



LV CONVEGNO DI STUDI

METAMORFOSI VERDE **AGRICOLTURA, CIBO, ECOLOGIA**

Complesso monumentale di San Pietro
Dipartimento di Scienze agrarie, alimentari e ambientali
PERUGIA 13-15 settembre 2018

An application of Material Circularity Indicator to Agricultural system

Rocchi L., Paolotti L., Cortina C., Fagioli F.F., Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università degli Studi di Perugia

Abstract

The transition from Linear to Circular Economy (EC) is considered as a worldwide research trend topic, as well as the possibility to measure the degree of circularity of products and systems (Elia et al., 2017). In linear economy raw materials are transformed in final products and disposable waste. In Circular Economy (CE) approach reuse, repair and recycle are becoming crucial points, therefore it is necessary measuring them.

Few studies are focusing on how to measure effectively the circularity level of a product, a supply chain or a service (Elia et al., 2017). Moreover, the definition of criteria and tools for measuring at companies or regional level is still lacking (Haas et al., 2015). Ghisellini et al. (2016) in a recent review highlighted that less than 1% of studies design or discuss on indicators for assessing CE strategies, although evaluation and monitoring are strategic issues for promoting Circular Economy. Some authors tried to fill the gap. Di Maio and Rem (2015) propose a Circular Economy Index (CEI) for evaluating the rate of recycling material not only using a material unit but including also environmental and economic aspects, in a decision-making perspective. Catzer et al. (2017) designed an indicator for measuring the CE Performance of industrial product. Genovese et al. (2017) proposed a methodology for assessing and comparing the circularity of supply chain. Zhijun and Nailing (2007) proposed a system of indicators for evaluating the degree of circularity in China and monitoring the Policy to improve it.

One of the newest attempts is the Material Circularity Indicator, proposed by the Ellen MacArthur Foundation (2015), which provides an indication on how much a product's materials circulate. The MCI has some similarities with Life Cycle Assessment (LCA) but it is more focused on the flow of materials, therefore it can be considered as complementary to LCA. MCI can be applied both at product and company level.

According to the Circular Economy approach there are two type of cycles: Technical and Biological ones. In the former the materials and components are restored into the market, whilst in the latter they are into the biosphere. Agriculture sector is mainly involved in the

Biological cycle but some productions greatly affect the environment (Notarnicola et al., 2017), in particular intensive meat production as poultry and pigs.

The aim of this paper is to apply to poultry meat production the approach of the MCI, for having a first evaluation of circularity. In particular, the study estimated:

- the mass V of virgin raw material used for the production of poultry meat;
- the mass W of unrecoverable waste attributed to the product;
- the conversion factor X , which is related to length and intensity of the use.

Then we proposed two complementary indicators, for better understanding the global impact of the rearing system. The first one is a risk indicator, based on scarcity and toxicity of the production and the second is an impact indicator, based on the LCA approach, which focused only on energy and water used.

The application showed as the MCI is good indicator for evaluating the degree of circularity of intensive agricultural systems. However, due to the peculiarity of the agriculture itself, MCI should be modify for fitting better these types of productions. Further developments of the present work are about the proposal of modification and improvement of MCI.

Keyword: Circular Economy, Material Circularity Indicator, Indicators

References

- Cayzer S., Griffith P., Beghetto V. 2017. Design of Indicators for measuring product performance in the circular economy. *International Journal of Sustainable engineering*,
- Di Maio, F. and Rem, P. (2015) A Robust Indicator for Promoting Circular Economy through Recycling. *Journal of Environmental Protection*, 6, 1095-1104.
- Elia V., Gnomi M.G., Tornese F. 2017. Measuring circular economy strategies through index methods; a critical analysis. *Journal of Cleaner Production*, 142: 2741-2751.
- Genovese A., Acquaye A.A., Figueroa A., Koh S.C.L. 2017. Sustainable supply chain management and the transition towards a circular economy: evidence and some applications. *Omega*, 66: 344-357.
- Ghisellini P., Cialani C., Ulgiati S., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic system. *Journal of Cleaner production*, 114: 11-32.
- Haas W., Krausmann F. , Wiedenhofer D, Heinz M. 2015. How circular is the global economy? An assessment of materials flows, waste production and recycling in the European Union and the World in 2005. *Journal of Industrial Ecology*, 19: 765-777.
- MacArthur Foundation. 2015. Circularity indicators – An approach to Measuring Circularity.
- Notarnicola B., Tassielli G., Renzulli P.A., Castellani V., Sala S. 2017. Environmental impacts of food consumption in Europe. *Journal of Cleaner Production*, 140: 753-765.
- Zhijun F., Nailing Y. 2007. Putting a circular economy into practice in China. *Sustain Sci*, 2: 95-101.