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CISA

Editorial

WE HAVE TO BE HONEST ABOUT CIRCULAR ECONOMY

Introduction

Debates relating to waste management (WM) are frequently reduced to the topic of Circular Economy (CE). However, the focus of CE does not extend to all fields of waste management. Moreover, waste management should not be considered a self-standing discipline, but rather as a part of a more global form of environmental management. WM therefore should ensure it operates in line with the United Nations Sustainable Development Goals (UN-SDGs) and aim to meet the Planetary Boundaries goals (Richardson et al. 2023, Earth beyond six of nine planetary boundaries. Science Advances, 9, 37).

Although waste is currently acknowledged as a resource, it should be taken into account that during separate collection, pre-treatment, and recycling significant volumes of residues are produced. These residues should be quantified and their compositions determined before being treated and/or safely stored in sinks.

In our view, kitchen and yard wastes (K+Y) are not adequately addressed in the context of a Circular Economy. To be deemed suitable for reuse, the produced compost needs to be of good quality with a low pollutant content: conversely, the composted K+Y waste should be disposed. Accordingly, kitchen and yard waste should be better integrated in the CE concept.

The incineration of residual waste is often included in the context of CE, although our opinion is that it is a contaminant sink and that material and product recycling alone should be comprised under the term CE. Indeed, as is the case in Germany, for example, incineration should invariably envisage total energy use (electrical and /or thermal). Pyrolysis and gasification may be considered differently as new products are created.

A frequently neglected group of pollutants in CE is represented by fine and ultra-fine particles, generated throughout all CE handling and treatment steps. Specific efforts should be aimed at eliminating or reducing the presence of these particles in order to prevent environmental pollution and detrimental effects on public health.

Recyclability of a series of waste types subject to separate collection and waste disposal

Waste components are characterized by varying rates of recycling, with glass, metals and to a significant extent, paper yielding consistently high rates; on the contrary, recovery rates for plastics are insufficient, while used textiles are rarely recycled, although they may be reused as second-hand clothes or cleaning rags.

It should of course be taken into account that materials such as paper, plastics, glass and metals, cannot be recycled infinitely; as an example, paper and plastics can only be subjected to the recycling process 3-8 times, thus implying a need to deal with the remaining residues. As the number of cycles increase, toxic compounds may accumulate during the recycling of mixed paper. Approximately 79% of pretreated waste paper is used in the production of new paper in Germany, or is exported to other countries; the remaining materials are largely disposed of as waste.

The situation regarding mixed waste plastics is rather more complex, with the majority being recycled into to new, low value materials at a rate of up to 30% only. For this reason, large quantities of mixed plastic materials are thermally treated or landfilled, with Germany exporting approx. 25% to developing countries.

Economic Aspects of Circular Economy

The European Union (EU) Waste Framework Directive (WFD) establishes that only waste fractions for which a market demand exists may be used in the manufacture of new products. At first glance, this approach makes sense. But what does the lack of a market mean? Does it imply that recycled products cannot be reused and have to be disposed? What happens with recovered waste paper, for example, when the market is saturated or paper prices are very low but the material properties are suitable for return into the material cycle? Will this material be recovered? In Germany, this situation became a reality for wastepaper and plastics when China changed their import rules. As a result, there was an abundance of these baled waste components available that could not be marketed and thereby caused significant costs and handling issues. The situation deteriorated further for plastics when oil prices fell; as a result, over a certain period, new materials were cheaper than recycled ones. Consequently, new markets were identified for baled wastepaper and waste plastics in Turkey, India, Malaysia and other Asian countries.

The overarching goal of CE is the conservation of natural resources by returning recycled waste materials back into the material cycle; emissions and wastes for disposal have to minimized. Cost reduction is of the utmost importance, but should not, in our opinion, dictate whether a material or product can be recycled and reused or not.

The export of wastepaper and plastics to Asian countries, for example, is carried out under the official condition that in the receiving countries the material will be handled

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by certified companies in line with standards similar to those adopted as in the exporting country. Unfortunately, this is not always the case, as shown by media reports documenting severe environmental damage with plastic litter ending up in the oceans. The export of used garments and shoes to DCs, particularly Africa and South America, for the specific purpose of helping poorer nations, has largely failed. The same is true for still functional electronic devices that end up - in the same way as textiles - in dumps, rivers or scattered on the land. In the case of electronic devices, the poor process applied in recovering useable materials from computers, phones, etc. is also associated with high health risks. In Europe, both products are officially classified under the heading export of used goods rather than waste.

Effect of Circular Economy on the Environment

It is evident that the powerful effects produced by CE on the environment should be given much deeper consideration. As indicators for the quality of the environment, we propose using the nine Planetary Boundaries (PBs) which humanity should not be allowed to cross.

Leaving aside additional aspects such as transport and pretreatment of waste materials, CE exerts positive effects on the majority of PBs; as an example, paper recycling leads to a reduction in CO_2 emissions and freshwater use, whilst also saving biotopes due to a lower consumption of wood. The avoidance of loss of biodiversity during CE should be further investigated for example by using a modelling approach. In so doing, the impact of the various recycling steps and modes on the loss or gain of biodiversity would become more transparent. This type of model should be much simpler to implement in routine use than an LCA.

The Spillover Index and Extended Producer Responsibility

An additional aspect is represented by the impact of social and environmental issues on CE, including the "Spillover Index" (https://dashboards.sdgindex.org/map/spillovers). Resources from many of the less developed nations are used in the manufacture of a wide range of products; these resources are often obtained under unacceptable labor and environmental conditions. The Spillover Index *measures how much the actions taken by individual countries in supplying resources to industrialized countries - including tropical wood and all kinds of ores - affect, the ability of other countries to achieve the UN SDGs* (https://sdgs.un.org › goals). The Spillover Index attributes all impacts produced by material mining, including carbon emissions, to the importing country. The latter implies that the industrialized country responsible for importing the goods is responsible for the environmental impact caused by the mining of materials in the exporting country. In this case, the importing country should first consider the negative impact of the mining process in their cost and environmental balance (negative Spillover Index). On the other hand, the Spillover Index approach may be used to ensure and consider the avoided environmental impact generated when a product is reused rather than being newly manufactured. The avoided impact on the environment in both the resource-exporting countries (e.g., mining of rare earth metals, cobalt) and the producing country (e.g., water pollution, destroyed habitats) may be positively valued in the industrialized country as complying with the UN-SDGs and/or the Planetary Boundaries (positive Spillover Index). This approach would also incentivize increased product repair, reuse and recycling of materials. Moreover, importing countries are expected to use all necessary political and financial power to improve the social and environmental situation in the mining industry of the exporting country. This Spillover Index is not governed by a law but is intended to act as guidance or an incentive to achieve improved sustainability.

Extended Producer Responsibility (EPR) represents a further tool for use in ensuring better product design and reuse. The OECD defines Extended Producer Responsibility (EPR) as an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. An EPR policy is characterized by the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities; and the provision of incentives to producers to take into account environmental considerations when designing their products.

This may sound like a powerful tool, but in Germany it is only valid with regards to packaging waste, batteries and WEEE. In addition, as mentioned earlier in connection with the management of wastepaper and plastics, actual practices and claims made are at times often characterized by significant discrepancies.

When considering these three approaches with a view to achieving increased sustainability, eventual overlaps should be addressed and reconciled.

Conclusions

Waste prevention is invariably highlighted as a major priority in the waste hierarchy, although it is frequently not sufficiently pursued, thus requiring the use of increasingly concerted efforts. In this context, efforts should be directed specifically at minimizing energy consumption in CE and producing energy at the site of operation to reach energy independence.

Since the export of used goods and separately collected paper and plastics to DCs represents a significant contribution to CE balance in the exporting country (where it is counted as recycled), this aspect needs to be given careful urgent reconsideration. Failing this, these exports need to be stopped.

In conclusion, the authors propose to further develop CE by considering, in addition to other aspects, the measures proposed herein, aimed at increasing the transparency and completeness of CE with an approach which should never be ideologically driven.

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