

CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA

BetterFly

- Bangkok, Thailand
- Food and beverage
- www.facebook.com/BetterFlyBSF/
- Analysis period: 2021-2023

Decentralised Food Waste Recovery through Insect Farming

Business Spotlight

The BetterFly Social Enterprise Company (BetterFly) had started under the name 'Food Loss Food Waste' to produce black soldier fly (BSF) derived products that are high in protein, fat, and minerals, and are a good alternative to traditional animal feeds such as fishmeal and soybean meal. Other byproducts, particularly frass (metabolic waste) and the pupae exoskeletons, can be used as fertiliser. BSF products are also used as feed for exotic pets such as roosters. BetterFly has achieved steady growth in its waste processing, which increased from zero tonnes in its initial stages to 5 metric tonnes in 2021, 7 metric tonnes in 2022, and 10 metric tonnes in 2023.

The company contributes to resource circularity as it uses organic waste as a raw material for growing the insects that become animal feed and organic fertiliser. The company has successfully developed a protein powder from the BSF larvae that is being used as a fish feed supplement. This sustainable protein source for aquaculture replaces fishmeal production with its environmental impact. BetterFly operates on a basis of 50–50 benefit sharing with the local operators of its decentralised BSF facilities in communities, schools, etc.

The company has successfully demonstrated potential, but several challenges remain in scaling up its operations to commercial and industrial levels. These include the need for substantial capital investment in infrastructure and equipment, the ongoing refinement of value-added production technologies, and securing suitable land for BSF farming. To overcome these hurdles, BetterFly is actively exploring partnerships and collaborations with local government agencies and landowners for setting up a larger BSF farm.

Keywords

Food waste, Animal feed, organic fertilizer

Innovation

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



Analysis of BetterFly

Context and baseline

Thailand faces significant challenges in managing its food waste. In the Bangkok Metropolitan Area, only 2% of collected food waste is claimed to be recycled, with the remainder ending up in landfills, causing soil, water, and air pollution. This issue is further exacerbated by the limited number of proper waste disposal sites, leading to environmental pollution and community health concerns.

The wastes also create a heavy financial burden for local government agencies. According to the Department of Pollution Control, the Thai government spends THB 20 billion per year (about EUR 500 million) on waste management and collects only about THB 2,800 million (about EUR 70 million) on waste management fees. This implies that the government is subsidising waste management to the tune of THB 17,200 million (EUR 430 million) per year from general revenue sources.

Driven by a commitment to contribute to food security and sustainable farming practices, founder Mr. Trin recognised the potential of Black Soldier Fly (BSF) larvae to transform organic waste into valuable resources. This led to the establishment of BetterFly, a social enterprise focused on developing a circular economy model that benefits both the environment and local communities.

Innovation

BetterFly innovates in waste management and sustainable agriculture through the utilisation of Black Soldier Fly (BSF) larvae. This process, known as BSF bioconversion, efficiently converts organic waste materials into high-quality protein-rich animal feed and nutrient-rich organic fertiliser.

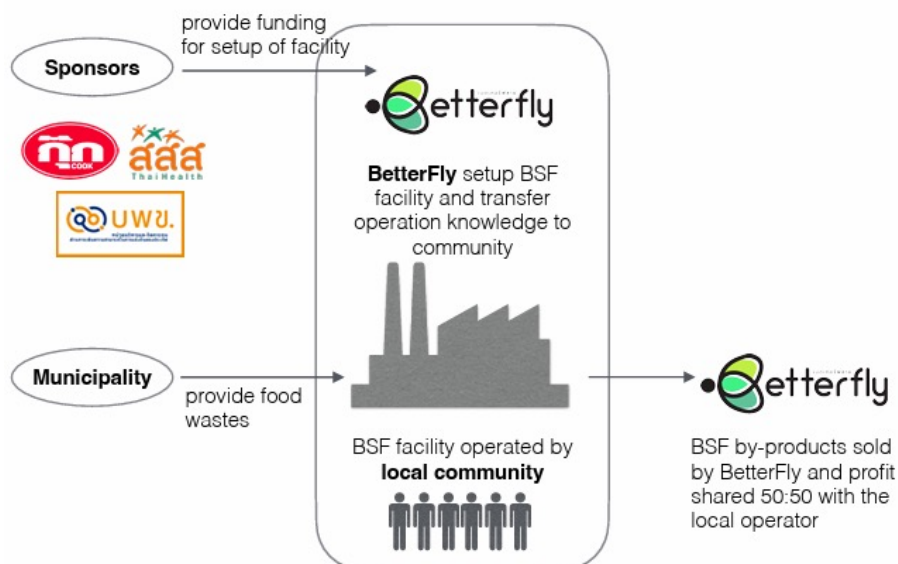
BetterFly provides technical support to local communities, schools, business, municipalities, and other organisations to set up and operate their own decentralised BSF farm. BetterFly incentivises the local operators of the decentralised BSF facilities in communities and schools with its 50–50 benefit sharing for the sales of BSF larvae products and byproducts.

The BSF larvae are voracious consumers of food waste, each capable of processing up to 200 mg per day and accelerating the bioconversion process, resulting in the production of a variety of valuable byproducts:

- *High-Protein Animal Feed:* BSF-derived products offer a sustainable and nutrient-rich alternative to traditional animal feed sources like fishmeal and soybean meal;
- *Frass Fertiliser:* The excrement of BSF larvae, known as frass, is a potent organic fertiliser that enriches soil and improves crop yields; and
- *Other byproducts:* BSF remains can be utilised as feed for specialised animals like roosters, further maximising resource utilisation.

BetterFly has demonstrated a significant increase in its waste processing capacity, from zero metric tonnes initially to 10 metric tonnes in 2023, the cumulative total of all the decentralised BSF facilities the company has set up.

BetterFly's commitment to innovation extends to partnerships with leading organisations like South Pole, an international organization specialising in emission reduction projects. South Pole has offered support in verifying carbon credits generated by BetterFly's BSF facilities, which may unlock additional economic benefits and confirm the environmental benefit of the technology.



BetterFly's innovation has improved access to sustainable and high-quality protein for animal farmers. Additionally, the byproducts have found applications as fertiliser and specialised animal feed. Notably, BetterFly has collaborated with the Faculty of Veterinary Medicine at Chulalongkorn University to develop a protein powder from BSF larvae for fish feed, and has explored the potential of BSF-derived oil for cosmetic applications.

Circular Economy impact

Based on the three years of piloting a business plan between 2020–2022, BetterFly contributes to a circular economy transition through the circular recovery and reuse of food waste ingredients, an example of resource circularity at local level. The company turns organic waste into valuable resources, particularly protein-rich animal feed (the BSF larvae) and nutrient-rich organic fertiliser (from frass and exoskeletons).

BetterFly diverted 5 metric tonnes of organic waste from landfills in 2021, which increased to 7 metric tonnes in 2022 and 10 metric tonnes in 2023. The company has estimated annual reduction of greenhouse gas (GHG) emissions by 9.5, 13.3, and 19 tonnes CO₂, respectively, demonstrating the climate benefits of its technology.

The BSF farming process uses a minimal amount of land, leaves minimal waste, and by drying with natural sunlight and the wind, the process uses minimal electricity.

Business and market impact

BetterFly's business model shows potential for replication and growth, with the main challenge being to achieve the goal of a guaranteed and steady supply of around 100 metric tonnes of food waste annually. Based on pilots thus far, this goal would yield 20 metric tonnes each of BSF larvae and organic fertiliser. At this scale, the company could expect a return on investment in 3 years.

Until now, however, revenue generation has remained minimal. In 2023, BetterFly generated THB 28,019 (approximately EUR 710) from the sales of 10,341 k of BSF products, which was shared equally with local partners operating the BSF facilities.

The community engagement creates a reliable supply of source-segregated food waste, albeit in quantities that are too limited. Taking a broader perspective, there is plentiful food waste generated and a growing demand for sustainable animal feed, which means that a foundation for commercialisation does exist. The company is trying to tap into funding

from the mandatory Corporate Social Responsibility contributions of regulated firms so as to mobilise capital for setting up a 100 metric tonnes/year BSF farm and processing system.

Stakeholders

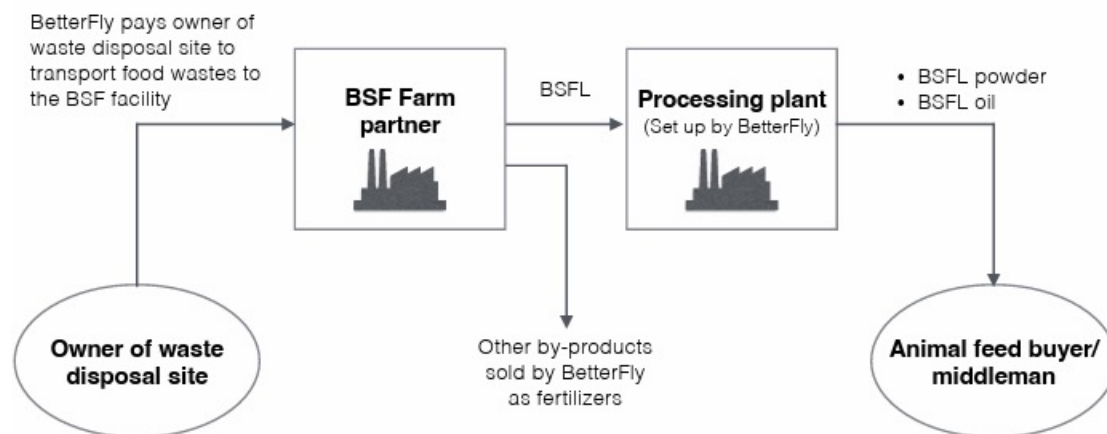
BetterFly has created a collaborative network. On Koh Samui and Koh Si Chang, BetterFly works with local communities to establish and operate small BSF systems with the active participation of communities in waste diversion, including training them on waste management and farming practices. Communities are empowered to divert food waste from landfills and utilise the resulting products for agricultural purposes. Elsewhere BetterFly collaborates similarly with local schools, businesses, and municipalities.

The company has secured funding from various organisations, including Thanakorn Vegetable Oil Products Co. Ltd (<https://www.cook.co.th/en/about/company-profile>) and the Thai Health Promotion Foundation. In Koh Samui, the company has also received financial support of THB 500,000 (around EUR 12,700) from the Program Management Unit for Competitiveness (PMUC, Office of National Higher Education Science Research, and Innovation Policy Council (NXPO)), and the Thai Health Promotion Foundation (THB 850,000, or EUR 21,600) provided funding for the installation of machinery and equipment along with operation investment.

BetterFly has gained significant media exposure through online platforms like 'Kong GreenGreen' and 'Pear is Hungry', as well as on national television programmes like 'Thai PBS'. This exposure has raised awareness of their innovative approach and attracted further support for their mission.

BetterFly has secured commercial partnerships for the supply of 3 metric tonnes of food waste annually with Central Si Racha, Chonburi province, part of its Corporate Social Responsibility programme. Food waste generation is especially high during the weekend with large numbers of visitors.

The company is actively engaged with government initiatives like Mae Moh Smart City, exploring opportunities to integrate BSF bioconversion into urban waste management strategies. Furthermore, BetterFly collaborates with academic institutions like Chulalongkorn University to refine its technology and develop new applications for BSF-derived products.



Implementation

Despite its achievements with local multi-stakeholder engagement, BetterFly faces challenges in scaling its operations to larger commercial and industrial levels. These challenges include:

- *Capital Investment:* significant investment is needed for expanding facilities, acquiring advanced equipment, and further developing value-added production technologies;
- *Land Availability:* Securing suitable land to rent or buy for BSF farming, especially in urban or densely populated areas, can be a constraint for a social enterprise such as BetterFly; and.
- *Competition:* The company faces competition from other waste management providers, particularly at the community level. In addition, government agencies appear to have set their focus on high-investment incinerators for solid waste management instead of low-cost investments like BSF farming.

To address these challenges, BetterFly is actively seeking collaborations with both private sector partners and local government agencies. Joint ventures and strategic partnerships could possibly help overcome financial and logistical barriers, enabling the company to expand its reach and impact.

Takeaways

BetterFly's achievements thus far depend on its efforts to create a multi-stakeholder model for the circular economy. By engaging with diverse partners and adapting its business model, the company has started to address pertinent challenges for Thailand's waste management and agricultural sectors.

Acknowledgements

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