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Chapter 9
Limits to Sustainable Development Goals: Discussing lessons from case studies in (un)sustainable production

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Abstract
Closed-loop production strategy, which aims to retain the highest utility and value of products, components, and materials at all times, aims to address resource depletion as part of Sustainable Development Goals (SDGs), particularly SDG 12, concerned with "responsible consumption and production." The circular economy is based on the 9R principles, supporting closed-loop systems, such as the circular economy and cradle-to-cradle (C2C), promising absolute decoupling of resource consumption from economic activity. However, while the SDGs single out "inclusive economic growth" as an overarching aim, economic growth is the cause of unsustainability, and absolute decoupling is impossible. This chapter addresses broader lessons from the critical assessment of products that strive towards or claim full circularity. This chapter discusses some supposedly "circular" or C2C products analyzed by business students. These case studies have taught the students more significant lessons concerning the limitations and paradoxes of production. The discussion section delves into the subject of how applying "ideal" and "realistic" circularity principles can help students develop critical thinking about the SDGs in general and "responsible production and consumption" in particular.

Keywords: circular economy, Cradle to Cradle (C2C), degrowth, Sustainable Development Goals (SDGs)

9.1 Introduction
The 17 interlinked Sustainable Development Goals or SDGs were set in 2015 by the United Nations General Assembly and intended to be achieved by 2030, were designed to be a "blueprint for achieving a better and more sustainable future for all" (https://sdgs.un.org/goals). The first SDGs are No Poverty (SDG 1), Zero Hunger (SDG 2), and Good Health and Well-Being (SDG 3), followed by Quality Education (SDG 4). The

terms “sustainable and inclusive economic growth,” while especially prominent in SDG 8, Decent Work and Economic Growth”, are used in most of the SDGs, including Gender Equality (SDG 5) and Climate Action (SDG 13). The SDGs follow the general “sustainable development” strategy that aims to combine social, economic and environmental aims (known as the triple Ps of People, Profit, Planet).

Progress has been seen in areas ranging from reducing child and maternal mortality globally to advances in health and food production technologies (https://unstats.un.org/sdgs/report/2020/goal-03/) and increasing human resilience to climate change through adaptive measures (https://unstats.un.org/sdgs/report/2020/goal-13/). While the COVID-19 pandemic in 2020 has caused a recession with deprivation and unemployment, the UN noted that the pandemic could serve as the impetus to make the global economy “more resilient to future shock access to essential services and social protection” (https://www.un.org/sustainabledevelopment/economic-growth/), aided by SDG 12, “Responsible consumption and production.” The European Union committed to the Circular Economy, the closed-loop system (https://ec.europa.eu/environment/circular-economy/) to meet this goal.

The closed-loop systems, otherwise known as Cradle to Cradle (C2C) framework (McDonough and Braungart, 2010) or circular systems, share a commitment to measures that address unsustainable consumption as resource loops are narrowed, closed, and slowed to deliver on the increasing demands of a growing world population (Bocken, 2021). In *Cradle to Cradle: Remaking the Way We Make Things*, McDonough and Braungart (2010) criticize the current method of production as a linear, "cradle to grave" (take, make, waste) process. In this process, built-in obsolescence and throw-away culture are encouraged. The Economist (2017) reports: “Firms say that restricting repairs, either by individual consumers or businesses, helps protect their intellectual property and works on the part of buyers.” Thus, “more products, from smartphones to washing machines, are thrown away rather than repaired, adding to waste and pollution” (Ibid).

C2C framework can be understood as both critique of existing sustainability models, such as eco-efficiency and recycling (as they lead to a reduction, not the elimination of damage), and also a proposal for a radical transformation of the production system to “100% good” (McDonough and Braungart, 2010). C2C suggests that "bad" products, such as fossil fuels or plastics derived from petrochemical waste, should not be made "efficient" but eliminated. C2C identifies three fundamental principles: (a) waste equals food, (b) use renewable energy, and (c) celebrate diversity. The "Waste equals food” principle can be exemplified by fruit trees' fruits and blossoms, which nourish other species and soil when decomposing. All materials can be designed as nutrients that flow through natural (biodegradable) or technical metabolisms suitable for, ideally, endless cycles of production, use, recovery, and remanufacture (McDonough and Braungart,

2010). The second principle, reliance on renewable energy, does not allow for "partial" renewables such as biofuels derived from burning trees or mixed garbage. Celebrating diversity applies to natural diversity or reliance on local materials (Ibid). C2C has attracted considerable interest and is often regarded as pivotal in the transition to a circular economy.

C2C has inspired the revision of the well-known 3-R framework (Reduce, Refuse, Recycle), stressing that Refusing to buy new products or *infinite* reuse is the only sustainable option (Kopnina and Blewitt 2018). Reducing and recycling serve to minimize but not eliminate the damage and lead only to partial decoupling (eco-efficiency) at best, “making a bad system last longer” (McDonough and Braungart, 2010). The circular economy can be defined as a system that applies C2C principles in operation at all levels of the economy, based on the nine dimensions in the waste hierarchy arranged by its level of increasing circularity which aims to retain the highest utility and value of products, components, and materials at all times (Potting et al., 2017).

9R hierarchy starts with Refuse, or avoidance of production and buying, followed by Rethink, Reduce, Re-use, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover (Potting et al., 2017). Refuse is the framework’s most circular concept. It is categorized into strategies that enable more ingenious product use that can infinitely extend its lifespan. For example, metal cooking pans can be used for many generations. Within the framework, surprisingly (as reduction does not mean the complete elimination of waste), Reduce is positioned higher than Reuse. Reuse, which can be aided by collaborative consumption and using second-hand instead of buying a new product, is prioritized over Recycling with the final option of Recovering embodied energy (Brennan et al., 2015). While Rethink suggests changing ways of consumption, Reduce refers to increasing efficiency (Potting et al., 2017). Repair and Refurbishment aim to put defective products back to their original condition. Remanufacture and Repurpose develop a new product with parts of old products. According to this model, Recycle itself would exhibit a low level of circularity by only processing materials to obtain the former quality as much as possible. The final option is to Recover, which is particularly difficult if not impossible in the food industry and packaging (Aarnio & Hämäläinen, 2008). This hierarchy generally requires a product-service shift from mere manufacturing and ownership to services such as lease and repair. The most service-oriented business models are expected to deliver the most significant environmental impacts in the product-service spectrum of business models (Bocken, 2021).

The circular economy is often seen as a magic wand to achieve ethical objectives and pragmatic sustainability in ecological modernization, which assumes that industrialization, *technology*, economic growth, and capitalism can solve environmental challenges (York and Rosa, 2003). A circular economy blends business and environmental value by adopting a sustainable supply chain management approach (Park et al., 2010).

The circular economy, as promoted by the Ellen Macarthur Foundation, is described as a “source of innovation and growth” and the “new engine of economic growth” (EMF, 2013), thus promising absolute decoupling of natural resource consumption from economic growth (Kopnina, 2020; Washington and Maloney, 2020). However, as this chapter shows, some supposedly "circular" or C2C products fall short of the ideal and seem to fit within a more conventional eco-efficiency paradigm. The question is whether the “politically attractive message of a circular economy that promises to enable continued economic growth while radically reducing the level of waste production scientifically, correct?” (De Man and Friege, 2016).

This chapter presents case studies chosen because they claimed to be either circular or C2C. These case studies served as part of a Bachelor-level course in sustainable business intended for students to learn to discern the difference between the claims of green advertising, analyzing "ideal" and "realistic" circularity principles as part of their critical thinking in sustainability. Based on these findings, this chapter recommends that a sustainable business curriculum should also focus on de-growth and the steady-state economy as part of a sustainability curriculum.

9.2 Sustainable development goals in the context of circularity

Absolute decoupling can have considerable potential for achieving sustainability. However, there is a growing recognition of the paradoxes of "sustainable and inclusive economic growth," as it is questionable that the planet can provide infinite resources for future generations (Washington, 2015; Adelman, 2018; Kopnina, 2020). Environmental problems are interlinked with demographic, social, and economic factors, such as consuming natural resources (e.g., Washington, 2015) or climate change and health (Watts et al., 2015). However, issues associated with demographic change, such as growing middle classes and people living longer (also in developing countries), are often downplayed by the “demographic transition theory” and observation that as mortality falls, fertility declines. However, in some parts of the world, fertility is high and constant despite lower maternal and child mortality (The Economist, 2015), with the African population predicted to double by 2050 (The Economist, 2020f). When writing this chapter during the COVID-19 pandemic, the UN still projects the global population to rise above 11.2 billion by 2100 (https://population.un.org/). At the same time, people in poorer countries consume less than in rich ones, the moral imperative of equal distribution of resources and providing decent lives for all (as SDGs aim to do, eliminating hunger and diseases). Also, international migration from low-consumption to high-consumption countries suggests that both population and consumption are a problem for sustaining future generations (York and Rosa, 2003; Washington, 2015; O’Sullivan, 2020).

The Limits to Growth report (Meadows et al., 1972) has been prominent as a warning of the exponential economic and population *growth* with a finite supply of resources. The cognitive dissonance of the SDGs the wicked problems associated with population growth

and the expansion of material demands are assumed to be addressed simultaneously with environmental problems (Washington and Kopnina, 2018). The SDGs support the "have your cake and eat it" optimism in maintaining the prosperity of a large and healthy human population and keeping the ecosystems intact (Kopnina, 2016; Adelman, 2018; Washington and Kopnina, 2018). Critical scholars have noted that the optimistic rhetoric of the triple Ps downplays the long-term effects of industrial growth, pressure on natural resources, the integrity of ecosystems, and biodiversity loss, failing to recognize that the Planet is an essential bottom-line, with People and Profit dependent on it (Victor and Jackson, 2015; Kopnina and Blewitt, 2018). In short: without ecological integrity, there is no society, economy, or health. The secure future of unborn generations is far from certain even with the present level of population and consumption, let alone with increased one (Washington, 2015; O'Sullivan, 2020).

This cognitive dissonance of the SDGs is similar to the publications of *The Economist* journal, with various authors stressing the science of and the importance of addressing climate change on the one hand, and yet praising the liberal economic models and corporate giants that support growth without discussion of finite resources and sustainability. Ironically, while *The Economist*'s leading articles often praise economic growth as a solution for sustainability challenges, science and technology articles in the same journal also point out that environmental conditions are worsening, witnessed by the increase in deforestation (Economist, 2020d), forest fires (The Economist, 2016) or biodiversity loss (The Economist, 2018a, 2018b; 2020a), but also wars and migration fueled by climate change (The Economist 2019). The Economist (2020b) cheers the global food supply system even during the COVID-19 outbreak; international flights carry food in cargo areas between continents. As the lockdowns began, and many feared that food would run short, causing a wave of stocking-up, the COVID-19 pandemic has shown that "today, thanks to fleets of delivery lorries filling supermarket shelves, you can binge-eat as you binge-watch" (Ibid, p. 13). Even in the poorest countries, the supplies remained more or less constant due to international aid's continuous operations of multinational corporate food supplies. The Economist (2020b) praises the fact that "four-fifths of the planet's 8 billion mouths are fed in part by imports", and companies that tie the system together: "giant middlemen like America's ADM, Bunge, and Cargill… all operate on a worldwide basis, sourcing, storing and shipping" (p. 13). It is noteworthy that these companies have embraced the circular economy (e.g., https://thecirculareconomy.com/2020/04/16/adm-announces-sustainability-goals/; https://www.cargill.com/2020/cargill-invests-to-promote-circular-economy-with-its-first) while some, like Cargill, are also responsible for massive deforestation (The Economist, 2020d). Simultaneously, the root causes of zoonotic pandemics, such as mass factory farming and global wildlife trade (Safina, 2020), remain less prominent in policy and media than the technical fixes such as vaccines, resulting from experiments on millions of genetically modified mice (e.g., The Economist, 2020e). As demand slows in some sectors

during the pandemic, “supply marches on, and animals born must, at some point, be slaughtered” (Economist, 2020b).

Aside from ignoring animal suffering and robust anthropocentric bias, the precariousness of the momentum of feeding increasing and insatiable global appetites is embodied in these assumptions of progress, both in *The Economist* and the SDGs. In this vision of the planet, “future for all” applies only to one species (Kopnina, 2020), exhibiting little ethical awareness of the intrinsic value of biodiversity (e.g., Piccolo et al., 2018; Washington et al., 2018). The SDGs only focus on the "inclusion" of a single species but also short-sighted "because it erroneously fosters the illusion of combining endless economic growth on a finite planet, social justice, and environmental protection" (Adelman, 2018). Biodiversity, which constitutes planetary evolutionary potential and ecological life-support systems comprised of various interrelated organisms and supportive environments, is often a valuable economic resource and not an intrinsic good (Buchmann-Duck and Beazley, 2020). Protecting biodiversity requires recognizing its intrinsic value and restraint of economic activities (e.g., Piccolo et al., 2018; Washington et al., 2018), often overlooked in the circular economy (Buchmann-Duck and Beazley, 2020). Buchmann-Duck and Beazley (2020) called for further research on the interaction between biodiversity and the circular economy and for circular economy advocates to acknowledge the concept's limitations explicitly.

9.3 Application of Cradle to Cradle and Circular Economy

The circular economy was first mentioned in policy frameworks in 1976 when Germany enacted their Waste Disposal Act (Ghisellini et al., 2016). Since then, various policies have been enacted in the EU, Japan, the USA, and China to stimulate bottom-up environment and waste management initiatives, including eliminating landfilling and requiring e-waste to be returned to producers (Ghisellini et al., 2016). The European Commission’s Action Plan for the Circular Economy states: “Better design can make products more durable or easier to repair, upgrade or manufacture” (https://ec.europa.eu/environment/circular-economy/). The European Commission proposed several policies, including *Circular Economy Closing the Loop* (European Commission, 2015) as an alternative to the linear economy, with the promise of creating new jobs in innovative design and business models, research, recycling, re-manufacturing, and product development, targeted at long-term measures to optimize waste management and reduce landfill. The most optimistic proposals promise infinite reuse and upcycling, eliminating waste (McDonough and Braungart, 2013). Upcycling promises to increase the value or quality of products, such as designing water cleaning and filtering so that after being used in a factory, it can be cleaner than it was (Ibid).

However, it is worth noting that there is no evidence that such is occurring (Victor and Jackson., 2015; Washington and Maloney, 2020). Multiple definitions of the circular economy create openings for subversion (Kirchherr et al., 2017; Kopnina 2021,

2019b). Not all is green or circular what seems so, as realistically, as will be discussed below, there are limitations to absolute decoupling. For example, while the potential recovery rate for fast food restaurant packaging is 64%, the actual recovery rate lies at only 29% (Aarnio & Hämäläinen, 2008). One of the challenges is that circular products need to be produced locally with a minimum environmental footprint and simultaneously satisfy the demand of global consumers. Circular design interventions are slowed down by rebound effects (Isenhour 2010) or negation of technological progress by unexpected behaviors of stakeholders in the value chain (Kirchherr et al., 2017; Bocken, 2021). Life cycle assessments can help make informed choices at various stages in the product's life and evaluate the manufacturing and delivery inputs, production outputs, use, and disposal of the product (Ünal and Shao, 2019).

Critical authors argue that without a radical reduction in population and material demands, natural resources will be constantly consumed (Daly, 1991; Rammelt & Crisp, 2014; Washington, 2015), with circularity used as a ruse to justify even more economic growth while ignoring biodiversity loss (Buchmann-Duck and Beazley, 2020). De Man and Friege (2016) note fundamental problems with the circular economy:
1. The first problem is that, in reality, waste is rarely 'food'. All production processes lead to downgrading materials, and to create value from downgraded materials, we always need energy.
2. The second problem is the assumption that natural nutrients can be fed into the ecosphere regardless of quantity.
3. A third problem is that our knowledge about the harmful effects of substance flows on the environment is limited (Man and Friege, 2016).

To address these problems, the concept of degrowth and a steady-state economy, which does not promise absolute decoupling but does require limits to demand, is helpful (Washington and Maloney, 2020).

9.4 Degrowth and steady-state-economy

To address social and economic justice, it was suggested that developed countries must contract their economy so that the developing world can expand somewhat to alleviate poverty, with the resulting steady-state economy being within the Earth's limits (Washington, 2015). Steady-state economists have recommended that society and economics need to be transformed from the longstanding model that has created our modern society to one that can thrive in a resource-constrained world (Daly, 1991, Czech, 2013). The Center for the Advancement of the Steady State Economy defines it as an economy with the best possible level of consumption constantly maintained (CASSE https://steadystate.org/) which is espousing the vision that the economy is an open subsystem of a finite environment (Daly, 1991), importing low-entropy raw materials and exporting high-entropy waste (Washington, 2015). Like C2C's critique of downcycling, due to the principle of entropy, recycling cannot continue forever as materials are gradually

downgraded and become productively useless as they exit the cycle of use (Ghisellini et al., 2016). It is assumed that any subsystem of a finite non-growing system must itself at some point, also become non-growing (Daly, 1991; Washington, 2015). Once achieved, the goal is to maintain a stable level of consumption with throughput constant and maintained within ecological limits (Washington and Maloney, 2020). The steady-state-economy indicators are derived from social welfare indicators and are not necessarily linked to GDP.

As the economies have expanded, the need for degrowth was identified (O'Neill, 2012). CASSE proposed "Degrowth Toward a Steady State Economy," unifying degrowth and steady-state economy: "Our mission is a democratic and just transition to a smaller, steady-state economy in harmony with nature, family, and community" (https://steadystate.org/). Barely mentioned in the SDGs, degrowth speaks about the need to restrain the economy. Daniel O'Neill (2012) defines degrowth as the voluntary transition towards a just, participatory, and ecologically sustainable society. Concretely, the objectives of degrowth are to meet basic human needs and ensure a high quality of life while reducing the ecological impact of the global economy to a sustainable level, equitably distributed between nations. The critical challenge of degrowth is reducing natural resource use and waste production while maintaining or even enhancing human (and, significantly, other species!) well-being. While several studies have examined the nature and consequences of degrowth or a steady-state economy (Daly, 1991; Czech, 2013), there is no consensus on whether such a state is compatible with capitalism (Washington and Maloney, 2020). Advocates of degrowth disparage the faith that discourses of ecological modernization place in the role of markets, pointing to the deficiencies of carbon markets and the likelihood that decarbonization will be cancelled out by unceasing economic growth (Adelman, 2018). However, Drews and Antal (2016) argue that unfortunately, in some interpretations, degrowth is a problematic term as it usually has a negative connotation of decline, a contraction, or decrease, rather than something related to improving welfare while addressing unsustainability, leading to unfavorable subsequent information processing and evaluating. Effective communication of the word degrowth is crucial for social and political impact. The aim of degrowth is better formulated to shield future generations against self-interested corporate interests and scale back the total production and consumption of materials and energy without decreasing human well-being. Even though the term degrowth is increasingly used in economic and social debates, it still needs to be promoted in education and production/consumption practices.

The problems will the current way of production resurface with the business students' analysis of case studies of supposedly circular or C2C certified products, either by Cradle to Cradle® or Cradle to Cradle Certified^{CM}. Cradle to Cradle® is a registered trademark of McDonough Braungart Design Chemistry, LLC (MBDC). Cradle to Cradle Certified^{CM} is licensed exclusively for the Cradle to Cradle Products Innovation Institute. Certification

involves specifications for five certification categories (Material Health, Material Reutilization, Renewable Energy, Water Stewardship, and Social Fairness), as analyzed by students as part of their “evaluation of circular products” assignment, described below.

9.5 The case study: student assignments

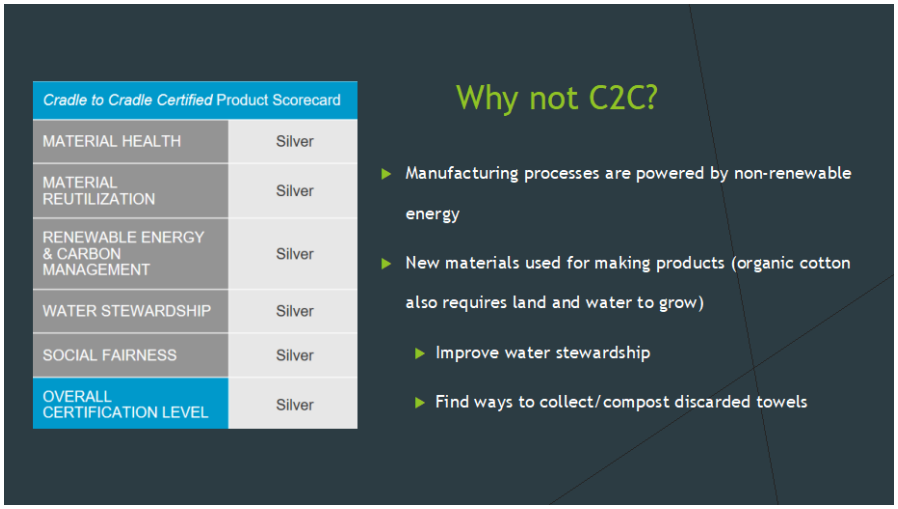
The two case studies presented below belong to Bachelor students of International Business Studies at The Hague University of Applied Sciences who have followed a minor in Sustainable Business in 2018. Within the Sustainable Business minor, one of the five modules, Politics, Business and Environment (PBE), involved (among other didactic strategies) students reading, presenting, and discussing the literature presented in the introduction of this chapter, engaging in debates about economic growth and possibilities of absolute decoupling, and considering alternatives such as degrowth. As part of PBE, the students had to examine the case of a product/process as either greenwashing, circular economy, or the best-case study. The students were asked to compare products to the 9R scale or on the C2C certification procedure by consulting the C2C Products Innovation Institute or corporate case studies on the website of Ellen MacArthur Foundation http://www.ellenmacarthurfoundation.org/case_studies/ and www.c2ccertified.org. It is worth noting that the minor commenced in 2010 and is presently continuing, each year involving different and updated case studies, with most of them being evaluated as “on the way to a circular economy.” The randomly selected cases (the first two in order of presentation) are presented below.

9.5.1 Infinity towel

The students have presented the case of Jules Clarysse, which achieved C2C Silver certification in 2011 for one of its products, Infinity Towel, “one of the first compostable European bath linens” (http://www.c2c-centre.com/product/interior-design-furniture/infinity-towel). The company claims that it uses 100% pure organic cotton and carefully selects dyes that leave no harmful substances behind after being composted. Students have outlined the factors responsible for the silver certification summing up that the towels are made to be “100% reusable as a nutrient in the biological cycle", using 100% pure organic cotton”.

The product website claims that the material uses “non-harmful dyes used for 27 different colors based on six dyestuffs and has the expected use time is >200 washes for private use”. Despite evaluating their selected product as “potentially C2C”, the students also noted some issues that did not fit C2C’s ideal strategy (see Figure 1).

Figure 1. Why is Infinity towel not C2C?



Regarding the use of "100% pure organic cotton", the producer uses virgin material, not recycled or reused material. All organic materials, from cotton to wool, are potentially compostable. The towel is buried in the consumer's backyard (as the producer has given no indication how towels can be taken back and where they can be "returned to biological cycle"), thus downcycled. In this way, the resulting waste product exists consumer use cycle and can be used as fertilizer which applies to the case of "100% reusable as a nutrient" – in the best-case scenario.

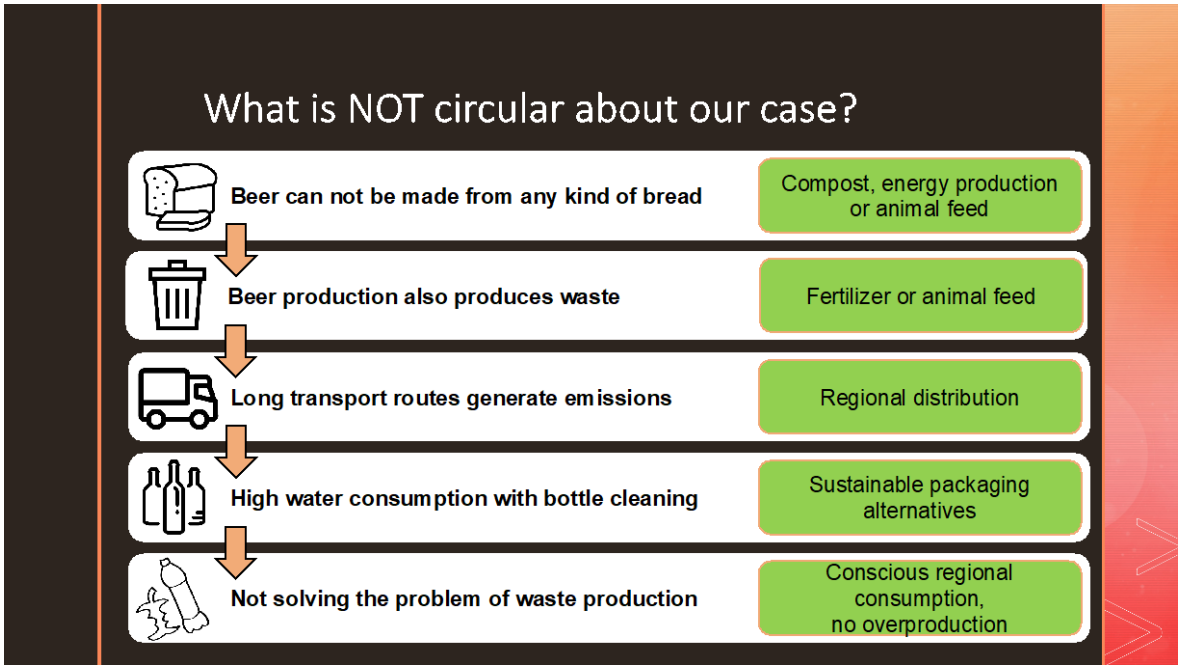
The producer does not indicate that the discount, for example, will be given to consumers for towels taken back to be either repaired (that would keep the product longer in use) or "returned to biological cycle" when the threads wear out after the claim "The expected use time is >200 washes for private use. In this way, material-service shift (as in the service such as collecting used towels and repairing or remanufacturing them) is not apparent or provided. It was unclear what energy was used for making bath linens and how producers could guarantee that the consumers were composting the towels.

Another issue is that at the price of twenty euros, the towel is hardly affordable. In reflecting on assigned literature, the students quoted Isenhour (2010), who reflected that many sustainable products are targeted at a specific small audience of responsible consumers but are less appealing to those who choose worse quality but cheaper options. One of the students quoted The Economist (2020c) article, “In the face of climate change, individual willingness to sacrifice the fruits of a high-energy lifestyle is not enough. People and countries that do not share such motivations must act, too” (p. 51). Thus, the students have highlighted their presentation; the real question is how to make a product, such as a towel, even more, durable if not fully circular, but also affordable to push less sustainable options out of the competition. The students wondered whether the transition to the alternative material or service model would require a complete overhaul of the existing model.

9.5.2 Toast Ale

Toast Ale is listed as one of the best case studies on the website of the Ellen MacArthur Foundation **(**https://www.ellenmacarthurfoundation.org/case-studies/brewing-beer-from-surplus-bread**).** Quoting the 2015 report *Growth Within A Circular Economy Vision for a Competitive Europe*, the website of Toast Ale states that about 31% of food produced is lost or wasted, both throughout the value chain and as consumer waste. "If food waste were a country, it would be the 3rd largest emitter of greenhouse gases" (after China & the USA). "An incredible 44% of all bread produced in the UK is thrown away". The company started by collecting surplus bread from delis, bakeries, and sandwich makers. In order to produce ale, it is incorporated into the brewing process with malted barley, hops, yeast, and water as this simple switch can replace around a third of the malted barley used for beer (https://www.ellenmacarthurfoundation.org/case-studies/brewing-beer-from-surplus-bread).
The students analyzed why this product is circular but have also identified the following problems (see Figure 2).

Figure 2. What is not circular about Bread Ale?



After the presentations by students, broader questions about circularity, sustainability, and the limits to growth were discussed. The students noticed that the supposedly "circular" or C2C products fall short of the ideal for infinite reuse or products that do not diminish in quality after use. For example, for food and drink items, while one can be transformed into another (bread into ale), it happens with the loss of quality, and the final waste in the toilet is by no means "upcycled." In the case of towels, after the multiple-use and the potential to let the materials biodegrade, they fit within more conventional eco-efficiency or reducing damage rather than the "100% good" paradigm. Also, the root problem of waste bread is not addressed. These cases motivated students to think of

more transformative solutions to sustainability challenges, but they also, regrettably, served to trigger cynicism in some students.

9.6 Discussion: larger lessons learned from towels and ale

The central issue with the "circular" food and drink is that it is rarely discussed in terms of the "waste equals food" C2C principle. While bread is transformed into ale as a supposedly circular product, urine produced, with the emission of ammonia, nitrogen, and other toxic or chemically treated materials in the sewage, is not discussed. This is different from waste by a grazing cow, whose excrement fertilizes the ground.

The global sustainability challenges cannot be addressed by simply producing more biodegradable towels or turning food waste into alcohol. Making “good” products more affordable for the global population is one challenge, but the critical question is whether global demand growth can sustain future generations of humans, let alone other species (Buchmann-Duck and Beazley, 2020). Also, while consumption of certain materials might become more sustainable in some segments of the population by choice, for example, by vegetarians, this does not apply to the majority of the population (Isenhour, 2010) and does little to restrain global trade agreements and subsidies, controlled by governments and large corporations. Relevant to the case of ale, large quantities of restaurant and café/bar supplies, such as beer, are wasted as they spoil in storage (The Economist, 2020b). The formidable quantities of food are increasingly cheap, and, aside from unequal distribution due to skewed trade agreements and subsidies, billions of people are fed, even in the time of the pandemic (Ibid). However, this international road, air, and water traffic and dependency on foreign supplies create climate and social vulnerabilities and appropriate the planet's finite resources for the good of one single species (Adelman, 2018). It is not just bread and beer that go to waste.

Without a planetary-scale reform of food production and the downscaling of human enterprise – the subject that the SDGs are silent on - no amount of efficiency can guarantee sustainability. Absolute decoupling of material products such as food or drink is impossible without considering waste products. It seems that some "circular" products fit within the conventional sustainability narrative rather than into a more critical and potentially transformative economic reform. They are optimizing production systems to completely close material loops that require a rigid coupling of diverse material conversion processes between processes in different companies and countries (De Man and Friese, 2016). Thus, rather than celebrating the global ability to “binge-eat as you binge-watch” (The Economist, 2020b), to move forward, one needs to ask a larger question, as the students did: is all this sustainable in the long term?

Despite these difficulties, it is essential not to “throw the baby out with the bathwater” (Kirchherr et al., 2017; Kopnina and Blewitt, 2018). A single company cannot address food waste, but it can consider system change when the entire supply chain and transport,

distribution, and consumer behavior are considered. Rather than churning out new products, future business professionals can consider how existing products, from ceramic cups to appliances, can stay in operation and what type of new business models (services, such as repair) can be offered. There are also positive examples of traditionally single-use products, such as gDiapers, a C2C certified product, that can be composted by adding them to compost – the urine turns the compost into nitrogen-rich soil. The consumer can opt for open-air, hot, or tumbler composting (Kopnina and Blewitt, 2018).

While it still has a long way to go in practice, the circular economy framework can reach beyond mainstream sustainability strategies. In line with the 9-R strategy, the producers can offer repairs and refurbishment. However, while repair enjoys bipartisan support, repair of less durable products, such as clothes, is complicated by the fact that most affordable clothes are made from mixed materials (in C2C terms, “monstrous hybrids”), and mechanical or chemical recycling degrades materials such as mixed polyester (The Economist, 2017b). To reverse the throw-away culture and defend its industry’s turf, the Repair Association, a lobby group funded by repair shops welfare organizations and charities, supports “right to repair” laws (The Economist, 2017). Gay Gordon-Byrne, executive director of the Repair Association, reflects that in America “repair isn’t a partisan issue”, pointing out that the liberal left and conservative right make a powerful coalition. The political left sees the livelihood of repair shops endangered by big corporations. On the political right, consumers see that “not being able to repair his tractor” amounts to an attack on the “very idea of private property” (The Economist, 2017a).

Understanding these limitations by students and future professionals requires a realistic view of the possibilities within the 9-R hierarchy and considerations of the price of and supply chain of the materials – subjects that the business students are well-positioned to approach. While undergraduate students are not yet capable of taking on such considerable global challenges, starting to think critically and honestly about the deceptive promises of the SDGs and over-optimistic promises of circularity is a good starting point. Consequent research evaluating students’ progress as future business professionals can show the long-term effects of such lessons, such as conducting and maintaining transparent operations in which ideal and realistic closed-loop production options are considered in earnest.

The broader questions students could ask are whether absolute decoupling promised by the circular economy is possible and under which circumstances. Can SDG 8 concerned with economic growth be combined with SDG 12, "Responsible consumption and production"? Moreover, what are the actual content and use of “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (SDG 4)? If this “quality education” can face fundamental facts and contradictions of realistic strategies of degrowth, it has the most significant future potential.

Closing remarks

This chapter discussed the potential and limitations of C2C and circular products in the larger context of Sustainable Development Goals (SDGs) and the limits to growth. Akin to the SDGs embrace ecological modernization, circular models rarely mention degrowth or a steady-state economy (Daly 1991; Czech 2013). The SDG approach and circular economy strategy tend to present an optimistic vision of "sustainable and inclusive economic growth" without addressing the root problems of unsustainability – population growth and expansion of material demands. With recommendations for efficient production, more radical transformative approaches seem under-represented. However, the degrowth strategy is missing from the SDGs, Ellen MacArthur Foundation case studies or C2C products discussed in this chapter. The case studies discussed here show that circular products may struggle to meet real-world material demands. The case studies of supposedly circular or C2C products, Toast Ale and Infinity Towels, demonstrated the limited potential of decoupling, let alone "upcycling." The virgin materials used for making towels or for the transformation of bread into ale become materially less valuable than the towels after use (in the case of towels producing, at best, biodegradable garbage, and in the case of ale, urine).

Ways forward include a greater understanding of how degrowth can be carried out in business operations and beyond, how non-coercive, volunteer population reduction and a drastic reduction in material demands beyond basic needs can be implemented at political, legal, social, and economic/corporate levels. Considering degrowth in corporate strategy demands nothing short of complete societal and economic transformation, starting with education. Rather than taking the desirability of "inclusive economic growth," a more critical approach demands nothing short of complete societal transformation toward "degrowth," starting with teaching it as part of (business) education.

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