

CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA



Ruy Reach

- Phnom Penh, Cambodia
- Waste management; agribusiness
- www.facebook.com/RuyReach/
- Analysis period: 2019-2024



Recovering Food Waste through Insect Farming

Business Spotlight

Ruy Reach farms Black Soldier Flies (BSF) to convert food waste into sustainable animal feed and fertiliser for circular economy in Cambodia's waste management and animal feed sectors. Ruy Reach collects food waste from restaurants, transforms it into nutrient-rich larvae and frass (insect excreta), which serve as animal feed and organic fertiliser, respectively.

The innovation involves producing different forms of larvae (live, dried, fresh), and development and application of a low-cost method for drying larvae, which are suitable for various applications in the local market. This process effectively reduces organic waste, diverts it from landfills and thus prevents Greenhouse Gas (GHG) emissions that would otherwise occur from decaying food waste. At the same time, it provides an eco-friendly alternative to traditional animal feeds like soy or fishmeal and chemical fertilisers.

Ruy Reach is selling larvae and frass in niche markets such as that of ornamental fish, however, with significant potential for expansion into larger markets for aquaculture, livestock and pig farming.

Looking ahead, Ruy Reach aims to raise funding to scale up production so that it can supply larger farms and feed companies. This expansion will increase the organisation's contribution to waste reduction, contribute to more sustainable feed production, and boost its business in Cambodia.

Keywords

Food waste, Insect farming, Animal feed

Innovation

Design, Operations, End of life management, Resource circularity, Resource substitution



Analysis of Ruy Reach

Context and baseline

In 2022, Cambodia generated almost 5 million metric tonnes¹ of garbage, a figure which is expected to increase by 1.5 times over the next decade due to economic development, population growth and urbanisation. While precise statistics on food waste are not available, it is estimated that organic waste constitutes about 60% of the total municipal waste. Just in Phnom Penh, in 2020, food waste generation was estimated at 2,200 metric tonnes/day.² Upon uncontrolled decomposition in landfills, food waste produces methane, a greenhouse gas (GHG) up to 80 times more potent than CO₂. In parallel, despite progress in food security, Cambodia's agri-industry sector continues to face challenges, particularly in aquaculture, which remains resource-intensive and environmentally damaging.

During a program addressing solid waste issues, Hunsopheary Hul, the founder of Ruy Reach, learned about Black Soldier Fly (BSF) farming as a circular solution to organic waste challenges. The BSF (*Hermetia illucens*) is an insect species renowned for its ability to efficiently convert organic waste into valuable high protein biomass. Native to the Americas, BSF is now found globally in tropical and temperate regions, thriving in environments rich in organic matter.

In Cambodia, Ruy Reach farms BSF to transform food waste from restaurants into protein-rich larvae for animal feed, which is currently used by ornamental fish producers. Additionally, the nutrient-rich BSF frass, a by-product of larvae production, is utilised as a high-quality organic fertiliser in agriculture and contributes further to the circular economy.

Innovation

Ruy Reach's innovation started with farming BSF which has gained traction globally in recent years. Leading companies such as the Dutch Protix and the Canadian Enterra Feed have pioneered techniques for large-scale BSF cultivation, harvesting and processing. In Southeast Asia, the Singapore-based Entobel and the Malaysian Entofood are the most well-known names in an expanding global industry, which despite its current niche position has the potential to significantly improve the future sustainability of global food chains.

In Cambodia, Ruy Reach offers a variety of BSF larvae products, particularly live, dried, and fresh. Ruy Reach has innovated in the process for dried

larvae production. Typically, dried larvae are ground into protein powder, a process requiring specialised machinery which Ruy Reach does not yet have. Instead, Ruy Reach developed a low-cost method to produce dry BSF larvae using a tailored harvesting and roasting machine. This adaptation improves the shelf life of the product (three to six months for dried larvae compared to one month for fresh larvae), enhancing its practicality and market appeal. While the dry larvae have a higher fat content compared to industrial BSF protein powder, this suits Cambodia's current niche market of high-end animal markets such as ornamental fish.

Ruy Reach's approach is new to the Cambodian market and is quite promising regarding sustainable waste management and animal feed production. Ruy Reach illustrates that local startups based on established international practices typically need to adapt international practices to accommodate the constraints of locally available resources in Cambodia.



Circular Economy impact

Black Soldier Fly (BSF) insect farming, as implemented by Ruy Reach, is a practical contribution to the circular economy transition through the combination of recovery of resources (resource circularity) and partial substitution of non-renewables by renewables (resource substitution).

Resource circularity is achieved as the BSF larvae turn food waste into protein and fat, which is a sustainable alternative for traditional animal feeds and thus reduces the use of soy or fishmeal with their associated environmental impacts. In its current niche market, Ruy Reach turns around 7 metric tonnes

1 See: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9322170/>

2 https://ethesisarchive.library.tu.ac.th/thesis/2019/TU_2019_6022040809_11459_11544.pdf

of food waste every month into 1,000 kg larvae. This diverts food waste from landfills and thereby avoids GHG emissions that would otherwise occur during food waste decomposition. Every metric tonne of municipal waste in Cambodian landfills is estimated to release around 1 metric tonne of GHGs, with the food waste fraction contributing significantly more than the average. Therefore, diverting food waste from landfills with BSF insect farming is climate-effective.

Resource substitution is achieved through the use of the residue from the larvae as high-quality compost or biofertiliser, which substitutes for chemical fertilisers, improves soil health and supports sustainable agriculture.

There is an abundance of food waste that could potentially be used for BSF farming at an industrial scale, and the BSF larvae be used to significantly improve the sustainability of fish production in Cambodia. Fish is one of the main protein sources for Cambodians, but recently, climate change has caused a notable decrease in fish capture in the Tonle Sap Lake, the largest freshwater lake in Southeast Asia, which plays a crucial role in the livelihoods of millions of people. The extensive use of trash fish and baby fish in aquaculture depletes natural resources and increasingly impacts the marine ecosystems of the Tonle Sap, with potential issues in food security for vulnerable communities such as fishermen. Creating a supply chain for industrial BSF-derived fish feed has the potential to counter this trend.

Business and market impact

Ruy Reach generates revenue by selling BSF larvae as animal feed and BSF frass as organic fertiliser. To move beyond its current market of ornamental fish and fighting chickens, Ruy Reach needs to significantly scale up its operations to achieve economies of scale.

BSF farming can be easily scaled up with the use of stackable racks so that only 0.24 square meters of space is required to produce 20 kg of larvae per week. The better quality of the BSF larvae could offset the price premium of current animal feed. Ruy Reach plans to streamline production, make it less labour-intensive and more reliant on quality machinery, to yield better quality feed at competitive prices. If scaled up to 60 metric tonnes/month, Ruy Reach expects a price of USD 250 to USD 450 per metric tonne, compared to imported high-quality fish meal priced at USD 1,600 to USD 2,000 per metric tonne. This would save an amount equal to 720 metric tonnes of baby fish annually. Scaling up production to 60 metric tonnes per month would require an estimated capital investment of USD 300,000 and would be sufficient to allow two or three large farms

to convert to BSF-derived feed, which would be a realistic next step towards scaling up BSF farming in Cambodia.

BSF farming has been successfully scaled up within Southeast Asia. For example, Entobel, a leader in BSF farming, raised USD 33 million from private equity investors in 2022 to expand with a second industrial-scale facility in Vietnam in November 2023, with an annual production capacity of 10,000 metric tonnes of insect protein, the largest of its kind in Asia. Vietnam is considered as a strategic location due to its tropical climate, abundant sources of feedstock, and a growing aquaculture market. Cambodia could also see more developments regarding the BSF market: the feed needs in aquaculture is around 1 million metric tonnes of trash fish per year. BSF larvae have the same nutritional value and can be a substitute for fish meal.

Stakeholders

Currently, Ruy Reach collaborates with six sustainability-oriented restaurants, mainly in Phnom Penh. They provide around 7 metric tonnes of food waste per month, but Ruy Reach is seeking more partners to ensure a consistent waste supply for larvae feeding. This step is crucial from the perspective of expansion. Producing 60 metric tonnes of larvae is an opportunity to recycle 420 metric tonnes of food waste per month.

Two potential partners have been identified: GOMI Recycle that can provide support to collect food waste from Phnom Penh Special Economic Zone, and GAEA, a waste collection company with some recycling pilot projects. Synergies with GAEA can be very impactful, particularly in Siem Reap where Ruy Reach plans to establish its new production facility. Siem Reap is a great location combining many fishery farms and communities in nearby Tonle Sap. The amount of food waste generated is also enough to feed the new facility to supply the aquaculture demand. By introducing a waste separation system at food waste generation points, GAEA would be able to segregate the organic waste more efficiently, which could be sold as a valuable material to Ruy Reach for a small fee.

Implementation

While on paper BSF farming offers numerous benefits, realising this as a business opportunity has turned out to be challenging. Whilst Ruy Reach has successfully proven BSF farming as a circular solution in the niche ornamental fish market, it would require a significant investment to scale up and reduce the cost to be able to supply in sufficient quantities to meet the needs, in the first instance, of small and medium farms.

On the regulatory side, Ruy Reach is not allowed to collect food waste from large markets but only from restaurants. There are also some limitations on shipping insect products across borders.

Public perception is also an issue. Involving individuals as collectors is a challenge because working with waste is stigmatized. There is thus a need to change mindsets. Also, for individual operators the logistics of collecting food waste are not easy, which they do not want to deal with it.

On a more general basis, for a startup operating for the circular economy some of the common issues are linked to access to finance, access to information and even registration. Access to financing is crucial as more green innovative instruments are needed to derisk circular initiatives, where there are clearly opportunities but where economies of scale are important.

Takeaways

Ruy Reach exemplifies the value of utilising insects and their larvae for food waste management. They have showcased a circular solution that requires fewer resources such as water and land by using vertical farming techniques. The BSF farming transforms waste into valuable animal feed and fertiliser, offering a sustainable and potentially cost-effective solution. This initiative, especially at a larger scale, has the potential to significantly reduce food waste and greenhouse gas emissions. Ruy Reach's current scale-up challenges appear exemplary for cleantech startups for their transition to commercial operations in terms of securing

customers and supplier markets, setting up appropriate infrastructure and business processes, and establishing a competent and entrepreneurial team, thereby securing access to affordable financing.



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Disclaimer

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