Black Soldier Fly Larvae Bioresource

- A Sustainable Waste Management Approach

Kankyo Bert

German Technology • Indian Engineering

About Us

- Design Engineering
- Project Management
- Technology Optimisation
- Turnkey Projects
- Operation & Maintenance
- Training
- Research & Development

Kankyo Bert has three decades of experience in biogas management starting from Concept to commission. Backed by a strong team of experienced professionals it offers pre-engineered and customised biogas solutions for a range of applications.

Our Core Values

Our Vision

Be a leading driver for a commercially viable biogas solutions globally

Our Mission

Our Mission to strive hard to achieve what has not been achieved hitherto and produce the world's best products & services in terms of quality, reliability and performance to serve the domain of biogas and translate our advanced technologies into value for our customers and stakeholders.

INTEGRITY

HONOR OUR COMMITMENTS TO THOSE WE SERVE.

We don't take our commitments lightly. We will do everything within our power to meet expectations. We own up to and learn from our mistakes. We do the right thing always.

GROWTH

EMBRACE OPPORTUNITIES TO LEARN AND IMPROVE.

We invest in ourselves and in one another not just to grow as an organization but also as individuals. Through personal development and continuous improvement we enrich our lives and are better prepared to tackle opportunities as they arise.

INNOVATION

BE CURIOUS, ADVENTUROUS AND CREATIVE.

We question conventional wisdom and challenge the status quo. If there is a better way, we'll find it. We're excited by ingenuity and thrilled to try something new.

COMPASSION

OBSERVE, LISTEN, UNDERSTAND AND ASSIST.

We're all human. Everyone we work with experiences the same hopes and fears. Our compassion is what allows us to understand where we're needed and what we can do to help.

DRIVE

NEVER BE SATISFIED WITH GOOD ENOUGH.

Excellence is a habit not a goal. We welcome a challenge with enthusiasm and go above and beyond the call of duty because it's who we are.

Need Of The Hour

Waste management is still a challenge in low income settings

- Organic solid waste is 50-80% of waste mass and is yet hardly recovered and recycled
- Strategies and policies are more and more including aspects of circular economy

Current organic waste recovery/recycling still faces a «value chain» challenge

- Compost typically has limited value and customers are not where the product is
- Biogas often suffers from cheap energy competition
- Char production (or biomass fuel) is promising but limited to dry materials

How else can we create value from waste?

BSFL - The right approach

Creates value from waste

Good substitute

- **Fishmeal**
- **Soymeal**

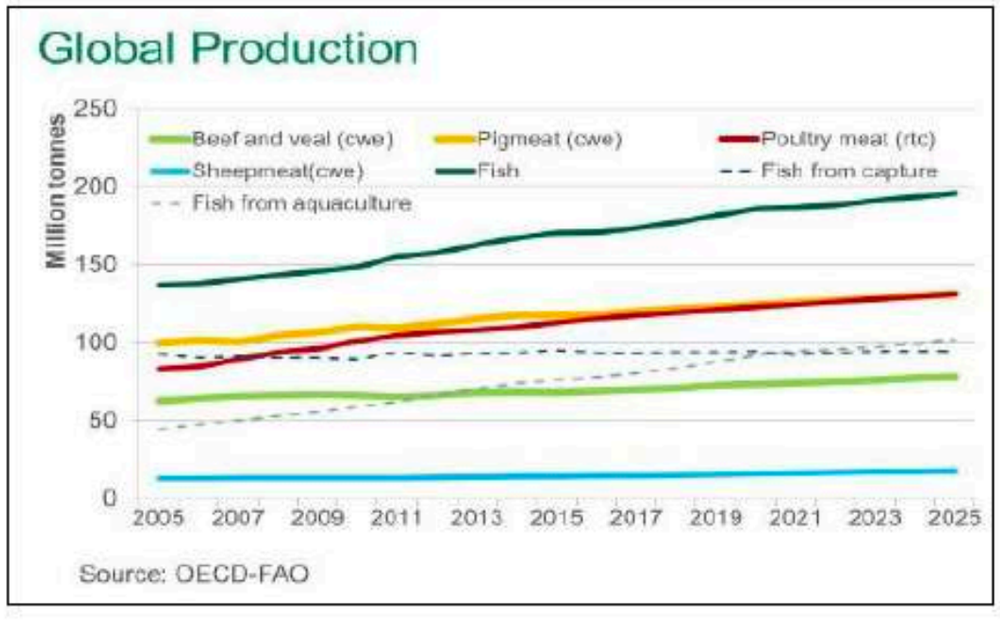
Why BSFL

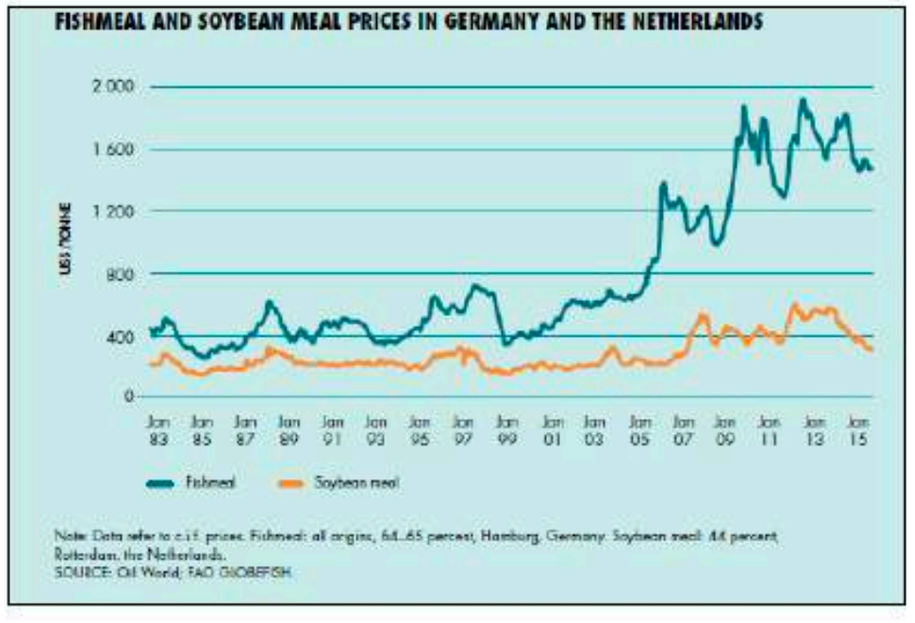
Harvested BSF larvae are versatile

- Whole larvae (fresh or desiccated) can be fed to pets, fish and poultry. Dried larvae can be ground to insect meal and fed to fish and pets.
- Larvae milk (pressed larvae devoid of the chitin part) can be further processed to insect meal or protein.
- The oil component can be separated and used for nutrition, as lubricant, for cosmetics, or for bio-diesel preparation
- Even the left-over can be collected and used as a high-value fertilizer.

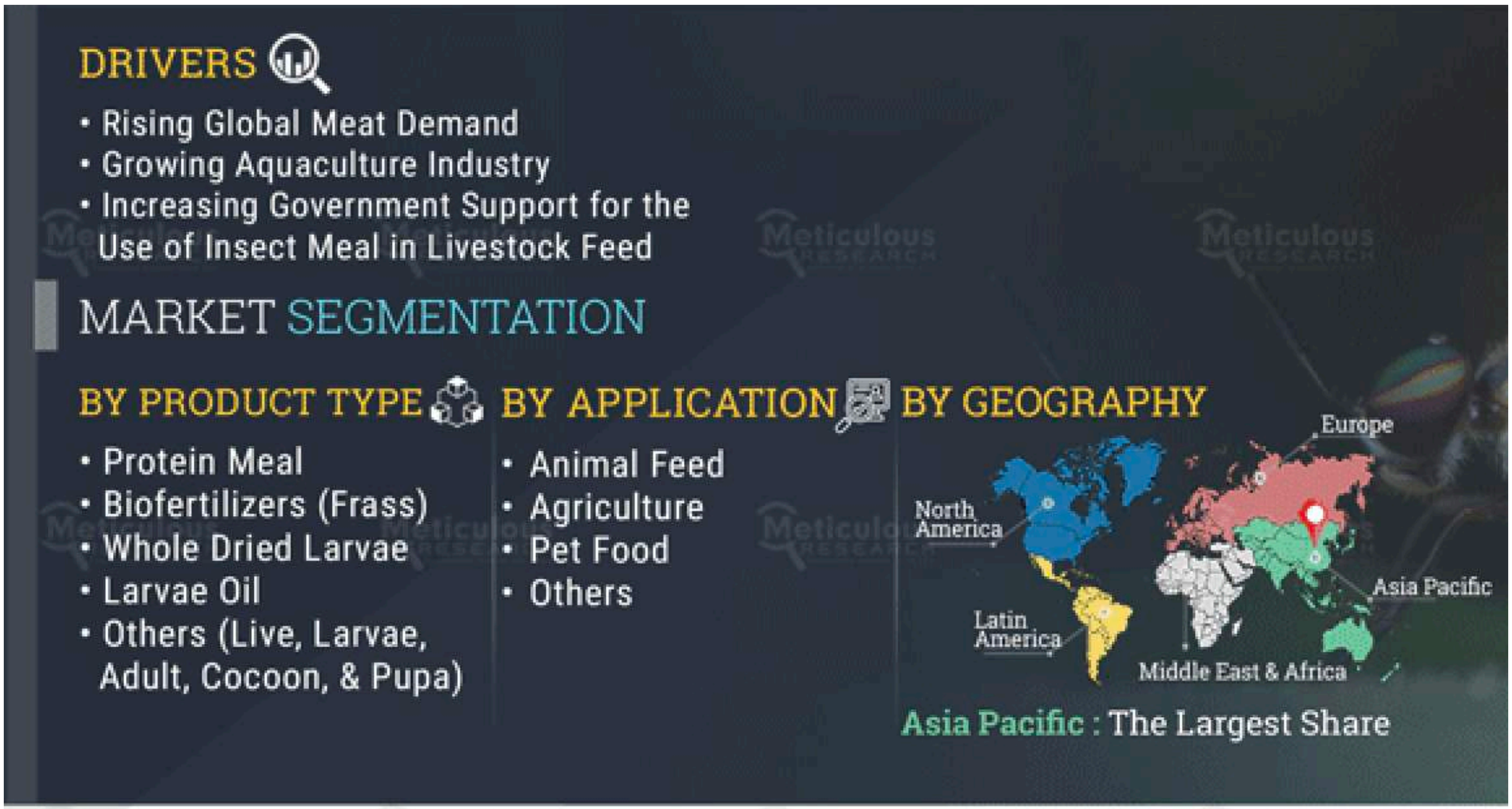
The Potential

- Demand for protein rich nutrition is rapidly increasing - driven by world population growth
- Insect protein can play an important part in human and animal nutrition in aquaculture, poultry and pig farming (FAO)
- Insects are traditional fodder animals
- Industrial produced defatted insect protein meal was successfully tested as animal feed
- Water consumption, land demand and required feedstuff quantities for insect farming are generally lower as for intensive animal production of pig, cattle and fish
- Other option: Application in biofuel, biolubricants and biotechnology sector





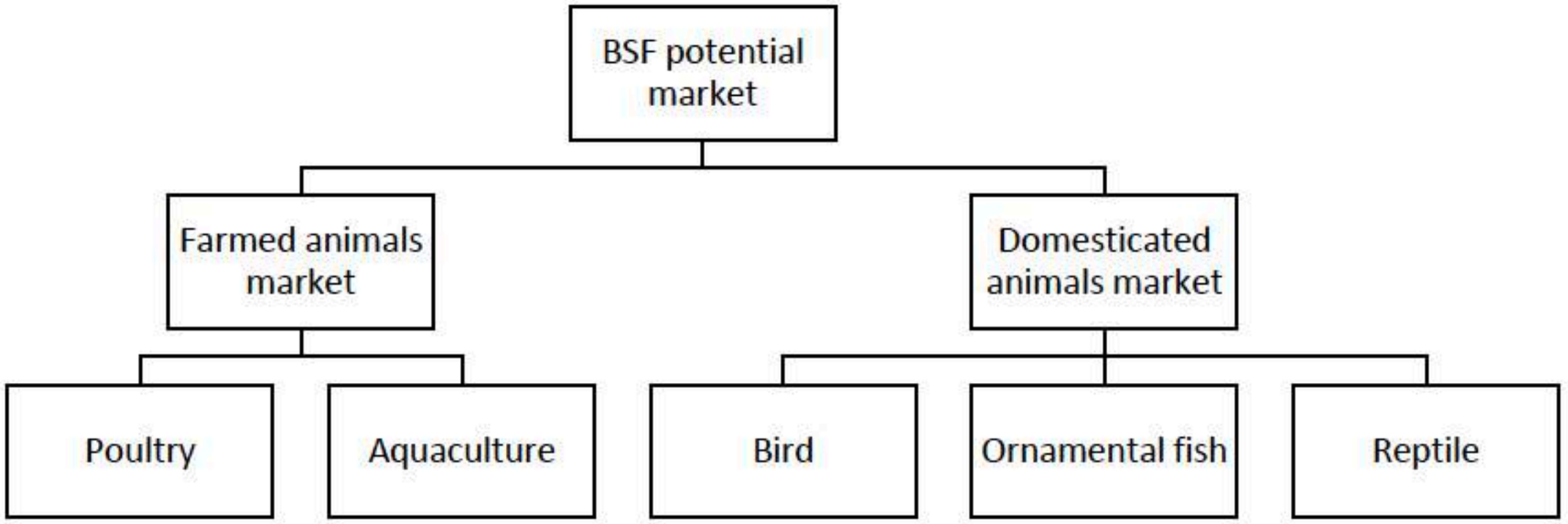
Global Opportunity

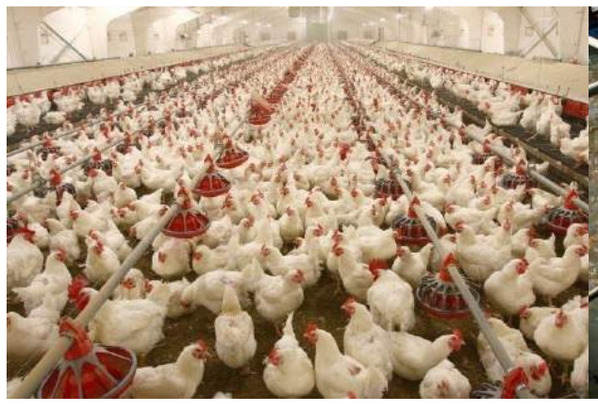


CAGR (2020-2030) 34.7%

Market Size USD 3.4 Billion

Target Segments





Potential Feedstuff

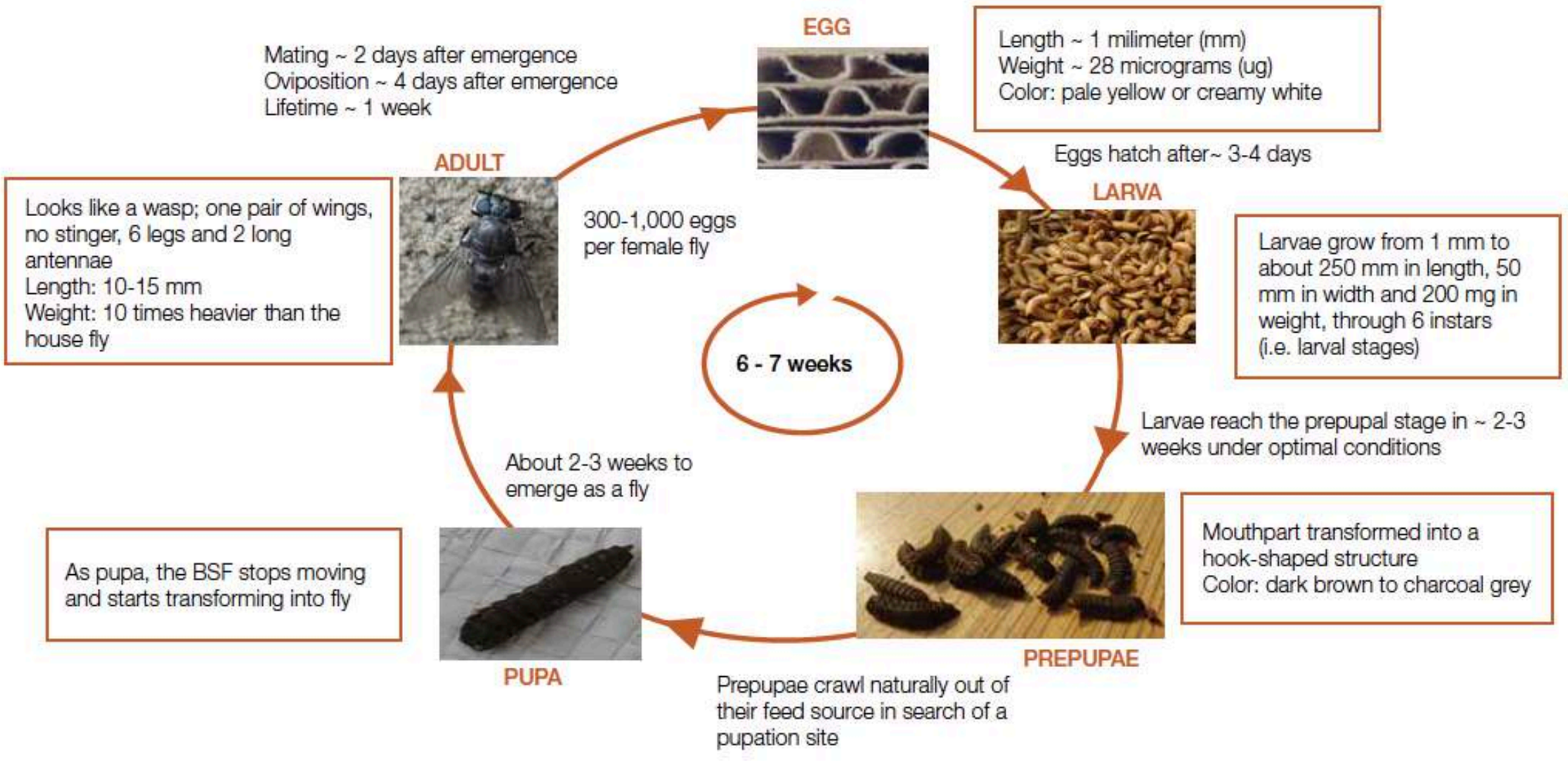
Potential feedstuff for technical product application

- Animal manure
- AD digestion plant digestate
- Organic fraction of municipal solid waste
- Biowaste (source separated organics)
- Restaurant waste and market waste
- Slaughter house waste

Feedstuff for product application in the feed and food sector

- Residues from ethanol and sugar production
- Residues from vegetable oil and biodiesel production
- Milling by-products
- Crop silage and feed grain
- Aquatic plants
- Brewery residues
- Residues from food Industry

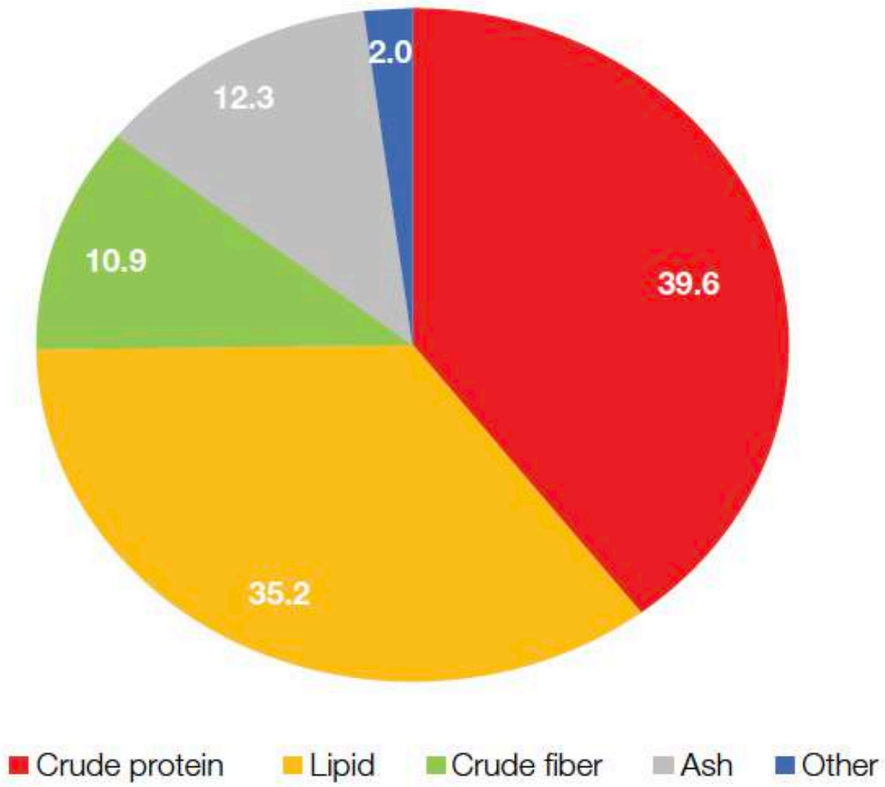
The Life Cycle

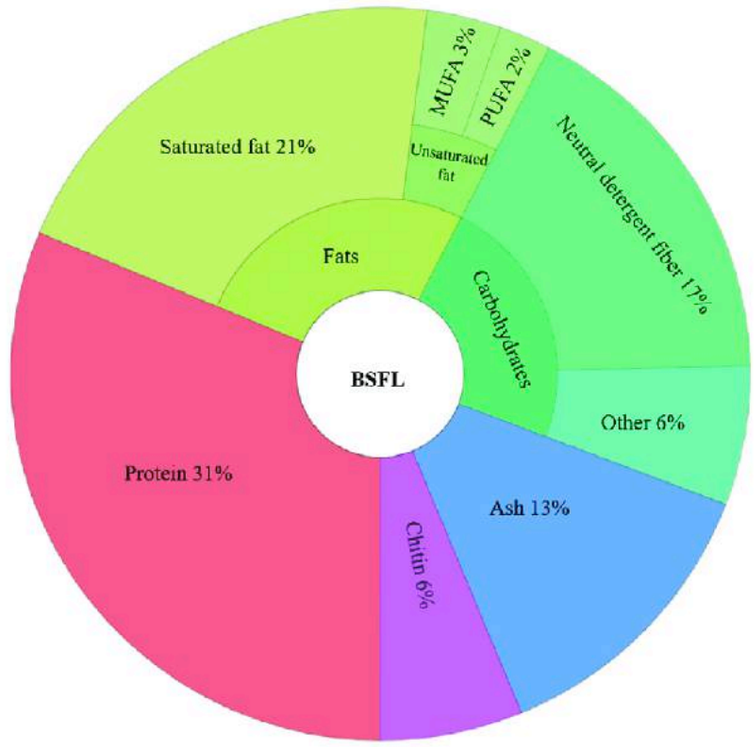


Factors Influencing BSFL

Factors influencing the growth performance of the BSFL		
Physical	Chemical	Others
• Moisture content • pH • Relative humidity • Temperature • Feeding system	• Protein • Amino acids • Carbohydrate • Lipid • Vitamins • Minerals	• Heavy metals • Larval density • Particle size of substrate • Light-dark cycle

BSFL Composition





Main components	Average value	Minimum value	Maximum value	Standard deviation
Crude protein (% DM)	39.6	35.0	43.6	2.7
Lipid (% DM)	35.2	13.9	49.0	9.5
Crude fiber (% DM)	10.9	7.0	24.4	6.7
Ash (% DM)	12.3	2.7	25.7	6.6
Dry matter of the fresh larva (% WW)	38.6	31.1	44.0	4.8
Chitin (% DM)	6.5	4.5	8.7	1.7
Gross energy (MJ kg^{-1} DM)	22.1	-	-	-

BSFL Mineral Composition

Table.3 Mineral composition of BSF larvae

Mineral	Mean value
Calcium	75.6 g/kg
Phosphorus	9.0 g/kg
Potassium	6.9 g/kg
Sodium	1.3 g/kg
Magnesium	3.9 g/kg
Iron	1.37 g/kg
Manganese	246 mg/kg
Zinc	108 mg/kg
Copper	6 mg/kg

(Source: Newton *et al.,* 1977)

Table.1 Comparison of nutritional value of black soldier fly larvae meals vis-à-vis conventional meal

Constituents (% in DM)	BSF Larvae	Fish meal	Soy meal
Crudeprotein	56.9	70.6	51.8
Lipid	26.0	9.9	2.0
Calcium	7.56	4.34	0.39
Phosphorus	0.90	2.79	0.69
Ca:P ratio	8.4	1.56	0.57

(Source: Makkar *et al.,* 2014)

BSFL Truly Sustainable

Simple labor skills

Natural matured technology

Very Low Carbon footprint

Low Investment cost

Non pest insect

Multiple product value

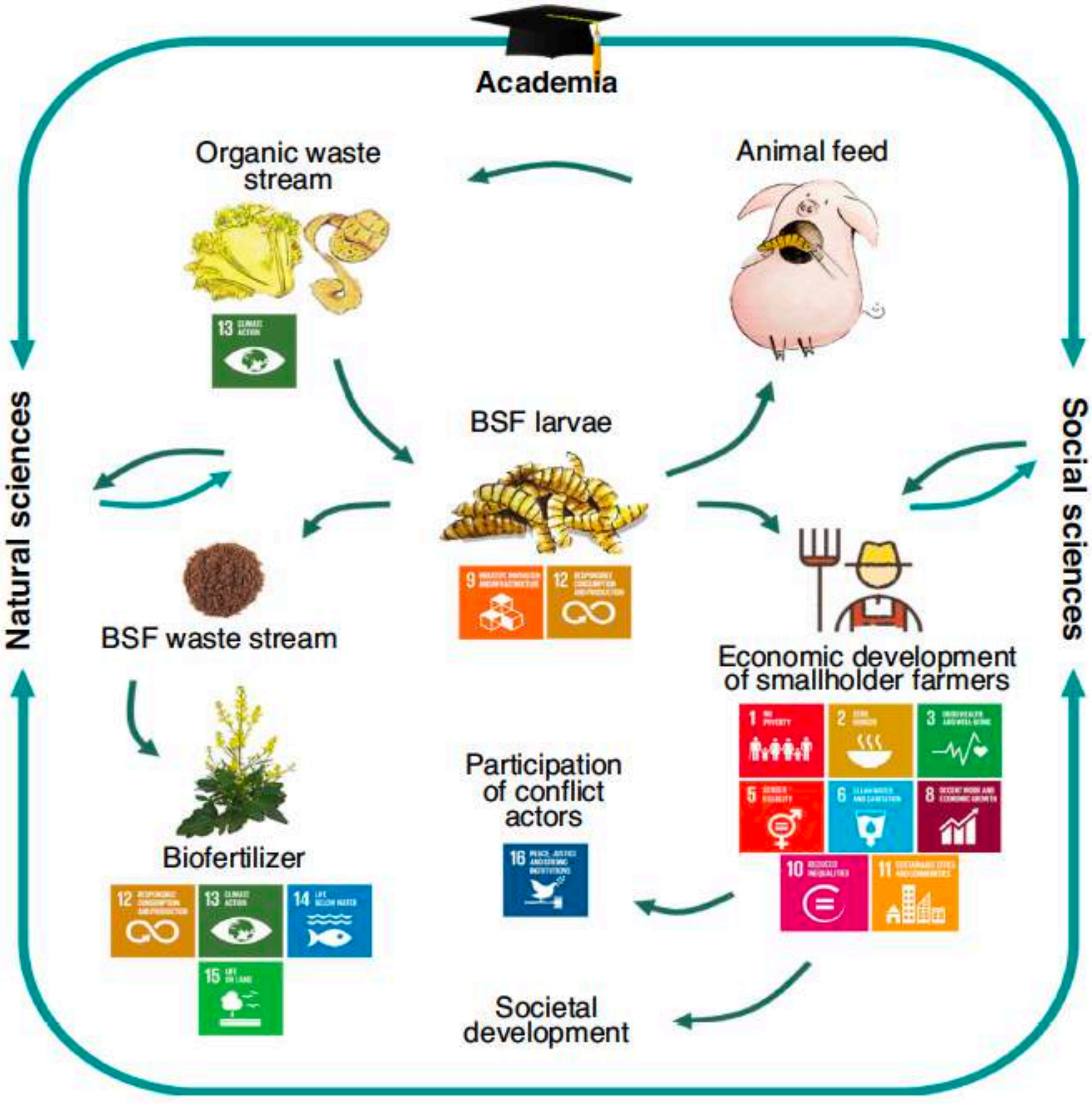
Social acceptance

Livelihood

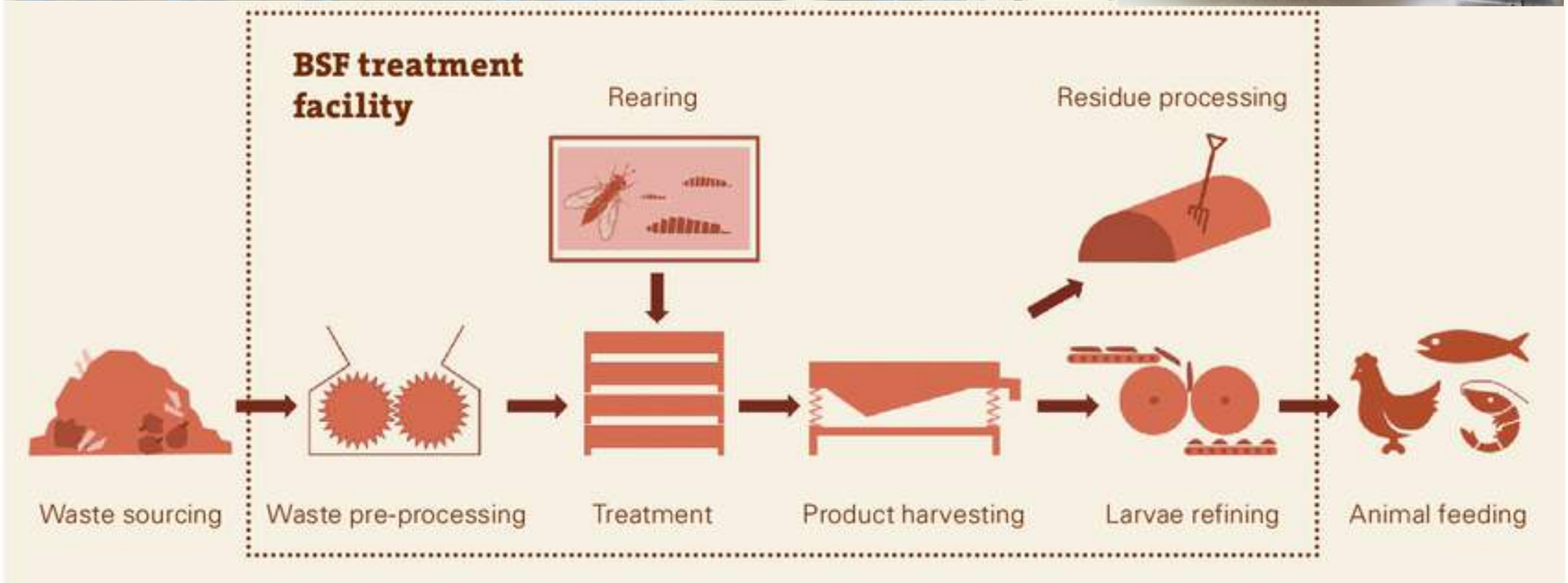
Environment friendly

Odourless

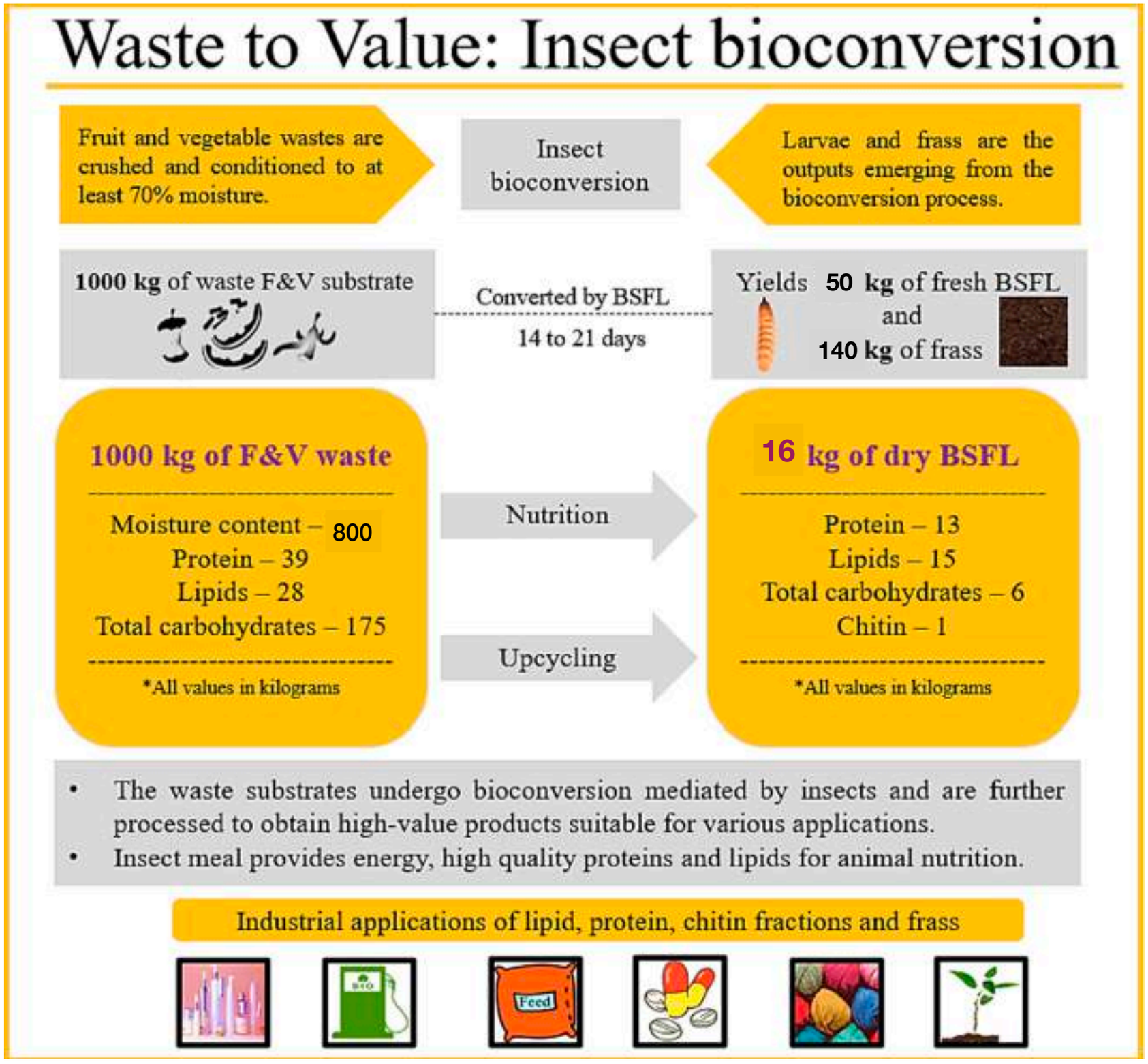
BSFL meets SD Goals



BSFL Process Facility



Waste to Value Concept



BSFL Frass

Main Features of BSFL Frass

✔ All natural & organic
✔ Rich in insect chitin and calcium
✔ Water soluble
✔ Odourless
✔ Pathogen-free
✔ Zero chemical additive
✔ High in organic matter and nutrients
✔ Full of beneficial microorganisms
✔ Sustainable and environmentally-friendly

Benefits of BSFL Frass

☑ Chitin provides a natural way to protect plants from pests, pathogens and diseases by boosting plant's immune response system
☑ Promotes rapid mineralization and faster nutrient release
☑ Promotes seed germination and early development
☑ Promotes healthy flowering, fruiting and root development
☑ Does not attract flies and other insects
☑ Can be used in fertigation and hydroponics
☑ Beneficial microbes improve overall soil health
☑ Helps retain moisture and nutrients in soil
☑ Helps maintain soil pH for optimum plant growth
☑ Great as soil amendment and conditioner
☑ Improvements can be seen as early as 2 weeks to 3 months

Bio-resource Outputs

Power
1200 KWH

Heat
2800 KWH

Space cooling
in tropical region

Biogas
Engine

Adsorption
Chiller

For Digester
Heating,Space heating
In cold regions

Food waste
100 TPD

Frass
14 TPD

Fresh water
8 TPD

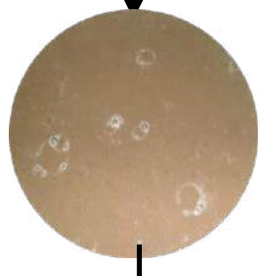
Digestate
54 TPD

Solids

Liquids

BSFL
5 TPD

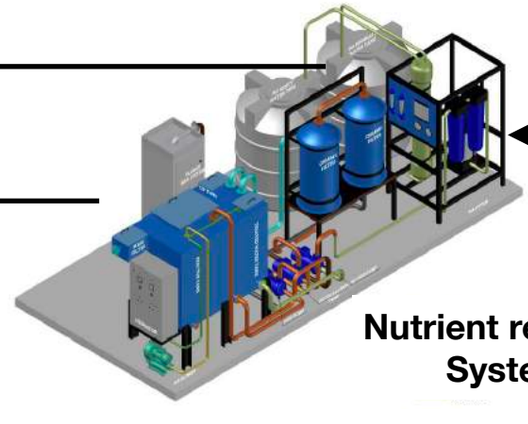
Granulated
Fertiliser
2.6 TPD



Treated Water
32 TPD

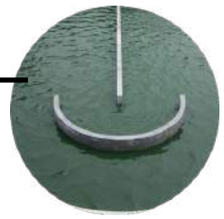
BSFL dry
1.6 TPD

Liquid Nutrient
13 TPD



Nutrient recovery
System

Bio-resource Outputs



Microalgae
300 kgs/day

CO2
600 kgs/day

Food waste
100 TPD

Algal
pond

Fresh water
8 TPD

Frass
14 TPD

BioCNG
300 kgs/day

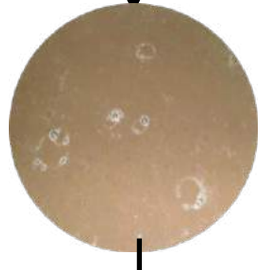
Digestate
54 TPD

BSFL
5 TPD

Solids

Liquids

Granulated
Fertiliser
2.6 TPD



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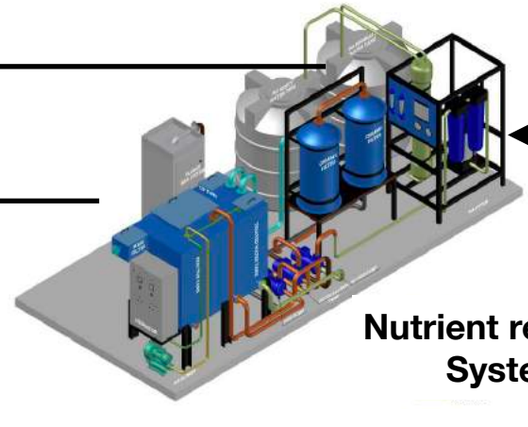

Nutrient recovery
System

Multiple Resources

Our R&D Team

ICAR-CIBA New Startup initiative for the production of 'Black Soldier Fly meal (BSF)' as an effective and sustainable fishmeal replacement source

The Specifics

A typical 100 TPD Organic waste to BSFL processing facility requires

12,000 m2

1700 - 2700 KWH

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BSFL the road towards sustainability