Enabling Policy Environment to Encourage Private Sector Investment for Circular Economy Practices in Indonesia's Agriculture-Based Food and Beverage Sector

FINAL REPORT

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CHAPTER I: INTRODUCTION

1.1. Introduction

Indonesia, with a population of 270 million people, is one of the world's greatest waste producers. Jambeck et al.[1] reported that Indonesia has the second largest contributor of plastic garbage released into the world's oceans, with an estimated 3.22Mt per year. Indonesia's poor national waste management significantly contributed to the issue. According to Ministry of Environment data, only 7% of total waste is recycled for usage in industry. Up to 69 percent end up in the garbage, and up to 24 percent are unmanaged (waterways, buried, burned).[2]

Moreover, inadequate waste management is correspondingly a significant contributor to greenhouse emissions. Waste is the largest contributor to Indonesia's total emissions after electricity, agriculture, and transportation.[3] Waste that is not segregated and ends up in landfills will emit GHGs such as methane, an even stronger greenhouse gas.[4] In addition, the waste problem is significant because garbage piles on the streets may attract mosquitoes, resulting in diseases such as dengue fever and malaria,[5] especially if the amount of existing waste is overgrowing. Waste emissions can cause asthma, birth defects, cancer, cardiovascular disease, pediatric cancer, COPD, infectious diseases, low birth weight, and preterm delivery.[6] Microplastics derived from the breakdown of plastic waste, on the other hand, can spread through the food chain or plastic pollution in the air and settle in the human body. Microplastics containing chemicals and contaminants can cause cancer and hormonal abnormalities.[7]

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[1] Jambeck, Jenna R et al. “Marine pollution. Plastic waste inputs from land into the ocean.” Science (New York, N.Y.) vol. 347,6223 (2015): 768-71. doi:10.1126/science.1260352
[2] Kementerian Lingkungan Hidup dan Kehutanan, UNEP, IETC, IGES. “National Plastic Waste Reduction Strategic Actions for Indonesia” (2020).
[3] Friedrich, J., Ge, M., & Pickens, A. This Interactive Chart Shows Changes in the World's Top 10 Emitters. (2020). Retrieved from https://wri-indonesia.org/en/insights/interactive-chart-shows-changes-worlds-top-10-emitters
[4] Bahraini, A. Getting to Know Waste-Related Greenhouse Gases. (2021). Retrieved from https://waste4change.com/blog/getting-to-know-waste-related-greenhouse-gases/
[5] Tomita, Andrew et al. “Exposure to waste sites and their impact on health: a panel and geospatial analysis of nationally representative data from South Africa, 2008-2015.” The Lancet. Planetary health vol. 4,6 (2020): e223-e234. doi:10.1016/S2542-5196(20)30101-7
[6] Downs, A., & Acevedo, R. “How Our Trash Impacts the Environment”. (2019, 28 February). Retrieved from https://www.earthday.org/how-our-trash-impacts-the-environment/.
[7] Geneva Environment Network. (2022, October 12). Retrieved November 25, 2022, from https://www.genevaenvironmentnetwork.org/fr/ressources/nouvelles/plastics-and-health/

Besides, renewable energy sources such as wind, solar, and hydropower are abundant in Indonesia. However, it is heavily reliant on nonrenewable energy sources such as fuels, coal, and LPG. Except for coal, which is produced in the country, the rest of the energy source is heavily reliant on imports, imposes a significant burden on the government, and is highly sensitive to international energy prices as well as IDR rupiah value fluctuations. Furthermore, reliance on nonrenewable energy leaves a carbon footprint, which contributes to global warming and has a negative impact on the environment and the economy.

Adopting the circular economy model is one of the strategies to address the waste problem and the reliance on non-renewable energy in Indonesia. The circular economy is a production and consumption model that involves the concepts of sharing, renting, reusing, repairing, renewing, and recycling existing materials and products for as long as feasible in order to extend the product life cycle. As a result, a circular economy differs from a linear economy built on a take-make-use-trash cycle (European Parliament, 2022), which uses more raw materials and energy while producing more waste and emissions. Adopting circular methods widely in households, business and industries, Indonesia can reduce the production of waste. Besides, the waste produced could be converted to energy that can be used to power homes, businesses, and industry, reducing the need for non-renewable energy sources such as fossil fuels. Moreover, as an example, waste heat generated during the electricity production process can be captured and utilized, reducing energy loss. This closed-loop system helps to conserve resources, reduce waste, and minimize the impact on the environment.

The Indonesian government has gradually adopted the concept of a circular economy, issuing some regulations supporting a green economy which includes a circular economy. Among those regulations are Presidential Regulation No. 97/2017 or JAKSTRANAS on Management of household waste and similar household waste and Government Regulation No. 46/2017 on Environmental Economic Instruments. Moreover, the Indonesian government has also issued the Low Carbon Development Initiative (LCDI) policy to achieve the NDC (National Determined Contribution) target, including waste reduction.

In developing EBT, the government has provided several fiscal incentives. one of which is the provision of tax allowances, or tax breaks, which are given in the form of reductions in corporate income tax. The award is based on PP No. 18 of 2015 (later amended in PP No. 9 of 2016) which regulates a number of Certain Business Fields that are entitled to PPh reduction facilities. In this regulation, investment in EBT-based power plants is included in the priority sector category, along

with activities for utilizing geothermal energy, generating electricity from waste processing, and the biochemical industry. Another incentive is the provision of levy relief on imported goods. This is regulated in Minister of Finance Regulation (PMK) No. 21/PMK/011/2010 concerning Provision of Tax and Customs Facilities for Utilization of Renewable Energy Sources. This arrangement states that specifically for EBT developers, apart from being entitled to a tax allowance, they are also entitled to exemption from PPh 22 for imported goods, exemption from import duties, and exemption from the imposition of VAT on imported goods.

Besides, a circular economy has a potential impact on Indonesia's social and economic aspects. Bappenas,[8] for instance, has identified five manufacturing industry sectors that will be targeted to implement a circular economy, namely food & beverage, textiles, construction, wholesale and retail trade (focusing on plastic packaging), and electrical and electronic equipment. The selection of the five sub-sectors is based on their high added value, their production system that can adopt a circular economy, and the support of stakeholders, both government and private. In the food and beverage industry, for example, several circular economy potentials that can be applied are reducing post-harvest food loss, reducing supply chain food loss and waste, reducing consumer food waste, and recycling processed food loss and waste.[9] The study also revealed that implementing the circular economy in the five sub-sectors will encourage an increase in economic value added, up to 2.5% of total GDP in 2030 as well as job creation which could reach 4.4 million, and a significant reduction in carbon emissions, namely 15 percent of its lower bound target of reducing CO2e emissions and around 11 percent of its upper bound target of reducing CO2e emissions by 2030 relative to the BAU scenario.[10]

However, while the circular economy has numerous positive effects on the economy as a whole, the challenges of implementing the model remain significant. According to a Bappenas survey (2021)[11], the industry faced a variety of challenges in implementing the model, including the difficulties of transforming culture, infrastructural limits, and implementation and enforcement failures. Furthermore, there are various regulatory issues, such as insufficient legislative frameworks.

[8] Bappenas, Embassy of Denmark Jakarta, and UNDP (2021), The Economic, Social, and Environmental Benefits of A Circular Economy in Indonesia. Retrieve from https://lcdi-indonesia.id/wp-content/uploads/2021/02/Full-Report-The-Economic-Social-and-Environmental-Benefits-of-a-Circular-Economy-in-Indonesia.pdf
[9] Bappenas (2021).
[10] Bappenas (2021).
[11] Bappenas (2021).

As a result, it is critical to conduct research to identify the sections of the manufacturing industry's supply chain that can be applied to the circular economy model, as well as the regulatory and governmental support required to implement it.

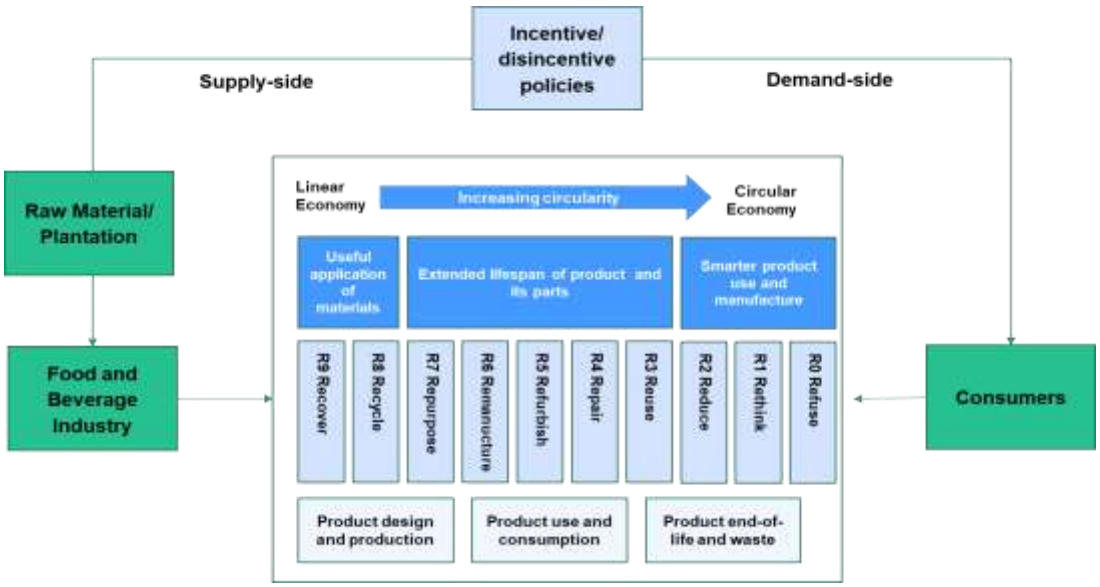
1.2. Research Objectives and Framework

The following are the research objectives of this research, as defined in the Term of Reference (TOR):

a. to identify the current Indonesia government's fiscal and non-fiscal stimulus to support a circular economy in the food and beverage industry in general and the palm oil industry in particular.
b. to analyze best practices from other countries (both developed and developing countries) on fiscal and non-fiscal stimulus to promote the circular economy in the food and beverage industry, including challenges and opportunities that would emerge if implemented in Indonesia.
c. to provide recommendations on necessary fiscal and non-fiscal stimulus, including enabling conditions, to support the circular economy in the food and beverage industry.

The framework of the incentive and disincentive policies for the circular economy implementation in the food and beverages manufacturing industry is described in Figure 1:

Figure 1. Framework of Incentives and Disincentives in Promoting Circular Economy



Source: Modified from Hartley et al (2020); Kirchherr & Piscicelli (2019)

1.3. Data and Methodology

Several methods are employed to achieve the objectives of this research as follows:

a. **Systematic literature review**. Using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol, the literature review focuses on the development of the circular economy in the food and beverage manufacturing industry, both theory and practices in various countries. The review process uses Google Scholar and Elsevier's Scopus as the main databases, limiting the publication data in the last ten years to capture the latest trend on the issue. The next step is screening for inclusion, assessing quality, extracting data, analyzing and synthesizing data, and reporting the findings. Moreover, a literature review also is deployed to analyze the framework of Indonesian government interventions as well as the other countries that support the model of the circular economy, such as the integration of CE on industrial policy roadmaps, regulations, and fiscal and non-fiscal incentives.

b. **In-depth Interview.** This research also deploys in-depth interviews with relevant F&B firms, especially in the palm oil industry-based F&B, business associations, government ministries/agencies, academics, and experts. The interview has explored the current development of CE in the F&B industry, the feasibility of implementing CE in the F&B Industry, as well as the appropriate government support. From October 19 to November 24, 2022, respondents who were interviewed are:

Ministries/institutions:

1. Ministry of Finance (Badan Kebijakan Fiskal/Fiscal Policy Agency)
2. BPDPKS (Badan Pengelola Dana Perkebunan Kelapa Sawit/ Palm Oil Fund Management Agency)

Food and Beverages Industry

3. Wilmar Group (Sania, Fortune)
4. PTPN III
5. PTPN V

Business Association

6. APKASINDO (Asosiasi Petani Kelapa Sawit Indonesia/ Indonesia Palm Oil Smallholders Association)

7. GAPKI (Gabungan Pengusaha Kelapa Sawit Indonesia/ Indonesian Palm Oil Association)

Academics and Experts

8. Prof. Dr.rer.nat. Martha Fani Cahyandito, S.E., M.Sc. (Professor at Universitas Padjadjaran)
9. Bandung City Main Waste Bank (Bank Sampah Induk Kota Bandung)

1.4. Literature Review

1.4.1. Circular Economy

The circular economy is an economic model that employs a systems approach in production and consumption activities, minimizing resource use and waste generation while maintaining material usability and being regenerative. The 9R framework summarizes the circular economy principle of refusing (not producing new products because there are products that function similarly), rethinking (intensive use of products), reducing (material efficiency), reusing (re-use products that are fit for use), repair (repair damaged products), refurbish (restore products), remanufacture (use some parts of old products for new products with similar functions), recycle (material reprocessing), and recovery (burning materials to extract energy).[12]

A fundamental transformation is urgently needed in our most critical sectors, particularly the food and agriculture industries, where current practices across the value chain have resulted in systemic inefficiencies, losses, and waste. Using a circular approach in the food sector, from agricultural production, processing, and manufacturing facilities, to transportation and distribution, retail outlets, and household consumption can have positive economic, social, and environmental consequences.[13]

The government of Indonesia is currently focusing on implementing circular practices in priority sectors, including the food and beverage industry. This is significant given that the food sector is one of the engines of the economy, accounting for 9.3 percent of GDP and 10% of the labor force. However, "Reduce" and "Recycle" offer the most opportunities in the food and beverage industry. As a result, four opportunities are prioritized: (1) reducing food waste after harvest; (2) reducing

[12] Denia I. Permata et al., "The Future is Circular: Langkah nyata inisiatif ekonomi sirkular di indonesia." https://lcdi-indonesia.id/wp-content/uploads/2022/08/The-Future-is-Circular.pdf
[13] Open Learning Campus of World Bank. "Circular Economy and Food." https://olc.worldbank.org/content/circular-economy-and-food

wastage and waste in the food supply chain; (3) reducing food waste and waste in the manufacturing process.[14]

In general, the existence of a circular economy may benefit both producers and consumers. For example, with the Product as a Service business model, consumers would be able to acquire high-quality items at affordable rates by reusing the products generated. As is well known, high-quality devices or technologies will consume comparatively little electrical energy. This will be a significant benefit for low-income users, as the cost of power will be lower. Aside from that, on the producer side, applying the circular economy to the things they make will be one of the guarantees that the firm would last longer.[15]

The Food and Beverage Industry outperforms other industry groups such as the Chemical, Pharmaceutical, and Traditional Medicine Industries, Metal Goods Industry, Computers, Electronic Goods, Optical and Electrical Equipment, and Transportation Equipment Industry in terms of GDP contribution. For example, in 2021, the Food and Beverage Industry contribution to total Indonesia GDP nominal value was Rp 1.121 trillion or 34 percent of manufacturing industry output.[16]

1.4.2. Palm Oil Economy

The agricultural sector has a vital role in economic activity in Indonesia, contributing 13,3% of the Gross Domestic Product (GDP) in 2021, the second largest to the manufacturing sector's 19.25%. The plantation subsector is the most significant contributor to the Agriculture, Forestry, and Fisheries sector, providing 3.9% of the total GDP, or 30% of the sector.[17] Furthermore, the palm oil plantation is the largest area of the smallholder plantations, including annual crops, reaching 17.5 million acres in 2020. Palm oil contributes 6.1 million hectares or 35% of total plantations, followed by 3.4 million hectares or 19% of rubber and rubber plantations, coconut 3.3 million hectares (19%), and cocoa 1.5 million hectares (8%).[18] In 2018, the Head of Bappenas reported

[14] Medrilzam et al., Manfaat Ekonomi, Sosial, dan Lingkungan dari Ekonomi Sirkular di Indonesia (January, 2021). https://lcdi-indonesia.id/wp-content/uploads/2021/09/The-Economic-Bahasa_.pdf
[15] Janis Brizga and Saïd El Khadraoui, *The Circular Economy and Green Jobs* (London: London Publishing Partnership, 2022).
[16] Badan Pusat Statistik, Quarterly Gross Domestic Product Of Indonesia 2018-2022.
[17] Badan Pusat Statistik, Quarterly Gross Domestic
[18] Badan Pusat Statistik, Luas Areal Tanaman Perkebunan Rakyat Menurut Jenis Tanaman (Ribu Hektar), 2019-2021. https://www.bps.go.id/indicator/54/770/1/luas-areal-tanaman-perkebunan-rakyat-menurut-jenis-tanaman.html

that the palm oil industry employed a total of 16.2 million people, including 4.2 million direct workers and 12 million indirect workers.[19]

The estimated area of oil palm plantations in Indonesia in 2021 is 16.8 million hectares, including 6 million hectares of smallholder plantations (41,2%), 0.55 million hectares of large state plantations (3,8%), and 8 million hectares (55%) of large private plantations. The majority of palm oil plantations are located in Riau Province (2,9 million hectares), Central Kalimantan (1,82 million hectares), West Kalimantan (2,02 million hectares), East Kalimantan (1,31 million hectares), and North Sumatra (1,25 million hectares) respectively. In 2021, Indonesia produced 45.1 million tons of palm oil, of which 25.6 million tons were exported, with a total value of US$26.7 billion while the remainder was consumed locally as food, biodiesel, or oleochemicals. This represents an increase from 2020, when Indonesia produced 25.9 million tons with a value of US$17.3 billion).[20]

Following the growth in domestic palm oil processing, the contribution of this commodity to the food and beverage industry, the most significant contributor to the manufacturing sector, continues to rise. According to the Ministry of Industry, the export share of palm oil derivatives expanded dramatically over the past decade, from 20% in 2010 to 80% in 2020. Domestic industries can currently produce 168 different types of downstream CPO products. FAME stands for food, phytopharmaceuticals/nutrition, chemicals/oleochemicals, and biodiesel. In contrast, there were just 54 varieties of downstream CPO products in 2011. The palm oil processing industry is one of the key contributors to the national economy, as its contribution to non-oil and gas exports in 2021 reaches 17.6% of the total.

[21]Moreover, the palm oil Industry, which is part of the food and beverage Industry, has a significant contribution to other sectors. Palm agribusiness has a backward linkage of 1.1-2.0, a forward linkage of 1.5-2.7, an output multiplier of 5.9-7.0, a value-added multiplier of 3.8-4.9, and a workforce multiplier of 4.8 to 7.1, indicating that it has a broad impact.[22] Furthermore, with 10% of the total global land bank for vegetable oil, Indonesia has the potential to become the largest palm oil-producing country, controlling 55% of the global palm oil or vegetable oil market share.

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[19] BPDPKS, Industri Kelapa Sawit Indonesia Serap 16,2 Juta Pekerja. https://www.bpdp.or.id/Industri-Kelapa-Sawit-Indonesia-Serap-16-2-Juta-Pekerja

[20] Badan Pusat Statistik, Statistik Kelapa Sawit Indonesia, 2021.

[21] Kemenperin: Industri Pengolahan Sawit Berorientasi Ekspor dan Padat Karya (March 10, 2022). https://kemenperin.go.id/artikel/23158/Kemenperin:-Industri-Pengolahan-Sawit-Berorientasi-Ekspor-dan-Padat-Karya

[22] Tungkot Sipayung, “Industri Sawit Kalimantan Timur: Restorasi Degraded Area Menjadi Area Menjadi Pusat-pusat Pertumbuhan Berkelanjutan” (Presented at the Palm Oil O'Corner Balikpapan University Webinar on June 26, 2021). https://palmoilina.asia/wp-content/uploads/2021/06/1.-Dr.-Tungkot-Sipayung-Direktur-Eksekutif-PASPI.pdf

It is also capable of producing 40% of the world's total vegetable oil, which is critical in terms of global food security.

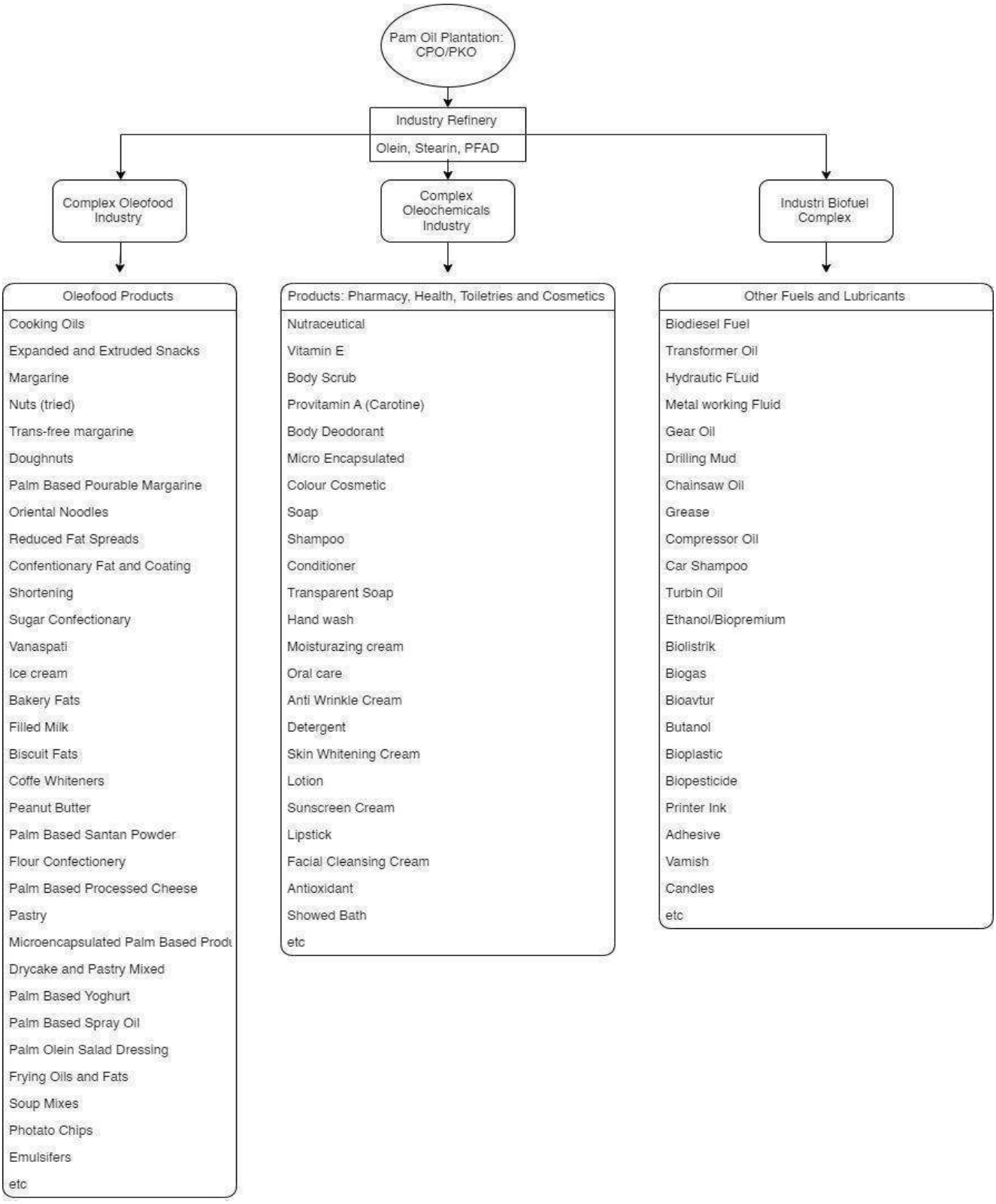
In general, the downstream of palm oil in Indonesia can be categorized into three groups: the oleofood complex, the oleochemical complex, and the biofuel complex. The downstream oleofood complex consists of industries that transform refinery industry products into intermediate oleo food products, which are ultimately transformed into oleo food finished goods. Indonesia has produced palm cooking oil, margarine, vitamin A, vitamin E, shortening, ice cream, creamer, cocoa butter/specialty fat, and other downstream oleo food items.[23] In addition, oleochemicals are a popular ingredient in medicinal, toiletry, and cosmetic products, such as soap, shampoo, hand wash, detergent, lotion, and lipstick. Biofuel products are currently combined with fossil fuels at concentrations of up to 30 percent. Figure 2 depicts the palm oil derivatives sector in Indonesia.

In light of the information presented, the palm oil industry constitutes a prime sector for the pilot implementation of circular economy principles in Indonesia. Moreover, according to Hidayat, this industry holds advantages over other sectors, based on economic criteria (annual growth rate and employment absorption), social criteria (potential to reduce poverty and improve education and awareness about environmental issues), circularity (energy recycling rate, industrial water recycling rate, and substitution of raw material sources with recycled materials), and energy systems (potential to reduce consumption and increase the use of renewable energy sources).[24]

[23] Kementerian Perindustrian. Tantangan dan Prospek Hilirisasi Sawit Nasional: Analisis Pembangunan Industri (edisi VI, 2021). https://kemenperin.go.id/download/28310

[24] Yosi Hidayat, “Green Economic and Inclusive Recovery through Circular Economy in Food & Beverage Sectors” (Powerpoint presentation, Kirei, Bappenas, UNDP, 20 May, 2022).

Figure 2. Palm Oil Derivative Industry



Source: PASPI, 2017

CHAPTER II: REGULATION AND IMPLEMENTATION OF CIRCULAR ECONOMY IN INDONESIA AND OTHER COUNTRIES

Various manufacturing industries, notably the food and beverage industry, have adopted the circular economy principles in their own supply chains. In order to promote the implementation of a circular economy, governments in a number of countries have enacted legislations that include incentives and disincentives for people and enterprises. The following are the existing rules of the circular economy in Indonesia and the examples of the implementation and relevant government regulations in South Korea, Australia, Iceland, and China. The selection of four foreign nations as best practice examples was based on their superior performance in the Green Future Index, the comprehensive nature of their Circular Economy (CE) strategies at the national level, and the presence of regulations and implementation of CE, particularly within the food and beverage sector.

2.1. Indonesia

The Indonesian government has adopted several regulations to support a more sustained development that balances economic, social, and environmental aspects (Table 1). Law No. 7/2021, for instance, has imposed a tax on carbon-to-carbon emission producers though its rate is relatively low compared to developed countries' tariffs. Furthermore, as stated in the 2020-2024 National Medium-Term Development Plan (RPJMN), the development of the palm oil industry in Indonesia will highly consider social, economic, and environmental factors. At the upstreaming level, for instance, Presidential Regulation No. 44/2020 has adopted Sustainable Oil Palm Plantation Certification System, which considers high labor absorption issues as well as assurance for social, economic, and environmental aspects.

Table 1. Circular Economy Regulation in the Indonesian Manufacturing Industry

No	Regulation	Description	Note
1	Law (UU) No. 7/2021 on Tax Regulation Harmonization	The rules, among other things, regulate carbon tax imposition on carbon emissions that harm the environment by a rate of Rp30/kg CO2 (this tariff is relatively very low compared to developed countries, such as the European Union which reaches US$50 [ETS]).	The regulation becomes a disincentive for industries that produce carbon emissions and indirectly pushes the Circular Economy concept.
2	Law (UU) No. 18 of 2008 on Waste Management	The rules, among others, explain the provision of incentives by the government to everyone who makes waste reduction; and disincentives to everyone who does not make the waste reduction.	The Ministry of Finance plans to provide fiscal incentives for waste management. However, according to the Indonesian Plastic Recycling Association (Asosiasi Daur Ulang Plastik Indonesia/ADUPI), they have not received tax incentives since the rule's promulgation.
3	Presidential Regulation No.98/2021 on the implementation of the Carbon Pricing (NEK)	This rule, among others, contains appreciation and awards to businesses and/or activities that reduce GHG emissions beyond their obligations through their efforts.	Government plans to provide incentives for industries that implement sustainability principles.
4	Ministry of Industry Regulation Number 47/2020 on Green Industry Standard for Mineral Water Industry	The regulation, among others, regulates Bottled drinking water (Air Minum Dalam Kemasan) suppliers to use plastic recycled at least one percent on the packaging and to have Wastewater Treatment Plant (WWTP) or WWTP managed by third parties licensed.	According to the government, the provision has been through discussion and approval of industry players.

No	Regulation	Description	Note
5	Ministry of Environment and Forestry Regulation Number 75/2019 on Roadmap of Waste Reduction by Producer	This rule, among others, obligates the manufacturing industry to use recyclable packaging and limit the size of food and beverage products. For example, carton packaging for liquid products must be at least 250 milliliters; and/or powdered products are made with a minimum weight of 200 grams.	Stages of waste reduction, according to the planning documents, will be run in 2023.

Source: CORE Indonesia

However, the Indonesian government needs more comprehensive regulations as well as incentives to encourage the manufacturing industry in Indonesia to implement a circular economy model. Our findings show that circular economy regulations in Indonesia are limited, with the majority focusing on emissions reduction. Some of them are still in the planning stage, therefore, their effectiveness is yet to be identified. For example, despite the fact that the regulation was promulgated in 2021, the carbon tax has yet to be implemented in Indonesia. As a result, the debate over the carbon tax rate's impact on carbon emission reduction as well as on the economy cannot be assessed. Furthermore, some of the provisions were not specific and clear. In the Roadmap for Waste Reduction by Producers, for example, it is stated that Ministers, Governors, Regents/Mayors can provide incentives or disincentives to producers. In other words, because the government is under no obligation to provide incentives or disincentives, the nature of the rules, whether mandatory or not for producers, is perplexing. Thus, the Indonesian government could adopt several regulations in developed and developing countries that have effectively encouraged circular economy implementations (Table 2).

Table 2. Example of Circular Economy Regulation in Other Countries' Manufacturing Industries

No	Incentive/ Disincentive	Description	Country
1	Deductions of Value Added Tax (VAT)	This incentive applies to environmentally friendly products, such as those with a longer lifespan and recyclable.	In Sweden, VAT rates for repair and reuse products, such as textiles, shoes, leather, and bikes, were lowered from 25 to 12%.
2	Income Tax Deductions and Tax Allowance	Incentives are for companies that carry out environmental management activities, particularly waste recycling such as toxic and non-toxic; chemicals and reclaimed rubber.	In Malaysia, companies that run the mentioned activities are considered to get income tax exemption by 70% (Pioneer Status) or Allowance Investment Tax by 60% of capital expenditures within five years.
3	Restriction on plastic packaging use (EU Single Use Plastic Directive)	This rule contains, among other things: ● Ban single-use plastics on cotton buds, cutlery, dishes, straws, stirrers, sticks for balloons, glassware, food and beverage containers made from polystyrene, and oxo-degradable plastic; however, natural polymers are excluded. ● The lid must remain attached to the plastic drink container; ● Beverage bottles must contain at least 25% recycled plastic from year onwards 2025, and at least 30% of plastic will be recycled from 2030.	European Union

No	Incentive/ Disincentive	Description	Country
4	Waste Tax	● Land Fill Tax: This policy makes the circular economy increase competitively. ● Pay as you throw (PAYT): pricing the volume of garbage disposed of. Users are charged a rate based on the garbage amount collected by municipal or local governments.	Applied in European Union countries, particularly in the western part. The tariff is MSW 28: 60 to 100€/ton for landfill and 10 €/ton for combustion.
5	Subsidies for Renewable Energy Convention	The provision of renewable energy subsidies includes the industry. The share was up 8% from 2015-2019. More than 92% of total renewable subsidies in the EU (€72 billion in 2019) occurred in the energy sector, while the share of other sectors, such as industry and transportation, is only 4% and 1%, respectively.	European Union

Source: CORE Indonesia

Several nations have already implemented regulations aimed at promoting circular economies, and multiple studies have analyzed the impact of them. The private sector, in addition to the government, has demonstrated an inclination towards operating under a circular economic system. Despite not all of these initiatives were carried out due to regulations set by the government, it is evident that the entrepreneur and the private sector possess a demonstrated desire to aid in the establishment of a circular economy.

2.2. South Korea

Korea ranked 10th in the Green Future Index in 2022, an increase of 31 positions from 2021. The Green Future Index is based on components such as carbon emissions, energy transitions, the efforts of each country's stakeholders in realizing a green economy, state innovations in reducing emissions, the country's climate policies related to financial initiatives, the country's sustainable

agricultural policies, and the country's post-pandemic recovery steps toward a green economy (MIT Technology Review Insights, 2022).[25]

In terms of the circular economy, Korea has enacted the Framework Act on Resource Circulation (FARC) since 2018. This framework aims to transform a waste-producing production system into a more efficient material-use system with a sustainable system. This system is supported by innovation and technology, so that waste generated can be reused and recycled rather than being burned or disposed of in a landfill.

FARC implementation in the community begins with defining the regulations that will be legislated. The Recyclable Resource Recognition Program (RRRP) is used to clarify the regulation. This program will exclude waste with a low environmental impact. Furthermore, the regulations about recycling facilities will be loosened. Companies involved in recycling collection, transportation, distribution, and everything else will not be bound by overly strict policies. It is speculated that this support will improve the performance and level of participation of companies in the trade of recycled goods. However, if the circularly verified companies fail to meet the established standards, the government has the authority to revoke the company's rights and no further policy waivers will be granted.

In addition to policy relaxation, training is facilitated in the recycling industry by opening an information center on recyclable resources and providing financial and technological assistance. The capacity of resource recycling management will continue to improve in order to achieve the previously set goals based on technological capabilities and the type of operated business. Fines for discarded waste are also regulated by the FARC supposed to reduce waste burning (Korea Environment Institute, 2016).[26]

The Framework Act on Resource Circulation is divided into six chapters and 36 articles. Article 16 explains Resources Circulation Performance Management and Support for Business Entities. The Ministry of Environment establishes targets for companies or related subjects based on their previous accomplishments, business scale, the level of technology use, and the level of competition in the international market. After obtaining these targets, business owners must develop and report on their plans to meet the goals that have been established. If there are

[25] MIT Technology Review Insights, "*The Green Future Index 2022."* MIT Technology Review Insights (2022).
[26] Korea Environment Institute. "Introduction of the Framework Act on Resource Circulation toward Establishing a Resource-Circulating Society in Korea." *Republic of Korea: Ministry of Environment*. Vol. XIV. No. 42. Ministry of Environment, 2016.

obstacles to meeting targets, such as damage to facilities supporting circular economy activities, companies can submit a request to the Ministry of Environment to reset the target they want to achieve.

If the companies meet a resource circulation target that is greater than the predetermined target in one year, the excess can be calculated for the following year. The government may also grant preferential treatment in administrative, technical, and financial matters to companies that outperform their circulation targets. If the predetermined target is not met, the shortfall will be calculated in the following year as well. Companies that fail to submit the required data or are unable to show compliance with the plans in place will face sanctions such as the publication of their names. Article 17 also states that the government has always notified the material standards for materials that can be used in circular production.

Article 21 FARC, it is explained in more detail about the Waste Disposal Fee. This article states that the government has the right to apply for a fine for the disposal of waste that should be recycled. The amount of the fee charged takes into account the circularity of the waste that has been burned by multiplying the amount of waste disposed of by the calculation index that has been determined in the Presidential Decree. Business actors who are late in paying the fine will get a warning from the government and get a 30-day time dispensation, but the business actor is also charged an additional fee of 3% of the waste fine that has not been paid. The imposition of this waste fine is excluded for business actors who bury their waste for a certain time with the aim of recycling the waste in the future, business actors who recover waste into energy or waste-to-energy, and small or medium-sized businesses.

The Waste Disposal Fee is discussed in greater detail in FARC article 21. According to this article, the government has the authority to levy a fine for the improper disposal of recyclable waste. The amount of fees charged is calculated by multiplying the amount of waste disposed of with the government-set calculation index. Companies that are late in paying fines will receive a warning and a 30-day grace period, but they will also be charged an additional fee of 3% of the unpaid waste fine. This waste fine does not apply to companies that bury their waste for a period of time in order to recycle it later, companies that recover waste into energy or waste-to-energy, and small or medium-sized businesses.

Article 26 outlines the types of assistance that the government can provide. Financial assistance, technical assistance, or loans are provided to parties or projects that support the circular

economy. The projects intended are projects aimed at developing circular economy communities, projects useful for the development of circular economy research and technology, projects for the maintenance of circular economy industries, business projects utilizing recycled goods, projects and individuals who support waste collection such as waste paper and scrap metal collection, and other projects that support circular economy activities.

In addition to incentives, article 36 outlines the penalties for circular economy agents who violate the rules, such as those who fail to send valid data for calculating waste disposal fines or who falsify documents related to circular economy documents. The penalty imposed is a maximum fine of one million won (Korea Law Translation Center, 2019).[27]

According to Lee and Cha's research (2020)[28], even if Korea lacks natural resources, the existence of FARC rules governing reuse and recycling may ensure that the country's needs can be met. Jang et al. (2020)[29] highlighted in their study that the presence of an Extended Producer Accountability (EPR) regulation in FARC, which controls producer responsibility of 22.3% for the plastic packaging it manufactures, expands the range of things that may be recycled. The more stringent the FARC's measures are, the less plastic pollution there will be, potentially reducing up to 6.6 million tonnes of CO2 eq. According to Yi (2019)[30], it is quite probable for Korea to reduce the amount of final waste disposal by 1.3% in 2027 based on an expected calculation of the 5 variables that are the major emphasis of FARC.

A lot has been done in Korea to implement a circular economy in the food and beverage industry. Particularly in terms of packaging and consumption. In general, business actors or companies prefer to reduce their use of raw materials that are difficult to recycle (reduce). An example of this implementation can be found in the Korea Food Industry Association (2022) publication, with the following summary:

1. Daesang Corp. decreases the amount of plastic in its products by altering the main product's structure and the packaging product's thickness. Up to 8.2 tons less polypropylene and polyethylene can be reduced.

[27] Korea Law Translation Center. https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=51210&type=part&key=39.
[28] Lee, K., & Cha, J. “Towards Improved Circular Economy and Resource Security in South Korea.” *MDPI Sustainability* (2020): 1-14.
[29] Jang, Yong-Chul, et al. “Recycling and management practices of plastic packaging waste towards a circular economy in South Korea.” *Resources, Conservation & Recycling* (2020).
[30] Yi, S. “Evaluation and development of Korea’s national plan for resource circulation towards a circular economy.” *Energy & Environment* (2019): 1-18.

2. Dongsuh Foods Corp. altered the composition of its packaging materials. For example, using paper instead of plastic and using less packaging material.
3. The size of paper packages is decreased by Dongwon F&B, and no longer use clear plastic containers in packaging.
4. Lotte Chilsung introduced ICIS ECO, a beverage with no label on the bottle. By 0.8 grams per 2L bottle, plastic consumption can be decreased.
5. Korea Ginseng Corporation is changing packaging with materials that are easy to recycle. Such as using biodegradable water-activated tape, certified recycled paper, and uncoated paper.
6. Lotte Foods uses one label for five pieces of packaging, removing the Polypropylene label for simple recycling.
7. Ottogi Co. and Sempio Foods Company changed product labels, stopped using colorful packaging, started using thermal alkaline adhesives, and started using mono-materials. This is done to reduce the difficulty level of recycling.
8. CheilJedang Corp. reduces the weight of plastic, using bioplastic materials (using the latest technology), using biodegradable LA+PHA materials in tofu packaging.
9. Dr. Chung's Food uses Bio-PE and paper-based green packaging
10. Pulmuone Corp. uses a combination of inorganic and bioplastic polymers.
11. Hyundai Green Food changed the glass in their cafe from disposable cups to reusable glasses.
12. LOTTE Confectionery recycles cocoa husks into biomass.
13. Maeil Dairies recycles antiseptic packaging.
14. Namyang Dairy Products collaborates with turning collected straws and lids into recycled product material.

In addition to producers, consumers are also invited to participate in the implementation of this circular economy. As did the following companies: Binggrae holding a campaign 'Banana, Protect Our Planet' by providing a container to put empty bottles of their products, Coca Cola Korea Company holding a campaign and making merchandise from plastic waste which will also be given to consumers, hy Co held a 'Removed Label' campaign, Nongshim Co. encourages consumers to separate their transparent plastic bottles by providing garbage disposal boxes.

Several companies have received government Green Certificates for their contributions to the implementation of a circular economy. Among these companies are CheilJedang group for carrying out production processes using microbial bacteria so that the waste is easily decomposed, Hyundai Green Food for its role in reducing plastic waste, LOTTE Co for reducing ecotoxic substances, SeoulMilk cooperative for participation in the use of the Green Label.

Table 3. Summary of Circular Economy Implementation in South Korea

Regulations / Programs	Program Details	Best Practice Companies
Framework Act on Resource Circulation (FARC) ● Running Recyclable Resource Recognition Program (RRRP) ● Implementing Waste Disposal Fee ● Opening a information center on recyclable resources ● Providing financial and technological assistance ● Establishing targets for companies or related subjects based on some indicators ● Implementing of a reward and punishment system, based on the company's circular economy performance.	● Lee and Cha's research (2020): Country's needs of natural resources can be met by implementing FARC. ● Jang et al. (2020): (EPR) regulation in FARC can reduce up to 6.6 million tonnes of CO2 eq. ● Yi (2019): Implementing FARC can reduce the amount of final waste disposal by 1.3% in 2027	● Daesang Corp. ● Dongsuh Foods Corp. ● Dongwon F&B ● Lotte Chilsung. ● Korea Ginseng Corporation ● Lotte Foods ● Ottogi Co. and Sempio Foods Company ● CheilJedang Corp. ● Dr. Chung's Food ● Pulmuone Corp. ● Hyundai Green Food ● LOTTE Confectionery ● Maeil Dairies ● Namyang Dairy Products

Source: CORE Indonesia

2.3. Australia

Australia has planning documents regarding waste management in its states. These targets include a ban on the export of waste such as plastic, paper, glass, and tires, achieving a waste reduction of 10 percent per capita by 2030, the average resource recovery rate of all waste streams being 80% by 2030, government and industry increase the use of recycled resources, eliminate unnecessary use of plastic by 2025, and reduce the amount of organic waste that goes to landfill by 50% by 2030.[31]

Several programs have been developed to achieve the aforementioned objectives. Some of them have already been implemented or are in the process of being implemented, but several programs will be implemented within the next 1 to 5 years. Programs related to the circular economy have been implemented, such as using the Australian Recycling Investment Fund to support the manufacture of recycled products, providing funding to Cooperative Research Centers Projects to support innovative discoveries regarding the reduction and recycling of plastic waste, and establishing a Product Stewardship Investment Fund. The Product Stewardship Investment Fund can help new industries, particularly the battery and electronics industries, move forward to realize a circular industry scheme.

The Australian government's support for the circular economy is mentioned in Global Australia (2021).[32] The National Reconstruction Fund provides funds totaling 15 billion Australian dollars for investment in high-value industries, including new and developing industries engaged in recycling and clean energy. The Recycling Modernization Fund has allocated 250 million Australian dollars to encourage the domestic recycling industry to demand waste that has previously been exported. The National Product Stewardship Investment Fund provides funding assistance in the amount of 26 million Australian dollars to encourage industries to shift their business models toward recycling. The Australian Recycling Investment Fund invests in large-scale projects that use clean energy technology to recycle waste. The fund was worth 100 million Australian dollars. The Australian tax system also contributed by introducing the New Investment Engagement Service, which is a guide for new investors looking to invest in Australia.

[31] Australian Government. “National Waste Policy”. (2022) Retrieved from https://www.dcceew.gov.au/environment/protection/waste/publications/national-waste-policy-action-plan
[32] Global Australia. “Circular Economy”. (2021). Retrieved from https://www.globalaustralia.gov.au/industries/circular-economy

According to MRA (2021)[33], there are several advantages to be achieved by Charitable Recycling activities in 2020, following the implementation of Australia's National Waste Policy. It was discovered that around one ton of rubbish may be salvaged from landfills by this charitable operation. As a consequence, it has an environmental impact of 66% reduction in carbon emissions, 59% reduction in world emissions, and 57% reduction in water use. From an economic standpoint, recycling one ton of garbage results in $ 1,700 in revenue and an increase in employment to 5,300 jobs.

Several Australian businesses have implemented the circular economy at the plantation, mill, or consumption levels. The majority of circular economy principles are repurposed. Following are some examples of such implementations:[34]

1) Banana flour is made from almost-wasted green bananas by Natural Evolution Food. However, it took the business owner years to discover a method for peeling green bananas, which is very challenging.
2) There is a sugar refinery in Australia called Mackay Sugar. Sugar manufacturing creates two types of waste: bagasse, which can be converted into biofuel (a renewable energy source), and molasses, which can be used as cattle feed. This facility feeds the national electricity system with any excess electrical energy.
3) The most significant supply retailer in Australia, Woolworths Supermarkets, played a crucial role in helping the country cut food waste by 8% in 2019. The tasks they do are:
    a) Extra fresh food that is still safe to eat is donated to a charity.
    b) Excess food that cannot be eaten is given to animals as feed or composted.
    c) Work with a brewery to produce beer from leftover bread (called Loafer beer). The profits are also given to charities.
4) Woolworths Group (2022)[35] stated that the government invested in this company for 20 million dollars to support recycling facilities.
5) Yume is a mediator between suppliers and buyers based on e-commerce for excess food. Suppliers include Kellogg's, Mondelez, and Unilever, while buyers include Sodexo,

[33] MRA Consulting Group (MRA). “Measuring the Impact of the Charitable Reuse and Recycling Sector: A Comparative study of clothing donated to charitable enterprises.” *MRA Consulting Group* (2021).
[34] KPMG. “Fighting Food Waste Using the Circular Economy” *FIght Food Waste Cooperative Research Centre* (2020).
[35] Woolworths Group. “Woolworths Group and Pact plan new strategic partnership to boost recycled packaging”. (2022). Retrieved from Woolworths Group and Pact plan new strategic partnership to boost recycled packaging

Spotless, Accor, and retailers. The food is still fit for consumption but becomes a surplus because of the new product or being rejected because of the damaged packaging. In May 2019, the Australian federal government also provided A$1.6 million in funding for establishing a National Circular Economy Hub and Marketplace that supports B2B eBay (a meeting place for sellers and buyers of circular waste).

6) Tarac Technologies has dedicated itself to the Australian wine industry's circular economy. The wine has solid residue and liquid residue. The treated solid residue can become resaleable wine alcohol. At the same time, the treated liquid residue can irrigate the vineyard.

7) A business called Peats Soil specializes in handling organic waste. It collects organic trash from public areas and commercial buildings, including hotels, supermarkets, schools, and food manufacturing facilities. The organic waste is processed into compost and biofuels. Treating methane gas produced by decaying organic matter to make biogas. Processing residual dirty fats from food service establishments and supermarkets to make biodiesel.

8) Amcor (a global packaging company) carries out a labeling standardization program called How2Recycle, whose function is to communicate recycling instructions to the public in a clear, concise, and easy-to-understand manner.

Table 4. Summary of Circular Economy Implementation in Australia

Regulations / Programs	Program Details	Best Practice Companies
National Waste Policy ● Banning on the export of waste. ● Funding the manufacture of recycled products, research centers, and new industries particularly the battery and electronics industries to realize a circular industry scheme.	MRA (2021): Several advantages to be achieved by Charitable Recycling activities in 2020, following the implementation of Australia's National Waste Policy: ● 66% reduction in carbon emissions ● 59% reduction in global energy used ● 57% reduction in water use ● Recycling one ton of garbage results in $ 1,700 in revenue and an increase in employment to 5,300 jobs.	● Natural Evolution Food ● Mackay Sugar ● Woolworths Supermarkets ● Yume ● Tarac Technologies ● Peats Soil ● Amcor

Source: CORE Indonesia

2.4. Iceland

In the 1970s Iceland still allowed the practice of open burning of waste. However, the practice of burning waste has been prohibited since 1999. Meanwhile, there were four incinerators in Iceland at the beginning of 2012, and three of them have been decommissioned since the end of 2012. Iceland has begun to recycle and treat biological waste since the 1990s. This waste management behavior continues consistently from time to time.[36] Iceland's dedication is also reflected in its ranking as the top country in the Green Future Index for 2021 and 2022.

[36] Helgadóttir, Ásta Karen, et al. “Report on Policies, Measures and Projections: Projections of Greenhouse gas emissions in Iceland until 2040.” *Reykjavik: The Environment Agency of Iceland.* (2022).

Iceland has planned and implemented several policies and measures (PaMs) related to waste management. The goals and regulations include limiting the buildup of organic and biodegradable waste, imposing landfill taxes, minimizing food waste, constructing new compost and gas factories, implementing pay-as-you-throw systems, and extending manufacturer warranties. All stakeholders, including the government, NGOs, and companies, work to reduce food waste. The activities carried out include creating various educational materials related to waste management, procuring public events and school projects that can raise public awareness, lowering the price of food products that are nearing the expiration date, innovating side food processing from existing food products, holding learning sessions on how to use food products properly, and, of course, the existing of definite government policies regarding waste. The government also contributes financially to this effort by allocating 15 million ISK every year for education related to food waste management.

According to a study by Ögmundarson, et.al. (2022)[37], the implementation of a ban on landfilling organic waste has a significant impact on reducing greenhouse gas emissions. This study found that waste management through recycling reduces greenhouse gas emissions by 6,000,000 kg CO2 eq/FU, which is higher compared to other waste treatment methods. Furthermore, when waste processing is carried out in Iceland, which primarily utilizes renewable energy sources, it produces a smaller greenhouse effect as compared to processing waste in other countries where renewable energy sources are not yet widely adopted (200,000 kg CO2 eq/FU vs 750,000 kg CO2 eq/FU).

In addition to implementing several policies, there are also several initiatives carried out in order to reduce greenhouse gas emissions. Two of them are related to the circular economy, namely Together against waste which is an activity to reduce food, plastic, textile, electronics, construction, and paper waste and focus on improving education to reduce waste production. Other measures towards a Circular Economy in the form of funding from the Ministry of Environment, Energy, and Climate to build the infrastructure that is essential for a circular economy.

[37] Ögmundarson, Ólafur, Laura Sophie Kalweit, Venkateshwaran Venkatachalam, Rakel Kristjánsdóttir, Hans-Josef Endres, and Sebastian Spierling. "Plastic Packaging Waste Management in Iceland: Challenges and Opportunities from a Life Cycle Assessment Perspective." *Sustainability* 14, no. 24 (2022): 16837.

The Iceland Food Waste Report (2020)[38] details some circular economy applications that have been developed in Iceland as part of a commitment to practice circular economy through reduction and repurpose. In general, the circular economy initiative in Iceland is mostly used for charity and social purposes. Among these implementations are:

a. Icelandic supermarkets are working with suppliers to prolong the expiration date of frozen food, providing a 5-cent discount on items such as bread, milk, fruit, and eggs that are fresh and cold with only one day remaining on their expiration date. Furthermore, Icelandic shops are planning to eliminate plastic food labels by the end of 2023.
b. Iceland collaborates with The Bread and Butter Thing (TBBT), a facility for providing extra food to underserved populations. Iceland contributed 7.8 tonnes of extra food to Northern England communities in need through TBBT.
c. Bread that is not sold in the Welsh store is delivered to Tini Rebel Brewing to be utilized as a raw ingredient for Bread Board beer. A portion of the beer revenues is contributed to the environmental community.

Table 5. Summary of Circular Economy Implementation in Iceland

Regulations / Programs	Program Details	Best Practice Companies
Iceland's Policies and Measures (PaMs) ● Ban on landfilling of organic waste ● Landfill tax ● Reduction in food waste ● Gas and compost plant ● Pay-as-you throw system ● Extended manufacturer's warranty	Ögmundarson, et.al. (2022): The waste management through recycling reduces greenhouse gas emissions by 6,000,000 kg CO2 eq/FU, and it produces a smaller greenhouse effect as compared to processing waste in other countries where renewable energy sources are not yet widely adopted.	● Icelandic supermarkets ● The Bread and Butter Thing (TBBT) ● Tini Rebel Brewing

Source: CORE Indonesia

[38] Iceland Food Waste Report. (2022). Retrieved from https://about.iceland.co.uk/wp-content/uploads/2022/09/2021-2022-Iceland-Food-Waste.pdf

2.5. China

The circular economy is not a new concept in China as it has already been discussed since the early 1900s[39]. On official signs, the country works on CE remarks by State Council issuance about the proposed policy frame, basic principles, main objectives, key tasks, and policy measures to promote a CE in 2005. This development was then followed by the issuance of a CE implementation roadmap within the 11th Five-Year Plans starting from 2006, CE Promotion Law with a focus on 3R strategies (reduce, reuse, recycle) published in 2008 and is effective in 2009, the 13th Five Year Plan (2016-2020), the Circular Development Leading Action Plan released in 2016, the revised and updated of the Circular Economy Promotion Law in 2018, and the recent 14th Five Year Plan on circular economy (2021-2025) in 2021.[40]

In its 14th five-year national plan, China targets some circular economy outcomes, including the increase of resource productivity by 20 percent than in 2020, the reduction of energy consumption and water consumption per unity of GDP by 13.5 percent and 16 percent compared to 2020 levels, utilize crop stalks, bulk solid waste, and construction waste by 86 percent, 60 percent, and 60 percent accordingly, utilize 60 million tons of waste paper and 320 million tons of scrap steel, produce 20 million tons of recycled non-ferrous metals, increase output value of the resource recycling industry to RMB 5 trillion (US$773 billion), build resource recycling industry system and improve resource utilization efficiency, building recycling system for waste materials and foster a recycling-oriented society, deepening the development of the agricultural circular economy and establishing circular agricultural production.[41]

The work of CE policy in China is involving several ministries such as The National Development and Reform Commission (NDRC) as the leading agency that build basic CE regulations, the Ministry of Industry and Information Technology as a resource recovery and product development policy maker, The Ministry of Finance that set up a special fund for key projects, the Ministry of Environment and Ecology that develops relevant standards and overlooks the program on Eco-

[39] Daxueconsulting. The circular economy in China: Why should foreign brans know about it. (2022). Retrieved from https://daxueconsulting.com/circular-economy-china/.
[40] Bleischwitz, Raimund, Miying Yang, Beijia Huang, X. U. Xiaozhen, Jie Zhou, Will McDowall, Philip Andrews-Speed, Zhe Liu, and Geng Yong. "The circular economy in China: Achievements, challenges and potential implications for decarbonisation." Resources, Conservation and Recycling 183 (2022): 106350.
[41] Koty, Alexander C. “China’s Circular Economy: Understanding the New Five Year Plan.” (2021). Retrieved from https://www.china-briefing.com/news/chinas-circular-economy-understanding-the-new-five-year-plan/.

Industrial Parks (EIPs), and the Ministry of Education and the Ministry of Finance and the National Tourism Administration together with the NDRC to facilitate education on CE promotion.[42]

The implementation of CE in China is inseparable from CE indicators as targets to achieve, demonstration of pilot projects to assess some criteria of CE, and Eco-Industrial parks as further demonstrators and upscaling mechanisms of the project.[43] Besides these efforts, China has also applied some incentives and disincentive measures to promote CE implementation. In the manufacturing industry for example, in order to advance the vehicle remanufacturing industry China provides subsidies to enterprises that collect both entire end-of-vehicle and component parts for remanufacturing and offers a 10 percent discount to customers that buy remanufactured products. This discount then can be claimed directly by the retailers from the government. Moreover, the country gives official certification for approved remanufactured products to build consumers' confidence in product functionality and quality that is equal to or better than the new original one. The country also regulates specific parts of a vehicle that can be sold to qualified remanufacturing enterprises to prevent illegal remanufacturing activities. Besides that, China has also invested in remanufacturing specialist skills since 2003 to support technological advancement and standards, and pilot programs and industrial clusters to promote best practices and foster vehicle remanufacturing activity.[44]

Those remanufacture efforts are a part of the circular economy in the end-of-life of the product life cycle or waste. These incentive schemes resulted in the increase of scrapped vehicle's collection rate by around 5% in 2016. In addition, a pilot program has resulted in a growing number of remanufactured enterprises. In 2014 there were 20 pilot enterprises licensed to sell remanufactured products and by 2016 there were 76 pilot companies in operation. Moreover, these pilot programs then led to the establishment of dedicated industrial parks for remanufacturing, with a target of more than 100 industrial zones set by the State Council.[45]

In the food industry, the country regulates food waste through the Anti-food Waste Law of the People's Republic of China No. 78 of 2021[46] (ILO, n.d). This law bans binge-eating videos (the creator of the video will be fined up to 100,000 yuan), competitive eating, and excessive leftovers

[42] Bleischwitz, Raimund, Miying Yang, Beijia Huang, X. U. Xiaozhen, Jie Zhou, Will McDowall, Philip Andrews-Speed, Zhe Liu, and Geng Yong, 3-10.
[43] Bleischwitz, Raimund, Miying Yang, Beijia Huang, X. U. Xiaozhen, Jie Zhou, Will McDowall, Philip Andrews-Speed, Zhe Liu, and Geng Yong, 7-10.
[44] Ellen Macarthur Foundation. "Advancing vehicle remanufacturing in China: the role of policy." (2021). Retrieved https://ellenmacarthurfoundation.org/circular-examples/advancing-vehicle-remanufacturing-in-china-the-role-of-policy
[45] Ellen Macarthur Foundation, 3.
[46] ILO. (n.a.). Retrieved from https://ilo.org/dyn/natlex/natlex4.detail?p_isn=111284

of food (restaurants may charge an extra fee to any patron who leaves excessive quantities of uneaten food). Moreover, restaurants that put consumers to order an excessive amount of food and or those who consistently waste large quantities may be fined up to 10,000 yuan and up to 50,000 yuan[47],[48]. Implementation of this practice can be seen in the case of Handadi Seafood BBQ Buffet in Changsha, which prohibited the presence of a Chinese food live-streamer due to excessive consumption.[49] Chinese Public Policy on Food Waste has been regulated in China since 1949, but the legal approach of imposing sanctions was first started in 2021 as it was considered necessary to change embedded cultural practices of traditional Chinese dining habits and pop culture.[50]

[47] Sheldon, M. "China Passes Law to Prevent Food Waste, Increase Food Security." (2021) Retrieved from https://www.nycfoodpolicy.org/food-policy-snapshot-china-food-waste-law/.
[48] Xinhua. "Law against food waste comes into force." (2021). Retrieved from www.npc.gov.cn/englishnpc/c23934/202104/708ea845b07c406a856e5814a407f048.shtml
[49] BBC News. (2021, November 18). Retrieved from https://www.bbc.com/news/world-asia-china-59331975
[50] Feng, Y., Marek, C., and Tosun, J. (2022). Fighting Food Waste by Law: Making Sense of the Chinese Approach. Journal of Consumer Policy 45:457-479.

Table 6. Summary of Circular Economy Implementation in China

Regulations / Programs	Program Details	Best Practice Companies
- **Circular Economy Promotion Law in 2018** - **Five Year Plan on circular economy** - **Anti-food Waste Law of the People's Republic of China No. 78 of 2021:** ● Banning binge-eating videos, competitive eating, and excessive leftovers of food. ● Fining up the restaurants that put consumers to order an excessive amount of food and consistently waste large quantities - **Holding pilot projects in Industries** ● Providing subsidies to enterprises that collect both entire end-of-vehicle ● Offering 10 percent discount to customers that buy remanufactured products	● Increasing scrapped vehicle's collection rate by around 5% in 2016. ● The pilot program has resulted in a growing number of remanufactured enterprises.	● The Shanghai Lingan Industrial Park of Remanufacturing ● Handadi Seafood BBQ Buffet in Changsha

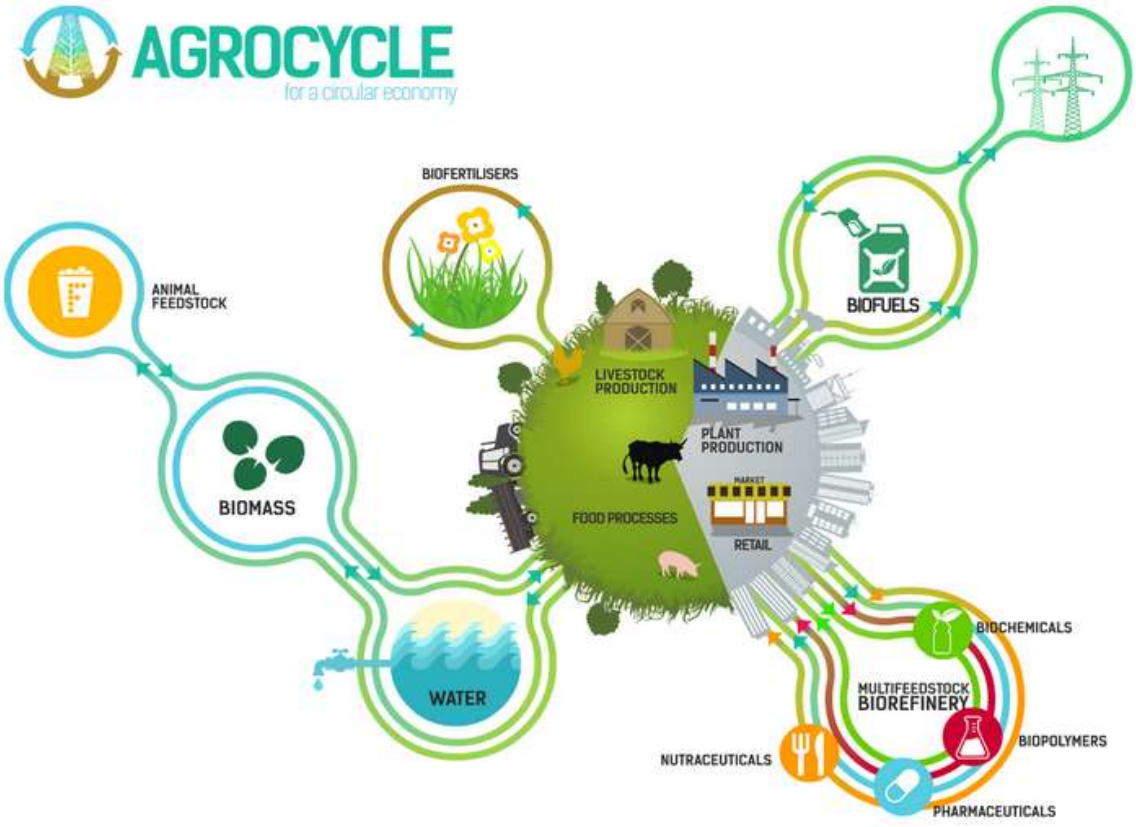
Source: CORE Indonesia

According to Velasco-Muñoz et al. (2021)[51], there is a lack of comprehensive regulations that specifically address the implementation of a circular economy in agriculture. The authors suggest

[51] Velasco-Mu˜noz, et al. "Circular economy implementation in the agricultural sector: Definition, strategies and indicators." *Resources, Conservation & Recycling* (2021): 105618.

that various indicators can serve as a benchmark for the implementation of a circular economy in this sector, as agriculture is inherently tied to natural resources and exhibits seasonality. Additionally, Dziedzic et al. (2022)[52] highlight sustainable water usage as a key factor in ensuring the sustainability of the agricultural sector. Specifically, the circular economy in agriculture can also be seen in Figure 1.

Figure 3. Agrocycle for a Circular Economy



Source: Cibe-Europe, 2014[53]

[52] Dziedzic, et al. "International circular economy strategies and their impacts on agricultural water use." *Cleaner Engineering and Technology* (2022): 100504.

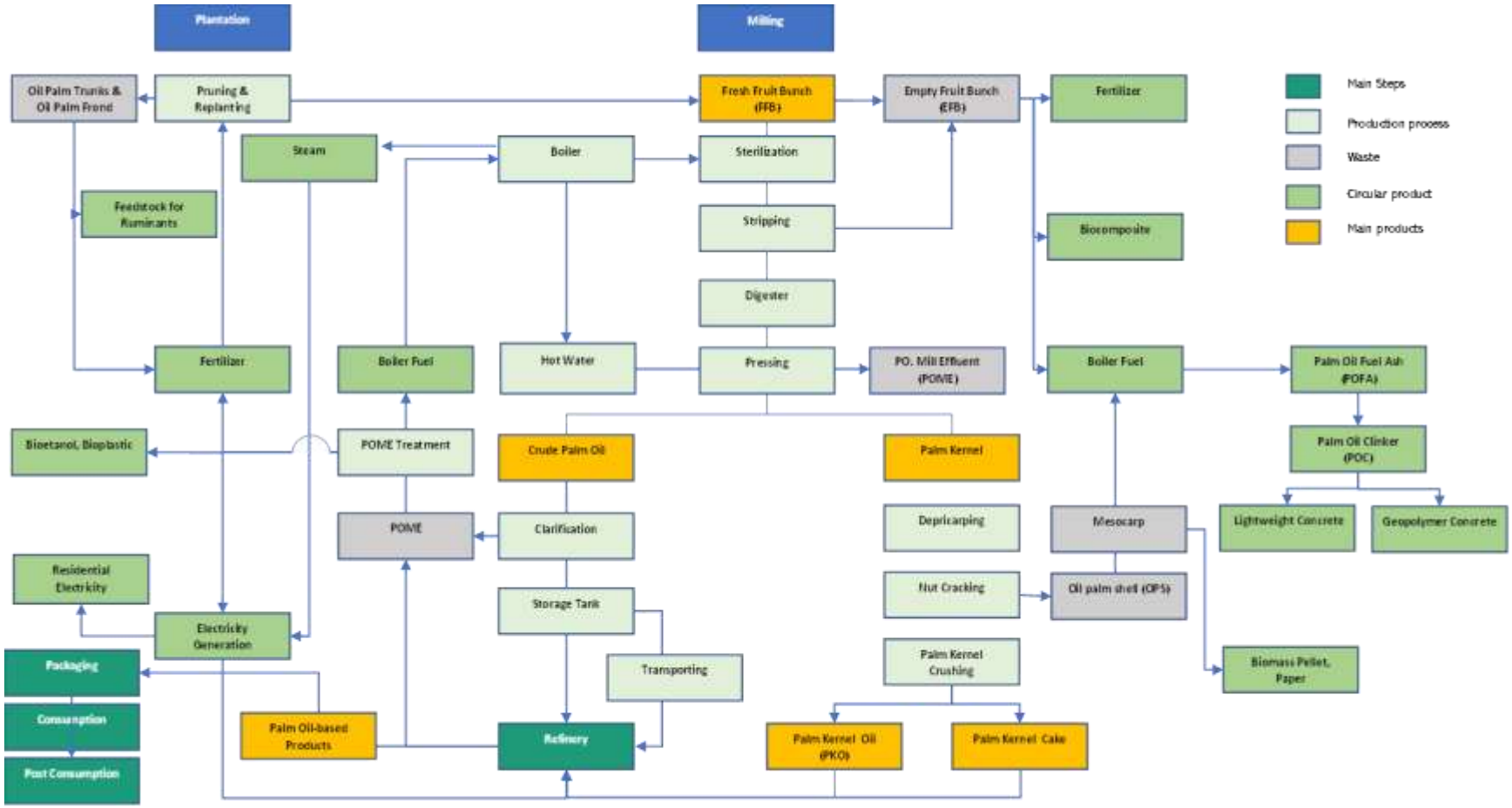
[53] International Confederation of European Beet Growers. https://www.cibe-europe.eu/agrocycle.

CHAPTER III: IMPLEMENTATION AND INCENTIVES FOR THE CIRCULAR ECONOMY IN THE PALM OIL INDUSTRY

The implementation of a circular economy in the palm oil industry through incentives will have a profound impact on other industries due to its far-reaching supply chain. In 2021, Indonesia was a major producer of palm oil, with an estimated 15.8 million hectares dedicated to its cultivation, including smallholder plantations (6.1 million hectares), state plantations (0.58 million hectares), and private plantations (15.1 million hectares). The palm oil industry is a crucial driver of the country's economy, with its contribution to non-oil and gas exports reaching 17.6% in 2021. Additionally, the industry has a significant influence on other sectors such as food and beverage and oleochemicals. Downstream products of palm oil include cooking oil, margarine, soap, shampoo, hand wash, and biofuel.

Several types of circular economy (CE) have primarily been applied in the palm oil industry's planting, milling, refining, and consumption supply chains. Nevertheless, based on the findings of literature reviews and interviews with business actors, academics, and regulators, their implementation has not been systematized because some implementation processes are hampered by obstacles such as a lack of information, technical difficulties, limited resources, and inadequate regulations. Following (Figure 3) are some examples of the implementation of a circular economy in the palm oil business, as well as its issues and alternative policies that might be enacted to support its implementation.

Figure 4. Implementation of Circular Economy in Palm Oil Industry



Source: Modified from Hamada et al., 2022; Mahlia et al., 2019; Walker et al., 2018; Ooi et al., 2017; ; Sukiran et al., 2017 Patthanaissaranukool et al., 2013; Subramaniam et.al., 2010; Shuit et al., 2009

Before elaborating on the policies that can stimulate the adoption of a circular economy in the palm oil-based food and beverage industry, a clear road map of CE with attainable goals and a list of those who should be involved is required. The road map will make it simpler for diverse parties to establish plans and coordinate in order to reach the predetermined goals. Indonesia requires a comprehensive plan for creating a circular economy. With the availability of the road map, it will be simpler for various stakeholders to formulate policies in accordance with their respective functions and responsibilities. In this particular scenario, the government is the key driver that is necessary to be able to stimulate the widespread implementation of the circular economy. Professor Martha Fani from the University of Padjadjaran stated that "*the government must be the leader in the implementation of a circular economy. There must be rules that force the implementation of a circular economy to reduce local regulations."*

Similar to that statement, Mr. Joko Tri Haryanto from the Fiscal Policy Agency (BKF) mentioned that the roadmap and target need to be built first. At the moment, Circular Economy discussion has not yet been expanded by Bappenas (National Development Planning Agencies) to other ministerial levels. Thus, there are still no circular economy regulations in BKF.

Although a detailed roadmap has yet to be available, the next sections identify the issues and policies expected in each production chain to implement the circular economy practice.

3.1. Plantation

3.1.1. Implementation of Circular Economy

The implementation of a circular economy at the palm oil plantation stage can be achieved through the execution of various strategies, including the improvement of plantation productivity through compliance with Indonesian Sustainable Palm Oil (ISPO) standards, which encompass a range of standards relevant to circular practices. The Indonesian government established ISPO in 2011 through Minister of Agriculture Regulation Number 19/Permentan/OT.140/3/2011, with the aim of promoting sustainable oil palm plantations. The regulations surrounding ISPO certification were later updated in 2015 through Minister of Agriculture Regulation No. 11, and further refined in 2020 through Presidential Regulation No. 44. According to Minister of Agriculture Regulation No. 38, The ISPO certification for Plantation Companies mandates adherence to a comprehensive set of principles, including compliance with legislative mandates, implementation of best practices in plantation management, conservation of the environment and

its natural resources, responsible employment practices, promotion of social and economic development within local communities, transparency in operations, and continuous sustainability improvement in business operations.

Following ISPO and RSPO, which are the part program of National Action Plan to reduce GHG emissions and the Reduction Emission from Deforestation and Forest Degradation (REDD+) program, palm oil plantations in Indonesia must implement greenhouse gas emission mitigation efforts, either in oil palm plantations and palm oil processing plants. These efforts include the reduction of land clearing in areas with high carbon content, such as primary forests and peatlands, using best practice methods to maintain soil and water conservation during opening new land or expanding existing land, promoting the use of empty fruit bunch for fertilization and reduction of non-organic fertilizer; reducing pesticide usage; installing methane capture facilities in palm oil mill effluents (POME); regulation of water level in peat areas; utilizing biomass produced in the palm oil sector, such as shells and fiber, for boiler fuel; and using fossil fuels and power efficiently.[54]

However, according to the Ministry of Agriculture, per March 31 2021, there are 755 plantations that have ISPO certification, of which 668 plantations are owned by private companies, 67 of them are owned by state-owned companies, and 20 of smallholder plantations. It covers 5.8 million hectares (ha) of 16.38 million hectares of oil palm plantations, which equals 35.4% of the total national oil palm plantations.[55]

The limited number of certificates is attributable to the comparatively high cost of the ISPO certifications, particularly for smallholder farmers. Besides the limitation of smallholders' budget, there are several technical hurdles that hinder the certification process, such as issues with smallholders' land legality. According to Pramudya et al., several issues related to smallholder palm oil land, including illegal plantations in forest areas, inconsistent ID numbers and land ownership documents, and issues with data synchronization with the Ministry of Agriculture's Directorate General of Estate Crops. Moreover, the funding from the central government for

[54] Suharto, Rosediana, et al. "Studi bersama persamaan dan perbedaan sistem sertifikasi ISPO dan RSPO." *Kementerian Pertanian Republik Indonesia dan Roundtable on Sustainable Palm Oil (RSPO). Jakarta* (2015).
[55] Berdaulat Melalui Sertifikasi Kelapa Sawit. https://www.indonesia.go.id/kategori/editorial/5573/berdaulat-melalui-sertifikasi-kelapa-sawit?lang=1#:~:text=Adapun%20luas%20total%20perkebunan%20kelapa,agar%20mengantungi%20ISPO%20per%202025.

certification is not sufficient for local governments to support the small farmers to process the ISPO certificate.[56]

Realizing the high cost of the ISPO certification process, the Indonesian government has explicitly supported its funding. According to article 53 of Minister of Agriculture Regulation No. 38 2020, smallholders may apply for ISPO certification fee assistance, which is funded by sources such as the APBN, APBD, and other sources as per relevant laws and regulations. This assistance may come in the form of training, assistance in meeting SOP criteria, or the initial ISPO certificate. However, despite the availability of funding for organizations such as Poktan, Gapoktan, cooperatives, and institutions, the availability of APBN funds remains a determining factor. Additionally, the Palm Oil Plantation Fund Management Agency (BPDPKS) has also established a program to finance smallholders' ISPO certification through infrastructure funding. However, the budget allocation for certifications, as per data from BPDPKS, remains circumscribed.

Additionally, obtaining the ISPO certificate is a difficult task. As noted by Mr. Mahmudi from PTPN III, the ISPO assembly experiences prolonged wait times as a result of its management by a limited number of individuals. Despite the increased production expenses associated with the certification process, there is currently no observable distinction in purchase prices between ISPO-certified and non-ISPO-certified farmers. Mr. Gulat Medali, chairman of APKASINDO, the Indonesian Oil Palm Farmers Association, stated:

> *"There is no financial incentive for farmers to adopt circular economy practices. As such, there is no difference in the purchase price of ISPO-certified and non-ISPO-certified farmers for ISPO only. ISPO increases the cost of production."*

Furthermore, farmers grow various crops in the same area, enriching the nutrients. As stated by Mr. Gulat Medali, the Chairman of APKASINDO, Indonesian Oil Palm Farmers Association who stated that:

> *"In addition to cultivating palm oil, smallholder farmers also intersperse their plantations with crops such as dog fruit, durian, stink bean, and similar plants. Unlike corporations that tend to adopt monoculture practices, smallholder farmers employ a polyculture approach".*

[56] Pramudya, Eusebius Pantja, et al. "Incentives for Palm Oil Smallholders in Mandatory Certification in Indonesia." *Land* 11.4 (2022): 576.

The circular economy in the palm oil plantation stage is also implemented by employing palm oil residues, such as Oil Palm Front (OPF) and Palm Oil Mill Effluent (POME) as fertilizer. OPF, for example, contains a high concentration of nutrients, which can improve nutrient recycling and soil conservation.[57] Furthermore, the palm oil industry generates several by-products that can be used as animal feed, including oil palm fronds (OPF), oil palm trunks (OPT), palm press fiber (PPF), empty fruit bunches (EFB), palm kernel cake (PKC), and palm oil mill effluent (POME). These co-products are obtained through the harvest of fruits, the extraction and refining of crude palm oil (CPO) or palm kernel oil (PKO). With biotechnological treatments, the inclusion levels of PKC in poultry feed can be increased to 30 percent, providing a cost-effective and sustainable solution for animal nutrition.[58] Furthermore, by employing chemical procedures such as sulfite, soda sulfite, and soda, OPF can be used as pulp, outperforming most hardwood pulps.[59]

3.1.2. Policy Incentives

Based on the information in the previous section, there are several policy incentives that the government can implement to encourage the implementation of the circular economy in the plantation stage. The government could increase financial support or subsidies to smallholder farmers that have legal land to make it easier for them to acquire ISPO certificates. The government could also simplify the certification process and provide training and resources to help farmers understand the benefits of ISPO certification and how to obtain it.

Similarly, to ISPO, Malaysia has also established MSPO (Malaysian Sustainable Palm Oil) certification for palm oil farmers, particularly after the European Union's decision to gradually phase out palm oil-derived biodiesel. In response, the Malaysian government has allocated RM100 million to assist smallholder plantation farmers in obtaining MSPO certification. This aid enables each oil palm smallholder to receive RM135 per hectare to cover the cost of certification, making it accessible and cost-free. In addition, the Malaysian government has provided tax relief to companies that invest in industries that use oil palm biomass, such as empty fruit bunches and logs from old palm trees, to create value-added products. The relief takes the form of tax exemptions, which vary based on the size and status of the company and can reach up to 100%

[57] Ooi, Zhong Xian, et al. "Oil palm frond as a sustainable and promising biomass source in Malaysia: A review." *Environmental Progress & Sustainable Energy* 36.6 (2017): 1864-1874.
[58] Zahari, M. Wan, A. R. Alimon, and H. K. Wong. "Utilization of oil palm co-products as feeds for livestock in Malaysia." Biofuel co-products as livestock feed (2012): 243.
[59] Yakari, Mohamad Izzuddin. Oil Palm Frond (OPF) as an Alternative Source of Pulp and Paper Production Materials. Diss. UMP, 2008; Wanrosli, W. D., et al. "Pulp from oil palm fronds by chemical processes." *Industrial crops and products* 25.1 (2007): 89-94.

of the statutory income.[60] Moreover, companies in Malaysia practicing sustainability in agriculture by turning agricultural waste into valuable products such as fertilizer, animal feed, and biogas are eligible for incentives like the Depreciation Accelerated Capital Allowance to purchase necessary machinery.[61]

Moreover, beside adopting relevant Malaysian government incentives above palm oil plantation, to further incentivize smallholder farmers to obtain ISPO certification, the Indonesia government could also reduce export taxes for companies that purchase ISO-certified products at premium prices. This would help to establish a price differential between ISPO-certified products and those that are not, which would help to offset the additional costs associated with ISPO certification. This approach would promote wider adoption of ISPO certification among smallholder farmers and help to improve the quality and safety of their agricultural products, while also making them more competitive in the global market. Based on this issue, PTPN V also recommended that "*the government should charge a premium price or encourage collaboration with other nations for plants that already have ISPO."*

The government should encourage businesses to adopt circular economy principles in their plantation operations by offering financial incentives. For example, the government could reduce corporate income tax or reduce export excise tax for companies that successfully implement a circular economy, such as using palm bunch ash and POME (palm oil mill effluent)-based fertilizers, in their plantations. It has been suggested by various researchers that the government can promote a decrease in the use of chemical fertilizers by implementing macro-control measures and relevant policies.[62] As an illustration, the national policies aimed at reducing the use of chemical fertilizers, such as subsidies, tax breaks, and substitution programs, have had a significant impact on farmers' willingness to adopt technology for substituting chemical fertilizers with organic fertilizers.[63]

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[60] Everchem. Government Aid, Incentives and Loans That Can Help Palm Oil Plantation Owners. https://everchem.com.my/government-aid-incentives-and-loans-that-can-help-palm-oil-plantation-owners/

[61] Ng, Wendy, et al. "A mini review of palm based fertiliser production in Malaysia." *Chemical Engineering Transactions* 61 (2017): 1585-1590.

[62] Wang, Yan, et al. "What could promote farmers to replace chemical fertilizers with organic fertilizers?." Journal of cleaner production 199 (2018): 882-890.

[63] Yang, Y. R., and X. F. Luo. "The influence of reduction and substitution policy on the adoption of organic fertilizer substitution technology model for farmers--an empirical analysis based on the survey data of tea growers in Hubei Province." Journal of Agrotechnical Economics 10 (2018): 77-85; Dong JP, Zhang YY, Sun SM. The evolutionary game analysis of the intensity of government environmental regulation and the clean production behavior of layer farms. Heilongjiang Agricultural Sciences 2019;07:140–4 (in Chinese) in Yang, Yurong, Zhaoliang Li, and Yan Zhang. "Incentives or restrictions: Policy choices in farmers' chemical fertilizer reduction and substitution behaviors." International Journal of Low-Carbon Technologies 16.2 (2021): 351-360.

Table 7. Circular Economy in Palm Oil Plantation Stage: Implementation, Obstacles, and Incentives

Implementation	Traits/Obstacles	Incentives	Enabling Conditions
• Higher productivity of oil palm plantations through compliance with ISPO instruments. • Using plant waste as fertilizer and land cover to prevent water shortages (APKASINDO). • Employing the Oil Palm Front (OPF) to improve nutrient recycling and soil conservation. OPF can also be used as bovine feed and processed as pulp.	• Cost and legality administration of ISPO is significant for small farmers. • The ISPO certificate process takes quite a long time as it is only managed by a few people (PTPN III). • No difference in purchase price between ISPO-certified and non-ISPO-certified farmers (APKASINDO).	• Provide sufficient subsidies for small and privately owned plantations which have clear legality of land to obtain and renew ISPO certificate. • Provide affordable financing schemes for ISPO certification such as through KUR (Business Credit for Micro and Small Enterprises) and UMi (Financing for Ultra Micro Enterprise). • Reduce export excise tax for companies that purchase ISPO-based products at higher prices in order to establish price differential between ISPO and non-ISPO-certified products. • Reduce corporate income tax and/or reduce export excise tax for companies using circular products, such as palm bunch ash and POME-based fertilizers in the plantation.	• Awareness of smallholder farmers regarding ISPO, its requirements, and the benefits derived from certification such as higher purchasing price for ISPO-product. • The legality of land ownership, particularly for smallholder farmers to obtain subsidies for ISPO certification. • The shared understanding of the circular economy urgency among relevant stakeholders, including the Ministry of Finance, the Financial Services Authority (OJK), and financial institutions, is necessary in order to provide various financial incentives. • Farmers understanding to utilize circular products such as palm bunch ash and POME-based fertilizers in the plantation. BPDPKS can play a role to increase farmer's knowledge.

Source: CORE Indonesia

3.2. Mill and Refinery

3.2.1. Implementation of Circular Economy

Empty Fruit Bunch (EFB), a type of palm oil biomass, has the potential to be used as compost in large quantities and is designed to improve the physical, biological, and chemical properties of the Ultisol subsoil.[64] EFB has the potential to be used as biofertilizers, which holds great promise for sustainable agriculture, especially in the face of climate change,[65] and utilized as a raw material in bioethanol production.[66] In addition, the composite materials produced from oil palm fibers and commercially available polymers exhibit properties comparable to those of conventional synthetic fiber composite materials.[67] In addition, Oil palm fiber (OPF) extracted from empty fruit bunches (EFB) has been demonstrated to be a valuable raw material for biocomposites.[68] Biocomposites are materials created by combining natural fiber with a non-biodegradable or biodegradable polymer derived from petroleum. Biocomposites derived from natural fiber and crop/bio-derived plastic (biopolymer/bioplastic) may be more environmentally friendly.[69]

Entrepreneurs in the palm oil industry have also used empty fruit bunches as organic fertilizer. Additionally, empty fruit bunches serve as a ground cover to retain moisture. The requirement for synthetic chemical fertilizers can be reduced by about 50% by using organic fertilizers made from oil palm tree waste. Therefore, it is beneficial to the business. As stated by Mr. Bandung from the Association of Indonesian Palm Oil Entrepreneurs (GAPKI) that " *the use of waste from oil palm trees is more efficient for businesses because it can reduce half of the chemical fertilizer needs we have to buy."*

PTPN III also explained that:

> *"POME accounts for 60% of waste in palm oil farms, with COD (Chemical Oxygen Demand) and BOD (Biological Oxygen Demand) concentrations ranging from 50 to 100*

[64] Windiastuti, E., Y. Bindar, and U. Hasanudin. "Identification of potential application of oil palm empty fruit bunches (EFB): a review." *IOP Conference Series: Earth and Environmental Science*. Vol. 1063. No. 1. IOP Publishing, 2022.
[65] Mahmud, Md Shawon, and Khim Phin Chong. "Formulation of biofertilizers from oil palm empty fruit bunches and plant growth-promoting microbes: A comprehensive and novel approach towards plant health." *Journal of King Saud University-Science* 33.8 (2021): 101647.
[66] Derman, Eryati, et al. "Oil palm empty fruit bunches as a promising feedstock for bioethanol production in Malaysia." *Renewable energy* 129 (2018): 285-298.
[67] Hassan, Azman, et al. "A review on oil palm empty fruit bunch fiber-reinforced polymer composite materials." *Polymer Composites* 31.12 (2010): 2079-2101.
[68] Shinoj, S., et al. "Oil palm fiber (OPF) and its composites: A review." *Industrial Crops and products* 33.1 (2011): 7-22.
[69] John and Thomas, 2008 in Shinoj et al., 2011

> *thousand ppm. This waste is processed aerobically and anaerobically, so COD and BOD concentrations are ranging from 2,000 to 3,000 ppm. This can result in liquid palm fertilizer, which makes palm oil trees more fruitful. It's only that the amount of liquid palm fertilizer is insufficient, necessitating the use of additional fertilizers such as NPK and urea."*

However, Mr. Pujuh Kurniawan from Wilmar stated that the reuse of waste is dependent on cost efficiency considerations. Once it does not meet cost efficiencies, the waste is rather given to the society around the plantation area. For example, when transportation costs exceed the sales revenue, producers better give the waste for the society to be utilized for their farm.

The use of EFB, mesocarp fiber (MF), and palm kernel shell (PKS) as fuel in mill boilers[70] is part of the circular economy application. The boiler dust produced by using those fuels, particularly MF and PKS, can be utilized as fertilizer for oil palm plantations (Shuit et al. 2009). Furthermore, the dust generated by MF and PKS has significant quantities of silica, calcium, potassium, and alumina, which can be utilized as pollutant absorbers.[71] Several studies have revealed that oil palm biomass (trunks, fronds, leaves, empty fruit bunches, shells, and so on) can be used as adsorbents to remove water pollutants such as acid and basic dyes, heavy metals, phenolic compounds, and different gaseous pollutants. Because it is the least expensive adsorbent compared to other materials, it is the most promising adsorbent for removing water pollutants.[72] However, according to Kahar et al., industries are still installing relatively low-efficiency boilers in mills to create steam for sterilization, drying, and power generation. As a result, the development of more efficient co-generation plants is highly encouraged in order to generate more energy while reducing emissions.[73]

Another potential circular economy implementation in the milling phase is the installation of POME as a source of electricity supply. In Malaysia, installing biogas capture in palm oil mills could reduce GHG emissions by 75% for every ton of crude palm oil produced. Furthermore, it has the potential to generate a 540 MW installed capacity or 37 million MMBtu of bio-compressed natural gas (Bio-CNG) or biomethane, which will contribute to the nation's energy mix for sustainable

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[70] Kahar, Prihardi, et al. "An integrated biorefinery strategy for the utilization of palm-oil wastes." *Bioresource Technology* 344 (2022): 126266.
[71] Mohamed et al., 2006 as quoted by Kahar, Prihardi, et al. "An integrated biorefinery strategy for the utilization of palm-oil wastes."
[72] Ahmad, Tanweer, et al. "Oil palm biomass–Based adsorbents for the removal of water pollutants—A review." *Journal of Environmental Science and Health, Part C* 29.3 (2011): 177-222.
[73] Kahar, Prihardi, et al. "An integrated biorefinery strategy for the utilization of palm-oil wastes." *Bioresource Technology* 344 (2022): 126266.

energy generation.[74] However, since its energy price competes with other fossil fuels that have a low cost, tariff incentives in the form of Feed-in Tariff (FiT) for POME could be adopted as a policy instrument to promote the integration of biomethane into the current gas grid.[75] As a result, it is essential to encourage palm oil mills in integrating technology for biogas energy and compost production as well as to synergize and reinforce private commitments and government support.[76] During the milling step, palm oil firms in Indonesia installed POME to provide energy. According to Mr. Bandung from Indonesian Palm Oil Association (IPOA):

> *"The company will lose money if it does not use POME to deliver electrical energy when the equipment is functioning."*

Several palm oil firms in Indonesia have used POME as an energy source. PTPN III, for instance, has 11 operational power plant units and one co-firing (fuel) unit under development. PTPN III utilizes this fuel to make PKO (Palm Kernel Oil) since it is less expensive than solar energy and PLN. PTPN and PLN have collaborated to sell PTPN's excess POME biogas to PLN. Wilmar Group is another enterprise that has embraced POME as a source of electricity. The Wilmar Group has even routed part of the extra electricity supply to nearby homes. Some factories of the two firms use electricity generated independently, while others still rely on electricity from PLN or coal and have not yet been electrified.

However, the installation of POME needs relatively high costs, such as the deployment of a qualified crew and extensive R&D, to achieve optimal environmental and economic outcomes. According to Mr, Pujuh Kurniawan, Head of the Sustainability Division at Wilmar International,

> *“Large mills have typically installed POME treatment since it can generate power and biofuel that can be sold and satisfy the requirements of a certificate that mandates their effluent be adequately treated. In contrast, several small to medium-sized milling enterprises prefer to disregard POME systems due to the significant investment costs involved and dispose of their waste improperly.”*

[74] Nasrin, Abu Bakar, et al. "A critical analysis on biogas production and utilisation potential from palm oil mill effluent." *Journal of Cleaner Production* (2022): 132040.
[75] Hoo, Poh Ying, Haslenda Hashim, and Wai Shin Ho. "Towards circular economy: Economic feasibility of waste to biomethane injection through proposed feed-in tariff." *Journal of cleaner production* 270 (2020): 122160.
[76] Yoshizaki, Tatsuya, et al. "Improved economic viability of integrated biogas energy and compost production for sustainable palm oil mill management." *Journal of Cleaner Production* 44 (2013): 1-7.

Large corporations such as Wilmar Group are able to embrace circular economy techniques because they have significant financial capital. It differs from industry and middle-class businesses, which have limited resources to convert to environmentally friendly technologies and maximize waste utilization. Mr. Kurniawan, argued that:

> *"The application of circular economy principles is hampered by the investment cost element. Not all businesses implement the absence of technology as a consideration. Implementing sustainable practices is challenging for small and medium-sized businesses. The technology hinges on its ability to be sustainable. Everything will become more sustainable once technology is mastered. For instance, medium-sized businesses find it challenging to apply for POME due to technological and financial obstacles. There needs to be a large investment in research and development, the company must have human resources who master it, and there is a clear market."*

Concerning the issue of energy sources for manufacturing machinery, the majority of PTPN do not use diesel fuel but have begun to utilize electricity. Whereas, according to PLN estimates, utilizing electric power equipment is more environmentally friendly than using diesel fuel. Unfortunately, PLN is only provided a low price for the sale of biogas energy sources, which is the same as the DMO (Domestic Market Obligation) of coal. As a result, the selling price of biogas energy is lower than the production cost.

Moreover, the government has yet to mandate the installation of the POME treatment, and enterprises have no incentive to construct it. Even the oversight of the disposal of milling waste has yet to be adequately enforced, and it is still frequently reported that some enterprises dump their trash directly into waterways, provoking outrage from locals. Therefore, if the producers acquire a solid understanding and support from the government, such as the assurance of purchasing the products resulting from waste treatment, they can be persuaded to implement this course of action due to its substantial economic worth.

3.2.2. Policy Incentives

Several incentives may be provided to assist the implementation of a circular economy at the milling and refinery process phases, which could be applied by other food and beverage firms. The government should encourage the use of circular economy practices through a business license issuance mechanism. The government can learn from the Malaysian government's attempts to reduce palm oil industry wastewater through a licensing system that consists primarily

of standard effluent and effluent costs. After being allowed for one year to develop treatment facilities, palm oil mills were required to reduce their wastewater discharges using biological oxygen demand (BOD) concentration as the key criterion (from 250,000 mg/L untreated effluents to 5,000 mg/L and then to 100 mg/L). In addition, the biological oxygen demand load surpassing a standard of 5000 mg/L after one year incurs higher effluent fees after passing the difficulties in the initial process[77] (for more Malaysia initiatives to develop palm oil-based biomass see box 1).

Box 1. The Incentives for Malaysia's biomass industry

The Malaysian government is promoting the use of biomass as a replacement for fossil fuels like coal, oil, and gas. Through the National Biomass Strategy 2020 program, it offers incentives to develop palm oil-based products, such as:

1. **Joint Venture (JV) clusters to help aggregation of biomass**: The creation of JV clusters will help alleviate the risk of vertical market failure between the owners of biomass and downstream users, such as biobased chemical refineries and pellet plants. The government, however, can facilitate the establishment of such partnerships and provide capabilities, expertise and advice where required by the biomass owners.

2. **Oil Palm Biomass Centre (OPBC)**: The creation of a consortium of upstream and downstream companies to accelerate the development of lignocellulosic conversion technologies benefits all companies in the industry. The ultimate objective of the OPBC, therefore, is to accelerate time-to-ommercialisation of the biobased chemicals opportunity. The OPBC focuses on developing technology, accelerating implementation and producing intellectual property for further commercialisation of technologies to convert lignocellulosic biomass into higher value-added uses such as bioethanol and biobased chemicals.

3. **Pelletisation Capacity Incentive**: The pelletisation capacity incentive (the Pellet Business Opportunity incentive under the palm oil NKEA) has already been put in place and provides 10-15 percent in capex incentives to the first 5 successful applicants for new pellet plants in Malaysia.

4. **Entry Point Project (EPP) 6 Developing Oleo Derivatives**: EPP 6 provides capex incentives of up to 40 percent to local investors for the establishment of a biobased chemical facility.

5. **BioNexus Status**: Companies that participate in "value-added biotechnology and/or life science activities" are eligible for tax breaks as well as funding application.

6. **Pioneer Status**: This is an incentive that is awarded by Malaysian Investment Development Activity (MIDA) to manufacturing businesses. Such companies receive 30 percent exemption from taxable statutory income for five years and 100 percent exemption if investments are made in promoted areas, i.e., the States of Sabah, Sarawak, Perlis and the designated "Eastern Corridor" of Peninsular Malaysia.

7. **Investment Tax Allowance**: This is awarded by MIDA to companies with high capex and R&D investments. Under this, companies are allowed to offset 60 percent of the qualifying capital expenditure they incur within five years against 70 percent of their statutory income.[78]

[77] Igwe, J. C., and C. C. Onyegbado. "A review of palm oil mill effluent (POME) water treatment." *Global Journal of Environmental Research* 1.2 (2007): 54-62.

[78] Agensi Inovasi Malaysia. National Biomass Strategy 2020: New wealth creation for Malaysia's biomass industry. https://www.cmtevents.com/MediaLibrary/BStgy2013RptAIM.pdf

In addition, because the investment to implement circular economy practices in the palm oil industry is still relatively expensive, the government can provide incentives to palm oil mill companies, especially to the small and medium-scale ones. In particular, the incentives can be directed to integrate the installation of POME treatment as feedstock for several circular products, such as biodiesel, biopolymers--biodegradable alternatives to petrochemical polymers and surfactants--and a distilled ethanol.[79] According to PTPN V, small farmers require government support and attention while establishing a policy.

> *"The implementation of an export tax by the government last year has had a detrimental effect on the community and small farmers who lack factory facilities, leading to an accumulation of Fresh Fruit Bunches that should have been sold. The government must pay close attention to this area in order to ensure that the circular economy can be effectively implemented at the community level."*

The government can establish and provide several fiscal and non-fiscal incentives to support the implementation of a circular economy at the firm level, i.e. providing financial incentives through import duty exemptions for imported components required for POME installation plans, tax allowances and tax holidays for new investment that integrated the plan in their factories, and establishing affordable financing schemes to encourage companies, particularly small and medium-sized enterprises. Technically, the government can also categorize the palm oil industry or industries implementing a circular economy as one of the prioritized business fields. Previously, through Presidential Regulation No. 10 of 2021 on Investment Business Fields, the government has provided special incentives for prioritized business fields that meet the criteria: national strategic programs/projects, capital-intensive, labor-intensive, high-tech, pioneer industries, export orientation, and/or orientation in research, development, and innovation activities. The investment in these prioritized business fields will be given fiscal and/or non-fiscal incentives, including income tax incentives for capital investment, tax holidays, and exemptions on import duties for machinery and materials for construction or development of industries for capital investment purposes. As for non-fiscal incentives, they include ease of business licensing, provision of supporting infrastructure, energy availability guarantees, raw material availability guarantees, immigration incentives, and employment incentives.

[79] Liew, Zhen Kang, et al. "Biogas production enhancement by co-digestion of empty fruit bunch (EFB) with palm oil mill effluent (POME): Performance and kinetic evaluation." *Renewable Energy* 179 (2021): 766-777.

Moreover, the government's investment in R&D for POME treatment and biodiesel production can drive the development of a circular economy in the palm oil industry. This approach not only addresses the environmental concerns associated with the palm oil industry but also incentivizes private sector involvement and attracts strategic financing partners. As a result, companies within the palm oil industry can adopt cost-effective technologies that support circular economy implementation, such as low-cost biodiesel production, which can also serve as an alternative energy source for internal operations, ultimately reducing dependence on fossil fuels.

Besides, in order to promote investment in palm oil-based biogas electricity and mitigate oversupply of large producers' biogas electricity, the government could provide a more competitive tariff for companies that sell their biogas-based electricity to the State Electricity Company (PLN). The government of Indonesia has made efforts to encourage investments in new and renewable energy sources through regulations such as Presidential Regulation Number 112 of 2022 on Accelerating the Development of Renewable Energy for Power Provision. This regulation established tariffs for various forms of renewable energy, including hydroelectric power plants, solar power plants, and biogas power plants. However, some industry stakeholders have reported that the tariffs established by the government are below the production cost, rendering them uncompetitive in the market.

Table 8. Circular Economy in Palm Oil Milling and Refinery Stage: Implementation, Obstacles, and Incentives

Implementation	Traits/Obstacles	Incentives	Enabling Conditions
• Empty Fruit Bunch (EFB) is potential to be used as compost and to improve Ultisol subsoil (Windiastuti, 2022). • EFB can also be utilized as raw material in bioethanol production (Derman et al., 2018) and raw material for biocomposites (Shinoj et al., 2011). • EFB have been used as organic fertilizer and serve as a ground cover to retain moisture. This practice can reduce the 50% requirement of synthetic chemical fertilizers (GAPKI). • POME can be processed as liquid palm fertilizer which makes palm oil trees more fruitful (PTPN III). • EFB, mesocarp fiber (MF, and palm kernel shell (PKS) can be used as fuel in mil boilers (Kahar et al., 2022). MF and PKS can be utilized as fertilizer (Shuit et al., 2009) and pollutant absorbers (Mohamed et al., 2006 as quoted by Kahar et al., 2022).	• Reuse of waste decisions depend on cost efficiency consideration (Wilmar Group). • The installation of POME requires a relatively high cost. Meanwhile, at domestic level, a clear market for the “green production” product still does not exist (Wilmar Group). • PLN purchases biogas energy sources at low level, which is the same as the DMO of coal, thus for company sides selling prices of biogas energy is lower than the production cost (PTPN III). • Inadequate supervision of milling waste regulation.	• Implement a business license issuance mechanism to effectively regulate and control wastewater discharges in the palm oil industry. • Provide financial incentives, such as import duty exemptions and tax allowances, to encourage companies to invest in POME treatment installations. • Establish affordable financing schemes, such as through KUR, to support small and medium enterprises in the palm oil industry to invest in POME treatment facilities. • Promote the utilization of biomass from POME by offering a competitive tariff to the state-owned power company, PLN, for the purchase of this renewable energy source. • Invest in research and development (R&D) to develop cost-effective solutions for POME treatment and biodiesel production	• The mutual recognition of the urgency of the circular economy among relevant stakeholders to promote a collaborative effort towards fostering circular economic practices. • The availability of business license technical guideline, including the boundaries for permitted waste production and the evaluation and monitoring system. • Existence guidelines regarding the constituent components of POME installations and system incentives given. • The establishment of regulations by the Financial Services Authority (OJK) to ensure that financial institutions provide accessible financing options for investments in the circular economy is necessary. Financial institutions, in turn, must develop business models to incorporate the mandate.

● POME can be installed as a source of electricity supply and several palm oil firms in Indonesia have been using it (GAPKI, PTPN III, and Wilmar Group).		in order to advance the development of a circular economy in the palm oil industry. ● Provide tax incentives, such as reduced VAT and corporate income tax, to companies in the palm oil industry that adopt repair and reuse practices in their production.	● The development of guidelines to classify and define repair and reuse practices in production.

Source: CORE Indonesia

3.3. Product Packaging

3.3.1. Implementation of Circular Economy

The application of circular economy can also be applied to palm oil-based food and beverage packaging. The form of packaging for these products can adopt a variety of present initiatives within the industry including the removal of unrecyclable plastics, packaging innovation, in-store retailer schemes, and label modifications.[80] However, the adoption of greater biodegradable packaging, is still under challenges since “the power of bioscience, using renewable biological resources to replace fossil resources in innovative products, processes and services have not yet been achieved”.[81] Therefore, the collaboration among industries as an essential enabler to promote its implementation should be supported by infrastructure to support the production of plastics in the CE and the technical implications of packaging.[82]

[80] Gong, Yu, et al. "Investigation into circular economy of plastics: The case of the UK fast moving consumer goods industry." *Journal of Cleaner Production* 244 (2020): 118941.
[81] Beltran, Macarena, et al. "Food plastic packaging transition towards circular bioeconomy: a systematic review of literature." *Sustainability* 13.7 (2021): 3896.
[82] Gong, Yu, et al. "Investigation into circular economy of plastics”

In a few Indonesian cities, a number of groups backed by local governments have created initiatives to recycle waste, including plastic. Unfortunately, the packaging used for cooking oil, for example, still contains plastic that cannot be processed or accepted at the recycling plant. In addition, the public requires additional information regarding the appropriate processing of waste cooking oil plastic. Due to a lack of processing, cooking oil plastics are typically discarded in landfills, which exacerbates the waste problem. As stated by Mrs. Yati, head of the Garbage Bank for the Bandung Municipal Government, stated that "*we do not purchase plastic garbage from used cooking oil because no one accepts it and there is no equipment to treat it. Therefore, we place the plastic in a landfill".*

Therefore, someone must acquire and recycle used cooking oil plastic waste in order to reduce the amount of waste in landfills. Companies utilizing plastic packaging should be compelled to manage non-recyclable waste. Alternatively, palm oil producers are obliged to use more eco-friendly packaging that can be recycled. Therefore, in order to support this strategy, the reward and punishment system must be modified to function as an incentive and disincentive for business actors. Professor Martha Fani from the University of Padjadjaran stated:

> *"There are currently no regulations for turning household waste into something else. Society as a whole has not yet been able to put the idea of a circular economy into practice due to a lack of understanding and motivation. A strong and persistent organization is needed to help the community move forward. Rules are necessary to gradually implement reward and punishment systems in society."*

3.3.2. Policy Incentives

Since linear items used in food and beverage packaging, including the palm oil products and their derivatives, tend to be less expensive due to their abundance, it is important to incentivize companies to implement circular economy principles in the packaging processes. Accordingly, the government may, for instance, offer financial incentives, such as reducing VAT and/or corporate income tax, for business that develop and utilize biodegradable packaging to businesses that develop and utilize circular economy-compliant packaging. This may include utilizing biodegradable packaging, reducing the size and thickness of plastic packaging, using biodegradable water-activated tape, utilizing certified recycled paper and uncoated paper, removing the polypropylene label for simple recycling, discontinuing the use of colorful packaging, and utilizing mono-materials to reduce the difficulty level of recycling.

On the other hand, the government can discourage corporations from using fossil fuel-based packaging by expanding the scope of plastic taxes. For example, they could extend the tax to cover not just plastic bags, but also packaging for various consumer goods. In 2019, the government drafted a regulation on excisable goods in the form of plastic bags, but it has not been implemented yet. According to the draft regulation, shopping bags made of plastic used to carry commercial goods are considered subject to excise duty.

Broadening the tax on plastic more than plastic bags has been implemented in the UK. Since 21 May 2021 UK government has obliged retailers of any size large, medium, small, micro, and airport retailers) in England to charge a minimum of 10 pence for single-use carrier bags that are (a) unused it's new and has not already been used for sold goods to be taken away or delivered, (b) plastic and 70 microns thick or less, (c) it has handles, an opening and is not sealed.[83] Furthermore, the UK government implemented the Plastic Packaging Tax on April 1, 2022, which imposed at a rate of £200 per tonne on plastic packaging that contains less than 30% recycled material and is made or imported into the country, including packaging on imported goods. The objective of the tax is to create a strong financial incentive for companies to utilize recycled plastic in their plastic packaging production, boosting demand for this material. This will lead to a rise in recycling and collection of plastic waste, reducing the amount sent to landfill or incineration. According to the UK Government, the tax will increase the usage of recycled plastic in packaging by around 40%, which equals carbon savings of nearly 200,000 tonnes in 2022 to 2023.[84]

[83] The Government of UK. *Carrier bag charges: retailers' responsibilities.* https://www.gov.uk/guidance/carrier-bag-charges-retailers-responsibilities. Accessed 8 February 2023.
[84] The Government of UK. *Policy paper: Introduction of Plastic Packaging Tax from April 2022.* https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax-from-april-2022/introduction-of-plastic-packaging-tax-2021. Accessed 8 February 2023.

Table 9. Circular Economy in the Palm Oil-Based Products Packaging Stage: Implementation, Obstacles, and Incentives

Implementation	Traits/Obstacles	Incentives	Enabling Condition
• Initiatives that can be adopted include the removal of unrecyclable plastics, packaging innovation, in-store retail schemes, and label modifications (Gong et al., 2020).	• The power of bioscience to replace fossil resources in innovative products, processes and services have not yet been achieved (Beltran, 2021). • Plastic packaging used for cooking oil is hard to recycle and ends up in landfills.	• Reduce VAT and/or corporate income tax for business that develop and utilize biodegradable packaging. • Broaden the scope of plastic excise tax, not only on plastic bags but also on plastic-based packaging for various consumer goods.	• The shared understanding about the urgency of the circular economy among relevant stakeholders, including consumer, to run the program. • The availability of guidelines to define biodegradable packaging and to outline the procedures for obtaining tax reductions.

Source: CORE Indonesia

3.4. Disposal

3.4.1. Implementation of Circular Economy

The use of waste cooking oil (WCO), including palm oil-based products, used as a sustainable feedstock for biofuel production is another implementation of a circular economy in the palm oil industry. WOC has significant potential for advanced transportation fuel production for the ground and aviation industries. Hence, it has become a solution to increase the value of biowastes through energy recovery while also overcoming the disposal issue. Therefore, advancements in fuel manufacturing technology and associated policies would accelerate the adoption of sustainable WCO biofuels.[85] Several countries have encouraged the recovery of WCO as biofuel feedstocks. In China, where WCO is estimated to exceed 5 million tonnes per year, the government has offered a variety of subsidies to recyclers in order to increase waste oil collection

[85] Goh, Brandon Han Hoe, et al. "Progress in utilisation of waste cooking oil for sustainable biodiesel and biojet fuel production." *Energy Conversion and Management* 223 (2020): 113296.

and management while preventing illegal WCO recycling. Furthermore, in Japan, where WCO production is estimated to be around 0.1 to 0.5 million tonnes per year, communities work with the government to collect WCO. The policy provides subsidies to biofuel companies, lowering their production costs and boosting their price competitiveness with illicit competitors, hence raising WCO recovery rates. In addition, the government imposes transaction tax reduction on consumers who prefer to fill their vehicles with 100% biofuel rather than fossil-based fuels.[86]

In the context of Indonesia, WCO has been utilized but still on a limited scale. One of the organizations that already manages WCO is Bandung City Main Waste Bank. This organization receives WCO from the society because buyers or off takers for that product are available, remembering the Waste Bank business model is "trading the waste" to reduce waste amount and extend its lifespan. The primary customer of WCO comes from AKAR (Asosiasi Kafe Restoran Jawa Barat/West Java Restaurant Cafe Association), for the export of biodiesel material to Eruope. In addition to AKAR, Bandung City Waste Bank also allows individual off stakers to purchase WCO. Although there is a significant risk of WCO being misused for consumption by certain parties, Waste Banks do not have strict procedures for choosing WCO buyers. Thus, when WCO management is implemented on a large scale in the future, the government is able to certify or issue a legal permit to specific organizations to prevent any potential abuse.

Besides aforementioned condition, Bandung City Main Waste Bank also have some challenge to increase the recycling rate due to:

1. Lack of capacity for waste-receiving units at the household level.
2. Lack of socialization, facilitation, and assistance related to waste banks in the community.
3. Insufficient volume of waste to be absorbed by advanced waste processing companies. This leads to landfill (open dumping).
4. Lack of waste vehicles, so it is not optimal to transport it.

3.4.2. Policy Incentives

The government could provide subsidies to biofuel companies that manufacture their products using recycled materials, such as waste cooking oil, to reduce their production costs and achieve competitive pricing with non-biofuel fuels. Providing subsidies to waste cooking oil (WCO)-based

[86] Zhang, Huiming, et al. "Subsidy modes, waste cooking oil and biofuel: Policy effectiveness and sustainable supply chains in China." *Energy Policy* 65 (2014): 270-274; Goh, Brandon Han Hoe, et al. "Progress in utilisation of waste cooking oil."

biofuel companies to lower their production costs and boost their price competitiveness with non-biofuel fuels to circular-based products is also important to encourage customers to shift to the product-based circular process from product-based linear and hence could stimulate more private sector to involve in this business. Moreover, the government could include WCO-based biofuel in the VAT-free list to stimulate demand for biofuels.

In addition, the government could also regulate the maximum amount of waste that food and beverage companies, including palm oil derivative companies, can dispose of in landfills. As a result, the government can impose fines on businesses that dispose of waste in excess of a predetermined quota by multiplying the amount disposed of by a government-established price. This method will encourage companies to reduce or treat their garbage, including recycling it for energy production. As an alternative, businesses that reduce or recycle their waste and comply with government regulations may be eligible for incentives such as tax income deduction.

The government has urged businesses to manage their waste in accordance with Law No. 18 of 2008 regarding Waste Management, which states in Article 1 that "producers are expected to manage packaging and/or products that cannot or are difficult to disintegrate by natural processes." However, because the regulation is optional, businesses tend to disregard it. Hence, with more specific and binding laws, it is envisaged that companies, particularly those in the food and beverage industry, as well as palm oil industries and their derivatives, will be enhanced to implement a circular economy for their waste.

Table 10. Circular Economy in the Palm Oil-Based Consumption and Disposal Stage: Implementation, Obstacles, and Incentives

Implementation	Traits/Obstacles	Incentives	Enabling Condition
• Use waste cooking oil (WCO) as a sustainable feedstock for biofuel production. • In Indonesia, the primary customer of WCO (West Java Restaurant Café Association/ AKAR) exports them as biodiesel material to Europe.	• WCO utilized in very limited scales due to: 1) lack of capacity for waste-receiving units at the household level 2) lack of socialization, facilitation, and assistance related to waste banks in the community 3) Insufficient volume of waste to be absorbed by advance waste processing companies 4) Lack of waste vehicles • No legal procedures about WCO management, thus it is risky to be misused for consumption.	• Provide subsidies to WCO-based biofuel companies to lower their production costs and boost their price competitiveness with non-biofuel fuels. • Include WCO-based biofuel in the VAT-free list to stimulate demand for biofuels. • Regulate maximum amount of waste that can be disposed of in landfills & gives incentives such as tax income deduction for businesses who comply with it.	• The shared understanding about the urgency of the circular economy among relevant stakeholders, including consumer, to run the program. • Awareness of WCO-based biofuel companies, both the existing and the new comers companies, regarding the availability of government subsidy programs. • Technical guidelines to define WCO-based biofuels product and to set permitted amount of waste. • Consumer awareness regarding the benefit of biofuels.

Source: CORE Indonesia

CHAPTER IV: CONCLUSION AND POLICY RECOMMENDATION

The food and beverage industry, particularly the palm oil business, has had a considerable impact on the Indonesian economy and, as a result, might be a leader in the implementation of a circular economy. This industry has considerably contributed to an expansion in agricultural sector value by generating foreign exchange reserves through exports, providing over 16 million jobs, and being highly interconnected with other industries. As a result, this company's successful implementation of the circular economy can serve as a model for other industries.

Several circular economy practices have been implemented in the palm oil industry, such as utilizing Palm Oil Mill Effluent (POME) based fertilizers and using Empty Fruit Bunch (EFB) as an energy source. However, several circular economy practices in the palm oil industry supply chain, i.e., plantations, milling, refinery, consumption, and waste, have not been widely implemented because the stakeholders involved in the industry face various challenges, such as financial constraints, in implementing circular economy principles. Thus, cooperation among stakeholders, including farmers, entrepreneurs, the government, and consumers, is essential in addressing the challenges of adopting a circular economy in the palm oil business. The government, in particular, plays a crucial role in fostering a circular economy by implementing rules and regulations that promote ecologically beneficial behaviors. However, before delving into the government incentives required for the adoption of the circular economy in the palm oil industry, it is important to recognize that its implementation necessitates a number of enabling factors that promote sustainability, such as those listed below.

1. **Formulating of a comprehensive roadmap for the advancement of a circular economy.** One of the major obstacles to advancing the development of a circular economy in Indonesia is the absence of a clear roadmap and objectives set by the government (The Indonesian government is currently in the process of formulating a circular economy roadmap to steer the development of a comprehensive circular economy ecosystem in the country. Therefore, the implementation of this initiative is still in its nascent phase and as a consequence it poses challenges in identifying clear and specific goals, determining the industries to target, effectively engaging relevant stakeholders, and implementing an efficient system for monitoring progress. Besides, there are currently no specific financial incentives or regulations in place to support the circular economy agenda, although some climate change programs aimed at promoting economic growth while reducing emissions could be considered as circular economy initiatives. In order to address this issue, the government

and industrial associations could take the lead in developing a circular economy roadmap and standards, including for the food and beverage sector, which would provide guidance for all relevant stakeholders. The roadmap at least identifying the current state of economy and and the sectors where circular economy principles can be applied; setting clear and measurable goals and objectives for transitioning to a circular economy; identifying the key stakeholders that should be involved the the process; outline the actions and initiatives to be taken in order to achieve goals and objectives; establishing a system for monitoring and evaluating progress; and composing a timeline and milestone to track the progress.

2. **Formulating and implementing policies and regulations that facilitate the transition towards a circular economy.** The government could provide several regulations to support a circular economy such as creating recycled content standards to help consumers identify and choose circular products. Besides, the government could give fiscal incentives, such tax breaks or subsidies for industries that implement a circular economy in their production process (a more comprehensive explanation of suggested incentive and disincentive policies is provided in the following section).

3. **Enhancing the knowledge and understanding of the principles and practices of the circular economy among producers and consumers.** The government might grant funding to increase consumer and societal awareness of a circular economy instead of a linear one. In addition, the government may boost the proportion of education that promotes knowledge of the necessity and advantages of a circular economy. Curriculums at schools and universities should provide students with early exposure to approaches to resource efficiency and circular economy (Ghose & Kapur, 2019). Moreover, the government could fund research and development at universities to develop an applied circular economy at the home and commercial levels.

4. **Promoting the development of a circular economy through collaboration among relevant stakeholders.** The government could support public-private partnerships to develop and implement circular practices, such as recycling and waste reduction programs. For example, the government could give funding to businesses and academic institutions to develop technology and standards in a circular economy. The government could also support a circular economy through procurement by preferentially purchasing goods and services from companies that adopt circular practices. Moreover, the industrial association could

collaborate to share knowledge and resources and to develop common strategies for circular practices.

Furthermore, the following recommendations can be implemented to encourage the private sector, particularly the palm oil business, to implement circular economy practices:

1) Plantation stage

To foster the integration of circular practices within the plantation stage, several incentives can be implemented, including:

- Provide sufficient subsidies for small and privately owned plantations which have clear legality of land to obtain and renew ISPO. This alternative is actually not a novel instrument as BPDPKS already has an infrastructure and facilities support program where ISPO is included. However, the beneficiaries of the program are still limited to only 14 planter institutions from 2015 until November 2022 with a total funding of Rp 41.9 Billion. We suggest BPDPKS to increase the funding, especially for smallholder farmers with a total about USD 1.4 trillion per year. It has been estimated that only 12.7 thousand hectares of the 6.02 million hectares of smallholder plantations have ISPO certifications, indicating that approximately Rp 7.2 trillion is required to fund the remaining 6.01 million hectares of smallholder oil palm farms that do not yet certified (the estimated cost required is Rp 1.2 million for one hectare). If financing is provided annually, it is estimated that the total ISPO expenses for each year will be approximately Rp 1.4 trillion. This policy is subject to be done by 2025 as the target of Presidential Regulation No. 44/2020.

- Provide affordable financing schemes for ISPO certification such as through KUR (Business Credit for Micro and Small Enterprise) and UMi (Financing for Ultra Micro Enterprise). This non fiscal instrument can be an alternative funding resource besides subsidies alternative given by BPDPKS. To run the system, the Financial Services Authority (OJK) can set certain green indicators as key performance indicators (KPI) for banks such as the number of credits for supporting circular economy implementations.

- Reduce export excise tax for companies that purchase ISPO based products at higher prices in order to establish price differential between ISPO and non-ISPO

certified products. The issue of inadequate price differentiation between ISPO certified products and non-certified products is a prevalent concern among smallholder farmers and in the domestic market. In contrast, in the global market, there is a notable level of price differentiation for products that possess RSPO certification. Given that large companies primarily conduct the export of products, it is imperative for the government to provide subsidies to establish a price differential for ISPO-certified products. And to ensure that the benefits of this price differential are effectively transmitted to smallholder farmers, such a prerequisite to set a higher purchasing price for ISPO-certified products is needed. Since it is a fiscal incentive, the Ministry of Finance would be the key stakeholder in implementing this policy. It would be advisable to implement the policy as soon as possible and aim to complete it by 2025, considering it is a critical component of promoting ISPO certification.

- Reduce corporate income tax and/or reduce export excise tax for companies using circular products, such as palm bunch ash and POME-based fertilizers in the plantation. The objective of this policy is to promote the demand of circular products as well as to optimize the utilization of their output product. As it is an ongoing process, the policy is implemented over a medium-term timeframe. The Ministry of Finance plays a crucial role in the implementation and execution of this fiscal instrument policy.

2) Milling and Refinery

Several incentives that can be applied at the palm oil milling and refining stages to promote the implementation of circular practices include:

- Implement a business license issuance process that regulates the discharge of wastewater from palm oil mills. This non-financial incentive will ensure compliance with discharge standards, which are mandatory for new mill investments and regularly monitored by government agencies such as the Ministry of Environment and Forestry and the District Government.

- Offer incentives to encourage companies to construct POME (Palm Oil Mill Effluent) treatment facilities, such as duty-free import for capital goods used in the installation and/or tax breaks, such as pumps and motors, and other equipment

that have not been produced domestically. Since installing POME treatment systems involves significant financial investment, providing these incentives from the government can help to lower the cost for mill companies, and encourage them to invest in these systems.

- To address the high investment cost of POME treatment installation, particularly for small and medium enterprises, the government should provide affordable financing options through schemes such as KUR and UMi. These schemes can include grants, free-interest loans, and crowdfunding, among others. Additionally, the Financial Services Authority (OJK) and financial institutions should consider incorporating circular economy financing as a key performance indicator in their sustainability reporting, as outlined in the regulations of Financial Services, Issuers, and Public Companies (PJOK No. 51/POJK.03/2017).

- To promote the use of POME biomass as an energy input for the state-owned power company, PLN, the Ministry of Energy and Natural Resources should establish a competitive tariff for the purchase of this renewable energy source. The Ministry has already mandated PLN to buy electricity produced from renewable sources, including biomass, but the current tariff is not considered competitive by producers. By implementing a more attractive tariff, the government can incentivize companies to invest in the production of biomass energy from POME.

- Provide research and development (R&D) funds focused on cost-effective solutions for biodiesel production, including POME treatment, in order to advance the development of a circular economy in the palm oil industry. The Indonesian government should provide funding to research and academic institutions to conduct research on circular economy-related topics, including the development of innovative technologies that can reduce the cost of producing biomass from palm oil. By investing in R&D, Indonesia can emulate the success of other countries that have established circular economy models and increase the competitiveness of the country's palm oil industry.

- Encourage the adoption of repair and reuse practices in the palm oil industry by providing tax incentives such as reduced VAT and corporate income tax for companies that implement these practices. To advance the implementation of a

circular economy in the manufacturing sector, including the palm oil milling and refining industry, the government can offer financial incentives such as reduced taxes on circular products. This will make it more cost-effective for manufacturing companies to prioritize circular methods in their production.

3) Packaging

It is recommended that the government take measures to promote the use of more environmentally friendly food packaging through:

- Reducing VAT and/or corporate income tax for businesses that develop and utilize biodegradable packaging. The Ministry of Finance's streamlining of taxation procedures for circular businesses could promote recycling efforts among these businesses. By ensuring that these circular businesses are not subject to equal taxation with linear ones, it allows them to redirect funds previously allocated for taxes towards the promotion of product recyclability.

- Broadening the scope of plastic excise tax, not only on plastic bags but also on plastic based packaging for various consumer goods by 2025. This incentive refers to Presidential Regulation No. 97/2017, which outlines the National Policy and Strategy for the Management of Household Waste and Household-like Waste with the aim of reducing plastic waste by 30% by 2025.

4) Disposal

- Creating a WCO collecting system and public campaign and monitoring WCO distribution and utilization. This initiative forms a crucial aspect to establish a sustainable WCO market, through the guarantee of its supply. Thus far, the collection of Waste Cooking Oil (WCO) has been undertaken primarily by certain groups or organizations. To facilitate the collection of WCO, the regional government could launch a campaign to establish official collection points in each region and disseminate information about these points through public service advertisements.

- Providing subsidies to WCO based biofuel companies to lower their production costs and boosting their price competitiveness with non-biofuel fuels. The

manufacturing costs of WCO based biofuel are relatively high compared to those of non-biofuel fuels, yet the selling price of WCO based biofuel remains the same. The profits generated from the sale of WCO based biofuel remain inadequate, necessitating the provision of subsidies to reduce production costs and stimulate interest in the sale of such WCO based biofuel.

- To encourage the use of environmentally sustainable options and reduce the cost of biofuel derived from waste cooking oil (WCO), the Ministry of Finance should consider including WCO-based biofuels in the value-added tax (VAT) exemption list. This incentive aims to shift fuel consumption patterns away from fossil-based fuels and stimulate demand for WCO-based biofuels. By providing an incentive on the demand side, it is expected that the market for WCO-based biofuels in Indonesia will grow. The implementation of this incentive should be gradual and implemented over a medium-term and ongoing timeframe, as the Ministry of Finance plays a key role in this initiative.

Table 11. Fiscal and Non-Fiscal Incentives to Support Circular Economy Implementation in Palm Oil Industry

Supply Chain Stage	Incentives/Disincentives		Time Frame to Run the Policy	Key Stakeholders	Targeted Stake-holders
	Fiscal	Non-Fiscal			
Plantation		Provide sufficient subsidies for small and privately owned plantations which have clear legality of land to obtain and renew ISPO certificate	By 2025	BPDPKS	Smallholder farmers
		Provide affordable financing schemes for ISPO certification such as through KUR (Business Credit for Micro and Small Enterprise) and UMi (Financing for Ultra Micro Enterprise)	By 2025	Financial Services Authority (OJK) and financial institutions	Smallholder farmers
	Reduce export excise tax for companies that purchase ISPO based products at higher prices in order to establish price differential between ISPO and non-ISPO certified products		By 2025	Ministry of Finance	Companies and farmers
	Reduce corporate income tax and/or reduce export excise tax for companies using circular products, such as palm bunch ash and POME-based fertilizers in the plantation			Ministry of Finance	Companies

Supply Chain Stage	Incentives/Disincentives		Time Frame to Run the Policy	Key Stakeholders	Targeted Stake-holders
	Fiscal	Non-Fiscal			
Milling and Refinery		Provide business license issuance mechanism to control wastewater discharges		Investment Coordinating Board (BKPM), Ministry of Environment and Forestry, and District Government	Companies
	Provide incentives for companies to build POME treatment installation, such as import duty free for POME installation-capital goods (e.g. Boiler) and/or tax allowance			Ministry of Finance	Manufacturing companies, especially small and medium-scale industry
		Provide affordable financing schemes for POME treatment installation such as through KUR and UMi		Financial Services Authority (OJK) and Financial institutions	Small and medium-scale manufacturing companies
		Encourage utilization of biomass from POME as an energy input for PLN, with a competitive tariff		Ministry of energy and mineral resources, PLN	Manufacturing companies
		Provide funding for RnD in palm oil based circular economy such as POME treatment and biodiesel production at a lower cost		BPDPKS	Manufacturing companies, research and academic institutions

Supply Chain Stage	Incentives/Disincentives		Time Frame to Run the Policy	Key Stakeholders	Targeted Stake-holders
	Fiscal	Non-Fiscal			
	Reduce VAT and/or corporate income tax for palm oil industries which adopt repair and reuse practices in their production			Ministry of Finance	Manufacturing companies
Packaging	Reduce VAT and/or corporate income tax for business that develop and utilize biodegradable packaging			Ministry of Finance	Manufacturing companies
	Broadening the scope of plastic excise tax, not only on plastic bags but also on plastic based packaging for various consumer goods		By 2025	Ministry of Finance	Manufacturing companies
Disposal		Create WCO collecting system and public campaign, and monitor WCO distribution and utilization		District/Local Government	Society or consumers
	Provide subsidies to WCO based biofuel companies to lower their production costs and boosting their price competitiveness with non-biofuel fuels			Ministry of Finance	WCO-based-biofuel Companies
	Include WCO based biofuel in the VAT free list to stimulate demand for biofuels			Ministry of Finance	Consumers (Individuals and companies)

Source: CORE Indonesia

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