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Futures of the social metabolism: Degrowth, circular economy and the value of waste

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ABSTRACT

Circular economy and degrowth offer two different imaginaries for a future social metabolism: both seek to downscale waste and the demand for raw materials. Yet whereas degrowth proposes a circular metabolism to reduce consumption and production, mainstream circular economy sees waste as an opportunity for sustainable growth. This paper puts these two visions of circular futures into dialog. It unpacks the institutional dimensions of these two approaches, focusing on how they produce relations with and responsibilities to the future. It argues that the extent to which circularity can deliver its promise of reduction depends on the value that is ascribed to both present and future waste. This value is defined by the institutional conditions that regulate the responsibilities, geographies and conceptions of value mobilized in dealing with waste. The paper dissects three institutional shifts necessary for a degrowth circularity: from individual consumers to collective responsibilities in waste reduction, from global regional waste markets to bio-regional waste economies and from monetary to socio-ecological value of waste.

1. Contested futures of the social metabolism

In postulating a society that can potentially thrive by reducing waste and producing goods using discarded materials, the circular economy (CE) has gained incredible momentum worldwide. Yet this imaginary is bound to techno-managerial and pro-growth assumptions. That waste is the product of capitalist profit-seeking strategies goes largely unrecognized. To addresses this fundamental limitation, this paper develops a critique of the circular economy from a degrowth perspective. It analyzes fundamental differences between two imaginaries for a future social metabolism, that is, how societies will organize their material input from and output to nature. Building on this critique, the paper envisions a degrowth circularity. In this future, waste would be reduced through a redefinition of its value in socio-ecological rather than monetary terms.

Both degrowth and CE address the depletion of resources and accumulation of waste. They recognize that the current, linear chain of production-consumption-disposal is environmentally and socially destructive. Against this system, both degrowth and CE promote reusing, repairing, remanufacturing, and recovering discarded goods (Latouche, 2014). Degrowth posits a society based on sufficiency, autonomy, and democracy, liberated from the drive to consume and produce, and therefore able to downscale economies' material throughput, beginning with all excess (for an overview of definitions see Kallis, 2017; Kallis et al., 2018; Schmelzer et al., 2022). For CE, by contrast, economies' material throughput can be reduced by changing modes and technologies of consumption and production. Defined as an economic model aimed at reducing demand for raw materials by maximizing the productivity of already circulating materials, CE generates economic value out of all residuals (for an overview of definitions, see Kirchherr et al., 2017).

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CE and degrowth anticipate two radically different future social metabolisms. They work as meaning-making discourses that create and shape present actions by enunciating expectations about society's future relations with nature (Groves, 2019; van Lente, 1993). These discourses structure to present by organizing investments in infrastructures, capital flows, and policy tools that will, in turn, alter the future range of possibilities (Urry, 2016). By producing assumptions that endow present practices with meaning in relation to the future, they reduce what is considered possible (Adam & Groves, 2007). To understand these imaginaries' potential impact, then, it is important to identify these assumptions and critique 'the structural bounds that allow them to become persuasive' and thus performative (Oomen et al., 2022:264).

As two different approaches to a circular future, CE and degrowth stake 'competing claims' (Adam & Groves, 2007: 14) and inhabit conflicting 'value frames' (Lowe & Genovese, 2022). Mainstream CE is primarily (but not exclusively) supported by a coalition of business interests, led by the state, EU institutions, and (multi)national corporations for waste is a new commodity frontier (Savini, 2023; Savini, 2019a; Schindler & Demaria, 2020). CE seems to reproduce a 'management narrative,' typical of eco-modern and anthropocentric approaches to the future, that is obsessed with calculation, exchange value, and controlling environments (Groves, 2019). Degrowth, by contrast, is based on the daily labor of reduction and reuse. To counteract waste, which it understands as the dangerous product of an economy geared toward growth, it envisions a society that reuses materials to satiate needs (Olsen et al., 2018).

Despite these differences, CE and degrowth share a concern with the accumulation of waste and exhaustion of raw materials. It is therefore important critically to discern their competing expectations about which institutions should deal with those problems. Degrowth scholars have just begun to approach this task (Lambert, 2020; Schröder et al., 2019, next section for complete literature review). This literature recognizes that by confronting circular economy imaginaries with degrowth thinking one can imagine a socio-economic system that thrives in a symbiotic and regenerative relationship with the environment (Garcia Olivares & Solé, 2014). In fact, many existing practices of circular economy, particularly at a local level, appear linked to both degrowth and CE imaginaries (Lambert, 2020). In keeping with this, critical research suggests that 'degrowth can and should contribute to circular economy principles, as circular economic principles can contribute to an anchoring of degrowth commitments in an inescapably resource-dependent world' (Schröder et al., 2019: 191; see also Lambert, 2020).

Given that circular futures are contested and contradictory, this paper puts degrowth and circular economy into dialog. It discerns the institutional trajectories along which these two approaches to the social metabolism produce relations with and responsibilities to the future. My main premise is that the extent to which circularity reduces material consumption depends on how waste's *value* is conceptualized in the future. Both waste's actuality (as existing industrial refuse) and potentiality (as possible future economic refuse) are central to CE and degrowth programs. To envision a degrowth circularity, I argue, we need to rethink the value of waste in socio-ecological rather than monetary terms. Overall, present and future waste becomes the matter through which a regenerative – not exploitative – relation between the economy and environment can be developed.

Building on social metabolism analysis, this paper identifies key expectations about the future in CE and degrowth along three main institutional axes: 1) the organization of responsibilities in waste reduction and recovery; 2) the geographical scale at which waste recovery is pursued; and 3) the type of value ascribed to waste. By dissecting differences between CE and degrowth along these lines, the paper rethinks the future relationship between society and waste in three ways, proposing a shift from individual consumers to collective responsibilities in waste recovery and reduction; from a global to a bioregional economy of waste processing; and from waste having monetary value to waste having socio-ecological value.

To illustrate these arguments, the paper draws on examples from Amsterdam, The Netherlands. Over the last decade, the city become prominent in European CE policy networks. Having recently adopted Raworth's doughnut framework to downscale material consumption (Raworth, 2017), the city's CE program now involves extremely diverse circular practices (see for an overview Savini, 2021a).

This paper begins by arguing that a degrowth critique of CE must problematize waste. Then, after introducing social metabolism analysis, I identify three axes – responsibilities, geographies, and value – with which I explain how mainstream CE discourses differ from degrowth perspectives on circularity.

2. Degrowth and circular economy: waste valorization and its institutions

The circular economy is often framed as the 'end of waste' (see for example Ragossnig & Schneider, 2019). Maximizing resource productivity would supposedly minimize useless and invaluable waste streams. (Potential) waste includes unused 'stock' in the economy that does not circulate and does not sustain economic processes. CE models involve circulating material stock – including liquid and gas – that no longer fulfils its primary use: discarded food is circled into biomass or nutrients; discarded electronic parts are upcycled at the end of their use-cycle; plastic bottles become material for 3D printing; residual heat is recovered for energy. The circular economy requires available underused resources to thrive.

In the 1970 s, early prototypes of circularity – sometimes called industrial symbiosis – devised infrastructural programs to capture the residues of production and use them as inputs for new production in industrial districts (Chertow, 2007). Today, mainstream CE

literature celebrates the economic value of waste—it turns 'waste into wealth' (Lacy & Rutqvist, 2016) and sees it as input for economic innovation (McDonough & Braungart, 2010). In CE literature, circularity is embedded in the shift from waste to resource management (Kirchherr et al., 2017). An analysis of existing circular business models confirms that two-thirds of CE start-ups are 'waste based', including waste management and core technology innovation for B2B and P2P platforms (Henry et al., 2020).[1] Environmental economics identifies the 'circularity gap' as the ratio between all materials that will become waste in the future (ie. the stock in the economy) and the infrastructural capacity for their reuse (Aguilar-Hernandez et al., 2019).

Mainstream definitions of CE point to a production/consumption system that simultaneously slows resource intake *and* closes material loops (Potting et al., 2017). Closing occurs when 'the loop between post-use and production is closed, resulting in a circular flow of resources, meaning the linear flows of waste are turned into secondary resources' (Moraga et al., 2019:453). The CE model is driven by the circulation of obsolete items that have exhausted their economic value (i.e., waste). According to the Ellen MacArthur Foundation (2013, 2015), CE eliminates waste by perpetually circulating materials. Mainstream CE advocates point to the potential of circulating materials for making a profit in an environmentally sustainable way. Circulation, state and market players claim, promotes research, design, technological innovation, new infrastructures, and new patterns of consumption.

From a degrowth perspective, these definitions of CE embody a new wave of greenwashing an economic system that entails increased production and consumption and thus produces more waste (see for example Hepp, 2020; Lambert, 2020). Yet CE discourses harbour a fundamental contradiction that makes them prone to a more radical interpretation. CE's assumption is that increasing the circulation of materials requires rethinking current production and consumption systems. For CE to be a viable business, waste recovery must be more economically viable than raw material usage. A decreased demand for raw materials would erode global commodity chains and open the possibility of reducing global labor and land exploitation. CE frameworks also problematize current economic tendencies to produce waste as a material surplus through planned obsolescence and cheap/quick production chains. This may foreground a change in consumer culture and displace materialism's dominant position in social relations. Finally, CE's valuation of waste opens the possibility of divesting from all activities that produce waste that cannot be reused. This opens the possibility to tax more wasteful activities and to invest productive capacity in non-wasteful activities, such as the care and the well-being economy.

These systemic changes echo a degrowth imaginary that problematizes wasteful consumption, extractivism, and increased production through planned obsolescence (see also Marín-Beltrán et al., 2022). Yet whereas CE narratives refrain from critiquing capitalism, degrowth is inherently anti-capitalist (Treu et al., 2020). Degrowth and circular economy indicate the same dangers (waste and the exhaustion of raw materials), but degrowth problematizes the social and economic structures that drive production and consumption, advocating for a society founded instead on sufficiency (Buch-Hansen & Nesterova, 2023).

Considering these weaknesses in mainstream CE research, few critical writings have explored possible ways to sophisticate CE ideas through a degrowth critique. Calisto Friant et al. (2020), for example, criticized CE literature for framing its societal ambitions within largely technocratic and reformist discourses, in which technology instigates transition. Bauwens et al. (2020) and Godelnik (2021) examine whether circular futures include sufficiency principles and decentralized decision-making. Temesgen et al. (2021) differentiate between reactive and proactive CE approaches (i.e., does CE address the fundamental problem of consumption). As these studies show, CE's more practical definitions often describe diverse, if not contrasting, approaches. However, the CE literature rarely considers if and how each approach would downscale consumption.

Empirical studies observing circular practices also interrogate the role of scale, institutions, and politics. Hobson (2015) argues that radical change through CE can only come from questioning the political role of consumers as producers of waste. She shows how the eco-modern approach to CE relies on the responsibilization of green consumers and the de-responsibilization of waste producers (Hobson & Lynch, 2016). Valenzuela and Böhm (2017) and Corvellec et al. (2020) similarly worry that putting more responsibility on consumers as agents of circularity could lead to new wasteful consumption practices. Savini and Giezen (2020) empirically confirm that circularity shifts the responsibilities – and costs – of waste management onto urban households, particularly those that are better positioned in the housing market.

CE's political profile varies, depending on how the circulation of materials is institutionally organized, the ownership of the technologies mobilized, and the subjects who profit from circulation (Genovese & Pansera, 2020). Because resource productivity always decreases at each reuse, CE risks fostering new labor and resource exploitation exacerbated by monopolistic technological property. In response, Genovese and Pansera (2020) argue for a circular economy that relies on convivial tools of production—combining the economic and social dimensions of productive activities. These arguments echo the diverse practices of repair, reduction, and reuse praised in degrowth research. These create meaningful non-monetary relations involving the circulation of materials and adopt convivial tools to pursue equity and satisfy everyone's basic needs (for an overview of practices around food see Nelson & Edwards, 2020).

Geography is also an important factor in distinguishing between degrowth and mainstream CE approaches. Circular production networks can operate globally but must rely on local production/maintenance in specific geographical areas (Ralph, 2021). Such localization may reduce reliance on monopolistic supply chains. Weber et al. (2019) also note the importance of grassroots initiatives that stimulate local waste reduction and degrowth practices. Moreau et al. (2017) argue that CE will only radically change our current linear economy if not-for-profit activities develop into a solidarity economy. Similarly, Savini (2021a) questions the scale at which

[1] In these types of analysis, both upstream and downstream businesses are defined as 'circular'. Upstream businesses include those that, for example, innovate production by using a less impactful resource to produce similar products (i.e., from concrete to wood). This stretches the notion of circular because not all these activities foster a strict closing of material loops. These activities can be important for CE, but producing sustainably does not directly include recovery or reuse.

waste is recovered and shows that the most innovative CE practices aim to reduce wasteful consumption by breaking global waste/commodity supply chains through the localization of waste recovery.

As Hepp demonstrated when looking at food waste reduction, although discourses promulgated by large institutional players (eg. FAO) and degrowth advocates share a critique of the current culture of consumption, they diverge when it comes to 'the strategy and agency of subjects' (Hepp, 2020: 194). For degrowth practices, 'reducing food waste is made possible through negotiating new meanings to revalue discarded produce' (Hepp, 2020). For institutional players, though, waste reduction strategies are 'focused on efficiency […], which does not lead to an ultimate reduction in resource consumption' (Hepp, 2020).

In the following section, I further accentuate the differences between CE and degrowth by analyzing three institutional trajectories along which these two imaginaries of the future clash: the agents responsible for increasing circulation; the key geographical scale at which action must be taken to tackle waste production and ensure its reuse; and the conceptions of waste's value and how it is appropriated.

3. Approach: questioning the social metabolism of waste

This paper identifies three institutional aspects to question the differences between CE and degrowth as imaginaries of the future social metabolism. The first considers how *responsibilities* are distributed to agents of circular production. The second examines the *geographies* produced by circular economy programs that promote waste recovery and reuse. The third analyzes the (re-)definitions of *value* – social, economic, ecological – that CE practices try to achieve.

This analysis is grounded in social metabolism theory, an approach that identifies the historical organization of *flows of matter and energy* between society and nature and *flows of information* within a particular society. It considers the institutions, legal rules, values, and knowledge that are mobilized to deal with materials and identifies different socio-metabolic regimes in human history (for an extensive introduction, see de Molina & Toledo, 2014; Fischer-Kowalski & Haberl, 2007). For example, the agrarian-to-industrial transition involved a steady increase in material and energy flows and formed global labor markets, nation states, global supply chains, and a culture of mass consumerism. This approach foregrounds the unprecedented institutional changes needed to downscale society's material/energy throughputs (Kallis, 2013). Degrowth research has already shown that this approach is able to identify and tackle the growth-dependent institutions that govern food, water, and material resources (Olsen et al., 2018).

The main assumption of this analysis is that the extent to which circularity reduces material consumption depends on the *value* (economic, ecological and social) ascribed to waste (for a complete theoretical grounding, see Savini, 2019b). According to this framework, the value of waste is defined by shifts in the responsibilities and geography of waste. Shifting responsibilities of waste recovery reshapes the geography of waste management by shortening commodity/waste value chains and by modifying the actors that deal with waste itself. Geographical shifts in turn modify the socio-economic costs and benefits of waste recovery, its potential uses, and the subjects who benefit or lose from it. Table 1 summarizes the key differences between CE and degrowth along these three dimensions. The following sections expand on each analytical dimension.[2]

4. Responsibilities: the shifting subjects of circularity

The valorization of waste through circular production reshuffles the positionality of waste producers, consumers, and processors throughout a product's whole value chain. As Gregson et al. (2015) note, the circular economy narrative is primarily a 'moral' tool to redefine the responsibilities of waste management. This new morality – waste as a resource – operates in both soft and hard forms: social norms define 'good' ways to dispose of waste while legal frameworks determine who is liable to manage waste production or consumption. As Gregson et al. argue, in EU circular economies moral judgments on waste drive legal and economic adjustments of resource markets (Gregson et al., 2015:221). As a prescriptive policy, CE redefines the economic status of waste and dramatically affects waste management organizations.

In the linear economy, the responsibility for waste processing rested primarily with the public administrations that guarantee public hygiene (Gandy, 2004). Yet, a wave of reforms in the 1990 s opened a market for landfill and incinerator concessionaries. This shifted the responsibilities and costs of waste management to global players and allowed national governments and producers to shun responsibility for their socio-environmental effects (Gregson et al., 2014). However, waste management has also regionalized into industrial networks of production. The introduction of waste hierarchies, landfill taxes, and extended producer responsibility programs responsibilized higher chain actors, closer to the source of the waste before it is turned into unsorted garbage. These reforms opened a market for secondary materials and took steps toward CE programs (Buclet & Godard, 2013). Producers, now accountable for their product's entire lifecycle, redesigned production processes to include fewer toxic materials and reduce unsorted residuals. Particularly in the electronics sector, waste was reimagined from hazard to 'stock' filled with valuable rare materials (Kama, 2015).

Consumers/users also grew more important in waste recovery. The responsibilization of consumers involved correctly disposing of waste, separating products, and reducing waste. These tactics remain essential components of eco-consumerism, a path to consumption developed from sustainability ideals (Soneryd & Uggla, 2015). The green consumer emerged from a variety of programs that involved circular material reuse (from repair to recycle). Consumers remain 'responsible' for disposing of used goods, searching for repair shops, separating garbage for recycling, and collecting compost.

[2] The table shows a conceptual distinction between pro-growth and degrowth circularity. In practice, real-life projects of circular reduction often refer to both circular economy and degrowth.

Table 1
The institutional differences between circular economy and degrowth.

	Mainstream circular economy	Degrowth circularity
Responsibility	Corporate project of resource efficiency built on individual consumer choice	Community approach to waste reduction through collective responsibilities
Geography	Global waste chains; Regional infrastructures	Bioregionalism; Bounded sufficiency
Value	Monetary: waste acquires value through circulation	Socio-ecological: waste is both a means of socio-ecological regeneration and a danger to be aggressively reduced

4.1. Individual consumers vs. collective users of waste

These trends showcase the contradictions between the corporate and the social root of circularity. CE is promoted as a corporate-led program of waste valorization; however, it advances a new economic position for consumers to make these valorization strategies possible.

The pursuit of economies of scale and massive technological innovation are central to corporate projects of waste valorization. This includes the development of industrial conglomerates that maximize the material throughput of production through industrial symbiosis (Saavedra et al., 2018). This symbiosis benefits from the development of new knowledge such as standardized systems of material stock accountancy and common databases of material stocks.

From the degrowth perspective, this CE model has a major shortcoming: its corporate and techno-driven nature does not address consumerism (Friant et al., 2020; Hepp, 2020; Lambert, 2020). Moreover, degrowth research has shown that shifting from one pattern of production and consumption to another, even if responsible consumerism is the aim, forecloses possibilities for decoupling unless maximum waste generation is capped per capita (EEB, 2019; EEB, 2020). Furthermore, for degrowth, if production and consumption are not addressed simultaneously, circularity becomes an exclusive luxury, enjoyed by consumers with high spending capacity. Higher-value waste recovery depends on the availability of sorted waste and the purity of reused waste. It also requires a consumer sector that prefers upcycled goods (eg. DIY furniture, upcycled clothes, artworks from collected materials). Consumers are still assigned individual responsibilities like buying upcycled (or recycled) products, including those that can be disassembled. As Hobson argues, this is an 'impoverished view of our relationships with complex material cultures' (Hobson, 2020: 99) because it overlooks the collective dimension of wasteful consumerism.

In contrast, a degrowth circularity must critique individual consumers as socio-political subjects (Fournier, 2008). Circularity, from this perspective, offers a set of tools that can turn waste into social cohesion, collective well-being, and democratic empowerment. Individuals might become part of collectives, associations, or organizations that hold shared responsibilities in the recovery of obsolete goods and waste. Through the collective valorization of waste, circularity can offer more than the monetary returns generated by responsible eco-consumers and appropriated by the waste management sector. It can also promote social cohesion, conviviality, and care within communities.

A degrowth understanding of circularity critiques waste as growth's inevitable surplus, which must be reduced. But it also reconceptualizes residuals as material for building practices of sufficiency. This shift is already practiced by grassroots initiatives tackling waste prevention and reuse. In these projects, citizens take direct responsibility for the management of their obsolete products and organize collective action around them. Yet, they do so without celebrating the monetary value of waste but recognizing its socio-ecological burden. Examples include bike repair shops, repair cafés, give-away shops, voluntary exchange of tools or toys, neighborhood-based organic composting, artisanal furniture productions or artwork from recycled goods, and local food pickers catering for neighborhood food banks. Such initiatives share the same goal: to 'create collaborative local networks to develop waste-prevention practices' (Zapata Campos & Zapata, 2017:1057). Collectives, not individual subjects, are responsible for these practices. Their work thrives from the networks of conviviality, assistance, and (self-)help created in place. As I argue below, these practices also reshape the geography of waste reuse and circularity.

In the Netherlands, Emmaus[3] is an organization that connects the country's second-hand and thrift shops and coordinates a network of volunteers who put discarded products into circulation for social purposes. These projects reject profit and do not seek financial growth.[4] They insert waste reuse into a program of reduction, collective responsibility, and citizenship. Another example is the WASTED project in Amsterdam. This initiative uses elements of gamification and a self-developed app to reduce plastic waste in households. It awards tokens for each bag of recycled waste to sustain local shops.

These examples showcase how a growing circular social sector can influence urban (policy) narratives around waste (see also (Bulkeley et al., 2007). The Amsterdam circular strategy 2020–2025 (Municipality of Amsterdam, 2020a, 2020b, 2020c) uses Raworth's doughnut framework of action (Raworth, 2017) to embed collective waste initiatives into the overall project of reducing material consumption and increasing minimum living standards for disadvantaged groups. However, in this policy, these activities are accompanied by projects that instead foster green consumerism. The challenge for a degrowth circularity program is that to disentangle the viability of social and collective forms of circular productions from those driven by corporate and consumption goals.

[3] https://emmaus.nl/over-emmaus/

[4] They use money to sustain their activities (e.g., refund of expenses, grants to pay for their flayers and webpage) but they have demonetized the circulation of materials, their primary function. From a degrowth perspective, the role of monetary exchanges is critical (Exner et al.,2020).

5. Changing geographies of waste: from global to regional

The geographical scale at which materials circulate is an essential factor in waste reduction since waste is expensive to transport and stock. Despite the importance of geography, little CE research has addressed this issue. Most CE literature examines the scales at which material stocks are accounted (e.g., the national, European, and recently, the municipal scale) (Aguilar-Hernandez et al., 2019; Bassens et al., 2020; Prendeville et al., 2017).

The main costs involved in waste management are circulation, stockage, and logistics. In linear economies, the devaluation of secondary materials vis á vis primary materials produced economies of scale that tried to minimize those costs for each ton of waste managed. Since WWII, cities and nation states have disposed of waste through soil reclamation projects, landfills, and incinerators as these methods maximize large-scale processing capacities and are easily monitored by public authorities (Melosi, 2004). The globalization of waste further facilitated the disposal of large waste stocks in countries with lenient environmental and labor protections (Gregson & Crang, 2015).

The rise of CE programs counters this globalized geography. Since the mid-90 s, post-industrial economies have shortened the distance between waste production and collection (i.e., cities), where it is stocked and processed (i.e., peri-urban areas), and where it is reused (i.e., incinerators, biogas, remanufacturing). This shortened waste value chain regionalized the geography of waste markets (Davoudi & Evans, 2005) and also integrated waste services into large utility conglomerates that combine water, electricity, raw materials management, and logistic services (Savini, 2021a). These conglomerates are today the primary advocates of CE policies.

It is therefore not surprising that the primary scale for CE innovation became the EU, with its city-regions as main hubs. The continent offers a middle political-geographical level to combine multiple goals: breaking global chains, fueling large-scale waste management integrated within multi-utility multinational corporations, and implementing these policies at the regional level, where efficiency can be best achieved. As Gregson et al. argue, 'there are right and wrong ways of constituting the economic circulation of materials, and, within the EU, the revalorization of wastes through global recycling networks increasingly counts as the wrong way to do this' (Gregson et al., 2015:221).

The degrowth perspective reveals a major contradiction in this geographical reshaping. Though waste management is regionalizing, it still requires large volumes of waste that are shipped across countries and city-regions. Degrowth research notes the value of localizing waste reuse practices, arguing that localization can break transnational and transregional flows of waste (Alexander, 2018). Yet the idea of locality remains contested. It is therefore important to identify the geographies being mobilized in circular imaginaries of degrowth more precisely (see also Kramer, 2022). Below, I argue that a bioregional perspective can address the challenge of large-scale waste reuse and reduction, as well as advance a program of social well-being and ecological regeneration.

5.1. *The bioregion as a scale to combine waste reduction and reuse*

The concept of bioregionalism is regularly referenced in degrowth research, though mostly in the context of eco-villages (for an overview, see Fanfani & Ruiz, 2020). Since the mid-1970 s, bioregionalism has critiqued the economistic and anthropocentric approach to metropolitan planning. Bioregionalists argue that planning prioritized the imperative of (inter)national economic growth over the cultural and ecological qualities of place (Fanfani & Ruiz, 2020). Their counter strategy stresses the importance of 'living in place,' co-evolving the living ecosystem with the economy, and dismantling artificial dichotomies like nature/culture (Sale, 1991; Young, 2000).

Bioregionalism combines local and trans-local elements. It advocates self-sustainable and self-reliant modes of urban living while recognizing the risk of enclaving caused by hyper-localism. To address this problem, it stresses the importance of federative and coordination processes across localities for co-managing essential common services (Bookchin, 1992; Scott Cato, 2012). Bioregionalism argues that sufficiency within bounded settlements like cities can never be fully achieved, so communities must coordinate through regional networks (Evanoff, 2017). Frequently cited examples include food production and the management of large water basins and other ecosystem services.

Current bioregional literature rarely deals with waste specifically but generally considers waste accumulation an effect of a globalized economy (Thayer, 2003). Yet, real-life bioregional practices demonstrate that, by reducing the geographical scale of socio-economic activities, waste production can be reduced. If a region's capacity to absorb waste shrinks, the production of waste will decrease, and more waste will be recovered. The upscaling of waste management to national and transnational scales has unleashed consumeristic derivatives of a linear economy. Bioregionalism advocates a homeostatic closed system that manages its own residuals and does not rely on waste exports or raw material imports. Fanfani (2018) refers to this as a strict 'circular' economy. To achieve the dual goals of waste recovery and waste downscaling, a bioregional economy must undertake waste reuse *and* consumption reduction. When waste cannot be exported or processed in large amounts, it is assumed that communities will disallow excessive waste production and trigger a proper degrowth trajectory and a virtuous circle of waste reduction.[5] This process invests all types of material flows, from food to electronics. Some can be reduced and processed at the very local level (e.g., food for compost), while others may require networks of localities cooperating, and forming federated networks of localities grounded on local democracy (e.g., construction materials, electronics) (Savini, 2021b).

Many European countries (e.g., The Netherlands, Italy, Germany) are motivated by the same assumption that downscaling

[5] A similar assumption has successfully changed car use in cities by reducing the amount of parking spaces and increasing their costs.

geography would incentivize waste reduction and have tried to bind regions to their waste management. However, growing transnational markets for secondary materials and incineration and the fact that waste management was never seen as central to overall ecological and social regional development have jeopardized the results. Most of the current regional programs do not address the sufficiency dimension of regionalism – and they often see regional waste imports as sources of income. They are not coupled with strategies to downscale consumption nor value the socio-ecological dimension of waste. Rather, they rely on a typical, economy-led, efficiency paradigm that devalues waste, separates waste management from production, and seeks 'bulk' circular productions.

The case of the MRA (*Metropoolregio Amsterdam*) food council in Amsterdam demonstrates instead the value of taking a sufficiency perspective as a core principle of a (bio)regional economic system. After much political advocacy starting in 2007, the food council emerged as a self-organized, bottom-up institutional platform for sustainable agriculture and agroecology in the region (van der Walk et al., 2021). Today, it is a milestone project in Amsterdam's circular strategy 2020–2025. The food council offers political advocacy services, information, education, and logistical coordination for food-related projects in the city. These include consumer cooperatives (e.g., VokoMokum, Foodcoop Amsterdam), cooperatives that purchase land to increase biodiversity (e.g., Land van Ons), and cooperatives that collect and redistribute left-over food within the city (e.g., Voedselbank, Taste before you waste). Other projects include community-supported restaurants that operate in cooperation with citizens and compost makers (Kaskantine). The food council was built from the needs of a single local initiative, but now spans municipal administrative zones and operates as a self-organized network of members. These members lead political advocacy and food activism in the region, including resisting the expansion of global logistics and the erosion of agricultural land (e.g., the Lutkemeer polder).

This bio-regional network promotes the reuse of organic mass in regional agriculture, better (and reduced) food consumption, agroecological regeneration, and education for green citizenship. One example is the Amsterdam's 700-hectare territory west of the city called Circular Tuinen van West.[6] Here, different food production/consumption activities symbiotically support each other. Restaurants sell food produced in urban gardens managed by volunteers from the city; the gardens also use compost collected from the city itself, redirecting organic mass from incineration. The gardens are located next to sport, education, and recreational facilities creating a spatial synergy between local production that protects the social metabolism of the area.

Most bioregional literature focuses on organic food and waste (and less on electronic or construction waste, for example). Yet, Amsterdam's steps towards a circular agenda show that regionalism also affects non-organic waste sectors. In 2014, the Amsterdam circular strategy (Municipality of Amsterdam, 2014) focused on construction, food, and textiles. It envisaged a regional value chain for these streams supported by a local inventory system. The policy advocated for the regionalization of the construction material industry through integrated CDW disposal, smart logistics, and housing production. These initiatives tried to break the (trans)national value chain for concrete and building materials. They regionalized CDW reuse for ecological and social development and coordinated regional governance to capture different steps along the construction value chain.[7] When combined with policies to reduce the use of raw materials, these programs can instigate material consumption downscaling.

From a degrowth perspective, these initiatives have shortcomings because they deal with the building stock after it is produced, not with its downscaling. However, they do reveal that waste reuse is prioritized once the boundary of circulation is reduced to the regional scale. For example, the city discouraged non-reusable materials on public land procurements using disassembling requirements, a reduction of concrete components, and circular waste/energy systems (Municipality of Amsterdam, 2017). They also created so-called building waste passports[8] that account for all components in a building that can be reused in new projects and opened a CDW bank site north of Amsterdam.[9]

6. The value of waste

For the European Commission, transitioning to a circular economy means 'the value of products, materials and resources is *maintained* [italic added] in the economy for as long as possible, and the generation of waste is minimized' (EC, 2015:2). This approach can supposedly combine sustainable development goals with a 'competitive economy' (EC, 2015:2). This definition captures the core of CE— value is maintained through the circulation of materials and products. By reframing waste as all that is not circulating, businesses and governments can capture untapped economic value embedded in the overall stock of the economy. As Gidwani (2018) argues, waste is capitalist value in waiting and, as such, is considered an externality by corporate interests.

Yet, waste *does* circulate in the linear economy already. Landfill waste leakage affects soils, residual heat dissipates, excrement in wastewater moves towards sewers, and electronics are shipped to wastelands to be recovered by waste pickers. However, this circulation is invisible to CE since it does not generate monetary value (see Anantharaman, 2021). Masses of waste are already being valorized, particularly in the Global South, but the monetary gains of this (often informal) economy are considered marginal or insignificant in the corporate economy. Waste is valorized in the 'need economy' (Sanyal, 2007) by informal waste pickers and longstanding networks of informal goods recovery and repair.

CE policy programs aim to maximize the monetary value of discarded materials and maintain the circulation of these materials *within* the economy. Most guidelines for CE policy advisors and businesses note that a well-designed product in the correct

[6] https://tuinenvanwest.info/leden/

[7] https://circulairebouweconomie.nl/wp-content/uploads/2021/04/Handboek-Circulair-Renoveren-voor-Woningcorporaties.pdf and https://www.cirkelstad.nl/metropoolregio-amsterdam-breidt-circulair-netwerk-uit/

[8] Building Waste passports: https://www.metabolic.nl/news/circular-economy-materials-passports/

[9] https://www.grondstoffenbankagriport.nl/

infrastructure can produce several circuits of value. For example, wastewater from sewage can provide phosphates for agriculture, sludge for incineration, and heat storage. A smartphone can provide parts for new phones, metals for jewelry, and plastic for 3D printing. A greater variety of secondary production opportunities (circularity potential) leads to higher monetary value. The monetary value also includes the knowledge generated through circular production, such as smart meters, databases, applications, and expert advice. The Ellen McArthur Foundation's (2019) 'butterfly' diagram displays CE's potential to create multiple circuits of waste monetary values, or 'wealth of flows' (Webster, 2015). From CE's perspective, the main economic problem of a linear economy is that waste is collected and disposed of in bulk, where each ton has a low monetary value.[10]

Both corporate and degrowth circularity perspectives seem to have the same objective: valorize and reduce waste by making it circulate. The critical distinction lies in *how* value is created. Corporate-led CE programs rely on a commodified view of waste, only seeking monetary added value through circulation. Such CE is a project brings waste management circuits back into the economy through the labor involved in waste recovery activities. As Schindler and Demaria argue, in current capitalist systems, 'waste represents a commodity frontier whose exploitation offers strategically positioned stakeholders the opportunity to accumulate capital' (Schlinder and Demaria, 2020:53). In contrast, a degrowth circularity stresses the socio-environmental value of circulation: the socialization of materials allows to fulfill essential needs, generate well-being, and ultimately reduce the source of waste itself—material consumption.

6.1. *The socio-ecological value of waste*

Demand is required to treat recovered waste as a commodity. This means circular productions will experience the same pressures as other growth-dependent industrial sectors: expand or perish. Rather than 'downscaling' the economy, this *grows* the economy by extending commodity-mediated relations into the realm of waste management. Even zero-waste or minimalist lifestyles can be commodified since they spur a market for gadgets, tools, books, and clothing that help individual consumers participate in a zero-waste society (Meissner, 2019). In contrast, a degrowth circularity overcomes the imperatives of individual competition, consumption, and environmental exploitation. To accomplish this, waste must acquire a social and ecological value.

Waste circulation, as a source of social value, creates social relations that are not profit-driven. Waste can be held in common, be publicly regulated, and be reinserted to satisfy social needs. In a linear economy, waste property has largely been concentrated into oligopolies, while public authorities are reduced to market regulators. In a circular economy, waste property and the work of recovery would be spread across a constellation of stakeholders. In a degrowth circularity, waste management is socialized through collective ownership structures derived from cooperation and public responsibility. Recently, scholars have recognized the social potential of circularity, with Hobson calling for a 'social circularity' (Hobson, 2020) and Morrow & Davies (2021) calling for 'careful circularities,' or the creation of circuits of care and solidarity through the process of material reuse. The social work of culture and care should be mediated through waste materials.

Cooperative structures provide essential services. They dispose of waste through socially 'restorative' production and explicitly challenge poverty, income disparities and bad labor conditions (Barford & Ahmad, 2021). Combining productive activities that address essential needs and the collective responsibilities of waste processing sidesteps linear economy outcomes (i.e., separating waste management from waste production activities, thereby deresponsibilizing wasteful consumerism).

As a source of ecological value, waste circulation can enable regenerative development. The reinsertion of organic waste into agroecological productions remains the classic example of this form of CE. In food cooperatives, waste as surplus disappears in so far as gains a use value (a nutrient for new activities) for social and ecological goals (the reduction of new raw materials intake to sustain basic human needs of food consumption and collective production). This approach should be expanded to other types of materials, while materials that cannot be recirculated (e.g., hazardous materials) would be aggressively disincentivized. The socio-ecological value of waste can be found in material banks (where waste is diverted to provide materials for social projects), nature recovery projects that reuse waste trees for rewilding purposes, repair cafés that use wasted goods recovery for community building, elderly and childcare, fair-phone production from underused parts, and the reuse of textiles for low cost, high quality, clothing.

Ascribing socio-ecological value to waste allows distinguishing between waste that can be effectively reused for social practices and waste that is purely damaging to nature and society – that surplus materials that are either lost in the ecosystem or reappropriated by profit-seeking strategies. This limit barely exists in pro-growth CE since all waste can potentially be transformed into monetary opportunities.

7. Conclusions: pathways to degrowth circularity

CE and degrowth advance two different imaginaries of a future social metabolism, but begin from a similar critique of the existing economy of wasteful production and consumption. As narratives of the future, they have performative capacities in the present: they mobilize resources – material, financial, social – into infrastructures, practices, and rules that will shape future possibilities for a sustainable society (Groves, 2019).

CE has become popular among policymakers willing to tackle the twin challenges of the accumulation of waste and depletion of resources. Yet this narrative is problematic in that it projects the eco-modernist ethic into a circular future. Although it questions

[10] From a Marxist perspective, the low value of waste is the result of mass processing that seeks high productivity and technological efficiency. Larger scale technologies allow for less labor power employed and thus a lower value of waste as commodity.

current modes of consumption and production, it does not question production and consumption as such, nor the centrality of economic thinking and exchange value (Groves, 2019). For degrowth, these are the actual sources of waste (understood as production's unwanted surplus material) and the reason that CE will not deliver its promises for a sustainable future.

This paper has unpacked the institutional trajectories along which these two views of circular futures build expectations and responsibilities concerning the future of waste. The extent to which present and future waste will be reused *and* reduced, I argue, depends on the value ascribed to it. I have shown how pro-growth CE approaches pursue an increase in waste's monetary value to boost profitable circular production and consumption. They therefore risk making economic wealth dependent on waste. A degrowth approach to circularity, by contrast, conceptualizes waste's value in socio-ecological terms, allowing for the creation of regenerative relations around collective social practices of waste recovery and reduction. This paper identifies the institutional bases of these two opposed conceptions of value – bases that frame the relations between present societies and future waste. I have questioned waste's geographies, the agents responsible for circularity, and the values ascribed to waste.

7.1. From individual to collective responsibilities

for pro-growth CE, valorizing waste fuels a corporate project of renewed production. By developing an economic sector around material reuse, waste recovery, and goods repurposing and manufacturing, it seeks to generate monetary value. The many corporations involved in waste recovery, plus their R&D institutions, are diving this transition. In line with the liberalization of the waste market, which began in the 1990s in Europe, individuals are identified as responsible consumers and the source of reusable materials.

Degrowth perspectives critique this individualist, consumer-driven path to CE. Instead, they cast consumers as a collective with a pivotal role in tackling waste reuse and consumerism. This suggests that consumers and industrial producers must assume more responsibility when it comes to disincentivizing wasteful practices (perhaps through a cap on maximum waste), thereby establishing more circular forms of production and consumption. To avoid greenwashing, this responsibility be articulated as a collective project of building socio-political consciousness against wasteful consumption. This collectivization of responsibility can favor a culture of waste reduction and help legitimize policies that aggressively tackle wasteful consumerism, penalize waste accumulation, and incentivize circular production.

7.2. From global regionalism to bioregionalism

the shift in responsibility just outlined relates to changes in the geography of waste flows. To end uneven transnational exchanges, a degrowth circularity would localize the circulation of materials. Mainstream CE research, by contrast, mobilizes the national and continental scales; these are the scales at which waste markets currently operate and significant capital can be mobilized. This paper argues that the region is the scale at which the imperatives to recover and reduce waste can be linked: regions can break global waste flows, as well as deal with waste streams that can either be reused locally (e.g., organic waste) or require larger, trans-local infrastructures (e.g. construction waste).

The concept of bioregionalism helps one imagine how the regulation of material flows overlaps with socio-political priorities. Thinking in terms of regional sufficiency makes it possible to envisage synergetic local production and consumption practices in a bounded territory. Amsterdam's bio-regional food network and circular strategy constitute examples of how the reduction of waste benefits from clustering material streams in regional boundaries. My argument is that applying sufficiency principles at a regional scale makes it possible to clear a path to waste reduction.

7.3. From monetary to socio-ecological value

this paper argues that changes in the responsibilities and geographies of waste underpin a reconceptualization of waste's value. Pro-growth CE programs seek monetary added value, which arises from the many circuits of production and consumption generated from discarded goods. Pursuing monetary value, however, makes it harder to undertake rapid and convincing reduction programs; in fact, it makes economies *more* dependent on waste.

The valorization of waste is also crucial for degrowth. Here, waste is not a commodity but both a socio-ecological problem and socio-ecological means for producing meaningful social practices and ecological regeneration. Profit from waste can be reduced by introducing cooperative forms of circular production. The ecological valorization of waste can foster policies that fiscally penalize non-reusable wasteful consumption and redistribute resources into circular production. These investments would fuel a socio-ecologically conscious regional economy, which reuses materials for collective goods (e.g., landscape, housing, cultural spaces, phosphates, and biomass).

It is beyond the scope of this paper to offer an extensive list of policies for a degrowth circularity. Rather, I have proposed a program for degrowth research on circular futures. As the examples show, practices that prefigure this agenda already exist. A degrowth circularity will likely require that the public takes a leading role in managing waste, divesting from global waste infrastructures, tightening disposal regulations, building public material accountancy models, and increasing the fiscal burden on waste producers, including wasteful households.

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