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**Marek Szajczyk**
University of Siedlce

ORCID: 0000-0002-0591-8174
e-mail: marek.szajczyk@uws.edu.pl

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# BUSINESS MODELS AND ACTIVITIES TOWARDS A CIRCULAR ECONOMY

## MODELE I DZIAŁANIA BIZNESOWE W KIERUNKU GOSPODARKI CYRKULARNEJ

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**Abstract:** The transition to a circular economy represents a fundamental shift in how businesses operate, one which involves moving away from the traditional linear model of “take, make, dispose” towards a system that prioritizes resource efficiency, waste reduction, and sustainable practices. The research presented here focuses on examining business models and activities that support the transition to a circular economy. It aims to identify and categorize business models aligned with circular economy principles; explore how companies implement circular practices and identify key challenges and enablers that impact businesses’ shift to circular practices. The findings unveil that there are two main approaches to resource circulations: the first involves slowing the resource flows and second involves closing resource loops. Moreover, the implementation practices at three levels: micro, meso and macro levels and four areas, production, consumption, waste management and development support were presented. The study probes the realm of circular economy within sustainability, unveiling its potential to make better use of finite resources, reduce emissions and boost economies. The conclusions of the paper emphasize that achieving a global circular economy model appears unrealistic.
**Keywords:** sustainable development, circular economy, closed resource loops

**Streszczenie:** Przejście na gospodarkę o obiegu zamkniętym oznacza fundamentalną zmianę w sposobie działania przedsiębiorstw, odchodzenie od tradycyjnego liniowego modelu „weź, wytwórz, pozbądź się” w kierunku systemu, który priorytetowo traktuje efektywność wykorzystania zasobów, redukcję odpadów i zrównoważone praktyki. Artykuł koncentruje się na badaniu modeli biznesowych i działań wspierających przejście na gospodarkę o obiegu zamkniętym. Celem jest identyfikacja modeli biznesowych zgodnych z zasadami gospodarki o obiegu zamkniętym; zbadanie, w jaki sposób przedsiębiorstwa wdrażają praktyki gospodarki o obiegu zamkniętym w różnych obszarach oraz zidentyfikowanie kluczowych wyzwań i czynników, które wpływają na przejście przedsiębiorstw na praktyki gospodarki o obiegu zamkniętym. Rezultaty wskazują na dwa główne podejścia do obiegu zasobów: pierwsze to spowolnienie przepływów zasobów, a drugie to zamknięcie pętli zasobów. Ponadto zaprezentowano praktyki wdrożeniowe na trzech poziomach: mikro, mezo i makro, w czterech obszarach: produkcji, konsumpcji, gospodarki odpadami i wsparcia rozwoju. W artykule przedstawiono obszar gospodarki cyrkularnej w kontekście zrównoważonego rozwoju, wskazując na jej potencjał w zakresie lepszego wykorzystania ograniczonych zasobów oraz redukcji emisji. Wnioski z artykułu podkreślają, że osiągnięcie globalnego modelu gospodarki o obiegu zamkniętym wydaje się nierealne.
**Słowa kluczowe:** zrównoważony rozwój, gospodarka cyrkularna, zamknięte pętle zasobów

## Introduction

Many countries on all continents have enjoyed economic growth and increased prosperity over the past few decades based on the intensive use of natural resources (UNEP, 2019; IRP, 2020). Currently, the economies of these countries are facing challenges related to maintaining economic growth and at the same time ensuring the quality and durability of this growth so that it is consistent with the principles of sustainable development. Among the many proposed and implemented strategies and programs ensuring further development, an idea that has been gaining in importance for several years is the concept known as the circular economy. This concept in itself is an organizational innovation with enormous potential, both in terms of reducing environmental pressure and ensuring climate neutrality. The foundations of the circular economy, such as selective waste collection and recycling, have historical roots dating back centuries. Although the first recycling center in the world was established in New York in 1897, these efforts were small-scale. Large-scale recycling and waste collection systems began to develop in the second half of the 20th century. However, it was only in the 21st century that these processes accelerated significantly. In the European Union, the shift towards a circular economy is estimated to generate savings of 8% of annual business revenues and create 170 000 new jobs in the waste management sector (Bukowski, 2018). To implement the circular economy concept on a large scale, a deep transformation is required not only in industry but also in energy, transportation, agriculture, and fishing. These processes are just beginning slowly. Additionally, a change in the awareness and attitudes of both producers and consumers is essential for this transformation. The circular economy concept is broad, encompassing many smaller elements, which is why practical implementations don't always yield the expected results.

The primary objective of this research is to explore and analyze the various business models and activities that contribute to the transition towards a circular economy. The study aims to achieve the following specific goals: to (1) systematically identify and categorize the different types of business models that support circular economy principles; (2) investigate how businesses implement circular activities, focusing on the practices related to product design, resource utilization, waste management, and value chain collaboration; (3) identify the key barriers that companies face in transitioning to a circular economy, as well as the enablers that facilitate the adoption of circular business practices.

## Literature review

A few decades back, the closed-loop economy concept emphasized not only the need for recycling but also the reuse and regeneration of products and over the years, the circular economy has increasingly been presented as an economic model (Arrow et al., 1995; Stahel, 2008; 2016). Over the last twenty years, significant research on the circular economy has been conducted in Asian countries, particularly in China, where it was incorporated into national policy to secure resource access and improve energy efficiency (Yuan et al., 2006; Zhijun et al., 2007; Yang et al., 2008; Zhou et al., 2014). Recently, the European Union has actively promoted the circular economy, defining it as a model focused on sharing, reusing, repairing, renewing, and recycling materials and products to minimize waste and extend product lifecycles, ultimately creating additional value (European Parliament, 2016). The OECD defines the circular economy as an integrated policy focused on the lifecycle of waste, materials, and products, aimed at improving resource productivity through sustainable material management, integrated supply chain management, and the use of tools to stimulate technological change. It also involves internalizing waste management costs into consumer goods and services prices and ensuring societal engagement in design processes (OECD, 2011). The Ellen MacArthur Foundation defines the circular economy as an industrial system, that is designed to be regenerative, that replaces the concept of end-of-life, restores the use of renewable energy, eliminates the use of toxic chemicals that hinder reuse and return to the biosphere, and strives to eliminate waste through excellent design of materials, products, systems and business models (Ellen MacArthur Foundation, 2013a; 2013b). In relation to building circular economy models, it is indicated that their primary goal is to decouple economic growth from environmental impacts, which is illustrated in Figure 1 (EEA, 2012; Ekins  et al., 2016).

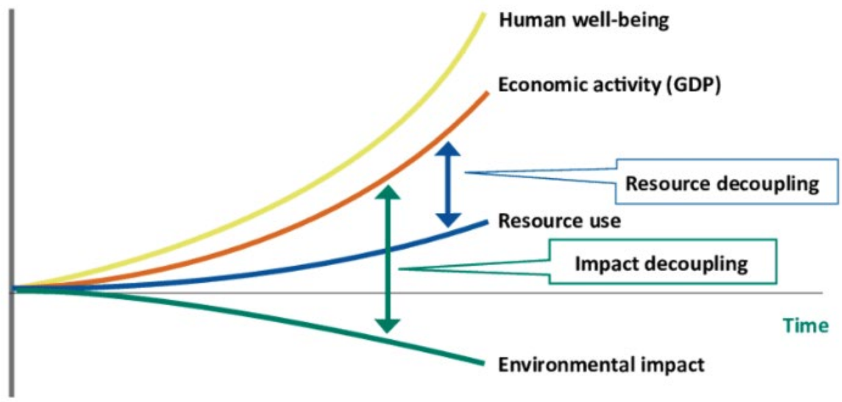


**Figure 1. Decoupling economic growth from environmental impacts**
Source: Ekins  et al. (2016)

According to a UN report, it is unlikely that economic growth can be decoupled from environmental impact by 2050, as the global population is projected to consume three times more minerals, metals, fossil fuels, and biomass annually than today, with usage reaching 140 billion tons per year. This growth will exacerbate disparities between high-income and low-income countries, where per capita resource consumption is already at least four times lower (UNEP, 2011). The Club of Rome reports and recent analyses highlight that continuous economic growth is unsustainable due to its dependence on increasing material and energy consumption (Meadows et al., 1973; 1995). Researchers from the University of South Australia warn of the "decoupling illusion," where misleading techniques create the false impression that GDP growth can be separated from environmental impact. Their findings suggest that GDP growth cannot be sustained indefinitely without increasing resource and energy use (Ward et al., 2016).

Understanding the circular economy requires an interdisciplinary approach that involves reevaluating the traditional development model, which relied on a continuous and increasing supply of natural resources for industrial and consumer goods, as well as energy needs. In this linear model, most industrial products, along with millions of tons of resources, ended up in landfills or incinerators after their use. This "take, make, dispose" approach leads to rapid resource depletion, significant energy loss, and severe environmental damage from resource extraction, transportation, and processing. Continuing on this path will inevitably result in catastrophic environmental degradation, unstable commodity prices, and increasing geopolitical tensions (Ellen MacArthur Foundation, 2013; 2014; 2015; Ku & Hung, 2014; Moran et al., 2015). Over the past four decades, global resource extraction has tripled from 27 billion tons to over 84 billion tons, and despite improvements in material efficiency, it is expected to more than double again to 167 billion tons by 2060 (European Commission COM (2020) 474). Given these trends, there is an urgent need to accelerate the adoption of actions and models supporting the transition to a circular economy.

The circular economy is an economic model where planning, sourcing, production, and distribution are designed to support ecosystem sustainability while enhancing human well-being. It operates on three essential subsystems: resource saving and pollutant reducing (RSPR), waste reusing and resource recycling (WRRR), and pollution controlling and waste disposing (PCWD) (Murray et al., 2017). These subsystems are interconnected and equally vital. The subsystems are guided by three core principles: preserving and enhancing natural capital by managing finite resources and balancing renewable resource flows, optimizing resource efficiency by circulation of products, components, and materials in use at their highest utility in both technical and biological cycles, and improving system effectiveness by minimizing negative externalities. Specific metrics accompany these principles, such as degradation-adjusted net value add, GDP generated per unit of net virgin finite material input, and total cost of externalities and opportunity cost (Ellen MacArthur Foundation, 2015a; 2015b; Becque et al., 2016). A general model of the circular economy based on the above subsystems and principles reflects two groups of activities. The first one concerns the circulation of biological materials, while the second one concerns technical materials (Figure 2). Both biological and technical material cycles involve various actions that can be undertaken at different stages of a product's lifecycle.

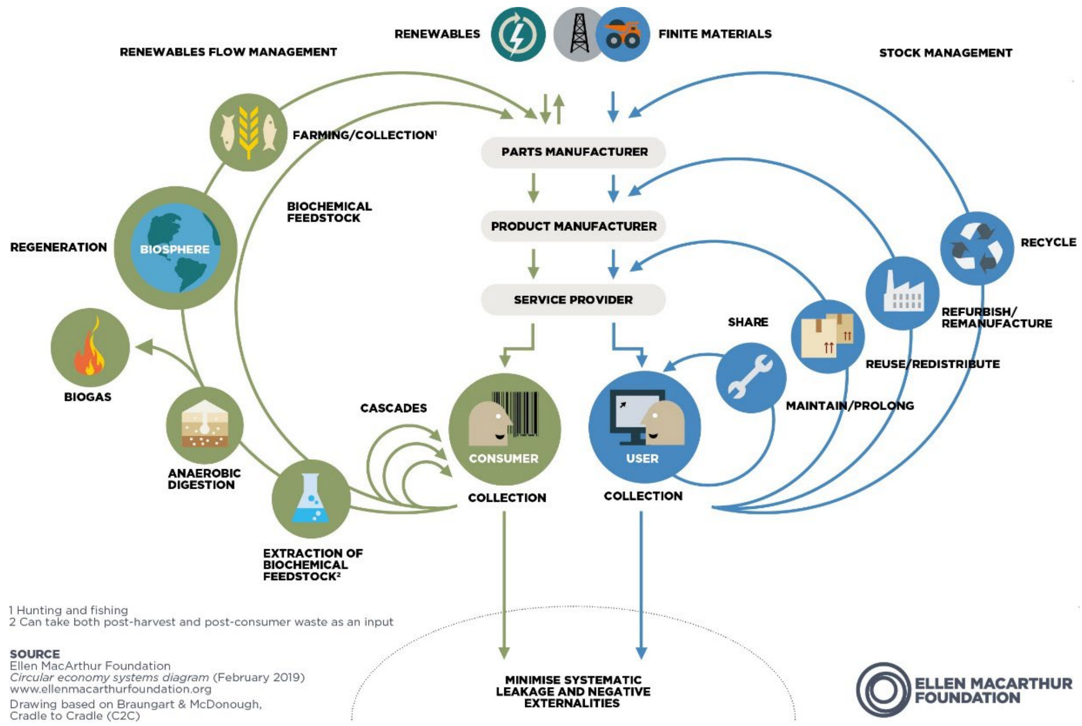


**Figure 2. The circular economy system diagram**

Source: https://www.ellenmacarthurfoundation.org/circular-economy-diagram

Transforming economic systems into closed loops for biological and technical materials necessitates the integration of new technologies, and for businesses to utilize these innovations; and for research and development institutions to improve resource recovery and processing efficiency. When analyzing circular-economy business models and activities, it is important to consider all product lifecycle phases and cooperative chains where businesses can create new value. A widely recognized classification of circular economy models provided by Accenture, identifies five models following models (Accenture, 2014):

1) Circular Supply – using renewable energy and bio-based or fully recyclable materials to replace single-use materials.
2) Resource Recovery – recovering embedded value at the end of a product's life cycle to provide inputs for subsequent cycles. The model promotes return chains and waste transformation, creating new value through innovative recycling and upcycling services.
3) Product Life Extension – extending the life cycle of products and components by repairing, upgrading, remanufacturing, and reselling products or by-products to generate revenues at all stages of the product life cycle.
4) Sharing Platforms – platforms for collaboration between product users, both individual and organizational, that enable the sharing of excess capacity or underutilized resources.
5) Product as a Service (PAS) – an alternative to the traditional "buy and own" model, in which products are used by one or more customers under various types of rental or usage fee agreements. This model creates incentives to create durable products and the ability to expand them, emphasizing performance over quantity.

The above approach to the models described by Accenture is consistent with the principles and the resulting package of six actions presented by the Ellen MacArthur Foundation in the study entitled Growth within: a circular economy vision for a competitive Europe. The business actions resulting from the above principles form the so-called ReSOLVE framework and include six actions:

1) Regenerate – switching to renewable energy and renewable materials; restoring, preserving and regenerating ecosystems and returning recovered biological resources to the biosphere
2) Share - maintaining a low rate of product circulation and maximizing their use by sharing among users (peer-to-peer). This applies to both privately owned and publicly available products. Sharing also includes extending the life of products through maintenance, repair and modernization, as well as designing for durability.
3) Optimize – increasing the efficiency and productivity of products and eliminating waste in the supply, production and distribution phases, as well as after the end of the product's use, where the nature of these activities does not require changing the product or changing the technology. An example of this type of solution is lean management.
4) Loop – maintaining components and materials in closed streams (loops), in which priority is given to internal loops. In the case of materials whose availability is limited, this action includes regeneration and, ultimately, recycling.
5) Virtualize – includes providing products and services in a virtual way, which comes down to providing specific product functions, e.g. books or music.
6) Exchange– replacing old, used products containing non-renewable materials with new and advanced products designed in accordance with the principles of the circular economy.

The ReSOLVE framework, along with technological advancements and innovations, is increasingly being adopted by businesses to enhance their cost competitiveness. Although circular economy models are becoming a more likely development path for companies, translating theory into practice often proves difficult, especially on a large scale. A major challenge is the need for the involvement of multiple stakeholders. Conflicting demands and the preference for short-term gains over long-term goals often result in a lack of readiness to implement radical changes, the benefits of which may only become apparent in the long term.

## Materials and methods

In order to establish a theoretical foundation on circular economy concepts, business models, and sustainability practices a comprehensive literature review was employed for data collection. The review included academic journals, industry reports, and case studies related to circular economy and sustainable business practices.

The key materials for the preparation of the article included academic databases, industry publications and governmental and international institutions reports. The analysis focused on works published between after 2014, however, several landmark publications from earlier years were also included. The main research methods used in preparing the article were analysis, synthesis and critical evaluation. During the literature review, attention was given to key elements concerning circular economy business models and activities. Trends and the evolution of concepts related to resource management were analysed. A literature synthesis approach was adopted to identify common themes and challenges. The collected materials and articles also underwent a critical evaluation regarding methodological quality, source reliability, and the validity of conclusions.

## Results and discussion

The review of literature as well as existing economic reports and case studies, indicates the growing importance of circular economy activities. As key results of the research, identified are strategies for resource circulation; the classification of the implementation levels of these strategies and the catalogue of circular economy practices.

Regarding the strategies for resource circulation, there are two main approaches used both at a national and international level. First is the strategy of slowing resource flows by designing long-lasting products, and the second is strategy of closing resource loops through different form of activity such as reusing, remanufacturing and recycling. These strategies can be applied at three levels: micro (individual products or organizations), meso (groups of organizations), and macro (regional, national, or international) levels. For the implementation of circular economy activities it is also useful to classify products according to their durability, which will influence the actions taken within the above strategies. The first category include long-lasting products, such as buildings or roads, where eco-design is crucial for extending lifespan through repair and regeneration, and recycling plays a key role; The second category includes medium-complexity products, such as machinery or electronics, where design and production processes significantly impact resource use and waste generation, making it essential to prioritize renovation, regeneration, and high-quality recycling; and the third category consists of short-lived products, such as textiles or food, where transitioning to circular models requires substituting technical components with biological ones, incorporating biodegradable materials, and designing for easy disassembly. Each of these three categories requires specific actions to close resource loops, with a focus on sustainability, reducing reliance on natural resources, and promoting innovations like biodegradable packaging and shared product use.

Pilot solutions that fit into the circular economy model are mostly implemented at the micro and meso level. These solutions are implemented in the European Union, the United States, Japan and also in China. China is becoming a leading country in the field of circular economy, both in terms of research conducted in the field of circular economy and in terms of implementation activities. Examples of circular economy practices at the micro, meso and macro levels are presented in Table 1.

**Table 1. Circular economy practices at the micro, meso and macro levels**

| Area | Micro level | Meso level | Macro level |
|---|---|---|---|
| Production | Cleaner Production; Eco-Design | Eco-industrial parks; Organic farming systems | Regional eco-industrial networks |
| Consumption | Green procurements; Eco-Consumption | Environmentally friendly parks/centers | Rental/product sharing services |
| Waste Management | Product Recycling System | Waste trade market; Industrial parks | Urban symbiosis |
| Development Support | Policies and regulations, information platforms, capacity building, projects and programs implemented by non-governmental organizations | | |

Source: own study based on Heshmati (2015, p. 28)

The implementation of the circular economy model is associated with various concepts, among which the cradle to cradle (C2C) is a distinctive one, constituting the basis for creating new systems for assessing materials in terms of efficient use of resources and the principles of sustainable development. The basic assumption in this concept is that all materials are perceived as raw materials that should return to technical or biological circulation without quantitative and qualitative losses, which is equivalent to the lack of any waste. Products created in the technological process based on the C2C idea should therefore meet strict criteria related to safety for the environment and human health. C2C products cannot contain any harmful ingredients and renewable energy sources should be used to produce them. Certification systems for materials based on the C2C idea are currently being developed (McDonough & Braungart, 2009).

As part of the analysis of the implementation levels of the circular economy, two key initiatives implemented at the micro level were identified. The first is a concept of industrial symbiosis, rooted in industrial ecology and eco-industrial development, and which focuses on optimizing material and energy flows within industrial systems. It involves the exchange of products, by-products, and waste to reduce environmental impact, particularly by decreasing natural resource consumption and promoting a climate-neutral economy. This approach has been successfully applied across various sectors globally, enhancing environmental efficiency. However, challenges include the lack of comprehensive assessment models for different industries. Industrial symbiosis encourages collaboration among diverse organizations, fostering environmental innovation, cultural shifts, and beneficial business contracts, with geographic proximity being a key success factor. Typically, collaboration in industrial symbiosis involves one entity using another's waste or by-products, benefiting both organizations and the environment (Gibbs, 2008; Lombardi & Laybourn, 2012). Examples include using waste from energy production, like ash and slag, in road construction or as alternative fuel in cement plants, and using biodegradable waste as substrate in biogas plants. Such collaborations can also involve shared use of equipment or resources. The environmental benefits include reduced resource consumption, waste, and emissions, turning negative environmental factors into positive outcomes, such as lower pollution and reduced demand for raw materials (Chertow & Ehrenfeld, 2012). The concept of industrial symbiosis significantly influenced the establishment of National Industrial Symbiosis Programs (NISP) in various countries, including the United States and the United Kingdom. The UK's NISP, demonstrated immediate benefits, such as reduced waste, lower carbon emissions, and decreased reliance on raw materials. The program's success led to nationwide implementation, supported by Defra funding. NISP became a national network open to businesses across all sectors, promoting resource efficiency and transforming waste into profit, which significantly benefited the environment. By 2007, International Synergies began exporting the NISP model to countries like Brazil, China, and Mexico, and it has since been replicated in 30 countries across five continents. At its peak in the UK, NISP involved 15,000 companies, primarily SMEs, contributing to a reduction of 42 million tons of CO2 emissions and diverting 48 million tons of waste from landfills to businesses. The program also created over 10,000 jobs, with nearly 20% of the synergies involving eco-innovation (https://international-synergies.com/).

The second initiative implemented at the micro level are Cleaner Production (CP) programs. They were initiated in the 1990s by UNEP under Agenda 21 and its aim was to enhance the role of business and industry in achieving sustainable development. It is worth mentioning that Agenda 21 recommends implementing CP programs as a strategy for sustainable and balanced growth. UNEP, along with UNIDO and other development organizations, introduced CP and related methods in developing and transitioning countries, including China, India, Poland, and Czechoslovakia. It was found that CP is as beneficial and effective in developing countries as in industrialized ones. The larger-scale implementation of CP led to the creation of National Cleaner Production Centers. By 2015, these centers were operational in 58 countries, establishing significant regional knowledge networks and facilitating various international initiatives (UNIDO, 2015). Initially defined by UNEP as an integrated preventive strategy for environmental protection in processes, products, and services to improve efficiency and reduce risks, the concept of CP has evolved and currently encompasses economic, social, health, safety, and environmental benefits (Hens et al., 2018). The CP programs were initially designed to reduce the environmental impact of industry by balancing production interests with environmental concerns. Over time, CP programs have become a symbol of responsible business practices, first in manufacturing and later in services. They are based on the 3P concept – Pollution, Prevention, Pays – and focus on waste reduction, recycling, and reuse at the enterprise level, making them microeconomic in scope. However, they also provide guidance on implementing circular economy programs at broader levels by increasing producer and consumer responsibility, utilizing renewable technologies and materials, and adopting clear and stable policies.

Despite the long-standing implementation of Cleaner Production (CP) programs, there are still many opportunities for optimizing products according to CP principles. Recent strategies in production design, aligned with CP, focus on extending product lifespan through easier maintenance, repair, reliability, and durability. Implementing CP programs, particularly through material substitution in production processes, supports the development of closed-loop products and enhances product value retention. Voluntary environmental commitments in CP programs directly reduce emissions, reduce the use of natural resources and increase the use of renewable and recyclable materials. CP practices are crucial for facilitating the adoption of circular economy concepts at the micro level, with key practices including designing for recyclability, improving recycling processes during operations, and simplifying product installation processes.

At the meso level, the organizational solution based on the circular economy model is mainly eco-industrial parks (EIPs). Eco-industrial parks are groups of enterprises operating in a specific geographical area, which aims to exchange resources and thus reduce their impact on the environment and at the same time, increase their profitability and improve social results. Enterprises operating in eco-industrial parks, based on the concept of industrial symbiosis, use common infrastructure and services; they jointly manage resource flows and trade in by-products, which reduces their environmental impacts and also reduces resource dependence. Eco-industrial parks (EIPs) align well with the circular economy model and can have a broader impact than isolated initiatives like eco-design or individual company efforts. Their influence can extend beyond the participating businesses to regional and national levels. Experiences from operating eco-industrial parks in countries such as Denmark, Sweden, Finland, and China show that they can significantly reduce waste and resource use throughout the product lifecycle. However, challenges include the complexity of large-scale infrastructure projects, geographical constraints, and managing complex stakeholder relationships.

Macro level implementations of circular economy solutions, recently may only be observed in pilot initiatives in China, in cities like Dalian, Beijing, Shanghai, and Tianjin (Geng et al., 2008; 2009; Wu H.Q. et al., 2014). However, there is an increasing number of initiatives promoting closed-loop resource systems in European Union countries. Moreover, the EU has already established administrative frameworks for monitoring the circular economy and established metrics to monitor progress in this field. These indicators cover key aspects of the circular economy, grouped into four areas: production and consumption; waste management; secondary raw materials and competitiveness and innovation (https://ec.europa.eu/eurostat).

## Conclusions

The shift toward a circular economy is seen as a solution for many countries to combat environmental degradation and resource shortages. Building a system that ensures full resource recovery and reuse is a major challenge requiring collaboration among all stakeholders, including non-economic entities. This transformation demands political dialogue, partnerships, and fair-trade policies, especially for poorer regions. Industrial enterprises are key players, as they must commit to sustainable resource use and cooperation across value chains. However, even with well-designed products, inefficient production can lead to waste and missed opportunities. Effective stakeholder management is vital, as various groups may influence interactions. Current knowledge and success stories show the importance of stakeholder engagement in shaping a responsible, sustainable economy that balances environmental, social, and business needs.

The circular economy concept has notable weaknesses, including the high energy and labor demands of waste recovery and reuse, as well as the risk of reinforcing current production and consumption patterns. Without changing consumer habits, a rebound effect could occur, potentially leading to increased resource consumption. Challenges to building a circular economy also involve legal, administrative, and ethical issues, as well as the need to ensure that resource loops function within free markets, not government-driven ones. For long-term sustainability, circular economy models must evolve independently of government support. Case studies show that projects driven solely by public entities without private sector involvement are less likely to succeed, especially on larger scales.

A critical review of the literature indicates that achieving a global circular economy model appears unrealistic. Countries would struggle to ensure economic security without accessing new raw materials, even if complete resource recovery were possible. Establishing a unified global environmental policy is improbable due to the vast developmental disparities between nations. Effective global implementation would require the unanimous adoption of similar solutions by all countries, but the difficulty in reaching consensus on climate agreements suggests this is unlikely.

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