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EVALUATING THE CIRCULAR ECONOMY AS A TOOL FOR ACHIEVING SUSTAINABILITY: BALANCING ENVIRONMENTAL, ECONOMIC, AND SOCIAL IMPACTS

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ABSTRACT

The circular economy concept has emerged as a transformative approach to achieving sustainability by reducing waste and optimizing resource use. Advocates argue that circular practices, such as reuse, recycling, and closed material loops, offer significant environmental and economic benefits. These include substantial reductions in greenhouse gas emissions, decreased energy consumption, and the creation of new job opportunities. However, critics caution that the circular economy may lead to unintended consequences, such as increased overall production and consumption, which could offset environmental gains. Concerns are also raised about the limitations of secondary materials and the neglect of social equity within circular frameworks. This paper explores both sides of the debate and supports the view that the circular economy holds substantial potential for driving sustainability. By implementing measures to minimize rebound effects and integrating social dimensions, circular practices can effectively align economic growth with environmental stewardship. Ultimately, the circular economy presents a viable pathway to a more sustainable and equitable future.

The idea of the "circular economy" has gained popularity since its inception over 50 years ago (Korhonen et al., 2018). Concepts like closed material loops, reuse, and recycling of industrial "nutrients" to extract their maximum value with minimal waste have been acknowledged by academics, governments, practitioners, and non-governmental organizations (Burke et al., 2023). Regarding the circular economy, there are several "schools of thought" that share a common core idea but have different goals and ideal ways to accomplish it. The minimization of environmental effects is a focus for some of them while minimizing waste and resource exploitation is the goal for others (Allwood, 2014). Despite these differences, all these schools of thought agree that the Circular Economy plays a vital role in advancing sustainability. However, some scholars have raised concerns about potential adverse economic and environmental impacts in the long run, casting doubt on its effectiveness in achieving sustainability. This paper will analyze the support for both sides of this debate using two credible sources, assess the most compelling information presented by each, state my stance, and offer additional information to bolster the chosen side.

Macarthur & Heading (2019), in their article 'How the Circular Economy Tackles Climate Change', conduct an extensive study on how the circular economy can address climate change-related challenges. According to the article, current efforts to combat climate change have primarily focused on renewable energy sources and energy-saving techniques, while the remaining 45% of emissions linked to product manufacturing also need attention if climate targets are to be met. A circular economy provides a systemic and economical approach to address this issue. The study demonstrates how circular economy strategies can potentially achieve a 40% reduction in emissions by the year 2050 when applied to four key industrial materials: cement, steel, plastic, and aluminum. In the context of the food system, this reduction could reach 49%, bringing emissions 45% closer to achieving net-zero emission targets.

The article argues that the circular economy reduces greenhouse gas emissions in several ways. Firstly, it reduces pollution and waste, leading to lower greenhouse gas emissions. The circular economy is a framework for mitigating the negative impacts of economic activities that result in the depletion of valuable resources, harm human health, and cause the destruction of ecological systems, including greenhouse gas emissions. Another aspect is the underutilization

of resources like cars and buildings, along with pollution of air, land, and water. In a circular economy, businesses make certain that at the product and material design stage, they avoid negative impacts by ensuring that products and materials are developed from the outset to be used indefinitely and/or regenerate natural systems. For example, in the case of plastic packaging, using refillable designs for all personal care, household cleaning, and cosmetic product bottles can result in an 80-85% reduction in greenhouse gas emissions compared to single-use bottles.

Additionally, the circular economy encourages the use of renewable resources and seeks to enhance natural systems by reintroducing essential nutrients to the soil, offering potential for carbon sequestration. Regenerative production is a method of managing agroecosystems, whether through agriculture, aquaculture, or forestry, that produces food and materials while benefiting the environment. This results in stable soils, improved local biodiversity, enriched air and water quality, and higher levels of carbon sequestration. These practices contribute to ecosystem restoration and resilience. Collectively, these circular economy solutions provide a range of opportunities that may be used in the larger economy to combat climate change.

Another article in support of the fact that circular economy helps in combating climate change is a report prepared by Deloitte in November 2016 titled 'Circular Economy Potential for Climate Change Mitigation'. According to the paper, because circular economies maintain resources and products "circulating" in the technological world, they largely forgo the extraction and creation of raw materials as well as some processing and manufacturing procedures. This is primarily achieved through reducing, reusing, and recycling, which lowers emissions from conventional waste management practices. Furthermore, circular economy practices significantly reduce the energy required for industrial production processes, further cutting emissions.

Deloitte performed research using a consumption-based methodology to reach the results of the study. Consumption-based emissions are those that are associated with goods and services that are used in Europe, taking into account all of the emissions involved in getting goods and services to their end users. The usage of the EXIOBASE input-output tables made this strategy possible. According to the study, a circular economy that emphasizes recycling and reuse may easily reduce the greenhouse gas emissions included in products by a third. Once more, recycling may cut the emissions that are built into cars and electric and electronic equipment by 43% and 45%, respectively. But product reuse and lifespan extension may considerably boost the possibilities. The building industry is likewise relatively resource-intensive, but it relies on commodities like concrete, bricks, and wood, for which simple material recovery offers limited advantages. In this scenario, recycling can help to reduce emissions by around 17% overall, and further product reuse techniques must be put in place to achieve greater reductions (up to 34% based on our predictions).

In contrast, Zink & Geyer (2017) "Circular Economy Rebound" suggests that the circular economy is not the answer to the problem of climate change since it has a long-term rebound impact. They contend that by raising total output through circular economy initiatives, these advantages may be partially or entirely negated. Circular economy rebound happens when activities that have reduced impacts on per-unit output also lead to higher levels of production, diminishing their benefit. The paper discussed two factors, including the inadequate substitutability of secondary products and the impact of secondary commodities on market pricing that led to a circular economy rebound. As is well known, the circular economy promotes material reuse and recycling. However, secondary commodities could not be adequate replacements for primary goods because they are of lower quality or less appealing to customers in other ways. For instance, recycled plastics and papers seldom directly compete with primary materials since the polymer quality deteriorates and the fiber lengths are reduced through usage, gathering, and reprocessing (Allwood, 2014). Aluminium that has been recycled is polluted with alloying components, which lowers its value and usefulness (Niero & Olsen, 2016). This means that recycled items are likely to be manufactured in addition to rather than instead of original materials, and the benefits of recycling will be decreased.

The article also suggests that price changes brought on by increasing secondary manufacturing are the second general mechanism for circular economy rebound. The article proposed we consider once again, that some products from the circular economy have poorer quality than those from primary manufacturing to see how this occurs. Sellers provide lower-grade materials at a discount compared to core resources to attract customers to acquire them. Also, manufacturers who intend to use substitute secondary materials have now become richer (the income effect) and can now buy more materials to manufacture more goods than they were producing before. The income impact has made

downstream manufacturers that opt to employ secondary materials more financially secure, allowing them to buy more material and use it to generate more goods than they previously could. The income effect may be multiplied when lower-quality products are offered to consumers, resulting in higher consumption and greater environmental impacts. The circular economy was also criticized in 'Closing the Loop for ResourceEfficiency, SustainableConsumption and Production: A critical review of the circular economy' (Camilleri, 2018). According to the paper, the premise of the circular economy, which suggests that we create items that last much longer, seems beneficial, but it's not always possible to do so and may not always be environmentally friendly. Some durable items that do not degrade quickly may use substantial energy and generate more entropy than products designed to function more naturally. For example, a bamboo chopstick is preferable to a highly specialized plastic fork due to its recyclability and will be quickly eliminated from the biosphere. Additionally, ecologically beneficial technologies like solar panels and wind farms depend on minerals that can be hard to recycle. They will always need to maintain and repair their green constructions. Because of this, the pricing of such green technologies could not always accurately represent the costs of their raw materials and individual parts. These structures contain technical nutrients that will inevitably require considerable, energy-intensive service and replacement as nothing in an entropic cosmos lasts forever (Murray et al., 2017). As a result, prolonging products through maintenance may not be a sustainable business practice.

Furthermore, the circular economy viewpoint is now concentrated on economic and environmental problems. It is essentially quiet on the social dimension since the social components that underlie other approaches to sustainable development are not explicitly acknowledged. It could seem that the circular economy is primarily concerned with redesigning the production and service systems that will help the biosphere, via ecological regeneration and survival, and by consuming less limited resources (Murray et al., 2017). Contrary to concepts such as corporate sustainability and responsibility, creating shared value, and social equity, the circular economy framework does not integrate social responsibility. The core framework of the circular economy does not take societal demands into account. Consequently, the transition to a circular economy may be ineffective in achieving overall sustainability.

I will endorse the side that believes the circular economy is a tool for attaining sustainability based on the analysis done above by both sides. To further strengthen my position, it is crucial to stress that the circular economy may be created in ways that reduce both economic suffering and environmental problems. For instance, during remanufacturing, the old product is disassembled, sorted and cleaned, and quality-tested before being released into the market. This extends the life cycle of the used items, which may positively impact the environment, economy, and society (Östlin et al., 2008). Benefits to the environment include a decline in energy and material usage as well as a reduction in carbon footprint (Wang et al., 2016). For example, the production of an equivalent quantity of remanufactured items consumes 85% less energy than what is required for manufacturing new products (Hazen et al., 2017). In addition, the process of remanufacturing engines leads to a reduction of 55 kg of steel and 565 kg of carbon dioxide emissions (Zhang et al., 2011). Using an equivalent amount of energy and materials for production, it is possible to manufacture an additional 7–11 units (Steinhilper, 2001). Furthermore, remanufacturing offers economic benefits because of the cheaper price of remanufactured goods and helps society through employment (Lund and Hauser, 2010). The United States leads globally as the largest remanufacturer, generating remanufactured goods valued at $43 billion and creating 180,000 jobs (Singhal et al., 2020). This increase in employment lowers unemployment and reduces inequality, two major obstacles to global sustainability.

In conclusion, the debate surrounding the circular economy features valid arguments on both sides. On one hand, proponents argue that the circular economy offers a promising path toward sustainability by reducing environmental impacts, lowering emissions, and creating economic opportunities. On the other hand, critics caution against potential rebound effects and point out challenges in achieving sustainability through prolonged product lifecycles and limited consideration of social dimensions.

After considering the analysis from both sides, I maintain the stance that the circular economy is indeed a valuable tool for achieving sustainability. This is due to its potential for significant environmental, economic, and societal benefits such as reduced greenhouse gas emissions, decreased energy and material usage, and the creation of jobs, as supported by the credible sources I used.

Embracing the circular economy is not just a choice; it is an essential step towards a more sustainable, equitable world where economic prosperity aligns with environmental responsibility, providing a holistic solution to the pressing challenges of our time.

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