Centre of Environmental Research

Waste Management, Circular Economy and Environmental Security

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VÚV TGM

WP 1F National Circular Economy Monitoring

Environment - Environment for Life
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T A
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Circular economy indicators

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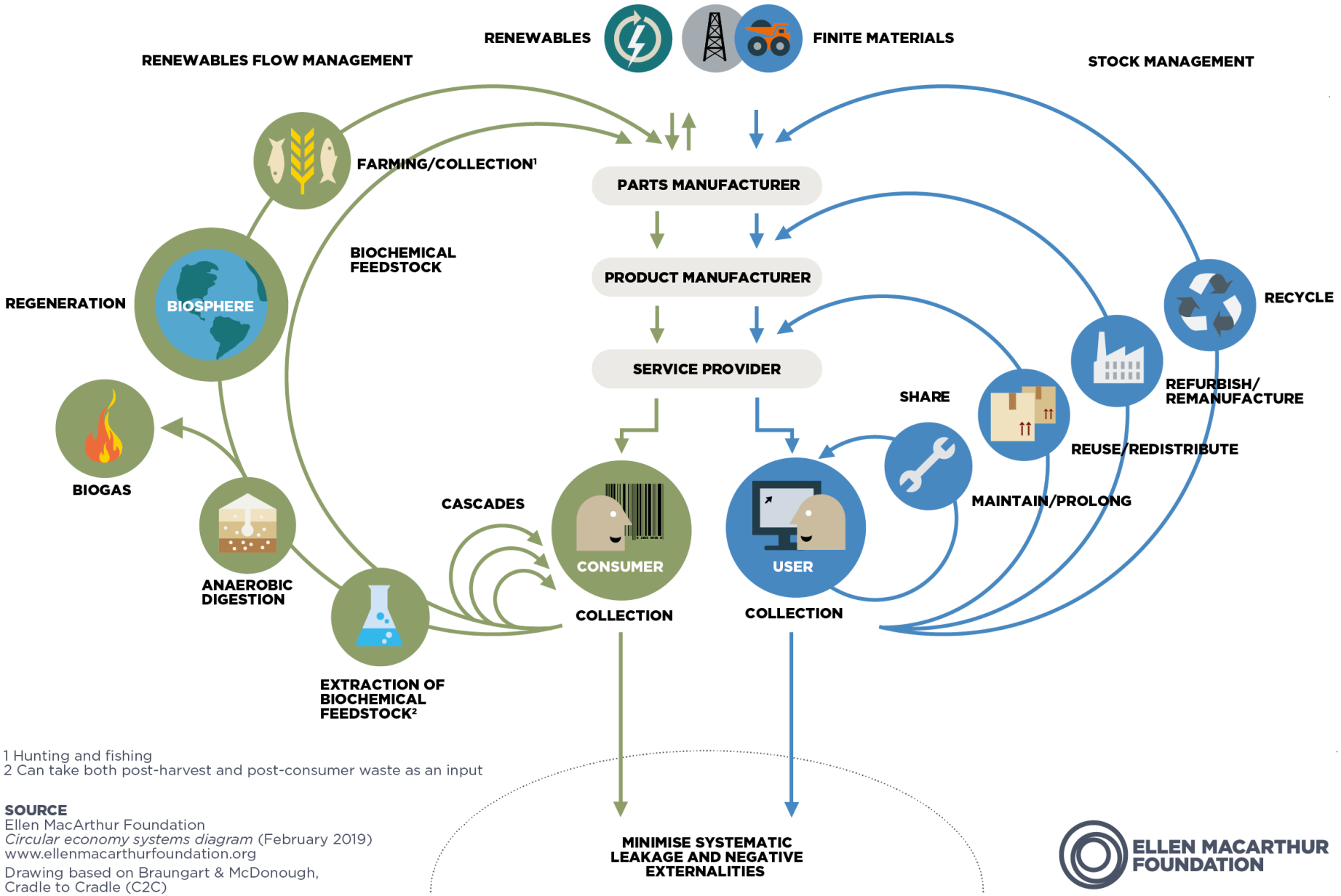


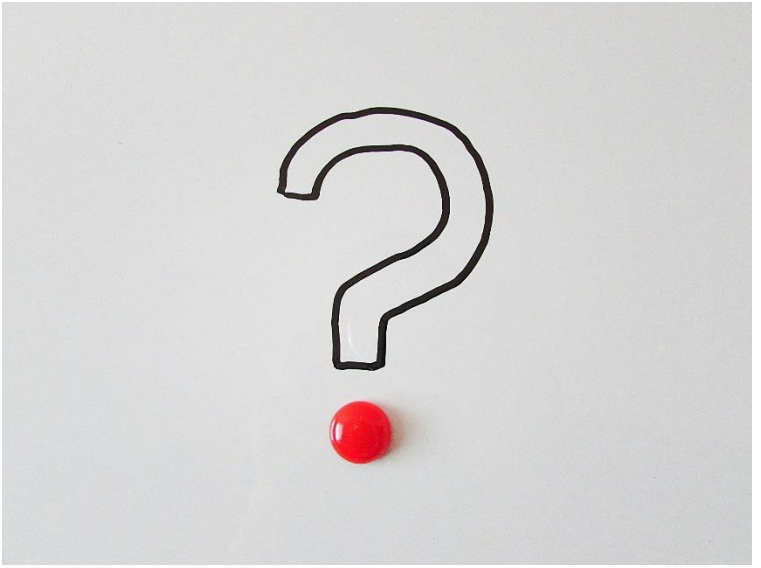
1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

SOURCE
Ellen MacArthur Foundation
Circular economy systems diagram (February 2019)
www.ellenmacarthurfoundation.org
Drawing based on Braungart & McDonough, Cradle to Cradle (C2C)

ELLEN MACARTHUR FOUNDATION

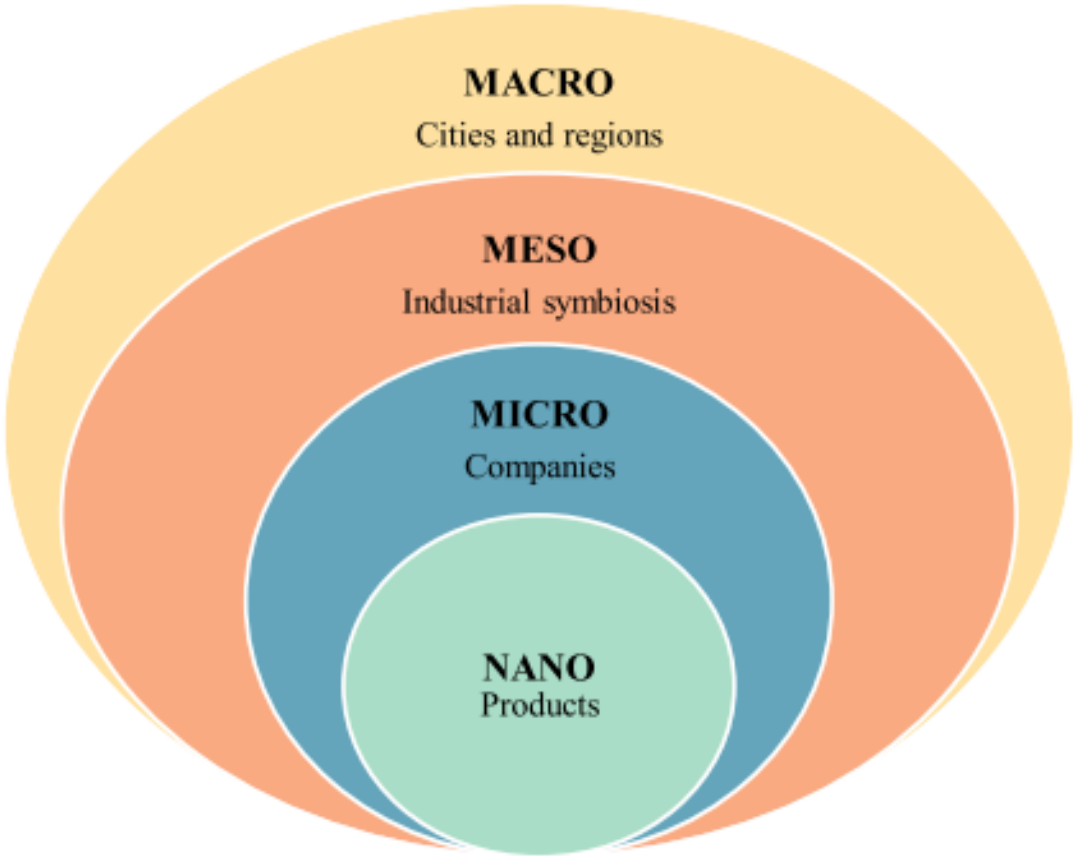
Circularity metrics– what it is good for?

- Give a measurement of the circularity level of an assessed system
- Consumers – choice of products, information
- Business – choice of business model, strategies
- Government – choice of politicy, strategies, information
- Requirements:
  - Validity
  - Reliability
  - Utility



Source: Pixabay.com

Levels of Circularity metrics



Source: de Oliveira, C. T., Dantas, T. E. T. and Soares, S. R. (2021)

EU Circular Economy (CE) Monitoring Framework

- Macro-economical level
- Prepared by European Commission
- 10 indicators structured in 4 groups:

  1) Production and consumption – municipal/packaging waste generated per capita, self-sufficiency of selected raw materials for production in the EU, the share of green public procurement in the economy, etc.

  2) Waste management– recycling of different waste (packaging waste, EEW, biowaste, etc.)

  3) Secondary raw materials – how recycled materials replace extraction of natural resources, how much of the waste materials are actually reincorporated back in the economy, etc.

  4) Competitiveness and innovation– development in jobs, investments, gross value added in CE sectors, etc.
- Based on existing datasets– CSO, ME, MLSA, MA, MIT, etc.
- Mostly focused on environmental aspects of CE

Different levels of circularity measurement?

- How to measure circularity on different levels (products, companies, region, etc.) ?
- How to include other aspects of CE in the assessment?
- Actual topic for academics and private sector

Circularity metrics

- (1) „Indicators“ – represent circularity degree of the system
  - 0-1, %, units – kg, Euro, etc.
  - e.g. amount of recycled content in the product
  - Inner circularity
- (2) „Assesment tools“ – analyze impacts or benefits of the system
  - Single or aggregated score
  - Multi-criteria evaluation
  - Assessment frameworks mostly based on LCA, MFA, IoA

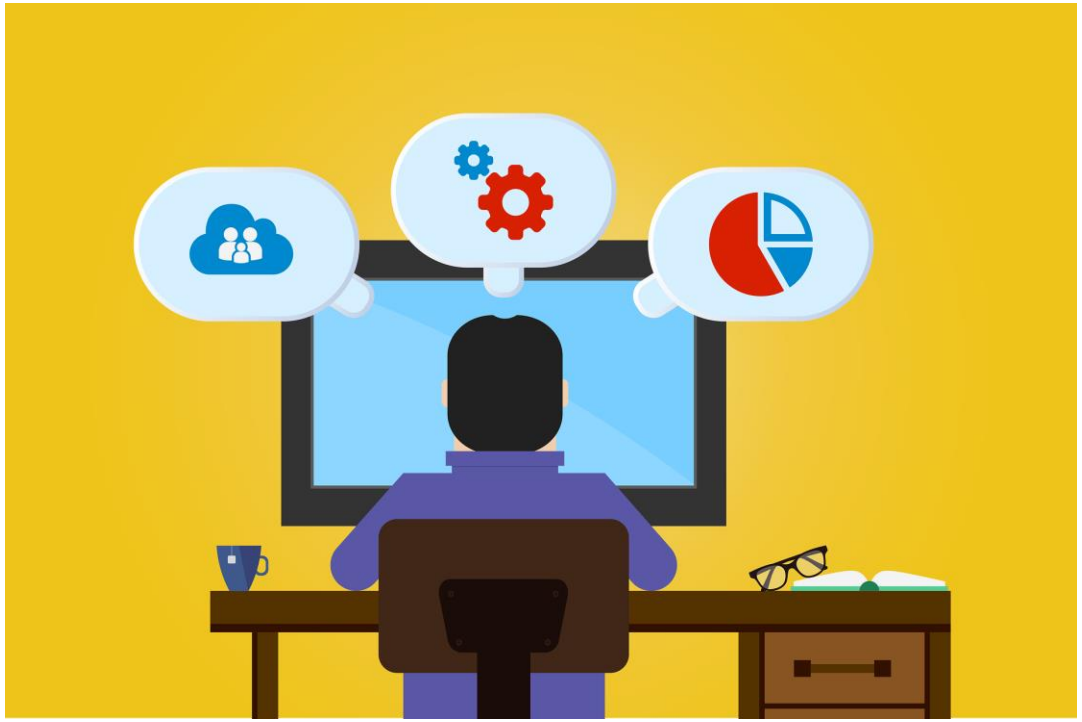
Product level indicators

- New Product – Level Circularity Metric
- Material Circularity Index
- Circularity Index
- Material Circularity Indicator
- Circular Economic Value
- Material Reutilization Score
- Circular Economy Index
- Longevity Indicator

Source: Pixabay.com

Product level indicators – website softwares

- Circular Economy Toolkit
- Circularity Calculator
- Circular Pathfinder



Source: Pixabay.com

Macro level indicators

- Global circularity metric
- Circ(T)
- Circularity Degree
- Resource Potential Indicator

Source: Pixabay.com

Assessment framworks

- LCA (Life Cycle Assessment)
  - Assess environmental impacts from resource consumption, ecosystem services to human health
  - kg CO_2 eq., kg MJ eq., aggregated results, etc.
  - Complex assessment from the entire life cycle perspective
  - E.g: Different methods of waste management, production of products
- MFA (Material Flow Analysis)
  - Assess flow of chosen material in defined time and space
  - kg, amount/per capita, etc.
  - Quantitative not qualitative information
  - E.g.: Amount of group of metals on the state level, efficiency of industry symbiosis, material flow via economics
- Input-Output Analysis
  - Economic models assess interdependence between the different sectors
  - Often connected with environmental or socio-economic analysis
  - E.g.: Linking the footprint of municipal waste production with national consumption

Overabundance of circularity metrics

- Plenty definition of CE => many indicators
- Hundreds of indicators assessing different aspects of CE
- Mostly environmental evaluation (recirculation of resources, use of recycled materials, consumption of primary materials, etc.)
- Other environmental aspects are often overlooked
- Low abundance of assessed economic criteria and nearly no assessed social criteria

Conlusion

- So far there is no universally valid metrics assessing CE
- Challenging to measure all CE aspects in environmental, economic and social terms
- It is necessary to define what we want to measure, which CE parameters are key for us (raw material scarcity, amount of recycled materials, amount of emission, share of renewable electricity resources, long-term use, economic value, social aspects, etc.)
- Promising combination of Life Cycle Sustainability Assessment (LCSA) with another indicators

Literature

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UCT PRAGUE

Thank you for your attention!

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