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ReTraCE

Realising the Transition towards the Circular Economy

Webinar on Economic Efficiency

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Key questions.



From policies to indicators

"You manage what you measure"



Selection of Resource Efficiency indicators



Consultations, European Resource Efficiency Platform



EU Resource Efficiency Scoreboard

What is Economic Efficiency?

- Different and competing concepts

What is their significance for Circular Economy?

- Different concepts provide different conclusions

But ...what is Efficiency?



Perhaps we could simplify the concept by saying “*efficiency is the ability to produce more with less*”

- ✓ “*more*” should comprise quantity + quality + [...whatever it characterizes a product or service]

Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result.

That is to produce a specific outcome with a minimum quantity of waste, expense, or unnecessary effort.

That represents an engineering view:

physical or technical efficiency (OECD, 2012):

- amount of resources input required to produce a unit of output, both expressed in physical terms.
- the focus is on maximising the output with a given set of inputs and a technology ...or on minimising the inputs per output.

Butwhat is **Economic Efficiency**?



....roughly speaking, a situation in which nothing can be improved without something else being hurt.

Depending on the context, it is usually one of the following two related concepts: *Allocative versus Productive Efficiency*

Allocative efficiency: we pay attention to both producers and consumers.

A market can be said to have allocative efficiency (e.g. optimal solution) if the price of a product that the market is supplying is equal to the marginal value consumers place on it, and equals marginal cost.

In other words, when every good or service is produced up to the point where if one extra unit is supplied to the market then it will provide a lower marginal benefit to consumers than marginal cost of production....

...that will represent an inefficient allocation of resources because consumers attach to the *last unit* a lower value (utility) that the cost to produce it ...and therefore production should be reduced up to the “optimal”.

Butwhat is Economic Efficiency?



Allocative efficiency ...are we sure that the economy will provide an *optimal mix of commodities*? ...a macro view:

In a market exhibiting *perfect competition* (no market power):

- ✓ prices are equal to marginal costs ...the supply curve coincides with the marginal cost curve, which measures the (private) cost of the additional unit.
- ✓ prices are equal to the marginal utility ...the demand curve coincides with the marginal utility curve of consumers, which measures the (private) benefit of the additional unit.

In a perfect market where there are *no externalities*:

- ✓ the supply curve measures the social cost of the additional unit.
- ✓ the demand curve is equal to the social benefit of the additional unit.
- ✓ And therefore, the marginal social benefit equals the marginal social costs.

At this point, *net social benefit is maximized*, meaning this is the allocatively efficient outcome at the macro level.

When a market fails to allocate resources efficiently, there is said to be market failure.

Butwhat is **Economic Efficiency**?

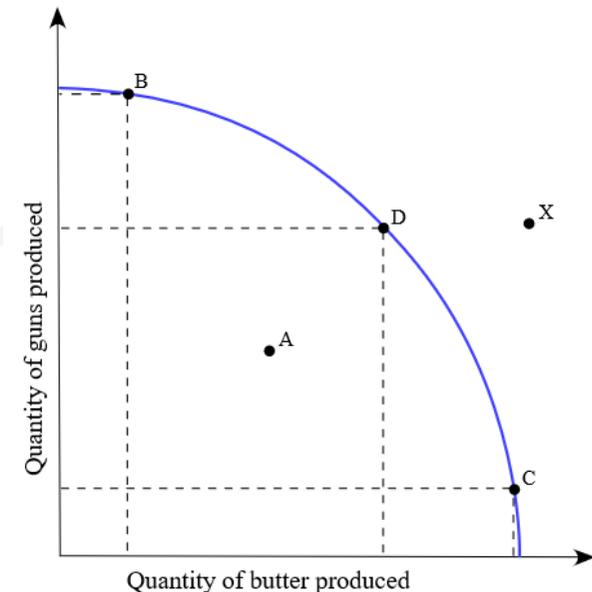
Productive efficiency: no additional output of one good can be obtained without decreasing the output of another good, and production proceeds at the lowest possible average total cost (according to the characteristics of the product and service with regard to quality and any other attribute).

Productive efficiency of an industry requires that:

- ✓ all firms operate using best-practice technological and managerial processes
- ✓ the economy is on its production possibility frontierthere is no further reallocation that bring more output with the same inputs and the same production technology.

These definitions are not equivalent: an economy may be allocatively but not productively efficient, or productively but not allocatively efficient.

Our interests regarding CE are probably more related to the **Productive Efficiency**...is that right? ...does it make sense?



“you manage what you measure”



physical or technical efficiency:

Life Cycle Analysis?

lot of problems

- amount of output relative to resources input required, both expressed in physical terms (e.g. kg / m³).
- the focus is on maximising the output per inputs and a technology ...or on minimising the inputs.

economic-physical efficiency:

- value added VA (€) of outputs per mass unit of resource inputs used (e.g. € / m³).
- the focus is to decouple VA and resource consumption.

economic efficiency:

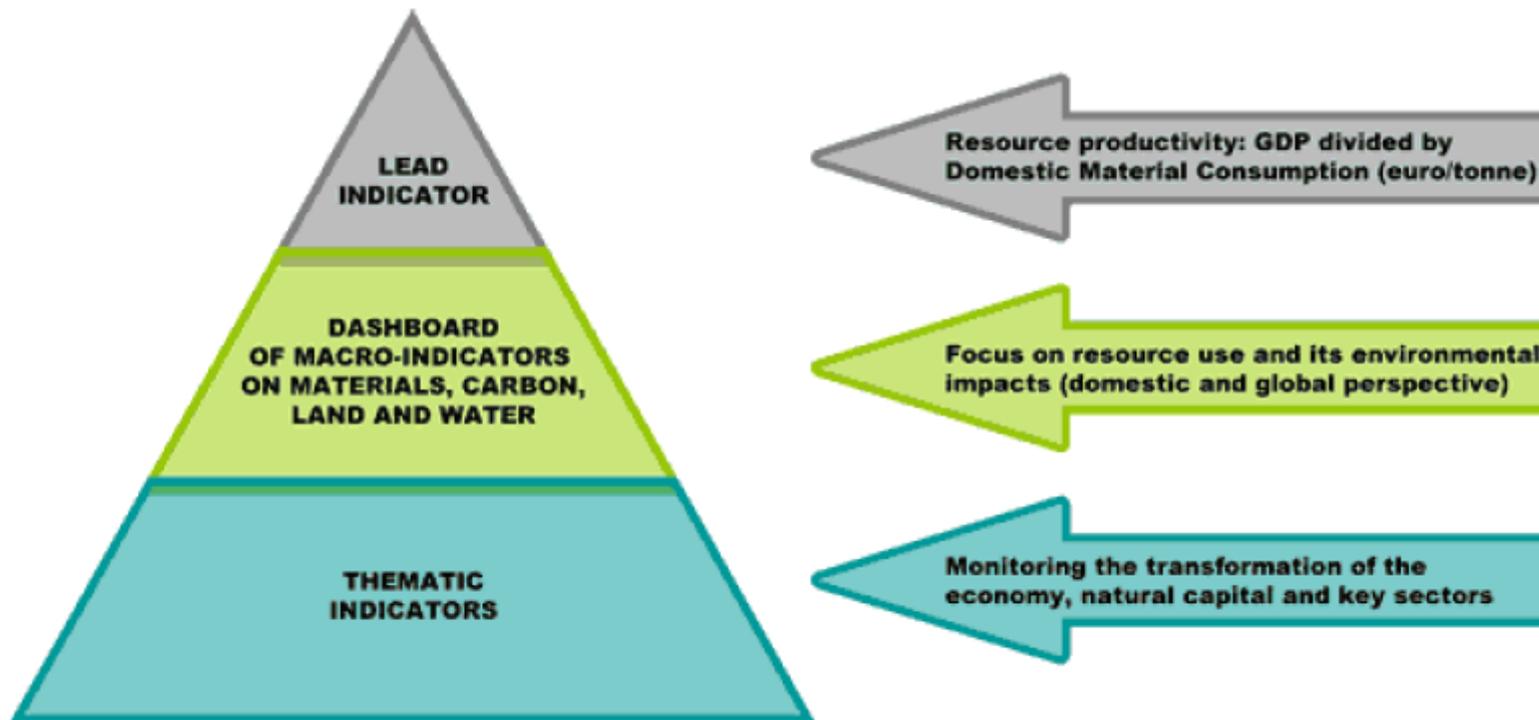
- the value of output relative to the value of inputs (e.g. € / €).
- the focus is on minimising resource input costs.

possible for energy,
water? minerals?

No data problems



EU Resource Efficiency Scoreboard



Measuring Circular Economy. The EU Efficiency Scoreboard.



Resource efficiency indicators (1/4)

Theme	Sub theme	Indicator	Source
Lead indicator	Resources	Resource productivity	Eurostat
Dashboard indicators	Materials	Domestic material consumption (DMC) per capita	Eurostat
		Land	Built-up areas
	Productivity of artificial land		Eurostat
	Water	Water exploitation index	Eurostat, EEA
		Water productivity	Eurostat, EEA
	Carbon	Greenhouse gas emissions per capita	EEA
		Energy productivity	Eurostat
		Energy dependence	Eurostat
	Share of renewable energy in gross final energy consumption	Eurostat	

“you manage what you measure” (EU Efficiency Scoreboard).



Resource Efficiency and **Resource Productivity** are largely identical in the way that they are used.

Resource Productivity = economic-physical efficiency (e.g. € / m³).

- the higher productivitythe higher efficiency?
- a very convenient concept for Academics, Think Tanks and Policymakers.
- easy to understand ...it resembles to Labour Productivity (VA / labour)

Problem: only primary factors “add value” ..so there is no sense for “resources productivity” concept.

Resource Intensity = inverse of Resource Productivity (e.g. m³ / €).

- a very common concept also.
- the lower intensitythe higher efficiency?

Productivity, Intensity, Efficiency ... too much confusion.



They have been extensively used for:

- Decoupling Analysis,
- to define Policy Objectives and Targets (Chinese voluntary pledges to UNFCCC),
- to conduct Assessments (e.g., for firms, countries, sectors; European Countries with regard to the EU energy savings targets).

They have been extensively used as proxies of Efficiency:

- in the Academic Literature,
- by well know Think Tanks, International Organizations (e.g., OECD, IEA, UN), Governments (e.g., EU, China).

Sustainable Materials Management.

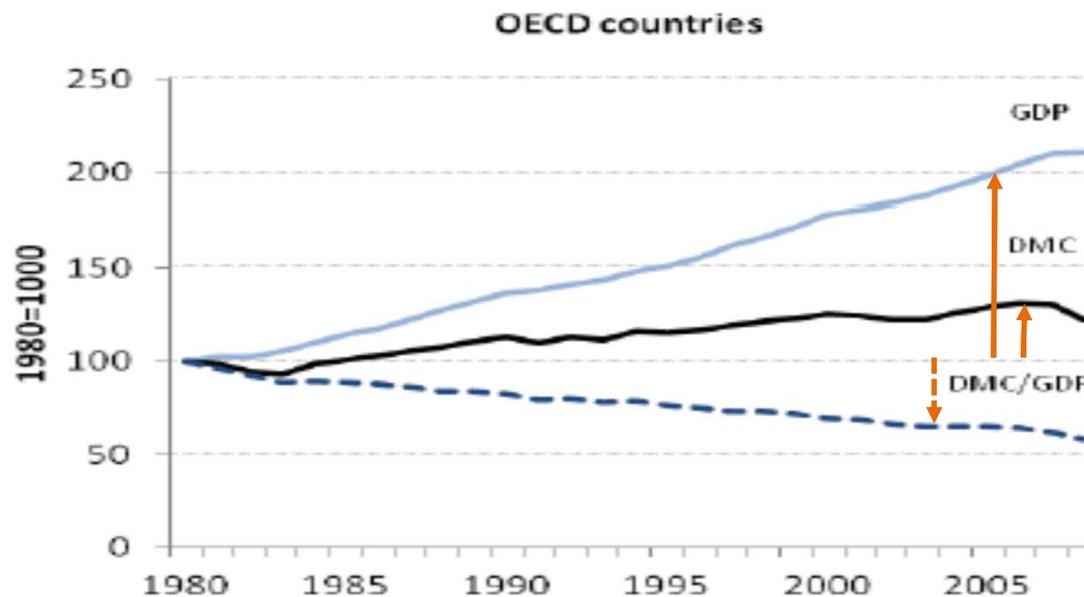
OECD 2012, Paris.



“Resource productivity (the inverse of DMC/GDP) has been improving throughout the OECD with a 42% increase between 1980 and 2008 (Figure 3).”

“This can be at least partly attributed to a range of policies that OECD countries have put in place to improve resource efficiency and the recovery of materials from waste.”

Figure 3. OECD material consumption versus GDP⁸



Resource Productivity & Decoupling

The problem of mixing monetary and physical units...

....changes in Productivity or Intensity may result from changes in labour productivity

Domestic Material Consumption (DMC) is a variable used in material flow accounting. DMC measures the mass (weight) of the materials that are physically used in the consumption activities of the domestic economic system.

The misleading conclusions from using Energy Intensity for understanding past trends in CO₂.



Rodriguez, M., and Pena-Borrego, Y. (2017). Carbon Intensity Changes in the Asian Dragons. Lessons for climate policy design. Energy Economics 66.

Improvements in Carbon Intensity is produced by rising Labour Productivity

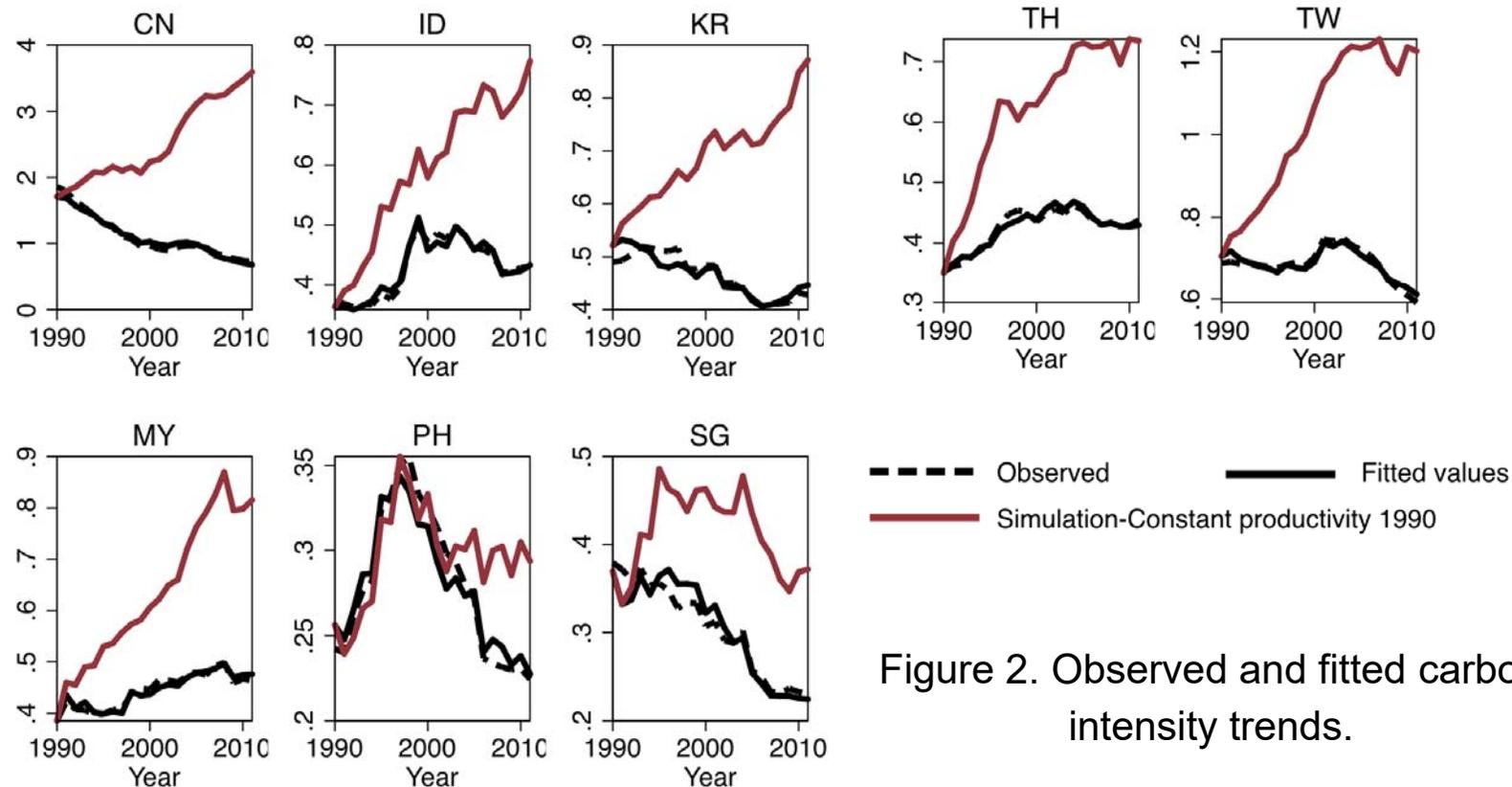


Figure 2. Observed and fitted carbon intensity trends.

The misleading conclusions from using Energy Intensity for forecasting future trends in CO₂.



Using Energy Intensity past trends

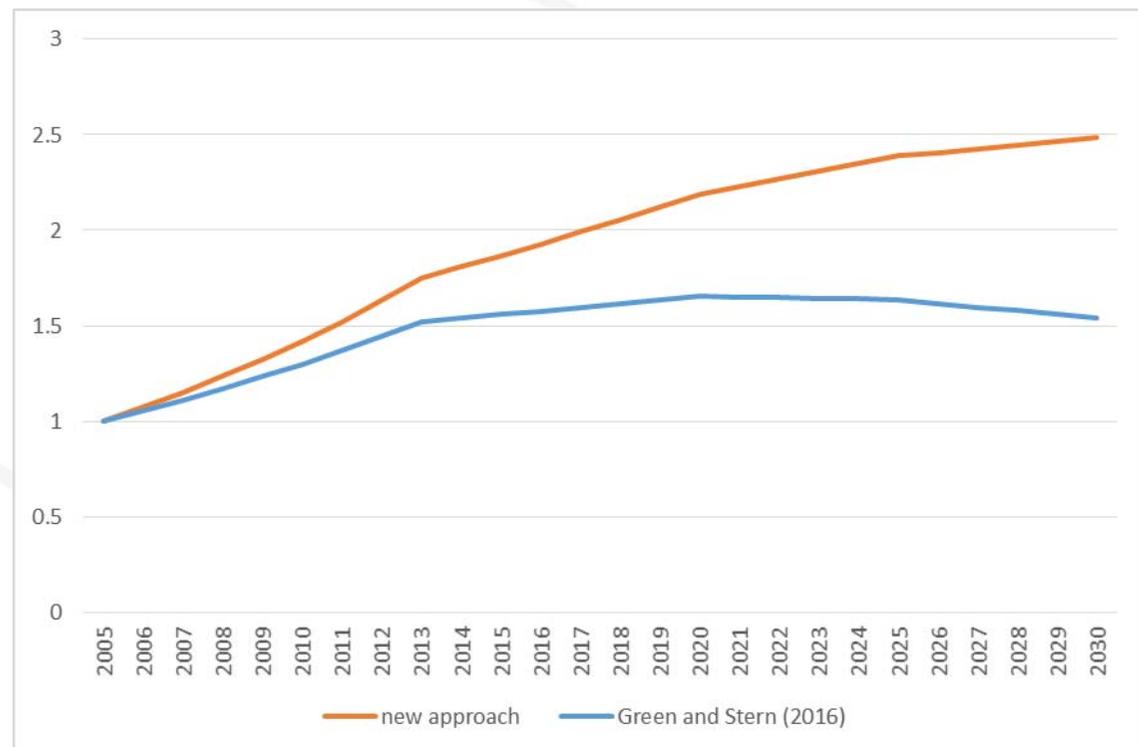
$$CO_2 = \frac{CO_2}{Energy} \times \frac{Energy}{GDP} \times GDP$$

Using Labour Productivity instead

$$CO_2 = \frac{CO_2}{Energy} \times \frac{Energy}{Labour} \times \frac{Labour}{GDP} \times GDP$$

The case of Chinese voluntary pledges to UNFCCC.

This is part of the contents of a paper submitted to Energy Journal by Miguel Rodriguez





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The annual Global Corporate Knights' 100.

It evaluates the most sustainable
companies in the World by assessing
intensity indicators

Top company profile: BMW

BY BRENDA BOUW

POSTED JANUARY 20, 2016

WINTER 2016 ISSUE

The iconic German brand leads the Global 100 pack with strong sustainability bona fides across the board.



Circularity Indexes



We found usually in the literature very different proxies:

Total Resource Consumption e.g. water footprint (total water) from a Life Cycle Analysis.

Resource Productivity & Intensity e.g. water per VA

Circularity Flows e.g. reused water per total water

Circularity Indexes e.g. Material Circularity Index (MCI) from Ellen MaCarthur Foundation

Material Circularity Index (*MCI*)



Problems:

- only for material flows ...no water, no energy, no biomass (Ellen MacArthur Foundation)
- it should be able to take into account both circular flows and efficiency rates.
- it is not straight forward to compare different products/sectors ...food industry, consulting, retail.

$$MCI = \frac{\text{Circular Flow (re-entry)}}{\text{Lineal Flow (no circular) + Circular Flow (re-entry)}}$$



I am producing an annual report about the Circularity of Galician Companies (Spanish Autonomous Region) from firm's micro data thus estimating each Firm's Circular Index based on the MCI.

<https://www.ardan.es/ardan/download/IndicadoresARDAN2018.pdf>



Thank you for your attention

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Circular Economy, Energy & Climate Change, Sustainability

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