

Market potential for BSFL products in Surabaya – East Java

Context

Valorising organic waste with the Black Soldier Fly Larvae (BSFL) is becoming increasingly popular, especially in low- and middle-income countries. The popularity links to the opportunity of using the harvested BSFL as an alternative to conventional feed. In low- and middle-income settings with lacking waste collection and treatment infrastructures and services, revenue creation from BSFL biowaste processing can play an essential role for a sustainable biowaste business. However, to achieve this, finding the right target market is crucial. This factsheet evaluates the market potential of two main market segments in East Java, potential product replacements for BSFL products as well as the awareness, popularity and perception of BSFL products as pet food in Surabaya (East Java).

Potential markets for BSFL products

A market assessment was conducted to investigate two main market segments for East Java: farmed animal feed for poultry meat production and aquaculture as well as pet food mainly for ornamental birds (OB) and ornamental fish (OF). The market demand was quantified for currently used feed products which are similar to BSFL products. Similar products included other insect based products as well as pellets containing soy or fish meal, which could be replaced by BSFL

defatted meal. Results are summarized and presented in Table 1. Based on these results and the current scale of BSFL biowaste processing, the pet food segment was identified as a promising market for sales for BSFL based on animal feed products in East Java (Antarest, et al., 2020).

Assuming all collected organic waste in Surabaya will be treated by BSFL, a total of 280 tons of fresh larvae or roughly 80 tons of dried products could be produced every month. We estimated a market size of around 300 tons per month and a market value of around one million US dollars per month for the pet food sector in the area of Surabaya. The pet food market would be large enough to absorb all BSFL products that could be produced from the available organic waste and at the same time small enough for BSFL producers to fulfil the quantities needed. The market demand for farmed animal feed is substantially higher with 60'000 tons per month in East Java which can be hardly be met by the BSFL producers currently. Additionally, pricing in the pet food segment seems to be more flexible and prices and potential profits in general are higher, with 1 to 25 USD per kg. Farmed animal feed prices of 1 to 3 USD per kg make it difficult for BSFL facilities to operate profitable, if BSFL products are the single revenue stream to cover all operating costs. Finally, the pet food segment is less regulated and there is a higher product variety which makes it easier to enter for market newcomers.

Table 1: Results of market assessment, comparing the farmed animal feed and pet food market segments as potential markets for BSF conversion products (Antarest, et al., 2020).

	Farmed animal feed (Area East Java)	Pet food (Area Surabaya)
Product variety (identified substitute products)	9	30
Market size (tons/month)	57'909.9	303.3
Market value (USD/month)	70 Mio	1 Mio
Market price range (USD/kg)	1-3	1-25
Market environment	Formal, many regulations	Informal, less regulations

BSF market studies focused on the pet food sector in Surabaya

A market survey among pet food retailers in Surabaya identified potential substitutes for BSFL products and their average sales prices and sales volumes per month. Moreover, the popularity of BSFL products in the local pet food market was evaluated by conducting questionnaires and asking the retailers e.g. about their awareness and sales activities of BSFL products. The survey was first performed at the beginning of the SIBRE project in 2018 and was repeated towards the end of the project in 2020 to evaluate the development of the popularity of BSFL products and the impact of the project.

Partnered with PRO BSF, the SIBRE project actively developed and marketed BSFL products to retailers in Surabaya between July 2019 and July 2020. Respondents were retailers which are actively selling pet food products for either OB or OF. All retailers interviewed were randomly selected and were in no relation to the project. The sample size was higher in 2020 with 77 retailers compared to 26 retailers in 2018. Therefore, mean sales prices and volumes of 2020 might be more representative for all retailers in Surabaya, as a larger subset was covered. For both analysis, the total number of retailer in Surabaya was assumed to be the same and was based on an analysis of certain selling "hot-spots".

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The analysis covered a total of 340 pet food retailers in Surabaya, of which 155 are selling mainly OB feed and 185 mainly OF feed. The SIBRE project actively partnered with retailers between 2019 and 2020, which then started selling BSFL products produced by the project partner PRO-BSF. The same questions were asked to the 23 partner retailer on top of the 77 random selected retailers.

Potential substitute products for BSFL feed and their market demand and value

The most popular pet feed products, which could be substituted, and their sales prices and volumes are listed in Table 2 for 2018 and Table 3 for 2020. Column A lists the product group with the most popular type or brand in brackets and column B indicates a BSF product that could replace the product in column A. All of the listed products represent the most common and famous products in the current pet food mar-

ket, which respondents mentioned that would be possible to be replaced with BSFL products. The mean sales volumes per retailer (column D) were extrapolated to the total number of retailers (column E) in Surabaya selling the respective pet food products to obtain overall sales volumes for Surabaya (column F and G).

By comparing Table 2 and 3, a shift to more insect based feed becomes evident. This becomes obvious when looking at the sales volumes of live insects and dried insects, which more than doubled within two years. Next to live insect feed and dry insects, in 2020 also insect meal made it to the most popular products. This indicates a higher awareness and interest in insect based feed products by retailers and costumers. Other than a shift to insect based feed, the two surveys had similar outcomes for the different product types. The popularity of products remained similar, especially also popular brands like Chirpy and Takari were still most dominant pellet brands, indicating that retailers tend to stick to known brands for processed feed products.

Table 2: Survey 2018: Popular substitute products for BSFL products and their mean sales prices, sales volumes and extrapolated market demand and market value. OB: birds, OF: ornamental fish, R: Retailers

Products (A)	BSF products (B)	Price (C)	Mean sales volume / R (D)	# of R (E)	Sales volume (F) (D*E)	Sales volume (G) (C*F)
		USD/kg	kg/month	#	kg/month	USD/month
Living insects (mealworm)	Fresh BSFL	7.1	20	340	6'800	48'280
Dried insects(mealworm)	Dried BSFL	25	20	340	6'800	170'000
OB pellets (Chirpy)	BSFL Pellets	1.7	622	155	96'410	164'982
OF pellets (Takari)	BSFL Pellets	3.3	759	185	138'897	460'611
Ants eggs (Kroto)	Eggs, dried BSFL	7.1	25	340	8'500	60'350
Crickets	BSF, dried BSFL	8.6	35	340	11'900	102'340
Total					270'875	1'011'597

Table 3: Survey 2020: Popular substitute products for BSFL products and their mean sales prices, sales volumes and extrapolated market demand and market value. OB: birds, OF: ornamental fish, R: Retailers

Products (A)	BSF products (B)	Price (C)	Mean sales volume / R (D)	# of R (E)	Sales volume (F) (D*E)	Sales volume (G) (C*F)
		USD/kg	kg/month	#	kg/month	USD/month
Living insects (mealworm)	Fresh BSFL	15	45.3	340	15'402	229'673
Dried insects(mealworm)	Dried BSFL	17	55	340	18'681	318'821
OB pellets (Chirpy)	BSFL Pellets	3.4	196.9	155	30'525	105'152
OB mix (Topsong)	BSFL mix	1.5	118.3	155	18'330	27'154
OF pellets (Takari)	BSFL Pellets	5.8	167	185	30'895	179'191
Ants eggs (Kroto)	Eggs, dried BSFL	21.4	15.3	340	5'202	111'471
Insect meal (cricket flour)	BSFL meal	22.2	1.4	340	486	10'783
Total					119'521	982'245

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Volume wise the market demand decreased in 2020 to 120 tons per month compared to 271 tons per month in 2018. Nevertheless, the market value remained almost constant at around one million USD per month, as mean sales prices of almost all products increased. The survey of 2020 was performed just when most of the retail stores started operating again after several months of lockdown due to the Covid-19 pandemic. This could have affected retailer's responses towards their monthly sales as well as their pricing strategy. Sales prices increased substantially for live insect products and ant eggs. Both product groups have a short shelf life and

hence, the availability might fluctuate more, which could explain higher and more fluctuating sales prices.

Awareness and popularity of BSFL products in the pet food market in Surabaya

The awareness and popularity of BSFL products is summarized in Table 2. Awareness, sales activities and sales volumes of BSFL products have clearly increased within the two years observed.

Table 4: BSFL product awareness and sales performance of respondents in 2018 and 2020.

	Unit	Survey 2018	Survey 2020
Sample size	#	26	77
Awareness of BSFL products*	%	3.5	7.7
Selling BSFL products*	%	0	3
Selling BSFL products (+ 23 SIBRE acquired retailers)*	%	0	9.7
Mean price of BSFL products	USD/kg	-	13.6
Mean price of substitute products	USD/kg	8.8	12.3
Sales volume of BSFL pop larvae (incl. SIBRE retailers)	kg/month	0	830

*based on the assumption of a total of 340 retailers actively selling pet food in Surabaya

In 2018, 3.5% of the retailers were aware of BSF products although no BSFL products were actually found on the market nor have actual sales been reported. In 2020, the awareness of BSF products increased to 7.7% and 3% of the retailers started selling BSFL products. As the SIBRE played an active role in marketing BSFL products, 23 more retailers are selling BSFL products within Surabaya. This results in a total of 9.7% of all BSFL products selling retailers in Surabaya. The mean sales price of BSFL products is with 13.6 USD per kg slightly

higher than the mean sales price of substitute products (12.3 USD per kg). Based on their mean sales activities, all BSFL retailers come to a sales volume of 830 kg per month with a value of 11'300 USD per month. Compared to the estimated market value of one million USD for products in Surabaya, that could be substituted by BSFL products, this would correspond to a market share of 1.2%. The most common BSFL product were Pop BSFL (i.e. dried BSF larvae), which are crunchy and puffed BSFL (see Figure 1).



Figure 1: POP BSFL (microwaved dried BSFL) produced and packed by PRO-BSF

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Perception of BSFL products

Respondents were also asked about strengths and weaknesses of the BSFL products. Figure 2 shows the five most frequently mentioned strengths and weaknesses of BSFL products by respondents. Strengths include the high protein content of the products and that the BSFL products are simple, natural, storable and come with a good packaging. Weaknesses of the products are their newness, unknown effects on animals, difficult usage, unpopularity and their high price.

By far the most dominant weakness is the newness of the product, which indicates that customers tend to stick to well-known products and selling new products is more difficult, especially when effects on animals is unknown. The strengths show that respondents see a lot of benefits in BSFL products and they can compete quality wise with current products as they are natural and meet the expectations in protein content.

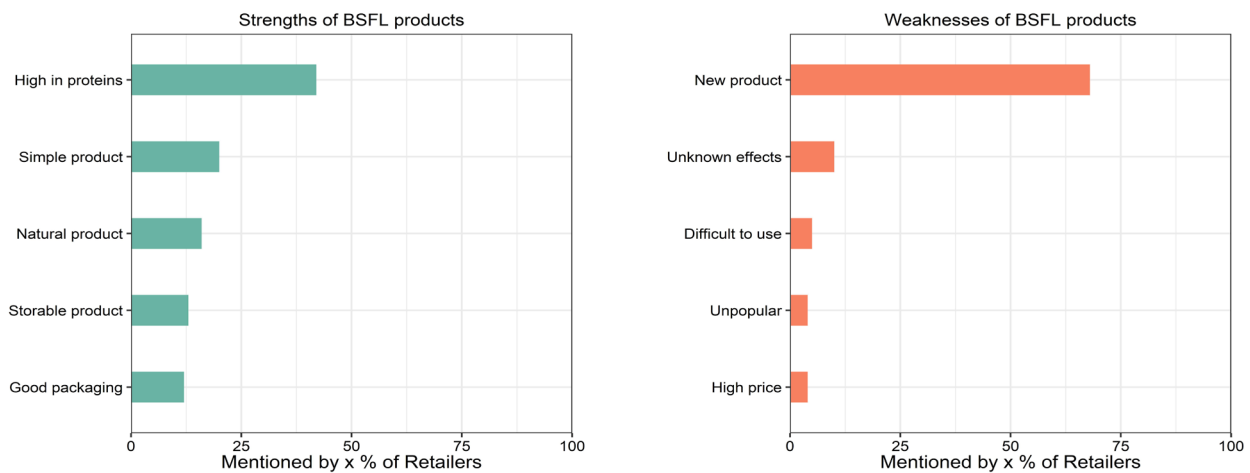


Figure 2: Five most mentioned strengths and weaknesses of BSFL products by retailers.

Perception of BSFL products

Finally respondents were also asked what they think which form of BSFL products might be most successful. Whereas in 2018 only images of different options were shown, actual products produced by the partner PRO-BSF were shown in 2020. Different options were BSFL meal (defatted powder), BSFL pellets, dried BSFL (oven dried BSFL), fresh larvae and Pop BSFL (microwave dried BSFL). Figure 3 illustrates the answers from 2018 compared to 2020. In 2018, the clear fa-

vorite were BSFL pellets, whereas in 2020 it was Pop BSFL. In contrast to 2018's survey, respondents in 2020 gained already some experience in selling BSFL products and are more convinced about the Pop BSFL product. Pellets are still the most dominant feed type (see Table 2 and 3), but the brand plays an important role. New pellet brands from BSFL facilities might be more difficult to sell in pellet form, as the competitor brands are well established and trusted.

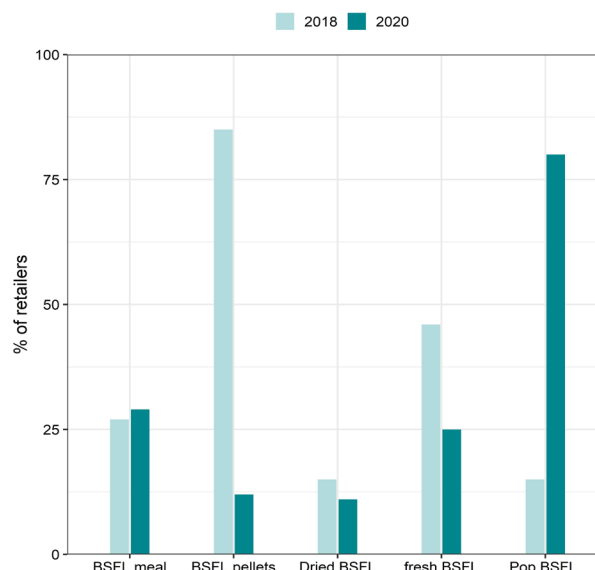


Figure 3: Popularity of BSFL product types by retailers

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Conclusions and outlook

For current BSFL producers in East Java, the pet food market has a high potential for selling BSFL products and achieving higher profit margins. Insect based feed is becoming increasingly popular in general, sales volumes are increasing and sales prices are on a higher level and comparable to current sales prices of BSFL products. BSFL products are still new products but it was possible to increase their sales volume from 0 to 830 kg per month in Surabaya and currently hold a market share of 1.2%. The most popular product is Pop BSFL, which are microwave dried larvae with a crispy texture

and puffed shape. The newness and other issues related to a newly marketed product still remain a challenge for the further growth of BSFL products in the selected market, as retailers and customers tend to stick to well-known products. Especially the effect on the animals fed (OF and OB) is still unclear. For a successful marketing of BSFL products a close engagement with the target communities is essential to gain trust and to proof positive effects of the products on the animals.



Figure 4: SIBRE staff member, Mauliddiana Nurul Ilyas, promoting BSFL products to Mas Sueb, a retailer in the market. Photographer: Yosa Padu

References

Antarest, E., Egger, J., Virard, G., Dortmans, B., Zurbrügg, C., 2020. Market Assessment for BSF products. Eawag: Swiss Federal Institute of Aquatic Science and Technology.