



Global   
**FOODTURE**

# Insects as the future of food proteins?

Workshop 1

7 October 2022

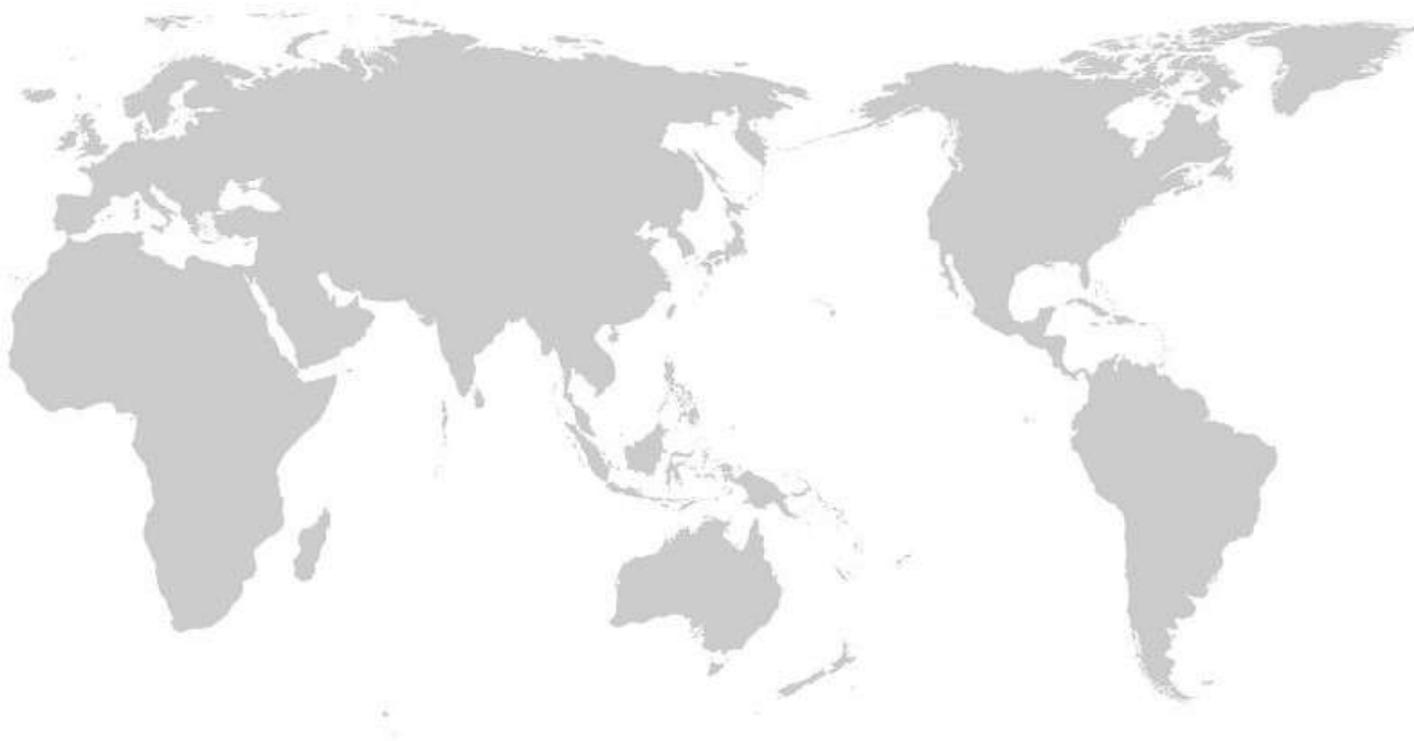


# Organisers



Global Foodture is co-funded by the European Union's COSME Programme. The content of this document represents the views of the author only and is his/her sole responsibility; it cannot be considered to reflect the views of the European Commission and/or the European Innovation Council and SMEs Executive Agency (EISMEA) or any other body of the European Union. The European Commission and the Agency do not accept any responsibility for use that may be made of the information it contains.

# Welcome!



Over 140 Participants

From 25 Countries

30 from Asia  
90 from Europe  
& other regions



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# Global Foodture project

European project, collaboration of 7 European Clusters and Asian partners: Enterprise Singapore, Foodpolis, FoodInnopolis, TMA Thailand, Kobe University and NARO.

Aiming to stimulate innovation collaboration between European SMEs and Asian organisations - Japan, Singapore, South-Korea Thailand

2022 - 2023: Several activities, including matchmaking, training program, international missions and online thematic workshops

Themes:

- Agriculture - cultivation & support solutions
- **Alternative proteins**
- Sustainable packaging
- Solutions to reduce food waste
- Health products, functional and personalised food



# Programme

09.00 **Welcome & General Introduction**

09.05 **Insects scan - opportunities and challenges in Europe & Singapore**

by Ying Xuan Lim, Enterprise Singapore &  
Jolijn Zwart-van Kessel, Innovation Lead Circular Agrifood Foodvalley NL

**Introduction Masterclass 1** 'Insects for human consumption'

09.25 **Company Presentations from:**

- Sibö B.V., Camila Cossetin, R&D manager

- Global Bugs Asia, Ms. Kanitsanan Thanthitawat, CEO & Head of M&S & Co-Founder

09.45 **Q&A**

**Introduction Masterclass 2** 'Insects and valorisation of by-products'

09.55 **Company Presentations from:**

- Insect Feed Technologies, Marcus Wong, Head of Commercial

- Entomo Agroindustrial, Juan Cortes, Research

10.15 **Q&A**

10.20 **Wrap-up & Closing**

10.30 **End of the Workshop**

# Insect Scan – Opportunities and Challenges in Europe and Singapore



Ying Xuan Lim,  
Development partner Agritech, Enterprise Singapore



Jolijn Zwart-van Kessel,  
Innovation lead Circular Agrifood, Foodvalley NL





# Insect Industry Overview: Europe & Singapore

Foodvalley NL & Enterprise Singapore  
October 7th, 2022



# About our Collaboration & the Insect scan that soon will be published



Soon Enterprise Singapore and Foodvalley NL will publish a jointly developed Insect Innovation Scan.

The scan brings together a shared vision on the development and opportunities of the insect sector internationally.

Foodvalley NL and Enterprise Singapore team up to highlight the rapidly occurring innovations in this exciting sector from an Asian and European perspective.

Please follow us on LinkedIn for the publication of the Insect!





- 1. About our collaboration**
- 2. Global Industry Overview**
- 3. Europe Market**
  - a. Key Facts & Figures
  - b. Challenges & Opportunities
  - c. Future Initiatives & Collaboration
- 4. Singapore Market**
  - a. Key Facts & Figures
  - b. Challenges & Opportunities
  - c. Future Initiatives & Collaboration

## Diapositiva 9

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- 1 I have moved the initiatives and collaborations to the end of our part because we don't have to switch speakers then. I think that is more logical.

Jolijn Zwart-van Kessel; 05/10/2022



**Section 1:  
Global Industry  
Overview**

# Farmed insects are mainly used for animal feed, organic fertilizers with frass, human consumption, biofuels, cosmetics, pharmaceuticals & more



Market for insects as feed was valued at USD 688 million in 2018 and expected to grow up to USD1.4 billion by 2024.



The insect-based food & beverages segment is expected to grow rapidly from 2020 to 2030 driven by rising food shortage worldwide and increasing demand for high-quality alternative protein sources among end users.



Frass, which includes the biological waste of insects and undigested food, is one of the main outputs of insect rearing, suitable as an organic fertilizer



Biomaterials like chitosan extracted from insects can be used for the cosmetics industry given its antioxidant, antimicrobial and wound-healing properties.

## Growth of insects sector driven by growing population and need for sustainably-produced source of protein for food and feed

### Growing population creating a protein gap



Global population will increase to **9.7 billion by 2050** from 7.9 billion today. In developing countries, per capita meat consumption has doubled since 1980 and is expected to rise by 50% by 2050, according to UN FAO.

### Current ways of producing protein are not sustainable



Concerns over the environmental impact of soybean cultivation and fishmeal production have led to a search for alternative protein sources. The cost of fishmeal and soybean have also risen, and are susceptible to price volatility.

### Large volumes of waste produced, with a need to valorize them



Around **931 million tonnes** of food were wasted in 2019. Insects feed on food waste, agricultural residues, and agri-business processing byproducts to convert into insect-based products.

## Globally, there are >250 companies working on insects for food and feed<sup>1</sup> and notable global and regional leaders



**Enterra Feed (Canada), 2007** – Manufactures BSF-based animal feed and oil



**Aspire Food Group (U.S.), 2013** – First fully automated cricket farm and produces cricket-based food products



**Hargol FoodTech (Israel), 2014** – First commercial-scale grasshopper farm and producers of grasshopper protein powder



**Nutrition Technologies (Singapore), 2017** – Grow and produce BSF protein and frass using proprietary decomposition process

**Entobel (Vietnam), 2016** – Produce insect based ingredients from BSF. Raised US\$30 million in 2022.



**Ynsect (France), 2011** – Cultivate mealworms to produce protein and fertilizer through a patented process. Raised US\$372 million Series C funding in 2020.



**InnovaFeed (France), 2016** – Runs a commercial-scale BSF facility with capacity of 15,000 tons of insect protein per year for feed industry. Raised US\$166 million in 2020. Temasek Investee



**Protix (Netherlands), 2009** – Rears BSF in a large-scale fully automated facility to extract BSF protein and fats for animal feed. Raised €50 million in 2022.

<sup>1</sup> Van Huis A. 2020. *Insects as food and feed, a new emerging agricultural sector: a review*. J Insects Food Feed 6:27–44.



## Section 2: European Market

## The European Insect Industry is a global leader, attracting significant investments to scale insect production for food & feed

### Application

Mostly specialized pet food, livestock feed (aquafeed) and soil fertilizer -> influence EU<sup>1</sup>



### Demand

As of 2021, demand higher than supply<sup>2,3</sup>



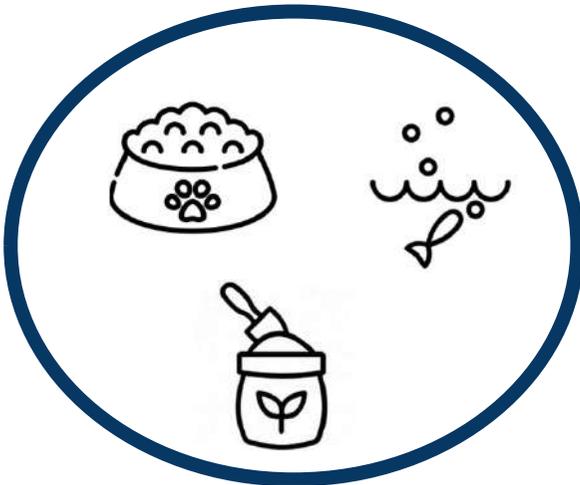
### Investments

Reached 1 billion in 2021 and just for feed



### Output volume

194.000 tonnes in 2020<sup>5,6</sup>



<sup>1</sup> IPIFF. (2022a). Factsheet: An overview of the European market of insects as feed.

<sup>2</sup> RaboResearch. (2021). No Longer Crawling: Insect Protein to Come of Age in the 2020s.

<sup>3</sup> Veldkamp, T., Meijer, N., Alleweldt, F., Deruytter, D., van Campenhout, L., Gasco, L., Roos, N., Smetana, S., Fernandes, A., & van der Fels-Klerx, H. J. (2022). Overcoming Technical and Market Barriers to Enable Sustainable Large-Scale Production and Consumption of Insect Proteins in Europe: A SUSINCHAIN Perspective. *Insects* 2022, Vol. 13, Page 281, 13(3), 281. <https://doi.org/10.3390/INSECTS13030281>

<sup>5</sup> Statista. (2019). • Forecast of insect protein production in Europe to 2025 | Statista. <https://www.statista.com/statistics/1148059/forecast-of-insect-protein-production-in-europe-food-and-feed/>

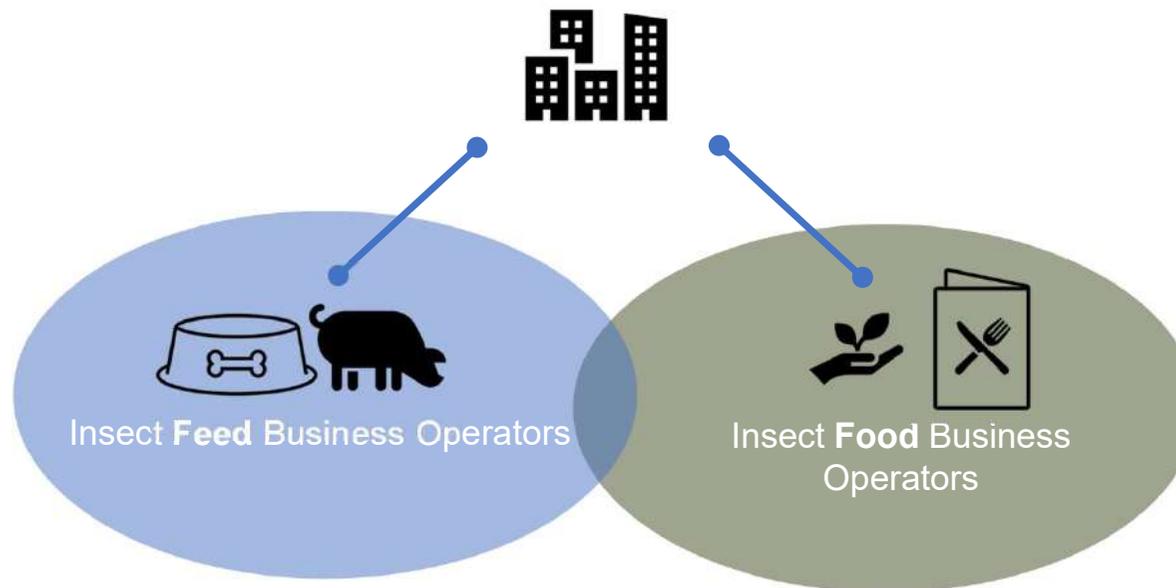
<sup>6</sup> Skotnicka, M., Karwowska, K., Klobukowski, F., Borkowska, A., & Pieszko, M. (2021). Possibilities of the Development of Edible Insect-Based Foods in Europe. *Foods*, 10(4). <https://doi.org/10.3390/FOODS10040766>

# Industry Overview Europe

## Companies Development Key Facts & Figures

### Edible insect industry Europe

- ❑ 40% Micro-sized companies<sup>7</sup>
- ❑ More medium-sized companies, few very large players



- ❑ 81% Micro-sized companies<sup>8</sup>
- ❑ No large producers



Micro-sized company: <10 employees  
 Small-sized company: 10 – 50 employees  
 Medium-sized company: 50 – 250 employees  
 Large-sized company: 500+ employees

<sup>7</sup> Mancini, S., Sogari, G., Diaz, S. E., Menozzi, D., Paci, G., & Moruzzo, R. (2022). Exploring the Future of Edible Insects in Europe. *Foods* 2022, Vol. 11, Page 455, 11(3), 455. <https://doi.org/10.3390/FOODS11030455>

<sup>8</sup> IPIFF. (2022b). Factsheet: Edible insects on the European market.

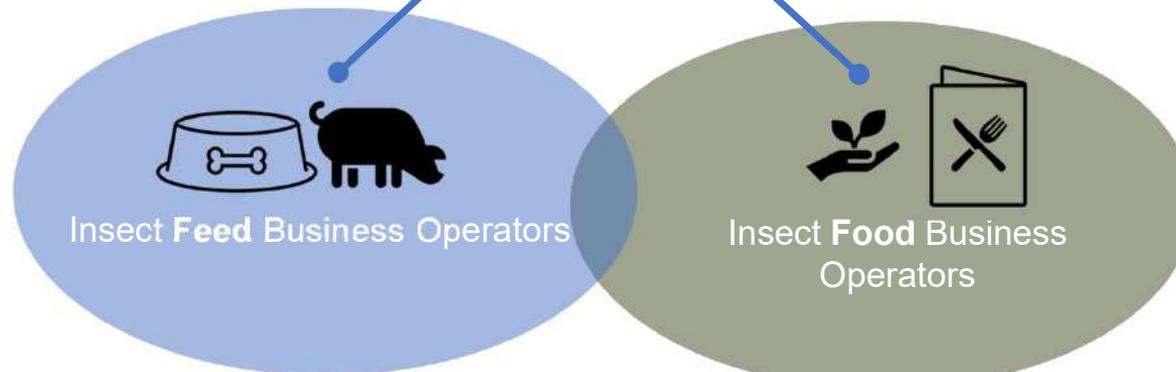
# Industry Overview Europe

## Investment Landscape

### Edible insect industry Europe



- ❑ Total 1 billion € as of 2021<sup>7</sup>
- ❑ Single investments up to 150 million €<sup>7</sup>



- ❑ Majority micro-sized companies investments are <500.000 €<sup>8</sup>
- ❑ 3% gets up to 25 million €<sup>8</sup>

Niche market<sup>9,10</sup>

<sup>9</sup> Jones, V. (2020). 'Just don't tell them what's in it': Ethics, edible insects and sustainable food choice in schools. *British Educational Research Journal*, 46(4), 894–908. <https://doi.org/10.1002/BERJ.3655>

<sup>10</sup> Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International*, 122, 661–678. <https://doi.org/10.1016/J.FOODRES.2019.01.041>

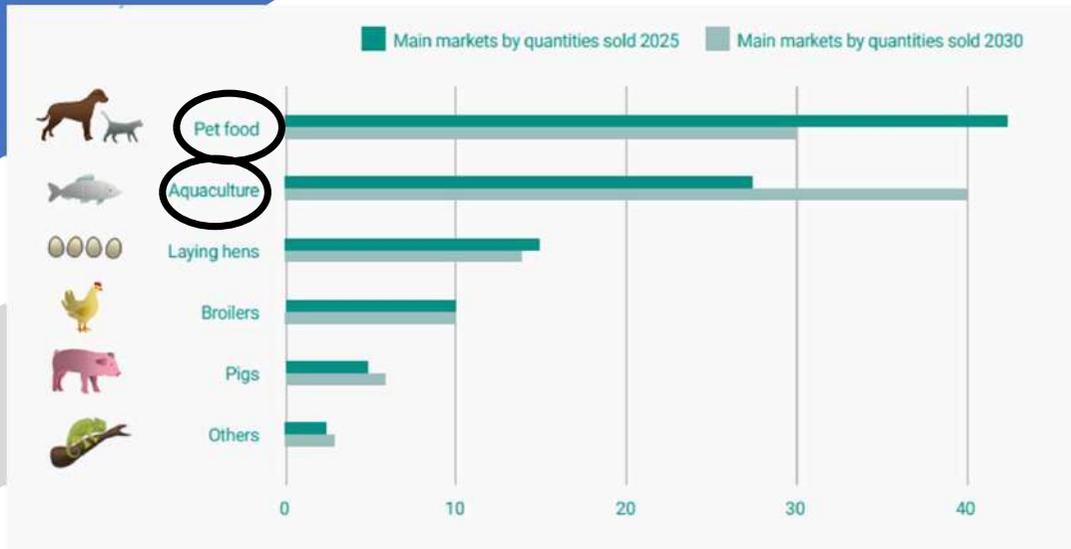
# Industry Overview Europe -- Feed

iFoodBOs



## General prospects – European edible insect market

- 2021: total value 46.75 million \$<sup>11</sup>
- Expectation 2029: total value 828.76 million \$<sup>11</sup>
- Closely related to legislation of European Union (EU)<sup>12</sup>
- Legislation expectations favorable<sup>12</sup>



As % of total

## Insect Feed Business Operators<sup>1</sup>

- 1 billion € invested
- 3 billion € invested by 2025
- 2 billion € turnover per year by 2030 (1 million tonnes of insect meal)
- Since 2022 pig and poultry

<sup>11</sup> Global Market Insights. (2022). Europe Insect Protein Market Opportunities, Drivers, Challenges, Scope, Share, & Analysis By 2029. <https://www.databridgemarketresearch.com/reports/europe-insect-protein-market>

<sup>12</sup> IPIFF. (2021). THE EUROPEAN INSECT SECTOR TODAY: CHALLENGES, OPPORTUNITIES AND REGULATORY LANDSCAPE.

2

Could we lose all animations?

Jolijn Zwart-van Kessel; 05/10/2022

# Industry Overview Europe -- Food

iFoodBOs



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## Insect Food Business Operators<sup>4</sup>

- 500\* tonnes produced in 2019
- 260.000 tonnes produced by 2030
- 9 million consumers consumed insects
- 390 million consumers consumed insects by 2030

\*relatively low number was due to regulation limits and could have been higher (i.e. causing companies to deliberately put productions on hold)

3

Could we lose all animations?

Jolijn Zwart-van Kessel; 05/10/2022

## Opportunities for the sector

### Europe

#### Market size

1

As of 2021, demand for insect protein is higher than its supply<sup>2,3</sup>

#### Market growth

2

450\* tonnes in 2019 to 236.000 tonnes in 2030 for just food, second largest growth region<sup>13,14,15,6</sup>

#### Legislation

3

Favourable prospects over the next years<sup>12</sup>



### Opportunities

### The Netherlands

1

#### Collaborative environment

Start-up innovation hub, presence of multiple partnerships (academic and industrial) and possible consolidation of supply which is crucial to development<sup>2,17,18</sup>

2

#### National legislation favourable

Legislation enables innovation and development in insect sector<sup>19</sup>

3

#### Large farming sector present

Industry infrastructure and know-how present and large sales market without crossing borders

4

Could we lose all animations?

Jolijn Zwart-van Kessel; 05/10/2022

## Challenges for the sector

### Europe

#### Complex regulations 1

European union legislation and differences in national legislation hamper innovation and growth<sup>19,20,21</sup>

#### Niche food market 2

Insect as human foods needs strong education to increase acceptance<sup>9,10</sup>

#### Young industry 3

It's a small developing industry that invest a lot to create more efficient and competitive production systems<sup>7,19</sup> causing too high cost prices<sup>24</sup>



### Challenges

### The Netherlands

#### 1 Cost price

Price of insect protein today are still too high compared to fishmeal and soy protein<sup>24</sup> and still need to scale

#### 2 Expensive food safety procedures

The favourable legislation causes expensive food safety procedures that decrease economic feasibility<sup>17,22</sup>

#### 3 Climate control necessary

Open air rearing not suitable due to low temperature and expensive energy intensive climate control necessary<sup>23</sup>

5

Could we lose all animations?

Jolijn Zwart-van Kessel; 05/10/2022

## Foodvalley NL collaborations on insects

- **KNOWLEDGE Network for Insect Knowledge**

Website (in Dutch) with all you would like to know about the (Dutch) insect industry

- **SHARED FACILITIES Foodvalley NL Shared facility Finder**

- Working in the insect sector and looking for an advanced research, demonstration, test or scale-up facility for temporary use? Interested in purchasing a new facility but the investment is too large? Or own a facility but not in continuous use? Shared facility finder helps companies and institutions active in healthy food and living to find or offer a facility for temporary use. And Shared facility finder provides financial advice on possibilities for realising shared new facilities.
- The aim is to encourage companies and institutions to realise maximum productivity and accelerate innovation. Sharing facilities helps in this, as it is fast, sustainable and cost-saving.
- Shared facility finder is an initiative of Foodvalley NL and Wageningen University and Research.
- **INTERNATIONALIZATION Global Foodture project**
- <https://globalfoodture.eu/the-project/>



## MARKET GROWTH

### Foodvalley NL initiative: Edible insects on the plate of the consumer in Northwest Europe!

- Insects are an important mean to upcycle agrifood side streams towards a value source for food.

As Foodvalley NL we want to contribute to the transition towards a professional and scaled market for edible insects. Our objective? Insects as a totally accepted food concept on the plate of the consumer.

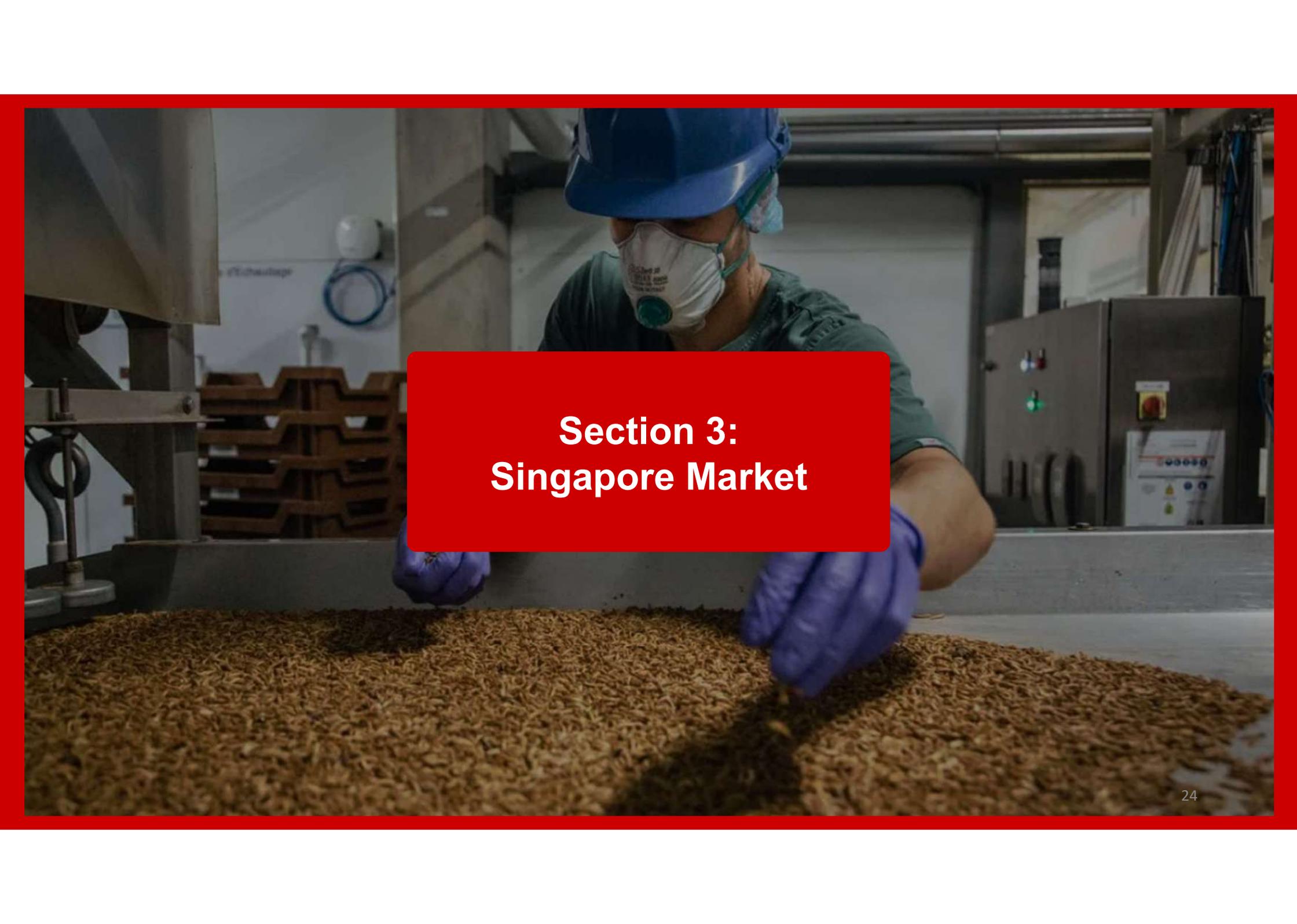
- We invite all partners in Northwest Europe, who are working on the market for edible insects and especially in the field of business to consumer to participate in the first workshop

***November 24th, 2022 in the afternoon,  
on location in Wageningen, The Netherlands.***

***More information and registration:***  
[Insects workshop | Foodvalley NL](#)



**Register for workshop: Edible insects on the plate of the consumer in Northwest Europe!**

A worker in a blue hard hat, white respirator, and blue gloves is working with a large pile of brown material in a factory setting. The worker is wearing a blue hard hat, a white respirator mask covering their nose and mouth, and blue nitrile gloves. They are leaning over a large pile of brown, fibrous material, possibly tobacco or a similar agricultural product. The background shows industrial equipment, including a control panel with a green light and a white panel with various buttons and indicators. The scene is set in a factory or processing plant.

**Section 3:  
Singapore Market**

# Singapore's National Agenda on Sustainable Development



## Singapore's Sustainable Development Goals by 2030:

- Reduce amount of waste to landfill per capita per day by 30%
- SG as the leading regional centre for developing new sustainability solutions
- To produce 30% of our nutritional needs locally by 2030.



## Singapore's Zero Waste Masterplan

Food waste is one of top 3 priority waste streams in SG, alongside e-waste and packaging. Singapore works towards a circular economy approach to close these 3 resource loops.

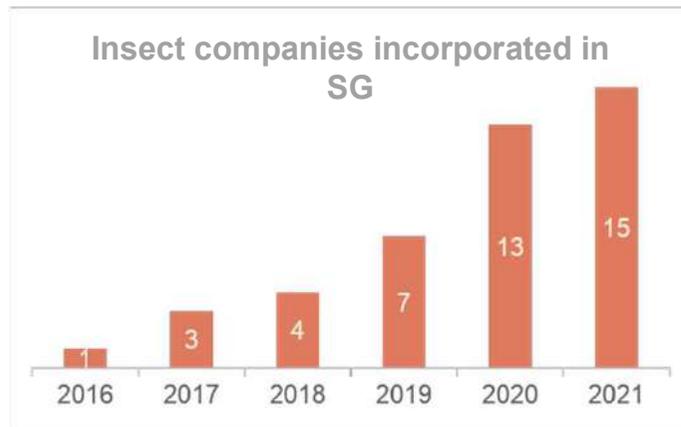


## Singapore 30 by 30 goal for Food Security

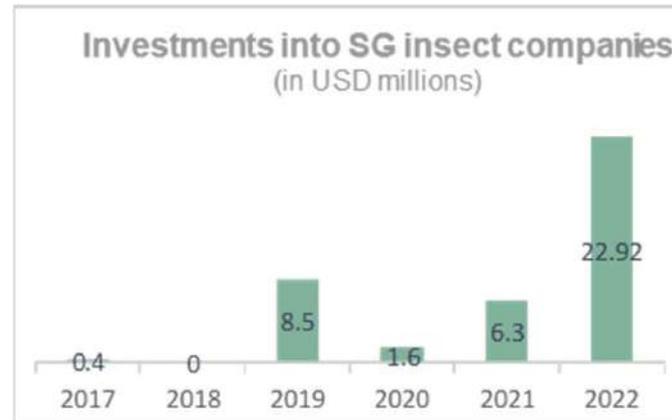
The Singapore **'30 by 30' goal** aims to build up our agri-food industry's capability and capacity to produce 30% of our nutritional needs locally and sustainably by 2030<sup>3</sup>.

While Singapore builds up capabilities in local food production, reducing reliance on imports for feed to strengthen feed resilience is also important.

## Singapore sees increasing number of insect companies over the last 5 years, driven by investments and R&D innovation



- No. of incorporated insect companies currently in operation has risen steadily
- Industry demand and interest for insect farming for protein and waste valorisation from ancillary sectors e.g. poultry, aquaculture, waste management increased.



- To date, Singapore has seen a total of **~US\$40M** in equity investments flow into SG-based insect companies over the past 4 years (publicly disclosed)
- Our insect companies are actively raising for 2022/2023



Professor Stephen Cairns, Asst Professor Alexander Mathys, Asst Professor Nalini Puniamoorthy, NUS

### Key Research Projects

- NUS Department of Biological Sciences Asst Prof Nalini Puniamoorthy is leading a 3-years international collaboration project to develop a blueprint to integrate food waste management and sustainable food production using black soldier fly. The project is done in collaboration with Singapore ETH Centre Future Cities Lab Global Programme, NTU and ETH Zurich

### Singapore as an R&D hub to support the insects ecosystem



#### Examples of research:

- **NUS, ETH Zurich, NTU** – Urban Food Waste Management and Food Systems Using Black Soldier Flies
- **IPI-Singapore** – Water-Soluble Melanin Nanoparticles Derived From Black Soldier Flies
- **RP** – Using Black Soldier Flies to Manage Carnivore Fecal Waste
- **A\*STAR** -- 5 research areas in BSF gut enzymes & microbia, waste valorization, novel food & feed additives, LCA, chitin extraction

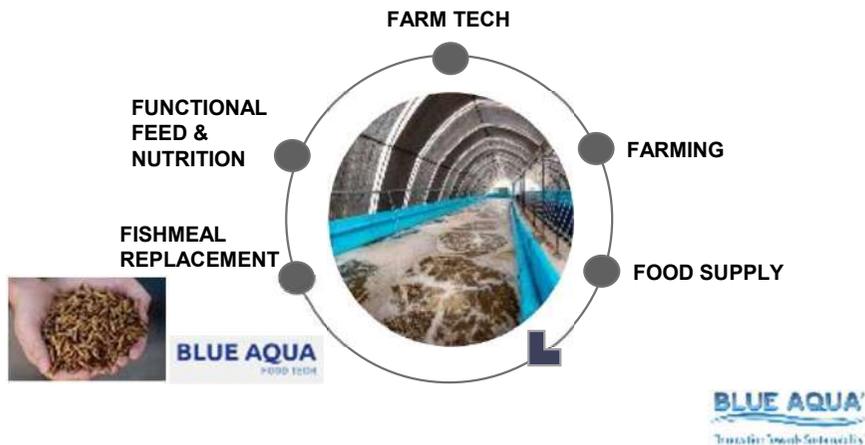
# Overview of SG-based insect companies – Most of our companies farm insects for feed and food



## There has been increasing demand from ancillary sectors in extending business capabilities into insects

### Aquaculture

Blue Aqua International, an aquaculture company founded Blue Aqua Food Tech, an alternative protein company to develop a resilient aquaculture supply chain to boost food security in Singapore



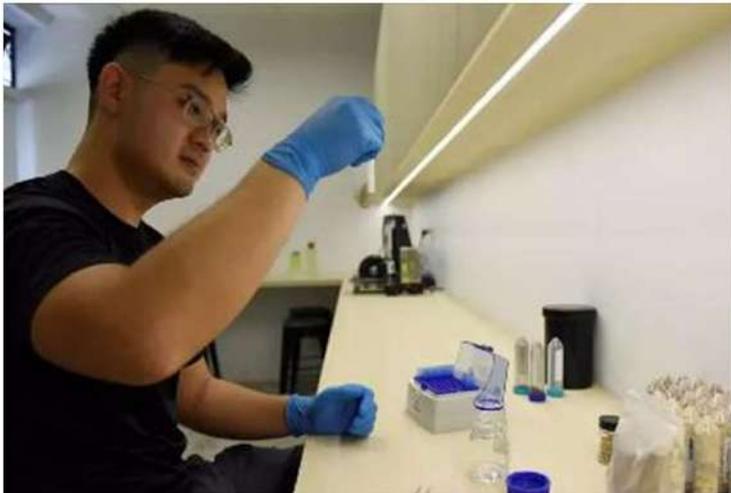
### Waste Management

2<sup>nd</sup> generation of Tiong Lam Supplies, a traditional waste management firm founded Ento Industries, a biotech black soldier fly company to tackle Singapore's food waste problem.



Photo courtesy of Nathaniel Phua- <https://mothership.sg/2022/03/ento-industries-nathaniel-phua/>

## Some local companies like Insectta do not farm insects for feed or food, but focus on extracting highly lucrative biomaterials from black soldier flies



Phua Jun Wei, CTO, Insectta, Source: World Economic Forum

- Insectta, Singapore's first urban insect farm extracts biomaterials – Chitosan and melanin to be used in pharmaceuticals and electronics from black soldier fly larvae.
- **Melanin** conducts electricity and can be used in semiconductors, supercapacitors or batteries.
- **Chitosan** has anti-inflammatory properties and is useful in manufacturing cosmetics and pharmaceuticals.
- The global market is valued at **\$7 billion** and is expected to grow sharply.

### Chitosan

Total Market Value (2019)	CAGR (2023-2030)	Projected Market Value (2027)
\$1.78 USD	14.5%	\$4.7B USD

### Melanin

Market Price (2022)
\$800 USD/gram

# The local insect subsector has opportunities to grow further given Singapore's existing strengths in complementary fields, our strategic location, investment and regulatory landscape

## 1. Strong talent base and research capabilities



### Biotechnology

- Research capabilities in genetic manipulation of BSF, etc

### Automation & Robotics

- Optimal way to design a data driven BSF rearing system through automation & robotics



### Specialty Chemicals

- Analysing nutritional and chemical composition of BSF outputs

## 2. Strategic Geographical Positioning

Singapore has a tropical climate which provide ideal environmental conditions for insects to grow all year round.

Singapore enjoys an Ideal geographical proximity to neighboring SEA countries for easy business. There is also close proximity to abundance of widely available feedstock (palm oil, food waste)

## 3. Growing investment landscape in Agri-Food tech

Singapore ranked 10th place globally with US\$1B of agri-food investments over 54 deals. Today, Singapore sees a growing corpus of early and growth stage investors including Temasek, Agfunder, Trendlines AFIC and The Yield Lab. Singapore has seen a total of ~US\$40M of investments into Singapore-based insect companies from 2019 - 2022,

## 3. Enabling Regulatory Environment

Singapore's food safety regulatory body -- Singapore Food Agency is in the midst of developing Singapore's first insect regulatory framework, slated to launch in Q4 2022.

The framework will see positive legislative developments in types of feeding substrates allowed, as well as the import and consumption of edible insects for human consumption.

# The Singapore Food Agency has just published a public consultation for Singapore's first insect regulatory framework to guide the application of insects as food and feed.



## Public Consultation

Proposed Amendments to Legislation

Others

### Others

Consultations	Responses to comments received from public consultation
<b>1. Approach for Regulation of Insects and Insect Products</b>	
First consultation (5 Oct 22 to 4 Dec 22) <a href="#">[Open]</a>	
<ul style="list-style-type: none"><li>• Consultation on Regulation of Insect and Insect Products (Imports and Locally Farmed/Processed)</li></ul>	

- SFA is proposing many changes to the insect regulatory landscape in Singapore.
- These changes will allow industry more flexibility to produce insects in a safe and sustainable way, particularly in the range of substrates which can be used. So Consumers would also have access to safe insect food products
- Further, it will also propose the allowing for import, sale and consumption of edible insects here in Singapore.

## However, insect companies are also met with a lack of consumer acceptance for insect as food and natural resource constraints

### 2. Consumer perception of insect based products

Given the nascency of insects farming as a subsector, and insects are not a historically predominant part of Singaporeans' diets, the lack of exposure means consumer perception of insect based products is still low.

### 3. Resource constraints

Insect companies in Singapore may find difficulties scaling up production facilities given Singapore's lack of land and space.

To be considered a sustainable alternative to conventional food and feed sources will require insect companies to increase production volumes exponentially, which will incur massive investments, space, and process optimizations.

Companies prefer setting up their R&D base and HQs in Singapore, and scaling operations in the Region.

A top-down photograph of various spices and herbs on a dark blue surface. In the foreground, there are several small spoons and piles of spices. On the left, a spoon holds a pile of dark brown, dried, and crushed plant material. In the center, there is a small pile of reddish-brown, dried, and crushed plant material. To the right, a spoon holds a pile of bright orange powder. The background is a dark blue, textured surface. A central green text box contains the text "Section 4: Future Initiatives & Collaboration".

**Section 4:  
Future Initiatives &  
Collaboration**

## Europe & Singapore Collaboration Programmes & Grants

### Internationalization

#### Global Foodture Programme

<https://globalfoodture.eu/the-project/>

### Internationalization

#### Global Innovation Alliance (France, Germany, UK)

<https://www.enterprisesg.gov.sg/industries/hub/startup/global-innovation-alliance>

### R&D Grant Funding

#### Eureka Eurostars

<https://www.eurekanetwork.org/open-calls/eurostars-funding-programme-2022-call-2>

### R&D Grant Funding

#### UK-Singapore R&D grant call

<https://www.enterprisesg.gov.sg/financial-assistance/grants/for-local-companies/international-co-innovation-programmes/uk-singapore-collaborative-rd-call>

## Diapositiva 34

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- 6 We need to change this to section 3, with the description of C  
Jolijn Zwart-van Kessel; 05/10/2022



**Thank You.**





# MASTERCLASS 1

Edible insect products for  
human consumption

# Company presentation



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**SIBO**

**Bridging the Gap between Insects &  
Food**



## Global



Healthier **food**, for more **people**, using less **natural resources**



## Food Companies



**Reduce GHG emissions by 50%** (70% food come from ingredients)



## R&D



Replacing animal based products with **better quality ingredients & complete nutrition**



Problem

There is a **BIG GAP** between **insects & food** companies



**Broken  
Value Chain**



**Technology &  
Functionality**



**Knowledge &  
Expertise**





## Bridging the Gap between the **Insects & Food** Companies

Connect



Qualified Insect  
Supplier Catalog



Enable



Entowise® Isolation  
Technology



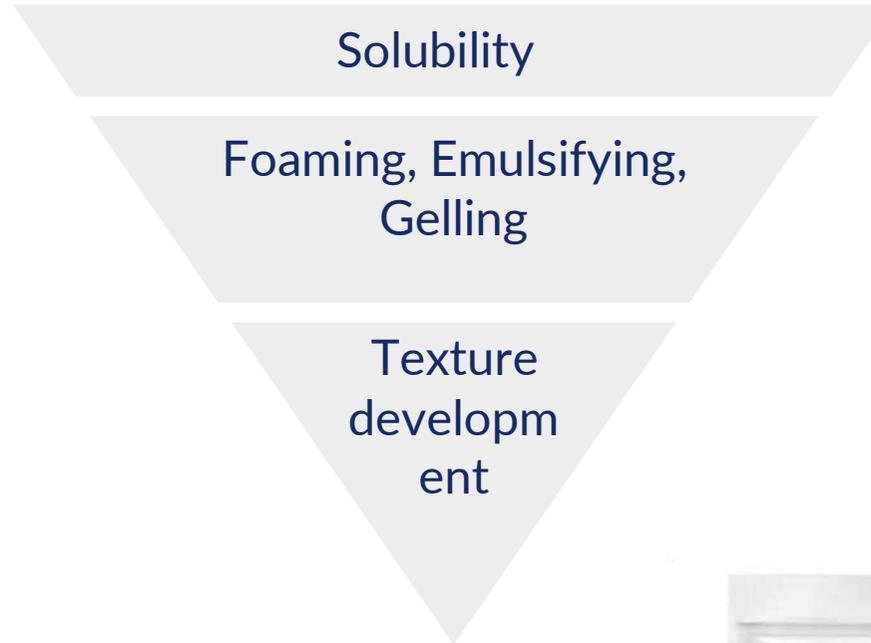
Discover



Entowise® Ingredient  
Discovery



Insect as the future of protein



**Without the right texture,  
food loses its appeal.**





Partners



Co-funded by the European Union





United States



Finland



Netherlands



Internationalization

United Kingdom



Switzerland



A close-up photograph showing several hands of different skin tones holding small green seedlings with dark soil. The hands are arranged in a circle, creating a sense of unity and shared care. The background is dark, making the green plants and the hands stand out.

*Provide access to affordable, healthy, and sustainable insect based food for every single person in the world*

An aerial photograph of a dense, lush green forest. The trees are tightly packed, creating a vibrant green canopy. In the center of the image, the word "SIBO" is written in large, white, sans-serif capital letters. The letter 'O' has a green horizontal bar above it, resembling a bridge or a stylized accent. The overall scene is bright and natural, suggesting a focus on environmental or sustainable technology.

# SIBO

Let's go Bridge the Gap

[www.sibo.tech](http://www.sibo.tech)  
[invest@sibo.tech](mailto:invest@sibo.tech)

# Company presentation



## GLOBAL BUGS



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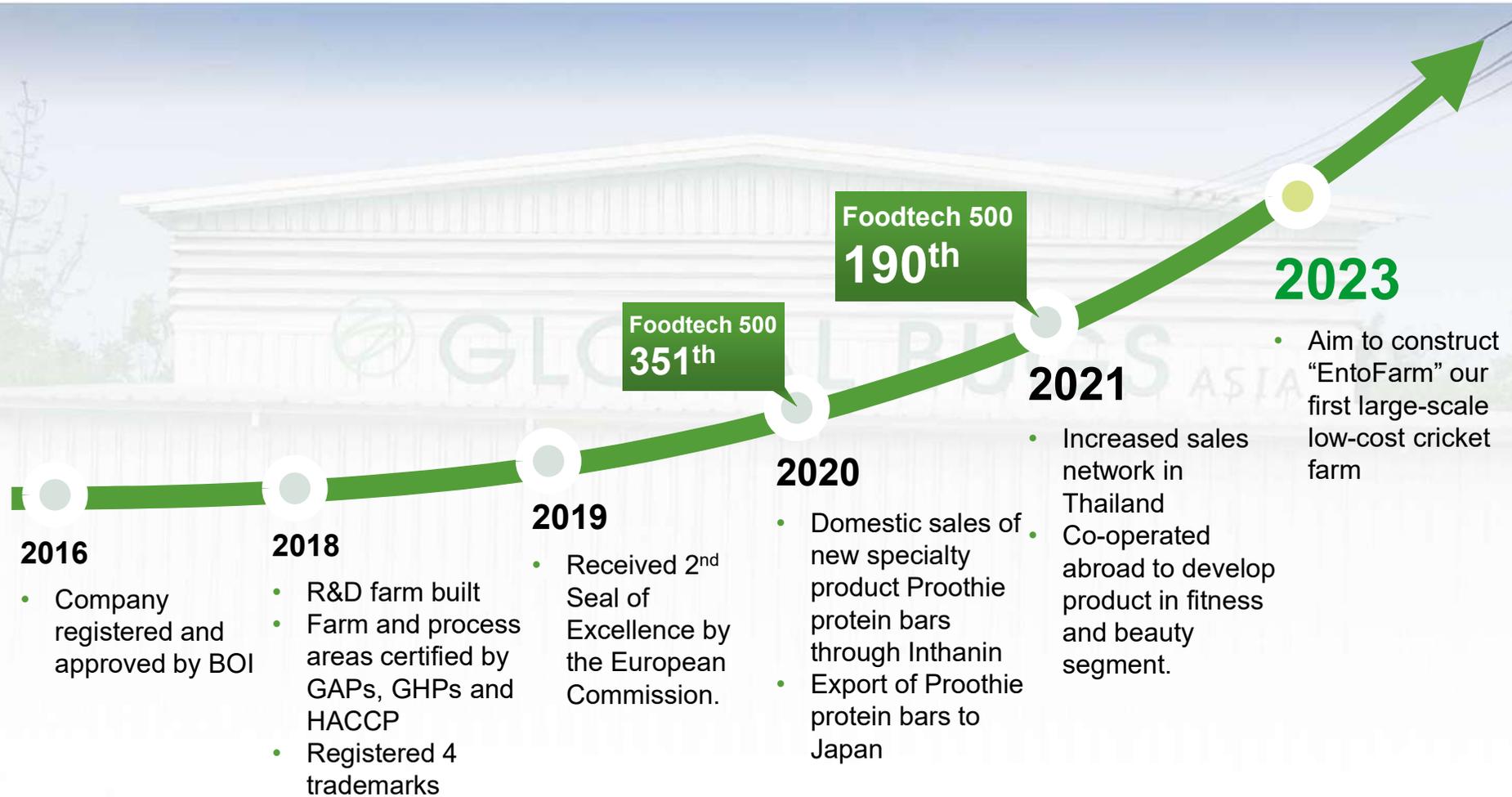
# Global Bugs

Protein, People, Planet & Profit Positive

A Thai Swedish company focused on  
Healthy and Sustainable alternative proteins



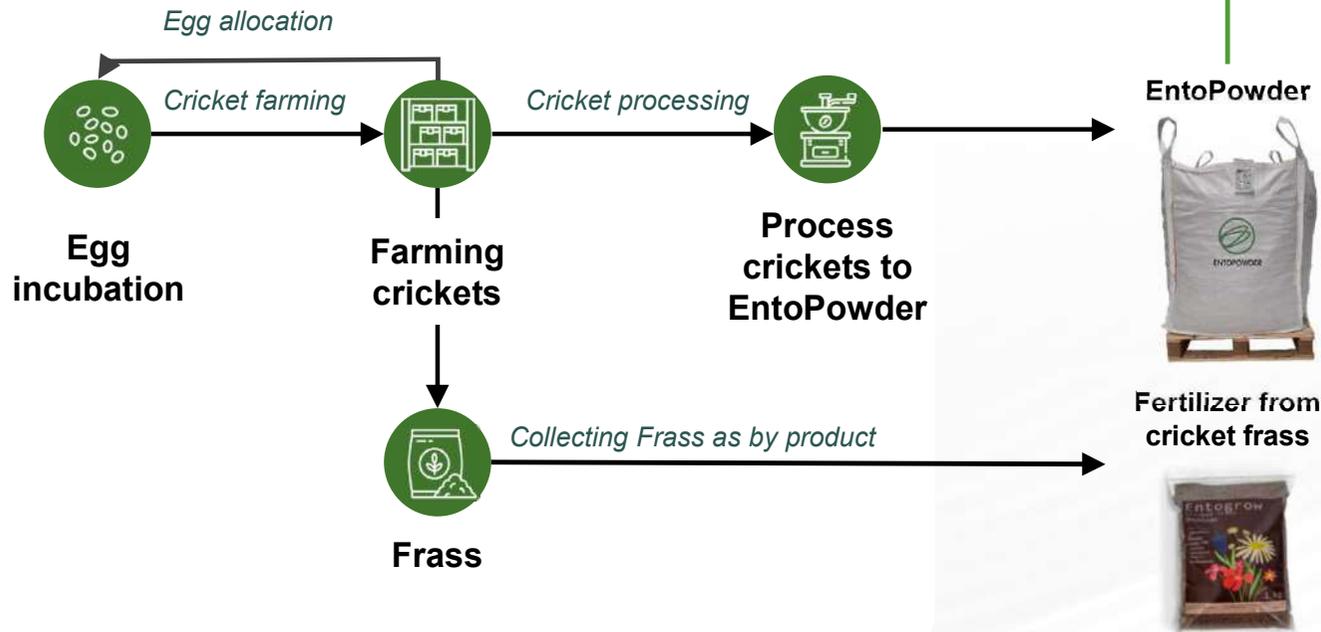
# Our Journey: From R&D farm until now



# We farm crickets and process them into high protein consumer products



## Key farm and process activities



## Our products

Protein bar



Collagen drink



Multiple application as ingredients in food ...



Savoury food



Bakery



Smoothie



Noodle



Soy sauce



Salt



Dango



Granola



Ale

# Our R&D farm produce protein rich EntoPowder with certified high and consistent quality



## Our R&D farm



## Farming



### Incubation

- Egg laying and incubation routines

### Farming

- 500 boxes of maximum operation capacity of 10 tonnes per year
- Zero risk of pathogen from inhouse farming
- Control feed quality
- Maintain the best standards in cricket farming practices

## Processing



### Harvest

- Harvest EntoBoxes that reached 30 days
- Separate frass from cricket
- Clean the cricket for 4 times



### Baking

- Bake the cricket until moisture is lower than 5%



### Grinding

- Grind baked cricket in to EntoPowder using advanced equipment to ensure minimal loss in nutrition

Our current products are well accepted by leading food stores in different market segments



Our products

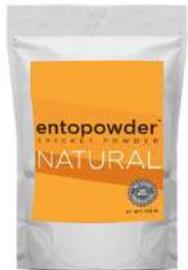
EntoPowder

EntoCrisp

Original Proothie bar

EntoGrow

We sell our products through more than 100 shops in Bangkok..



Versatile cricket protein powder



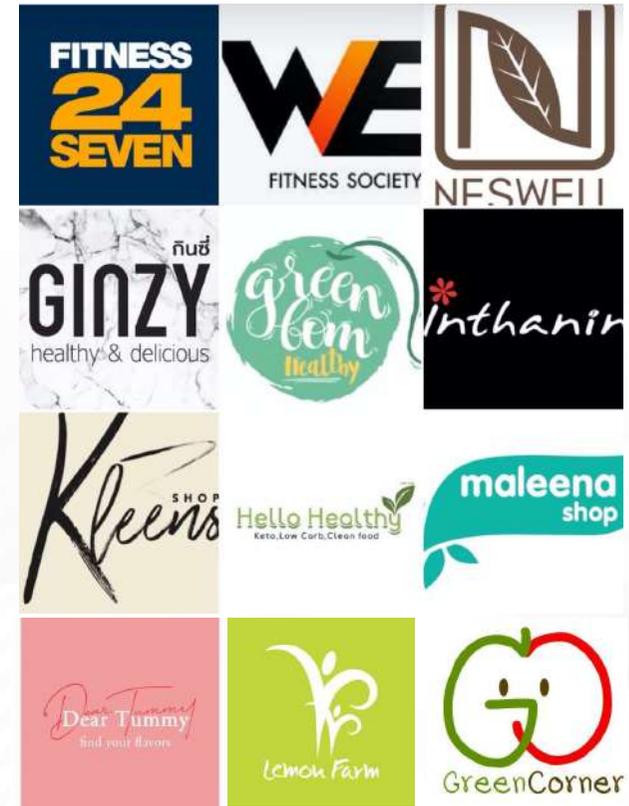
Whole roasted cricket snacks



High protein snack bar



Nutritional fertilizer from cricket frass



We provide EntoPowder as an upgrading supplement to different industries increasing value over proportionally



### Food



5-15% of EntoPowder increase up to  $\approx$  15% sales margin



### Beverages



10% of EntoPowder increase up to  $\approx$  15% sales margin



### Dietary Supplement



20% of EntoPowder increase up to  $\approx$  15% sales margin

DENGAN KOLAGEN

### Pet Food



5% of EntoPowder increase up to  $\approx$  25% sales margin



# Q&A



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# MASTERCCLASS 2

Insects and valorisation of  
by-products

# Company presentation



**INSECT FEED**  
TECHNOLOGIES



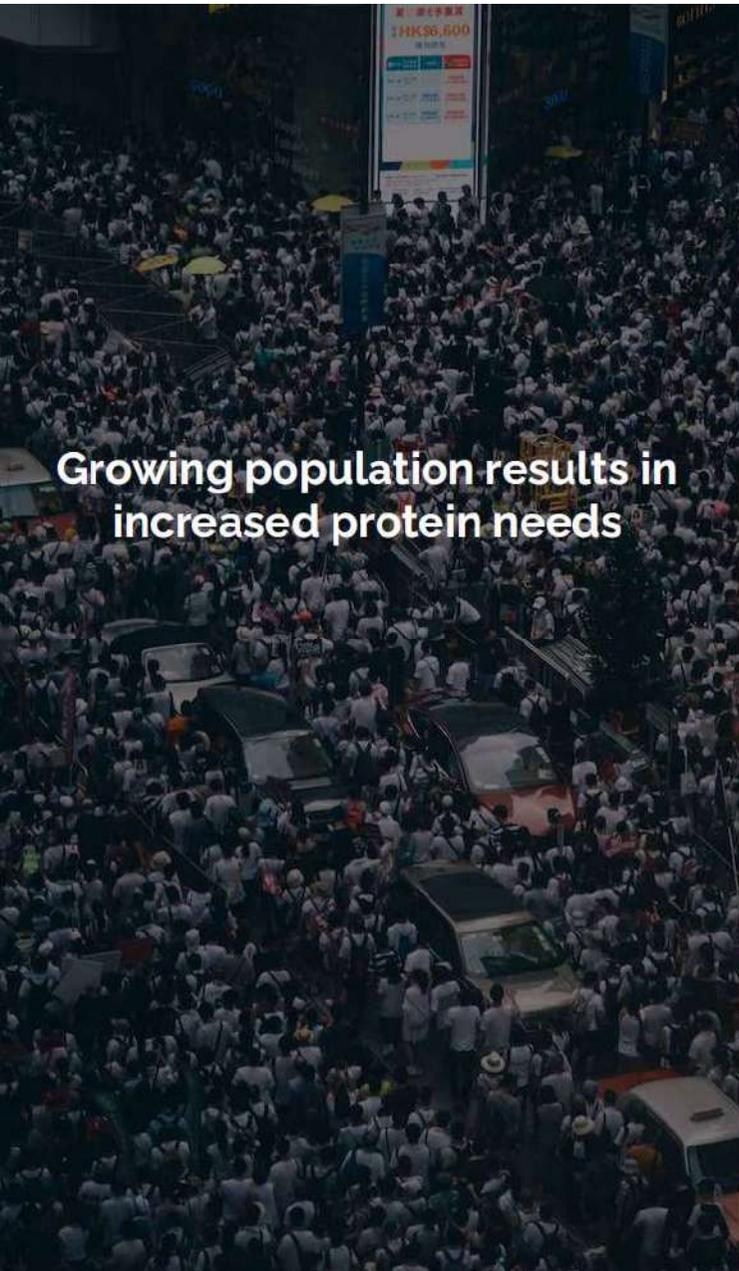
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A scenic landscape featuring a vibrant green field in the foreground, a dense line of trees in the middle ground, and a sky filled with soft, grey clouds. The overall atmosphere is serene and natural.

# Insect Feed Technologies

For Food Valley NL

7 October 2022



**Growing population results in increased protein needs**



**Current protein sources are unsustainable**



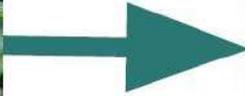
**Large volume of food waste produced**

## Our Process

We convert food waste into useful insect products – insect protein for animal feed and fish feed and frass for plant and soil nutrition



**Input: Food waste**



**BSFL feed on food waste**



**Insect frass (compost)**



**Insect protein (dried larvae)**

## We are building Singapore's largest insect facility

From our current pilot facility, we are moving to an automated facility to increase our capability to handle more waste



Insect Feed Technologies Pte Ltd © 2022. Proprietary and Confidential. All Rights Reserved.



## Our Farming Processes

We harvest 3 key beneficial products from the BSF



### Insect Larvae/Protein

- Our insect protein has a balanced amino acid profile with good palatability and digestibility for animals
- Insect protein is a sustainable substitute for conventional protein sources, like soybean and fish meal.
- This can be used as an ingredient for animal feed.



### Insect Oil & Lipids

- Insect oil is an easily digestible source of energy, high in lipid content such as lauric acid and antimicrobial peptides.
- We are conducting research on insect oil applications and extraction techniques that can maximize its potential



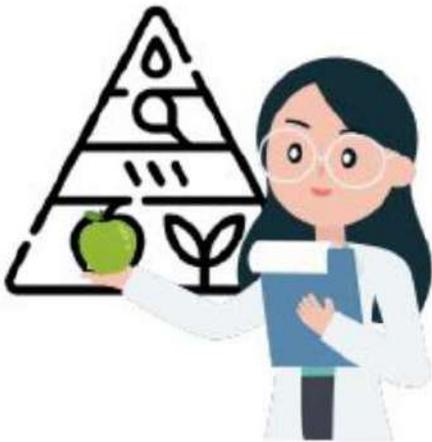
### Insect Frass/Fertiliser

- Frass is the residue from growing BSF larvae consisting of droppings from the larvae, exoskeletons and feed remnants
- BSF frass is rich in micronutrients for plant growth and contains valuable microbes that improve soil quality

## Our Value Proposition

We focus on 3 aspects to scale-up: microbiology, advanced manufacturing, and functionality benefits in aquafeed & fertiliser

**Microbiology solution to use low-grade agri and food waste for insects**



**Proprietary advanced manufacturing systems for BSF production**



**Functionality benefits of insect-based ingredients for feed & fertiliser**



# Company presentation



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# AgroIndustrial **entomo**

[www.entomoagroindustrial.com](http://www.entomoagroindustrial.com)



# Mission

## Industrial Solutions

for the

Valorization of **Organic Matter**

Using **Insects**

# Solution

B I O W A S T E



R A W M A T E R I A L S

- PROTEIN
- LIPIDS
- CHITOSAN
- FRASS

# Pilot Plant

## 01 | GENERAL

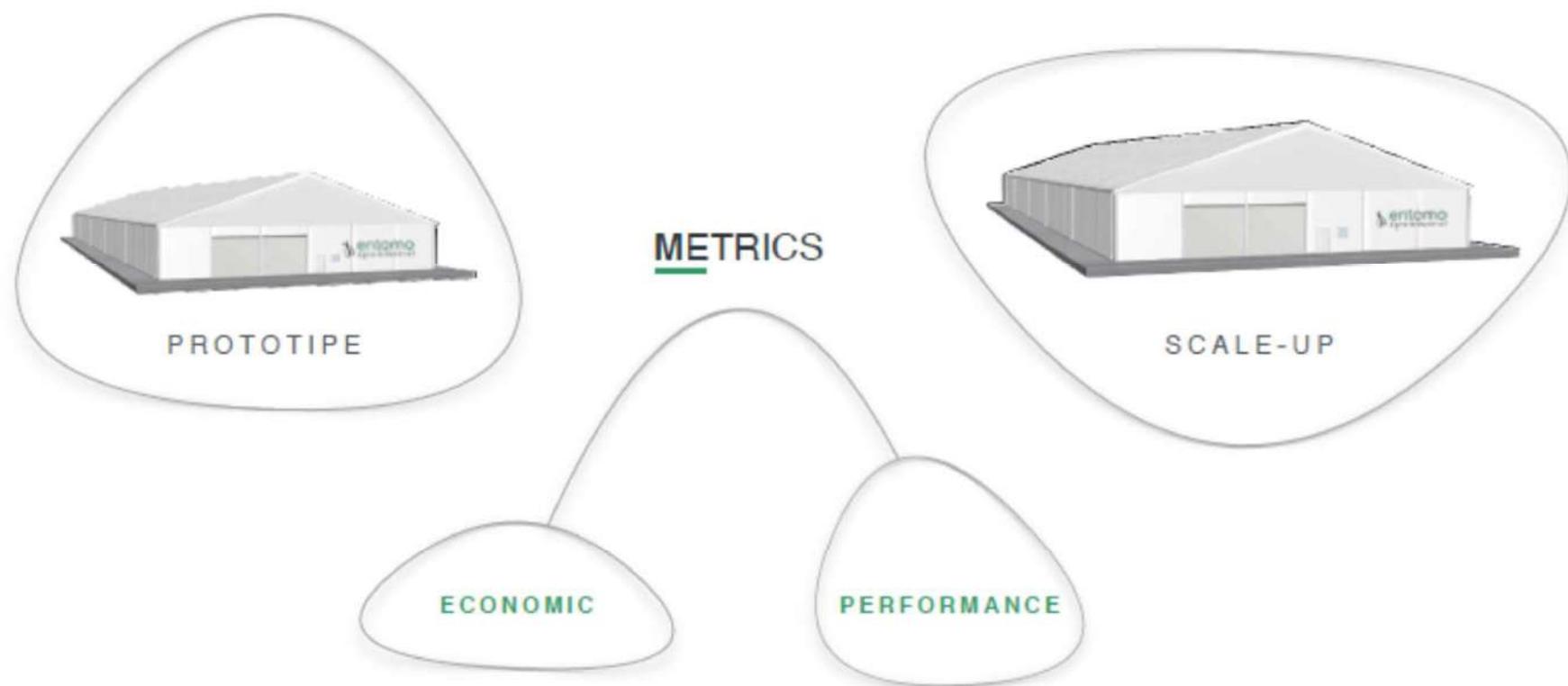
- VALIDATION AND REDUCTION OF ORGANIC MATTER
- SHOWCASE FUNCTION
- RESEARCH AND DEVELOPMENT

## 02 | SPECIFIC

- TYPOLOGY AND EXTRACTION OF FATS
- DEVELOPMENT OF HYDROLYSATES
- GENERATION OF PRODUCTS FROM TOXIC SUBSTRATES
- USE IN BIODIGESTION
- PREPROCESSING OF SUBSTRATES TO FACILITATE DIGESTION
- SECOND GENERATION REACTORS
- LIFE CYCLE ANALYSIS
- DIGITAL-TWIN



# Scale-Up



# Global Vision



# Agroentomo industrial

[www.entomoagroindustrial.com](http://www.entomoagroindustrial.com)



# Q&A



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# Wrap Up & Closing



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Next  
Event!

## SECOND WORKSHOP NOVEMBER



17 November 2022 - 09:00-11:00

### ARE THE FUTURE FARMERS FLYING FARMERS?

Agriculture



Please check the catalogue for all the  
Thematic Workshops



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## PRELIMINARY PROGRAM

### Introduction text:

Today's agriculture has transformed into a high-tech enterprise that most 20th-century farmers might barely recognize. Self-driving machinery and flying robots able to automatically survey and treat crops will become common place on farms that practice what's come to be called precision agriculture. The ultimate purpose of all this high-tech gadgetry is optimization, from both an economic and an environmental stand point. This thematic workshop will point out and showcase different solutions that are on the market, ready to be used by farmers worldwide.

### Topics to be covered

- Smart use of robots and drones
- Satellite data in support of cultivation

### Agenda

- 09.00 Welcome and Introduction by Susanne Baden Jørgensen, Food & Bio Cluster Denmark
- 09.05 "Experiences with the collection and use of data for precision agriculture from the project SQM-Farm" by Henrik Skov Midiby, Associated Professor, Mærsk- Mc-Kinney Møller Institute, University of Southern Denmark
- 09.25 "Use of drones in agriculture" by Andreas Siggaard, Hecto Drone ApS
- 09.35 Presentation by Asian technology company (TBD)
- 09.45 "FarmDroid - the world's first fully automatic robot for both sowing and weeding control" Presentation by xxx FarmDroid
- 09.55 Introduction to presentations 'Satellite data in support of cultivation' by Tomaz Zadavec, Project manager, ITC
- 10.00 Presentation of the theme Satellite data in Agriculture by Panagiotis Ilias, Senior Information Technology Business Analyst at ILVO
- 10.20 Presentation by LISTENFIELD
- 10.30 Presentation by WORLD FROM SPACE
- 10.40 Presentation by TERROIR FROM SPACE TBC  
Options EU: AGROAPPS, GEOVILLE, ILVO, TERMODRON, AGRICOLOUS
- 10.50 Q & A and reflection by Susanne Baden Jørgensen, Food & Bio Cluster Denmark
- 11.00 Wrap-up & Closing



# INTERNATIONAL TRAINING PROGRAM

## DEDICATED MATCHMAKING

<b>30 November</b>	<b>2022</b>	<b>Japan</b>
February	2023	South Korea
April	2023	Thailand
September	2023	Singapore



# Matchmaking Events

- Prepare for the event by improving your profile
- Fill in the Marketplace
- Browse through the Participants and/or Marketplace
- Find relevant meeting partners
- Request meetings - or be booked for meetings
- Wait for acceptance - sometimes also no thank you
- Schedule the meeting for the dedicated event (30 November)
- Prepare for the meeting
- Have the meeting on the day



# Matchmaking beyond events

- **Long term matchmaking**
- You can book and have meetings beyond the dedicated events throughout the entire period from October 2022-October 2023.
- Eg. You e-meet a participant at one of the workshops or trainings, then you through your profile then request a meeting with the person. Wait for a reply and if positive, then book and have the meeting



**Thank you and see you around**  
**For more events click [here](#)**



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