The role of recycling companies in the circular economy: Opportunities and challenges towards a materials management transformation

Leonidas Milios[1], Carl Dalhammar[1]

[1]International Institute for Industrial Environmental Economics, Lund University, Lund, 21100, Sweden
Keywords: circular economy, recycling, reuse, materials management, circular business.
Presenting author email: leonidas.milios@iiiee.lu.se

Introduction

Material stocks, i.e., infrastructures, buildings, machinery, etc., are physical objects created through the socially organized flows of materials, energy, and human labour. Millions of products are produced, used, and ultimately disposed of every day, resulting in accelerating the rate of material resource depletion and the accumulation of waste (Haberl et al., 2019). This is known as the 'linear' economy, manifested through the 'take-make-waste' approach. In response to this wasteful practice, a circular economy is presented as an alternative approach to disrupt this linear pattern. In a circular economy, resources (i.e. products, components and materials) circulate through successive lifecycles, by extension of product life through repair, refurbishment, and remanufacturing; and finally, by recycling materials.

Today the level of circularity in the economy remains low (Circle Economy, 2021), predominantly due to inefficiencies at the end of product use, for example, when resources end up in landfills or get incinerated rather than reaching a recycling facility. Traditionally, the recycling industries have been collecting and processing materials, but the involvement of several other actors (both public and private) in the formal waste management structures have not always facilitated recycling and have contributed to the observed inefficiencies.

To address these inefficiencies new business models are gradually emerging, with the potential to enhance the management and flow of resources. The rather mature concept of (industrial) product-service systems (PSS) (Tukker, 2015); the emergent concept of material-service systems (MSS) (Aurisicchio et al., 2021); and the novel theoretical approach of resource-service systems have been identified as potential mechanisms for enabling the adoption of a circular economy (Blomsma et al., 2022). These models can operate both in business-to-business (B2B) and in business-to-consumer (B2C) contexts.

In addition to new business opportunities to achieve circularity in the economy, there is a strong emphasis in the EU and national policy frameworks regarding the transition to a circular economy, which has great potential to contribute to the reduction of GHG emissions and deliver higher sustainability in the material processing and manufacturing sectors, and the environment in general (EMF, 2019). The recent EU Circular Economy Action Plan (COM(2020) 98 final) and several national circular economy strategies, e.g. in Sweden (Renegingen (2020), are clear indications for this direction and pave the way for binding legislation to boost reuse and recycling in the economy, favouring options that retain higher value in products and generally adhering to the waste hierarchy principle (i.e. prioritising prevention, reuse, recycle, recovery, and discouraging disposal).

Against this background, this contribution seeks to answer the following research questions: 1) What role does the recycling industry envisions to have in a circular economy? 2) What are the main drivers for the recycling industry to transition to this role, and who are the actors behind those main drivers? 3) What legal and policy frameworks, e.g. related to the waste regulations, hinders or would make it easier for them to transition to this role? and 4) What else besides the legal and policy framework hinders or enables them to transition to this role?

Research approach

The scope of this research was primarily the Swedish recycling industry, focusing on national operations and extending the research base to include both national and international stakeholder networks, including partners, industry organisations, and competitors in the same market. Major Swedish recycling companies have recently expressed a strong drive – both internal and external – to diversify their operations to include alternative business models away from their "traditional" recycling business. Through this experimental process, the researchers identified a great opportunity to study the potential transformation of the industry.

An exploratory approach was adopted for this research and aided by a comparative case study methodology carried out in close contact with five Swedish recycling companies and informed by the input of relevant industry organisations. Although case studies are sometimes criticized for lack of generalizability, they are beneficial at providing in-depth descriptions as well as context-dependent knowledge and a more "nuanced view of reality" (Flyvbjerg, 2006). Case study research does not rely on statistical generalization due to the low number of studied cases; instead it relies on understanding and analytical generalization.

Qualitative methods were used to collect data and observations, mainly through semi-structured interviews and case study site observations.

Preliminary results and concluding remarks

The research identified the current barriers for reuse for the various material streams currently recycled. Recycling companies are locked-in by current legal frameworks and/or dependent on product policies on how to access materials. For example, the common characterisation of End-of-Life (EOL) products as waste or non-waste and the different management pathways that are prescribed in each option critically hinders the available waste treatment. Another example concerns the presence of non-removable batteries in products which severely hinders its recycling potential. It is clear that policy-making and regulations upstream in a product's value chain affect the recyclers' access of incoming material and products downstream.

To address these issues the companies have invested in developing circular consulting activities which helps them refocus their operations on the whole life cycle of products. This way, they become better in the identification of useful parts in products, so that they can optimize the design of their operations and that the products can be used effectively and not be affected by some small default, and rather be reused.

The research also shed light in the future perspectives of the recycling industry, by identifying potentially valuable future resource streams for adapting to future realities and adjusting business operations. Electromobility batteries appears to be a fast-growing fraction of soon-to-be EOL products and the recycling companies face new challenges in how best to accommodate the variety of valuable materials included within. Moreover, opportunities for reuse of EOL batteries are high in the agenda and new business opportunities seem to appear. For this, a wider stakeholder network within the national (and potentially international) context would inevitably be considered.

What comes as a big question to recycling companies is the shift to a "high value" circular economy – prioritising reuse – which can sometimes be interpreted as an existential threat for the industry. A new imperative might arise in the situation that the waste streams decrease in size due to diversion of "waste" at EOL for reuse. So, recycling companies must be ready to face decreasing market volume and respond by increasing market value through high value-retaining operations such as repair and reuse. There is increasing policy pressure and business interest for reuse operations, even though their financial viability is not certain (Dalhammar et al., 2021). Thus, the need to shift towards such operations might seem as a "one-way" path, since other market actors would readily jump in to fill this market opportunity.

Therefore, it is of critical importance for recycling companies to identify potential competitors that could lose a share of their resource streams, and potential partners that would facilitate joint collection and management of resources (EOL products). If not, they would have to develop internal capabilities and new processes to explore the challenges, and business opportunities of reuse instead of recycling. A relevant question is from where/who and how to get access to the resource streams for reuse. The ownership of resources becomes a central issue in this new reuse over recycling "setting"; who owns and how uses resources? Therefore, recycling companies need to look at contractual aspects with potential partners that respond to the above questions, that are not always obvious in the current state of affairs.

The outcomes of the research could be immediately actionable or lead to further research, requiring collaboration with partners and academic institutions, domestically and internationally. This in turn might lead to new opportunities that would benefit recyclers to develop their capabilities and prepare for the circular economy.

References

Aurisicchio M., Van Der Laan A.Z., Tennant M. (2021) Material-service Systems for Sustainable Resource Management. In: Kishita Y., Matsumoto M., Inoue M., Fukushige S. (eds) *EcoDesign and Sustainability I. Sustainable Production, Life Cycle Engineering and Management*. Springer, Singapore.

Blomsma, F., Tennant, M., Brennan, G. (2022). Chapter 8 - Exploring resource-service systems—Beyond product-service systems and toward configurations of circular strategies, business models, and actors. In: Stefanakis, A., Nikolaou, I. (eds.), *Circular Economy and Sustainability*.

Circle Economy (2020). *The circularity gap report 2021*. Amsterdam: Circle Economy. Retrieved from: https://www.circularity-gap.world/2021

Dalhammar, C., Wihlborg, E., Milios, L. Richter, J.L., Svensson-Höglund, S., Russel, J., Thidell, Å. (2021). Enabling Reuse in Extended Producer Responsibility Schemes for White Goods: Legal and Organisational Conditions for Connecting Resource Flows and Actors. *Circular Economy and Sustainability 1*, 671–695

EMF (2019). *Completing the Picture: How the Circular Economy Tackles Climate Change*. Ellen MacArthur Foundation. Retrieved from: https://materialeconomics.com/publications/completing-the-picture

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry 12* (2), 219–245.

Haberl, H., Wiedenhofer, D., Pauliuk, S., Krausmann, F., Müller, D.B., Fischer-Kowalski, M. (2019). Contributions of sociometabolic research to sustainability science. *Nature Sustainability 2*, 173–184.

Regeringen (2020). *Circular economy – Strategy for the transition in Sweden*. Stockholm: Regeringskansliet. Retrieved from: https://www.government.se/information-material/2020/11/circular-economy--strategy-for-the-transition-in-sweden/

Tukker, A. (2015). Product services for a resource-efficient and circular economy—a review. *Journal of Cleaner Production 97*, 76–91.