The impact of Implementing a Circular Economy on the Environment and the Food Industry

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Abstract. Indonesia produces a significant amount of food waste per person, placing it at a high rank globally in terms of food waste generation. This situation raises concerns among various stakeholders due to the potential negative impacts that can be mitigated. There are several factors influencing the high quantity of waste in Indonesia, and one of them is the lack of a widespread circular economy system. Consequently, both product manufacturers and consumers do not consider the ultimate fate of these products. However, by examining the entire production process, we can minimize waste generation by implementing a circular economy system in manufacturing companies. The purpose of this research is to explore the benefits of implementing a circular economy system in the product flow of these companies, benefiting the company itself, the environment, and even the government. This scientific article adopts a qualitative descriptive method. By implementing a circular economy in product manufacturing companies, a balanced relationship can be targeted between quality economic growth and the natural regenerative capacity, ultimately leading to an environmentally friendly approach.

Keywords: Economy, Circular Economy, Environment, Food Industry.

1 Introduction

1.1 Research Background

The linear economy or consumption model originates from the word 'take-use-waste' which comes from the Industrial Revolution. This scientific article first considers how food industry companies that implement a circular economy system in their companies can have an impact on their environment by considering several factors that indicate that the linear production and consumption model is unsustainable and, as a consequence, an alternative model, namely the circular economy. [1] A circular economy is an economic system that aims to eliminate waste and promote the efficient use of resources by keeping materials and products in use as long as possible. The circular economy is under the umbrella of Low Carbon Development (PRK), which is also one of the efforts to achieve a green economy by emphasizing its activities in five priority sectors. Three of the five PRK sectors are closely related to circular economy principles, namely waste management, sustainable energy development, and green industry development. This linkage can be seen from implementing a circular economy that can reduce the amount of waste generated and disposed of, prioritizing the use of renewable energy, and

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supporting the efficient use of natural resources, the products produced, and the processes used in this industry so that they are more environmentally friendly.

In this case, the circular economy is not limited to the recycling process. The circular economy concept involves making maximum efforts to utilize the value of a product and its components repeatedly so that there is no wastage of resources (resource efficiency). This input efficiency is carried out thoroughly by maximizing the use of products or components repeatedly, extending the life of the product, and avoiding wastage of resources. Simple activities, such as avoiding the waste of food or changing clothing styles that are no longer attractive, can be done. In addition, by donating items that are still viable, we can avoid piling up unused items in cupboards or waiting for them to break down. According to the [2] report on the Circular Economy concept, the aim is to make the components of various products interchangeable. Thus, the product can be easily converted into other products with different benefits according to the wishes of consumers. The main difference with the conventional economic concept or linear economy is that the circular economy aims to achieve a balance between quality economic growth (including welfare) and limits to acceptable natural regeneration, or, in other words, is environmentally friendly. Therefore, supply chain flow needs to be made in a circular form, which is often referred to as a closed supply chain. However, this requires careful planning. Within the supply chain, producers from different sectors of the economy need to work together to create mutually beneficial ecosystems based on transparency and the common goal of reducing waste to zero.

Fig. 1. Data Sampah Makanan Indonesia

Source : Rizaty, Monavia Ayu (2021)

According to a study conducted in 2017 by [3]**,** Indonesia produces nearly 300 kilograms of food waste per individual, and the country ranks second in the world in terms of food waste

production. This situation is of serious concern considering that there is still a fairly severe level of hunger in Indonesia [3]**.** However, this amount of waste can feed around 28 million people or around 11% of Indonesia's total population. According to [3]**,** food waste is generated both in the distribution and consumption stages. Food waste at the distribution stage, such as expired products, comes from traditional markets or supermarkets.

Currently, waste management still relies on the direct disposal method to the final disposal site (TPA), which results in the life of the TPA being shorter than planned. This also causes an increase in the level of environmental pollution, be it water, air, land, or sea. Based on a study conducted by [4], an average of 72 percent of waste ends up in landfills, and 17 percent leaks into the surrounding environment. One of the TPAs will soon reach full capacity and will have to be closed this year. This needs to be given serious attention because it is estimated that in the next 2–4 years, similar problems will arise if there is no available land for landfill expansion.

Meanwhile, the waste recycling rate only reaches 11 percent, a figure that is far from ideal for reducing the amount of waste that eventually ends up in landfills. [3] states that food waste at the consumption level is caused by leftover pieces of fruit or vegetables and eating habits. On the other hand, [1] states that a culture of fast and instant consumption also plays a role in increasing the composition of plastic waste. Data from the Ministry of Environment and Forestry (KLHK) shows that the amount of plastic waste accumulation continues to increase, from 11 percent in 2010 to 17 percent in 2021. In addition**,** [4] found that the dominant composition of waste consists of food waste (48 percent), plastic (16 percent), and parks (13 percent), based on a survey conducted in six cities and districts within the project area.

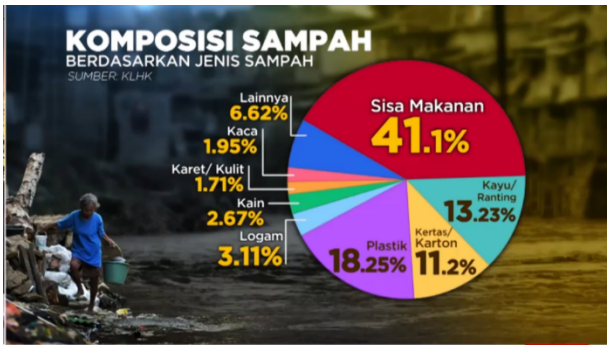

Fig. 2. Indonesia Waste Composition Diagram 2023

Source: N/A Metro TV (2023)

To implement proper processing procedures, it is important to determine the appropriate and most efficient processing method using mixed waste [3]**.** [5]In a webinar in Jakarta in 2023, Arifin Rudiyanto, Deputy for Maritime Affairs and Natural Resources at the Ministry of National Development Planning/Bappenas, said, "If there is no policy intervention, we will continue to do business as usual and can reach 112 million tons per year. This means food waste per capita of 1 kilogram per day." Arifin also mentioned that, according to a study by the Economist Intelligence Unit, Indonesia is the second-largest country in terms of food production in the world and produces nearly 300 kilograms of food waste per person per day

every year. According to data from the Ministry of Environment and Forestry (KLHK), around 44 percent of the piles of waste in Indonesia in 2018 were food waste. Arifin revealed, "Overall, more vegetables are thrown away than consumed."

Previous research conducted by [3] showed that about a quarter of the food supply for human consumption is wasted in the food supply chain in high-income countries. Based on this concept, the government has scheduled strengthening economic resilience to achieve quality and just growth, one of which is through the implementation of a circular economy system. [3] states that a change from a linear economy to a circular economy is a must to overcome the crisis that the world is currently facing. Many efforts have been made to overcome the environmental degradation crisis, and economic activity is considered one of the factors causing this degradation. In this context, the neoclassical economy, which is the main economic management framework throughout the world, with market mechanisms and the concept of GDP, is considered to be the cause of the current environmental crisis.

[1] "Economic, Social, and Environmental Benefits of the Circular Economy in Indonesia" This report reveals the potential for an increase in GDP of IDR 593 to 638 trillion in 2030 through the implementation of a circular economy. Thus, it can be concluded that the circular economy is an economic concept that is based on the efficient and sustainable use of resources. By implementing this concept, it is hoped that a good environment and sustainable economic growth can be created, as well as having a positive impact on the environment and the national economy.

1.2 Research Question

- What are the advantages for food industry companies that operate a circular economy?
- What are the benefits for the environment if the company uses a circular economy system?
- How can the circular economy contribution of a food industry company have an impact on the environment and the national economy in general?

1.3 Research Objective

This study aims to conduct an in-depth analysis of the circular economy contribution made by companies to the country and the environment. The results of this research are expected to be a source of information for policymakers to implement circular economy policies. Because the country's economy has a relationship with gross domestic product, we can relate it to the circular economy concept. This research will also look at the strategies implemented by the government, as well as their impact on society in managing the country's economy and implementing circular economy strategies that can help strengthen state finances and reduce the possibility of economic turmoil in Indonesia. It is hoped that this research will produce findings that are balanced and not detrimental to any party. In addition, we hope that current technological advances can provide benefits in disseminating information to all levels of society regarding policies implemented by the Indonesian government, including in remote areas.

1.4 Sistematika artikel

The preparation of this article is divided into 4 (four) chapters, which will be explained as follows:

Section 1 Introduction
: Discusses the elaboration of background issues, problem identification, the scope of research, aims and benefits of research, and research systematics.

Section 2 Study Methodology
: Discusses the systematic and structured approach used to review or evaluate research. establishing a clear framework for conducting the review, defining the scope of the review, identifying evaluation criteria, and selecting appropriate methods for data collection and analysis.

Section 3 Results and Discussion
: Discusses the results of the research along with the description of the data that has been
found.

Section 4 Conclusions and Suggestions
: Discusses the conclusions, namely the answers to the formulation of the problem in chapter one as well as suggestions for further research and also the limitations of the research.

2 Review Methodology

This study used a qualitative method with a descriptive study design. [6], descriptive research is research that describes the current facts of a population. Researchers will collect data from journals related to companies that implement a circular economy in their business. Furthermore, researchers will conclude whether the results of data collection are relevant to the research objectives. Qualitative research. [6], aims to understand the phenomena experienced by research subjects, such as behavior, perceptions, motivations, and actions as a whole, by describing them in the form of words and language, in certain natural contexts, using natural methods. [6] States that qualitative research is a process of naturalistic inquiry that aims to gain an in-depth understanding of natural social phenomena. Therefore, this research will provide an overview of the circular economy phenomenon carried out by companies, especially in the food industry, and its positive impact on the environment. Secondary data will be obtained from documents that can complement researchers and provide relevant information in achieving research objectives. Secondary data collection techniques involve media analysis and literature studies using documents related to the circular economy carried out by companies and their impact on the environment.

3 Result and Discussion

Generating less and utilizing more waste could have a significant impact on the Indonesian economy. [7], there are around 64 million Micro, Small, and Medium Enterprises (MSMEs) in

Indonesia that provide jobs for around 61 million people (about 90 percent of the total workforce). Circular economy practices can also reduce the production costs of MSMEs by increasing production efficiency and reducing waste, providing significant opportunities for MSMEs. However, MSMEs often have limited knowledge about implementing a circular economy. Therefore, the government needs to develop adaptive policies to support various types of MSME businesses in adopting the circular economy concept. Governments may also consider involving MSMEs in supply chain partnerships, as has proven effective in Europe. In the food industry, business people routinely implement a circular economy system every year to achieve sustainable development goals and maximize their business processes.

3.1 PT. INDOFOOD SUKSES MAKMUR Tbk

Grup Bogasari, which is part of PT Indofood Sukses Makmur Tbk, has been recognized at the Global Clean Energy Action Forum in Pittsburgh, United States, for its achievements in decarbonizing the supply chain and implementing digital automation systems to integrate production outcomes with energy management. Currently, Grup Bogasari is the only flour mill in the world to have received the International Energy Management Leadership Award of Excellence. Additionally, the group has been honored with the Level 5 Green Industry Award, the highest recognition from the Indonesian Ministry of Industry for innovative production process efficiency aimed at environmental preservation. With over 90,000 employees, PT Indofood has a broad impact on the lives and welfare of the community. The contributions of PT Indofood Sukses Makmur Tbk in supporting the Sustainable Development Goals (SDGs) are as follows:

1. Sustainable and responsible
supply management involves PT Indofood Sukses Makmur's efforts to manage raw materials responsibly and strengthen cooperation throughout the value chain. This aims to create a positive impact on the economy and society in the company's operational areas.

2. Inclusive Social -Economy
Creating an inclusive business through partnerships with farmers, MSMEs, and suppliers is part of the value chain, to promote community development

3. Energy Management
The use of biomass from oil palm shells as a source of renewable energy in our production facilities, as well as the use of biomass, solar photovoltaic, and methane capture technology

4. Employment Practices and Employee Development
Build productive employment conditions and ensure that all employees receive proper remuneration. We also comply with applicable minimum wage regulations

5. Waste Management and Packaging
All usable food waste resulting from the production process is processed into animal feed through cooperation with animal feed producers

In the quote, it is stated that the company PT. Indofood Sukses Makmur Tbk contributes significantly to achieving the Sustainable Development Goals (SDGs) and supports the circular economy program promoted by the government. This contribution involves benefits for the surrounding economy, environment, government, and also for the progress of the company itself.

PT. Indofood is involved in working with MSME companies that are responsible for their business processes. Through this collaboration, they build product resilience over the long term. This has an impact on improving the quality of business and better economic activity. In addition, this approach is also beneficial for the environment and society socially.

Thus, PT. Indofood plays a role in developing a circular economy, in which its products are designed to minimize waste and maximize the efficient use of resources. By partnering with responsible MSMEs, they can create a greater positive impact in terms of the environment, the economy, and society as a whole.

3.2 Nestle

Packaging of food products helps protect food and beverages, ensure product quality and safety, communicate nutritional information, and prevent food waste. However, the use of packaging should not harm the planet. Specifically, Nestle is making its best efforts to reduce plastic waste by increasing the use of recycled plastics, reducing the use of new plastic resins, and supporting the creation of a circular system that facilitates collection, recycling, and reuse.

Nestle has achieved its commitment to packaging recycling. 88% of Nestle's packaging is now recyclable or reusable, while 40% of the materials used in 2020 were renewable. Nestle is innovating with new materials, alternative delivery systems, and packaging-free options. Through these programs and innovations, Nestle contributes to the Sustainable Development Goals (SDGs), including Industry, Innovation, Infrastructure, Responsible Consumption and Production, Climate Action, Marine Ecosystems, Terrestrial Ecosystems, and Partnerships to achieve goals.

Fig 3. SDGs 9,12,13,14,15 and 17

Nestle has been assisting in resolving various agricultural issues in Indonesia. The challenges faced by agriculture and poverty require an integrated and sensitive approach. In recent years, Nestle has employed the innovative Theory of Change (ToC) to enhance its capabilities and impact. By utilizing ToC, Nestle can identify the most crucial problems. Through this approach, Nestle has developed unique local support strategies for specific raw materials, such as coffee and milk. Nestle invests in helping farmers build resilient businesses through initiatives like Connected Farmers, which provides basic training to over 355,000 farmers and fosters agricultural entrepreneurship among 39,000 young farmers. Through these programs and innovations, Nestle contributes to the Sustainable Development Goals (SDGs) including No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality,

Clean Water and Sanitation, Decent Work, and Economic Growth, Industry, Innovation, and Infrastructure, Responsible Consumption and Production, Life Below Water, Life on Land, Peace, Justice, and Strong Institutions, and Partnerships for the Goals.

Fig 4. Sustainable Development Goals (SDGs)

From this statement, it can be seen that the Nestlé company plays an important role in supporting the Sustainable Development Goals (SDGs) and circular economy programs supported by the government and other companies. Nestle makes a positive contribution in various aspects such as the economy, education, environment, and government. To address the global challenge of food waste, Nestle is also considering operating its own company. One way for them to progress and develop is through collaboration with MSME companies that are responsible for their business processes. This is done through educating farmers to ensure their success in agriculture.

In addition, Nestle is also working with industry partners and educating consumers to ensure that more food produced from agriculture reaches the dinner table. These programs run by the Nestlé company make a significant contribution to the achievement of the Sustainable Development Goals.

3.3 Danone

In this case, Danone is committed to implementing an efficient production system to achieve sustainable consumption and production. They try to make optimal use of resources and reduce the waste they produce. In addition, Danone also tries to increase consistency to create a cleaner and healthier environment through the following activities:

1. Control of emissions and energy consumption: Danone seeks to reduce greenhouse gas emissions and control energy consumption in its operations. This aims to reduce the negative impact of climate change.
2. Water and wastewater management: Danone has a water management program that aims to minimize water use and manage the wastewater it produces. They try to maintain the availability of clean water and reduce the negative impact on the environment.
3. Solid waste management: Danone seeks to reduce the solid waste generated in its production process. They adopt appropriate waste recycling and treatment practices to reduce their negative impact on the environment.

4. Assessment of environmental aspects for suppliers: Danone conducts assessments of the environmental aspects of its suppliers. They seek to work with suppliers who are committed to sustainable and environmentally friendly practices.

From the programs and innovations carried out by Danone, they contribute to several Sustainable Development Goals (SDGs), including:

1. Clean water and sanitation: Through efficient water management and reducing negative impacts on water resources, Danone contributes to efforts to provide safe and affordable access to clean water and sanitation.
2. Clean and affordable energy: By controlling energy consumption and reducing greenhouse gas emissions, Danone strives to support the use of clean and affordable energy.
3. Responsible consumption and production: Through efficient production practices and good waste management, Danone contributes to efforts to achieve sustainable consumption and production patterns.
4. Mitigating climate change: By controlling greenhouse gas emissions and reducing the negative impacts of climate change, Danone seeks to contribute to tackling climate change.
5. Marine ecosystems and land ecosystems: Through good water and waste management, Danone tries to maintain the sustainability of marine and land ecosystems.

It is important to note that this information is based on the assumption that Danone has certain programs and innovations that match the description given, and no information is provided about Nestle's contribution to the SDGs in question.

Fig 5. SDGs 6-7, 12-15

Community empowerment, By providing counseling and teaching skills to the community to improve their economic status. The community development promoted by Danone has the maximum impact on the desired goals.

1. Stunting prevention programs: Danone provides financial and in-kind support for stunting prevention programs. This program aims to reduce stunting rates in children by providing nutrition counseling, providing nutritious food, and monitoring children's growth regularly.
2. Fill My Plate: Danone supports the Fill My Plate program which aims to improve people's healthy eating patterns and nutrition. Through this program, Danone provides education about the importance of a balanced diet and provides access for the public to obtain nutritious food at affordable prices.
3. Generation of Healthy Indonesia (GESID): Danone contributes to the GESID program which focuses on children's health. Financial and in-kind support from

Danone helps in the provision of nutritious food, health checks, and education about the importance of a healthy lifestyle for the younger generation.

4. Healthy Children Stalls: Danone supports the Healthy Children Stalls program which aims to improve community access to nutritious food in small stalls. Danone provides financial assistance and training to shop owners to provide healthy food for children.
5. Smart Park: Danone provides financial and in-kind support for the Smart Park program, which aims to improve access to quality education for children in Indonesia. Through this program, Taman Pintar provides interactive and innovative learning facilities.

Through the financial and in-kind support provided to these programs, Danone plays an active role in empowering communities and improving their economic well-being.

Fig 6. SDGs 1,3,4,8,9

In the quote, it is stated that the Danone company has made a significant contribution to achieving the Sustainable Development Goals (SDGs). They play an active role in promoting circular economy programs supported by the government and other companies. This effort has had a positive impact on the economy, education, environment, and government sectors.

The Danone company also aims to face global complexities and challenges related to emission control and energy consumption. They are committed to creating a cleaner and healthier environment and contributing to community development by collaborating with responsible parties. Through these programs, Danone companies make a significant contribution to achieving the Sustainable Development Goals.

3.4 PT. Nippon Indosari Tbk

Recycling of Plastic Packaging Waste, To carry out its commitment to a circular economy, PT Nippon Indosari Corpindo Tbk, a company engaged in the production of food and beverages, has launched a Plastic Packaging Waste Recycling program. This program aims to reduce the negative impact of plastic packaging waste on the environment by promoting the recycling and reuse of this waste. This program involves working with national suppliers involved in the Company's supply chain. Suppliers who have passed strict selection based on regulatory compliance criteria and product safety for consumers are prioritized in this program. The Company seeks to partner with national suppliers, geographically operating in Indonesia, to strengthen the local economy and support the development of the recycling industry in the country.

In its implementation, PT Nippon Indosari Corpindo Tbk has invested Rp 289,000,000.00 to support the continuation of this program. The funds are used to set up a special recycling facility for plastic packaging waste, including machinery and supporting equipment. In addition, the company also conducts outreach campaigns to the public and consumers regarding the importance of recycling and reducing the use of single-use plastic packaging.

Through the Plastic Packaging Waste Recycling program, PT Nippon Indosari Corpindo Tbk hopes to reduce the negative impact of plastic waste on the environment, support a circular economy, and increase public awareness of the importance of preserving the environment through concrete actions.

1. The Company has a subsidiary engaged in trading. Through these subsidiaries, the Company can create more job opportunities.
2. The Company completes products with good prior date information, product composition, production code, and other information needed by consumers on each product packaging.
3. PT Nippon Indosari Tbk made changes to the product packaging by reducing the packaging by 2cm.
4. PT Nippon Indosari Tbk does not differentiate between men and women, the appraisal and remuneration system is not seen from gender but according to the performance of each employee.

Fig 7. SDGs 1,8,12, 13, 14, 15, 5

In the statement, it appears that PT. Nippon Indosari Tbk makes a significant contribution to achieving the Sustainable Development Goals (SDGs). Positive impact on the economy, PT. Nippon Indosari Tbk also contributes to education, environment, and governance. In addressing global complexities and challenges, this company cooperates with the responsibility to carry out community development.

Thus, the program is run by PT. Nippon Indosari Tbk significantly contributes to achieving the Sustainable Development Goals.

3.5 PT. Campina Ice Cream Industry Tbk

PT. Campina Ice Cream Industry Tbk is committed to being an environmentally friendly company. Campina's focus on environmental aspects revolves around prioritizing waste management to prevent pollution. Campina adopts the best environmental impact management practices, such as implementing green practices by replacing diesel fuel with natural gas in our factory area to reduce emissions that contribute to global warming. In supporting Campina's efforts to become a sustainable business, Campina collaborates with two global licenses, Disney and Nickelodeon. In this collaboration, Campina must meet various requirements for labor standards, hygiene, and product quality in line with global standards. Campina strives to improve consistency to create a cleaner and healthier environment through several activities, as follows:

1. Use of environmentally friendly materials.
2. Energy usage and efficiency efforts.
3. Water consumption.
4. Conversion of solar emissions to Compressed Natural Gas (CNG).
5. Waste management.

Fig 8. SDGs 11,12,13,15

The growth of PT Campina Ice Cream Industry Tbk is closely linked to the support of highly professional and integrity-driven human resources. The management of human resources is conducted by adhering to best practices and labor regulations. PT Campina Ice Cream Industry Tbk continually enhances the capacity of its employees through training and development. In building a sustainable Campina, the company selects the best raw materials that incorporate ESG aspects, improve operational efficiency, and implement cost-saving measures for energy and water utilization. These efforts aim to maintain operational costs while supporting environmental sustainability. Campina strives to enhance consistency to achieve high social performance, which is achieved through various activities, namely:

1. Equal employment opportunities
2. Industrial relations
3. Upholding and respecting human rights

Fig 8. SDGs 5,8,10,16

From the company, it can be seen that PT. Campina Ice Cream Industry Tbk has contributed significantly to achieving the Sustainable Development Goals (SDGs) to support circular economy programs supported by the government, like other companies. The company's performance in the economic aspect has provided additional benefits or positive impacts for all stakeholders. The economic value generated by the company has been distributed through the payment of salaries to employees, payment of taxes and fees to the government, as well as payments for services and goods from local suppliers. The existence of PT. Campina Ice Cream Industry Tbk also indirectly encourages economic growth in its operational areas by creating jobs both in factories and representative offices, as well as providing opportunities for the community to open micro-scale businesses.

4 Conclusion

From several companies implementing a circular economy system, it can be concluded that all companies have the same goal, which is to transition from a linear economy to a circular economy. The same pattern can be seen in several companies in the development of a circular economy, including developing human resources and reducing the cost of producing goods through processing waste to create products that are efficient, useful, and have high selling value. The results show that companies that implement a circular economy succeed in lowering their production costs because they consider the use of their products from start to

finish. From these results, it can also be seen that the company seeks to minimize waste through internal waste management and the use of the latest technology to reduce gas emissions and manage water better to protect the environment. The company also contributes to the government, such as creating jobs, improving employee welfare, and developing the local economy. The Ellen MacArthur Foundation (2013), a community that promotes a circular economy, states that the essence of a circular economy is to design products to be recycled and reused as a source of production, by separating long-term and short-term waste. This system uses green energy to reduce dependence on non-renewable energy sources.

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