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Circular Economy in Indonesia Towards Sustainable Development and the 2030 SDGs

Haniva Mulyani[1]

[1] Universitas Trisakti, Jakarta Barat, Indonesia

Abstract

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Indonesia, as the world's fourth most populous country, faces serious challenges related to waste accumulation, environmental degradation, and carbon emissions that contribute to ecological crises. The linear economy model based on the "take–make–dispose" approach has proven unsustainable, relying heavily on the continuous exploitation of natural resources and generating waste that pollutes ecosystems. Circular economy emerges as an alternative solution, emphasizing the principles of Rethink, Reduce, Reuse, Repair, and Recycle to preserve the value of products and materials within the economic cycle. This study employs a literature review method to examine the implementation of circular economy in Indonesia and its connection to achieving the Sustainable Development Goals 2030. The findings indicate that Indonesia has incorporated circular economy policies into several priority sectors, including plastics, textiles, construction, food and beverages, and electronics. Nevertheless, significant challenges remain, such as insufficient incentives, inadequate facilities, and limited cross-actor collaboration. Circular economy demonstrates strong potential to support Sustainable Development Goals, particularly in sustainable consumption and production, resilient cities, and climate action.

1. Introduction

Global environmental issues are increasingly demanding the world's attention due to the negative impacts caused by unsustainable consumption and production patterns. The accumulation of waste, environmental degradation, and increasing carbon emissions are major interconnected challenges. The buildup of solid waste, especially plastic, causes land and marine pollution, threatens biodiversity, and disrupts human health. At the same time, greenhouse gas emissions from industrial activities, transportation, and linear production patterns accelerate the rate of climate change, raise global temperatures, and trigger natural disasters and ecosystem damage (Irma & Gusmira, 2023). This situation reinforces the need for a transition toward a more sustainable economic system. For several decades, the global economy has been dominated by a linear paradigm based on a "take–make–dispose" model (Elisha, 2020).

This model focuses on the extraction of natural resources, mass production, rapid consumption, and the disposal of products after use. As a consequence, the resulting waste accumulates in landfills and natural ecosystems, while natural resources are increasingly depleted (Albar & Sisdianto, 2024). This model not only creates environmental vulnerability but also poses long-term economic risks due to excessive dependence on limited resources. As an alternative, the concept of a circular economy emerged to replace the linear economic model. A circular economy is defined as a system designed to eliminate waste and pollution, keep products and materials in the economic cycle, and regenerate natural systems (Malihah & Magfiroh, 2024). The main principles in the circular economy include

Rethink (rethinking product design and function), Reduce (reducing resource use), Reuse (reusing products), Repair (repairing broken goods), and Recycle (recycling materials). This approach not only promotes resource efficiency but also enhances industrial competitiveness, creates new jobs, and reduces carbon emissions.

For Indonesia, the transition to a circular economy is highly relevant, given the country's major issues in waste management. Based on data from the National Waste Management Information System (*Sistem Informasi Pengelolaan Sampah Nasional*/SIPSN), in 2022, waste generation in Indonesia reached 18.3 million tons per year, but only 9.25 million tons were successfully managed (KLHK, 2022). This figure indicates a large gap in the national waste management system. On the other hand, Indonesia is ranked second in the world as a contributor to marine plastic waste (Jambeck et al., 2021), which has serious implications for the sustainability of coastal and marine ecosystems.

The Indonesian government has demonstrated its commitment to integrating a circular economy into national development policies. This is reflected in the National Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*/RPJMN), which emphasizes the importance of waste management, green industry development, and resource efficiency. Besides policy aspects, the implementation of a circular economy in Indonesia is also closely related to achieving the Sustainable Development Goals (SDGs). The circular economy can support SDG 8 on inclusive economic growth by creating new jobs in the recycling and green innovation sectors, SDG 11 on sustainable cities by reducing the burden on landfills, SDG 12 on sustainable consumption and production through material

efficiency, and SDG 13 on climate action by reducing greenhouse gas emissions (Yuniar et al., 2024). Thus, the application of a circular economy is not only an environmental strategy but also an instrument for inclusive economic and social development.

Despite its great potential, the implementation of a circular economy in Indonesia faces a number of challenges. Some key obstacles include a lack of adequate recycling facilities, low public awareness, limited incentives for green industries, and suboptimal collaboration among the government, academics, businesses, and civil society (Tleuken et al., 2022). These challenges demand a comprehensive strategy based on multi-stakeholder collaboration to ensure that the circular economy can run effectively and provide tangible benefits. Given this background, this article aims to analyze the implementation of a circular economy in Indonesia, review its contribution to achieving the 2030 SDGs, and identify the opportunities and challenges faced. Through a literature study, this research is expected to provide a deeper understanding of the role of the circular economy as a key strategy in sustainable development in Indonesia.

2. Literature Review

2.1. The Concept of the Circular Economy and Its Main Principles

The circular economy is an innovative approach to resource management with the goal of keeping the value of products, components, and materials in the economic cycle for as long as possible. Unlike the linear model, the circular economy does not view waste as the end of the production chain but rather as a new resource

that can be reprocessed (Malihah & Magfiroh, 2024). The principles underlying the circular economy are the 5Rs: Rethink, Reduce, Reuse, Repair, and Recycle. Through more durable product designs, the use of environmentally friendly materials, and repair and recycling strategies, this approach can reduce the environmental burden while creating additional economic value (Albar & Sisdianto, 2024).

A number of studies emphasize that the circular economy plays an important role in industrial decarbonization. For example, the textile sector in Indonesia can reduce carbon emissions by utilizing recycled materials, while the food and beverage sector contributes to the reduction of organic waste through innovative processing of food scraps into energy or organic fertilizer (Yuniar et al., 2024). The implementation of a circular economy in various sectors not only reduces environmental impact but also increases production cost efficiency and national industrial competitiveness. Comprehensive operational management strategies are key to facing challenges in the plastic recycling industry, such as high production costs, the need for energy efficiency, and sustainability demands. The application of lean manufacturing has been shown to reduce waste and increase efficiency through the optimization of production processes (Dewi et al., 2021).

2.2. The Circular Economy in the Context of Sustainable Development and SDGs

The link between the circular economy and the Sustainable Development Goals (SDGs) is gaining increasing attention in both academic and public policy discourse. According to Septiana et al. (2024), the implementation of a circular economy supports SDG 12 on sustainable consumption and production through

material and energy efficiency. In addition, circular economy practices in the urban sector, such as integrated waste management and green infrastructure development, also support SDG 11 on sustainable cities and settlements. In the Indonesian context, the integration of a circular economy is also an important strategy for reducing carbon emissions in line with the Paris Agreement targets. The adoption of a circular economy in the plastic and construction sectors can reduce the carbon footprint by up to 15% by 2030. Furthermore, this approach also creates social opportunities, such as the creation of green jobs, increased social inclusion, and strengthening cross-sector collaboration (Yunus, 2024).

Thus, the circular economy is not only oriented toward the environmental aspect but also supports the economic and social dimensions of sustainable development. The application of the circular economy with the dimension of resource efficiency has been able to support the achievement of sustainable development for environmental, economic, and social goals (Gao et al., 2024). An illustration that can be given is an evolutionary definition that can be used for sustainable development to increase economic growth while maintaining social and environmental conditions to provide the best benefits for the current and future generations (Hariram et al., 2023).

3. Methods

This research uses a literature study method as the main approach. The literature study was chosen because it can provide a comprehensive understanding of the development of theories, practices, and policies related to the circular

economy in Indonesia and globally, especially in relation to the achievement of the Sustainable Development Goals (SDGs). This method allows researchers to identify knowledge gaps, compare findings between studies, and formulate a more complete conceptual synthesis. The literature collection process was carried out through several international scientific databases such as Google Scholar, as well as relevant national sources from Sinta-indexed journals, government policy reports, and seminar proceedings. Inclusion criteria were established to narrow the scope of the study, namely: articles published so that the analyzed data is up-to-date; articles that focus on the topics of circular economy, sustainability, waste management, and SDGs; and articles that contain the Indonesian context or international comparisons that can be used as references for the Indonesian case study.

The stages in this literature study method include: Identification of the research problem, namely the role of the circular economy in supporting the achievement of SDGs in Indonesia; Selection of literature based on inclusion and exclusion criteria; Evaluation of article quality through content analysis and methodological suitability; and Synthesis of study results to produce conceptual conclusions.The literature analysis was conducted with a thematic approach. The collected data were categorized into major themes, such as the principles of the circular economy, implementation in priority sectors (plastic, textile, food and beverage, construction, and electronics), contribution to the SDGs, and implementation challenges. Through this grouping, researchers can identify the relationships between variables and the policy implications that emerge.

In addition, this method also adopts the principle of critical review, where each source is analyzed not only based on its content but also its context, limitations, and relevance to Indonesian conditions. This approach is important so that the research does not just summarize but is also able to provide a critical perspective on the opportunities and challenges of implementing a circular economy in Indonesia. Thus, this literature study not only presents a theoretical overview but also provides a strong argumentative basis for formulating policy strategies and practical recommendations. The results of this method are expected to enrich the academic discourse as well as support evidence-based policy making.

4. Results

The implementation of a circular economy in Indonesia is one of the important strategies in facing environmental, social, and economic challenges while also supporting the achievement of the Sustainable Development Goals (SDGs). The results of the literature review show that the application of a circular economy in Indonesia is developing through a combination of government policy, private sector involvement, public participation, and academic support.

The Indonesian government has placed the circular economy issue as part of the medium-term development agenda contained in the RPJMN 2020–2024 and reinforced through a number of presidential regulations, including Presidential Regulation Number 97 of 2017 concerning National Policy and Strategy for Household Waste and Similar Household Waste Management and Presidential Regulation Number 83 of 2018 concerning Handling Marine Waste. Both of these

policies affirm the government's commitment to encouraging more sustainable waste management by reducing waste generation while increasing the recycling rate.

Study results indicate that Indonesia has set five priority sectors for the application of a circular economy, namely food and beverage, construction, electronics, textiles, and plastics. These five sectors were chosen because they have a significant contribution to national waste generation and great opportunities in reducing carbon emissions. According to a Bappenas report, the application of circular economy strategies in priority sectors is projected to reduce CO_2 emissions by 11–15 percent by 2030 if implemented consistently. In addition, the implementation of a circular economy has the potential to produce economic benefits in the form of efficiency in resource use, the creation of new jobs in the field of recycling and product repair, and the strengthening of national industrial resilience through the use of more environmentally friendly secondary raw materials.

In terms of regulation, the Indonesian government also encourages the application of the Green Industry Standard (GIS), which includes energy efficiency, waste management, pollution prevention, and the development of environmentally friendly products. The application of GIS is expected to be an important instrument for industries to transition to a more sustainable production model. In addition, the existence of a roadmap for waste reduction by producers encourages the manufacturing, retail, and food and beverage service sectors to reduce waste generation by 30 percent by 2029 through an approach of limitation, recycling, and reuse. This indicates a shift in waste management responsibility from the

government alone to an Extended Producer Responsibility (EPR) model that emphasizes the active role of producers in the product life cycle.

Other findings in the literature indicate that the development of circular economy implementation in Indonesia still faces a number of structural challenges. First, limited waste management infrastructure leads to a low recycling rate. Data from the National Waste Management Information System (SIPSN) in 2022 recorded that the amount of waste generation reached 18.30 million tons per year, while the amount successfully managed was only 9.25 million tons per year, or about 50 percent of the total generation. This condition indicates that the capacity of recycling facilities and processing technology is still not balanced with the rate of waste growth. Second, the lack of economic incentives to support green industries is a separate obstacle, given that the initial investment to build environmentally friendly production facilities is relatively high. Third, the level of public awareness regarding sustainable consumption and waste management practices is still varied, thus requiring a more massive education and campaign strategy.

Nevertheless, the opportunities for developing a circular economy in Indonesia remain wide open. Several good practices have emerged at the local and private sector levels. For example, a number of multinational companies operating in Indonesia have adopted circular economy principles in their supply chains by introducing environmentally friendly packaging, take-back programs for used products, and increasing energy efficiency in the production process. In addition, local startups in the field of digital waste management are also growing, with business models that connect households or businesses with collectors and recycling facilities.

This model not only increases the volume of waste that is successfully processed but also strengthens the circular economy by involving the informal sector as part of the waste management ecosystem.

The results of the literature review also highlight that the implementation of a circular economy in Indonesia has a close connection with the SDGs agenda. In the environmental aspect, the circular economy contributes directly to the achievement of SDG 12 on sustainable consumption and production, SDG 13 on climate action, and SDG 14 on marine ecosystems through the reduction of plastic waste that pollutes the waters. In the economic aspect, the circular economy supports SDG 8 related to decent work and inclusive economic growth through the creation of new jobs in the recycling sector and green innovation. Meanwhile, in the social aspect, the circular economy also plays a role in improving community welfare by expanding access to more affordable products through the practice of reusing and repairing goods.

In addition, international comparisons reviewed from the literature show that Indonesia can learn from the practices of other countries. Denmark, for example, succeeded in formulating a national circular economy strategy 2020–2032 that focuses on reducing plastic waste by up to 80 percent by 2030. Germany has implemented a sustainable development strategy for more than a decade by emphasizing efficient resource management. Japan applies the concept of an eco-city that integrates urban development with the principles of energy efficiency, emission reduction, and environmental preservation. These international practices can serve as a reference for strengthening Indonesia's national policies, especially in

building supporting infrastructure, creating consistent regulations, and fostering a culture of sustainable consumption in the community.

In the academic context, the literature also emphasizes that the principles of the circular economy have six main aspects that are relevant to implementation in Indonesia, namely rethink, refuse, reduce, reuse, repair, and recycle. The application of these six principles in everyday economic activities is seen as being able to break the linear cycle that has been the main cause of waste accumulation and environmental degradation. For example, through a rethink approach, producers are encouraged to redesign products to be more durable and easy to repair. The reuse and repair approach can extend product life while reducing the need for new raw materials. Meanwhile, the recycle approach encourages the use of used materials as secondary resources that have economic value.

The results of the literature study confirm that the implementation of a circular economy in Indonesia provides great opportunities in supporting sustainability, but still requires strengthening from the aspects of regulation, infrastructure, and multi-stakeholder collaboration. The success of circular economy implementation is not only determined by government policy but also by active industrial participation, technological support, and broad public involvement. Therefore, strengthening the institutional framework, providing incentives for green industries, increasing the capacity of recycling infrastructure, and developing digital technology-based innovations are key factors in encouraging the transition to a sustainable circular economy in Indonesia.

5. Discussion

The results of the literature review show that the circular economy in Indonesia has great potential to support the achievement of the Sustainable Development Goals, but its successful implementation still faces a number of structural obstacles. This discussion is important to elaborate on the findings by highlighting strengthening factors and challenges, as well as offering a critical perspective related to policy relevance and sustainability. First, from an environmental perspective, the transition to a circular economy in Indonesia focuses on efforts to reduce waste generation, lower carbon emissions, and increase resource utilization efficiency. However, the literature emphasizes that success in this aspect is highly determined by the existence of adequate waste management infrastructure. The reality on the ground shows that the capacity of recycling facilities is still limited, while unmanaged waste ends up in landfills or polluting marine ecosystems. In this context, the role of government and private investment is crucial.

Fiscal incentives and green financing directed at developing waste management infrastructure have the potential to accelerate the application of circular economy principles, especially in the plastic and food sectors, which are the largest contributors to waste generation. Second, from an economic perspective, the circular economy provides significant opportunities to create new jobs, strengthen industrial competitiveness, and reduce dependence on raw natural resources. The literature mentions that the circular economy can open up job opportunities in the recycling sector, sustainable product design, and environmentally friendly technology. However, obstacles arise from the high initial investment costs,

especially for small and medium-sized industries that dominate the Indonesian economy. Without policy support in the form of tax incentives, technology subsidies, or easy access to financing, MSMEs find it difficult to transition to a circular production model. In addition, there is still a skills gap among the workforce, so special training programs are needed in the fields of recycling, material engineering, and environmental management (Muaddab et al., 2024).

Third, the social aspect is also an important highlight in the literature. The circular economy is not only seen as an environmental strategy but also has a social dimension related to improving community welfare. The practice of reusing and repairing products, for example, allows people to access goods at more affordable prices, while the involvement of the informal sector, such as scavengers, in the recycling supply chain can increase economic inclusivity. In addition, the discussion of international literature shows that developed countries such as Germany, Denmark, and Japan have succeeded in building strong circular economy ecosystems through consistent regulation, public education, and large investments in green technology. This comparison is important for Indonesia because it provides an overview that the transition to a circular economy requires a holistic approach that integrates policy, infrastructure, and changes in public behavior. Indonesia's biggest challenge actually lies in the consistency of policy implementation, coordination between institutions, and weak enforcement of environmental laws.

From a long-term sustainability perspective, the literature emphasizes that the circular economy should not only be seen as a waste management strategy but must be positioned as a new paradigm for economic development. This means that

circular economy principles need to be integrated into every stage of development planning, from product design, production processes, distribution, and consumption, to end-of-life management of goods. Thus, this discussion confirms that the implementation of a circular economy in Indonesia requires a multi-level approach that combines regulatory instruments, economic support, technological innovation, and changes in social behavior. If the gap between policy and practice can be bridged, the circular economy has the potential to be an important engine in driving low-carbon, resilient, and inclusive development.

6. Conclusion

Based on the results of the literature review, it can be concluded that the circular economy is one of the most relevant strategies for answering the environmental, social, and economic challenges faced by Indonesia. As a country with a large population and high waste generation, Indonesia needs a development model that not only reduces waste and emissions but is also able to maintain the sustainability of natural resources. The concept of a circular economy offers a solution by prioritizing the principles of reuse, repair, recycling, and product redesign so that the value of materials remains in the economic cycle for as long as possible.

The implementation of a circular economy in Indonesia has begun through national policies such as the RPJMN 2020–2024 and presidential regulations related to waste management, as well as application in priority sectors such as plastics, textiles, food and beverage, construction, and electronics. However, the literature emphasizes that the success of implementation still faces major challenges, including

limited waste management infrastructure, high initial investment costs, and low public awareness.

Nevertheless, great opportunities remain open. The circular economy not only contributes to the reduction of carbon emissions and the achievement of SDGs but also has the potential to create new jobs, improve social welfare, and encourage green industrial innovation. Therefore, multi-stakeholder collaboration involving the government, industry, academics, and civil society is needed to ensure that the transition to a circular economy is consistent, inclusive, and sustainable. With the right steps, Indonesia has the potential to become one of the developing countries that successfully leads the transformation toward a low-carbon and globally competitive future.

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