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Editorial: What is a waste? A potential resource to favor a sustainable transition. Evidence from the practice

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Editorial on the Research Topic
What is a waste? A potential resource to favor a sustainable transition. Evidence from the practice

In today's dynamic sustainability dialog, the concept of "waste" has undergone a profound evolution. Once viewed simply as a by-product of consumption, it is now increasingly recognized as a reservoir of untapped potential—a potential resource brimming with opportunities for transformation and value creation. The Research Topic, "*What is a waste? A potential resource for sustainable transition. Evidence from the practice*" delves deep into this paradigm shift and how our perception of waste profoundly affects environmental sustainability and the transition to a circular economy (CE).

CE models capture the great attention of both practitioners and academics (Kirchherr et al., 2023). The CE focus is based on waste management, waste prevention, and resource efficiency, while the Green Economy focus also concerns human wellbeing and ecosystem resilience (European Environment Agency, 2015). The literature has emphasized the 5R model: redesign-reduction-recovery-recycle-reuse (Chen et al., 2020). However, it is evident how many papers talk about CE but do not pay attention to problem-solving (Kirchherr, 2023).

This Research Topic presents six papers in which an interdisciplinary approach emerges. Municipal solid waste if put back into circulation can generate opportunities and this aspect is very relevant in developing countries (Barma et al.). Wastewater sludge from which sustainable materials can be combined with other substances in order to identify an optimal ratio by evaluating the results associated with technological processes (Ki, Kang, Park). Further interesting results concern the recycling of synthetic resin waste, including rigid and film plastics, based on a technical-environmental perspective (Ki, Kang, Ma et al.). Sometimes, waste-to-energy technology is not seen from a sustainable perspective, but it is useful for minimizing waste problems and producing energy (Farooq et al.) when it does not alter the collection rate. The pandemic period has resulted in reduced GDP in several countries, and recycling, remanufacturing, and reuse practices identify opportunities for

recovery and resilience (Corrêa and Corrêa). In addition, strategies are suggested for the use of amendments in agricultural soils that support this basic concept of systems resilience (Bondi et al.).

The Research Topic of sustainability can be analyzed according to its three classical dimensions (environmental, economic and social) from which, however, emerges the relevance of the technological side as highlighted by the proposed works. This result is consistent with the fundamental role of technological sustainability in manufacturing systems (Vacchi et al., 2024). The link between sustainability and CE is highlighted by some authors in order to achieve SDG 12 (Nikolaou and Tsagarakis, 2021). Businesses are called to integrate these aspects and tend to show it in the firm mission statements (Tsironis et al., 2023) and their competitiveness could be based on two practices: green-circular premium and sustainable certification (Appolloni et al., 2022). Organizational strategies and innovation models play a key role in this transition (Bocken et al., 2022). CE models have certain risks when CE rebound occurs (Zink and Geyer, 2017), but likewise, technology neutrality can benefit as much from the circularity of resources as from involving citizens and businesses in the processes (D'Adamo et al., 2024).

Traditionally, waste has been perceived as something to be disposed of—an inevitable consequence of industrial processes and human consumption. However, as our understanding of sustainability deepens, so too does our recognition of the latent value embedded in what was once considered waste. The concept of a CE model underscores the imperative of keeping resources in circulation for as long as possible, extracting maximum value from them, and then recovering and regenerating products and materials at the end of their useful life.

While recycling has long been touted as a solution to reducing the environmental impact of waste, its effectiveness is not without question. Consider the recycling process itself: it requires resources—energy, water, and often chemical treatments. In some cases, the environmental footprint of recycling can rival or exceed that of the original manufacturing process. In addition, not all materials are created equal in terms of recyclability or economic viability, leading to inefficiencies and inequities within the recycling infrastructure. An overemphasis on recycling can inadvertently overshadow more sustainable alternatives, such as reusing or repurposing materials. These alternative approaches not only minimize the need for energy-intensive recycling processes, but also extend the life of products and materials, thereby reducing overall resource consumption.

In addition, categorizing something as "waste" often creates cognitive barriers that limit our ability to imagine creative solutions. By reframing our perspective and recognizing the inherent value in so-called waste streams, we unlock a wealth of opportunities for resource optimization and sustainability. Empirical evidence from a wide range of industries lends credence to this notion. Case studies from various sectors illustrate how organizations are embracing waste as a resource and developing innovative strategies to minimize waste generation, maximize resource efficiency, and promote a more CE. This approach is the basis for research projects that foster youth involvement, interdisciplinarity and collaboration between business and academia (https://www.bioeconomy-in-transition.eu/peace/ and http://start-en-innovability.it/).

In addition, the Research Topic underscores the critical importance of re-evaluating our perception of waste and recognizing its potential as a valuable resource in the transition to a more sustainable future. By shifting our focus from mere disposal to resource optimization and innovation, we can forge new paths to environmental stewardship and economic prosperity, ensuring a more resilient and harmonious relationship between humanity and the planet.

Moreover, the discourse on waste is evolving from one of disposal to one of resource management and optimization. Embracing this evolution requires a fundamental shift in mindset—from viewing waste as a problem to recognizing it as an opportunity. By harnessing the potential of waste, we can not only mitigate environmental degradation, but also pave the way for a more sustainable and prosperous future for generations to come.

Finally, waste is not just a problem to be managed, but a reservoir of opportunity waiting to be tapped. By redefining waste as a valuable resource, we can catalyze sustainable change, usher in a new era of resource efficiency, and pave the way to a more sustainable future for all.

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ID'A: Writing – original draft, Writing – review & editing. DS-B: Writing – original draft, Writing – review & editing.

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