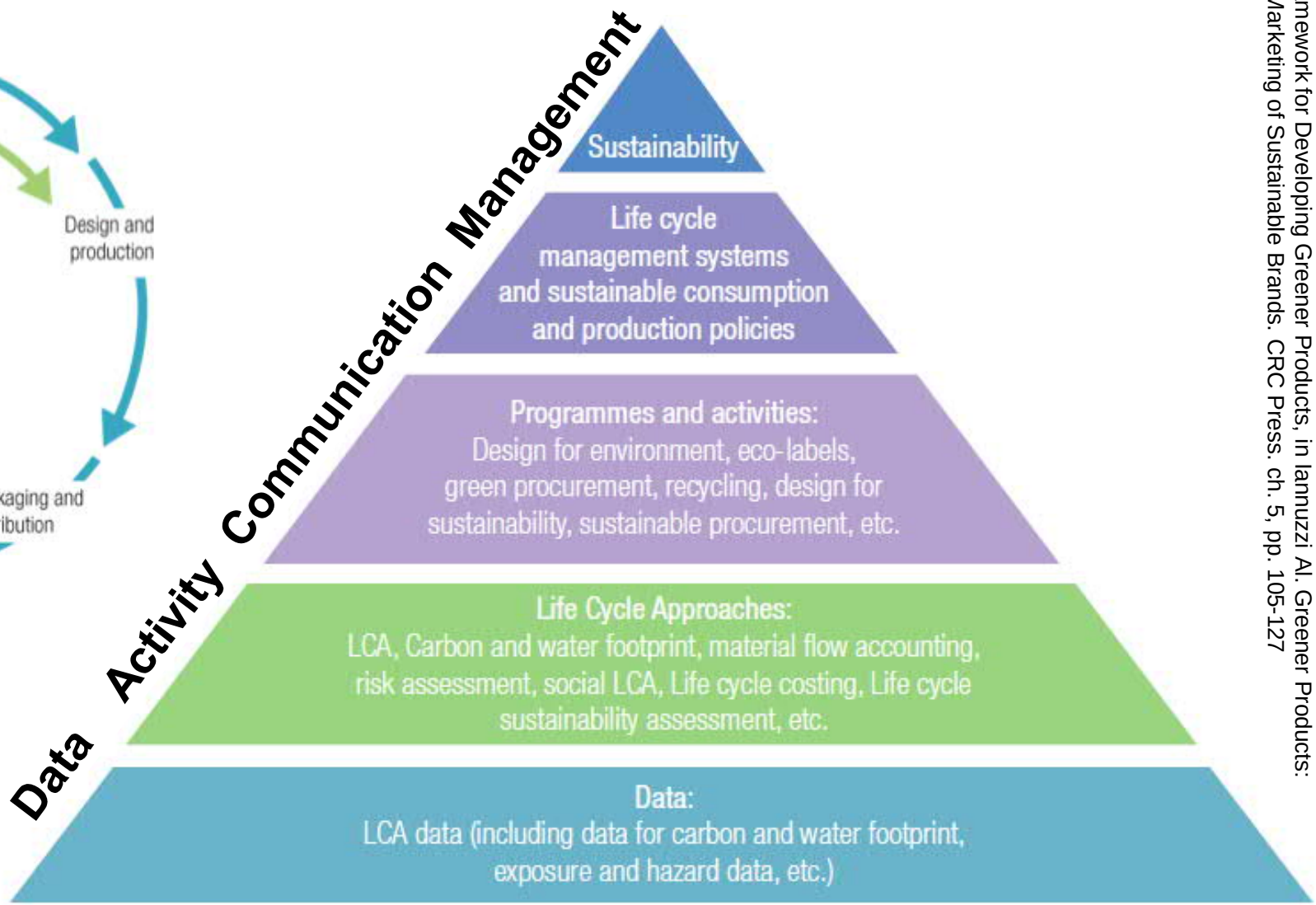
Life cycle thinking and approaches



Lifecycleinitiative.org



Fava J. 2011. Framework for Developing Greener Products, in Iannuzzi Al. Greener Products: The Making and Marketing of Sustainable Brands. CRC Press. ch. 5, pp. 105-127

Disuss with a pair briefly:

- What is an indicator?
- Why do we need indicators?

5 min

An indicator is:

1. OECD: ”a parameter, or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value”

2. Sustainability measures*: ”An indicator is something that helps you understand:

- where you are,
- which way you are going, and
- how far you are from where you want to be.

A good indicator alerts you to a problem before it gets too bad and helps you recognize what needs to be done to fix the problem.”

*http://www.sustainablemeasures.com/

What is an effective (environmental) indicator?

According to ISO (2013)

- **relevant** to the environmental policy and the important environmental aspects;
- **appropriate** to the management activities, operations or the environment;
- **useful** to and **representative** of the environmental performance criteria;
- **understandable** to internal and external stakeholders;
- **easily obtainable, measurable and informative**;
- **adequate** in relation to data quality and quantity; and
- **responsive** to changes in environmental performance.

A good sustainability indicator:

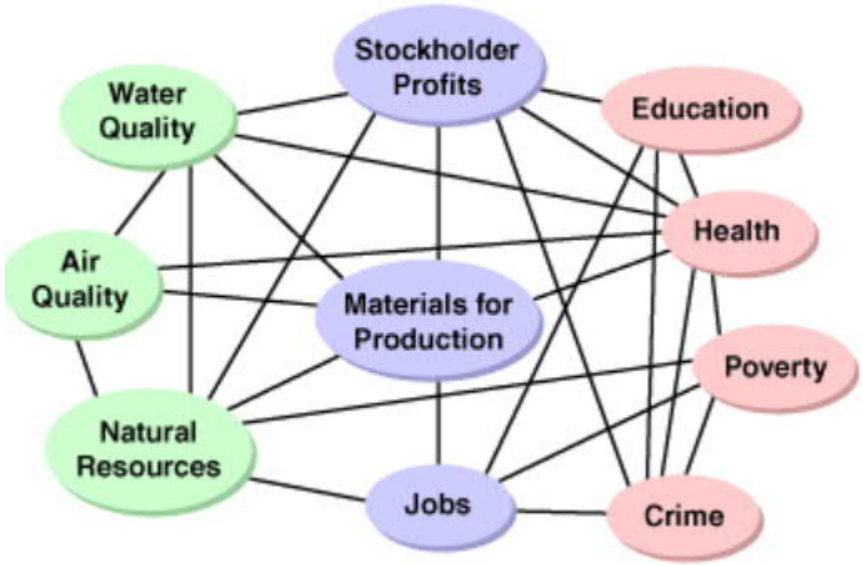
- Addresses carrying capacity
- Is relevant to the community
- Is understandable to community
- Is useable by the community
- Takes a long term view of progress
- Shows links between economy, environment and society

ISO (2013). International Organization for Standardization. ISO 14031:2013: Environmental management – Environmental performance evaluation – Guidelines.

http://www.sustainablemeasures.com/

Sustainability indicators

Sustainability needs multidimensional indicators

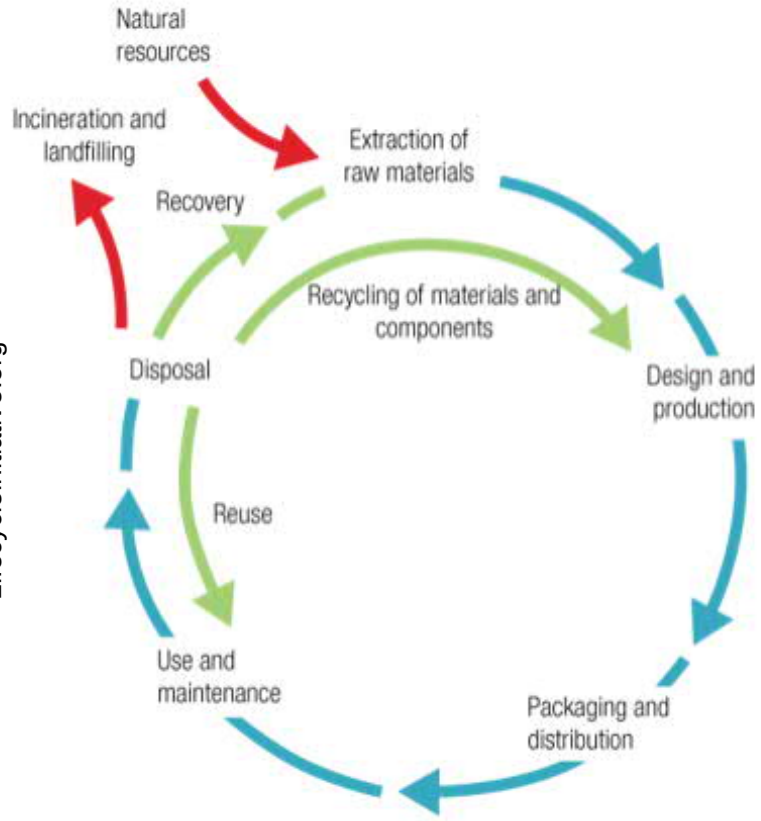


	Traditional	Sustainability	Emphasis of SD ind.
Economic	Unemployment rate Number of companies Number of jobs	Diversity and vitality of local job base Number and variability in size of companies Number and variability of industry types Variability of skill levels required for jobs	Resilience of the job market Ability of the job market to be flexible in times of economic change
Ecological	Tons of solid waste generated	Percent of products produced which are durable, repairable, or readily recyclable or compostable	Conservative and cyclical use of materials
Social	Number of registered voters	Number of voters who vote in elections Number of voters who attend town meetings	Participation in democratic process Ability to participate in the democratic process

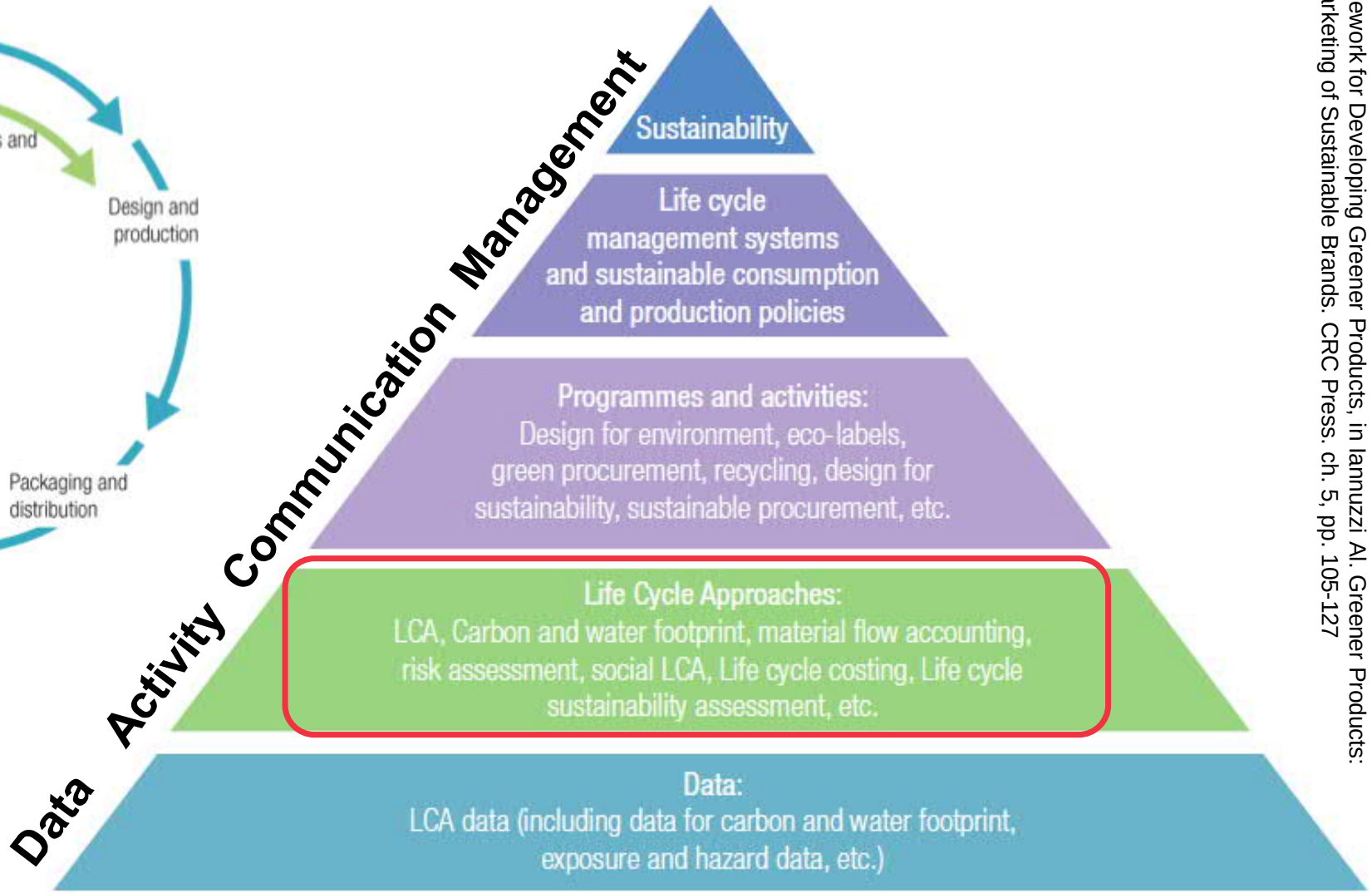
→ Pointing to the interlinkages between ecological, social and economical parameters

http://www.sustainablemeasures.com/node/89

Life cycle thinking and approaches



Lifecycleinitiative.org



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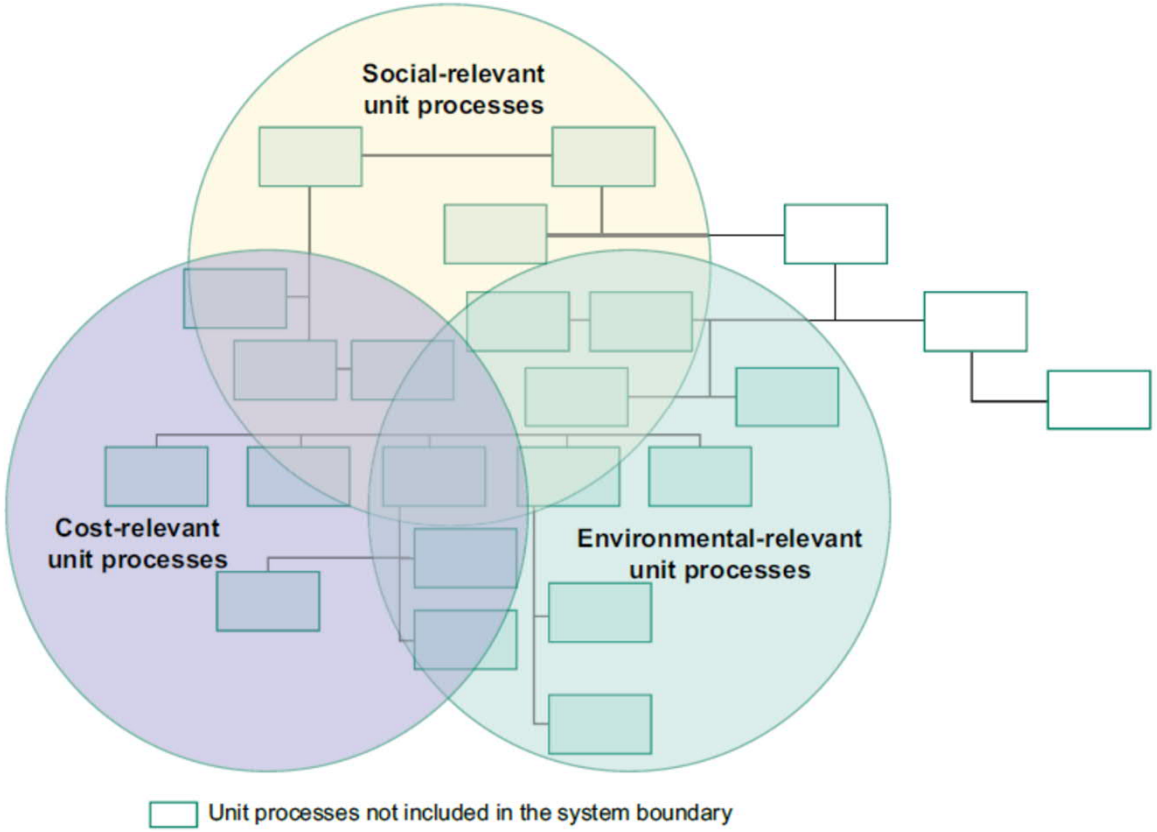
Life Cycle Sustainability Assessment

Table 6. Example of life cycle sustainability assessment data for marble slabs case study (Traverso and Finkbeiner, 2009).

(Environmental) LCA data	LCC data	S-LCA data
Energy consumption	Fuel costs	Total employees
Natural resources	Water-disposal costs	Wages
Water use	Electricity costs	Accidents
CO_2	Labour costs	Child labour
NO_x	Revenues	Working hours
SO_2	Raw material costs	Employees - Employees gender

UNEP/SETAC Towards a Life Cycle Sustainability Assessment (2011)



LCA=Life Cycle Analysis/Assessment
LCC=Life cycle Costing
SLCA=Social LCA
LCSA=Life Cycle Sustainability Assessment
(2 phases of an LCA: LCI=Life Cycle Inventory, LCIA=Life Cycle Impact Assessment)

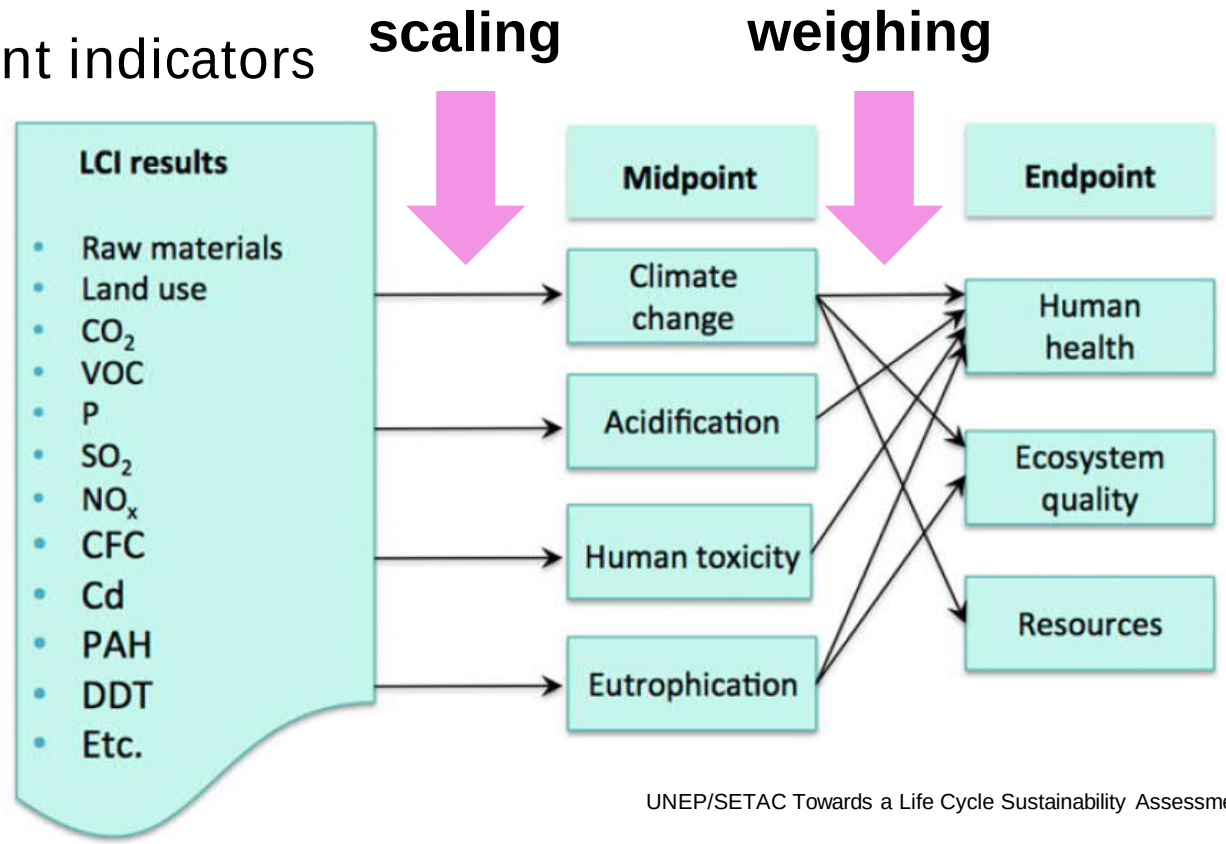
Indicators in LCA

Midpoint indicators

- results of different impact categories
- depict potential environmental impacts of certain impact categories, e.g. climate change, acidification, eutrophication
- can be aggregated to endpoint indicators

Endpoint indicators

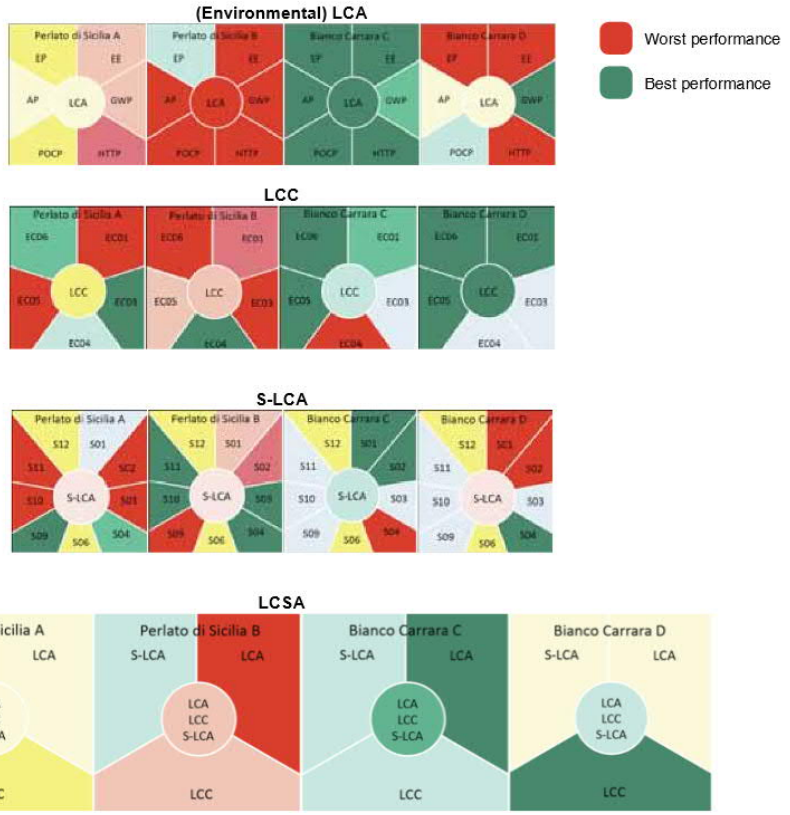
- represent ultimate impacts to human health, ecosystem quality and resources

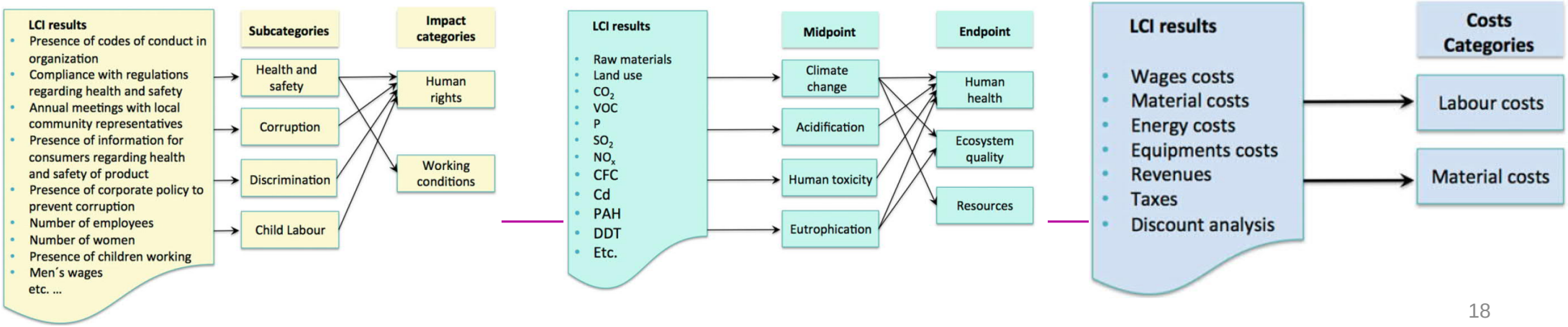


UNEP/SETAC Towards a Life Cycle Sustainability Assessment (2011)

Indicators in LCSIA

- **Data categories vary!**
  - Affects the presentation of the results
- **Results presented in a Dashboard**
  - Expertise needed to evaluate
  - Subjective





UNEP/SETAC Towards a Life Cycle Sustainability Assessment (2011)

Challenges of LCA for sustainability

- **Time consuming → companies use easy-to-use software and databases**

  → May be too generic for reliable product/project –specific assessment
- **Data availability**
- **Immaturity of the LCSA method**
  - Identifying the scope and interconnections of endpoint impacts
  - Selecting the indicators (quality / relevance)
  - Non-linearity of LCI and LCIA (proportional scaling)
    - *Specifically in tackling biodiversity and financial indicators*
- **Subjectivity in scaling and weighing**

Break 10 minutes

Footprints

Carbon footprint

- Many different standards, ISO14067 for products' CF

Water footprint

- Global Water Footprint Standard + ISO 14046

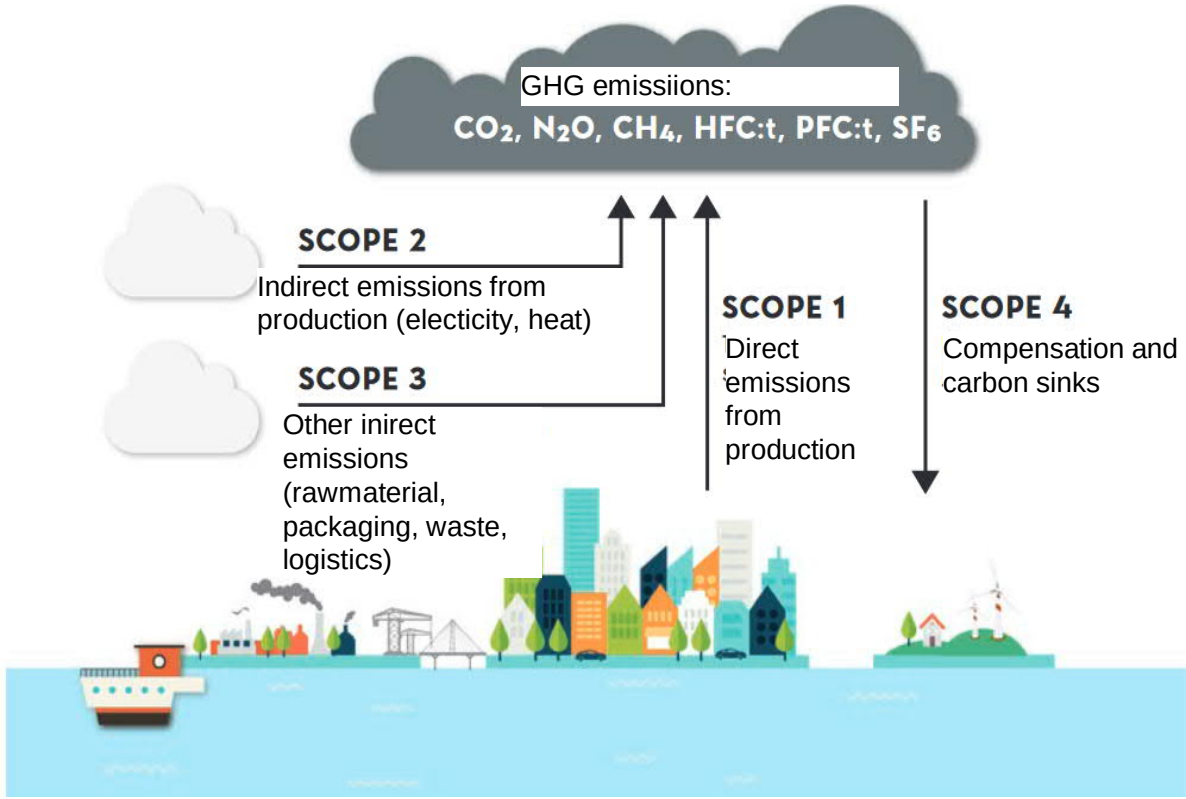
- Health, biodiversity, social (child labour, forced labor etc.)
- Are footprints always negative?

Footprints and scopes

Bottom up vs. top down

Production-based vs. consumption based

- Environmentally extended input-output EE I-O



WATER FOOTPRINTS OF SELECTED FOOD ITEMS

(Juha-Matti Katajajuuri, VTT)

One glass of wine
120 l

Pork
1 kg
4800 l

Cheese
1 kg
5000 l

Beef
1 kg
15500 l

Mika Jalava: disseration in 2019 on methods to calculate the water consumption of different diets
https://www.aalto.fi/en/news/the-water-we-eat

One apple
70 l

Barley 1 kg
1300 l

Milk 1 l
1000 l

Chicken meat 1 kg
3900 l

One cup of coffee
140 l

Rice
1 kg
3400 l

Cane sugar
1 kg
1500 l

One slice of bread
40 l

One egg
200 l

Ecological footprint

Demand (2019):

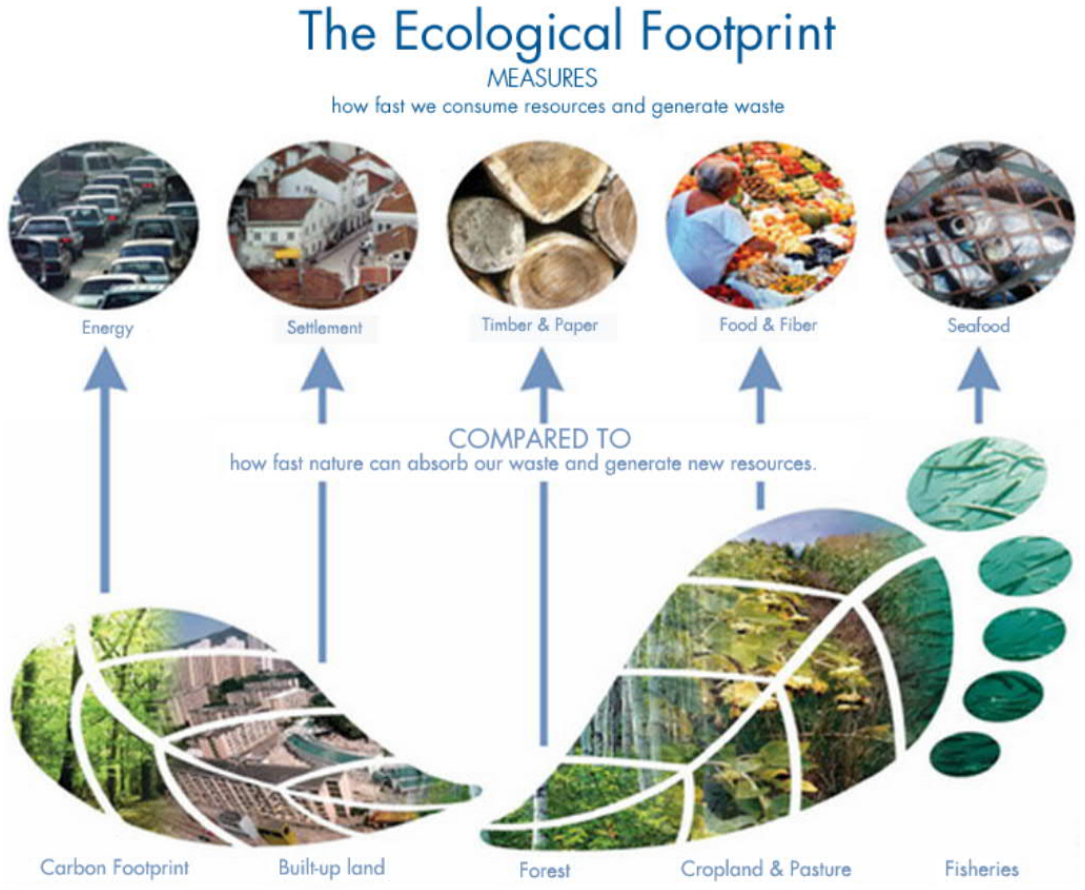
Global = 2,2 gha (global hectares)

Vs.

Biocapacity (2019)

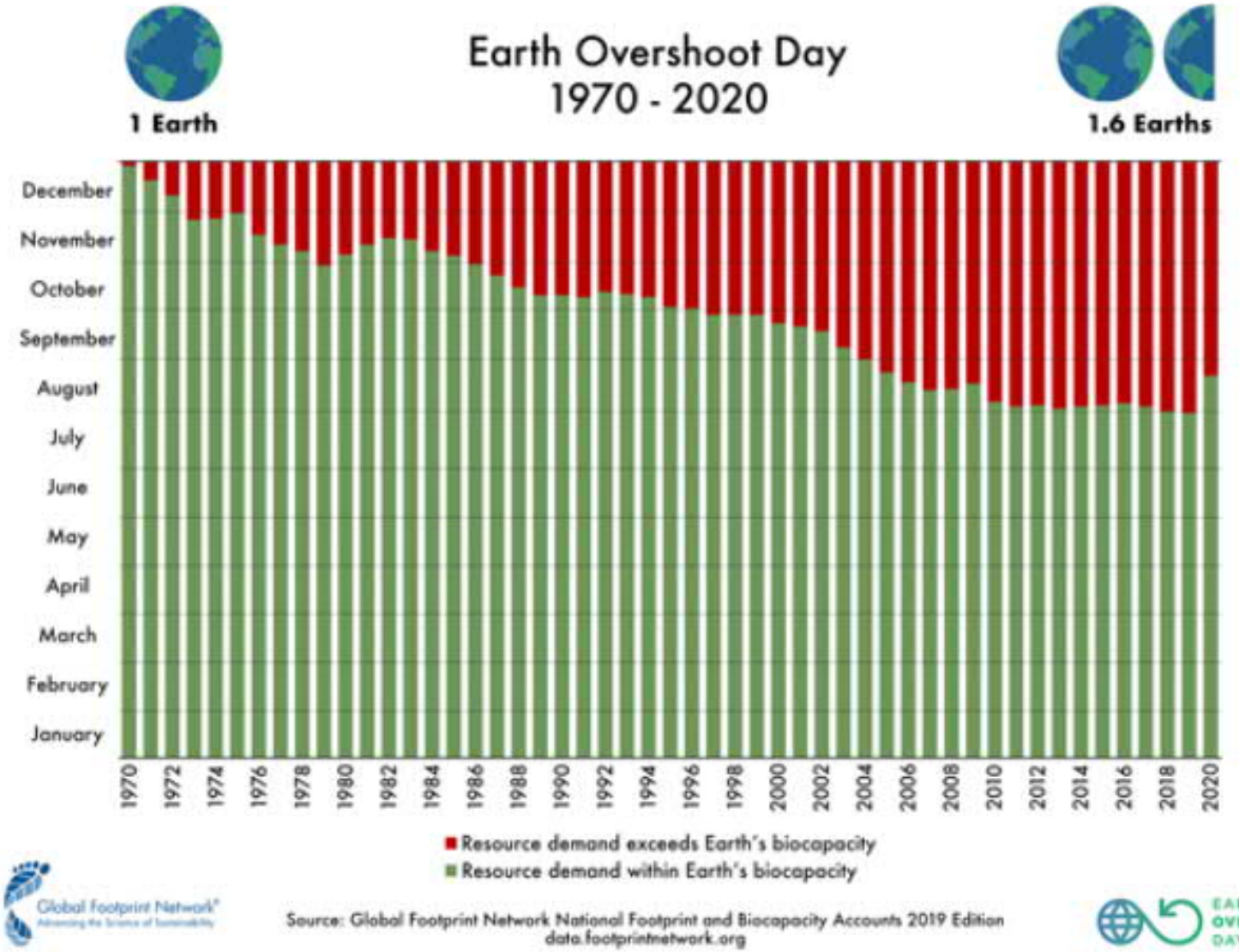
Global = 1,8 gha

- Cropland & pasture, fishing grounds, built-up land, forest area, and carbon demand on land



Earth overshoot day 2019
in July 29th
(FI: 9.4.2019)

2020: August 22nd



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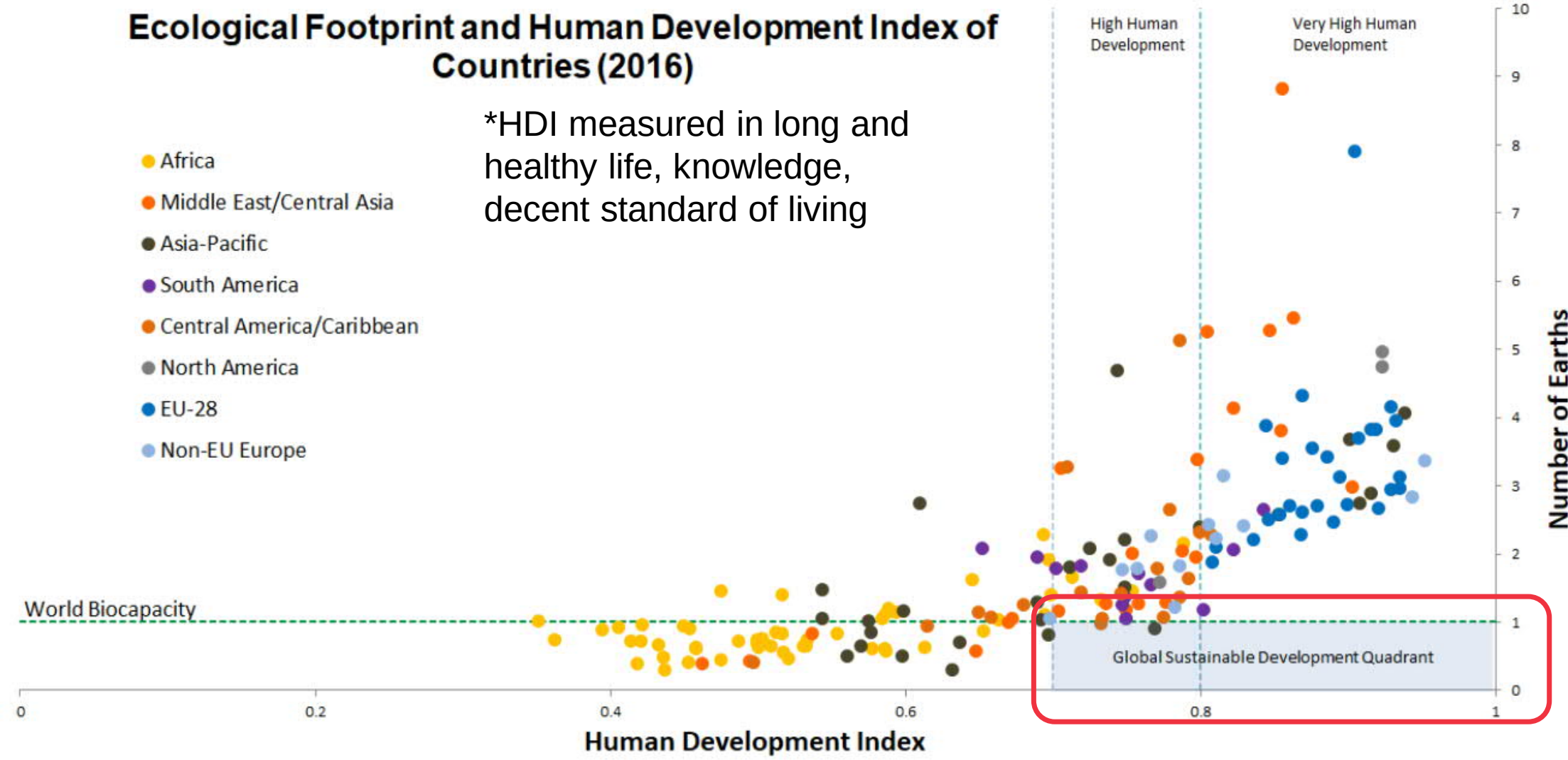
Eco-social Sustainability

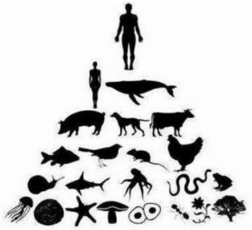


Source: Ecological Footprint (in number of Earths): National Footprint and Biocapacity Accounts, 2019 Edition, Global Footprint Network.
Human Development Index: Human Development Report, 2018, United Nations Development Programme.

Handprint

"What if each of us thought of our careers as opportunities to create our lifetime environmental handprint?"

Key aim: shift the focus on positive impact instead of negative



World as a resource

Interconnected

Regenerative

TABLE I.
THE FOOTPRINT *AND* THE HANDPRINT

Foot Print Thinking		Handprint Thinking
The harm we do		The good we do
Limited resources		Unlimited potential
Reduce /Reuse/Recycle		Recover/Restore
Admonish		Influence/Educate/Inspire
Measure quantities	+	Count accomplishments
Calculate		Appreciate/Celebrate
Resist destruction		Advocate protection
Problem Solving		Entrepreneurism

Biemer, J., Dixon, W., & Blackburn, N. (2013). Our environmental handprint: The good we do.

Additional value of handprint

The aim: Footprint – Handprint = Net positive

- Reducing your footprint ≠ handprint

→ Handprint is something you perform outside your footprint, e.g. reducing others' (a friend / customer) footprints

Are handprints always positive?

Calculation:

- LCA-based assessement (ISO 14040-44): comparing a handprint solution to a baseline solution

Figure 5. Carbon handprint solution provider receives a handprint equivalent to the achieved carbon footprint reduction.

Pajula, T., Vatanen, S., Pihkola, H., Grönman, K., Kasurinen, H., & Soukka, R. (2018). Carbon Handprint Guide.VTT Technical Research Centre of Finland.

Group discussion

Which of these results in a handprint from my point of view:

- I change my old light bulb to a led
- I change to a biogas car
- I give a led light bulb to my friend
- I eat vegetarian food
- I give a ride to my friend with my biogas car

How about from the point of view of the producer (light bulb, car, food?)

Compensation / Offsets

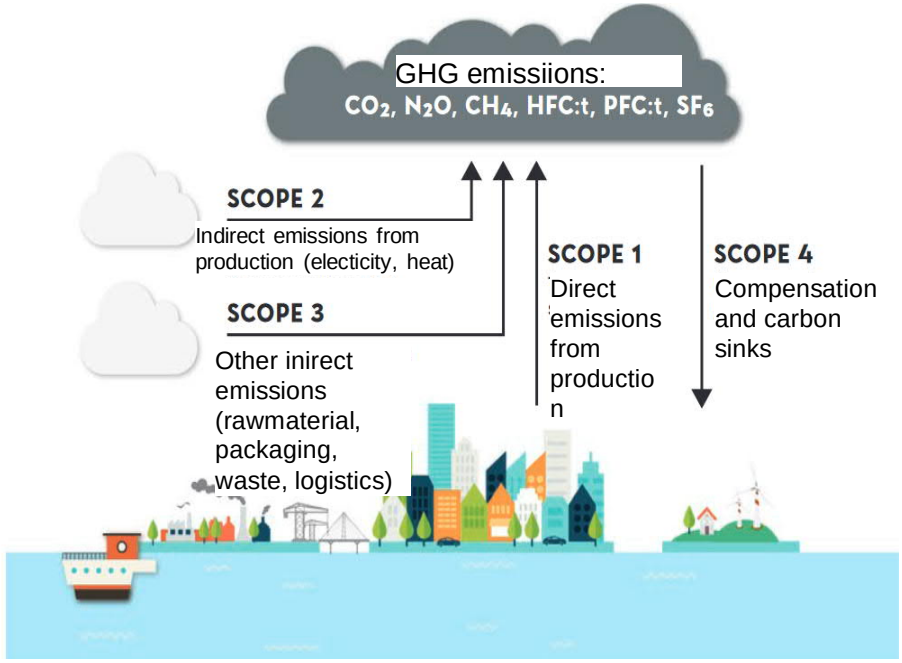
Footprints are inevitable – they enable our presence

Compensation is making up for the emissions that cannot be avoided and further reduced (“Scope 4”)

Companies aim at carbon neutrality by

1. Avoiding emissions that can be cut of
2. Reducing the existing footprint
3. Compensating for the remaining emissions

Handprint = compensation?



Definitions

Ecological compensation = making up the land use that has reduced biodiversity by restoring or conserving habitats

Carbon compensation = making up GHG emissions by funding emissions-cutting somewhere else

→ **interconnected:** by restoring ecosystems we also create carbon sinks

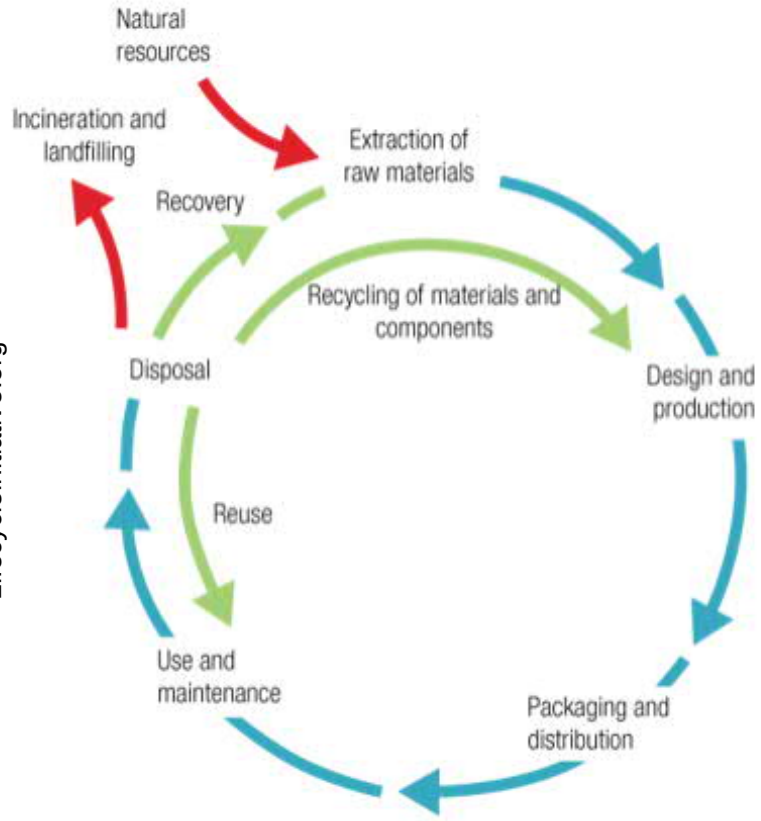
Greenwash or compensation?

Additional value as the premise of responsible compensation

Some criteria for credible compensation:

- Based on science
- Impact, additional value
- Sufficient and Sustainable – how permanent the compensation activities are?
- Environmental impacts and emission reductions must me verifiable
- Transparency throughout the process

Life cycle thinking and approaches



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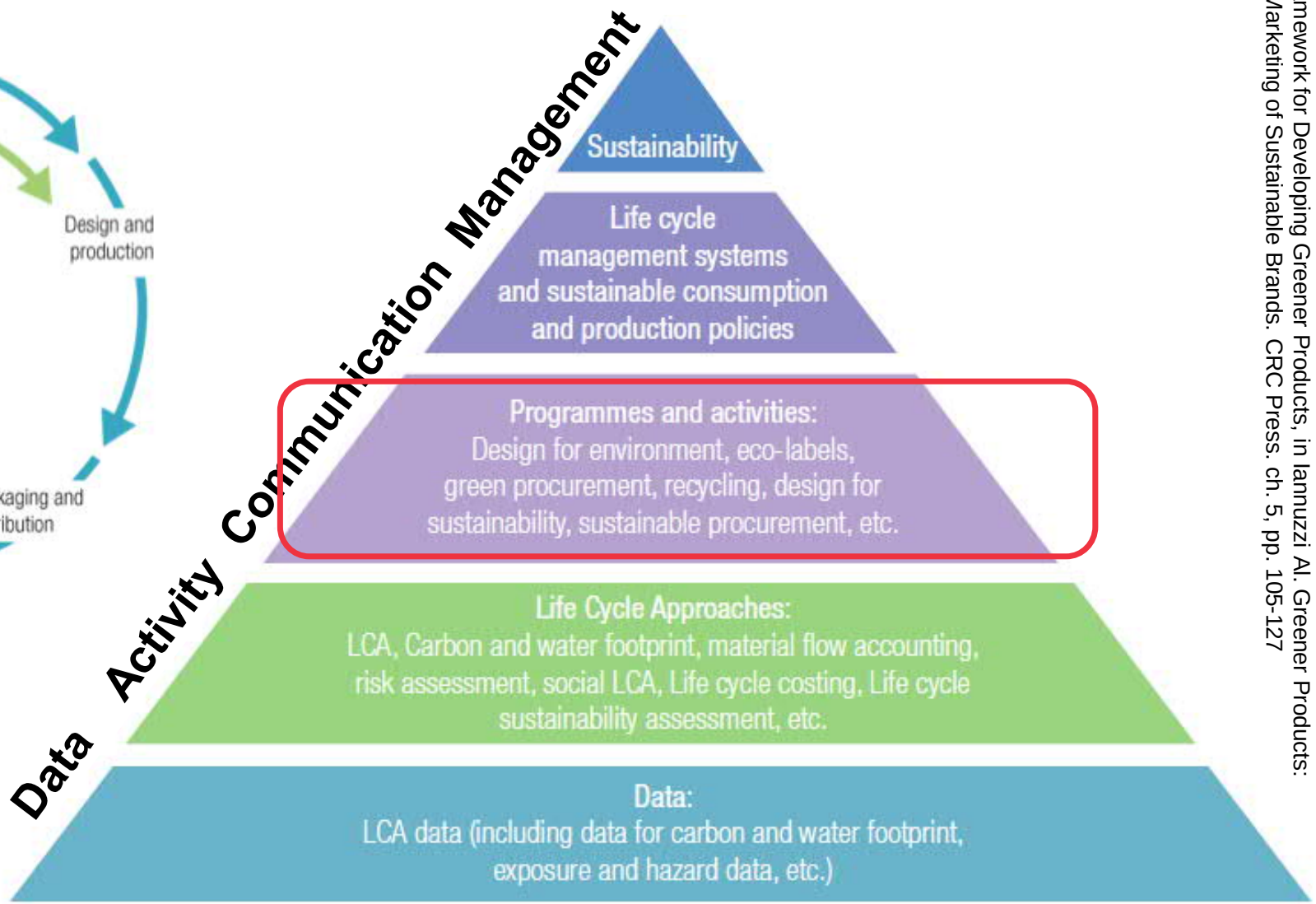

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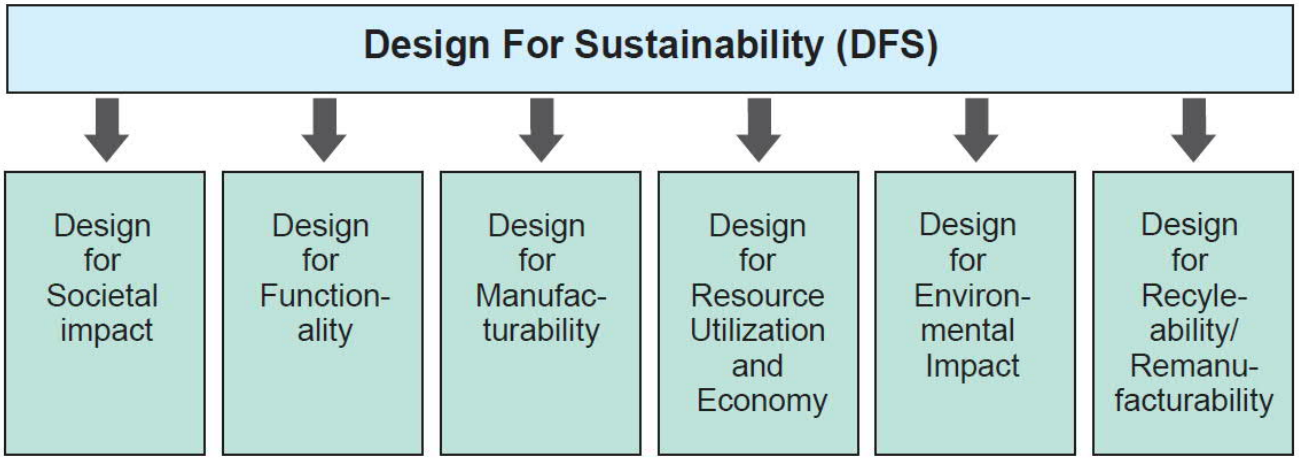
Ecodesign

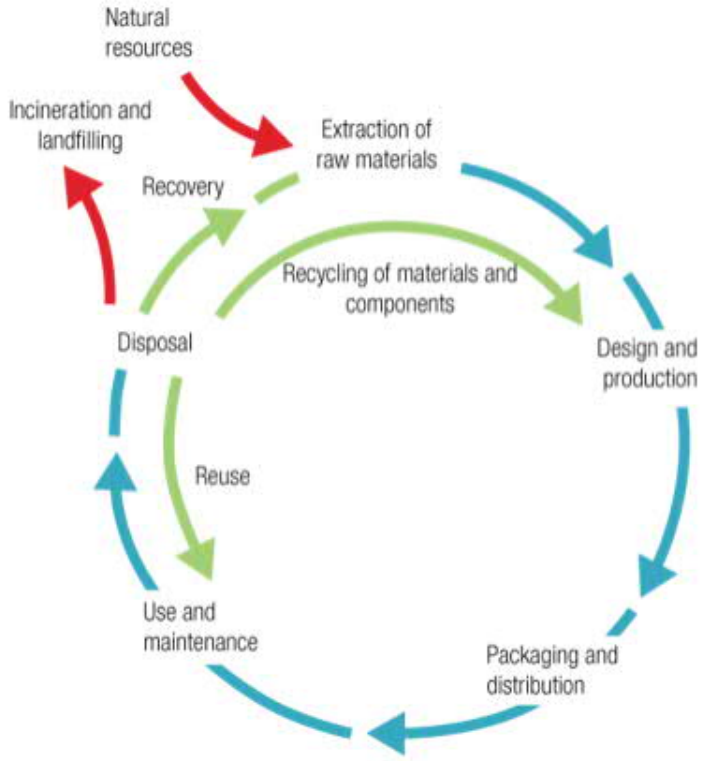
- An approach to **designing** products with special consideration for the environmental impacts of the product during its whole lifecycle
- ECODESIGN products are flexible, reliable, durable, adaptable, modular, degradable and reusable (6Rs: Rethink, Restore, Repair, Reduce, Reuse and Recycle). In addition to proving **economical** reasonability and **social** compatibility, these products represent an **ecological** necessity.
- EU Ecodesign Directive, mostly concerning electronic devices (e.g. CE-labelling, take-back schemes, info provided on rawmaterials etc.)

Design for Sustainability DfS

→ Towards **Circular design**

- •Design out waste and pollution
- •Keep products and materials in use
- •**Regenerate** natural systems

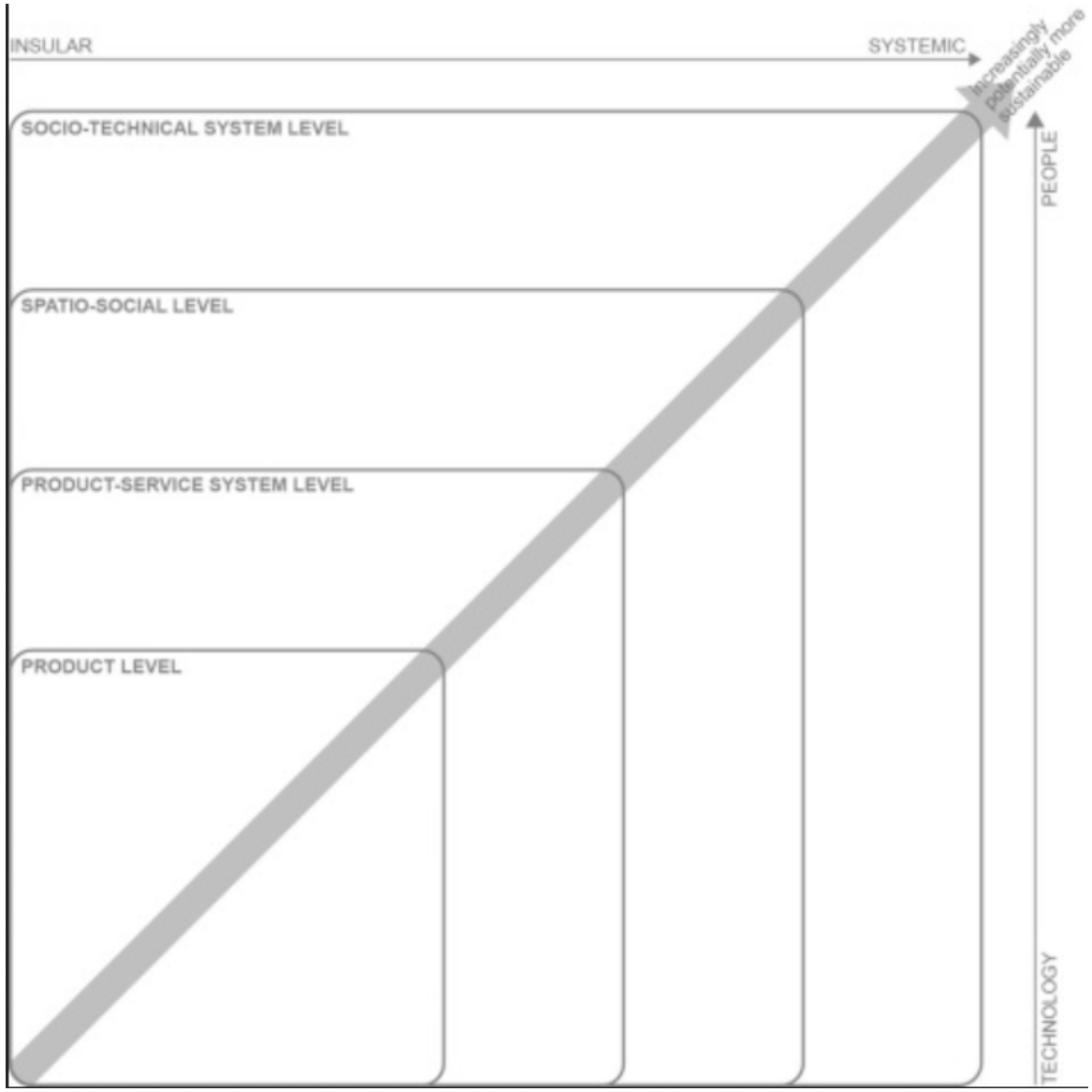




Evolution of DfS

From technologically focused **product design** to **user practices and behavior**

From **internal issues** to **large-scale systemic change**



Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design studies*, *47*, 118-163. https://doi.org/10.1016/j.destud.2016.09.002

Ecolabels

http://ehp.niehs.nih.gov/118-a246/

ISO 14020 to 14025 series:

Environmental labels and declarations

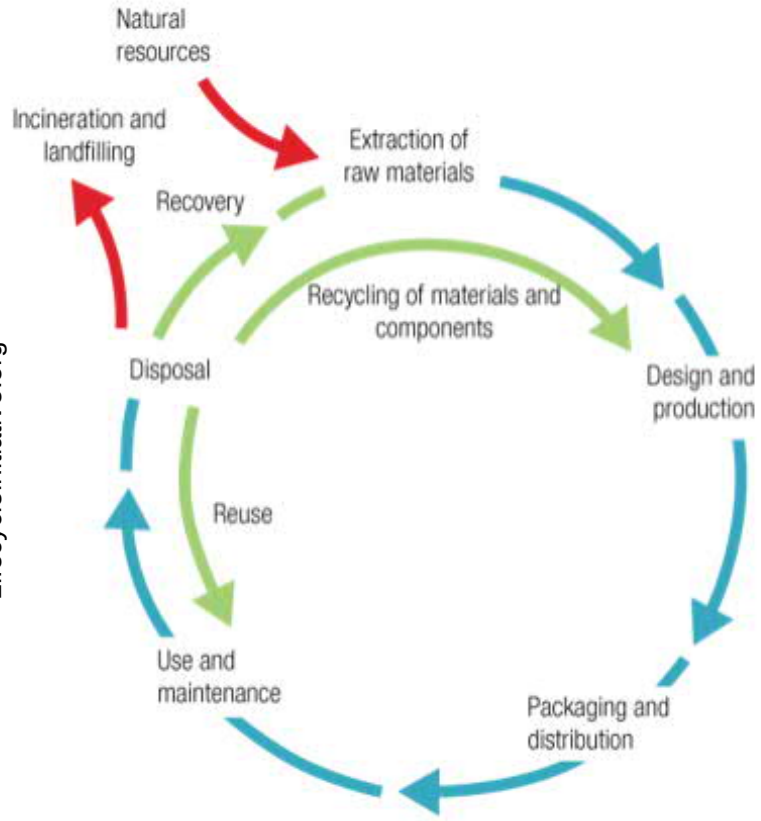
***Type I*:** Voluntary, multiple-criteria based, third party program developed for a specific product or products.

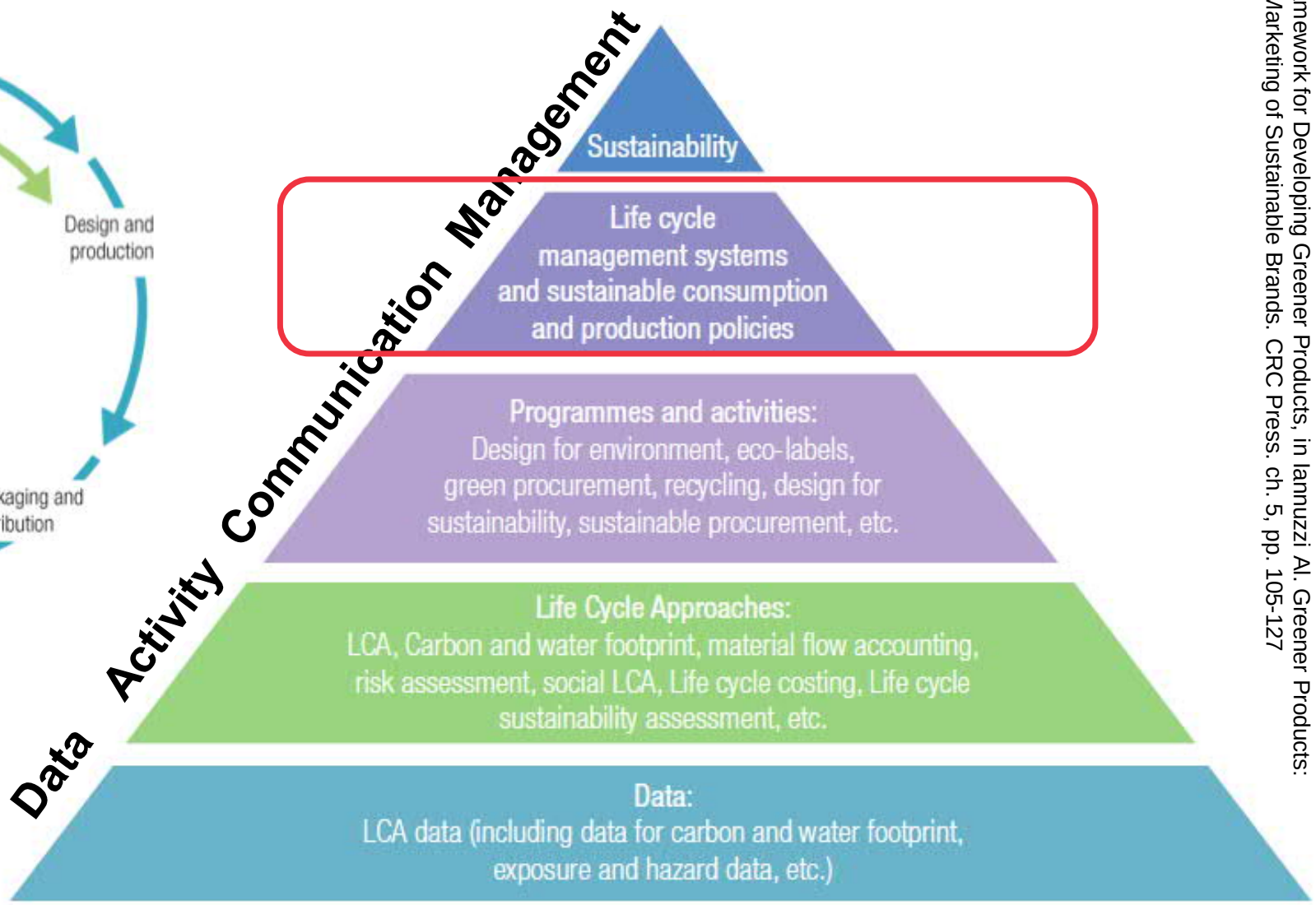
***Type II*:** informative environmental *self-declaration* claims

Type III: voluntary, LCA-based declarations on environmental impacts of products. Includes 1) Product Category Rules (PCRs): guidelines for the calculation of the environmental impact of products with similar characteristics, and 2) Environmental Product Declarations (EPDs) gained after following the PCRs: concise document containing relevant environmental information about a product.

Type I **ISO 14024**	**Type II** **ISO 14021**	**Type III** **ISO/TR 14025**
Environmental Labels	**Environmental Claims**	**Environmental Declarations**
Selected criteria as hurdles, demonstrating environmental excellence	Single issues describing specific environmental characteristics	Life cycle performance data, aim is continuous improvement
Life cycle thinking	Life cycle thinking	LIife cycle assessment
✓ Mandatory certification ✓ Issued by private or publics, accredited institution	✓ Issued by manufac-turer ✓ Certification possible	✓ Mandatory 3rd party validation ✓ Cerification possible ✓ Issued by private, accredited institution
Public product group based criteria	Claims must be based on available public initial information	Initial information data should be available except private company information
like: Swan Label, European Eco-Label	like: Recyclabillity, Compostable	like: Environmental Product Declaration

Life cycle thinking and approaches





Lifecycleinitiative.org

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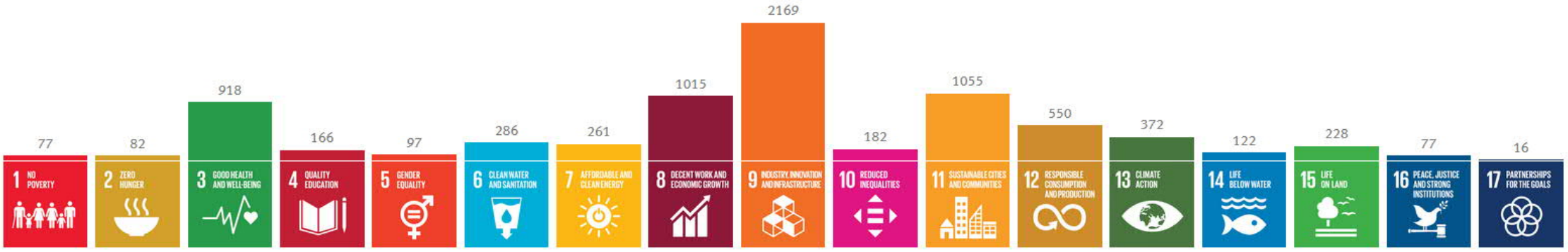
ISO standards for managing sustainability

- ISO Guide 82 for addressing sustainability in standards
- Over 600 standards contributing to the SDGs (2018)
  - https://www.iso.org/sdgs.html
- Goal: All >22000 standards contributing to the SDGs

IMPACT AT A GLANCE

ISO contributes to all of the SDGs. Here you can see the number of ISO standards that are directly applicable to each Goal.



Some common ISO standards

- Environmental management system (EMS): ISO 14001
- Social responsibility ISO 26000
- Occupational Health and Safety Assessment Series OHSAS
- (ISO 45001 for the same)

→ Integrated management system IMS tries to combine all*

Finnish Standards Association: https://www.sfs.fi/

*Silva, C., Magano, J., Moskalenko, A., Nogueira, T., Dinis, M. A. P., & Pedrosa e Sousa, H. F. (2020). Sustainable Management Systems Standards (SMSS): Structures, Roles, and Practices in Corporate Sustainability. *Sustainability*, *12*(15), 5892.
https://doi.org/10.3390/su12155892

Life cycle management

To start with the use of some life cycle approaches and tools on a product-oriented or project-organized basis.

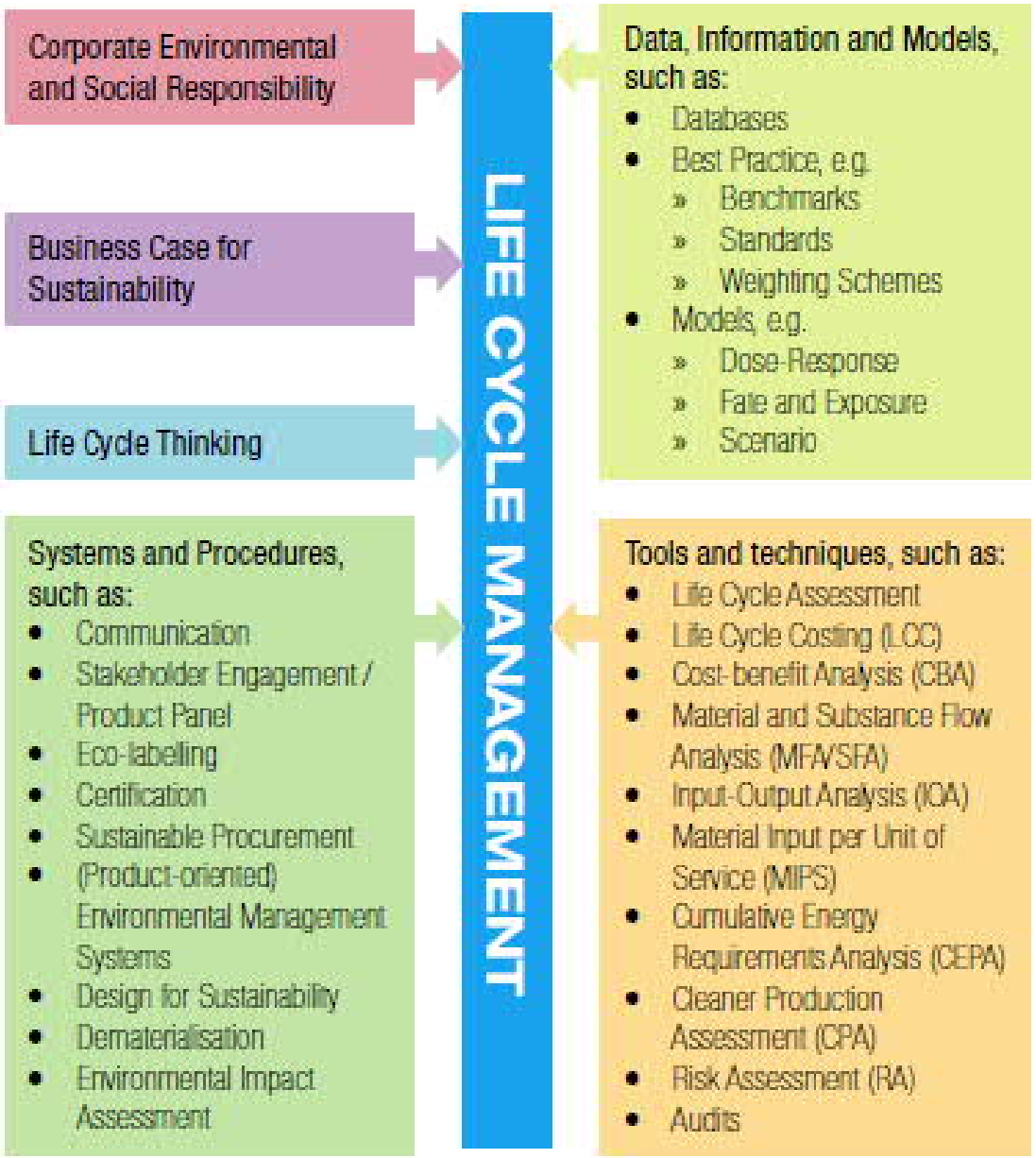
To broaden the integration of life cycle thinking on a ‘top to bottom’ basis, including internal policies, management systems, accountabilities, and incentives.

→ **Continuous improvement** included in the strategy

→ Concerns also encouraging suppliers and supply chains to do so

P-D-C-A

Plan-Do-Check-Act



Next?

- Video lectures on environmental legislation and the IED + BAT/BREFs: https://mycourses.aalto.fi/mod/page/view.php?id=651828
- Preparing your presentation on Friday

Thank you, see you on Friday at 9.00!