Valorising Biowaste Using BSF: A Cost Model and Market Assessment

Technical viability of the Black Soldier Fly biowaste conversion system has been shown. Economic viability, however, requires cost analysis of the technical system and analysis of what products could be substituted by BSF products. These are needed to plan viable business models. Bram Dortmans[1], Grégoire Virard[1], Early Antarest[1], Putu Putri Indira Sari[1], Christian Zurbrügg[1]

Introduction

Two Eawag projects are currently ongoing in Indonesia with a focus on Black Soldier Fly (BSF) biowaste conversion. From Organic Waste to Recycling for Development (FORWARD) started in July 2013 (funded by the Swiss State Secretariat for Economic Affairs, SECO) and had the main objective to improve biowaste recycling by exploring local market opportunities for biowaste conversion products. After evaluating waste amounts, waste accessibility and the market potential of different biowaste conversion products, results showed that the most promising biowaste derived value product is protein for animal feed. FORWARD then piloted a facility where biowaste conversion by Black Soldier Fly Larvae (BSFL) was developed as the core technology. The project is now in its final phase, assisting private partners and the local government of Surabaya to set up BSF facilities and develop financially viable business models.

Although BSF biowaste conversion is now being replicated worldwide by private enterprises, municipalities and waste utilities, it remains an innovation. More evidence on product development, respective markets and economic feasibility is required to make a stronger case for BSF technology. Therefore, in December 2017 a second project, Sustainability of Insect-Based Recycling Enterprises (SIBRE) (funded by the Swiss-Re Foundation) started, focussing on the financial and business aspects of the BSF biowaste conversion system.

Figure: Black Soldier Fly life cycle at the BSF biowaste conversion pilot facility in Sidoarjo, Indonesia.

Early Antarest

Photo 1: Survey work by the SIBRE team in the local markets around Surabaya.

Activities

In 2018, SIBRE worked on two main activities: 1) cost analysis of setting up and running a BSF facility, using the data from the FORWARD pilot site in the city of Sidoarjo and 2) market analysis exploring the potential for BSF conversion products in Eastern Java (Figure). Cost analysis work started by structuring each operation of the BSF system with its inputs and outputs in a flow chart. This flow chart was then used to collect the data for a cost model. The market analysis study targeted two customer groups: 1) the farmed animal market (poultry and aquaculture feed) and 2) the domesticated animal market (bird, ornamental fish and reptile feed). For the farmed animal market, existing reports and literature were used to estimate the market size based on sales of existing products that could be substituted by BSF conversion products. Such data was, however, not available for the mostly informal, small-scale, domesticated animal market. There-

fore, surveys and interviews were done to identify potential products to substitute and better understand the existing supply chains and business models (Photo 1).

Results

A first version of the cost model, structured as an Excel spreadsheet, was finalised at the end of 2018. It includes an overview of all costs and revenues of a BSF biowaste conversion system, comprising all individual components, starting from biowaste sourcing to biowaste processing, up to marketing of conversion products. Given its activity-based structure, an operator can choose to analyse only one section of the system as a potential business scenario, much like in the poultry industry where hatching and breeding of chicks, fattening the chickens, and slaughtering and processing the meat into products are often divided into separate businesses.

More than 80 interviews with breeders, retailers and customers in the domesticated animal market were done for the SIBRE market analysis (Photo 2). Results estimate that the market size of this segment for the Surabaya region is ~3331 tons/year, and that there are around 40 potential products that could be substituted by BSF conversion products. Survey results show that interest in BSF products is high and because of the informal environment, there is no obvious obstacle that could hinder the introduction of BSF products in this segment. In contrast to the domesticated animal feed market, the prices for potential substitute products fed to farmed animals are low. Therefore, based on this study, this market segment is not considered a viable option for BSF conversion product sales in eastern Java.

The survey team also managed to compile data on current pricing for most products that could be replaced by (processed) BSF products. Preliminary cost-analysis data of the post-processing equipment and other operational costs show that the production costs would allow for a generous margin if sold at the same prices collected by the surveying team. Yet, respondents faced a major issue. Handling insects as a feed for pets requires storing the product. Live insects cannot be purchased in bulk and even if the insects are processed, their expiration date is often only a few months. The respondents would, however, accept these challenges in handling the product. 80 % answered that they would buy the product because insects are a natural part of their pets' diets.

Early Antarest

Photo 2: Preparation for a singing bird contest in Surabaya.

Conclusion

As the BSF cost model is still quite complicated to use, SIBRE will focus on verifying and simplifying the model as a planning tool for those interested in setting up a BSF system. The currently available version can serve to analyse the performance and cost optimisation of an existing BSF facility.

Besides continuing research to optimise BSF operations at scale, both projects will continue their support and dissemination activities of the BSF technology for worldwide use. Specifically, for Indonesia, in collaboration with SECO and the Ministry of Public Works and Housing, the project will provide technical support to private enterprises and the Municipality of Surabaya. The results will be disseminated to the government of Indonesia and other stakeholders to help them improve waste management at the local level.

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