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Circular Economy on Organic Waste Management with MASARO Technology

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Abstract. MASARO technology presents a solution in solving the waste problem through an organic waste processing unit, known as IPPO (Organic Fertilizer and Feed Industry). The Masaro system characterises solid waste into five categories including organic waste, low value plastic waste, incinerated waste, recycled waste, and hazardous waste. The organic waste will be separated into an organic fast-decaying waste to produce POCI (Special Liquid Organic Fertilizer) and KOCI (Special Liquid Organic Concentrate), and an organic slow-decaying waste to produce a compost. POCI is used as an organic fertilizer and its farming produces a higher production number, higher quality product, faster production rate while its production cost is lower. KOCI and compost is applied in the farm industry where the organic waste with low economic value is used as a raw material to produce new materials with higher economic value. These products can produce an environmentally friendly system and reflect the circular economy principle application. The organic waste is used as raw material for IPPO and its products form a circular economy through application in the farm industry that create lower cost production and sustainable development.

1. Introduction

Today's domestic waste problem is serious to consider that the volume and rate of a landfill are increasing along with the increase in handling costs. In line with the enhancement in population and economic activity, the waste generated an increase in number every day, when the handling faces many obstacles due to limited costs and existing facilities.

National waste accumulation from year to year continues to increase. The collect - transport - waste management paradigm causes the diversion of problems from urban activity sources to a problem at the final landfill location. According to data from the Ministry of Home Affairs Research and Development Agency and the National Waste Management Information System, Indonesia's waste production is 65.2 million tons per year, when only 36% is transported to the landfill, and the rest is burned, dumped, thrown away into rivers, and others. Sources of waste include households, industry, and traditional markets. So far, there are still many illegal piles of garbage on the side of the road. Even when the waste is moved to the landfill, the waste is only stored up because no processing is conducted so that the amount is getting bigger and even creates new problems.

Waste handling that is still done conventionally cannot control the waste produced by the community. Handling municipal waste in Indonesia has until now been a challenge for the local government. Waste management is an environmental problem with a complex level of resolution, so it requires the involvement of all related components, namely the community, government, and the industrial sector, including academics and experts (professionals) in the environmental field, especially in the waste



utilization sector and utilization. The management approach that has been done so far is ineffective and sustainable, so a paradigm shift is needed in managing waste from collect-transport-waste to sort-transport-process-sell and from cost centre to profit centre. In this paper, a solution to dealing with waste is with MASARO (Zero Waste Management) directly from the source that is the community.

On the other hand, the problem of Indonesia is that national agriculture is stuck in inorganic chemical fertilization that has an impact on accelerating the degradation of agricultural land fertility. This matter can occur due to various problems, especially the culture of using chemical fertilizers that have been going on for too long. As a result, agricultural land is very critical and slight in soil nutrients that at the end have an impact on low plant productivity and reduced immunization power of plants that results in a large number of plant pests that attack plants (the cost of production increases). Eventually, farmers will always depend on the need for insecticides (to increase the cost of the crop) and destroy the qualifications of the production of residue-free crops. To be able to improve agricultural land that is already critical and poor in nutrients, it takes courage from all parties to go out of the box, to leave inorganic chemical fertilization and return to using more natural organic fertilizers.

Apart from the fertilization aspect, another thing that can be improved in the agricultural industry is the sustainability aspect. Currently, the high dependence of agriculture compared to other fields, such as the fertilizer industry, has resulted in a lack of control and sustainability of the industry. MASARO technology can form a circular economy in the agriculture industry, thus helping the sustainability of the industry by processing organic waste into POCI (*Pupuk Organik Cair Istimewa*/special liquid organic fertilizer) that has the potential to eliminate problems caused by landfills and while producing fertilizers at the same time.

2. Method

The principles of MASARO Technology in Waste Processing are (1) Waste sorting on source, (2) waste treatment nearby the source of waste, (3) Community, government, and industries involvement, (4) educate the community, (5) environmentally friendly technology implementation, and (6) create sustainability management.

MASARO technology principles are intended to reduce waste pile to 0% by waste sorting on source to classify waste in to 5 categories, in which are: fast-decaying organic waste, slow-decaying organic waste, waste-to-energy, recyclable waste, and plastic/film waste. The sorted waste is going to be transferred to the waste treatment facility to eliminate the need for landfill, waste will be kept on houses or waste sources and transferred to the waste treatment facility on a scheduled period based on the type of waste that is produced. This system will increase the awareness towards waste piles. Therefore, developing waste reduction behavior within the community. To increase the effectiveness of waste reduction, educational programs must be paired with adequate waste treatment facilities located in areas such as houses, markets, offices and other public facilities. Hence, the need for communal, governmental and industrial involvement. The purpose of this system is to reduce waste by shifting the paradigm towards waste itself that used to be seen as cost-center material. With the implementation of MASARO technology, the paradigm towards waste will be shifted from cost-center material to profit-center material.

MASARO technology is designed to process all waste and produce high value products as pictured in figure 1. The overall products are differentiated into two categories based on the type of waste being used. The products produce from organic waste are POCI (*Pupuk Organik Cair Istimewa*/Special Liquid Organic Fertilizer), KOCI (*Konsentrat Organik Cair Istimewa*/Special Liquid Organic Concentrate), Growth Medium, and MASARO Compost. This paper will focus on organic waste treatment using IPPO (*Industri Pupuk dan Pakan Organik*/Organic Fertilizer and Animal Food Industry).

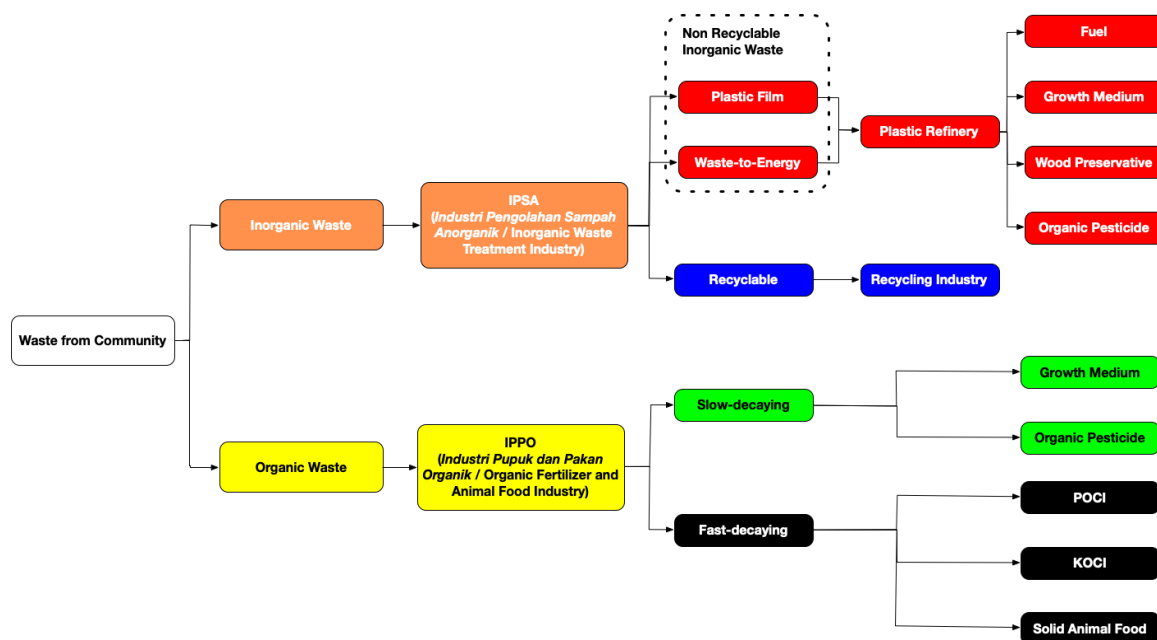


Figure 1. MASARO's waste classification and treatment.

MASARO's organic waste treatment is divided into two programs, which are social programs and industrial program. These two programs are aiming for waste pile reduction but with different scales. MASARO's social program for organic waste treatment is scoping on community scale organic waste management. The program itself is held to increase the awareness towards waste management while also creating a space for social interaction in the community. MASARO's social program is consists of slow-decaying organic waste collection from local sources and process them through MASARO compost process with MASARO Bio-composter. The compost later be used as fertilizer for the polybag farming system that is implemented in the community. The polybag farming is using the 4:3:2:1 volumetric ratio, with 4 parts growth medium, 3 parts animal feces, 2 parts MASARO compost, and 1-part charcoal. The development of this system can create RPL (*Rumah Pangan Lestari*) with integrated polybag farming. Crops from RPL is used as one of the food sources of the community. Waste created from the food production process is also the source of organic waste thus creating a circular economy. The whole social program system is illustrated in figure 2.

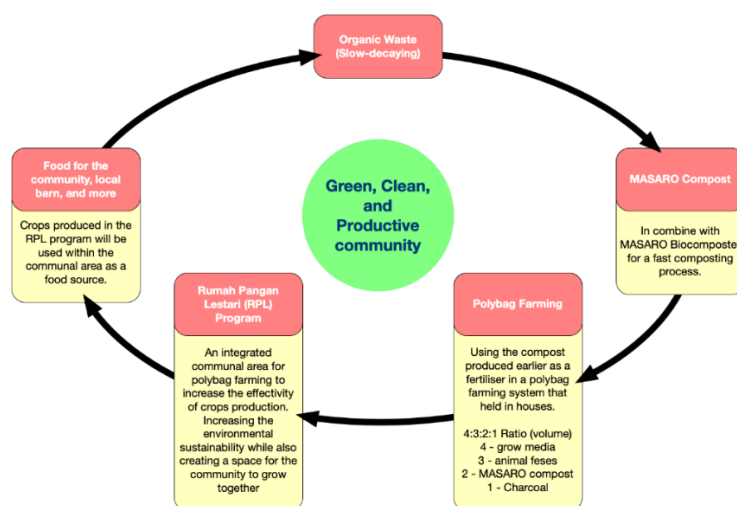


Figure 2. Circular economy system for the social program

The Industrial program is aiming for the agricultural, farming, and fishery industries. Organic waste produced within the industry are processed in IPPO to produce POCI/KOCI/growth medium/MASARO compost. These products are implemented directly to the industry by using POCI as fertilizer, KOCI as animal food additive, growth medium and MASARO compost in polybag farming system. The product of the industries is allocated as food and waste produces in the food industries are transferred back to IPPO creating a circular economic system as illustrated in figure 3.

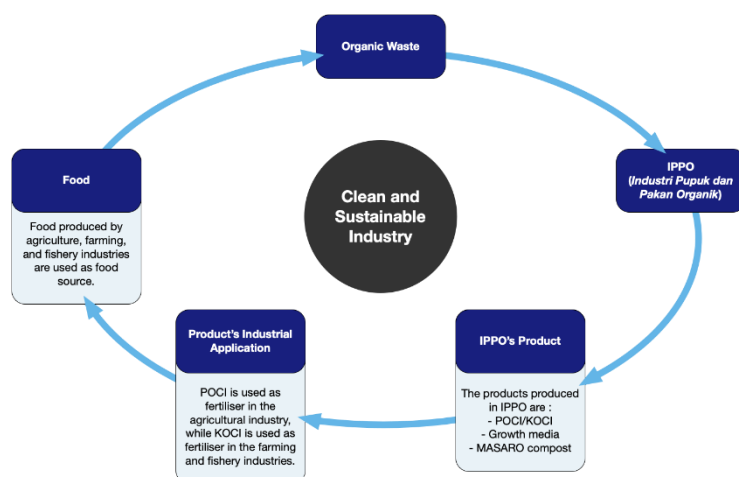


Figure 3. Circular economy system for the social program.

3. Result and Discussion

3.1 Social Program

One of the case studies in the MASARO's social program implementation is in the Pasawahan region, Bandung. One of the critical points in this system is the local market. This market is acting as the place for crops selling and waste source. The waste is then transported back to the community where it will be shredded. The shredding process is held by 2 methods, using a shredding machine or with the help from the community. This step is also acted as a vessel for social interaction and movement towards a green, clean, and productive Pasawahan region community. The shredded slow-decaying organic waste will be processed for composting. The composting process is done using MASARO bio-composter. This process is more effective compared to a typical composting process by only taking 7 days of composting process. Product of this process is used as fertilizer for the polybag farming system with 4:3:2:1 volumetric ratio, 4-parts growth medium, 3-parts animal feces, 2-parts MASARO compost, and 1-part charcoal. This polybag farming is held from houses in the community. Social program implementation in Pasawahan region can be seen in figure 4.

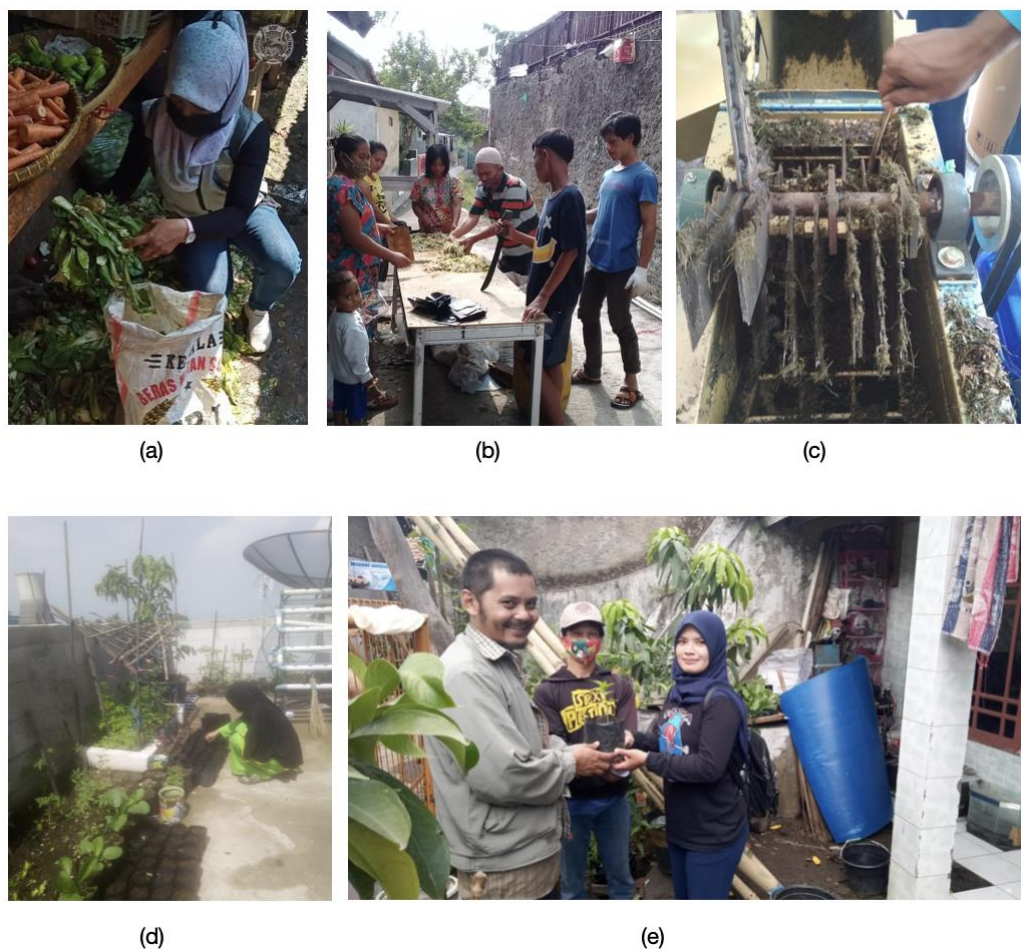


Figure 4. MASARO's social program implementation in Pesawahan Region (a) Slow-decaying organic waste collection, (b) communal waste shredding, (c) shredder machine, (d) polybag farming, (e) local community working with MASARO.

3.2 Industrial Program

3.2.1 Agricultural. The agriculture industry using MASARO technology will improve the saving of farming costs and decrease the amount of waste from agriculture. Waste generated from agricultural products, both fast-decaying organic waste and slow-decaying organic waste will be processed using MASARO technology. Fast-decaying organic waste is processed using IPPO to produce POCI, while slow-decaying organic waste will be processed using MASARO compost technology to produce MASARO compost. Then the two products will be reused in the agriculture industry to produce organic agriculture that has better quality agricultural products. The leftover of the agricultural product will then be reprocessed in IPPO and form a circular economy system in the agriculture industry. The circular economy diagram in the agriculture industry can be seen in figure 5.

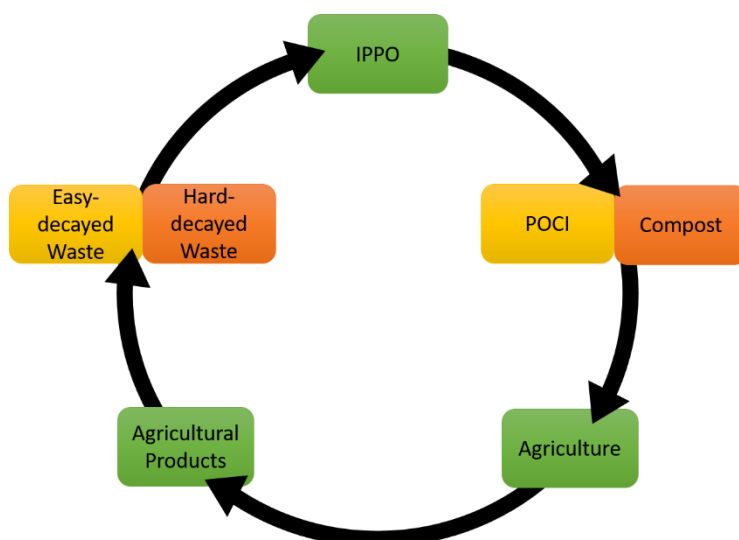


Figure 5. Circular economic system in agriculture industry.

With the use of MASARO as fertilizer, several advantages will be obtained, including: improve agricultural land and fertilize the soil, accelerate plant growth, accelerate the cropping period, accelerate, and improve the growth of fruit, prolong plant life, improve flower quality, color, a taste of fruits and vegetables, prevent pests and grass growth, stabilize soil pH and grow NPK from nature.

3.2.2 Farming. MASARO technology on organic waste treatment can also be the key for the circular economy in farming industry. As fast-decaying organic waste is used as material to produce POCI/KOCI in IPPO, residual solid material is also produced. This solid material can be used as animal food. This food is still contains a residual amount of KOCI but more KOCI can be added if needed. Meat produced by the farm is then consumed. The leftover food waste and animal feces are classified as fast-decaying organic waste and processed again with IPPO, creating a circular economy system in farming industry as illustrated in figure 6.

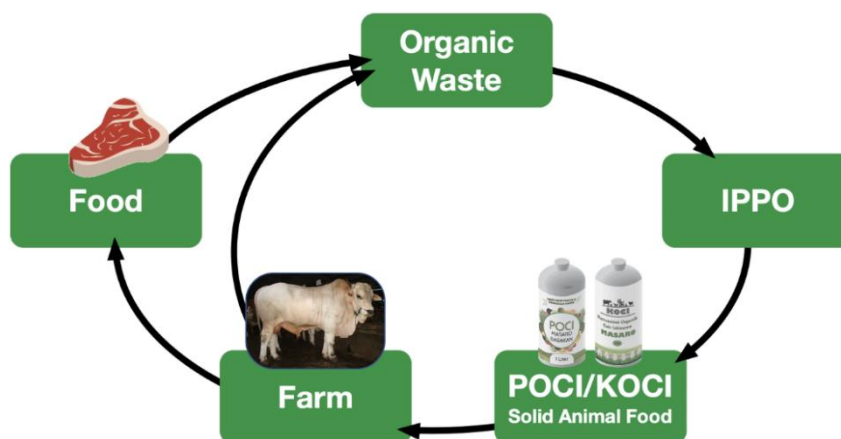


Figure 6. Circular economic system in farming industry.

Another advantage of using MASARO technology in creating a circular economic system in farming industry is the impact towards the animal growth, immune, or fertility. In the case of cow farm in Padalarang, KOCI usage had led to increase of cow's growth from the typical 30-45 kg monthly to 57 kg of weight gain within a month with cows that are more immune towards diseases.

3.2.3 Fishery. KOCI MASARO is a special liquid organic feed concentrate made from perishable organic waste which has no sale value, but after processing it in IPPO it becomes a special, highly valuable feed concentrate, and becomes a milestone in circular economies in the field of organic fisheries. Circular economy in fishery industry has a similar concept to the circular economy in farming industry. The fast-decaying organic waste will be processed in IPPO and produces KOCI that will be used in the fishery industry. After the fish is consumed, the leftover food will be processed again using IPPO. The circular economy diagram in fishery industry can be seen in figure 7.

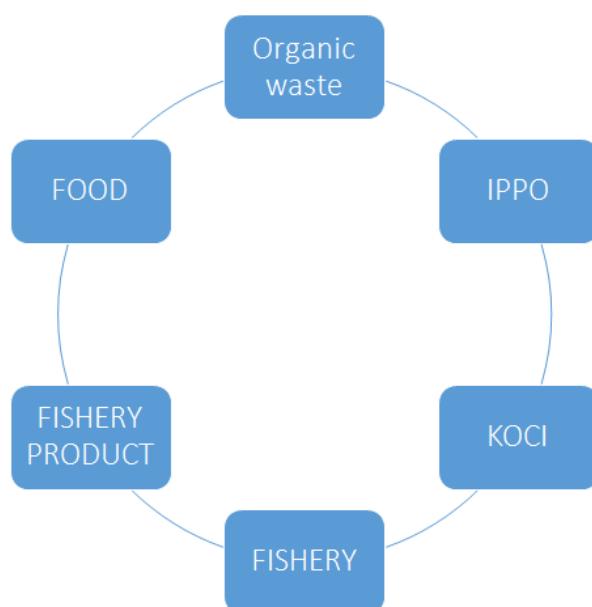


Figure 7. Circular economic system in the fishery industry.

KOCI MASARO applications in the field of fisheries have been proven to produce fish that are healthier, shiny, longer and have more significant changes than fisheries without using KOCI MASARO. Industrial Program implementation of fisheries using KOCI MASARO is in the Gorontalo area in catfish fisheries this skin which indicates disease susceptibility, higher appetite, 2 months the size reaches 4 cm and there are catfish that are ready to harvest.

4. Conclusion

Organic waste processing with MASARO technology and "sort-collect-transport-though-sell" system can save lots of costs and operational land when compared to the current waste processing system with some impacts such as:

1. Circular economy from organic waste treatment with IPPO MASARO. Based on organic waste characterisation into 2 groups, fast-decaying and slow-decaying organic waste. These wastes will be processed accordingly with fast-decaying organic waste will be treated in IPPO to produce POCI/KOCI while slow-decaying organic waste will be treated with MASARO Bio-composter to produce MASARO compost.
2. MASARO technology implementation on social program has been applied in Cileunyi Kulon village and Pasawahan region with highly satisfactory result and ability to process 100% of organic waste while also creating a social movement in the area. This process is integrating in house planting in the neighborhood/community association and increasing the social harmony of the area. Hence, MASARO technology implementation is solving environmental problem and increasing social environment quality.
3. MASARO technology implementation on industrial scale can be applied in agricultural, farming, and fishery industries with IPPO as the key for the creation of circular economy. Food waste and

animal feces are some of the material used in IPPO. POCI/KOCI produced in IPPO can be used in the three industries and has been showing a positive result in the crops growth. The crops will be used as food source and the food sector will produce food-waste used as material for IPPO. Thus, creating a circular economy.

4. MASARO technology implementation with both social and industrial programs in applicable to Indonesian villages to create a circular economy waste management system that eliminate the reliance on landfill.

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