

## CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA



## Masaro

-  Indonesia
-  Waste Management
-  masaro.id
-  Analysis period: 2020-2024

## Revolutionising Waste Management with Zero Waste Techniques

## Business Spotlight

PT Masaro was founded in 2010 to research and practice plastic waste management and recovery. Over time, this research has expanded to include technical solutions for handling community solid waste. Masaro is recognised for its zero-waste management approach that has transformed the waste management paradigm from cost centred (collect-transport-dispose) to profit centred (sort-transport-process-sell). Masaro employs three distinct waste processing technologies for rapid decaying organic waste, for slow decaying waste, and for non-organic waste. Central to their non-organic waste processing is the Masaro Smokeless Furnace Technology, combining incineration and pyrolysis to achieve energy-efficient, environmentally friendly, and circular economy outcomes. This Masaro technology effectively converts waste residues into valuable resources. For instance, from one tonne of waste residue, Masaro produces 3,000 L of bio-pesticide-alternative. Masaro's product line reflects their innovations, categorised into liquid organic fertiliser, liquid feed concentrate, bio composter, compost, and biopesticide. These products bring significant benefits to organic agriculture, livestock, and fisheries sectors. Masaro is committed to converting household waste, waste from community

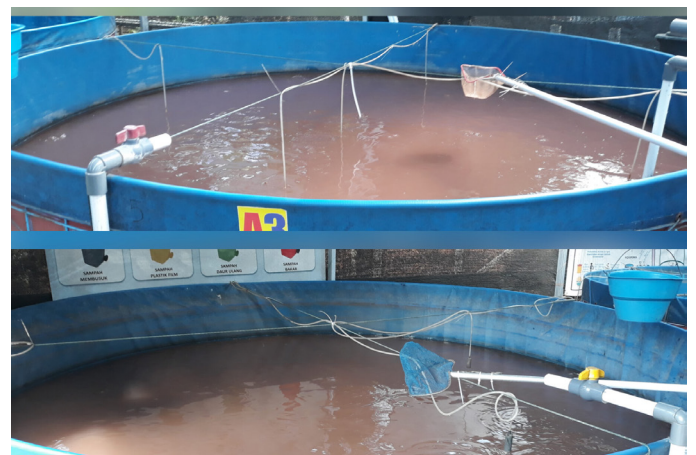
waste collection points (TPS3R), and landfill sites (TPA) into developmental assets, ensuring an environmentally sound, efficient, and profitable waste-recovery cycle.

 **Keywords**

Innovation, Community Solid waste, Agriculture

 **Innovation**

End-of-life management, Resource circularity, Resource substitution



# Analysis of Masaro

## Context and baseline

Household waste management continues to be a prevalent problem in Indonesia. Around 51% of the 38 million metric tonnes of Indonesia's waste were generated by households in 2023, according to the Indonesia Ministry of Environment and Forestry, representing a 40% increase in household waste from 27 million metric tonnes in 2019. Of the total waste, food comprises about 41%, followed by plastics (about 19%), wood (about 12%), and paper (about 11%). Such an acute waste problem requires innovative solutions.

Established with the initial intention of conducting research on plastic waste management and recycling, Masaro has challenged several waste management paradigms: a) shifting from 'collect-transport-dispose' to 'sort-transport-process-sell', b) transforming development expenses into development capital, c) turning waste from a cost centre into a profit centre, and d) redefining waste management from waste to energy (WTE) to waste to agriculture (WTA).

## Innovation

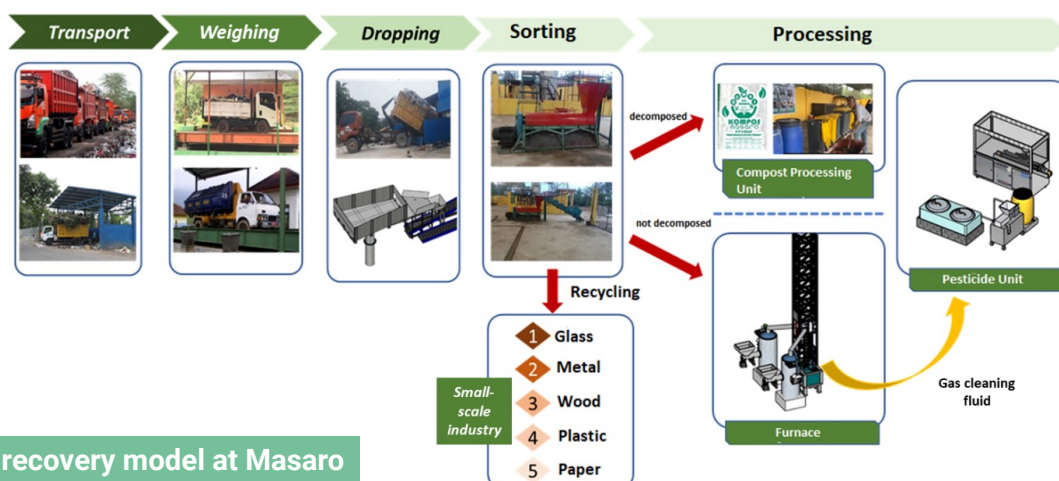
Masaro has transitioned from the traditional 'collect-transport-dispose' paradigm to the alternative of 'sort-transport-process-sell' in community waste management, and developed three circularity solutions:

- technology for rapidly decaying waste, capable of converting one kg of waste into 12 l of organic fertiliser or concentrate,
- technology for slowly decaying waste, producing compost or bio-composters, and
- technology for handling difficult-to-decompose waste, called 'smokeless furnace technology', capable of processing residual waste at a rate of 8 m<sup>3</sup>/unit/hour.

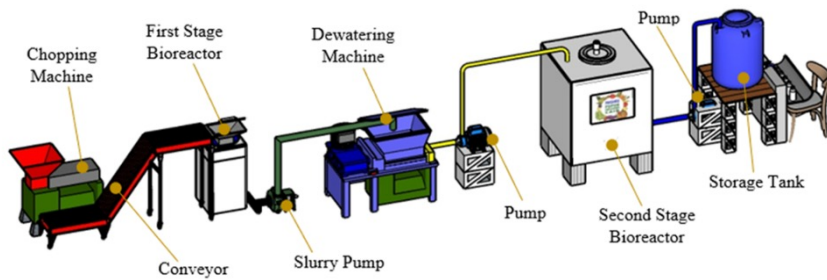
The company's end-products are liquid organic fertiliser (Pupuk Organik Cair Istimewa/POCI), liquid concentrate pellets (Konsentrat Organik Cair Istimewa/KOCI), compost, planting media, bio-fuel and an insecticide substitute from their integrated municipal solid waste management model, benefiting agriculture, farming, and fisheries across Java.

In Masaro's waste management scheme, fast-decaying organic wastes such as food waste and vegetables are shredded and fed into first-stage bioreactors. The mixture is diluted with water and allowed to react for 14 days. A thick slurry from the first-stage bioreactors flows into the dewatering machine before going to the second-stage bioreactor. Second-stage fermentation proceeds for another 14 days. Finally, a pump pushes the organic liquid products into storage tanks. Meanwhile, slow-decaying organic wastes, such as leaves and hard-skinned fruits, are converted into compost using a biological process.

For non-biodegradable waste recycling, Masaro has adopted an advanced smokeless furnace technology based on pyrolysis. Masaro separates non-biodegradable waste into waste suitable as fuel waste-to-energy) and low-value plastic waste, suited as feed material for pyrolysis. Wood, diapers, and unrecycled papers are used in the incineration section to produce the heat required for the pyrolysis process. The pyrolysis unit is installed vertically above the furnace to maximise heat recovery and utilisation. Meanwhile, low-value plastic waste, such as plastic film, thermoset plastic, and biodegradable plastic, is processed in the pyrolysis section to produce a liquid fuel. The ash from the incineration section is utilised as a planting medium. The condensed water collected from the wet scrubber on the pyrolysis section can be used as an insect repellent, replacing chemical insecticides.

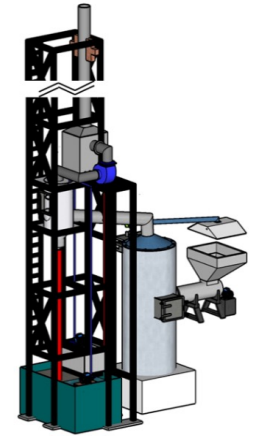


The waste recovery model at Masaro



Technology for processing fast-decaying organic wastes

Smokeless furnace for processing of non-biodegradable wastes



## Circular Economy impact

The Masaro waste recovery and utilisation model contributes to a circular economy by recovering valuable products from previously discarded community waste streams (illustrating resource circularity) and by substituting non-renewable fertilisers and pesticides with renewable alternatives (illustrating resource substitution).

Resource circularity is achieved through the valorisation of four substreams of municipal waste: fast decaying organic waste (mainly food waste), slow-decaying organic waste (mainly peelings, leaves, etc.), non-decaying organic waste (wood, paper) and plastics and residual waste, respectively. INTI, a state-owned telecommunication company, installed Masaro's waste processing plant in Dumai, Riau, in 2023. The plant processed over 255 metric tonnes of non-organic waste and over 28 metric tonnes of organic waste from January to October 2024. Meanwhile, Masaro's processing plant in Cirebon has processed over 865 metric tonnes of non-organic waste and over 220 metric tonnes of organic waste during the 5 years of its operation, from 2020 to 2024.

The plastic treatment is particularly innovative. It has been estimated that less than 10% of plastic waste is recycled in Indonesia. Pyrolysis is a promising method for recycling plastic waste, but the process entails higher investment and operational costs, which prevents widespread application. To improve the feasibility of the pyrolysis method, Masaro developed a new application named 'Smokeless Furnace Technology', based on extracting value as insect repellent from the strong smoke generated by the pyrolysis – which is scrubbed (thus 'smokeless' technology) – and sold as an alternative to pesticides. Smokeless technology incinerates residue waste at a rate of approximately 8 m<sup>3</sup> per unit per hour, with the incineration section producing the heat to drive the pyrolysis process. The pyrolysis section can process up to 1 tonne of municipal waste daily,

yielding 4,000 L of organic pesticide. For example, Masaro's pyrolysis plant, funded by Polytama Propindo, recycles 700 kg of plastic waste into 17.5 L of oil per month in Indramayu, West Java.

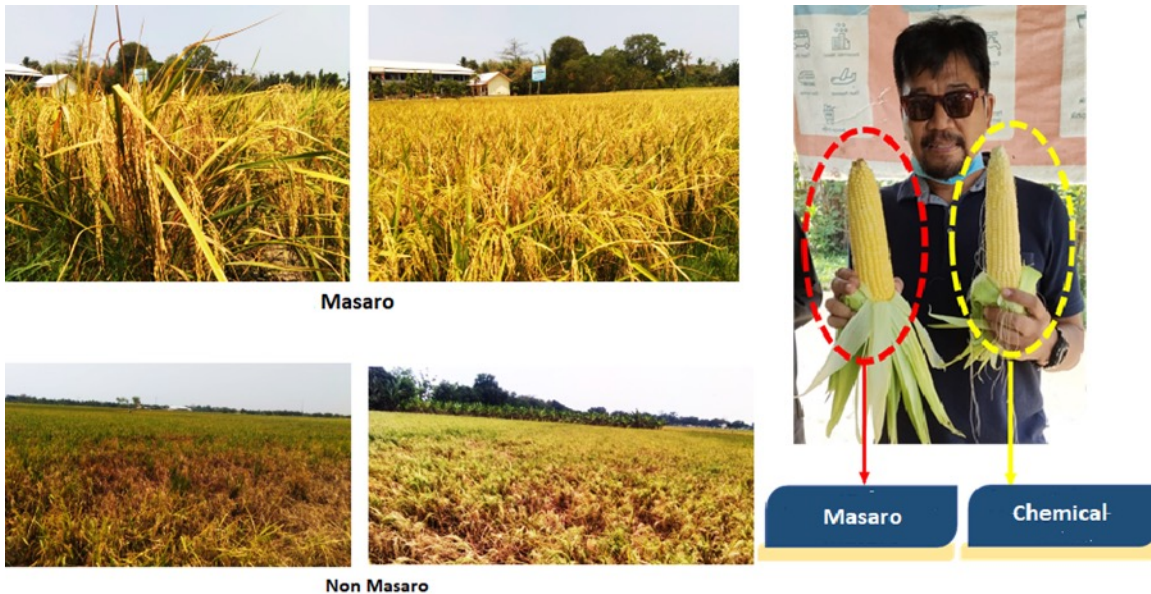
Masaro asserts that its smokeless technology efficiently heats low-value plastics and other waste residues at a reduced cost, thereby enhancing overall efficiency. The products derived from this process present a promising circular economic model for replication and scale up. These products have proven to be effective substitutes for chemical inputs in the agriculture, farming, and fisheries sectors.

The Masaro approach supports 3R (Reduce, Reuse and Recycle) waste processing at the community and district scale, with active engagement of government and communities to achieve full diversion of waste from landfill, also known as 'zero waste' disposal. Masaro's organic products have improved the quality and quantity of agricultural yields in several areas, such as rice field farms in Indramayu in West Java (2016), corn farms in Luwu Timur in South Sulawesi (2020), and vegetable farms in Cirebon in West Java (2020). Moreover, the establishment of integrated farming, a combination of crops and livestock farming, under the Masaro Cicalengka project, exemplifies efforts toward local economic enhancement and waste management.

## Business and market impact

The smokeless technology used at waste processing sites, installed in a Indonesian local 3R model<sup>1</sup>, has a processing capacity of approximately 10 metric tonnes of waste per day. The construction of the plant requires a capital investment of IDR 5 billion IDR (≈ EUR 300,000) for such capacity. The company advocates two investment schemes with an internal rate of return ranging from 28% to 47% over 5 years, and a payback period of 1 to 3 years. TPS3R facilitates the operation of zero-waste plants, generating products that benefit agriculture, fisheries, and livestock by reducing dependence on chemical inputs.

1 Commonly referred to in Indonesia as TPS3R, Tempat Pengolahan Sampah Reduce Reuse Recycle.



### Comparison of crops with and without application of Masaro products

In another investment initiative, Masaro’s integrated farming project in Cicalengka, which includes cow farming, yields a net profit of IDR 4–5 million per cow over the life of the cow (approximately EUR 240-300) through partnerships with local residents. Additionally, Masaro and PT Agro Inti Maslahat have established PT Masaro Jabar Lestari to invest in sheep farming, providing a threefold profit return when the sheep is sold. In partnership with PT INTENS, the company is dedicated to implementing its technology across various regions in Indonesia to transform waste processing into value-added products. Target markets include agriculture, farming, fishers’ associations, city governments, waste collectors, and the recycling industry.

### Stakeholders

Masaro collaborates with different stakeholders across different locations with the primary objective of customising waste processing paradigms. This transformation begins with community training in zero-waste processing, and focusing on waste segregation at the source. Masaro views segregated waste as an economic asset. Concurrently, collaborations with several recycling industries and local governments are underway to facilitate the development of Masaro plants, capable of processing up to 10 metric tonnes of waste per day. Masaro has been recognised with several awards, including Corporate Social Responsibility (CSR) awards from Polytama Propindo in 2015, CSR from Chandra Asri Petrochemical, and USD155,000 from Dow Chemical International USA. Their collaborations yield economically valuable waste-processing products and established frameworks for sustainable natural resource management programmes. Through its technologies, Masaro has enabled the establishment

of model villages in Cirebon, Cilacap, Indramayu, and Cilegon in West Java province; Gorontalo City in Gorontalo province, and Dumai in Riau province.

### Implementation

In Indonesia, waste management has traditionally tackled waste issues from a cost-centre perspective. Masaro aims to revolutionise this paradigm by transforming it into a profit centre. Through collaborations with the recycling industry and government entities, Masaro is promoting the adoption of waste processing technologies that generate value-added products across Indonesia. Masaro offers environmentally friendly technologies with cost-effective operations to support these initiatives. PT INTI partners with Masaro and local governments to implement their technologies for effective waste management solutions. Several regional governments, including Cilegon, Dumai, and Indramayu, endorse these initiatives and plan to scale up Masaro technology from processing 10 metric tonnes to 100 metric tonnes daily, which will alleviate shortfalls in waste management and expand the availability of recycled waste products, thus benefiting broader communities, particularly in the agriculture, farming, and fisheries sectors.

Masaro’s technologies are deployed in social programmes with funding from diverse sources:

1. Bio-composters are used in Cileunyi Kulon, Bandung, funded by ‘Dana Desa’
2. Pasawahan, Bandung, funded by the Ministry of Energy and Mineral Resources (ESDM)
3. Sukadana, Ciamis, funded by ‘Dana Swadaya Masyarakat’

4. Lumbung, Ciamis, funded by 'Dana Swadaya Masyarakat'
5. Tawang Sari, Wonosobo, funded by local government (Dana APBD)
6. Waste management plant in Cilegon, Banten, Java funded by Chandra Asri Petrochemical
7. Waste management plant in Dumai, Riau, Sumatera funded by Industri Telekomunikasi Indonesia (INTI)

Masaro has collaborated with Islam Tarbiyyatul Falah Senior High School for a composting plant (Rumah Kompos Masaro) and PT Agro Inti Maslahat in Cicalengka, Bandung, resulting in the integrated farming initiative, Masaro Cicalengka.

## Takeaways

Masaro's journey illustrates the transformative power of adopting circular economy principles in waste management. By shifting the focus on waste as a cost centre to leveraging it as a profit centre, Masaro is not only addressing environmental challenges, it is creating economic opportunities. Moreover, collaboration with stakeholders from the recycling industry along with local communities and governments has been shown to be essential in implementing sustainable waste processing technologies.

## Acknowledgements

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## Disclaimer

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