Special Collection Policy Briefs

Circular Economy

Policy Briefs – 01/2024

Maastricht University

STUDIO EUROPA MAASTRICHT

Table of Contents

01

Introduction to the policy briefs series on Circular Economy.

Nancy Bocken.

School of Business and Economics, Maastricht Sustainability Institute, Maastricht University.

The effects of climate change on society and the natural environment are increasingly visible through extreme weather patterns[1], and biodiversity and species collapses[2]. It is evident that these impacts are human induced - through the way we typically live, move around and consume products and services[3]. Although the biggest negative impact is in the Global South[4], the summer 2021 floods and heatwaves in 2022 and 2023 illustrate that also the Euregion is not immune for increasingly likely weather damages.

To mitigate any further damage, human-induced carbon emissions would need to be halved by 2030, compared to 1990 levels[1] and biodiversity issues will need to be tackled through new policies[2]. **An entirely new perspective on business, society and the economy is needed, where unnecessary consumption and waste are avoided and products and materials are reused, and the economy is fuelled by renewable energy**[5]. We need to move from a so-called **"linear economy"**, in which materials are extracted to make products that are discarded after limited use, towards a "circular economy": a new economic model of production and consumption where waste is eliminated, materials are recycled, and nature is regenerated[6].

At the European level, the Von der Leyen Commission (2019) has put questions of climate change and increased sustainability on the top of its agenda. The **'Green Deal'** presents a roadmap aimed at achieving EU climate neutrality by 2050. In addition to a variety of measures in the area of energy and the cutting of greenhouse gas emissions, the creation of **a circular and sustainable economy by 2050** is one of the key building stones. As a first step in the European trajectory towards sustainability, a Circular Economic Action Plan (March 2020), has defined a first series of concrete legislative measures and actions that need to be developed to reach the EU's ambitions.

The circular economy is still in its infancy with a recent report concluding that the global economy is only 7% circular[7]. In a future circular economy, topics like sufficiency[8,9] and tackling planned product obsolescence causing unsustainable consumption patterns need to be addressed, as recycling cannot outpace increasing levels of consumption[7]. In addition, nature regeneration becomes increasingly important to restore the damage done so far and improve the natural environment[7,10,11]. This requires a reform at multiple levels such as business, education, consumer lifestyles, and the different levels of policymaking.

This Policy Brief series by Studio Europa Maastricht explores how the objectives of the creation of a European Circular Economy have been given shape and reflects on its policy challenges. In that light, the following topics will be discussed:

- **How Can We Promote the Circular Economy? A Perspective on Current Developments, Challenges and Indicators**.
  Marco Serafini, Cris Garcia-Saravia Ortiz-de-Montellano, Yvonne van der Meer.
- **Intellectual Property Rights in the Circular Economy**.
  Anselm Kamperman Sanders and Dalindyebo Shabalala.
- **The circular city – what does it mean and (how) can it be achieved?**
  Joop de Kraker.
- **Regenerative Economics for Planetary Health and Thrivability: the European Green Deal.**
  Anneloes Smitsman & Pim Martens.
- **The role of business in the circular economy: a focus on sufficiency & regeneration.**
  Nancy Bocken, Ankita Das & Laura Niessen.
- **Towards Education for Urban Circular Development in Secondary Education.**
  Özlemnur Ataol and Darian Meacham.
- **Towards sustainable circular societies: confronting the need to change deep structures.**
  Frank Boons.
- **Re-envisioning Civil Society in the Circular Economy.**
  René Kemp and Job Zomerplaag.

1. Pörtner, H.O., Roberts, D.C., Adams, H., Adler, C., Aldunce, P., Ali, E., Begum, R.A., Betts, R., Kerr, R.B., Biesbroek, R. and Birkmann, J. (2022). Climate change 2022: Impacts, adaptation and vulnerability. IPCC Sixth Assessment Report, pp.37-118.
2. WWF (2022). Living Planet Report 2022. Accessed 17 January 2023 at: https://livingplanet.panda.org
3. Creutzig, F., Roy, J., Devine-Wright, P., Diaz-José, J., Geels, F., Grubler, A., Maïzi, N., Masanet, E., Mulugetta, Y., Onyige-Ebeniro, C.D. and Perkins, P.E., 2022. Demand, services and social aspects of mitigation. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 752-943). Cambridge University Press.
4. Diffenbaugh, N. S., & Burke, M. (2019). Global warming has increased global economic inequality. Proceedings of the National Academy of Sciences, 116(20), 9808-9813.
5. Ellen MacArthur Foundation (2013). Towards the circular economy – economic and business rationale for an accelerated transition. Available from: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf [Accessed 17th January 2023].
6. Bocken, N., & Geradts, T. (2022). Designing your circular business model. Stanf. Soc. Innov. Rev, 20, 34-39.
7. Fraser, M., Haigh, L., & Soria, A. C. (2023). The Circularity Gap Report 2023. Circle Economy.
8. Alexander, S. (2012). The sufficiency economy: Envisioning a prosperous way down. Available at SSRN 2210170.
9. Niessen, L., & Bocken, N. M. (2021). How can businesses drive sufficiency? The business for sufficiency framework. Sustainable Production and Consumption, 28, 1090-1103.
10. Hahn, T., & Tampe, M. (2021). Strategies for regenerative business. Strategic Organization, 19(3), 456-477.
11. Konietzko, J., Das, A., & Bocken, N. (2023). Towards regenerative business models: A necessary shift?. Sustainable Production and Consumption, 38, 372-388.

02

How Can We Promote the Circular Economy?

A Perspective on Current Developments, Challenges and Indicators.

Marco Serafini, Cris Garcia-Saravia Ortiz-de-Montellano and Yvonne van der Meer.

Aachen-Maastricht Institute for Biobased Materials, Faculty of Science and Engineering, Maastricht University.

Introduction

A circular economy (CE) is an economic system that aims to minimise waste and maximise the use of resources by keeping materials and products in use for as long as possible. It is based on the principles of designing out waste and pollution, keeping products and materials in use and regenerating natural systems. Materials and products are kept in use through strategies such as recycling, remanufacturing and refurbishment that prolong the lifetime of products and prevent waste from being generated [1].

A CE is seen as a more sustainable and resilient alternative to the traditional linear economy which is based on the take-make-use-dispose model. By keeping resources in use for as long as possible,

a CE can reduce the environmental impact of economic activities, promote resource efficiency and create new business opportunities. It is seen as a key strategy for achieving the goals of sustainable development and addressing the challenges such as climate change, resource depletion and waste management [2]. For this reason, the concept of CE is gaining popularity among academics, governments and businesses. Across these sectors, important efforts are being made in developing cohesive frameworks to assess CE and moving current metrics beyond resource efficiency [3]. Current metrics do not allow the full potential of a CE to be measured, as they do not allow all possible strategies of maintaining the value of products to be measured. Moreover, CE strategies are targeting improved sustainability; therefore, circularity metrics should also include indicators that demonstrate the social, economic and environmental impact.

To bridge this gap, a CE framework based on the review of 298 academic and non-academic publications has been developed [4] and is represented in Figure 1. The framework centres on processes that enable value retention, and it includes eight value retention stages (VRS) and 27 strategies that refer to the different paths to extend the value and lifetime of any product, its components and materials within a system. The eight VRS are redesign, reduce, use/reuse, resell, refurbish/remanufacture, recycle, recover and recirculate. The description of each VRS is provided in Table 1.

The framework acknowledges that value retention is not a one-size-fits-all approach and recognises the importance of tailoring strategies based on the characteristics of specific products, their components and materials. Each VRS in the framework serves as a pathway to prolong the value and lifespan of a product. The VRS are represented in the framework as a spectrum from high-value retention to low-value retention and can be applied at different levels of the value chain: at material level, impacting the use and efficiency of raw materials, energy and emissions through the supply chain; at product and component level, influencing the design, production and utilisation of products and their components; at company level, involving the practices and choices of individual companies, including their business model and operational strategies; and at system level, considering the contributions and interactions of all actors within the broader economic and environmental context [4].

In this policy brief, we will reflect on how the developed CE framework can be used to guide policymakers and companies in their activities to make the transition to a CE. For this, we took the plastic packaging industry as a case study and identify the major environmental challenges, development and CE indicators for each level of interest.

Figure 1. CE Framework, adapted from Garcia-Saravia Ortiz-de-Montellano et al. [4]

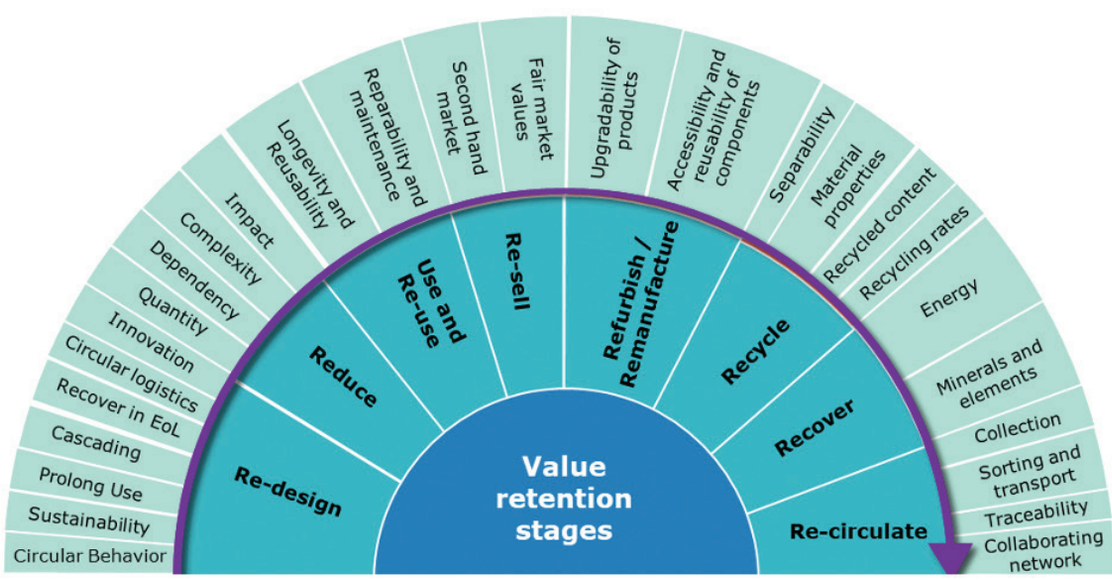


Table 1. Value retention stages and their targets, adapted from Garcia-Saravia Ortiz-de-Montellano et al. [4]

VRS	Description
Redesign	Modifyingthe products and processes design to enhance durability, reparability, and overall lifespan. By considering factors such as material selection, modularity, and ease of maintenance, the goal is to optimize the product for long-term use and promote circular behaviour and cycle back to the system.
Reduce	Minimizing resource consumption and waste generation throughout the product lifecycle. This involves optimizing the design, manufacturing processes, and consumer usage patterns to reduce material inputs, energy requirements, and environmental impacts.Strategies like lightweighting,efficient manufacturing techniques, and eco-design principles are employed to enhance resource efficiency.
(Re)use	Maximizing the timespan of the use phase through second use, finding new applications or purposes for products, components, or materials that have reached the end of their original use. This includes practices such as repurposing and upcycling. By diverting items from the waste stream, this stage prolongs their lifespan, reduces the demand for new production, and minimizes environmental burdens associated with manufacturing.
Resell	Selling products to new owners or markets, enabling them to continue serving their intended purpose. This stage encompasses activities such as second-hand markets, online platforms, and business-to-businesstransactions. By diverting items from the waste stream and reintroducing them into the economic system, this stage extends the useful lifeof products, maximizes their value, and reduces waste generation. Furthermore, this stagepromote economic inclusivity, helping users with different purchasing power allowing access to secondary markets.
Remanufacture/ refurbish	Restoring products or components to a like-new condition. Through repair, refurbishment, or remanufacturingprocesses, the functionality and appearance of the product are revitalized with minor changes and components are reused or cascaded to different applications. This stage enables the reintroductionof refurbished or remanufacturedproducts into the market, extending their lifespan and reducing the demand for new manufacturing.
Recycle	Recovery of valuable materials from products or components that have reached the end of their useful life.This involves sorting, shredding, and reprocessing to obtain secondary raw materials. By extracting and reusing materials, this stage contributes to resource conservation, reduces the extraction of virgin resources, and minimizes waste disposal.
Recover	Materials that cannot be recycled are processed to produce energy, with method such as incineration or biodegradation,and recover minerals and scarce elements. By harnessing the energy potential of discarded materials, this stage reduces reliance on fossil fuels and contributes to renewable energy generation.
Recirculate	Promote the circulation of products, components, or materials within closed-loop systems. Reverse logistics, product take-back programs, and efficient supply chains are implemented to facilitate the return of products to the market after use. By maximizing the utilization of resources and minimizing waste, this stage promotes circularity and enhances the overall sustainability of the system.

Circularity in the Plastic Packaging Industry

Thanks to its versatility, low cost, durability and low weight, plastic has become one of the most common and reliable materials, and its use has been rapidly increasing since the first applications. In 2020, 367 million tonnes of plastic was globally produced with Europe accounting for 15%. Three sectors are responsible for 70% of the plastic produced: packaging (41%), construction (20%) and automotive (9%) [5]. The plastic industry is facing three primary challenges. The first challenge is the large loss of value of most plastic products, especially in the case of packaging applications that are designed as single-use products and/or have a short lifetime. Recycling of plastic is around 14% in Europe with the remaining plastic ending up in incineration, landfills or in the natural environment due to leaking [6]. Moreover, recycled plastic often ends up in applications with a much lower value than the original.

The second challenge is the dependence on finite sources such as oil or gas, which represent more than 90% of the plastic industry's feedstock. With the current growth of plastic production, the use of fossil feedstock will further increase; and besides the problem of limited availability, this has negative consequences for the environment - the third challenge for the plastic industry. Environmentally, the main concerns of the industry are the emissions of greenhouse gases, the major cause of climate change, during the production and incineration of plastic [7], and the depletion of non-renewable sources such as fossil fuel and water. Other environmental challenges are the leakage of plastic and microplastics into the environment which cause the degradation of natural environments, and the use of substances that are dangerous to human health and the environment that are released during the production and incineration stages of plastic [8].

Adopting CE principles in the plastic industry can tackle a number of these challenges. The improvement of the collecting and recycling system would lead to a reduction of leaked or incinerated waste and, at the same time, the dependency on fossil sources as feedstock would be reduced [8]. By incorporating diverse CE strategies at the production, use and end-of-life stages, the plastic industry can increase its resource efficiency and reduce waste production which provides benefits to the industry and the environment. Specifically, developing new products and services that reuse products or utilise recycled components or materials can support the economy through the generation of new business opportunities. Moreover, consumers are increasingly aware of the impact of plastic waste on the environment and are looking for companies and products that prioritise sustainability. By adopting circular practices, companies can improve their brand reputation and attract more customers [9]. Regardless of the importance of the use of innovative technological advances in recycling and recovering plastic, it appears from recent studies that practices with low-value retention are prioritised over those with high-value retention [10].

The CE framework was applied to the plastic packaging industry to identify the major challenges, developments and indicators at different levels; namely material, product and components, business and system, as shown in Figure 2, and explained in the following paragraphs. Using the CE framework to perform this analysis helps identify the weaknesses and opportunities of the plastic packaging industry and provides potential pathways to drive further improvements.

Material Level

From a material level, the main challenges are attributed to the heterogeneity of plastic packaging materials and the additional presence of colorants and additives. This complexity hinders the efficiency of recycling processes and slows down the transition toward a CE [11]. Biodegradable and compostable materials for packaging lack consistent standards and regulations, which makes it difficult to implement them in a CE. Furthermore, prioritising biodegradation over recycling means prioritising a lower VRS, making biodegradable plastic favourable only for specific applications [12].

Developments and applications of new recyclable or biodegradable materials contribute to keeping the materials in the loop, in either the technical sphere or the biosphere. The use of such materials

helps to reduce the production of waste. Furthermore, developments in chemical recycling help to increase the recyclability of multi-materials packaging hence reducing the need for virgin sources and the production of waste [13].

Three main indicators are used at material level to measure circularity. Firstly, resource efficiency, which expresses the amount of material used in the production of the packaging and the amount of waste generated [3]. The other indicators are the recycled and bio-based content that express the proportion of recycled material and of renewable materials used to produce new packaging, respectively. The last two are aimed at measuring the reduced demand of virgin plastic and fossil fuels [14].

Product and Components Level

Similar to the material level, the main challenges are derived from the heterogeneity of parts and components used for a single packaging, such as multi-layered packaging, bottle and caps or cardboard boxes containing plastic bags. This complexity hinders the collection and recycling processes [15]. The application of eco-design to rethink packaging, using fewer materials and easily separable and recyclable parts has been the major development at this level to push toward a CE. Furthermore, the use of reusable packaging is increasing as a means to reduce the need for single-use packaging.

Several indicators are used at this level to measure the circularity of packaging products. Durability, for example, indicates longevity and eventual reusability of the packaging. Recyclability indicates the proportion of the packaging that can be recycled (or reused) [14]. Moreover, the environmental impacts generated during the production, use and disposal of the packaging are often used as indicators of circularity, such as the carbon footprint, water footprint and toxicity [16].

Company Level

The challenges at the company level are related to the high cost of developing and implementing new recycling technologies and infrastructures. Additionally, the uncertainty and instability of the global plastic packaging market make it difficult to justify and plan investments in the long term. Well-directed incentives are helpful to overcome these challenges, but at the same time incentives from different stakeholders are misaligned, creating barriers to collaboration and cooperation and generating further challenges.

Developments at company level include research and development for closed-loop recycling systems, which enable plastic packaging to be recycled repeatedly without value loss, improving sustainability and reducing waste production. Furthermore, the application of extended producer responsibility (EPR) schemes makes the producer responsible for the disposal of their products, encouraging them to adopt more sustainable practices [17]. EPR can also be used as an indicator of a producer's circularity level, making them responsible for the implementation of policies such as take-back programs or deposit systems.

System Level

One of the main challenges at system level is the limited innovation regarding technologies and practices for better circular plastic packaging. This is caused, in addition to the technical feasibility, by the presence of existing regulations and policies that create barriers to the needed developments. Furthermore, the limited collection, sorting and recycling capacity, as well as the lack of infrastructure in many areas do not meet the demand for recycled materials from packaging producers, increasing the use of virgin materials [18]. Limited awareness of the benefits that a CE could bring, and limited consumer engagement towards a CE and recycling process, can reduce the support and momentum needed for change and further undermine the efforts to achieve a CE.

To address these challenges, consumer education campaigns have been launched to encourage people to recycle, reduce waste and increase awareness. At the same time government regulations of the plastic packaging industry have increased, encouraging the adoption of more sustainable practices and technologies, such as including more recycled content in packaging applications.

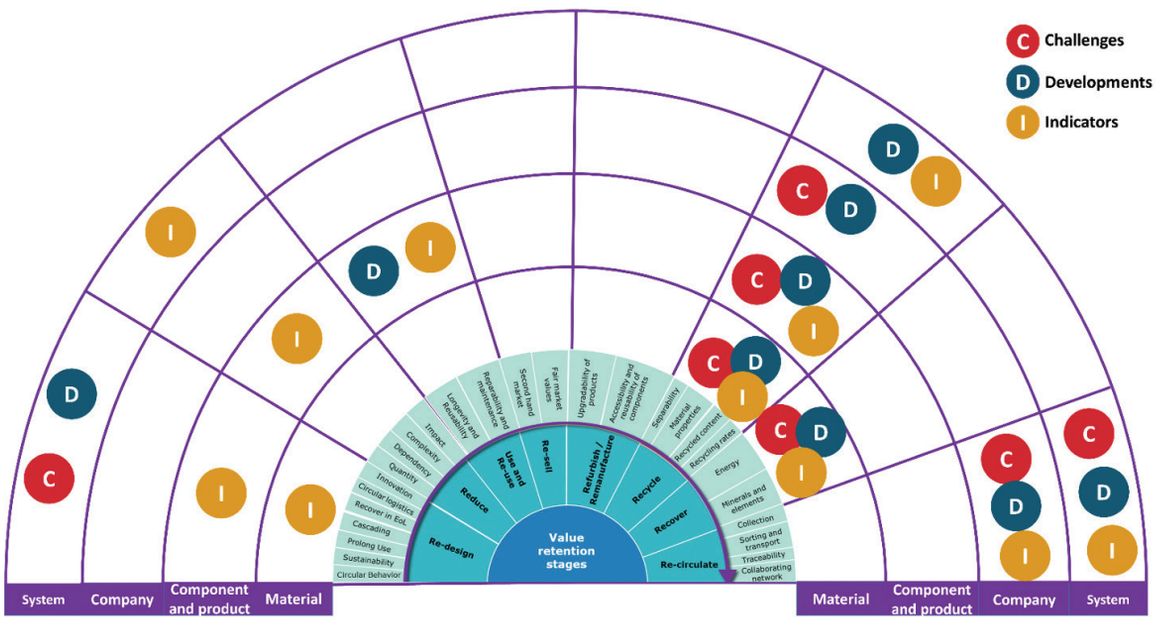
Circularity indicators used at system level often incorporate economic output as a means to measure materials and resource efficiency [19]. Additional indicators include the percentage of waste generated and the recycling or recovering rates, as well as the percentage of recycled content used in substitution of raw materials. Environmental footprints of the whole system are also used to evaluate the system's environmental impact [14]. Furthermore, indicators of collaboration and partnerships between stakeholders, businesses, government and other organisations are an expression of the progress towards a CE. Finally, indicators of innovation, research and development measure the level of investments and progress in new technologies, models and processes that are also used at company and system levels to evaluate efforts towards the transition to a CE [19].

Application of the CE Framework

The application of the CE framework was used to understand what is currently being developed, what the challenges are and how to measure them to improve circularity. Stakeholders and companies could use this approach to improve policies, regulations, processes and value chains. Additionally, the framework can be employed to conduct hotspot analyses of circularity levels, either at different system levels or within the VRS. While adopting a circular approach increases system resilience, it does not guarantee sustainability. Hence, for comprehensive analysis, the framework should be integrated with social, economic and environmental assessments to demonstrate the sustainability of the value chain and identify potential hotspots and trade-offs. When the above-described key challenges, opportunities and indicators are mapped through the lens of the CE framework, certain patterns emerge. Figure 2 illustrates that prevailing developments are concentrated at the last VRS, with recycling and recirculation of materials between companies and regions having a prominent place. This marks an interesting discussion point, as researchers such as Knäble et al. [20] have pointed out that recycling might have little to no impact on achieving sustainable development.

On the other hand, higher VRS, such as reduce, resell, refurbishment and remanufacturing (i.e., cascading strategies other than recycling) are much less prominent in current policies and developments for the plastic packaging industries. The presence of indicators for measuring these VRS indicates a growing focus on these stages. This mismatch is relevant for practitioners and policymakers as it signals areas where research and development of strategies and indicators are still required. Despite these limitations, the current CE framework helps to provide a useful overview of potential lines of action that can be taken across the value chain.

Figure 2. Application of the CE framework to the challenges, developments and indicators of the plastic packaging industry and their distributions at different value chain levels and VRS.



Conclusion

An overview of the CE framework [4] and its potential application in the plastic packaging industry was provided. The case study highlights the challenges faced by the industry, such as the loss of value in plastic products, dependence on finite resources and environmental concerns. The CE framework offers a comprehensive approach to address these challenges with several VRS and strategies and to promote circularity. Additionally, it can be a valuable tool for policymakers and companies to guide their efforts in transitioning to a CE. By considering the specific challenges, developments and indicators at each level of interest, stakeholders can identify weaknesses and opportunities for improvement in the plastic packaging industry.

To facilitate the transition to a CE, it is necessary to develop circularity metrics with holistic perspectives not limited to material or energetic value retention, but metrics that include all aspects of the CE. Furthermore, it is necessary to back those results with sustainability analysis to allow formation of clear pathways towards the Sustainability Development Goals [21]. The CE framework [4] can be used as a basis for the future development of a quantitative assessment of circularity.

1. Liu, L. & Ramakrishna, S. *An Introduction to Circular Economy.* (2021). doi:10.1007/978-981-15-8510-4.
2. Arruda, E. H., Melatto, R. A. P. B., Levy, W. & Conti, D. de M. Circular economy: A brief literature review (2015–2020). *Sustain. Oper. Comput.* 2, 79–86 (2021).
3. Parchomenko, A., Nelen, D., Gillabel, J. & Rechberger, H. Measuring the circular economy - A Multiple Correspondence Analysis of 63 metrics. *J. Clean. Prod.* 210, 200–216 (2019).
4. Garcia-Saravia Ortiz-de-Montellano, C. & van der Meer, Y. A Theoretical Framework for Circular Processes and Circular Impacts Through a Comprehensive Review of Indicators. *Glob. J. Flex. Syst. Manag. 2022 232 23,* 291–314 (2022).
5. *Plasctics Europe. Plastics-the Facts 2021 An analysis of European plastics production, demand and waste data.* https://plasticseurope.org/wp-content/uploads/2021/12/Plastics-the-Facts-2021-web-final.pdf (2021).
6. SYSTEMIQ. *ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe.* (2022).
7. Chen, Y. C. Evaluating greenhouse gas emissions and energy recovery from municipal and industrial solid waste using waste-to-energy technology. *J. Clean. Prod.* 192, 262–269 (2018).
8. Ellen MacArthur Foundation, World Economic Forum, McKinsey Center for Business and Environment. *The New Plastics Economy: Rethinking the future of plastics.* https://ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics (2016).

9. Maranesi, C. & De Giovanni, P. Modern Circular Economy: Corporate Strategy, Supply Chain, and Industrial Symbiosis. *Sustain. 2020, Vol. 12, Page 9383 12, 9383* (2020).
10. Pieroni, P. et al. Transition to a Sustainable Circular Plastics Economy in The Netherlands: Discourse and Policy Analysis. *Sustain. 2022, Vol. 14, Page 190 14, 190* (2021).
11. Hahladakis, J. N., Velis, C. A., Weber, R., Iacovidou, E. & Purnell, P. An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling. *J. Hazard.* Mater. 344, 179–199 (2018).
12. Springle, N., Li, B., Soma, T. & Shulman, T. The complex role of single-use compostable bioplastic food packaging and foodservice ware in a circular economy: Findings from a social innovation lab. *Sustain. Prod. Consum. 33,* 664–673 (2022).
13. Kaiser, K., Schmid, M. & Schlummer, M. Recycling of Polymer-Based Multilayer Packaging: A Review. *Recycl. 2018, Vol. 3, Page 1 3, 1* (2017).
14. Indicators - Circular economy - Eurostat. https://ec.europa.eu/eurostat/web/circular-economy/indicators.
15. Jacobs, C. ; *et al.* Challenges to the Circular Economy: Recovering Wastes from Simple versus Complex Products. *Sustain. 2022, Vol. 14, Page 2576 14, 2576* (2022).
16. Cozzolino, A. & De Giovanni, P. Portfolios of sustainable practices for packaging in the circular economy: an analysis of Italian firms. *Int. J. Logist. Manag. 34, 24–49* (2022).
17. Leal Filho, *W. et al*. An overview of the problems posed by plastic products and the role of extended producer responsibility in Europe. *J. Clean. Prod.* 214, 550–558 (2019).
18. Maione, C., Lapko, Y. & Trucco, P. Towards a circular economy for the plastic packaging sector: Insights from the Italian case. *Sustain. Prod. Consum. 34, 78–89* (2022).
19. Moraga, G. *et al.* Circular economy indicators: What do they measure? *Resour. Conserv. Recycl. 146, 452–461* (2019).
20. Knäble, D., de Quevedo Puente, E., Pérez-Cornejo, C. & Baumgärtler, T. The impact of the circular economy on sustainable development: A European panel data approach. *Sustain. Prod. Consum. 34, 233–243* (2022).
21. THE 17 GOALS | Sustainable Development. https://sdgs.un.org/goals.

03

Intellectual Property Rights in the Circular Economy.

Anselm Kamperman Sanders and Dalindyebo Shabalala.

Faculty of Law, Maastricht University and University of Suffolk.

Introduction

Industrial capitalism has developed with a tight link between efficient production that externalises the costs of disposal of waste or excess raw materials on one hand, and the repetitive consumption of the same, slightly modified or improved products by end consumers. Modern industrial capitalism generates an astonishing amount of waste, driven by the need for greater novelty and increased marginal profits on a quarterly basis and dependent on an illusory infinite growth curve of sales. Traditionally, the role of industrial design has been to increase the ability of producers to market replacement products to consumers by making them more attractive or slightly more useful than those they already own; or in redesigning production processes to make them less costly and more efficient, with sustainability and lower waste sometimes a happy accident or co-benefit.

Eco-design steps outside of that paradigm and asks the question of whether it is possible to engage in production that does not produce excess waste and that, rather than continue to pull raw materials into the process, reincorporates products that have been used further down the use chain all the way to consumer use. This full and dynamic reintegration all along the production and consumer chain presumes collaboration and cooperation between raw materials providers, intermediate and input product designers and providers, final product designers and assemblers, user/consumers and waste collection end-receivers - what Siderius and Zink call ecosystem circularity [1]. Achieving the goal may require well-designed regulatory interventions to coordinate between all these actors, to address what Siderius and Zink call segmented circularity and to remove barriers to such collaboration to achieve the goals of a circular economy and fulfil the potential of eco-design [2]. The goal of this policy brief is to examine the role of intellectual property (IP) as an enabler and as a barrier to coordination and collaboration in achieving the circular economy, especially in the realm of eco-design. In the first section, the brief provides an introduction to the specific technology development and diffusion problems raised by the circular economy and eco-design and the different types of intellectual property that are implicated. The second part outlines the academic and policy consensus on the specific ways that intellectual property poses both as a barrier and an enabler of technology development and cooperation in the circular economy. The brief concludes with a set of recommendations for policymakers for regulating firms and intellectual property rights to find the optimal way forward in achieving the circular economy.

Right to Repair, the Circular Economy and Eco-design

On 31 August 2022, the European Commission published a draft on eco-design and energy labelling requirements for phones and tablets. The purpose of this draft is to ensure that in a linear economic model end users and repair service providers have access to all that they need to lengthen the economic lifecycle of these products. This means access to component parts, access to manuals for repair and access to the device itself. In the phone sector, eco-design encompasses easy repair and replacement of parts, use of recyclable materials, longer more durable materials and low environmental impact manufacturing processes. Easy repair would require, for example, that a phone not use soldered and glued-together parts, but screws which allow deconstruction, access and reconstruction. An example of this is the Fairphone [3], which not only uses recyclable parts but is modular, allowing removal, repair and replacement of most components.

The concept of the circular economy, however, goes beyond this basic idea of right to repair to the concept of full reintegration and absorption of all materials used in production back into the production cycle. It aims to redesign, reduce material use, reuse, repair, recover and recycle. The circular economy has most clearly and visually been depicted by the Ellen MacArthur Foundation (Figure 1).

Figure 1.

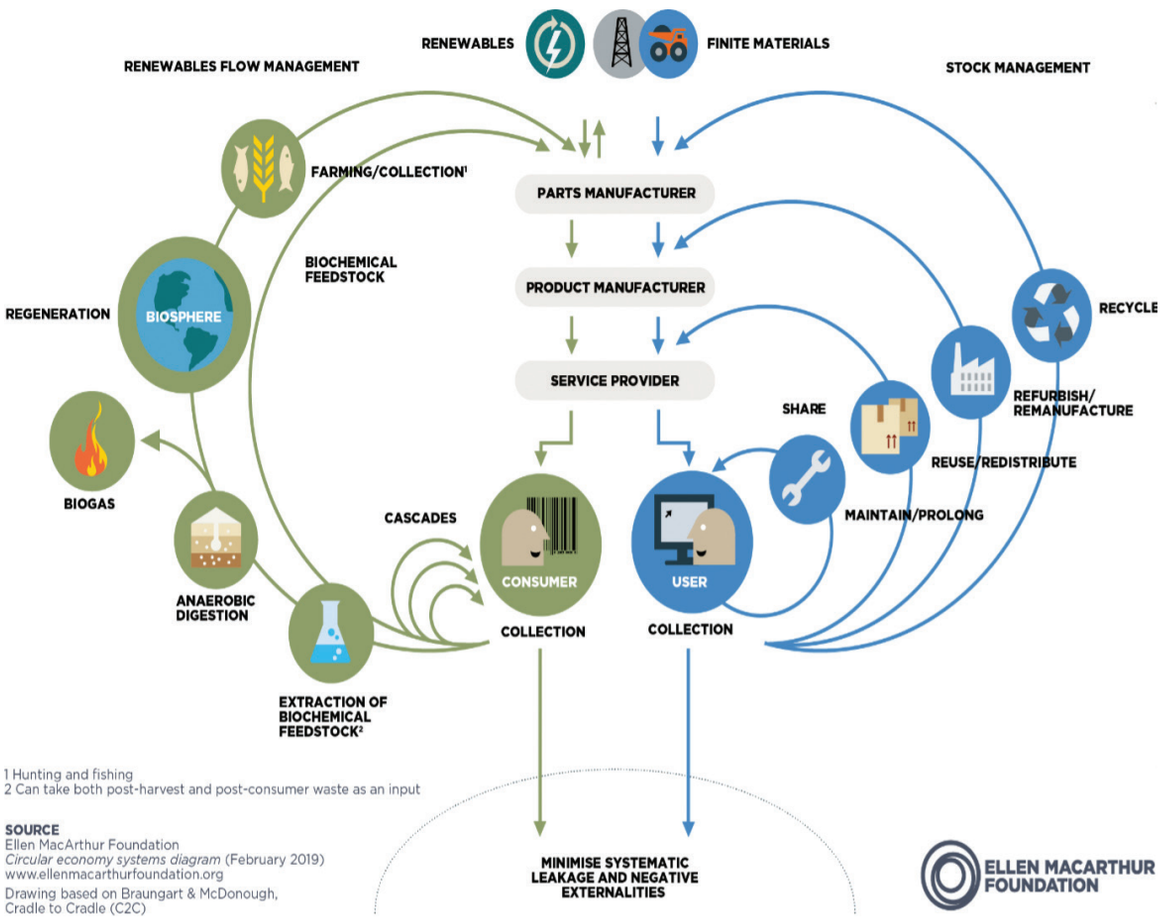
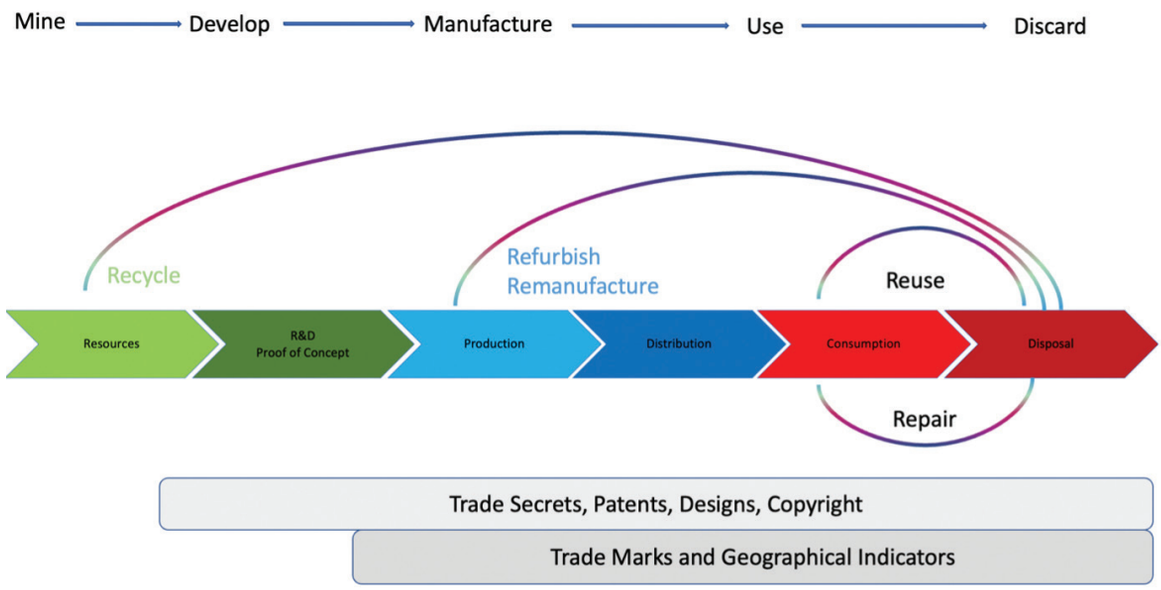


Figure 1 shows an ideal complete technological and biological circular reintegration system. While not intended to be fully descriptive of how things work in current circular economies, one critique and addition made by Siderius and Zink [4] is that many of the nodes identified in the diagram are not simply black boxes but are sectoral markets with their own internal dynamics, structured by policy drivers that any circular economy design must take into account. In this policy brief, we examine the ways in which intellectual property structures the internal aspects of several sectors of the circular economy, parts manufacturers, product manufacturers, consumers and recyclers. This policy brief address both the intermediate step of repair and the fuller step of reintegration. Eco-design is integral to achieving both, and this brief will discuss the role that intellectual property plays in both frameworks.

Eco-design and Intellectual Property

Figure 2.



At its core, eco-design seeks to enhance the possibilities for repair, refurbishing and remanufacturing (the so-called Three Rs). However, many firms have business models that seek to bind consumers to their products. They do this either by creating a walled-garden ecosystem of related products or binding them to an exclusive relationship that makes customers return frequently for repairs, updates and new products. All of this is enabled by the protection of intellectual and industrial property and the use of contract law. As the image above shows, it occurs at every stage of the eco-design process.

For eco-design, there are four primary types of intellectual property protection implicated. The first is patent protection. Patents are technical products or processes that receive protection because they are novel and achieve an inventive step beyond the status quo. Getting a patent prevents others from:

- manufacturing a product incorporating the invention;
- using a product incorporating the invention;
- offering for sale a product incorporating the invention;
- selling a product incorporating the invention;
- importing a product that includes the invention.

This is extensive protection that covers many high technology products and pharmaceuticals, as well things such as software that solves a technical problem. Under most patent law, the very act of refurbishment or remanufacturing by a third party without permission would be a violation of the right to a patent. In his 2014 *Guardian* article on intellectual property and the circular economy [5], Kyle Wiens visits a BMW auto recycling centre where they are stripping cars down. BMW has developed a proprietary (i.e., patented) tool for draining oil from its transmission, but it has not licensed others to manufacture it. Nor has BMW sold or authorised for sale to others the tool, despite how useful it would be to the broader market of repairers, refurbishers and recyclers.

Patent law can also lead to the capture of platform or standard technologies making it expensive for other firms to enter the market or force consumers to purchase multiple versions of the same product. Even without patent law, proprietary standards can be used to limit consumer movement

and keep out competitors. A clear example for this is the market for power charger cords in which not only were there multiple versions of the USB standard in the market, but firms like Apple developed their own proprietary versions that only worked with Apple products - and not always across different generations of the same Apple product. The mandatory adoption of USB-C as a standard will come into effect in the EU in 2024 [6] precisely because the proliferation of chargers and the attempt by large firms such as Apple to capture that market for themselves in relation to their products created wasteful spending, significant amounts of waste and created friction for customers who sought to change to other products.

The second type of intellectual property protection is related to design and protects the aesthetic (appearance and shape) elements of industrial and other products, including fashion, vehicles and components of vehicles (i.e., spare parts), but also household products such as furniture and kitchen appliances. Design protection excludes others from making, offering, putting on the market, importing, exporting or using the product in which the design is incorporated or to which it is applied. Design patents or design protection can prevent others from manufacturing the same components for replacement outside of those authorised by the original manufacturer. The classic example of this is the auto industry, which has historically used design protection to prevent an aftermarket in spare parts, something which has had to be revisited through regulations over and over again as firms have kept finding ways around actions by competition authorities and new regulations designed to limit this ability.

The third type is trademark protection. Trademarks (sometimes incorporated into the broader idea of brands) are indicators (words, logos or even colours and sounds) of the commercial source of services or products that also embody the reputation of the source and the goodwill (i.e., the customer loyalty) to the source. The main aim is protection of consumers, but it also includes protection of well-known brands against misuse, free-riding and tarnishing of their reputations and goodwill. Trademark protection prevents others from using the protected trademark in commerce in a specific market in a manner that will likely cause confusion or damage the reputation or goodwill of the trademark holder. The holder can prevent the manufacture, sale or import of products or services with the trademark on it. Trademarks have been used to try to prevent importers from using trademarked parts to help repair customers' equipment, as in the example of Norwegian shop owner Hendrik Huseby, who was sued by Apple to prevent him importing genuine Apple parts for his repair shop [7].

The fourth type is copyright which provides protection to literary and artistic works. This would normally not have much relevance to industrial production except for the fact that software (that is not aimed at solving a technical problem) is protected by copyright. Copyright protection prevents others from copying, selling, making derivative works or distributing the work and allows the owner to prevent import. Independent repair of malfunctioning products can be prevented by copyrights on software that is protected by digital rights management systems embedded in products. This has been used to prevent farmers in the US from repairing their John Deere tractors, for example.

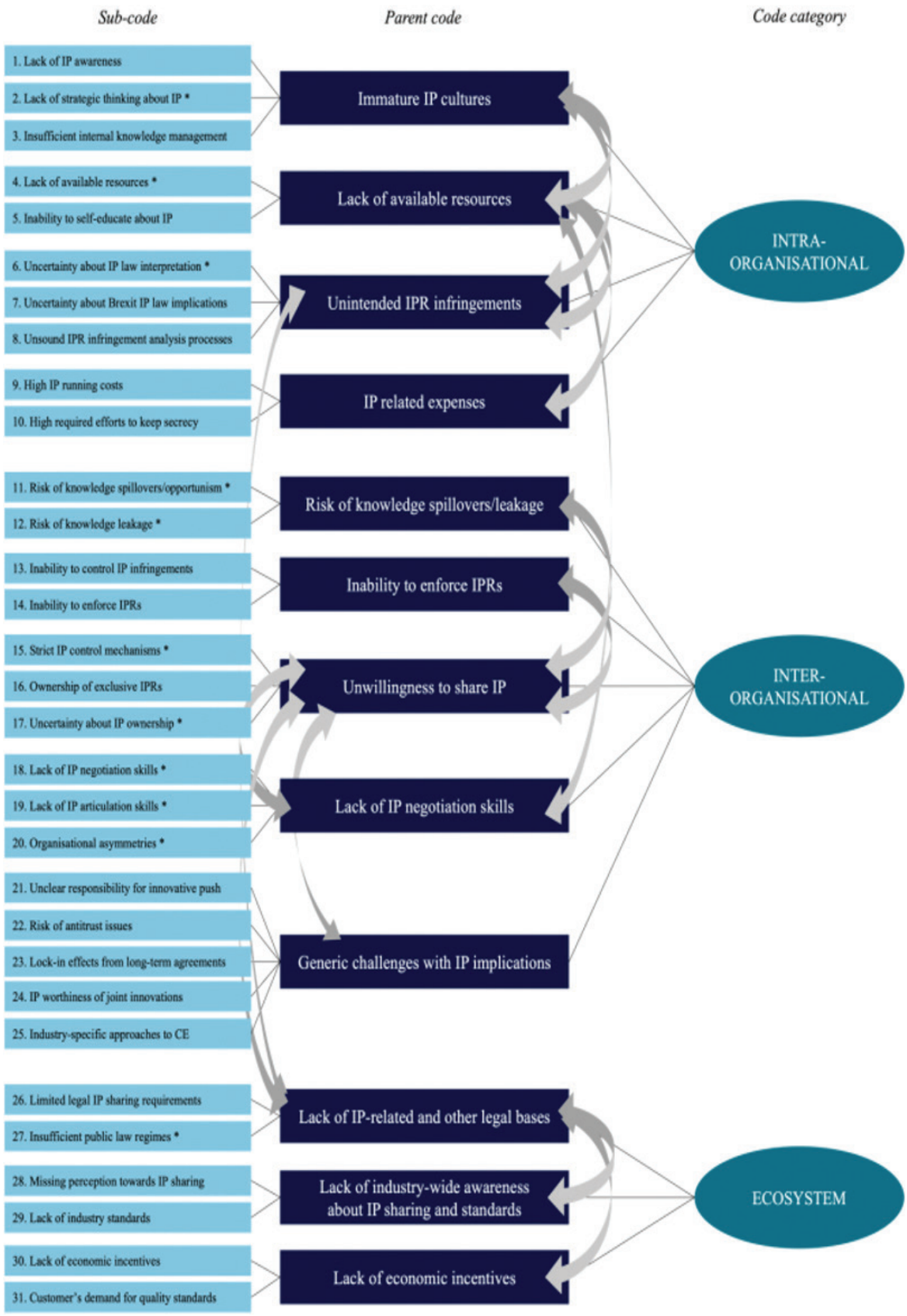
Contract law is also used to close markets related to products, preventing others from innovating around, repairing, reusing, refurbishing or integrating into other products. Rather than use an open approach to production that allows access, firms use contract law, for example, by limiting warranties for products, binding consumers to use only authorised spare parts and spare parts dealers. For example, until 2021, Apple used its contractual power to prevent independent repair of its phones by voiding warranties and restricting access to parts and manuals.
Intellectual property has been identified as playing a major role in the circular economy by several authors. Eppinger et al. point out that it is key to innovating new technologies but can also be responsible for delaying diffusion [8]. Achieving the circular economy will require rapid innovation and diffusion of technologies. To the extent that intellectual property rights favour large incumbent firms in gaining and holding market share, they can get locked into older less sustainable technologies. A classic example is the energy generation industry in which coal power stations have multi-decade lifetimes encouraging solutions focused on coal (e.g., carbon capture and storage) rather than new technolo-

gies that do not integrate into the coal energy cycle, such as wind or solar power. This can discourage the kind of rapid innovation that smaller firms are better suited for in creating inventions that are better and displace those held by major firms [9]. On the other hand, major incumbent firms, because of economies of scale and more vertical integration, may be better suited to enable rapid diffusion of technologies within industries. By ensuring that there are incentives to claim intellectual property and participate in broad platforms, IP protection may enable such diffusion. However, it is precisely the need for broad, standard setting and platform-based technologies that have an impact industry-wide that can also make intellectual property protection a barrier. In the absence of strong regulations or incentives, firms tend to move towards fragmented competition rather than collaboration. Eppinger et al. emphasise the need for incentives to push firms into such collaboration, low transaction licensing and know-how sharing [10].

Wien argues that firms' commitment to closed markets may make it impossible to achieve the closed loop necessary to make the circular economy a reality [11]. He argues that if the bigger firms such as Nikon, BMW and Apple do not work with smaller independent contractors and consumers, it will be impossible to achieve the necessary market-wide economies of scale. The argument being that the necessary economies of scale to actually disassemble and reintegrate materials and parts further up the production chain would not happen. The companies themselves are not big enough and do not have strong enough internal incentives to do so. Additionally, because they are concerned about maintaining control over their markets and consumers, they are reluctant to let anyone else have access to even non-proprietary elements of their production process. This is even stronger for their proprietary elements such as diagnostic codes, circuit schematics and replacement parts.

Wangrin et al. add to this consensus that intellectual property rights impede the cooperation and collaboration necessary to achieve the goals of the circular economy [12]. They point out that IP creates a double-edged dilemma for firms; engaging in technology exchange risks knowledge leakage and spillovers, so firms are less likely to engage in collaboration and cooperation if they cannot be assured of control over the information or technology they share, especially if these are know-how and trade secrets. However, IP ensures that they themselves have internal R&D costs above the optimal level and higher costs in accessing technologies developed by others, which can be a problem in areas where regulations require the rapid development and adoption of best available technologies. The owners of any IP rights relating to materials, parts and products can also be difficult to identify, especially in complex supply and value chains, increasing uncertainty and making it more difficult for firms to truly understand how much room they have to operate in [13]. Their research identifies 10 circular economy IP challenges that tend to arise inside an organisation, 15 that arise between organisations and five at the level of the broader innovation system in which firms operate. The visualisation in Figure 3 shows just how complex and intertwined IP is in the circular economy and the need for regulatory interventions targeted at each level [14]: intra-firm, inter-firm and market sector-wide.

Figure 3.


Sub-code
Parent code
Code category
1. Lack of IP awareness
2. Lack of strategic thinking about IP *
3. Insufficient internal knowledge management
Immature IP cultures
4. Lack of available resources *
5. Inability to self-educate about IP
Lack of available resources
6. Uncertainty about IP law interpretation *
7. Uncertainty about Brexit IP law implications
8. Unsound IPR infringement analysis processes
Unintended IPR infringements
9. High IP running costs
10. High required efforts to keep secrecy
IP related expenses
INTRA-ORGANISATIONAL
11. Risk of knowledge spillovers/opportunism *
12. Risk of knowledge leakage *
Risk of knowledge spillovers/leakage
13. Inability to control IP infringements
14. Inability to enforce IPRs
Inability to enforce IPRs
15. Strict IP control mechanisms *
16. Ownership of exclusive IPRs
17. Uncertainty about IP ownership *
Unwillingness to share IP
18. Lack of IP negotiation skills *
19. Lack of IP articulation skills *
20. Organisational asymmetries *
Lack of IP negotiation skills
INTER-ORGANISATIONAL
21. Unclear responsibility for innovative push
22. Risk of antitrust issues
23. Lock-in effects from long-term agreements
24. IP worthiness of joint innovations
25. Industry-specific approaches to CE
Generic challenges with IP implications
26. Limited legal IP sharing requirements
27. Insufficient public law regimes *
Lack of IP-related and other legal bases
28. Missing perception towards IP sharing
29. Lack of industry standards
Lack of industry-wide awareness about IP sharing and standards
30. Lack of economic incentives
31. Customer's demand for quality standards
Lack of economic incentives
ECOSYSTEM

Siderius and Zink point out that without some shift or transformation in the very underlying structure of markets, it may be impossible for the circular economy to achieve its environmental and social goals. In particular, they point to the need to reduce components of competition that create incentives for firms to try to maintain exclusive or monopoly control over their product and supply chains as well as their consumer base [15]. The current market forces are designed to encourage segmented circularity, decreasing incentives for collaboration and coordination. This is especially true for the newer technologies underpinning the circular economy; those of the fourth industrial revolution that meld data, design and artificial intelligence alongside the supply chain complexity of manufacturing [16]. Sharing and transfer of knowledge and information will be even more necessary to enable innovation and diffusion of these technologies to actors in the circular economy, emphasising the need for stronger surveillance and regulation of anti-competitive behaviour [17].

With manufacturing and supply chains spread across continents, including middle-income countries, such as China, India or Brazil who are seen as competing with Europe and the United States, the need for mechanisms for technology collaboration and cooperation are crucial. The incentives established by the international trading system, especially the WTO TRIPS Agreement [18], encourage and enable technology diffusion between subsidiaries and partners of vertically integrated multinational firms, but limit horizontal diffusion to other firms in the same or similar industry in those countries. These intellectual property barriers have been an issue in the realm of access to medicines, most recently in the development and distribution of COVID-19 vaccines, and in the climate change negotiations where developing countries have made very clear their need for technologies to mitigate and adapt to climate change [19].

Addressing Intellectual Property to Enable Eco-design

For eco-design to be successful, a working interface between the goals of sustainability and protection of intellectual property needs to be found. As Rimmer points out, there is a strong connection between intellectual property and achievement of the UN Sustainable Development Goals [20] including SDG#12 on responsible production and consumption. This requires a dual approach: directly addressing the interface between specific intellectual property rules that prevent specific circular economy actions such as repair; and systemic changes that increase collaboration, technology and knowledge sharing and adoptions of common standards and platforms that enable interoperability.

This policy brief will suggest some targeted intervention at the intra-firm level and the innovation ecosystem level. At the inter-firm level, targeted intervention becomes crucial for creating predictable rules that prefer scalable solutions for the circular economy. In many sectors this requires addressing specific rules for reuse, refurbishment and remanufacturing.

Right to repair legislation has been developed in several places across the world. Australia has included such a defence in its design protection system, including, but not limited to, spare parts for cars [21]. In Australia, we also see what is prevalent in other countries where the defence to design infringement is not accompanied by a duty to share information and knowledge by the original equipment manufacturer. This issue is not addressed with respect to patent law where there is a need to clearly set the boundary between infringement of a patent and reuse and refurbishment of pre-existing products. At present there are no places yet where such a defence for patent infringement exists.

In the EU, the attempts have been rather sector-specific, and only the design industry has been dealt with in something approaching a comprehensive manner through the must-fit and must-match exceptions to design protection. This is to be found in the Community Designs Regulation 6/2002 and the Directive 79/71/EC on legal protection of designs. Sector-specific rules are furthermore found in the following instruments:

- Regulation (EC) 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information;
- Waste Framework Directive 2008/98/EC
- Eco-design Framework Directive 2009/125/EC.

The right to repair has been the topic of longstanding discussion in the EU, and its core issues were addressed in a book by Kamperman Sanders and Heath [22]. In that book, the authors point out long-standing problems that have reduced consumer welfare and resulted in anti-competitive and unfair competition. These problems often stem from the lack of a strong approach to enabling repairs and access to spare parts by over-protecting the interests of original equipment manufacturers. After much debate, the EU has finally moved to put in place full right to repair legislation. In late 2022, the Commission was supposed to put forward regulations on the right to repair, but these have been delayed to 2023 because the initial proposal was blocked by the EU Regulatory Scrutiny Board. The sector-specific rules for smartphones and tablets were put forward in November 2022, and these include elements of a right to repair, but leaked drafts have suggested that the intellectual property of incumbent firms remains highly protected [23].

Other than this, the eco-design framework in the EU does not truly address IP issues at the necessary level or scope. There is some siloing between the development and implementation of intellectual property systems in the EU internal market and those addressing environmental and sustainability issues. In fact, the CJEU upholds the rights of intellectual property holders in a linear rather than circular economic model. Perhaps a key reflection of how the EU IP system views eco-design and sustainability is what they do to products that violate intellectual property rights: the Intellectual Property Enforcement Directive provides for the destruction of products, not only counterfeit, but also parallelly imported products produced by the right holders themselves [24]. Another example is Burberry's burning of millions of euros worth of clothes, bags and perfumes in 2018 to prevent counterfeiting [25].

Recommendations

If eco-design is to be truly effective, a shift in policy mindset and a reframing of the purpose of intellectual property protection is required. For policymakers there are a few key initial steps to take and lessons to be learnt, especially in the newly proposed enhanced eco-design regime:

- The system must prioritise the development of open innovation and common licensing systems especially as signals to market participants. Creative Commons is a copyright framework that provides for a simple, easily adoptable and communicated set of licensing frameworks for people in the market to use. The default is an open license that makes the work free to use for any purposes but requires identifying the original author [26]. In the patent, trademark and design area, the EU should encourage the development and use of such approaches and begin to provide incentives in its subsidies and R&D frameworks. Although there have been significant failures, such as the 2009 Eco-Patent Commons pledging systems, lessons have been learnt that can further spur the development of future frameworks [27].
- The EU must encourage the development of platforms, standards and licensing practices that favour widespread diffusion of best available technologies and processes for sustainable manufacturing, remanufacturing and recycling. In particular, standardisation accompanied by highly accessible information and knowledge about the standards, the underlying technologies for the standards and easy, low transactions costs licensing and fees that prevent market capture by one or more firms are crucial to the success of a circular economy. Mandatory standards may be the best approach, but private ordering through standard setting organisations may be appropriate provided that they comply with stronger anti-competitive regulatory requirements. Current frameworks and experience so far in regulating standard-setting organisations suggests that regulation is too lax and too favourable to incumbent firms.

- In domestic and EU law, policymakers should establish and broaden an exception to the protection of Technical Protection Measures and Digital Rights Management under copyright for the purposes of engaging in repair and refurbishment of products. They should also include an exception for reproduction and making of derivative works for the same purposes.
- The EU Commission, acting as competition authority, should be more proactive when it comes to enforcement of consumer-unfriendly restrictions. In Australia, similar concerns led to recommendations to the competition authority that the mandate against designs for anti-competitive components would make it difficult to allow repair or achieve interoperability [28]. This suggests a need for a true, positive right to repair framework that goes beyond simply providing defence under design protection rules and extends to requiring firms, in their designs and in their contracts, to explicitly design for and enable repairability and access to information to allow manufacture and use of spare parts [29]. The approach needs to extend beyond designs to other intellectual property rights including patents and trademarks which have been used to prevent entry into the recycling, reuse and refurbishment market by third parties.

Conclusion

While there is not a significant amount of literature and research on the circular economy and intellectual property, the existing research presents consensus that intellectual property is intimately intertwined with achieving the circular economy, and that it presents a barrier at multiple levels to creating the collaboration and cooperation necessary for the circular economy. As this policy brief notes, interventions are needed at the intra-firm, inter-form and systemic level to address the challenges posed by intellectual property. It is not sufficient to simply hope that intellectual property will generate technologies and that they will be diffused. In the new circular economy, intellectual property must be refashioned and harnessed to promote rapid development and diffusion of technologies in order to rebalance the power relationships between incumbent firms and new entrants - and between consumers and producers.

1. T. Siderius and T. Zink, 'Markets and the Future of the Circular Economy', Circular Economy and Sustainability (2022), at https://doi.org/10.1007/s43615-022-00196-4.
2. E. Eppinger et al, 'Sustainability transitions in manufacturing: the role of intellectual property', Current Opinion in Environmental Sustainability 49 (2021), at 118.
3. https://www.fairphone.com/en/
4. See Siderius and Zink, above n 1.
5. K. Wiens, 'Intellectual Property is Putting Circular Economy in Jeopardy', The Guardian, 3 June 2014, https://www.theguardian.com/sustainable-business/intellectual-property-circular-economy-bmwapple?CMP=share_btn_tw.
6. 'Long-awaited common charger for mobile devices will be a reality in 2024' (4 October 2022), News: European Parliament https://www.europarl.europa.eu/news/en/press-room/20220930IPR41928/long-awaited-common-charger-for-mobile-devices-will-be-a-reality-in-2024 (visited 21 January 2023).
7. https://motherboard.vice.com/en_us/article/a3yadk/apple-sued-an-independent-iphone-repair-shop-owner-and-lost
8. See Eppinger et al, above n.2
9. Ibid. at 119
10. Ibid.
11. See Wiens, above n.5
12. M. Wangrin, P. Vimalnath and F. Tietze, 'Enabling the Circular Economy: An Exploratory Study on Intellectual Property Challenges in Innovation Ecosystems', 1 Centre for Technology Management, University of Cambridge, UK (2023), at.
13. Ibid. at 3.
14. Ibid. at 7.
15. See Siderius and Zink, above n 1.
16. A. Kamperman Sanders, 'Data and Technology Transfer: Competition Law in the Fourth Industrial Revolution', Intellectual Property Law and the Fourth Industrial Revolution (Kluwer Law International, 2020), at 199.
17. Ibid.
18. Agreement of Trade-related Aspects of Intellectual Property (TRIPS Agreement), Annex 1C to the Marrakesh Agreement establishing the World Trade Organization (WTO Agreement), Marrakesh, 15 April 1994, in force 1 January 1995, 1867 United Nations Treaty Series 4 (1995).
19. See D. Shabalala, Climate Change, Technology Transfer and Intellectual Property: Options for Action at the UNFCCC, Maastricht University, October 2014.

20. M. Rimmer, A Submission on Intellectual Property and the United Nations Sustainable Development Goals, Submission (Australia) https:// www.aph.gov.au/ Parliamentary_Business/ Committees/ Senate/ Foreign_Affairs_Defence_and_Trade/ SDGs.
21. L. Wiseman and K. Kariyawasam, 'Revisiting the Repair Defence in the Designs Act (2003) in Light of the Right to Repair Movement and the Circular Economy', AIPJ 31 (2020), at 135.
22. A. Kamperman Sanders and C. Heath, Spares, Repairs and Intellectual Property Rights (Kluwer Law International, 2009).
23. https://repair.eu/news/new-eu-rules-for-smartphones-and-tablets/
24. Regulation (EU) No. 608/2013 of the European Parliament and the Council of 12 June 201 concerning customs enforcement of intellectual property rights and repealing Council Regulation (EC) No. 1383/2003.
25. BBC (2018) Burberry burns bags, clothes and perfume worth millions. https://www.bbc.com/news/business-44885983
26. More on these licenses can be found at https://creativecommons.org/about/cclicenses/
27. J. Contreras, B. Hall and C. Helmers, 'Pledging Patents for the Public Good: Rise and Fall of the Eco-Patent Commons', 1 Houston Law Review 57 (2019), at 61.
28. See Wiseman and Kariyawasam, above n 21. at 144.
29. Ibid.

04

The Circular City – What Does it Mean and (How) Can it be Achieved?

Joop de Kraker.

School of Business and Economics, Maastricht Sustainability Institute, Maastricht University and the Open University NL.

Introduction

Many European cities have adopted circularity as a policy goal, often as part of their local sustainability policy and in line with European and national policy goals. The translation of the concept of circularity or circular economy to the urban scale is also known as the circular city. However, more than in the case of the climate-neutral or climate-resilient city, local governments struggle with a clear understanding and practical implementation of circularity. This policy brief discusses the concept of the circular city and ways to assess the current state and monitor the impact of policies at the local level, as well as local policy goals, approaches and challenges. Examples are often taken from the case of Amsterdam, a frontrunner in circular city policy within Europe. Throughout, recommendations are given on how circularity can be feasibly translated to the urban scale, what can be realistically achieved with local policies and what areas are best focused on. The policy brief ends with a recap of these recommendations.

The Circular City

The basic idea of a circular economy, in which raw materials are reused as much as possible and extraction of new raw materials is minimised, goes back a long way. Throughout human history, the disposal of waste was the exception and reuse was the norm. The linear economy of take-make-waste could only become dominant when technological development made the extraction of primary raw materials increasingly large-scale, faster and cheaper. In the past century, the annual amount of raw materials used worldwide has increased eightfold and continues to increase sharply. The risks of depletion, shortages, sky-high prices and undesirable dependencies are therefore also increasing. Reusing raw materials has thus become an interesting option again, and that may explain why the concept of a circular economy has become so widely accepted and is now anchored in policy at all levels, including the local level. The translation of the circular economy to the local level has resulted in the concept of the circular city. In essence, a circular city is nothing more than a city where the principles of the circular economy are applied in all sectors. The requirement often added to this is that material cycles must be closed locally, and therefore goods must be produced, consumed and reused locally as much as possible.

A major criticism of the concept of the circular economy is that it fails to address social justice and inclusiveness. The question is asked whether the emphasis on innovation, highly-skilled work and competition does not entail the risk that the existing socioeconomic inequalities will be increased even further. In response to this criticism, local initiatives often combine the goal of circularity with societal goals, such as *involving all talents and no one left behind*. The city of Amsterdam, a leader in this field, has emphatically combined the pursuit of a circular economy with the concept of the so-called doughnut economy with an ecological upper limit and a societal lower limit, which is also reflected in the Amsterdam Circulair programme motto: Amsterdam is a thriving city, socially just and ecologically safe.

Sustainability Problems of the Linear Economy

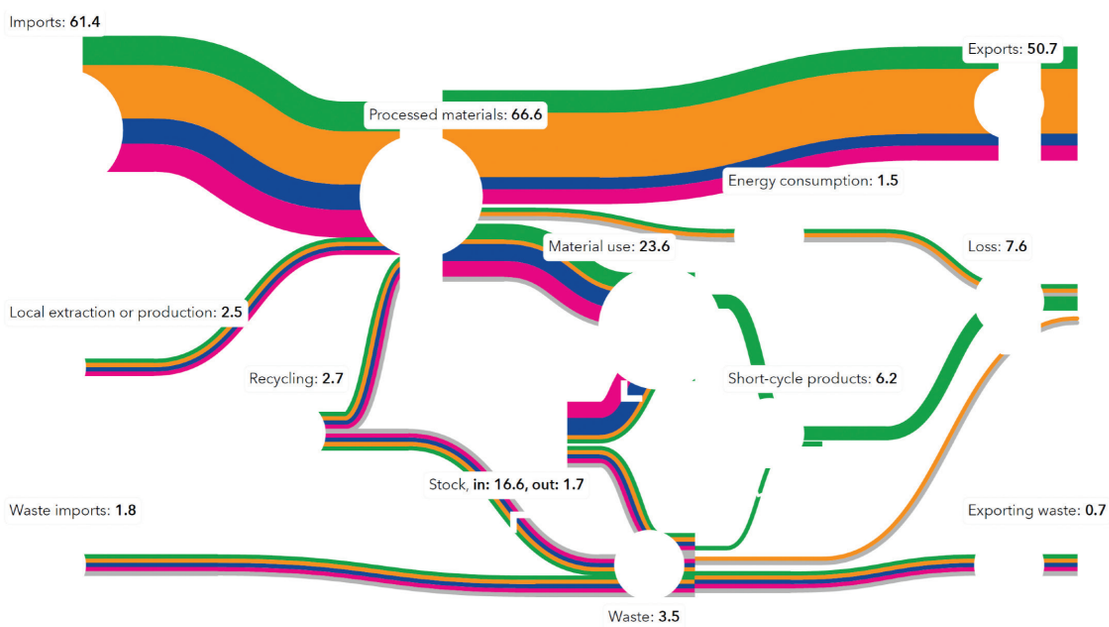
Remarkably enough, at the urban level the linear economy does not cause major problems, at least not in Western Europe. During the period of rapid growth of cities in the 19th century, the large production of waste by companies and households caused a lot of nuisance; for example, odours and vermin, as well as disease. These problems were solved by the construction of drinking water and sewer systems and the organised collection of waste. Since then, the living and working conditions in cities have greatly improved. Known among health scientists as the Hygiene Revolution, it has been invaluable to public health. The handling of waste is therefore still highly regulated because of this health concern. Seen in this way, the transition from the old circular economy to an efficient, well-oiled linear economy was in many ways a major advance. When returning to a circular economy, it is therefore important to avoid the problems that were traditionally associated with it. This is a real concern, as the increase in waste recycling is already causing new problems; such as unsafe or unhealthy working conditions in the recycling industry, and bad smells and swarms of flies from waste recycling companies causing severe issues in neighbouring residential areas.

The fact that problems caused by the linear economy are hardly noticeable in the city does not mean that they do not exist. They just occur on a different scale or in different places. The main sustainability problem has already been mentioned: depletion and supply problems of essential raw materials, which is an issue at European and national level. At the global level, and increasingly also at the European and national level, greenhouse gas emissions during extraction, transport and processing of primary raw materials are considered a major problem of the linear economy. These emissions are even greater than what is released during the production of electricity and heat with fossil fuels, but largely take place outside our cities. On a local scale, but elsewhere and usually outside Europe, the extraction and processing of primary raw materials also often leads to environmental pollution and damage to nature.

A Sankey diagram can be used to provide insight into which local material flows are relevant to reduce the environmental impact of raw material consumption. A Sankey diagram shows how many materials

are imported from outside the system (city, municipality, metropolitan region) or sourced locally, what happens to these materials within the system and how many materials leave the system again and in what way. Figure 1 is a Sankey diagram for the Amsterdam metropolitan region. The diagram shows that on an urban scale the economy is largely linear. Most raw materials come from outside, and after processing most materials leave the urban region again. The vast majority leave through the export of products and a much smaller part through the combustion of fossil fuels and waste. The diagram also makes it clear that a circular city in the sense of a fully circular economy on a local or regional scale is not a realistic possibility. Most companies have their markets outside the city or region and would disappear if the export of products were no longer allowed. Moreover, there are no local alternatives for many imported raw materials, and therefore many products could no longer be made locally.

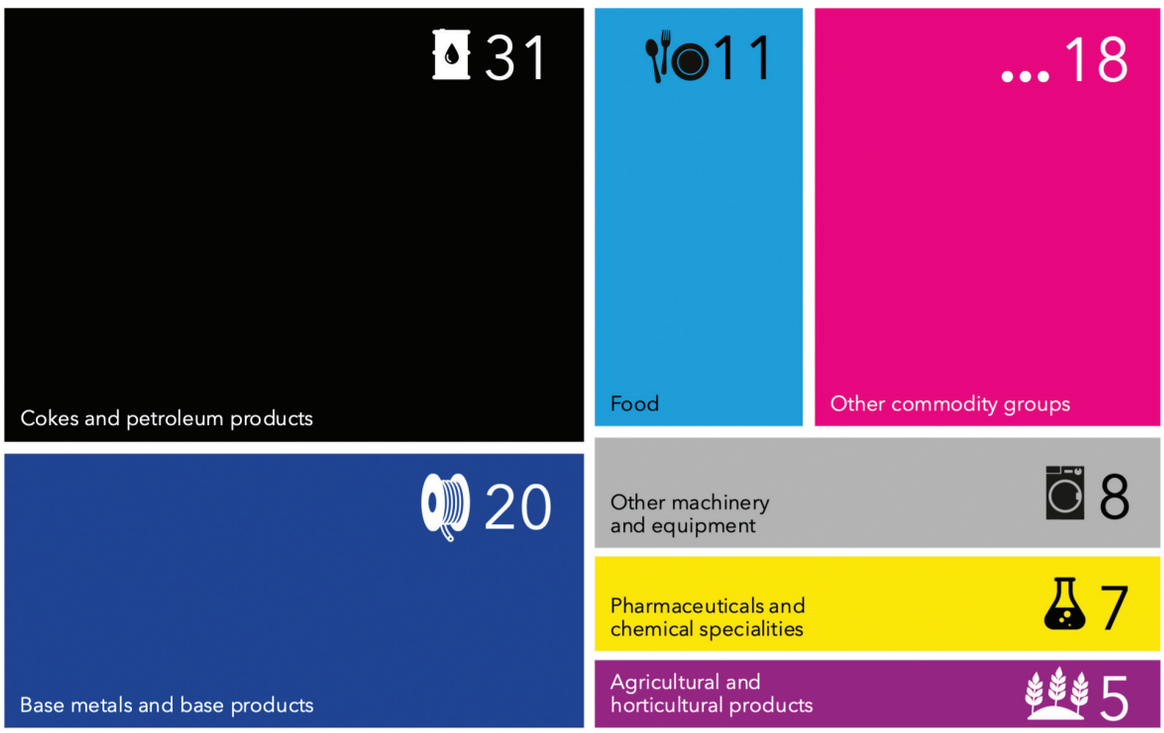
Figure 1. Material flows in Amsterdam (billions of kilos), 2019. (Municipality of Amsterdam, 2022) [1]



For a better understanding of the problems that the extraction and processing of raw materials can cause, it is important to distinguish between the different materials and products. There is often no direct relationship between the total volume or weight of the quantities used and the magnitude of the environmental impact. For example, in terms of weight, sand, gravel, concrete and other minerals make up almost half of the Dutch raw material consumption; but the environmental effects of these materials are relatively small. The situation is different for fossil fuels and food products, both important groups in terms of weight. The environmental effects of these groups are proportional to their weight (fossil fuels) or even much greater (food products). It therefore makes little sense to focus solely on the volume or weight of processed raw materials when addressing the sustainability problems of the linear economy.

Depending on which problems have the highest priority, the policy can focus specifically on certain sectors or product groups. For example, fossil fuels and the materials made from them (such as plastic) are important to focus on when reducing greenhouse gas emissions is a priority. To reduce land use, and thus the pressure on nature, policies should focus on biotic raw materials and products. Figure 2 shows the environmental impact of the materials consumed by the Amsterdam economy based on their weight and environmental impact per weight. In the policy choices at urban level, in addition to the importance of a material or product group in the local economy and its environmental effects, the influence that a municipality can exert on it also plays a role.

Figure 2. Environmental impact (% of total) of the product groups consumed by the Amsterdam economy in 2019, calculated on the basis of weight and environmental impact per weight. (https://onderzoek.amsterdam.nl/interactief/monitor-circulaire-economie)



Circular solutions and indicators

In a circular economy, as few raw materials as possible are used in products and these raw materials are kept in the production chain for as long as possible in order to minimise the demand for new raw materials and the associated environmental impact. Recycling (i.e., reuse as raw material) is only one of the ways in which reuse can take place in the circular economy and is usually not preferred because it often concerns a lower-value application than in the original product. Based on the classic waste hierarchy, in which prevention is at the top, recovery of energy in the middle and landfill at the very bottom, an ever-expanding menu of reuse options has been developed. Since in English most of these words start with an R, these options are also known as the R-strategies or R-ladder of the circular economy.

In a circular city, these R-strategies are applied as much as possible to as many sectors as possible with a preference for the strategies high up the ladder. However, this will usually not mean that no more raw materials enter the city, no end products leave the city and that all materials are reused internally. First of all, the scale of a city (and for many products also a region) is too small for this. Moreover, the goal is not so much to maximise reuse, but to minimise the use of primary raw materials and the associated environmental impact. This can also be done even better by consuming less *(Refuse)* or using less primary raw material in products *(Reduce)*.

Nevertheless, closing the material cycles locally as much as possible is often seen as an important aspect of the circular city. Perhaps because intuitively consuming and reusing local products (so-called short chains) feels sustainable and less harmful to the environment. However, scientific studies have often shown that local products score little or no better in this respect because the environmental impact of transport is usually only minor compared to the environmental impact of other links in the production and consumption chain. Of course, there can be other reasons to strive for local production and local reuse, such as supporting the local economy and employment, increasing mutual trust

through personal contact and the idea of being able to contribute directly to a better use of one's own, local waste. Ultimately, it depends on the type of product and type of reuse whether the local or regional scale offers the best solution. Sharing books, tools or cars requires an even smaller scale of organisation than a city. This also applies to, for example, repair cafés; while the recycling of raw materials or the reuse of parts requires a much larger scale in order to achieve a good match between supply and demand.

The district level is popular in experiments with circular area development in which cities try to discover how far you can go in circular building and inhabiting residential areas. In circular area development, attention is mainly focused on the two most important waste streams in urban areas: construction and demolition waste and household waste. Technically, much is already possible, but there are still many practical, economic and institutional obstacles. Moreover, also in the case of circular area development, the question arises of how effective it is to close cycles on this scale.

Due to the diversity of circular solutions, materials and environmental impact, it is not easy for city policymakers, buyers and consumers to determine the best circular initiative to support or the best circular product to purchase. The ranking of R-strategies is inconclusive in this regard. In fact, high-quality reuse of a niche product may yield less sustainability gains than a bulk product made from recycled raw materials. Every case should be assessed by experts, but that is not possible in practice. There is clearly an increasing need for a checklist, quality mark or quality label that is not too complicated.

In addition to the need for criteria that can help in choosing the best circular solution, policymakers need indicators that provide insight into the progress made towards a circular economy. At first glance, this seems simple: less use of primary raw materials and less incineration of waste means a more circular economy. The point is, however, these are not goals in themselves but ways to mitigate raw material supply risks, reduce greenhouse gas emissions or halt the loss of biodiversity. Furthermore, it is not expected that policy measures will have clearly observable effects on the use of raw materials or its impact in the short term. It is therefore important to also look at which effects of policy measures can already be observed, in particular with regard to the basic conditions for a circular transition. This offers the opportunity to adjust policy in a timely manner. The Netherlands Environmental Assessment Agency has developed an approach for monitoring the circular transition at national level that also appears to be useful at urban level (see Figure 3).

Figure 3. The Circular City Indicator Set (https://circulairestad.nl/wp-content/uploads/2018/10/Indicatoren-set-City-Deal-Circulaire-Stad-2.pdf)

- **Status indicators,** describe the state of the circular economy
    - Examples: import and use of raw materials, volume of waste streams
- **Impact indicators,** describe the impact on key goals
    - Example: CO2 emissions, Environmental Cost Indicator
- **Process indicators,** describe the conditions for the transition
    - Example: new circular business models, number of circular jobs

Local Policy for Circularity

Policy Goals and Instruments

Compared to policy in the field of energy transition and climate adaptation, the policy for the circular transition is recent. For example, the EU's first Circular Economy Action Plan dates from 2015. Hard, concrete targets for the circular economy are currently still lacking in European policy. They do exist in Dutch policy however. In the government-wide programme for the Netherlands Circular 2050 (2016), the government has formulated the ambition to achieve a fully circular economy by 2050. The aim for 2030 is to halve the use of primary abiotic raw materials (minerals, metals and fossils). Unlike with energy transition or climate adaptation, for example, no binding agreements have been made with regional and local governments in the Netherlands about circular policy goals.

Nevertheless, most municipalities have developed local policy in the field of the circular economy. This includes the so-called best effort obligation that municipalities have with regard to circular procurement and waste separation and recycling. In addition, the themes of circular construction and sharing platforms are popular. In the Netherlands, the most developed policy for urban circularity can be found in Amsterdam, where the strategy Amsterdam Circulair has the same goals at the urban level as the national policy: 50% less consumption of raw materials in 2030 and 100% circularity in 2050. An implementation programme is linked to the strategy with concrete projects, and a monitor has been developed specifically for the Amsterdam metropolitan region to assess the progress of the circular transition.

The policy instruments to kick-start a circular transition are considerably more limited for local governments than at national or European level. However, a local government does have direct influence in a number of areas, which is reflected in the roles and areas of focus that are most often found in local policy. This concerns the themes of waste management, management and design of public space, management and development of municipal real estate, municipal tendering and procurement, and construction projects and area development. In the case of the first four themes, the municipality is responsible for policy, owner or client; and in the latter case, the influence is via environmental zoning plans and building permits. In all these roles, a municipality can set requirements in the field of circularity. Moreover, there are good opportunities for synergies with other sustainability transitions, such as a circular approach in making the built environment climate-neutral or in the climate-proof design of public space. However, companies and private households make up the largest part of the local economy, and municipalities have little or no direct influence on the circularity of their production and consumption. However, many municipalities choose to be active in this area as well. This involves raising awareness, exploring opportunities and stimulating and facilitating initiatives; for example, by organising information meetings, setting up platforms and bringing parties together, providing subsidies and making voluntary agreements. Often, one or a few areas are chosen that play an important role in the local or regional economy and seem to offer good opportunities for circularity (see Figure 4).

Figure 4. Strategy Amsterdam Circulair (Municipality of Amsterdam, 2020) [2]

As a municipality, we focus on three value chains: Food & Organic Residual Flows, Consumer Goods, and Built Environment. We have chosen these three value chains because of their economic significance for the city, their impact on the environment and climate and the possibilities of the municipality to exert influence, for example on the collection of organic waste and disposed consumer goods.

- **Food & organic residual flows -** This value chain was chosen because our food supply has a major ecological impact.
- **Consumer goods** (electronics, textiles and furniture) - We chose consumer goods because they contribute to the depletion of rare resources, their production is polluting and often takes place under poor working conditions, and they have a huge impact on climate change.
- **Built environment -** This value chain was chosen because the municipality itself decides on how public space will be used and what will be built where. Moreover, the municipality itself is a major user of buildings. At the same time, there is a lot of potential to deal better with raw materials and materials in the construction industry. Therefore, there is a lot to be gained here.

Progress and Challenges

In the Netherlands, the progress of the transition to a circular economy is monitored and evaluated annually at national level. In 2022, the conclusion was that 'although the use of raw materials has increased in efficiency, the extent of that use in the Netherlands has hardly changed since 2010. The policy efforts to date have laid a foundation and developed a structure for a circular economy in the Netherlands, but the Dutch economy still mainly functions in a linear manner. Research and innovation are for the most part technological in nature and mainly focused on recycling and repair. There are hardly any initiatives in the field of socioeconomic innovations, such as changing consumer behaviour or new business models, that are necessary to enable other circularity strategies. We also note that policy intensification is necessary to realise the government's ambitious ambitions for 2030 and 2050' [3,4]. The latter means that, in order to really get the transition off the ground, there must be more binding policy in the form of regulations and levies.

At the urban level, Amsterdam is a leader in circular policy and also monitors policy impact. A first, still limited, evaluation was conducted in 2022. Here too, the conclusion is that at the current stage, work is mainly being done 'on the right preconditions to move towards a circular economy' [1]. An important aspect of this is that the municipality of Amsterdam has incorporated circular methodologies and standards into its own ways of working. Effects on material flows in the Amsterdam economy are not yet visible, however. On the contrary, the city's total material consumption seems to be developing in line with the urban economy and has actually increased. The share of circular jobs is only slowly increasing and is less than 7%. The projects mainly reach front runners in circularity and not yet the main pack. The ambition of halving primary material consumption by 2030 does not seem feasible with these trends. Here too, the conclusion is that 'more pressure and coercion' is needed to be able to scale up. With regard to the role of the municipality in the transition, the recommendation is to

concentrate on its own sphere of influence where the greatest impact can be achieved. In concrete terms, this involves using the purchasing power of the municipality as a so-called launching customer for innovative circular initiatives and products.

Both the national and Amsterdam's local evaluation come to the conclusion that the circular transition is still at an early stage, and circular initiatives constantly collide with the prevailing linear system. Without a change in this system, which consists of rules and norms, but also attitudes and habits, the circular economy cannot really develop. The 2021 national evaluation lists the most important system obstacles as:

- insufficient pricing of environmental effects;
- secondary markets are not working well yet;
- administrative burdens and concerns about image;
- lack of formal requirements and standards;
- restrictive laws and regulations;
- licensing is often difficult;
- consumers have difficulty adapting their behaviour;
- consumers are still not very open to circular products and services.

Naturally, the aforementioned obstacles also play a role at the local level. In addition, municipal authorities experience challenges that are more characteristic of the local scale:

- **Dependence on national and European laws and regulations.**
  Not only are there many rules that hinder the development of a circular economy or rules that promote it are lacking, local governments cannot make any changes in these rules themselves.
- **Shortage of expertise in municipalities.**
  The economy, also at a local level, consists of a great diversity of industries. Stimulating and facilitating this in the direction of a circular economy requires a high level of expertise, while knowledge of industries is not an area that is traditionally well-represented in municipal organisations.
- **Costs and benefits often do not lie within the boundaries of a local initiative.**
  A good example of this is the local production of circular products through urban agriculture where less CO2 is emitted in the production chain than before because much less transport is required. However, the consequence is that the decrease in emissions takes place outside the city, while within the city it may even increase due to local production activities.
- **The circular economy does not solve local problems.**
  In contrast to climate adaptation or the electrification of urban transport, the transition to a circular economy does not lead to a noticeable improvement in the lives or living environment of the inhabitants. The problems that are solved with it occur at a higher scale level or elsewhere. It is therefore difficult for local authorities to actively involve citizens in circular initiatives on a large scale.

In conclusion, given these challenges, it seems sensible for municipalities to concentrate, also in terms of expertise, on those areas where they can exert direct influence: circular municipal procurement and tendering, waste management and circularity of the built environment. Insofar as residents are (or should be) involved in this, circular goals can best be combined with social goals or improvement of the living environment. For making companies circular, local governments can better leave the initiative to the sectors or national actors. A brief summary of the recommendations given throughout this policy brief can be found below.

- A circular city in the sense of a fully circular economy on a local or regional scale is not a realistic possibility.
- Local policies to minimise the use of primary raw materials and the associated environmental impact should not focus solely on the volume or weight of processed raw materials, but on the environmental impacts that have the highest priority.
- In addition to the importance of a material or product group in the local economy and its environmental effects, the influence that a municipality can exert on it should also be considered.
- Local governments have most direct influence on waste management, management and design of public space, management and development of municipal real estate, municipal tendering and procurement, and construction projects and area development.
- Activities in areas where municipalities have much less influence, such as production and consumption of consumer goods, can focus on raising awareness, exploring opportunities and stimulating and facilitating initiatives.
- Recent evaluations have shown, both at the national and local scale, more binding policy in the form of regulations will be needed to really get the transition off the ground.
- A checklist, quality mark or quality label that is not too complicated for urban policymakers to determine the best circular initiative to support is still lacking. The ranking of R-strategies is inconclusive in this regard.
- Indicators to measure the progress made towards a circular economy should include: status indicators, describing the state of the circular economy; impact indicators, describing the impact on key goals; and process indicators, describing the conditions for the transition.

1. Municipality of Amsterdam (2022). *Circular Economy Programme: Lessons and Recommendations 2020 – 2021.*
2. Municipality of Amsterdam (2020). *Amsterdam Circular Strategy 2020-2025.*
3. PBL (PBL Netherlands Environmental Assessment Agency) (2021). *Integral Circular Economy Report 2021.* PBL publication number 4124, The Hague.
4. PBL (PBL Netherlands Environmental Assessment Agency) (2022). *Progress Report Circular Economy 2022.* PBL publication number 4470, The Hague.

05

Regenerative Economics for Planetary Health and *Thrivability*: The European Green Deal.

Anneloes Smitsman and Pim Martens.

Maastricht University College Venlo.

Introduction

In March 2020, the European Commission adopted the EU Circular Economy Action Plan (CEAP) as one of the main building blocks of the European Green Deal, Europe's leading agenda for addressing the multiple complex crises we see today [1]. This policy brief explains the importance of regenerative economic principles for achieving climate neutrality by 2050. Furthermore, we offer a perspective on why mainstream economic systems are unsustainable by design; as they are a legacy of the earlier mechanistic paradigm of the Industrial Age dominated by Newtonian sciences and Darwinian economics. We will explore how a mechanistic approach for societal and human development leads to economic growth models that operate at the cost of vital planetary boundaries and social ceilings; as such, undermining the planetary health conditions on which all life on Earth depends.

Furthermore, we offer a complete overview of the circular economy principles and explain why circularity principles need to expand through regenerative principles in order to achieve the transition to post-carbon economies. We also emphasise the importance of the human factor in sustainability transitions which tends to be undervalued in many of the mainstream circular economy models. Yet, more fundamentally, we address how the Circular Economy Action Plan needs to go further by addressing the underlying economic growth models and their systemic barriers [2,3].

To support policymakers and sustainability leaders, this brief includes several Living Systems Protocols from the EARTHwise Constitution for a Planetary Civilization[1] to explore how to transition to regenerative post-carbon economies where growth is decoupled from use of resources. In particular, how to shift economic design as extractive GDP growth machines within a free-market environment to economies as complex living systems embedded within vital planetary and social carrying capacities [4,5].

Finally, we conlcude with reflections for a larger global vision based on collective so-called *thrivability* for people, planet and future generations. We invite decision-makers, influencers, thought leaders and think tanks to embrace a planetary health and thrivability perspective, which goes further than including natural capitals and ecosystem services as costs and assets in economic models.

Transition Challenges and Global Trends

To remain below 2ºC global warming and stay within safe planetary boundaries, all foundational sectors of a low-carbon society have to be architected, explored and implemented with regard to energy, food, production, resources, transportation, healthcare, defence and human consciousness. Although this task may seem daunting and slow, it offers unprecedented opportunities to collectively build the new post-carbon civilisation. To do so successfully necessitates radical new approaches based on a holistic understanding of life and the universe [6]. Furthermore, it requires exploring how technology, especially when linked to human potential and evolutionary systems design, can help accelerate the sustainability transitions to post-carbon economies [7,8].

Climate scientists Armstrong McKay et al. (2022) recently published an updated assessment of the most important climate tipping elements and their potential tipping points. Their research outlines how our world is on the brink of five disastrous climate tipping points while we are heading towards 2-3ºC of global warming. Population growth and unsustainable resource usage (production and consumption) are exacerbating already existing geopolitical security risks and increasing the likelihood of wars and conflicts.

Underlying these global trends is a common factor, namely, the mechanistic growth models and worldviews of the Industrial Age. Mechanistic growth models are characterised by singular goals, dualistic drivers and imposed objectives that are decoupled from the evolutionary process of life [9]. In other words, mechanistic systems behave contrary to living systems. Mechanistic growth models became standardised during the Industrial Age as the engines of the economies for driving rapid technological development and the industrialisation of the Western world [4].

To better understand the root causes of the sustainability crisis, we need to understand the scientific worldview of the Industrial Age which was based on Newtonian sciences that studied the laws of the universe like a deterministic machine (hence the term mechanistic). The Newtonian scientific worldview was not limited to the physical sciences, as it was simultaneously adopted by social scientists, economists, politicians, the judiciary and policymakers who sought ways to better govern and control a world of seemingly separate entities that compete for survival [10].

1. The EARTHwise Constitution for a Planetary Civilization, by Anneloes Smitsman, serves as a Compass and Social Contract for co-creating thrivable worlds and futures with the wisdom and capacities of living systems. For more information: https://www.earthwisecentre.org/constitution

The economies of the Industrial Age developed on the backbone of the politics of domination. Economic exploitation through rapid extractive economic growth is easier to rationalise when one lives in a mechanistic worldview. The classic economic paradigm has now reached its growth limit. The climate and biodiversity crises will not resolve unless we fundamentally redesign our economic and governance systems [11]. Although it has become common knowledge that business as usual undermines the planetary conditions for present and future generations—causing ecosystemic collapse—its economic trajectories have not slowed down.

To shift those trajectories from collapse towards regeneration and thriving, courageous political and economic leadership is imperative [12]. Unfortunately, policymaking is lagging globally [13], and increasing wealth inequalities and social polarisation reveal even larger leadership gaps. The World Inequality Report 2022 states that, 'The richest 10% of the global population currently takes 52% of global income, whereas the poorest half of the population earns 8.5% of it. Global wealth inequalities are even more pronounced than income inequalities. The poorest half of the global population barely owns any wealth at all, possessing just 2% of the total. In contrast, the richest 10% of the global population own 76% of all wealth' [14].

To stop runaway climate change and mass extinction, systemic investments are required in solutions that make the sustainability transitions feasible [15]. Europe is at the leading edge in providing solutions for these global trends. Sustainability leadership and policymaking for regenerative post-carbon economies require awareness of the challenges of sustainability transitions. We have summarised some of the key challenges below with recommendations for policy designers, sustainability leaders and decision-makers:

1. **Strong commitments are required by governments, industries and corporations to resolve the sustainability crisis.**
   This requires using and trading energy and resources regeneratively, i.e., within planetary boundaries [16].
   a. Implement scientific sustainability targets that are based on systemic thresholds and allocations for monitoring the energy and resource transitions necessary for achieving the European Green Deal.[2]

2. **Policy implementation for biodiversity regeneration and sustainable development is lacking.**
   Leading industry groups representing some of the world's largest companies have delayed many biodiversity related policies and key actions for the energy and resource transition.[3] Furthermore, biodiversity issues are to be understood and governed as part of the resource nexus of sustainability.[4]
   a. Develop genuine public-private partnerships for building sustainable business cases on the basis of the resource nexus of the energy transition and focussed on transforming the systemic barriers that hinder successful transitions.[5]
   b. Translate the resource nexus in a meaningful way to corporate sustainability governance and investment opportunities.

2. The proposed EU benchmarks and sustainability targets do not yet include measurements based on sustainability thresholds and allocations as is now proposed by the 2022 UNRISD SDPI Indicators for Authentic Sustainability Assessment through science-based targets. For more information, see Ralph Thurm of r3.0 - https://bit.ly/3ikrsuu.
3. According to a 2022 pilot study demonstrating Industry Associations' Engagement on Biodiversity-related Policy and Regulations, researchers found that 89% of engagement by leading industry associations in Europe and the US are designed to delay, dilute and block progress on tackling the biodiversity crisis which scientists say is as serious as the climate emergency.
4. Resource nexus assessments, in the context of the European Green Deal, analyse the direct and indirect interconnections between different natural resources, their management, use and governance, as well as the synergies and trade-offs that can be generated through policy interventions.
5. As a word of caution, public-private partnerships in Europe have often been used to maintain vested financial interests in business as usual, and thus require measurable accountability commitments toward planetary regeneration and economic action for safeguarding collective thrivability. To avoid greenwashing, civil society will need to play a watchdog role by insisting on transparency and proof of action based on sustainability indicators that use a methodology of impacts on thresholds and allocations.

3. **The energy transition and digitalisation of societies increase resource demands of rare minerals and metals.**[6]
   Thirty of these have been listed as critical within the European context.[7] Furthermore, technologies for healthcare and defence also require increasing resource budgets. Control over critical and rare minerals is becoming a geopolitical security issue.
   a. Use resource transition monitoring systems based on resource budgets and allocation mechanisms for managing geopolitical risks and assessing the resource dependencies of technologies and material productions and consumptions.

4. **The energy transition focusses on limiting global warming; however, this increases demand for rare metals and minerals used in many renewable technologies.**
   The European energy transition for becoming climate neutral by 2050 cannot be achieved without a sustainable resource transition.[8]
   a. Make the resource nexus of the energy transition visible and manageable through integral sustainability assessments and resource-based risk management monitoring systems for governments, industries and corporations [16].
   b. Create incentives through the European Sustainable Finance policy frameworks and taxonomy for encouraging investments in regenerative solutions that increase geopolitical security and reduce resource dependencies on potential conflict countries.

5. **Socioeconomic inequalities between people and nations are increasing.**
   This adds to growing distrust in existing governance institutions and corporations. Populist groups and authoritarian political leaders are on the rise by exploiting these divisions.
   a. Proactively enhance European security through more inclusive, participatory and decentralised forms of governance. Top-down control and rigid bureaucratic procedures play into the hands of populist groups and separatist political leaders. Communicate from a human-centred and planetary global perspective in ways that restore trust in what unites. Provide a feasible transition plan for a thriving European future, including leadership for planetary health and collective well-being.

Sustainability Policies for Achieving the European Green Deal

The 2020 European Green Deal for reaching climate neutrality by 2050 includes a 10-step action plan which unfolds through the following new policies and regulations:

- **The EU taxonomy** scales up sustainable investment and implements the European Green Deal with classifications for environmentally sustainable economic activities. To further develop this taxonomy a Platform on Sustainable Finance has been tasked.[9]
- **The Circular Economy Action Plan (CEAP)** sets Europe's new agenda for sustainable growth starting in March 2020.
- **Sustainability-related disclosures** ensure that distributors and manufacturers of financial products openly inform investors on the potential impact of sustainability on decisions and financial returns. As of 6 April 2022, the Sustainable Finance Disclosures Regulation (SFDR) specifies the exact content, methodology and presentation of the information to be disclosed. Financial market participants are required to provide detailed information about how they tackle and reduce any possible negative impacts their investments may have on the environment and society in general.[10]

6. According to the International Energy Agency, electric cars (on average) require six times the mineral inputs of a conventional car mostly due to battery production.
7. See the EU Critical Raw Material Act https://bit.ly/3ZV1Ntw.
8. According to IIER, the quality (i.e., density) of copper ore dropped from 2% at the beginning of the last century to 0.5% today. This means four times more ore (and energy) is needed for the same quantity of copper. The implications for global GDP are poorly understood: https://bit.ly/3GOuOyb
9. EU taxonomy for sustainable activities - https://bit.ly/3GHykdu
10. Sustainability-related disclosure in the financial services sector - https://bit.ly/3HeOWuA

- **Climate benchmarks and environmental, social and governance (ESG)** disclosures facilitate the adoption of climate-correlated strategies and put forward higher methodology standards of low-carbon and ESG benchmarks in the EU.[11]
- **The 2022 European Critical Raw Materials (CRM)** Act addresses the resource nexus of the energy transition. In particular, how critical raw materials (CRMs) are the originators of industrial value creation and therefore have a significant effect on downstream sectors. The CRM Act also recognises the strategic importance of reducing European dependencies on potential conflict countries based on a comprehensive CRM strategy.[12]

Implementation Challenges

The European Commission has pledged to mobilise over €1 trillion of private and public sustainable investments over the next decade to achieve the goals set out in the European Green Deal. The Sustainable Europe Investment Plan (2020) has been created to enable the transition to a climate-neutral, green economy. However, the PwC EU Green Deal Survey of 2021 indicates that most businesses (60% of the 300 companies who took part in this survey) are unfamiliar with the EU Green Deal and many are unprepared (51%) and lack a comprehensive strategy to respond to its implications [17]. Whilst some of these numbers may have shifted today, it still reveals a significant policy gap concerning implementation at corporate levels.

To support the uptake of the European Green Deal, we highly recommend close collaboration between policymakers and businesses. In particular, to help translate the relevant EU policies and frameworks to a business-user perspective. For Europe to become climate neutral by 2050, an even greater economic and societal transformation is required than what took place at the onset of the Industrial Age. The EU is starting to implement a Carbon Border Adjustment Mechanism (CBAM) starting in October 2023, with the aim of reducing emissions 55% by 2030.[13] The CBAM will put a carbon price on selected imports to ensure that emissions reductions in Europe contribute to a global emissions decline. CBAM targets imports of products in carbon-intensive industries with the aim to prevent European post-carbon efforts from being undermined by increasing emissions outside its borders through relocation of carbon-intensive productions to non-EU countries.
Sustainability policies, such as the EU Green Deal and Circular Economy Action Plan, can serve as key leverage points for building regenerative post-carbon economies. However, it is important to keep the focus on the larger global perspective and encourage industries and businesses to go further than compliance. Sustainability leadership begins from within and is a transformative learning process [2]. Creating new business models that are regenerative by design goes much further than aiming for mere sustainability or circularity.

Rather than taking the compliance route, take a more proactive systemic leadership approach:

1. Make the transitions from degenerative industrial economies to regenerative life-sustaining economies feasible.
2. Meet human and societal needs without sacrificing the needs and rights of future generations and the Earth.
3. Shift from compliance and minimum harm to creating value for maximum goodness based on evolutionary principles of life [4,6].

11. EU labels for benchmarks (climate, ESG) and benchmarks' ESG disclosures - https://bit.ly/3wbfcQp
12. For more information see - https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_22_5523
13. See https://bit.ly/3ktGCyw /
14. The United Nations Research Institute for Social Development (UNRISD) has improved the benchmark for sustainability assessments through new Sustainable Development Performance Indicators (SDPIs), 2022 - https://sdpi.unrisd.org/

From Sustainability Compliance to Leadership for Thrivability

The core tenet of sustainable development is about meeting the needs of present generations without compromising the ability of future generations to meet their needs [18]. Economic exploitation of natural resources and their ecosystems have played a key factor in wars and conflict and continues today. Future-facing leadership goes further than mere sustainability, which the European Green Deal acknowledges by including elements of regeneration. The next step after regeneration is thrivability which is always ecosystemic. Our working definition for thrivability is: our innate ability to develop our capacities and actualise our potentials in ways that are generative, life-affirming and future creative [19].

This paradigm mind shift, to move from sustainability compliance to regeneration and thrivability, is especially important for policymakers, business leaders and economists. It is time to radically change the ways we think about economies [4]. Below, some further food for thought to embark on this paradigm shift:

1. Economies are complex living systems with multiple interwoven collective intelligences and feedback loops—human, ecosystemic, technological (AI), etc...
2. Life creates conditions that are conducive for life; enabling collective well-being, prosperity, evolutionary development, new futures and planetary health.
3. Growth and development need to remain responsive to ecosystem feedback of planetary and social carrying capacities.
4. Regenerative economies support and improve the carrying capacities on which our lives depend.
5. Regenerative economies are diverse and responsive. Aiming for one single European circular economy that is regulated through policy and taxonomy is not regenerative.
6. Nature experiments through diversification and nested collaborative networks. Nature creates capacities for ecosystemic wealth.
7. Networked ecologies enable the creation of new futures which is the underlying premise of systemic thrivability.

Transitioning to regenerative and distributive circular economies requires indicators and systemic monitoring systems that are designed on the principle of thresholds and allocations [20,21]. To our current knowledge, such indicators[14] are not yet part of the European Green Deal or the new European taxonomy. Companies, investors, and industries require access to these kinds of sustainability assessments to better govern their sustainability impacts.

As explained by Baue and Thurm [20,21], ESG is not offering context-based sustainability targets and assessments, and can thus not deliver on the premises it sets out. In fact, according to the duo, ESG merely legitimises greenwashing [20-22]. To summarise:

- Set higher (more integral) goals from a planetary and future-thriving perspective—make the shift from sustainability to thrivability feasible.
- Create policy implementation mechanisms for attracting critical business engagement and financial investments in the energy, resource and human transitions for post-carbon regenerative economies.
- Work with science-based sustainability and biodiversity targets (based on thresholds and allocations).
- Use transition incentives for attracting investment and business buy-in; i.e., subsidies, tokenisation, and a responsive, inclusive and distributive taxonomy.
- Use integrative monitoring systems and governance tools that are based on scenario planning of current and future usage of renewable and non-renewable resources. These must take into account natural capitals and ecosystem services, resource dependencies of renewable and digital technologies and resource-based geopolitical security risks.

From Circular to Regenerative Economies for Planetary Health and Thrivability

Planetary health is a complex process which requires understanding and respect for how boundary conditions and tipping point elements of planetary and social systems interact. By learning how to work with (rather than against) the evolutionary process of life [23,24], we learn how to work with complexity in a life-affording way [4,6,19].

Planetary health has always been the foundation of sustainable development. However, in many countries the sustainability debate has been hijacked by industries and governments who make sustainable development subordinate to the dogma of unlimited economic growth at the expense of planetary health [25]. To illustrate the consequences of this shortsighted focus, the multiple outbreaks of zoonotic diseases are indicative (with the coronavirus as one of the latest examples). Furthermore, unlimited economic growth is the root cause of the worsening climate crises and the global decline of biodiversity [26,27]. Planetary health is vital for human thriving. Positive, life-affirming, regenerative and future-enhancing development is therefore imperative.

According to the Ellen MacArthur Foundation, one of the leading organisations in the circular economy movement, the circular economy is based on three main design principles [28]:

- eliminate waste and pollution;
- circulate products and materials (at their highest value);
- regenerate nature.

The Ellen MacArthur Foundation further outlines how these principles are underpinned by a transition to renewable energy and materials, whereby 'a circular economy decouples economic activity from the consumption of finite resources. It is a resilient system that is good for business, people and the environment' [28]. Circular economies combine technical and biological materials. Technical materials, such as rare earth metals and plastics, will need to be recovered in production and fed back into the economy, whereas biological materials can be recycled and are biodegradable.

Practitioners who work at the forefront of regenerative economic design, such as John Fullerton, Daniel Christian Wahl, Bill Baue, Ralph Thurm, Kate Raworth, Morris Fedeli, Peter Purcell, Jessie Henshaw and Hazel Henderson, to name just a few, have been advocating that circular economies do not guarantee regenerative or thrivable outcomes. Below are some of the main critiques for explaining why circular economies are not regenerative by design and do not guarantee thrivability:

- Circular economies do not incorporate the human factor, instead they merely focus on life cycles, resources (production and consumption) and energy usage. This ignores the vital social and human dimensions of economies, including equity, well-being and evolutionary development.
- Circularity does not imply regeneration or thrivability. There are cases where purchasing new, more energy efficient equipment or entirely new carbon neutral technologies can lead to more sustainable and regenerative outcomes [21].
- Design for regeneration and thrivability is about aligning with the evolutionary process of life on our planet. As such, creating conditions for planetary health, collective well-being and evolution for generations to come [2,5]. This goes far beyond using circular principles for natural resources in production and design.
- By design, circularity of resources goes against the second law of thermodynamics, which indicates how systems become more entropic over time, and how biological processes are irreversible [21,29].

15. See John Fullerton's eight Principles of Regenerative Economics - https://bit.ly/3GQo2YB

- Regeneration is cyclical and not just circular. As such, circularity does not guarantee regeneration[15][29].
- Regenerative economics for thrivability invites participation in the making and transformation of our economies as an evolutionary learning process and provides reinforcing feedback loops and attractors for the collective caring of our planet and bioregions. Circular economies tend to exclude this dimension of societal learning and engagement.
- Circular economics is predominantly a technological macroeconomic policy framework that is materially focussed, without sufficiently addressing the underlying human factors and inbuilt imperatives for continual (and expansive) economic growth [20].

Finally, Baue and Thurm [20,21] offer an important distinction between cyclical and circular design principles. In their words, 'We see a Cyclical Economy also being a Sustainable and Regenerative Economy that operates within the carrying capacities of the multiple capitals, and within the thermodynamic demands of dynamic equilibrium between a population and the resource thresholds for meeting its needs, on a bioregional basis' [21].

Economies as Complex Living Systems

To shift from circular to regenerative economics for planetary health and thrivability, we need to treat economies as complex living systems. The evolutionary principles of living systems offer essential guidelines for how to work with the complexity of life. To illustrate this, we offer the following three articles from Article 6 the EARTHwise Constitution for a Planetary Civilization, which serves as a compass for applying the wisdom of living systems for societal transformation [6]:
Article 6.3 Honor Systemic Boundaries and Cycles—Living systems grow and mature through circulatory flows, metabolic processes, life cycles and systemic boundaries. Be as nature, become regenerative and thrivable by design.

6.3.0 Apply living system principles to the design and development of our political, financial, economic and educational systems, as well as for guiding how we learn, grow and collaborate.
6.3.1 Listen to the feedback of living systems, planetary boundaries, sustainability thresholds, ecological ceilings and social foundations. Make this feedback visible, meaningful and relatable for decision-making and storytelling.
6.3.2 Stop and transform activities that harm circular flows, life cycles and systemic boundaries. Design for zero-waste, thrivability and planetary wellbeing.

Article 6.9 Address Systemic Thrivability Barriers—Human systems that mechanistically operationalise goals, objectives and activities at the expense of living systems are unsustainable by design. Mechanistic systems create systemic thrivability barriers that undermine the necessary solutions, resources and capacities for thrivable worlds and futures and the maturation of human consciousness.

6.9.0 Reveal and take responsibility for systemic blind spots that are rooted in mechanistic thinking, dualistic bias and separation dynamics.
6.9.1 Diagnose and make visible the presence and impact of systemic thrivability barriers that result from mechanistic systems, including blocked collaboration, lack of reciprocity, blocked empathy and love, little to no responsiveness to pain, harm to interdependencies, distorted informational loops and lack of capacities for regeneration and thrivability.
6.9.2 Address systemic thrivability barriers through strategies that transform the underlying mechanistic growth archetypes and their operationalisation through dualistic polarisation, win-lose competition and extractive expansive growth without systemic boundaries.

Article 6.11 Invest in the Fertility and Abundance of Life—The universe enables planetary abundance through the fertility, health and evolutionary capacities of living systems which evolve as collaborative communities of life. Make true wealth a planetary and economic incentive by incentivising systemic

health and collective wellbeing. Allocate and distribute resources equitably. Invest in the health and fertility of planetary and social ecosystems and stop what undermines this.

6.11.0 Commit to true wealth by integrating multiple forms of capital that contribute to whole system value—including natural, social, relational, cultural and spiritual forms of capital. Apply true costing, true pricing and true value accounting by including the costs of negative externalities and the value creation of ecosystem services.

6.11.1 Apply ecosystemic growth archetypes, patterns and algorithms that are designed for true wealth creation and inclusive, equitable and distributive value allocation.

6.11.2 Stop ecological bankruptcy by making the pursuit of unlimited material growth obsolete and undesirable. Promote ecological economies that add more system value than they extract and strengthen the carrying capacities of vital ecosystems.

Indigenous Wisdom for Economies of Life

Finally, we would like to offer the following indigenous perspectives and wisdom which call for a life-centred and stewardship-based approach to societal transformation and planetary health. Indigenous perspectives are holistic and offer an economies-of-life approach rather than models for economising life [30]. Indigenous practice tends to be rooted in bioregional development, where limits to economic growth are assessed and honoured through criteria such as: evolutionary integrity, biodiversity, inclusiveness, collective learning, rights of nature, well-being of future generations, equity, stewardship of the commons and planetary health [2,3].

Indigenous practice is based on place-based learning and a reciprocal (rather than utilitarian) relationship with nature [2]. This is in stark contrast to the monocultures of Western globalisation and liberal-market mechanisms or imperialist societies that centrally impose policies and regulations. Many people in Europe have lost touch with their ancestral indigenous roots. However, there is a growing movement in Europe to opt out of the colonial systems that wiped out most of the earlier indigenous European nations. Seeking a return to indigenous principles that are based on our belonging to the Earth. Economies draw resources from the ecologies of life that sustain us. The indigenous principle of interdependence is also a vital principle for policy design for planetary health and collective thrivability. We recommend that European policymakers learn about such indigenous principles to develop a holistic understanding of our societies as complex living systems. Including an expanding understanding of what it means to be indigenous, and how this extends beyond a narrow definition of belonging to a specific indigenous group or culture.

Within indigenous cosmologies and practice, kinship is deeper than mere human interaction and includes the natural world as family[16][31]. Indigenous knowledge does not create a definitive border between human and nonhuman nature, as is common in Western thought. Kinship thus also embraces nonhuman beings as kin. There is a strong understanding that animals are relatives, and some indigenous communities also include flora as kin. Terms such as brother, cousin, grandmother or sister are often used to refer to members of the natural world, including the more common reference to nature and the Earth as Mother Nature and Mother Earth. For many indigenous people, the Earth is honoured as our planetary mother who cares for us and protects us. Indigenous elder John Mohawk explains, 'Mother Earth is a spirit. She is an energy force that shows itself to us in matter, and we call this matter Earth'[17][32].

This relational cosmology of kinship offers serious considerations about the ways we treat the Earth, nature, each other and ourselves. By acknowledging how we are all related and form part of the same larger kinship of life, people are encouraged to treat nonhuman life with the same respect and care as human life [31].

Kinship with life is the foundation for developing a planetary ethics for economies *as* life. From this fundamental kinship perspective, respect and care for Mother Earth demands that we stop using our planet as nothing more than a resource for human flourishing. To become a wise and mature species, we must care for our Earth mother as we would for our human mother. The human treatment of the nonhuman world is an important indicator of the maturation of a culture, a nation and even our species.

Reflections and Summary

Economies form part of the Earth. Human activity always intersects with, and draws from, natural living systems and the planetary ecologies of life. Unfortunately, the majority of human economies impact planetary life in ways that are best compared with harmful viruses and parasites—i.e., extracting and drawing resources from host organisms without reciprocation or regeneration.

The European Green Deal provides a significant policy framework for advancing European economies towards trajectories of sustainability and perhaps even regeneration. It provides an important stepping stone towards a thriving European future; it is however not the road.

It is our hope that this paper will inspire you to take on this quest for a better world and future and discover how to partner life in the design of our societal development. To complete this policy brief, we offer the following thought-provoking questions:

- If you were to start from the premise that life is thrivable and regenerative by design, what new decisions would you make, and how would you prioritise your actions?
- Why does achieving the EU's 2050 climate neutrality target matter to you, and what is beyond this?
- How can your actions, leadership and decisions help halt biodiversity loss and runaway climate change?
- What has changed for you by reading this paper about your understanding of economies and design for regenerative development?
- Do you believe it is possible for Europe to become a regenerative and thriving continent that honours its future generations and the planet as a whole?

Acknowledgements

We thank Mariana Bozesan, Ph.D. for her valuable contribution to this work.

1. Fetting, C. (2020). The European Green Deal, ESDN Report, December 2020 ESDN Office, Vienna.
2. Smitsman, A. (2019a). *Into the Heart of Systems Change.* [Doctoral dissertation, International Centre for Integrated assessment and Sustainable development (ICIS), Maastricht University]. https://dx.doi.org/10.13140/RG.2.2.28450.25280
3. Smitsman, A. (2019b). Transition Plan for a Thrivability Civilisation. Medium. https://bit.ly/3WRlqjX
4. Smitsman, A. (2021). Economy of Life: The architecture of wholeness for an economy that is life sustaining and regenerative In Eds. Klomp, K & Oosterwaal, S. *Thrive: Fundamentals for a New Economy.* Amsterdam: Business Contact.
5. Wahl, D. C. (2021). Circular Economies & Regenerative Cultures. Medium. Accessd on 20 January 2023, via https://bit.ly/3XES20q
6. Smitsman, A. (2022a). *EARTHwise Constitution for a Planetary Civilization.* EARTHwise Publishing, www.earthwisecentre.org/constitution
7. Bozesan, M. (2020). *Integral Investing: From Profit to Prosperity.* Springer, Switzerland.
8. Bozesan, M. (2022). From profit to prosperity. In, *The Impossibilities of the Circular Economy.* DOI: 10.4324/9781003244196-29
9. Smitsman, A., Martens, P. & Laszlo, A. (2019). The Polarization Effect: Healing our Worldviews. Systema 2019, Vol 7 (1). http://www.systema-journal.org/article/view/414
10. Smitsman, A., Patra, S. & Laszlo, A. (2023, forthcoming). Complexity and Uncertainty in a World of Emergence - Part 1.
11. Klomp, K and Oosterwaal, S. (2021). *Thrive: Fundamentals for a New Economy.* Amsterdam: Business Contact.
12. Smitsman, A. & Laszlo, A. Eds. (2022). *The New Paradigm in Politics.* The New Paradigm Symposia Series - Book 1. New York: SelectBooks.
13. The Guardian (2022). The Guardian view on accelerating global heating: follow the science. Guardian Editorial. Accessed 10 January 2022 via: https://bit.ly/3wfIr4L
14. Chancel, L., Piketty, T., Saez, E., Zucman, G. et al. (2022). World Inequality Report 2022, World Inequality Lab wir2022.wid.world
15. Bozesan, M., Kehler, T., & Schulz, T. (2020). *Job Creation through Sustainable Investing Using Human-Centered AI: An Integral Approach.* https://bit.ly/3ilUIRH
16. Sverdrup, H.U. & Olafsdottir, A.H. (2020). System Dynamics Modelling of the Global Extraction, Supply, Price, Reserves, Resources and Environmental Losses of Mercury. Water Air Soil Pollut, 231 (439). https://doi.org/10.1007/s11270-020-04757-x
17. PwC. (2022). EU Green Deal Survey. Accessed 10 January 2022 via: https://www.pwc.com/gx/en/tax/publications/assets/eu-green-deal-tax-report.pdf
18. Brundtland, G. et al. (1987). *Our Common Future: Report of the 1987 World Commission on Environment and Development.* Oxford: Oxford University Press.
19. Smitsman, A. (2022b). Applying the Cosmic Architecture of Consciousness for a New World Paradigm. In, *The New Paradigm in Cosmology.* The New Paradigm Symposia Series - Book 2. New York: SelectBooks.
20. Baue, B. & Thurm, R. (2020a). *Sustainable Finance Blueprint.* r3.0. Retrieved 30 August 2020, from https://bit.ly/31IMJTJ
21. Baue, B., Thurm, R. (2020b). Value Cycles - From Value Chains and Circular. Blueprint 7. Retrieved 10 January 2023, from https://www.r3-0.org/blueprint-7-value-cycle/
22. Thurm, R. (2021). The Big Sustainability Illusion–Finding a Maturation Pathway for Regeneration & Thriving. r3.0 Opinion Paper 1. Accessed 10 January 2022 via: https://www.r3-0.org/wp-content/uploads/2021/04/Opinion-Paper-1-Ralph-Thurm-The-Big-Sustainability-Illusion-March-2021.pdf
23. Capra, F & Luisi P. L. (2014). *The Systems View of Life: A Unifying Vision.* New York: Cambridge University Press. Kindle Edition
24. Laszlo, A. (2001). The epistemological foundations of Evolutionary Systems Design. *In Systems Research and Behavioral Science,* Vol. 18. Pp. 307-321.
25. Martens, P. (2020). *Sustanimalism: a sustainable perspective on the relationship between human and non-human animals.* Global Academy Press, De Bilt.
26. IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. IPCC Sixth Assessment Report by Working Group 2. IPCC. Accessed 22 July 2022 via https://www.ipcc.ch/report/ar6/wg2/.
27. Sachs, J. et al. (2020, August 4). Letter from economists: to rebuild our world, we must end the carbon economy. In, The Guardian. Retrieved from - https://bit.ly/3jdl9nv
28. Ellen MacArthur Foundation. (2022). *What is a circular economy?* Accessed on 10 January 2023, via: https://bit.ly/3iThW1S
29. Fullerton, J. (2015). Regenerative Capitalism How Universal Principles And Patterns Will Shape Our New Economy. Capital Institute. Retrieved 10 January 2023 via: https://bit.ly/3GRqluz
30. Lane, P. (2019a). International Treaty to Protect and Restore Mother Earth. The Four Worlds International Institute. Retrieved 26 January 2019 from https://goo.gl/p3xRtm
31. Lane, P. (2019b). Sixteen Indigenous Guiding Principles for Co-Creating a Sustainable, Harmonious, Prosperous World. Retrieved 4 June 2019 from https://bit.ly/32b5IV5
32. Kemp, A, and Martens, P. (2023). Indigenous spirituality and worldview as an alternative approach to deal with the cause of COVID-19. GC Human Rights Preparedness Blog, January 2023.

06

The Role of Business in the Circular Economy: a Focus on Sufficiency and Regeneration.

Nancy Bocken, Ankita Das and Laura Niessen.

School of Business and Economics, Maastricht Sustainability Institute, Maastricht University.

Introduction to the Circular Economy in Business

The effects of climate change on people and the planet are ever more evident through extreme weather patterns [1] and biodiversity and species collapses [2] which will ultimately affect the way we are able to live. It is also clear that these impacts are human induced - through the way products and services are typically produced and consumed [3]. These challenges to society are unprecedented. For example, human-induced greenhouse gas emissions would need to be at least halved by 2030, compared to 1990 levels, to mitigate further global warming [1] and species and biodiversity collapses [2].

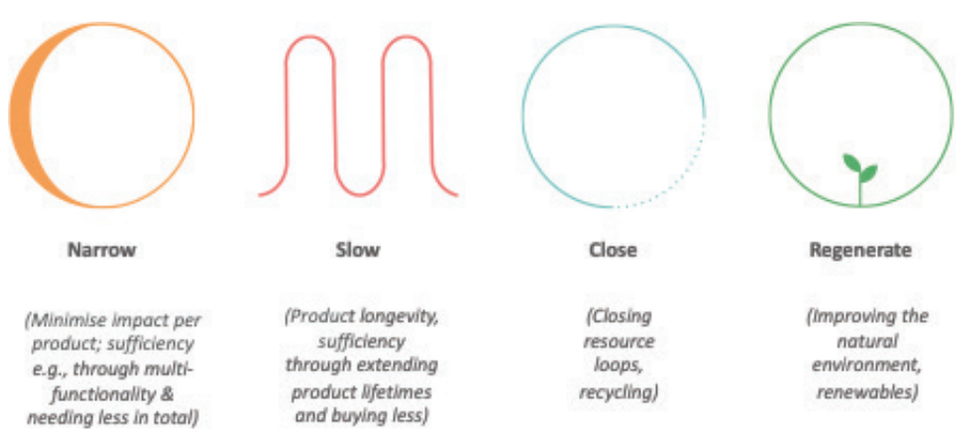
Business is at the heart of the problem; and potential solutions to these issues need to come from it, as it is responsible for dominant linear production and consumption patterns. Businesses can take

control of their own emissions; indirect emissions, e.g., from purchased electricity; and further indirect emissions from their upstream and downstream value chains, including the ways in which products are used by customers and disposed of [4].

An entirely new perspective on business and the economy is needed; where unnecessary consumption and waste are avoided and products and materials are reused, and the economy is fuelled by renewable energy [5]. We need to move from a linear economy, in which materials are extracted to make products that are discarded after limited use, towards a circular economy: a new economic model of production and consumption where waste is eliminated, materials are recycled and nature is regenerated.

Four key circular strategies can be distinguished in the circular economy (see Figure 1). *Narrowing the loop* is about minimising resource use per product, e.g., through efficient design and production processes using fewer resources. In the case of multifunctionality as another strategy to narrow the loop (e.g., a mobile phone that replaces a separate phone, calculator and camera), fewer products in total might be needed, supporting sufficiency or consuming less in total. *Slowing the loop* is about making products that last and ensuring the possibility for product lifetime extension. This strategy would ideally lead to sufficiency, or using fewer products in total over time, because products would last longer. The difference with narrowing and slowing the loop is the time dimension as the impact of the slowing the loop is only felt over time [6]. Closing the loop is about recycling or reusing materials post-consumer. Preferably and where possible, a product is used many times before it is recycled. Finally, *regenerating loops* is about using renewables and restoring the natural environment within which the business operates through, for example, regenerative construction practices.

Figure 1. Circular strategies (Bocken et al., 2016; Konietzko et al., 2020) [6,7]



Why Sufficiency and Regeneration are Important: Less and More

In this policy brief, a case is made for a prominent focus on *sufficiency* and *regeneration* in the circular economy, in particular in a business innovation context. The low-hanging fruit in the circular economy are already being picked: narrowing and closing the loop are the resource strategies prominently pursued by business [8]. Narrowing the loop through efficiency can lead to resource and cost savings at the same time, for example, saving energy saves costs. As for closing the loop, many viable recycling routes already exist for materials such as paper, metal, plastic and glass. Recycling typically does not change the business model of a company very much. For example, consider plastic packaging; it is typically being recycled on a municipal level by other parties than the producer itself. It is therefore not surprising that many large established companies have focused on narrowing and closing the loop

innovations with immediate results and proven or easier innovation approaches [9]. It is important that such strategies continue to be pursued as these can lead to important resource and cost savings. However, the more challenging and potentially highly promising strategies seem to be *sufficiency* and *regeneration*. Why should we pursue such challenging strategies then? Why should they become more common?

First, sufficiency is an important strategy that prevents unnecessary consumption. Sufficiency is at the top of the waste hierarchy, representing strategies such as avoidance, reduction and reuse [10]. This principle of not consuming at all, or consuming much less, is required because affluent parts of society are overconsuming the resources of our planet [11]. While circularity and efficiency gains are crucial for sustainability, sufficiency is needed to outweigh rebound effects and the highly extractive or intensive processes and energy needed for new production and recycling. Hence, sufficiency is essential because of its preventive and corrective character.

Sufficiency is also important because we live on a finite planet, but we strive for infinite growth. This is not possible and leads to unsustainable consumption and production patterns. Furthermore, various studies have shown that prosperity can also be achieved without growth [12], and that owning more things does not necessarily make one happier – on the contrary, it might make us less happy [13]. The dominant growth paradigm has so far delivered socioeconomic value, but the system is starting to crumble with resource degradation and the effects of climate change and biodiversity losses.

Second, regeneration is needed to tackle the damage that has already been done to the natural environment, but also to allow for future adaptation to the unavoidable aspects of climate change. This goes beyond strategies that just focus on minimising harm, and instead actively works towards restoring and regenerating the natural environment. Consider organisations such as Ocean CleanUp whose goal is cleaning up the so-called plastic soup in the ocean; and others such as Patagonia who pursue organic regenerative agriculture to improve soil health. At the product level, regeneration can involve using biobased, biodegradable and/or non-toxic materials that are renewable, and whose decomposition contributes to ecosystem regeneration.

To adapt to climate change, regenerative business principles call for a whole-systems way of thinking that focuses on the health and well-being of the customers, employees, company and organisation [14]. For example, green building facades can be built to absorb pollution and CO2 and have a cooling effect in cities. Moreover, regenerative agriculture applications can help draw down CO2 from the atmosphere into the soil. Another example is alternative packaging startup Notpla that uses seaweed as the raw material for compostable plastic-like packaging [15]. The raw material, seaweed, is a highly regenerative crop and helps improve health of ocean ecosystems and the communities farming them.

However, these strategies are also complex and challenging and need encouragement by policy. Sufficiency in a business context is challenging, as it requires companies to radically transform their business models and incorporate product longevity, high levels of service or warrantees, as well as design for repair, upgrading and multiple product lifetimes. Regeneration is complex as it requires learning new skills and collaboration because topics related to nature and social regeneration typically go well beyond conventional business skills.

Business Strategies for Sufficiency and Regeneration

What can business do to support regeneration and sufficiency? Regarding sufficiency, the business for sufficiency database [16], provides ample examples of companies promoting some form of sufficiency. Although the actual number of companies focusing on moderating consumption is still in the minority [17,18], many examples can be found in sectors such as clothing, furniture and electronics. Typically, these include strategies of long warrantees enabled by product design for durability (e.g., the Fairphone smartphone), or an all-round offering that allows customers to consume more consciously

(e.g., Patagonia's repair service and second-hand offering).

To promote sufficiency, businesses should ask themselves:
- How can we enable the customer to have a lasting product?
- How can we retain and increase our customer base by offering quality over quantity?
- How can we provide access to a product or help fulfil a temporary need without requiring users to buy the product (e.g., through a service model like rental or subscription)?

Regarding regeneration, the work by Polman and Winston [19] on net positive business is highly relevant. They argue that the scope impacts should go far beyond Scope 1 and 2 [4] towards even Scope 3, 4 or 5 emissions, which involve trying to influence consumer behaviour, policy and broader institutional frameworks to protect the natural environment.[18] The work by Hawken [20] provides specific pathways to protect spaces on Earth which could potentially also be supported.

To promote regeneration, businesses should ask themselves:
- How can we do *more good* rather than just *less bad* as a business?
- How can the world be made a better place because our business is in it?
- Who can we collaborate with to achieve these goals?

In Table 1, some key examples for sufficiency and regeneration strategies are found.

18. Scope 1 and 2 emissions refer to direct emissions in company facilities and emissions from energy and gas purchased by the company. Scope 3 emissions refer to emissions from suppliers and customers (the value chain). Polman & Winston (2021) add the terms Scope 4 emissions which they define as 'avoided emissions' (e.g., preventing your suppliers from cutting down trees for palm oil), and Scope 5 emissions, which are about the positive climate lobbies, so the political sphere of influence a business might have.

Table 1. Business strategies for regeneration and sufficiency. Based on: Bocken (2020); Niessen & Bocken (2021); Konietzko et al. (under review) [14,18,21]

Business strategies for sufficiency		**Business strategies for regeneration**	
Examples	**Typical sectors**	**Examples**	**Typical sectors**
• Longer lasting and upgradable	• Clothing • Furniture • Electronics	• Use of renewable energy and materials	• Energy sector • Plant-based compostable packaging
• Quality over quantity	• Food • Clothing • Consumer products	• Regenerative design	• Buildings (facades) • Consumer products
• Design for upgrading and multiple lifecycles	• Furniture • Electronics • Buildings	• Regenerative production	• Agriculture • Food
• Second hand marketplaces	• Household goods • Furniture • Clothing	• Net positive impact – for society and environment	• Any product/ sector
• Frugal innovations (less complex/ resource intense)	• Electronics • Home and garden equipment • Personal care products	• Collaborative platforms to resolve nature-related and societal problems (e.g., ocean plastic, forced labour)	• NGOs/pressure groups, local governments in collaboration with business
• Sharing	• Clothing • Mobility	• Full transparency models that measure and internalise externalities	• Any product/ sector
• Alternatives to materialistic consumption	• Leisure • Travel	• Service providers that support nature regeneration	• Consultancies, governments, NGOs
• Services - not products	• Electronics • Clothing • Mobility		

Policy Suggestions

Policies for Sufficiency

Several of the circular economy policies in the EU Green Deal can support sufficiency on the product/industry level [22]. Examples include:

- the right to repair;
- mandatory spare-parts and upgrades/support;
- product warrantees;
- minimum product lifetimes and banning planned obsolescence.

At the consumer level, it is important to create awareness and provide options to consume more prudently. This may be achieved through policies that, for instance:

- increase awareness about product longevity, repair and maintenance;
- enable repair and maintenance, e.g., tax breaks, as done in Sweden [23];
- discourage unsustainable alternatives, e.g., taxes or bans on premature product disposal or flights (e.g., higher flight tax in Netherlands since 2023 and ban of air journeys in France that can be completed conveniently by train in under four hours).

Policies for Regeneration

Policies for regeneration are in line with guidelines on biodiversity protection [24] and include the increase of protected conservation areas on land and sea. In a business context, this can be in the form of:

- Mandates to internalise negative externalities even further to include pollution, biodiversity and how products are being used by consumers. This means the cost of products and services need to reflect the true cost of manufacturing them.
- Incentivise business practices that use regenerative means in their production and manufacturing processes through, for example, access to innovation funds.
- Promote and enforce transparency in reporting of environmental and social impact of business.
- Disincentivise greenwashing in marketing that uses regenerative claims only superficially.

From a consumer perspective, this can be achieved through policies like:

- Subsidising cost of regenerative products and services in the short-term to raise awareness.
- Awareness campaigns that show how particular buying practices are helping improve nature and society.
- On a more individual level, encouraging contribution to biodiversity in one's own environment (e.g., green spaces in gardens or balconies, planting bee friendly flowers, adopting water retention measures) and local conservation activities.

Concluding Thoughts

The circular economy concept is continuously gaining traction and is here to stay. With its growing popularity, we need a more prominent focus by policy and business on regenerative and preventative strategies: regeneration and sufficiency. For business, the strategy of sufficiency requires experimentation with strategies like longer-lasting, upgradable and multiple life-cycle products, enabled by service-oriented business models or reuse platforms. The strategy of regeneration requires a deeper understanding of the natural and societal ecosystems in which the business is based. We need to understand what impact the business has on these ecosystems, and how they might be impacted

positively. This typically requires new forms of collaboration with governments, NGOs and conservation agencies.
As for policymaking, a myriad of responses is needed to incentivise both business and individual consumers to refocus on sufficiency and regeneration. The EU Circular Economy policies are a good start but require bolder action to disincentivise the most unsustainable linear business models and break through unsustainable consumption patterns. Unsustainable, extractive business models are still the norm rather than the exception [25] and businesses that want to take action and become more sustainable are faced with too many barriers. Similarly, regeneration requires a refocus of policy: business responsibility needs to be extended, so companies are not only asked to do less bad but to do more good.

For each person, the way we consume, eat, and move around matters for our personal footprints [26]. Circular economy policies may push us in the right direction by allowing us to keep products for longer and purchase products from companies with regenerative practices, but this is not enough. Policies are needed that further increase awareness of our role in the transition, showing the impact of the way we consume. We also need to further promote circular business models, taking away current barriers and rewarding sustainability efforts. By laying sufficiency and regeneration as the foundation of new circular economy policies, we can move towards truly sustainable consumption and production patterns, focusing on well-being inside the limits of the Earth.

1. Pörtner, H.O., Roberts, D.C., Adams, H., Adler, C., Aldunce, P., Ali, E., Begum, R.A., Betts, R., Kerr, R.B., Biesbroek, R. and Birkmann, J. (2022). Climate change 2022: Impacts, adaptation and vulnerability. IPCC Sixth Assessment Report, pp.37-118.
2. WWF (2022). Living Planet Report 2022. Accessed 17 January 2022 at: https://livingplanet.panda.org
3. Creutzig, F., Roy, J., Devine-Wright, P., Diaz-José, J., Geels, F., Grubler, A., Maïzi, N., Masanet, E., Mulugetta, Y., Onyige-Ebeniro, C.D. and Perkins, P.E., 2022. Demand, services and social aspects of mitigation. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 752-943). Cambridge University Press.
4. GHG Protocol (2022). FAQ. Accessed 18 January 2022 at: https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf
5. Ellen MacArthur Foundation (2013). Towards the circular economy – economic and business rationale for an accelerated transition. Available from: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf [Accessed 17th January 2023].
6. Bocken, N. M., De Pauw, I., Bakker, C., & Van Der Grinten, B. (2016). Journal of industrial and production engineering, 33(5), 308-320.
7. Konietzko, J., Bocken, N., & Hultink, E. J. (2020). A tool to analyze, ideate and develop circular innovation ecosystems, Sustainability, 12(1), 417.
8. Bocken, N.M.P., Ritala, P. Huotari, P.(2017). The circular economy: Exploring the introduction of the concept among S&P 500 firms. Journal of Industrial Ecology. 21 (3), 487–490.
9. Ritala, P., Huotari, P., Bocken, N., Albareda, L., Puumalainen, K. (2018). Sustainable business model adoption among S&P 500 firms: A longitudinal content analysis study. Journal of Cleaner Production. 170, 216-226.
10. Bocken, N., Short, S. (2016). Towards a sufficiency-driven business model: Experiences and opportunities. Environmental Innovation and Societal Transitions, 18, (41-61).
11. Wiedmann, T., Lenzen, M., Keysser, L. T., & Steinberger, J. K. (2020). Scientists' warning on affluence. Nat Commun, 11(1), 3107. https://doi.org/10.1038/s41467-020-16941-y
12. Jackson, T. (2009). Prosperity without growth: Economics for a finite planet. Routledge, London, UK.
13. Osikominu, J., & Bocken, N. (2020). A voluntary simplicity lifestyle: Values, adoption, practices and effects. Sustainability, 12(5), 1903.
14. Konietzko, J., Das, A., Bocken, N., (under review) Towards regenerative business models: a necessary shift? Sustainable Consumption and Production.
15. Circular X. (2022) Case study: Notpla – Regenerative packaging alternative. Accessed from www.circularx.eu
16. Niessen, L., Bocken, N. (2022) A Sufficiency Business Database as a Tool to Drive Sustainable Business Models. 7th International Conference on New Business Models, 22-24 June, Rome, Italy. https://www.circularx.eu/en/tool
17. Bocken, N. M., Niessen, L., & Short, S. W. (2022). The Sufficiency-Based Circular Economy—An Analysis of 150 Companies. Frontiers in Sustainability, 3 https://doi.org/10.3389/frsus.2022.899289
18. Niessen, L., & Bocken, N. M. (2021). How can businesses drive sufficiency? The business for sufficiency framework. Sustainable Production and Consumption, 28, 1090-1103.
19. Polman, P., & Winston, A. (2021). *Net positive: How courageous companies thrive by giving more than they take*. Harvard Business Press.

20. Hawken, P. (2021). Regeneration: Ending the climate crisis in one generation. Penguin.
21. Bocken, N.M.P. (2020). *Circular Economy: Slowing resource flows and increasing value.* In: S. Eisenriegler (eds). Circular Economy in the European Union. Springer Nature, Switzerland.
22. European Commission. (2019). *The European Green Deal - Communication from the Commission.* COM(2019)640 final. Brussels. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN
23. Dalhammar, C., Richter, J. L., Almén, J., Anehagen, M., Enstroem, E., Hartman, C., Jonsson, C., Lindbladh, F., & Ohlsson, J. (2020). *Promoting the Repair Sector in Sweden.* International Institute for Industrial Environmental Economics, Lund University.
24. OECD (2023). Policy instruments for biodiversity. Available from: https://www.oecd.org/environment/resources/policy-instruments-biodiversity.htm [Accessed 24th January 2023].
25. Bocken, N. M. P., & Short, S. W. (2021). Unsustainable business models – Recognising and resolving institutionalised social and environmental harm. *Journal of Cleaner Production, 312.* https://doi.org/10.1016/j.jclepro.2021.127828
26. Ivanova, D., Stadler, K., Steen-Olsen, K., Wood, R., Vita, G., Tukker, A., & Hertwich, E. G. (2016). Environmental impact assessment of household consumption. *Journal of Industrial Ecology, 20(3),* 526-536.

07

Towards Education for Urban Circular Development in Secondary Education.

Özlemnur Ataol and Darian Meacham.

Faculty of Arts and Social Sciences, Maastricht University.

Executive Summary

Earth dwellers face global climate change caused by atmospheric warming, environmental degradation and ecosystem collapse resulting from unsustainable production and consumption of goods, food and energy. Cities are central to addressing these challenges, as they are ecosystems conflating mass production and consumption. Cities are also social habitats for more than half of the world's population. As cities increasingly face sustainability challenges, there is a growing need for more resilient urban communities as an ongoing process of enhancing the adaptability of citizens.

In that context, circular urban development, in the form of so-called circular cities which adopt six actions (loop, regenerate, adapt, localise, substitute and share; as detailed in Williams [1]), becomes prominent as a means of sustainable development. Circular development attaches a critical role to

the social systems of cities, including the day-to-day lifestyles and actions of citizens; shedding light on those consumption behaviours that directly affect the production system in cities. Hence, it is vital to equip urban dwellers with the necessary knowledge, values and skills to create resilient communities through urban circular development (UCD).

Education for sustainable development (ESD) is a crucial aspect of this effort because it seeks to provide individuals, starting from a young age, with the ability to comprehend multifaceted sustainability challenges (social, environmental and economic) and evaluate the consequences of their actions on both local and global sustainability [2]. By integrating UCD into ESD, young urban citizens can develop critical thinking about their roles and agency in urban production and consumption systems. This will facilitate them towards adopting sustainable lifestyles (as producers and consumers) and becoming well-informed stakeholders in promoting circular development as aligned with SDG #11 (creating sustainable cities and communities).

Based on the emerging literature on UCD, this policy brief begins by answering several questions. First, it presents the idea of urban circularity, responding to the question: What does a circular city do? Next, by expanding on the existing circular development framework designed by Williams [1], which focuses on the operational side of circular development, this policy brief addresses the question: How does circular development proceed? It then conceptualises a framework of UCD that presents a circular development process that is experimental and collaborative; one in which the goal is emergent circular societies supported by local networks and community-led actions, but without yet incorporating justice concerns in terms of benefit distribution and inclusivity.

Further, this brief proposes a conceptual framework of education for urban circular development (EUCD) in response to the question: How can urban circular development be integrated into ESD? EUCD adopts teaching/learning approaches (specifically, holistic and action-based approaches) in ESD that contribute to the experimental, just and locally collaborative nature of UCD. It follows Eilam and Trop's [3] ESD pedagogy which relays four basic iterative principles that build upon each other as steps where each one brings an additional component for reaching the aim of ESD.
According to the proposed conceptual framework, this policy brief concludes by making a set of recommendations for creating an approach to learning/teaching urban circular development. The recommendations focus on enhancing ESD content with different forms of sustainable development, as well as employing an action-based (subject-wise and dimensional) collaborative learning process rooted in the multi-perspective approach.

Introduction

Cities on Earth are habitats for billions of people, more than 60% of the world's population. These centres of human activity are also often referred to as 'resource sinks' [4]. They are ecosystems of mass production (of goods and waste) and consumption (of resources and goods). Cities are responsible for using 60-80% of the world's resources and generating 50% of global waste [5]. In the face of the global climate emergency, the role of cities as hubs for production, creativity, science and human interaction; but also for waste, over-consumption and emissions – drivers of atmospheric warming and environmental degradation – is an urgent and dramatic challenge. Unfortunately, it is no surprise that global climate change will worsen, with catastrophic consequences, unless the current approach of unsustainable production and consumption is abandoned, and cities take action to facilitate the transition to more sustainable modes of urban existence.

The impact of cities and urban dwellers on environmental degradation is not evenly distributed. Wealth and income also play a significant role, with the top decile of earners driving 30-35% of emissions [6]. Even in countries with relatively lower per capita emissions, the concentration of population, production and wealth within urban areas can mean that emissions from these cities are similar to those in wealthier, higher-emitting countries. In this sense, cities constitute a distinct set of challenges for efforts to mitigate global warming and environmental degradation as well as for climate justice

(i.e., a fair distribution of the cost and benefits of climate change mitigation efforts). The fact that production in many cities is oriented towards consumption elsewhere and vice versa further compounds the challenge.

Cities embody two central systems: procurement and social. The procurement system, which pertains to producing goods and services, relies on the producers, such as those in the food and fashion industry, as well as service providers, such as local governments. On the other hand, the social system, which includes communities and their citizens (also known as users) and their urban lifestyles, refers to consumption behaviours. These two systems are interconnected in creating waste but also in paving the way to sustainable futures [7-9]. While cities consist of non-living assets such as infrastructure and buildings, focusing solely on sustainable production is insufficient without a corresponding community-led move towards sustainable consumption and lifestyle.

In this context, there is a growing need to empower citizens by enhancing their capacities toward creating resilient communities that can withstand transitions and ensure the survival and well-being of both people and places through sustainability in transition [10]. There are various city-related sustainability transition approaches, such as eco-cities [11], carbon-zero cities [12] and smart cities [13]. However, 'urban circular development' [14] or 'urban circularity' [15] has emerged as a promising approach to introduce (individual and collective) skills together with urban circular actions that contribute to sustainable development [14].

Callaghan and Colton [16] argue that enhancing the resiliency of communities is a better investment in sustainable futures than chasing the ultimate goal of sustainability. In circular development, providing urban residents with the required knowledge, values and competencies becomes crucial in creating resilient communities. This is in line with Sustainable Development Goal #11 which aims to create sustainable cities and communities. SDG#11 not only entails providing safe, affordable, sustainable and inclusive environments and services, but also involves collective efforts to protect natural heritage and reduce the environmental impact of cities.

Education for sustainable development (ESD) is an important platform for mainstreaming circular development in urban living as it aims to provide individuals with increased capacities to comprehend the multifaceted aspects of sustainability (social, environmental and economic) and to assess the consequences of their choices and actions on global sustainability [2]. Yet, content-wise it also requires some updating in terms of advances or new approaches in the means of sustainable development, circular development being a prime example.

The introduction of circularity and its aspects in secondary education through ESD is particularly important as secondary education marks a threshold for individuals before starting higher education or pursuing a career. Enhanced capacity for holistic, pluralistic and critical thinking on topics of sustainability at an early age allows young people to explore their interests and passions in contributing to a sustainable future. This can also help them develop a sense of independence and responsibility as they navigate the adult challenges of global issues. Developing capacities for circular thinking, design and actions is also a matter of value change. We know from social psychology research that values are incredibly stable at the individual level and 'are mostly shaped by life conditions during childhood, adolescence and early adulthood, through the influence of parents, neighbours, friends, and schools'. This is why the secondary school age group is so important in imparting the values and capacities necessary for this transition [17].

Building on the latest research on circular cities and education for sustainable development, this policy brief aims to make a set of recommendations for incorporating circular development into secondary education curricula by suggesting a conceptual framework of education for urban circular development. To do so, we address three questions:

1. What does a circular city do?
2. How does urban circular development proceed?
3. How can circular development be integrated into ESD?

The focus here is not on specific skills that will be necessary for the development of the urban circular economy across different sectors and encompassing production, consumption and policy and regulation; but rather on the development of a set of capabilities and values that we think underpin specific actions for urban circularity in particular sectors, e.g., construction, food waste management or fashion. This explains our focus on the six circular actions outlined in the next section.

What Does a Circular City Do?

A List of Circular Actions Toward Sustainable Futures

According to Williams [14], circular development in urban settings is 'a new normative model for sustainable urban development' that embraces circular economy principles, commonly applied in industry, in the systems of cities. The circular economy concept is built on three principles driven by system design and redesign through the elimination of waste and pollution, the circulation of products and materials and the regeneration of nature [18]. Adopting a circular model in urban contexts where industry, local governments and citizens are aiming to work towards a zero-waste urban ecosystem entails introducing responsible and sustainable ways of approaching urban resources, such as materials, energy, water and land by matching the two ends of a product or service: its production and its life after consumption.

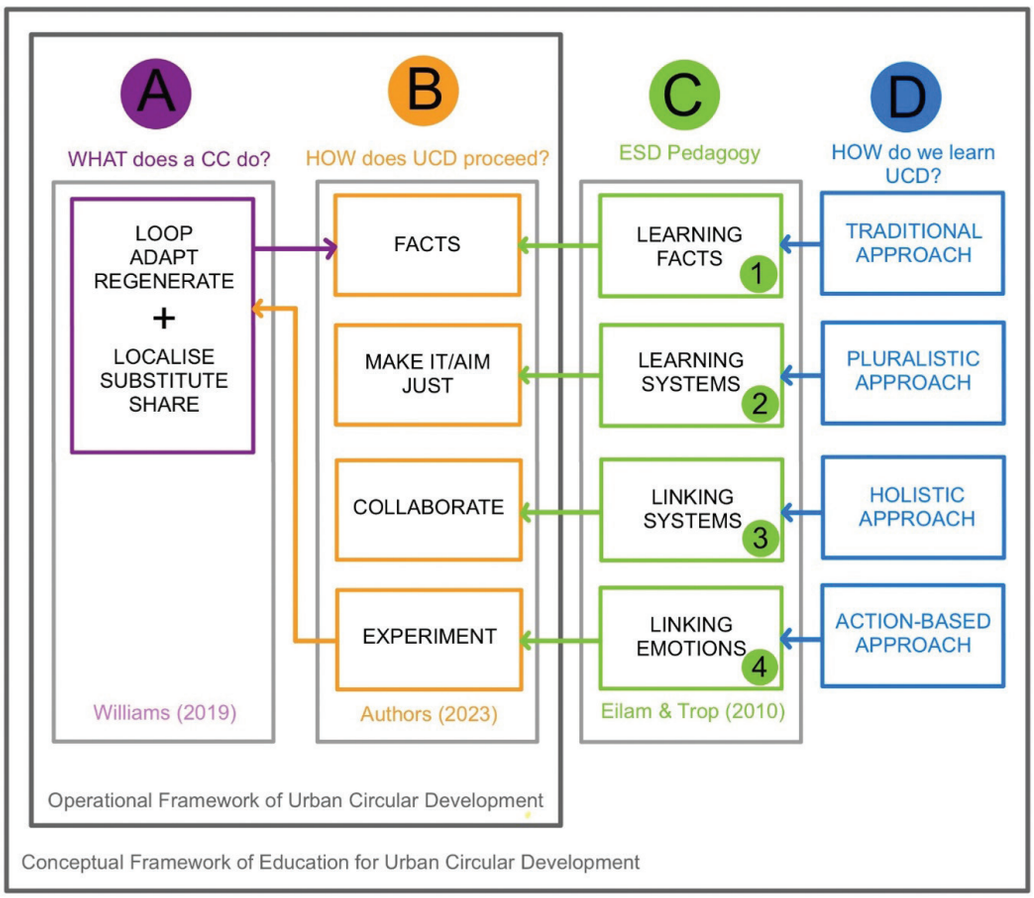
Pioneered by Williams [1], circular economy principles have been translated into urban environments - with the important caveat that cities are more complex ecosystems than industrial systems. Williams' framework outlines six circular actions: loop (RE-actions), adapt and regenerate; and localise, substitute and share (Figure 1, Column A). The objective of looping actions is to close the loop of resources by utilising RE-actions: recycle, reuse, recover, reduce, repair, refurbish, remanufacture, repurpose and refuse (also referred to as 9Rs by Kalmykova et al. [19]). Regenerative actions aim to preserve natural capital and restore the urban ecosystem by implementing permeable surfaces, green roofs, and urban farms and gardens. Adaptive actions aim to plan and design cities to enable adaptation and renewal of existing infrastructure with minimal waste of urban resources. Localisation focuses on developing local symbiotic capital, encouraging collaboration and promoting pro-environmental behaviour. Substitute involves replacing physical with virtual, non-durable with durable and non-renewable with renewable. Lastly, share involves promoting co-existence and waste reduction (also conceived in terms of space, time and skills - not just material waste) by using systems such as co-housing, co-working, and vehicle sharing; and promoting public interest in mobility infrastructure, such as public transportation.

How Does Circular Development Proceed?

An Operational Framework for Circular Development

Next to the discussion on what actions circular cities take toward sustainable urban development, an examination of the emerging literature reveals a somewhat hidden operational framework of circular development (Figure 1, Column B) that includes how circular development proceeds in urban environments. The operational framework of circular development relays that circular cities proceed with circular development in an experimental fashion, opening up new arenas for communities to explore novel, cooperative and locally-led solutions. In particular, those that create fair procedures and fair results where the benefits and costs of circular development are distributed in an equitable manner.

Figure 1. Conceptual Framework of Education for Urban Circular Development



Circular cities are increasingly recognised as more than the accumulation of businesses that adopt circular economy principles in cities [15]. The concept of a circular city is a means of renewing cities and enabling communities to work toward sustainable development goals [14, 20, 21]. This is because circular cities offer a way to experiment with novel processes that facilitate sustainable development. While there has been growing literature on circular cities since the 2010s, there is still limited empirical evidence to validate the concept internationally [22]. Nevertheless, circular cities have demonstrated an experimental front facade as they have narrated a process of learning from failure/success based on the evidence from projects in European cities such as London, Amsterdam, Rotterdam, Barcelona, Stockholm and Paris [7, 14]; as well as from conceptual projects like Masdar City and R-Urban [15].

Achieving sustainable futures through circular development in cities involves promoting various skills that should also facilitate the creation of equal opportunities for all individuals and communities [14]; the concept of just development is thus central to UCD. Nonetheless, due in part to its experimental nature, circular development does not yet serve everyone equally. Just as the costs and risks of environmental degradation are disproportionately borne by the poor in both wealthy and poorer countries, the benefits of circular development can also be subject to inequitable distribution. Williams [14] highlights the unintended consequences of circular development, including disparities in accessing its benefits throughout society, with only wealthy groups and areas benefiting from accessing the natural environment and services of the adjacent ecosystem. Additionally, she describes insecure, underpaid and unhealthy working conditions for low socioeconomic groups due to the informal recycling sector that serves circular development. These examples demonstrate that while circular development potentially intends to create equal opportunities and benefits, it can, in practice, lead to the exacerbation of existing inequalities.

Therefore, an emphasis is needed within urban circular development and education for urban circular development on creating fair procedures and aiming at fair outcomes for everyone. In other words, in order for acceptance to take hold, the social dimension should be given equal weight to the material one. There is emphasis in some of the relevant literature on the potential for circular development itself to become a driver for reducing social disparities while also addressing ecological and economic crises. Fusco Girard and Nocca [20] argue that circular cities require rejecting the trade-off between environmental health and human well-being.

The potential for equal benefits in circular development activities can be leveraged to promote solidarity as happens in locally-rooted circular activities such as food recycling and repair cafés; both of which can benefit everyone, and disadvantaged groups in particular [14]. Achieving circularity for solidarity requires collaborative synergy that is locally driven, engaging both providers and users [15, 23]. To do so, CO-actions such as co-plan, co-design and co-decision are required in both systems [7, 9, 14, 23]. More importantly, community-led circular development initiatives hold significant potential for transformation, as they can drive changes in both production approaches and users' lifestyles, leading to more resilient and circular communities [20]. Community-led actions in circular development can promote accountability and ownership and thereby help build stronger communities. Evident in existing circular city projects run through community-led processes, a future where waste is minimised, resources are conserved, and communities thrive can be achieved [7].

How can Circular Development be Integrated into ESD?

A Conceptual Framework of Education for Urban Circular Development

Responding to the need to integrate circular development into education, this section explores approaches within ESD that support the circular development process and the individual capabilities it requires. This exploration adopts Eilam and Trop's [3] ESD pedagogy as a structure to follow. It involves four steps that build upon each other, with each step adding another component for achieving the aim of ESD (Figure 1, Column C).

The foundation for natural learning is the academic knowledge acquired through a fact-based approach to education [3] (Figure 1, Column C1). This traditional approach is teacher-centred and focuses on delivering subject-related content to learners [24]. As new approaches to sustainable communities emerge and the world becomes more urbanised, it is expected that ESD literature will provide multi-dimensional information on circular development and how it can lead to sustainable development in cities. ESD content, primarily in higher education and to a lesser degree in secondary education, has already been updated with information supportive to urban circularity; for example, content related to consumption habits, biodiversity, social inequality, environmental footprint, green energy, entrepreneurship and local economy [25-28].

The subjects taught in secondary education rooted in social and applied sciences, such as geography, economics, life skills, chemistry, biology and history, can also respond to the urban circularity framework. This is because they individually address the ecological, economic and social aspects of sustainable development. Borg et al. [24, 29] highlight this potential unintentionally in their comparison of the contents, traditions and methods of social science and applied science in secondary education. They state that applied sciences, which follow a fact-based tradition and are taught through traditional methods like experiments and presentations, focus on ecological issues such as renewable energy, conservation and climate change. Conversely, social sciences, which follow a pluralistic tradition, address the social dimensions of sustainable development and focus on issues like poverty reduction, gender equality and human rights. The social sciences are commonly taught through collaborative and cooperative methods like small group research projects, class debates and group discussions.

To establish a comprehensive understanding of sustainable development, learners must comprehend it through pluralistic approaches building on more traditional forms of learning [24]. The pluralistic

approach allows learners to understand different perspectives, views and values from the individual, community and non-human levels and enables them to acquire systems thinking skills [3] (Figure 1, Column C2). Building a society using a pluralistic approach [30] potentially explains the interconnectedness of systems in cities, furthering the concepts of active citizenship and inclusive pluralism [31]. Active citizenship requires democratic exchanges of ideas, evaluation of various perspectives and deliberative communication to establish collective values and norms [24, 31]. The pluralistic approach enhances learners' willingness and capacity to engage in arguments, collaborate with others and explore their contributions, therefore activating urban citizenship. However, the lack of collaboration between subjects, so-called siloing, weakens the distribution of benefits and results in broken or separate insight acquisition from one discipline perspective to another [32].

In other words, for ESD to be effective, an interdisciplinary approach is necessary, as traditions (fact-based, normative or pluralistic) of each discipline individually contribute to ESD pedagogy. The interdisciplinary or holistic approach enables learners to link systems [3] (Figure 1, Column C3), whether they are subject-based (e.g., ecological, social and economic domains of sustainable development) or based on systems of cities. However, the holistic approach is not commonly applied because it requires extra effort and intense coordination between subjects [24, 32, 33]. There are, nonetheless some subjects, such as geography and science, that are commonly considered potential catalysts for interdisciplinary work [32].

Collaboration at the school management level is necessary for the holistic approach to succeed. The Whole School Approach, a model of school organisation, responds to this need by facilitating the interdisciplinary approach, focusing on co-creating knowledge and know-how and providing the required practicalities to implement ESD across curricula as a whole [34]. Although interdisciplinary work can cause tensions between teachers over resources and capabilities [35], it brings higher quality and coherence to ESD pedagogy. It also provides possibilities to expand traditional teaching methods with interdisciplinary, collaborative and action-based methods [24], such as planning community activities which integrate emotion into education [3] (Figure 1, Column C4).

While approaches within ESD help build a conceptual framework of education for urban circular development (Figure 1), applying this framework requires educators' willingness and effort, both potentially affected by operational challenges. While these challenges differ between various subjects [24], most concentrate on logistical requirements furthering the need for collaboration and external support. For example, educators face time constraints [36, 24] and the lack of practical opportunities for experimentation [36], adequate textbooks and inspiring examples for incorporating sustainable development into the curriculum [24, 36]. It is crucial that school management effectively provides teachers with the necessary training and collaborative opportunities [24].

What Should Policymakers Do?

UNESCO has responded to the urgent challenges that the planet faces. Through its education sector for ESD, inhabitants of Earth are empowered to take action toward individual and societal transformation. Yet, sustainable development, a multi-dimensional transformation embarking on a pluriform society concept, faces challenges, such as catching up with new means of sustainable development and their required skills. Accordingly, this policy brief attempts to integrate circular development into education for sustainable development by creating a conceptual framework of education for urban circular development. This framework provides a roadmap for education policymakers that integrates the recommendations below to bring change to sustainability education. The goal is to equip young citizens with knowledge and competences on sustainability in order to build resilient circular urban communities, thus contributing to SDG#11.

- As the world is becoming more urbanised, sustainable development education in urban settings should place a renewed focus on the potential transformation of urban environments towards circu-

lar development as a means toward sustainable futures. For learners living in urban areas, this also has the function of localising the sphere of application of subject knowledge and skill development.

- This can be partially can be achieved through updating ESD content with different forms of sustainable development in urban settings, such as circular cities. This content gap can be first explored via related subjects, such as geography, economics and history, to better understand the disciplines and find integration possibilities.
- The process of updating content also needs to include the (social and procurement) systems of cities, and the role of urban citizens in the functioning of cities within their daily urban lives. The pluralistic approach, built upon the concept of a pluriform society, can potentially explain cities' interconnected (social and procurement) systems; therefore, the dynamics of a pluriform society should be highlighted. The goal in these approaches is to guide learners toward systems thinking from an earlier age through the use of examples and cases that can be concretely interacted with and also intervened in. This entails facilitating a shift from the position of being an outside observer of a system to being a change agent within a system.
- The move towards collaboration between applied and social sciences and the emphasis on the interconnectivity of traditionally siloed disciplinary knowledge is a key element to education for urban circular development. A problem- or challenge-based learning approach to urban circular education requires that input from both applied and social sciences be integrated. This also includes the integration of civics and economics education into the study of urban social and procurement systems at an early stage. This is a challenge, especially for educators, also in higher education, who were themselves educated in a more siloed fashion.
- It is not necessary that educators, especially in secondary education, are well prepared to present knowledge on urban circular development. Yet, their willingness to collaborate and network with organisations outside of school boundaries, such as NGOs or education consultancies producing resources on education for circular development, is vital and enables access to the knowledge accumulated within those organisations. These resources cannot only respond to logistical challenges, but are critical for upskilling teachers at all levels.
- International and national funding, incentivising participatory approaches built upon shared/co-generated knowledge on urban circular development, is required to encourage educators to enhance their confidence and pedagogical skills. More importantly, an expanded participatory approach to education for urban circular development brings beneficial consequences not only on knowledge creation from a fresh perspective, but also supports young learners' agency in decision-making about their own urban environments.

Conclusion

What is the aim of education for urban circular development (EUCD)? One possible response is that the primary objective is to build capacity among young people as agents of meaningful and positive change in their surrounding urban environments. It is also for young people to become ambassadors of change, developing capabilities for systems, pluralistic and critical thinking in the area of sustainability and circularity that can also be transferred to older generations. These high-level cognitive capabilities can be further developed in a circular-specific manner through the six dimensions of urban circular action (this list is not exhaustive, but instructive). Additionally, the more instrumental economic reality is that employment relating to sustainability and circularity in value chains is likely to be a labour market growth area in the coming years. Introducing concepts like systems thinking, interconnectivity and pluralism through circularity early on in educational trajectories can help better prepare young people for the labour market and tertiary education.

Circularity is an important approach to sustainability, but it also remains largely experimental. It is not a panacea to the problem of sustainability. Full circularity – no waste in production and consumption chains – is an untested theoretical ideal, not something that is achievable in the here and now. As such, it is a concept that is also open to manipulation and accusations of greenwashing. It must be treated with care. Though the general concept of circularity is hard to fault, there are many problems

that circularity as a concept and concrete urban development programme faces. For example, the scientific practicalities and resource intensity of extraction of materials for reuse; the lack of infrastructure for renewable energy, and the material and energy cost of building that infrastructure; as well as the lack of incentive to share potentially sensitive information and know-how in a capitalist economy – to name just a few.

Climate change and environmental degradation can also be anxiety-provoking topics, leading to feelings of hopelessness and a sense of paralysis. For this reason, experimental, localised and action-based approaches can help to instil a greater sense of agency and hopefully reduce feelings of powerlessness. There is also a need to be truthful and critical, as young people tend to have well-honed detectors for authenticity. A dose of realism, not just about circularity, but also related to the limited possibilities for large-scale behavioural change through communicative means (including education) is therefore necessary.

Given what we know about the challenges to ESD, building direct casual links between EUCD and broader action going to be a challenge. This is another reason to focus on value change and capacity building with a focus not so much on what specifically students are learning and thinking about when it comes to urban circularity or sustainability more generally, but how they are learning about it. Hence, our emphasis on systems thinking, interconnectivity and pluralism within a whole school approach.

Understanding the link between technical and behavioural challenges from holistic and interdisciplinary perspectives is also a central component of EUCD. As is the importance of understanding and studying the many system barriers to circularity (urban and otherwise), especially at the levels of governance and regulation. Cities are important hubs for production, consumption and creation, but from a policy standpoint are often constrained by larger scale political and policy dynamics at the regional, national and even transnational level. The political pressures facing high-level politicians - who will ultimately regulate the flows of material and energy through cities - can be quite different than in urban settings. Coming to grips with these realities requires the same kind of systems and interconnective thinking that is necessary for imagining and working towards the transition to a more circular economy. Despite being taken up by industry and increasingly in value-chain and supply-chain thinking, circularity in education should remain framed not as a silver bullet, but rather as one, potentially very important, tool for achieving resilient urban communities.

1. Williams, J. (2019). Circular cities. Urban Studies, 56(13), 2746–2762. https://doi.org/10.1177/0042098018806133
2. UNESCO. (2020). Education for Sustainable Development: A Roadmap (Education 2030, p. 73). United Nations Educational, Scientific and Cultural Organization (UNESCO). https://unesdoc.unesco.org/ark:/48223/pf0000374802
3. Eilam, E., & Trop, T. (2010). ESD Pedagogy: A Guide for the Perplexed. The Journal of Environmental Education, 42(1), 43–64. https://doi.org/10.1080/00958961003674665
4. Kisser, J., & Wirth, M. (2021). The Fabrics of a Circular City. In L. Liu & S. Ramakrishna (Eds.), An Introduction to Circular Economy (pp. 55–75). Springer. https://doi.org/10.1007/978-981-15-8510-4_4
5. Camaren, P., & Swilling, M. (2012). Sustainable, Resource Efficient Cities—Making it Happen! (p. 64). United Nations Environment Programme. https://sustainabledevelopment.un.org/content/documents/1124SustainableResourceEfficientCities.pdf
6. Moran, D., Kanemoto, K., Jiborn, M., Wood, R., Többen, J., & Seto, K. C. (2018). Carbon footprints of 13 000 cities. Environmental Research Letters, 13(6), 064041. https://doi.org/10.1088/1748-9326/aac72a
7. Prendeville, S., Cherim, E., & Bocken, N. (2018). Circular Cities: Mapping Six Cities in Transition. Environmental Innovation and Societal Transitions, 26, 171–194. https://doi.org/10.1016/j.eist.2017.03.002
8. Gravagnuolo, A., Angrisano, M., & Fusco Girard, L. (2019). Circular Economy Strategies in Eight Historic Port Cities: Criteria and Indicators Towards a Circular City Assessment Framework. Sustainability, 11(13), 3512. https://doi.org/10.3390/su11133512
9. Williams, J. (2022). Circular cities: Planning for circular development in European cities. European Planning Studies, 0(0), 1–22. https://doi.org/10.1080/09654313.2022.2060707
10. Dale, A., & Newman, L. (2006). Sustainable Community Development, Networks and Resilience. Environments, 34(2). https://papers.ssrn.com/abstract=2479757

11. Tang, W., Niu, Z., Wei, Z., & Zhu, L. (2022). Sustainable Development of Eco-Cities: A Bibliometric Review. Sustainability, 14(17), Article 17. https://doi.org/10.3390/su141710502
12. Kennedy, S., & Sgouridis, S. (2011). Rigorous classification and carbon accounting principles for low and Zero Carbon Cities. Energy Policy, 39(9), 5259–5268. https://doi.org/10.1016/j.enpol.2011.05.038
13. Chen, C.-W. (2023). Can smart cities bring happiness to promote sustainable development? Contexts and clues of subjective well-being and urban livability. Developments in the Built Environment, 13, 100108. https://doi.org/10.1016/j.dibe.2022.100108
14. Williams, J. (2021). Circular Cities: What Are the Benefits of Circular Development? Sustainability, 13(10), 5725. https://doi.org/10.3390/su13105725
15. Marin, J., & De Meulder, B. (2018). Interpreting Circularity. Circular City Representations Concealing Transition Drivers. Sustainability, 10(5), 1310. https://doi.org/10.3390/su10051310
16. Callaghan, E. G., & Colton, J. (2008). Building sustainable & resilient communities: A balancing of community capital. Environment, Development and Sustainability, 10(6), 931–942. https://doi.org/10.1007/s10668-007-9093-4
17. Scharfbillig, M., Smillie, L., Mair, D., Sienkiewicz, M., Keimer, J., Pinho, D. S. R., Vinagreiro, A. H., Vecchione, E., & Scheunemann, L. (2021). Values and Identities—A policymaker's guide. Publications Office of the European Union. https://doi.org/10.2760/349527
18. EMF. (2015). Growth Within: A Circular Economy Vision for a Competitive Europe. Report. https://ellenmacarthurfoundation.org/growth-within-a-circular-economy-vision-for-a-competitive-europe
19. Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). Circular economy – From review of theories and practices to development of implementation tools. Resources, Conservation and Recycling, 135, 190–201. https://doi.org/10.1016/j.resconrec.2017.10.034
20. Fusco Girard, L., & Nocca, F. (2019). Moving Towards the Circular Economy/City Model: Which Tools for Operationalizing This Model? Sustainability, 11(22), 6253. https://doi.org/10.3390/su11226253
21. Papageorgiou, A., Henrysson, M., Nuur, C., Sinha, R., Sundberg, C., & Vanhuyse, F. (2021). Mapping and assessing indicator-based frameworks for monitoring circular economy development at the city-level. Sustainable Cities and Society, 75, 103378. https://doi.org/10.1016/j.scs.2021.103378
22. Cavaleiro de Ferreira, A., & Fuso-Nerini, F. (2019). A Framework for Implementing and Tracking Circular Economy in Cities: The Case of Porto. Sustainability, 11(6), 1813. https://doi.org/10.3390/su11061813
23. Paiho, S., Mäki, E., Wessberg, N., Paavola, M., Tuominen, P., Antikainen, M., Heikkilä, J., Rozado, C. A., & Jung, N. (2020). Towards circular cities—Conceptualizing core aspects. Sustainable Cities and Society, 59, 102143. https://doi.org/10.1016/j.scs.2020.102143
24. Borg, C., Gericke, N., Höglund, H.-O., & Bergman, E. (2012). The barriers encountered by teachers implementing education for sustainable development: Discipline bound differences and teaching traditions. Research in Science & Technological Education, 30(2), 185–207. https://doi.org/10.1080/02635143.2012.699891
25. Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. The Journal of Environmental Education, 51(4), 280–291. https://doi.org/10.1080/00958964.2019.1710444
26. Sukiennik, M., Zybała, K., Fuksa, D., & K□sek, M. (2021). The Role of Universities in Sustainable Development and Circular Economy Strategies. Energies, 14(17), Article 17. https://doi.org/10.3390/en14175365
27. Scalabrino, C., Navarrete Salvador, A., & Oliva Martínez, J. M. (2022). A theoretical framework to address education for sustainability for an earlier transition to a just, low carbon and circular economy. Environmental Education Research, 28(5), 735–766. https://doi.org/10.1080/13504622.2022.2031899
28. Díaz-López, C., Serrano-Jiménez, A., Chacartegui, R., Becerra-Villanueva, J. A., Molina-Huelva, M., & Barrios-Padura, Á. (2023). Sensitivity analysis of trends in environmental education in schools and its implications in the built environment. Environmental Development, 45, 100795. https://doi.org/10.1016/j.envdev.2022.100795
29. Borg, C., Gericke, N., Höglund, H.-O., & Bergman, E. (2014). Subject- and experience-bound differences in teachers' conceptual understanding of sustainable development. Environmental Education Research, 20(4), 526–551. https://doi.org/10.1080/13504622.2013.833584
30. Roegholt, S., Wardekker, W., & Van Oers, B. (1998). Teachers and pluralistic education. Journal of Curriculum Studies, 30(2), 125–141. https://doi.org/10.1080/002202798183666
31. Kopnina, H., & Cherniak, B. (2016). Neoliberalism and justice in education for sustainable development: A call for inclusive pluralism. Environmental Education Research, 22(6), 827–841. https://doi.org/10.1080/13504622.2016.1149550
32. Summers, M., Childs, A., & Corney, G. (2005). Education for sustainable development in initial teacher training: Issues for interdisciplinary collaboration. Environmental Education Research, 11(5), 623–647. https://doi.org/10.1080/13504620500169841
33. Summers, M., Corney, G., & Childs, A. (2004). Student teachers' conceptions of sustainable development: The starting-points of geographers and scientists. Educational Research, 46(2), 163–182. https://doi.org/10.1080/0013188042000222449
34. Mogren, A., Gericke, N., & Scherp, H.-Å. (2019). Whole school approaches to education for sustainable development: A model that links to school improvement. Environmental Education Research, 25(4), 508–531. https://doi.org/10.1080/13504622.2018.1455074
35. Nordén, B. (2018). Transdisciplinary teaching for sustainable development in a whole school project. Environmental Education Research, 24(5), 663–677. https://doi.org/10.1080/13504622.2016.1266302
36. Kim, C., & Fortner, R. W. (2006). Issue-Specific Barriers to Addressing Environmental Issues in the Classroom: An Exploratory Study. The Journal of Environmental Education, 37(3), 15–22. https://doi.org/10.3200/JOEE.37.3.15-22

08

Towards Sustainable Circular Societies: Confronting the Need to Change Deep Structures.

Frank Boons.

School of Business and Economics, Maastricht Sustainability Institute, Maastricht University.

Over the past ten years, the societal ambition to create a circular economy has gained enormous traction. Across governments, business and civil society in a large number of countries there is a recognition that we need to use the materials on which our welfare and well-being is based in a much more efficient way [1]. No material or energy source is endless; we call resources like solar and wind energy *renewable* simply because we cannot imagine the timescales at which they will deplete. However, for a lot of the materials we rely on for building a sustainable future, the timescale is easy to fathom.

Take a material such as lithium, the metal that we currently depend on to build car batteries for electric vehicles. The current effort to move to electrified mobility means that the International Energy

Agency expects shortages of this material as early as 2025 [2]. Phosphates, the resource base for fertilizers and thus vital for world food supply as we currently know it, will likely reach their maximum global production rate in the next few decades; after that, shortages are inevitable as well [3]. Certainly, such predictions have a margin of error; but with a world population that is still growing, ensuring adequate fulfilment of human needs is an increasingly huge effort, and shortages of any kind will cause serious disruption and social unrest. We cannot be comforted because these predictions might not be entirely accurate. The general trend is clear: our desired level of affluence will be difficult to meet given the number of human beings on Earth who require resources that are increasingly scarce. Technological advances are not helping to make this task any easier either, as they often make use of additional (and sometimes highly scarce) materials. This is why the effort to create a circular economy makes sense as a way to use resources as effectively and efficiently as possible.

I will use a down-to-earth definition of the circular economy: an economy is the set of activities that are required to fulfil the needs of all members of society, and an economy is circular when the material flows generated through those activities form a closed loop, that is, no material ends up as waste. The ambition to bring about a circular economy is increasingly being reframed as the need to work towards circular societies. Societies where economic systems that provide for human needs fit within planetary boundaries while functioning in a socially inclusive way [4].

The recognition that our economies are wasteful is not new. At least since the 1960s, there have been social movements, scientists and policymakers in many countries who have pointed out how economic growth and affluence were generating increasing amounts of waste and advocated for the reduction of the waste produced in society. This was not mere talk among environmentalists at the fringe of society. Especially in the last two decades of the 20th century, there were systematic attempts to prevent waste and increase recycling; the necessary technological innovations were developed and the legal frameworks created. There was a widespread belief that change would come about through so-called win-win solutions: those that benefited the environment while simultaneously making business sense. A key question is: Why did we not succeed in transforming our economy to make it more circular at that time? Answering this question is important to make sure current circular economy initiatives do not meet the same fate.

By reflecting on why we would have the circulation of materials, or the products we make out of them, as an objective can lead to part of the answer. Intuitively, it makes sense to use a material more than once if we are seeking to use it more sustainably. Does the same hold for products? A well-known dilemma is that of using an electronic appliance, such as a washing machine, longer. This saves the cost (environmental, production and procurement) of making a new device. However, the newer device might be much more energy efficient. Thus, a trade-off needs to be made between time-in-use and energy efficiency. This might lead to choosing a newer device against the principles of the circular economy. This example also highlights how interrelated our use of materials is.

Similarly, taking a look at personal mobility also demonstrates these relationships. When using a car, we are simultaneously using an energy source (based on fossil fuels or renewable energy stocks), as well as the road infrastructure. Nowadays, we also use electronic navigation systems for route guidance, and highways are increasingly becoming smart involving the use of still more materials. Thus, using a car also means using other artefacts that have a material footprint. Understanding what is more sustainable depends on the impact of all the elements in the systems we are using to provide for our needs.

Furthermore, recycling and reuse are deceptive terms, as they are in fact circulation from one product into a completely different one. With the exception of chemical recycling (a promise for decades but still far from being commercially viable) [5], materials inevitably decay in terms of performance during use and then as a result of the recycling process. This means that, for instance, a polymer that is originally used in clothing cannot be recycled into a similar piece of clothing. Instead, its circulation is actually a descending flow from one application to one in which the requirements are less demand-

ing. This downwards cascade of recycled and reused material makes it inevitable that at the top, new material needs to be fed into the system. We need to realise that circulation is not an objective to be strived for blindly; rather, we need to reflect on whether it actually helps provide for human needs in a more sustainable way.

A second part of the answer lies in the nature of most of the world's economic systems. Much of the effort to make them circular implicitly assumes that this linearity is a surface characteristic, something that can be changed without tinkering with its deeper structure. This structure is in part physical, as linear ways of provisioning are built into, for instance, our roads, power networks, pipelines, waste incinerators, as well as into our computer soft- and hardware. However, the structure is just as much societal; it can be found as engrained patterns in our habits and routines, our values, desires and expectations, and our norms and processes for making decisions.

One simple example: for the majority of the world population, acquiring more disposable income means that the income will be spent, sooner or later, on consumption. It is important not to frame this as an inherent human trait. It is very much a social behaviour that is incentivised by our peers, firms and governments, and therefore continuously reinforced in many of our interactions. Current debates on degrowth and sufficiency suggest a future society where such incentives are no longer operative. When contemplating a change in the structure of our economies in that direction we need to be aware that it took at least 150 years to build the physical and social structure of our current linear economies [6]. From that perspective it is hardly surprising that we have not yet succeeded in making the transition.

A third part of the answer is related to the expectation that we can make this transition largely through private initiative and the market mechanism. This is the assumption behind the win-win rhetoric of the 1990s. If material efficiency makes good business sense, then entrepreneurs will jump on it to make a profit and the environmental benefits will come as a positive side effect. In this way, there is no need for a moral sense of obligation, nor for a regulatory role from governments. There are several reasons why this approach failed.

As a very general rule (and there are many caveats to consider), entrepreneurial activity under market conditions generates innovative activities. Crucially, part of the reason why this mechanism works and generates growth is that there is no direction specified in which innovation must occur. To put it simply: an entrepreneur may choose to innovate towards more circular products and services, but they might also choose to invest in a completely different direction. This may be digital technologies, but it could also be so-called elf bars, cheap disposable vaping devices that contain a small lithium battery, are made of plastic and contain vaping fluid that poses a hazard to surface water [7]. Additional incentives need to be present for entrepreneurs to choose circular business models as a focus for their innovative activities. This is the first reason why the win-win expectations were not met.

A second reason is that for a circular economy to operate within society, a complete route of circulation must be established, and this is not easy to coordinate solely via market transactions. It involves a variety of economic agents to develop a range of things, including:

- Manufacturers need to design products in a way that they can be disassembled, marking components for easy reference once they get to a sorting station.
- Consumers need to separate products and bring them to designated waste parks.
- Local authorities need to create those waste parks to accommodate relevant material streams.
- Recycling facilities need to be able to sort out relevant materials and separate them.
- Waste needs to be transformed into recyclate (the form that material takes in which it can substitute a virgin material flow).
- There must be a demand for recyclate, i.e., manufacturers are willing to use recyclate as an input to production processes.

- There must be a consumer demand for products containing recyclate.
- There need to be regulations allowing recyclate to be used in new products.

We do have such routes of circulation in place for some material streams, for instance aluminium, paper, certain types of plastic and glass. In societies across the globe (but not everywhere) we also have routes of circulation in place for some products, such as refrigerators and cars. In all of these cases, circulation is less than 100%, especially if we consider recyclate going back into the same use. Importantly, none of these routes have resulted in a significant reduction of raw materials extraction; the gains of circulation have been offset by an overall increase in supply of and demand for primary materials. Building up these routes has cost a lot of effort, and in many cases required explicit, policy support, either structurally or at times when material prices crashed. Coordinating the building of a complete route of circulation becomes trickier when there are significant time lags between parts of the circle. For example, cars are designed some time before they are produced; they are then used for years before being discarded and becoming the input for post-consumption processes of dismantling and recycling. The economic viability of each of these steps builds up gradually over time. That is why there are many uncertainties as to what the circulation route for electric car batteries will look like. Why have we not succeed in transforming our economy to make it more circular – given that we already started in decades ago?
The answer is:

1. Circulating materials and products is not always sustainable and therefore raises questions as to when it should be implemented.
2. Linearity is deeply ingrained, and the transition to circularity will take much longer than one policy cycle.
3. Building up complete routes of circulation requires the coordination of many players that, in the linear economy, do not engage with each other.

This three-pronged answer to our central question gives some insight as to why previous efforts to deal with the linearity of our economic systems did not succeed. Using this knowledge, we can begin to understand what is required. This provides some immediate points to ponder for policymaking. Contrary to the implicit message of win-win, these insights will need to be worked through at many levels: we are not dealing with low-hanging fruit here.

A first and most important requirement is simple. We need absolute targets for resource use, the equivalent of planetary boundaries for a range of resources. This means discarding an engrained practice used to facilitate economic growth: the formulation of policy targets and objectives, as well as strategic objectives for firms in relative terms. As long as we formulate improvements in relative terms per unit of product or service delivered, we are not addressing growth of total unit/service sales, which can offset or even go against relative improvements. Relative targets are part of the logic of capitalism, and feed the continuation of the growth narrative that needs to be scrutinised by each and every one of us.

We can immediately start to formulate targets in absolute terms - in all societal sectors and at all levels from global climate plans to individual firm strategies. This will raise questions related to our societal priorities: if a resource use has an absolute limit, what is the best way to use it? Equally important - who has access to that use? In short, thinking about absolute targets means building a circular economy becomes a political project rather than a technocratic effort. It will bring with it some contestation, but it also means that everyone will want to be involved.

Secondly, we need to critically assess under what conditions circulation actually helps us meet these absolute targets. In many cases, extending the time-in-use of a product is the best way to maximise the use of a material. Therefore, in our policies we need to be cautious to privilege circulation unless it is based on sound judgment about its contribution to sustainability. As a part of this critical assess-

ment, we need to take a close look at the use of the term 'regenerative'. It suggests a situation where materials can be endlessly reused without loss or even with enhanced characteristics. While this works as a rhetorical device, in physics (i.e., the science of materials and their behaviour) it is impossible. Any transformation of a material requires the input of energy and materials, and there is no material transformation process that is completely without waste.

Absolute targets imply difficult decisions on how we distribute available resources over alternative uses - on who gets what. This is the social sustainability of a circular society. In terms of narrowly defined economic growth, it may mean we will be dividing a pie that is no longer getting bigger every year; but the reason for doing this is to assure that quality of life is attainable for all. This means we need a redefinition of what is valuable; this is evidently not adequately expressed in existing measures of economic growth. It will be a major political effort to instigate the societal dialogue about replacing ever-rising expectations of affluence with the value of sufficiency across society. For this, we need participative forms of deliberation and dialogue that ensure inclusivity.

This is especially relevant because by leaving behind the win-win rhetoric, we will inevitably have winners and losers. We will want certain activities to grow, for instance, increased use of public transport. However, this growth only contributes to sustainability if it is accompanied by a simultaneous decline of other modes of transport. Policies need to be underpinned by a perspective that combines a focus on sunrise activities (growth of sustainable provision) with sunset activities (build-down of unsustainable provision) [8].

Both the dialogue to redefine what is valuable and the need to build down unsustainable activities question the core of our current economic system, and thus challenges existing values, interests and positions. The potential for contestation and conflict is evident, and it will become more prominent as the window of opportunity to change is rapidly narrowing. While celebrating positive initiatives remains important, policymakers need to use tools that help them to productively address these dilemmas to help build sustainable circular societies. This will definitely require innovation: the policy tools currently in use are simply not doing the trick, as evidenced by the recent second progress report on the Dutch Circular Economy Initiative by the PBL. Despite substantial policy efforts and private sector initiatives, the economy is becoming less rather than more circular on all indicators.

We will gain much if we leave behind the optimistic, market-based euphoria about the circular economy and realise that this necessary objective actually requires us to change the deep structure of our economies, and hence our societies. For policymakers, this means taking a critical stance and active role to create the conditions in which members of society can develop inclusive and fair forms of human need provision that stay within planetary boundaries and take into account the limited resources available to humankind to provide for its needs.

1. Fitch-Roy, Oscar, David Benson, and David Monciardini. "All around the world: Assessing optimality in comparative circular economy policy packages." Journal of cleaner production 286 (2021): 125493.
2. IEA (2022), Electric cars fend off supply challenges to more than double global sales, IEA, Paris. https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales
3. Approaching peak phosphorus. Nat. Plants 8, 979 (2022). https://doi.org/10.1038/s41477-022-01247-2
4. Raworth, Kate. Doughnut economics: seven ways to think like a 21st-century economist. Chelsea Green Publishing, 2017.
5. Garcia, Jeannette M., and Megan L. Robertson. "The future of plastics recycling." Science 358, no. 6365 (2017): 870-872.
6. Kanger, Laur, and Johan Schot. "Deep transitions: Theorizing the long-term patterns of socio-technical change." Environmental Innovation and Societal Transitions 32 (2019): 7-21.
7. https://thetab.com/uk/2022/08/30/its-time-to-admit-that-your-elf-bar-habit-is-killing-the-planet-269096
8. European Environmental Agency [accessed 2021]. https://www.eea.europa.eu/themes/sustainability-transitions

09

Re-envisioning Civil Society in the Circular Economy.

René Kemp and Job Zomerplaag.

United Nations University MERIT, Maastricht Sustainability Institute and Studio Europa Maastricht, Maastricht University.

Every citizen has a role to play in pursuing transitions towards a more sustainable society. The European Commission, EU member states and local authorities are therefore actively promoting citizen action in the transition towards renewable and resilient energy systems. In 2022, over 1 million European homes were solar battery-powered and an estimated 9000 energy communities (legal entities that empower citizens, small businesses and local authorities to produce, manage and consume their own energy) were in operation across the EU.[19] While millions of European citizens are investing their time, creativity and resources into the energy transition, citizen action in and transitions to a circular economy (CE) appear to be a fringe activity thus far. Perhaps the best-known exception, the EU fashion resale/second-hand market is booming and projected to reach a value of €34 billion in 2025.[20] Many EU member states have a long-standing tradition of thrift shops and second-hand stores, and most have extensive municipal waste recycling programmes.

19. https://www.solarpowereurope.org/press-releases/new-analysis-reveals-over-1-million-european-homes-are-solar-battery-powered and https://energy.ec.europa.eu/news/focus-energy-communities-transform-eus-energy-system-2022-12-13_en
20. https://www.cbcommerce.eu/blog/2021/12/08/the-rise-of-the-resale-second-hand-market/

Yet, there seems to be a relative absence of civil society initiatives in the transition towards a CE, especially in comparison to initiatives aimed at creating more just and sustainable energy and food systems. Further research is needed to explain this difference, but the following reasons might partially explain why civil society lags behind in the circular transition. First, there may be technical difficulties in repairing, as original equipment manufacturers have a vested interest in their products not being repaired. In addition, the market for repaired and refurbished goods is grossly underdeveloped, and they are largely unavailable for sale in shops. Original manufacturers may charge high costs for critical components, and people with technical skills can make more money using those skills in other ways. Moreover, companies prefer to source from recyclers who are able to supply materials in large volumes; only recently have designers turned their attention to circularity. It should be noted, however, that the role of civil society regarding the CE goes beyond repair. It may also encompass campaigns to promote circular practices and introduce CE principles in community initiatives and city making.

Next to these possible impediments, it does not help that academic literature and policy agendas on the CE largely disregard the role of civil society actors in a CE (or in the transition to one) or depict them as passive consumers with responsibilities for separating waste (i.e., as good citizens). In recent years, however, a citizen-driven movement has emerged consisting of, but not limited to, waste collection initiatives, repair cafés and makerspaces and infrastructures for the local sharing economy. Such organised initiatives align with CE thinking and envision a more active role for civil society in slowing, closing and narrowing material and energy loops across Limburg, the Netherlands and other regions in Europe and the world. Therefore, it is worthwhile to examine this topic.

Photo of a repair café.

With this policy brief, we want to offer insights into possibilities for citizen-based CE initiatives. We will do this by discussing different forms of citizen-based CE initiatives and the need for redefining responsibilities for a CE. We believe that the current discourse and policies for a CE do not do justice to the ways in which civil society actors can contribute to transitions to a CE in their cities and regions. This policy brief therefore raises critical yet neglected questions in ongoing discussions: Why, and in what ways, do citizens participate in the CE? And what is needed to expand this?

Our contribution is structured as follows. In the first section, we offer an overview of citizen-based initiatives for a circular economy. We describe three examples in the Meuse-Rhine Euregion of how principles of a CE are put into practice from the bottom up with support from government. Initiatives in Geleen (the Netherlands), Aachen (Germany) and Hasselt (Belgium) show that individuals and communities can engage in activities that contribute to CE agendas in their regions and cities when supported adequately.

Next, we discuss why the predominant vision of society as a tripartite classification of market, state and civil society is problematic in transitions to a CE. We argue in favour of a hybrid sphere of governance based on different institutional logics. In this sphere, civil society is not envisioned as a coherent domain separate from state and market logics, but is rather understood as a pluriform and conflict-ridden space in which different types of responsibilities, norms and values are shifting, blurring and contested.

In the final section, we discuss two contrasting sets of political strategy that seek to revive and re-contextualise the significance of civil society. The first is top-down responsibilisation in which citizens and communities are rendered responsible to lighten the governance burdens of state authorities. The second strategy is to facilitate bottom-up emancipatory action through social innovation and hybrid partnerships which combine different institutional logics, including those of joint ownership and decision-making and responsible collective action.

After having discussed concrete examples of citizen action towards circularity and the topic of responsibilisation and emancipatory action in relation to this, Section 4 proposes a number of recommendations for policymakers. While the alternative approaches discussed may not directly generate economic profit, they reveal that a CE is not merely about new ways of doing business, producing or consuming, but about expressing values to be acted on by business, government and knowledge institutions. For example, in the energy field people become prosumers and co-owners of wind farms and solar parks. Circularity constitutes a different domain in which a wider involvement of actors is needed and the articulation of responsibilities for all is necessary.

Bottom-up Circular Economy Initiatives in the Meuse-Rhine Euregion

Regions play a critical role in the development and implementation of CE policies. As a governance level between supranational, national and local policy spheres, regional authorities are well-positioned to promote coalition-building, share knowledge and best practices. They have a particular set of policy instruments, such as licensing, zoning, supervision in area development and the promotion of the regional economy which grants them opportunities to accelerate CE practices regionally. A report published in 2021 by PBL, the Netherlands Environmental Assessment Agency, suggests that many regional administrators consider the CE a relevant topic, but are not yet convinced of its urgency and it is not acknowledged as a core task [1]. The predominant perception remains that the CE is about waste policy and recycling. Moreover, regional administrators are found to have a limited understanding of what potential the CE holds for their regions. Consequently, it is not or only a limited part of policy agendas and implementation programmes on a regional level.

Circular Policies in the Meuse-Rhine Euregion

In the Meuse-Rhine Euregion, several regional authorities have committed themselves to policy frameworks and agendas that envision regional transitions to a CE. The Dutch province of Limburg adopted the framework Beleidskader Circulaire Economie Limburg 2.0 (2020), and a number of municipalities collaborate in Grondstoffenvisie Zuid-Limburg (2021). The German city Aachen signed the Circular Cities Declaration (2021) to underline its circular ambitions. The economic accelerator office of the Belgian province of Limburg has set up a plastics community to support local industries, and the Belgian Limburg city Hasselt has launched several initiatives to promote collective action locally. Several regional circular initiatives also exist in the German-speaking Community and the Liège Province in Belgium (as shown by the examples in Table 1).

Table 1. Examples of citizen-based and citizen-oriented activities towards circularity and their contribution to CE transitions

Examples of initiatives in the Euregion	Contribution to CE transitions
Tool and equipment libraries: • Godskes.bieb (Hasselt, Belgium)	Reducing resource consumption through sharing, enabling use of shared access to equipment.
Fix-it clinics and repair cafés: • Repair Café Parkstad (Heerlen, the Netherlands) • Repair Café (Beek, the Netherlands) • De Deelfabriek (Hasselt, Belgium)	Repair and reuse, transmitting the knowledge and skills of how to do so, and changing the ways in which people relate to one another.
Maker communities: • Precious Plastic (Maastricht, the Netherlands)	Recovery and recycling, for example, through devices for converting plastic waste into new filaments for reuse of plastics as 3D printer 'ink'.
Circularity communities and hubs: • Stadslabs (Sittard-Geleen, the Netherlands) • OecherLab (Aachen, Germany) • Circulair Werk(t) (Hasselt, Belgium)	Organising events and activities to challenge designers and suppliers to think creatively about how their waste resources could be used in projects by others, and to experiment with local production and circular economies.

Details about of the city lab projects and hubs for citizen actions are given in Table 2.

Table 2. Three examples of circularity hubs involving citizens in the Meuse-Rhine Euregion

Name and project partners	Description	Examples of projects
Circulair Werk(t) (Hasselt, Belgium) Project partners: City of Hasselt, University of Applied Sciences UCLL, LUCA School of Arts, sheltered workshop Springplank vzw and social cooperative 37 Graden	Hub for a local social circular economy in which project partners work together with local entrepreneurs and civil society towards social circular business models. The hub organises workshops and networking opportunities to connect citizens, entrepreneurs and policymakers.	Deelfietsen Jessica Ziekenhuis: bicycle sharing system with former company bikes of the local hospital maintained by a sheltered workshop. Kringloop Okazi: thrift shop at festivals with tents and camping equipment left behind at previous editions of the local pop music festival Pukkelpop.
Stadslabs (Sittard-Geleen, the Netherlands) Project partners: Municipality of Sittard-Geleen with the support of 40+ so-called stadsmakers (locally engaged citizens)	City lab that initiates and facilitates urban experiments that support partnerships between citizens, entrepreneurs, local authorities and schools. The lab has a particular focus on promoting local circular practices and initiatives.	Fleurfietsen: old bikes are turned into flower pots and put in public spaces. The bikes are decorated by primary school children and the flowers are maintained by local shop owners and residents. HutsSpots: art workshops for local youth to meet and create art and design with circular and sustainable materials.
OecherLab (Aachen, Germany) Project partners: City of Aachen, co-working space CoWork AG, marketing company Dialego LTD, RWTH Aachen University	City lab where citizens, entrepreneurs and city administration representatives and politicians can meet to present, design and test visions, goals and projects that support the circular economy and smart city strategy of Aachen.	No Time to Waste: public exhibition and workshops showcasing local innovations in reusing waste as raw material. Circular Fashion: public exhibition and creative workshops that promote sustainable and circular fashion, showcasing local businesses and designers.

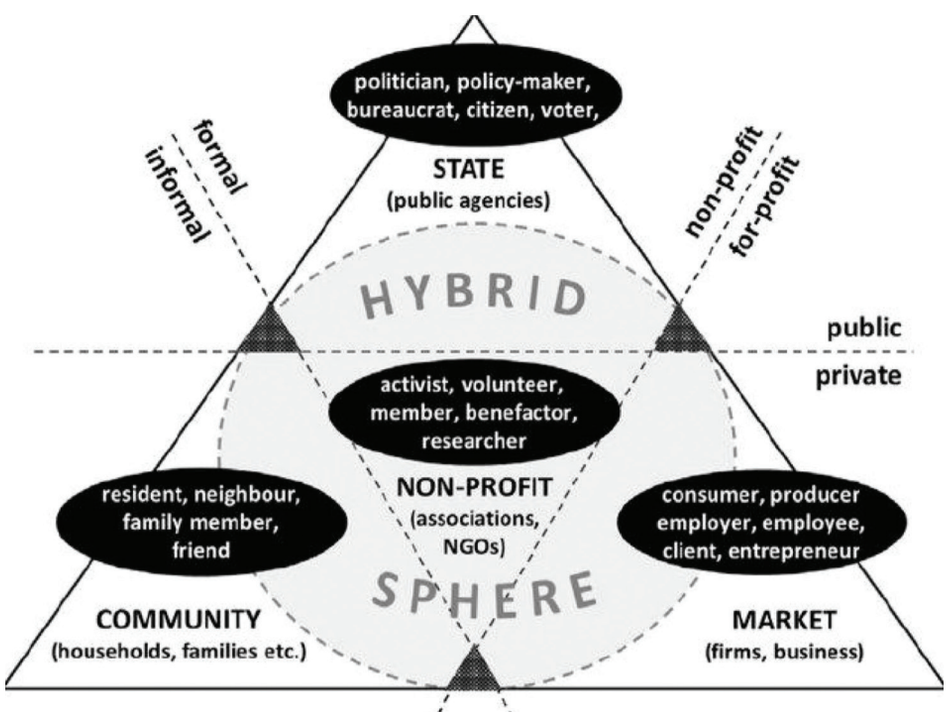
The three examples in Table 2 show that local CE initiatives are not only about repairing broken items that would otherwise be thrown away. Instead, they also revolve around changing the ways in which people think about and value these items, sharing skills and knowledge that support this new way of thinking and about changing the ways in which people relate to one another. The initiative enabled and encouraged through these local coalitions may further contribute to developing a new appreciation for the value of waste, sharing skills and knowledge that empower people to reuse materials and envision alternative business models for a social circular economy. The focal actors are government and citizens, with citizens doing something business-like. This complements social business initiatives where businesses create value for society.

Putting Civil Society in its Place in the Circular Economy

A study by Niki Frantzeskaki and colleagues [2] described the different ways in which civil society is understood in sustainability transitions. They found that civil society is understood in different ways, with some arguing that it encompasses grassroots and community-based organisations, advocacy groups, professional associations and other organisational forms. Others define it as all organisations that are institutionally separate from the state and the market. Frantzeskaki et al. [2] argue that civil society is 'somewhat autonomous from the state and acting upon interest and motivations that do not aspire to winning political office nor economic benefits'. However, the boundary between the two is not rigid, as a growing number of initiatives originate in the hybrid sphere, which is understood as an intermediary sector 'within a triangular tension field, the cornerstones of which are the state, the market and the informal sector' [3]. It includes the non-profit sector that is formalised in private, but also intermediary organisations that cross the boundaries between profit and non-profit, private and public, formal and informal, such as social enterprises and cooperative organisations (Figure 1) [4].

The current neglect of alternative, citizen-driven initiatives in (transitions to) a CE may originate in the difficulty of positioning them in the tripartite classification of market, state and civil society. In this vision of social relations in governance, civil society is denoted as a coherent domain that exists separate from the institutional logics of the state and market. The hybrid sphere shows that speaking of actors is no longer sufficient to capture the heterogeneity and plurality of actors that constitute civil society. We therefore argue in favour of an understanding of governance as a hybrid sphere, in which civil society is a space of institutional logics and frames of references within which collective or individual actors operate and with which they interact [5]. Such interactions can be confrontational. Examples of conflicts include conservation organisations that protest against the construction of wind parks near local nature, or residents that resist local community energy projects. Boundaries between institutional logics and associated interests, norms and values in the hybrid sphere are shifting, occasionally blurred and contested. Consumers may develop into prosumers and businesses may become more social (Figure 1).

Figure 1. The hybrid sphere where different institutional logics are shifting, blurring and contested (Avelino & Wittmayer, 2016)



Responsibilisation and Emancipatory Action

The shifting of responsibilities is happening in ways that beg a deeper discussion. They reflect changing agendas of government and demands on business to be more responsible. In the past decade, CE has gained importance on the agendas of policymakers across all levels of governance. On a global level, the 2030 Sustainable Development Goals and the Paris Agreement have set ambitions regarding resource efficiency and the reduction of greenhouse gas emissions. In a European context, the European Commission adopted the new Circular Economy Action Plan (CEAP) in 2020 as one of the main pillars of the European Green Deal, the EU's agenda for sustainable growth. On a national level, the Dutch government implemented a set of policy objectives in 2019 with the aim of the domestic economy becoming completely circular by 2050. These objectives have been translated into policy frameworks and transition agendas on regional and local levels, such as the Beleidskader Circulaire Economie Limburg 2.0 (2020) by the Province of Limburg and the Grondstoffenvisie Zuid-Limburg (2021) which have been adopted by a number of municipalities in southern Limburg including Maastricht.

All these policies stress that a CE and transitioning to one are dependent on the capacity and willingness of state, market and civil society actors to cooperate in the governance of slowing, closing and narrowing material and energy loops. Despite this attention to partnerships, the primary focus thus far has been on how CE principles can, should be or are applied in business and top-down policymaking. The perspectives of civil society remain largely neglected in most policies and academic publications [6]. If the involvement of civil society in a CE is discussed at all, citizens are typically understood to be passive consumers [7]. Consequently, the potential of involving citizens remains largely untapped.

It does not help in this regard that there is neither a coherent vision of what a CE entails nor how to classify civil society in transition pathways. Existing studies suggest that transitions to a CE are predominantly viewed as overcoming technological and managerial issues, with a predominant role for supply chains and top-down policies [8]. Those in charge of steering such policies rarely problematise how this may affect political liabilities and structures of accountability in governance [9]. They tend to reduce responsibility to a problem of dividing tasks among stakeholders [10] and often avoid discussing responsibility before decisions are made [11].

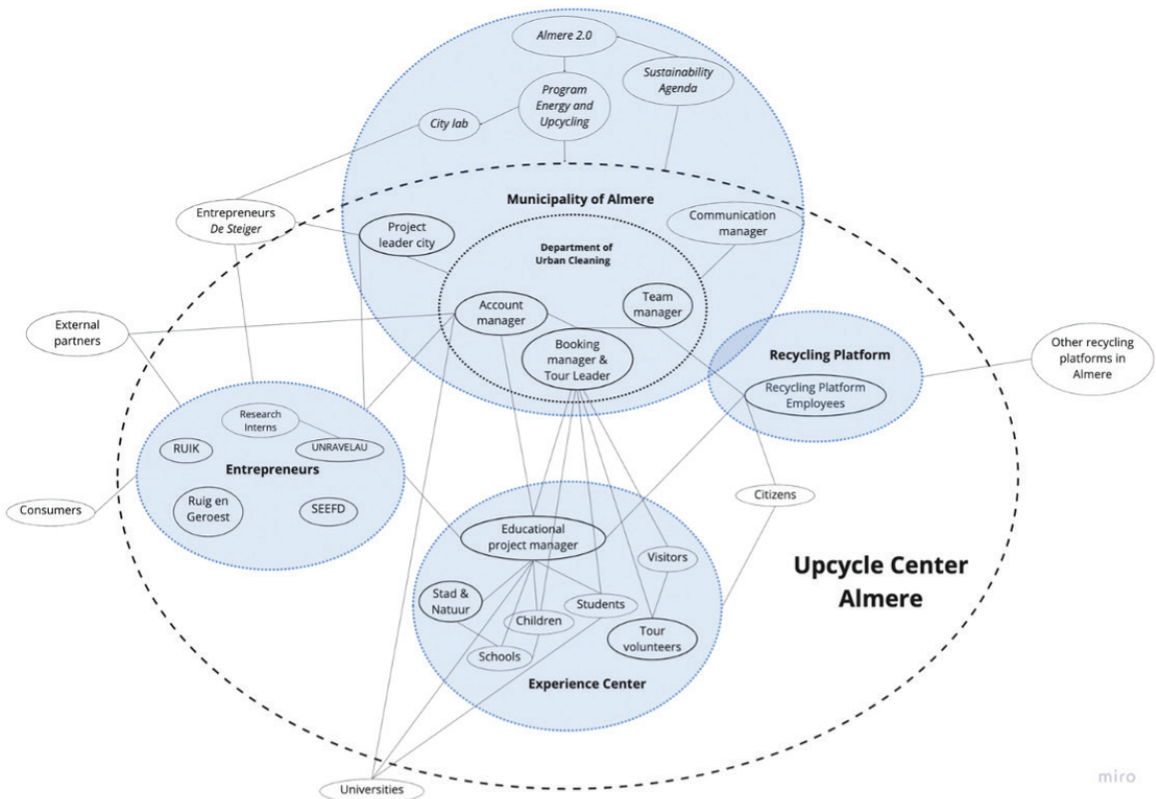
Predominant visions on a circular society rely heavily on the development of circular business models by firms, facilitated by legal frameworks put into place by policymakers and driven by consumer demand for more sustainable products [12]. This logic reveals an underdeveloped view of the role of citizens, depicting them as mere user-consumers [13]. Citizen initiatives which engage in entrepreneurial activities, for instance through selling beer made out of food waste, are not acknowledged as civil society action but rather as a successful example of business venture.

An interesting initiative outside the Euregion is the Upcycle Centre in Almere (a Dutch city near Amsterdam). The centre is part of the municipality, more precisely the Department of Urban Cleaning. The location itself is relatively new; it was realised in 2017 and is next to the site of the 2022 Floriade horticultural exhibition. The city saw this as an opportunity to signal its commitment to sustainability towards its citizens and visitors to the exhibition. Next to a circular platform where people can bring discarded products, three working studios for entrepreneurs and a visitor centre were created. In the working studios, entrepreneurs are given the opportunity to process old materials and resources into new products. Guided tours through the Upcycle Centre are offered to visitors and educational programmes for schools are provided. The centre is to be transformed into a living lab for a CE and contribute to the further development of the business district of De Steiger where it is located.[21]

A visual of the stakeholders involved in the Upcycle Centre Almere is provided in Figure 2.

21. The description of the UC Almere is based on Wenning (2021).

Figure 2. The circular innovation ecosystem of the Upcycling Centre of Almere (Wenning, 2021) [14]



As far as we know, all those initiatives are created without explicit discussions of responsibility for the actors within and outside the initiatives. *Responsibilisation* is a term developed in academic literature referring to a top-down process to offload governance problems. Citizens and communities are rendered responsible for a task which previously would have been the duty of another – usually a state agency or the market – or would not have been recognised as a responsibility at all [15]. While responsibilisation is certainly not always forced upon others, it often appears as an overly unidirectional process from state and market to citizens. Examples in the context of a CE include the way in which citizens are made responsible for promoting CE business models through consumer choices [16].

Citizens are expected to inform themselves about the consequences of unsustainable consumption, promote awareness on this matter in their own communities and engage in the reuse of products and the correct separation of household waste. Households are coerced and incentivised to separate their waste to aid recycling by specialised companies. This is the outcome of businesses outsourcing their corporate responsibility for circularity to waste companies. So-called downcycling, such as the burning of waste for energy recovery, is a typical strategy. As a result, a lesser evil has crowded out a more sustainable solution that would promote citizen engagement. Instead of designing products with longevity and repair in mind, current policies do not empower consumers to play a role in system change beyond recycling. Contrary to the current debate on renewable energy, public authorities do not play an active role in system change either, as they are not pressured by citizens and no-waste businesses to do so.

A different strategy is pursued by repair café and maker movements. Here people empower themselves to engage in creative action or repair activities. Emancipation via collective action presents a bottom-up approach, whose success can be – and often is – enhanced by a facilitating environment. As a form of resistance (to the linear economy and exploitative forms of production) and self-em-

powerment, citizen-based productive activities are facilitated through social innovation and hybrid partnerships in which civil society takes the initiative to envision alternative approaches to a CE. This happens, and sometimes not without contention, in dialogue with market and state.

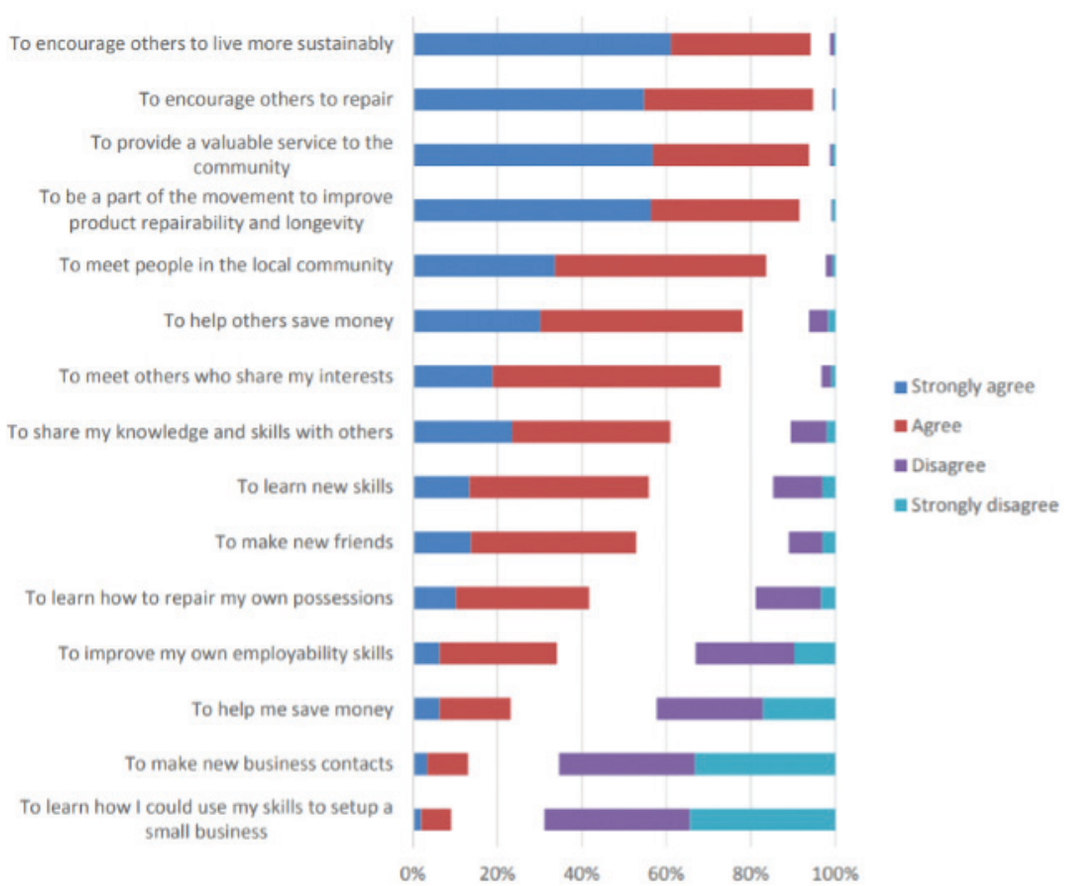
The theory of Transformative Social Innovation [17] describes how social innovation involves challenging, altering or replacing the dominant institutions in a specific socio-material context. Social innovation aims to change both formal as well as informal institutions. Through challenging instances and trends of marketisation and bureaucratisation, it targets not only various organisational forms and institutional arrangements, but also the associated social norms and discourses. Viewing those initiatives as entrepreneurial overlooks the transformative and political element of citizen-based actions for circularity. A study by Charter and Keiller [18] shows that members usually do not self-identify as activists, even though the answers to their motivations reveal an activist element. The top four motivations of people participating in repair cafés are:

1. to encourage others to live more sustainably;
2. to encourage others to repair;
3. to provide a valuable service to the community;
4. to be a part of the movement to improve product reparability and longevity.

Few of the participants are motivated to set up a new business.

Figure 3. Responses to the question: Why do you participate in the repair café?

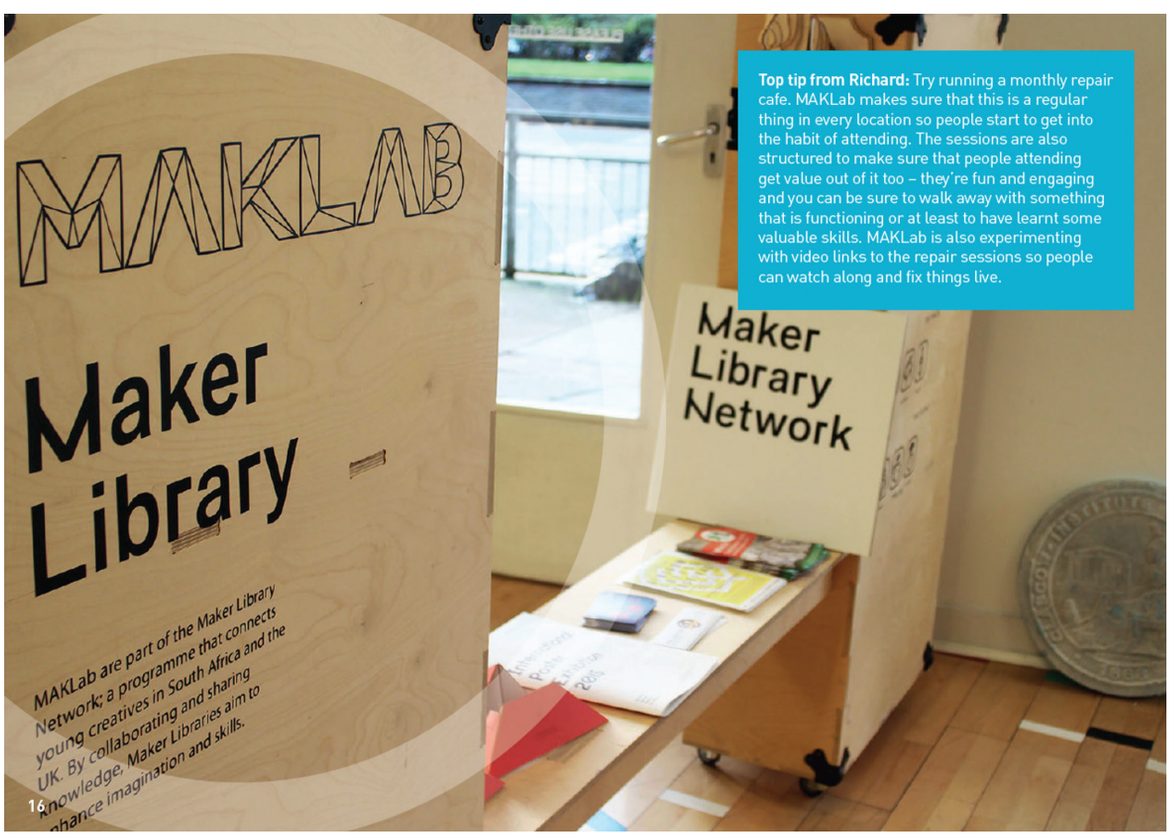
Responses were given to a list of statements on a five-point Likert scale from strongly agree to strongly disagree (Charter & Keiller, 2016).



In contrast to community energy, which is well organised nationally and internationally, the repair movement does not have a strong business lobby. However, demands for legislation and support are made by RREUSE, an international network representing social enterprises active in reuse, repair and recycling. The demands include the following:

- Extended Producer Responsibility (EPR) rules must support waste prevention and preparation for re-use activities.
- Products must be designed to be durable and easily repairable.
- Reuse, repair and preparing for reuse must be made more economically viable and competitive.
- Legislation must also encourage reuse of products such as packaging and construction/demolition waste.

An example of a government programme to support repair and reuse is the Zero Waste Scotland initiative. Next to having created hubs for repair and reuse with online retailing in the Highlands, Edinburgh and rural Argyll and Bute, the initiative produced a report with descriptions of six repair and share projects with guidance on setting up an organisation and marketing it [19]. The programme is remarkable as it actively stimulates a government to engage in repair and reuse. Intermediary actors can bridge the different institutional logics that exist between brand owners interested in selling new products, recyclers interested in recycling but not in repair, and citizens interested in long-lived goods that can be easily repaired. In order to facilitate this, intermediaries have to be funded. Thus far, local governments shy away from this task for budgetary reasons and because of different priorities. Experiences with systemic intermediaries (so-called transition brokers) in the regional governance of implementing a circular economy in the Netherlands are described and discussed in Cramer [20].



Page from Zero Waste Scotland report (2016)

Conclusions and Recommendations for Policy

This policy brief has shown that transitions to a CE are not merely about new ways of doing business, producing or consuming. Instead, they are also about envisioning and rethinking ways in which people and materials relate to each other in a circular society. There is, however, a lack of a coherent vision of what a CE entails; and particularly, how to enable and encourage the participation of civil society actors in transitions to a CE in their cities and regions. A circular economy can include attempts at city making, emancipation via collective action and skilling and socialising (as in repair cafés). We argue in favour of the revival and recontextualisation of the significance of civil society in light of these transitions, by acknowledging the hybrid sphere as a space for experimentation and partnerships which combine different logics of state, market and society. This requires sensitivity towards the role of civil society in different transition pathways; what may be beneficial for energy communities may impede nature preservation and regeneration. Alternative strategies, such as reducing the use of virgin materials in manufacturing and extending product lifespans, could provide new paths to building sustainable product life cycles for renewable energy technologies. The CE constitutes a distinct domain in which a wider involvement of actors is needed than in the energy transition which necessitates the articulation of responsibilities for all.

To summarise, to those working in policy and practice we suggest the following range of components to help establish such a hybrid sphere and make it flourish:

People with relevant knowledge and skills that can support and liaise between different institutional logics and governance levels. This requires technical skills to use equipment and strategic skills to build local hybrid partnerships, a funding base and communication campaigns. Additionally, business and administrative skills, as well as knowledge of regulations that need to be complied, with are necessary. Retired people and consultants doing volunteer work (via corporate volunteer programmes) are often doing this, but the pool of experts should be expanded.

A receptive and facilitative environment involving intermediaries that work with civil society actors across a range of topics; for example, providing and securing funding and in-kind support, and helping navigate the regulatory and legal frameworks.

Access to technology and equipment such as tools to create circular products and recover materials. Cross-sector collaboration and the establishment of makerspaces can support the use of shared access to equipment.

Realistic expectations of what may be expected from civil society actors as local initiatives are first and foremost practical in their approach to enacting their vision of a CE. Even though some may aspire to develop greater involvement and reach, upscaling is not necessarily beneficial for local initiatives as they have limited resources, especially time, to engage in additional activities. This also requires that the expectations of participating citizens are surveyed and monitored.

An integral approach and ability to learn from other transitions (e.g., in sustainability) is needed. The transition to a CE is connected and interlinked with multiple sub-transitions, ranging from energy transition to questions of inequality. People and institutions that can look beyond sectoral and territorial boundaries are therefore critical to the success of any transition process, and in particular to that of the CE.

We believe that policies and programmes based on an individual concept of responsibility (i.e., doing one's bit for the environment) will not get us anywhere near the zero-waste economy of the future. Responsibilisation may end up in a blind alley if not enough actors are being mobilised. More action and commitment by governments at different levels, citizens, knowledge institutions and intermediaries is necessary. Furthermore, attention to value creation will help to expand strategies beyond waste reduction only. When different institutional logics are brought into interaction with one another in the hybrid sphere, new and more effective pathways for system change can be created.

Acknowledgement

We thank a reviewer for helpful comments which led us to write a better brief.

1. Kruk, K., Pruijn, M., & Rood, T. (2021). *Samen leren in de regio. Verkenning van een kennisinfrastructuur voor de circulaire economie in de regio.* Den Haag: Planbureau voor de Leefomgeving. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl-2021-samen-leren-in-de-regio-4666.pdf
2. Frantzeskaki, N., Dumitru, A., Anguelovski, I., Avelino, F., Bach, M., Best, B., ... & Rauschmayer, F. (2016). Elucidating the changing roles of civil society in urban sustainability transitions. Current Opinion in *Environmental Sustainability,* 22, 41-50. https://doi.org/10.1016/j.cosust.2017.04.008
3. Fyfe, N. R. (2005). Making Space for 'Neo-communitarianism'? The Third Sector, State and Civil Society in the UK. Antipode, 37(3), 536–557. https://doi.org/10.1111/j.0066-4812.2005.00510.x
4. Avelino, F., & Wittmayer, J. M. (2016). Shifting Power Relations in Sustainability Transitions: A Multi-actor Perspective. *Journal of Environmental Policy & Planning, 18(5),* 628–649. https://doi.org/10.1080/1523908X.2015.1112259
5. Friedland, R. (2012). The Institutional logics Perspective: A new approach to culture, Structure, and Process.: Patricia H. THORNTON, William OCASIO & Michael LOUNSBURY (2012)The Institutional Logics Perspective: A new approach to Culture, Structure, and Process. Oxford: Oxford University Press. *M@n@gement,* 15(5), 583. https://doi.org/10.3917/mana.155.0583
6. Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling,* 127, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005
7. Camacho-Otero, J., Boks, C., & Pettersen, I. (2018). Consumption in the Circular Economy: A Literature Review. *Sustainability, 10(8),* 2758. https://doi.org/10.3390/su10082758
8. Hobson, K., & Lynch, N. (2016). Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world. *Futures, 82,* 15–25. https://doi.org/10.1016/j.futures.2016.05.012
9. Evans, D., Welch, D., & Swaffield, J. (2017). Constructing and mobilizing "the consumer": Responsibility, consumption and the politics of sustainability. *Environment and Planning A, 49(6),* 1396–1412. https://doi-org.mu.idm.oclc.org/10.1177/0308518X17694030
10. Mostert, E. (2015). Who should do what in environmental management? Twelve principles for allocating responsibilities. *Environmental Science & Policy 45,* 123–131. https://doi.org/10.1016/j.envsci.2014.10.008
11. Flyvbjerg, B. (2016). Policy and planning for large-infrastructure projects: Problems, causes, cures. Environment and Planning B: *Planning and Design, 34*(4), 578–597. https://doi-org.mu.idm.oclc.org/10.1068/b32111
12. Johansson, N., & Henriksson, M. (2020). Circular economy running in circles? A discourse analysis of shifts in ideas of circularity in Swedish environmental policy. *Sustainable Production and Consumption, 23,* 148–156. https://doi.org/10.1016/j.spc.2020.05.005
13. Hobson, K. (2021). The limits of the loops: Critical environmental politics and the Circular Economy. *Environmental Politics, 30*(1–2), 161–179. https://doi.org/10.1080/09644016.2020.1816052
14. Wenning. T. (2021). Circular innovation ecosystems for multiple value creation and the role of design thinking and partnerships – The case of the Upcycle Center in Almere, MSc. Sustainability Science, Policy and Society, Maastricht Sustainability Institute | Maastricht University (UM)
15. O'Malley, P. (2009) "Responsibilization", in A. Wakefield and J. Fleming (eds) *The SAGE Dictionary of Policing* (pp. 277–279), London: Sage.
16. Savini, F., & Giezen, M. (2020). Responsibility as a field: The circular economy of water, waste, and energy. *Environment and Planning C: Politics and Space, 38*(5), 866–884. https://doi.org/10.1177/2399654420907622
17. Pel, B., Haxeltine, A., Avelino, F., Dumitru, A., Kemp, R., Bauler, T., Kunze, I., Dorland, J., Wittmayer, J., & Jørgensen, M. S. (2020). Towards a theory of transformative social innovation: A relational framework and 12 propositions. *Research Policy,* 49(8), 104080. https://doi.org/10.1016/j.respol.2020.104080
18. Charter, M., Keiller, S. (2016). The Second Global Survey of Repair Cafés: A Summary of Findings. The Centre for Sustainable Design (CfSD). https://cfsd.org.uk/site-pdfs/The%20Second%20Global%20Survey%20of%20Repair%20Cafes%20-%20A%20Summary%20of%20Findings.pdf
19. Zero Waste Scotland (2016). Repair and Share guide. http://d2zstfw65zv9v0.cloudfront.net/wp-content/uploads/20190710131523/ZWS938_Repair_and_Share_FINAL-LR.pdf
20. Cramer, J. (2020). The Function of Transition Brokers in the Regional Governance of Implementing Circular Economy—A Comparative Case Study of Six Dutch Regions, *Sustainability,* 12, 5015. https://doi.org/10.3390/su12125015

Editor in chief

Nancy Bocken
School of Business and Economics, Maastricht Sustainability Institute, Maastricht University.

Editors

Gonny Willems
Director Studio Europa Maastricht, Maastricht University.

Joyce Habets
Senior Policy Advisor Research and Societal impact, Studio Europa Maastricht, Maastricht University.

Job Zomerplaag
Programme editor Studio Europa Maastricht, Maastricht University.