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CIRCULAR ECONOMY INDICATORS: WHAT DO THEY MEASURE?

Gustavo Moraga; Sophie Huysveld; Fabrice Mathieux; Gian Andrea Blengini; Luc Alaerts; Karel Van Acker; Steven de Meester; Jo Dewulf



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Full length article

Circular economy indicators: What do they measure?

Gustavo Moraga^a, Sophie Huysveld^a, Fabrice Mathieux^{c,*}, Gian Andrea Blengini^c, Luc Alaerts^d,
Karel Van Acker^d, Steven de Meester^b, Jo Dewulf^a



^a Department of Green Chemistry and Technology, Ghent University, Coupure Links 653, 9000, Ghent, Belgium

^b Department of Green Chemistry and Technology, Ghent University, Graaf Karel de Goedelaan 5, 8500, Kortrijk, Belgium

^c European Commission – Joint Research Centre, Sustainable Resources Directorate, Via E. Fermi 2749, 21027, Ispra, Italy

^d Department of Materials Engineering, KU Leuven, Kasteelpark Arenberg 44, 3001, Leuven, Belgium

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ABSTRACT

Circular Economy (CE) is a growing topic, especially in the European Union, that promotes the responsible and cyclical use of resources possibly contributing to sustainable development. CE is an umbrella concept incorporating different meanings. Despite the unclear concept, CE is turned into defined action plans supported by specific indicators. To understand what indicators used in CE measure specifically, we propose a classification framework to categorise indicators according to reasoning on what (CE strategies) and how (measurement scope). Despite different types, CE strategies can be grouped according to their attempt to preserve functions,

PRC
COLLABORATION
WITH THE JOINT
RESEARCH
CENTRE

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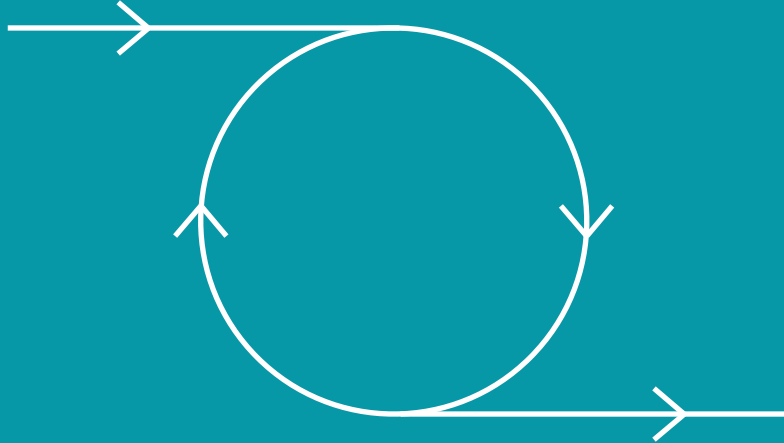
WHAT IS CIRCULAR ECONOMY?



CIRCULAR ECONOMY: MORE THAN 100 DEFINITIONS



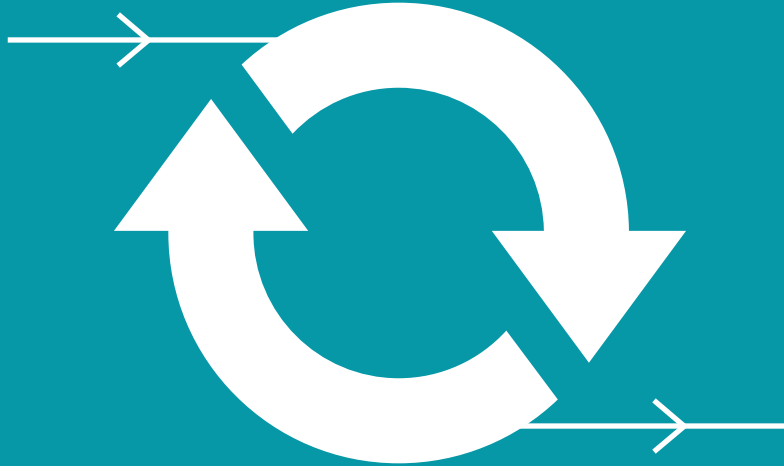
NATURAL
RESOURCES



WASTE



NATURAL
RESOURCES



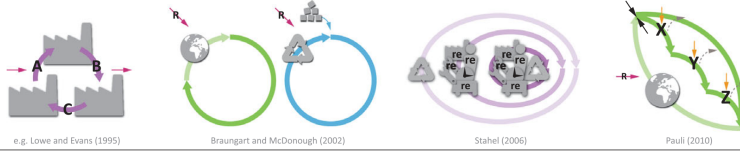
WASTE

CIRCULARITY physical cycles
of resources

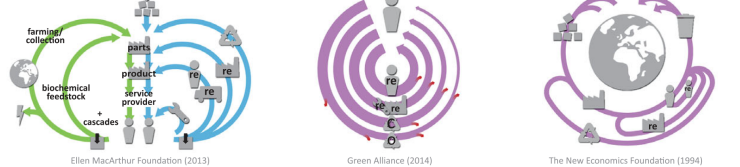


IT IS NOT CLEAR WHAT CIRCULARITY SHOULD MEASURE

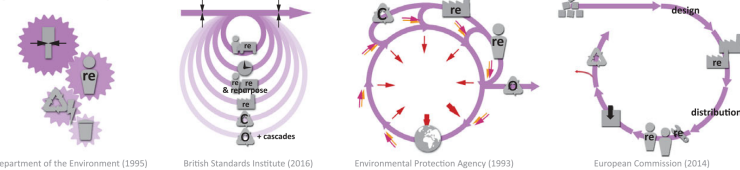
Seminal thinkers/ frameworks



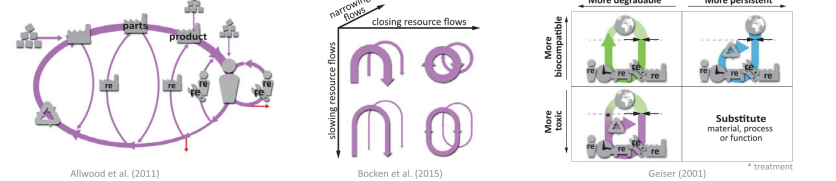
Think tanks



Legislative & advisory



Academia




Business





WHAT CE INDICATORS MEASURE SPECIFICALLY, AND HOW THEY DO SO?

- ▶ proposal for a classification Framework
- ▶ illustration with existing indicators
 - today: 10 indicators from the European Commission



ESTABLISHING THE CLASSIFICATION FRAMEWORK



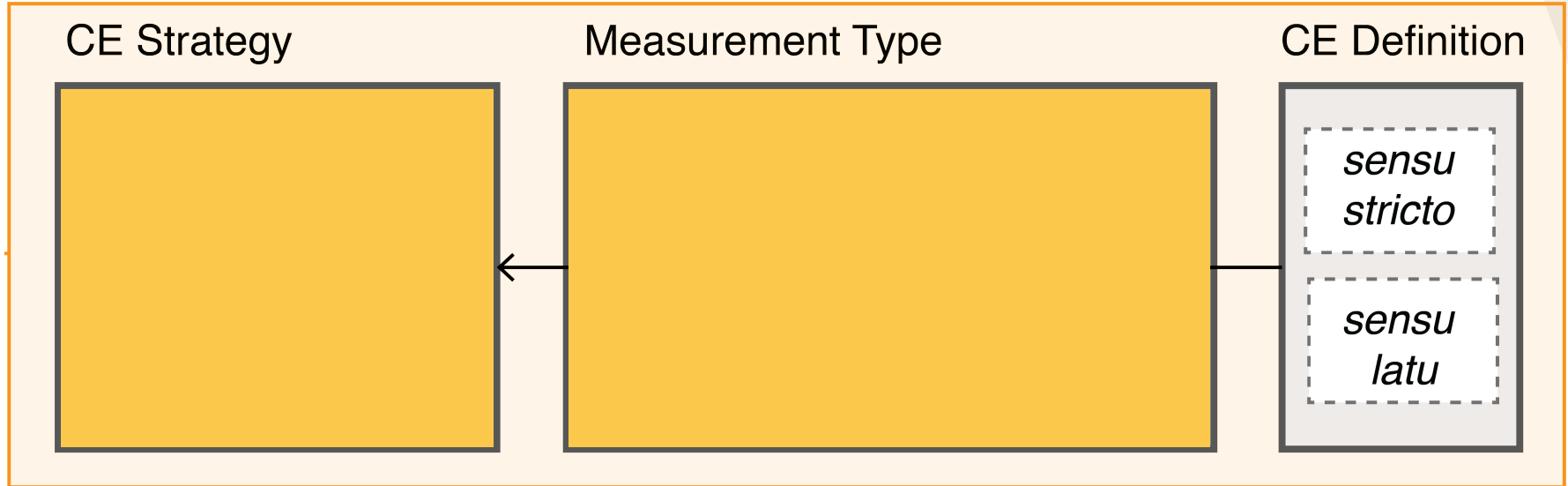
CE INDICATORS

WHAT TO MEASURE ?

HOW TO MEASURE ?



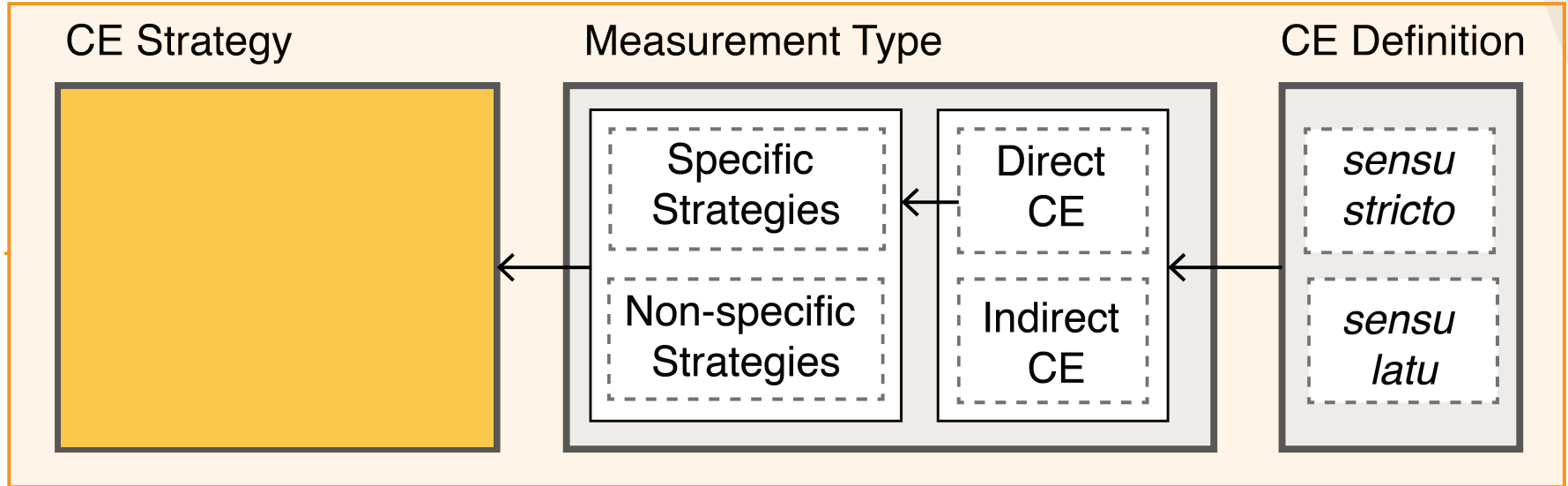
WHAT TO MEASURE?



INDICATORS USE DIFFERENT CE DEFINITIONS



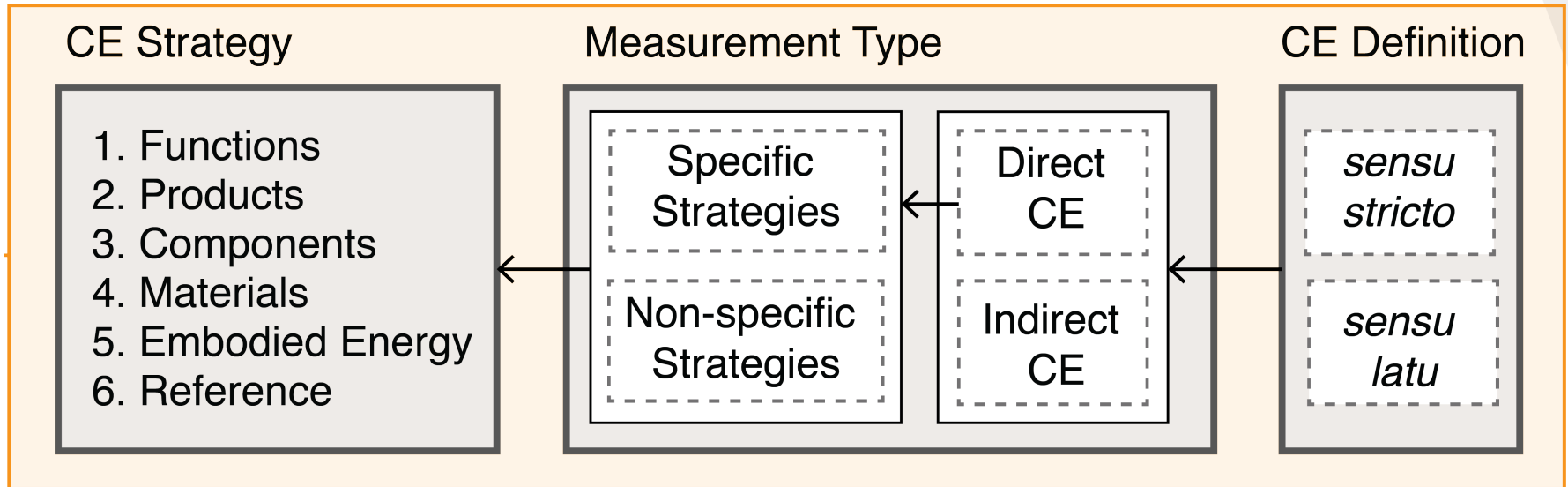
WHAT TO MEASURE?



INDICATORS CAN BE DIRECT OR INDIRECT TO CE



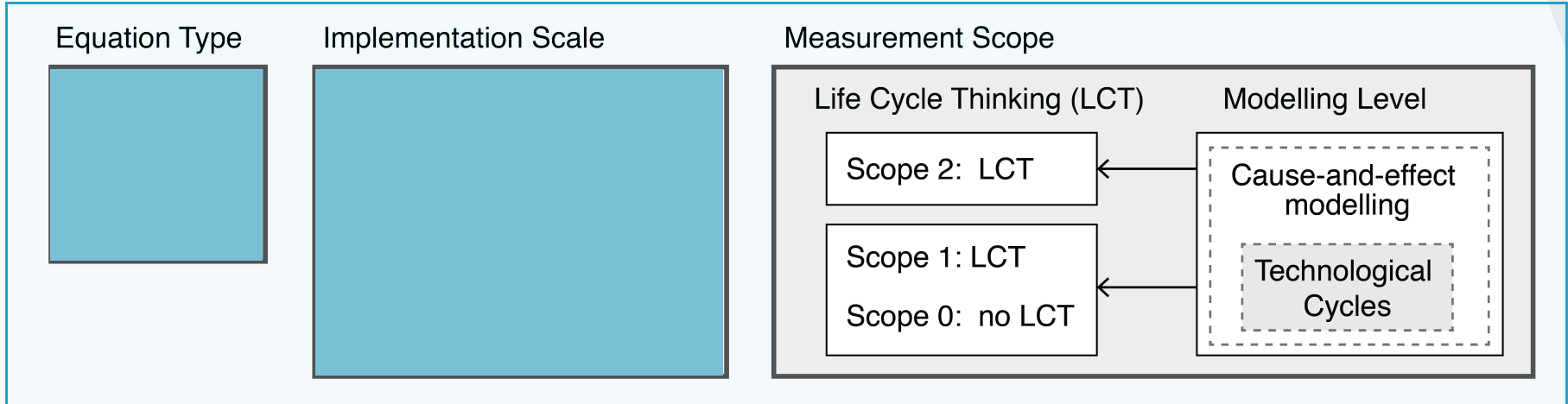
WHAT TO MEASURE?



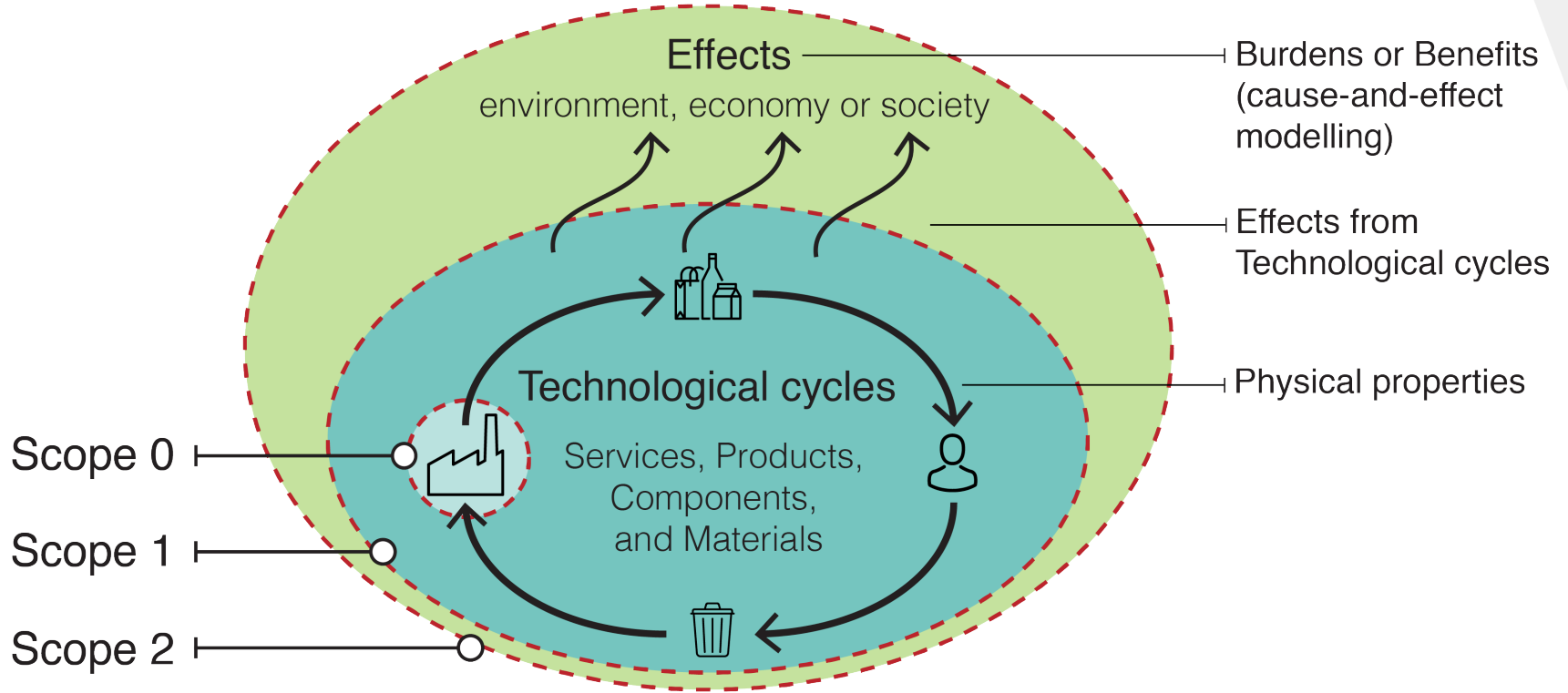
INDICATORS MEASURE CE STRATEGIES



HOW TO MEASURE?



INDICATORS MEASURE DIFERENT SCOPES





HOW TO MEASURE?

Equation Type

- Parameter
- Ratio
- Index
- Composite

Implementation Scale

- micro*
- Product / Service
 - Corporate
 - Inter-corporate
 - City
 - Region
 - Nation
 - World
- macro*
-

Measurement Scope

Life Cycle Thinking (LCT)

Scope 2: LCT

Scope 1: LCT

Scope 0: no LCT

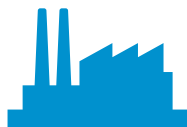
Modelling Level

Cause-and-effect
modelling

Technological
Cycles



**EUROPEAN COMMISSION'S
CIRCULAR ECONOMY
MONITORING FRAMEWORK**



PRODUCTION AND CONSUMPTION

WASTE MANAGEMENT

SECONDARY RAW MATERIALS

COMPETITIVENESS AND INNOVATION

Waste generation

EU self-sufficiency for raw materials

Food waste
(under development)

Green public procurement
(under development)

Recycling rates

Recycling / recovery for specific waste streams

Trade in recyclable raw materials

Contribution of recycled materials to raw materials demand

Private investments, jobs and gross value added related to circular economy sectors

Patents related to recycling and secondary raw materials

Municipal waste per capita

Waste per GDP unit

Waste per DMC

RR of municipal waste

RR of all waste

RR of e-waste

RR of overall packaging waste

RR of packaging waste by type

RR of wooden packaging

Recycling of biowaste

RR of CDW

Imports from non-EU countries

Exports to non-EU countries

Imports from EU countries

Exports to EU countries

Circular material use rate

EOL-RIR

Value added at factor cost

Gross investment in tangible goods

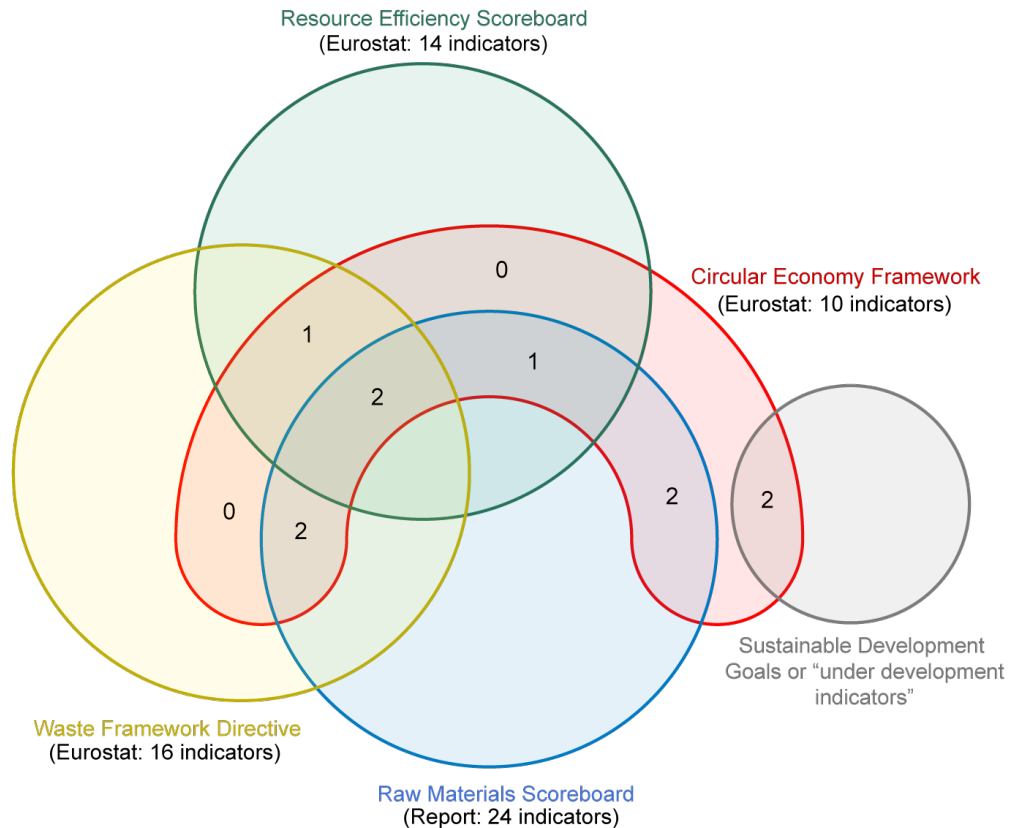
Number of persons employed in CE

4 THEMES

10 INDICATORS

20 SUBINDICATORS

CE INDICATORS REFER TO EXISTING EUROPEAN FRAMEWORKS





**CLASSIFICATION
FRAMEWORK
ILLUSTRATION**



HOW DO INDICATORS MEASURE?
Measurement scopes

Technological cycles with
physical properties

Cause-and-effect modelling from
Technological cycles

WHAT DO INDICATORS MEASURE?
CE Strategies

Preservation strategies

Linear

1 Function

e.g. refuse, rethink, reduce

2 Product

e.g. reuse, refurbish, remanufacture

3 Component

e.g. reuse, repurpose

4 Material

e.g. recycle, downcycle

5 Embodied Energy

e.g. energy recovery,
landfilling with energy recovery

6 Reference

e.g. waste generation,
landfilling without energy recovery

Scope 0

Technological cycles without aspects of
Life Cycle Thinking

Scope 1

Technological cycles with aspects of
Life Cycle Thinking

Scope 2

Cause-and-effect modelling with/without
aspects of Life Cycle Thinking

Recycling Rate - WEEE (1)

Self-Sufficiency (1)
Recycling Rates (8)

Waste Generation (3)
Recycling Rates (8)

Contribution to raw
materials demand (2)

Investments, jobs, add value (3)

Investments, jobs, add value (3)

Investments, jobs, add value (3)
Trade (4)
Patents (1)

Investments, jobs, add value (3)

EU indicators: Strategy 4 groups the majority of the indicators



WHAT DO INDICATORS MEASURE? CE Strategies		HOW DO INDICATORS MEASURE? Measurement scopes		
		Technological cycles with physical properties	Technological cycles with physical properties	Cause-and-effect modelling from Technological cycles
		Scope 0 Technological cycles without aspects of Life Cycle Thinking	Scope 1 Technological cycles with aspects of Life Cycle Thinking	Scope 2 Cause-and-effect modelling with/without aspects of Life Cycle Thinking
Preservation strategies	1 Function e.g. refuse, rethink, reduce			
	2 Product e.g. reuse, refurbish, remanufacture			Investments, jobs, add value (3)
	3 Component e.g. reuse, repurpose	Recycling Rate - WEEE (1)		Investments, jobs, add value (3)
	4 Material e.g. recycle, downcycle	Self-Sufficiency (1) Recycling Rates (8)	Contribution to raw materials demand (2)	Investments, jobs, add value (3) Trade (4) Patents (1)
Linear	5 Embodied Energy e.g. energy recovery, landfilling with energy recovery			
	6 Reference e.g. waste generation, landfilling without energy recovery	Waste Generation (3) Recycling Rates (8)		Investments, jobs, add value (3)

EU indicators: Functions and products not assessed by direct indicators



WHAT DO INDICATORS MEASURE? CE Strategies		HOW DO INDICATORS MEASURE? Measurement scopes		
		Technological cycles with physical properties	Technological cycles with physical properties	Cause-and-effect modelling from Technological cycles
		Scope 0 Technological cycles without aspects of Life Cycle Thinking	Scope 1 Technological cycles with aspects of Life Cycle Thinking	Scope 2 Cause-and-effect modelling with/without aspects of Life Cycle Thinking
Preservation strategies	1 Function e.g. refuse, rethink, reduce			
	2 Product e.g. reuse, refurbish, remanufacture			Investments, jobs, add value (3)
	3 Component e.g. reuse, repurpose	Recycling Rate - WEEE (1)		Investments, jobs, add value (3)
	4 Material e.g. recycle, downcycle	Self-Sufficiency (1) Recycling Rates (8)	Contribution to raw materials demand (2)	Investments, jobs, add value (3) Trade (4) Patents (1)
	5 Embodied Energy e.g. energy recovery, landfilling with energy recovery			
Linear	6 Reference e.g. waste generation, landfilling without energy recovery	Waste Generation (3) Recycling Rates (8)		Investments, jobs, add value (3)

EU indicators: most of the direct indicators in Scope 0



WHAT DO INDICATORS MEASURE? CE Strategies		HOW DO INDICATORS MEASURE?		
		Measurement scopes	Technological cycles with physical properties	Cause-and-effect modelling from Technological cycles
		Scope 0 Technological cycles without aspects of Life Cycle Thinking	Scope 1 Technological cycles with aspects of Life Cycle Thinking	Scope 2 Cause-and-effect modelling with/without aspects of Life Cycle Thinking
Preservation strategies	1 Function e.g. refuse, rethink, reduce			
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	3 Component e.g. reuse, repurpose	Recycling Rate - WEEE (1)		Investments, jobs, add value (3)
	4 Material e.g. recycle, downcycle	Self-Sufficiency (1) Recycling Rates (8)	Contribution to raw materials demand (2)	Investments, jobs, add value (3) Trade (4) Patents (1)
	5 Embodied Energy e.g. energy recovery, landfilling with energy recovery			
Linear	6 Reference e.g. waste generation, landfilling without energy recovery	Waste Generation (3) Recycling Rates (8)		Investments, jobs, add value (3)

EU indicators: only indirect indicators in Scope 2



WHAT DO INDICATORS MEASURE? CE Strategies		HOW DO INDICATORS MEASURE? Measurement scopes		Cause-and-effect modelling from Technological cycles
		Technological cycles with physical properties	Technological cycles with physical properties	Technological cycles
		Scope 0 Technological cycles without aspects of Life Cycle Thinking	Scope 1 Technological cycles with aspects of Life Cycle Thinking	Scope 2 Cause-and-effect modelling with/without aspects of Life Cycle Thinking
Preservation strategies	1 Function e.g. refuse, rethink, reduce			
	2 Product e.g. reuse, refurbish, remanufacture			Investments, jobs, add value (3)
	3 Component e.g. reuse, repurpose	Recycling Rate - WEEE (1)		Investments, jobs, add value (3)
	4 Material e.g. recycle, downcycle	Self-Sufficiency (1) Recycling Rates (8)	Contribution to raw materials demand (2)	Investments, jobs, add value (3) Trade (4) Patents (1)
	5 Embodied Energy e.g. energy recovery, landfilling with energy recovery			
Linear	6 Reference e.g. waste generation, landfilling without energy recovery	Waste Generation (3) Recycling Rates (8)		Investments, jobs, add value (3)

EU-CE INDICATORS:



- ▶ Indicators build in from existing knowledge;
- ▶ Strong focus on materials, but promise for products/functions with indicators in development;
- ▶ Energy recovery is not relevant;
- ▶ Narrow life cycle perspective (scope 0).

CONCLUSION

- ▶ innovative framework to classify output/outcome indicators;
- ▶ more research needed for input indicators;
- ▶ a single indicator might not be sufficient for CE.





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THANK YOU

Gustavo.Moraga@UGent.be



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