

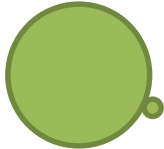
in VALUABLE

Danish R&D projects 2017 (>100k €)



BSF

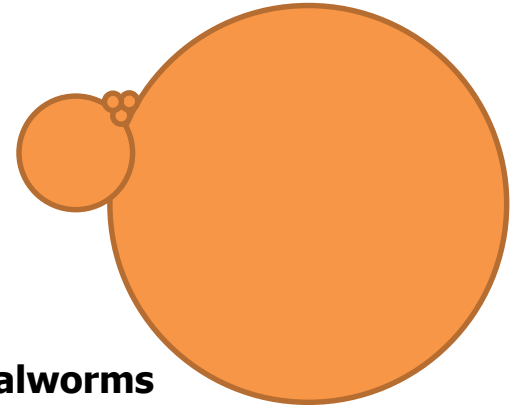
- WICE (390k €, MUDP)
- SUPERIOR (375k €, MUDP)
- Green Biorefining (360k €, F&I)



Crickets

- GREEINSECT (1.34M €, DANIDA)
- Syngja (200k €, IFD)

**>7M €
portfolio**



Mealworms

- inVALUABLE (3.7M €, IFD)
- SUSMEAL (1.1M €, IFD)
- VALIN (175k €, GUDP)
- ENORM (100k €, IFD)
- NLF (135k €, IFD)

inVALUABLE: Overview

Insect Value Chain in a Circular Bioeconomy



The vision of inVALUABLE is to **create a sustainable resource-efficient industry for animal production** based on insects

The partners span the entire value chain and include entrepreneurs, experts in biology (entomology and nutrition), biotech, automation, processing and food technology and safety, as well as an international leading insect producer. This **interaction of competences is key to lifting insect production to an industrial level**

inVALUABLE: Project stats

Insect Value Chain in a Circular Bioeconomy



Duration: 2017-2019 (36 months)

Total budget: 3.7M € (2.5M € investment from Innovation Fund Denmark - one of the largest international R&D projects on insects as feed and food)

11 Partners (1 RTO, 3 Universities, 7 companies)



Insectinov 2 - Adebiotech / AgroParisTech



inVALUABLE: Objectives

Insect Value Chain in a Circular Bioeconomy



inVALUABLE aims to **demonstrate the potential of using mealworms** to meet the increasing demand for protein in the food chain by:

- 1) developing an insect value chain using low-value by-products - **reintroducing valuable resources back into the food chain**
- 2) **document the nutritional potential of insects** using state-of-the-art animal models
- 3) combine best technologies to **enable market penetration** focusing on large-scale production, automation and processing
- 4) **support Danish/EU authorities on feed/food legislation** providing data to ensure safe insect products



inVALUABLE: Focal areas

Insect Value Chain in a Circular Bioeconomy



Project Management (WP9)



Production

- WP1: Optimization of production (reproduction, production environment, pilot)
- WP2: Nutrition and Health (mealworm diet and diseases)
- WP3: Automation of production (robotics – handling, vision)



Processing

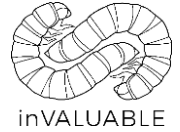
- WP4: Development of processing (treatment of substrates and insect biomass)
- WP5: Feed/Food safety (safety assessment, legislative advocacy)



Product Application

- WP6: Feed assessment (animal feed trials; nutritional and health)
- WP7: Food assessment (insect-based food and functional food ingredients)
- WP8: Influencing the market (dissemination; consumer acceptance)

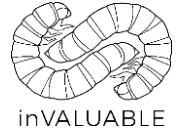
WP1: Bio-production



- **Optimization of mealworm production** (*T. molitor* and *A. diaperinus*) with special emphasis on e.g.:
 - **Reproduction**
 - Development of **diets for adult beetles** (with WP2)
 - Developing a reproduction assay to assess key parameters (e.g. egg hatchability).
 - **Optimizing production conditions** regarding temperature and larvae density
 - Establishment of **pilot facilities** at DTI and Ausumgaard
 - Interaction with automation (in collaboration with WP3)



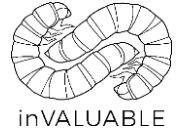
WP2: Nutrition & Health



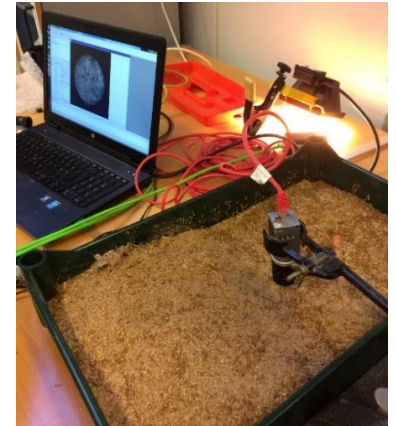
- **Nutritional assessment of selected by-products** (feed/food grade and 'grey zone' – see WP5) as feeding substrate for mealworms to boost future yields
- **Preventing mealworm diseases**
 - Assess how different diets, as prebiotics, **influence immune traits in mealworm**
 - **Screening of probiotic bacteria** with antimicrobial properties against insect pathogens
 - Assessment of promising prebiotic diets as well as selected diets including probiotics to **assess in vivo effects of pre- and probiotic treatments on mealworm resistance** and tolerance towards pathogens



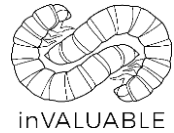
WP3: Automation of production



- **Developing innovative technologies** for implementing cost-effective production systems through improved **mechanization and automation, including digitalized visual monitoring** of mealworm health; delivering '**second generation**' solutions customized for the insect industry
 - Design a **cost-effective automated system** for rearing mealworms based on data-exchange to integrate an adaptive process control (Industry 4.0)
 - **Implementation of relevant prototype(s)** (e.g. either for monitoring or handling operations) in at least one of the projected pilot production facilities (with WP1)



WP4: Development of processing



- Development of **processing of feeding substrates and insect biomass** using different established and new technologies, e.g. various drying methods, defatting, extrusion and enzyme treatment; ensuring that a high quality protein meal is developed as raw material for application in various feed and food product
 - Product specification and performance will be evaluated on the processed insect biomass in WP6
 - Application of a **'value logistics tool'** based on modifying an existing biomass supply chain tool to evaluate the cost of biomasses from different industries



WP5: Feed/Food safety



- **Assessing the safety** of the obtained mealworm products depending on the utilized feeding substrates (WP2) and processing methods (WP4). Data for **risk assessment of insect-based products** will be generated by testing insects (WP2) that are currently in a legal 'grey zone', due to possible chemical and/or microbial contaminants in the feeding substrate
 - Providing a basis for: i) authorities to establish the legal framework; and ii) industry to identify critical control points for **safe insect production**; advocating marketing of insect-based feed/food in dialogue with stakeholders and legislators
 - **Hazard characterization of relevant "grey zone" substrates** – identified based on availability, magnitude and cost for the insects industry (WP2). Focus will be on i) microbiological hazard that may have an adverse effect on insect health and/or food/feed safety and on ii) chemical hazards



WP6: Feed Application



- **Assessing the nutritional and health value of mealworms** by the use of state-of-the-art animal models
 - Rat studies to assess e.g. **bioavailability and digestibility** of the mealworm components after different pretreatments
 - Digestibility study in pigs to **evaluate mealworms for human nutrition** (WP7); and to formulate diets in a second pig study to assess the effects of mealworms on animal performance and health; including assessment of whether mealworms have an **effect on immune and antimicrobial effect**
 - Assessment of growth performance in broiler chickens using mealworms as starter feed



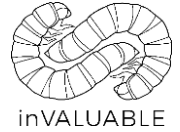
WP7: Food Application



- Utilize data generated in WP6 to **assess the human nutritional value of mealworms** using the DIAAS (Digestible Indispensable Amino Acid Score protein) method.
- **Food application testing** with different types of treated (defatted, texturized or enzymes) insect-meal products in selected products and recipes; supplemented by **sensory assessment and screening of functional properties** of the insect-meal
- **Product development** at Nordic Food Lab (UCPH), e.g. during the UCPH MSc-course 'Thematic course in Food Innovation and Health', where students will be involved in ideation and execution of food with insects.



WP8: Influencing the market



- **Consumer acceptance** of different types of insect food products will be assessed by online surveys and at selected national events
- Strong collaboration with e.g. **Municipality of Copenhagen** on mutual event
- Consolidation of stakeholder network in collaboration with **Dansk Insekt Netværk (DIN)** >150 members since Nov 2016



WP8: Dissemination Y1Q1-Q3 (25 events)

- Danish Insect Network (DIN) – participation/presentation of project activities
- Keynote speeches at national workshops and conferences
- Public dissemination events; e.g. Science days (Forskningens Døgn) 2017, Folkemødet 2017
- Copenhagen Bug Fest
- International conferences

Insectinov 2 - Adebiotech / AgroParisTech



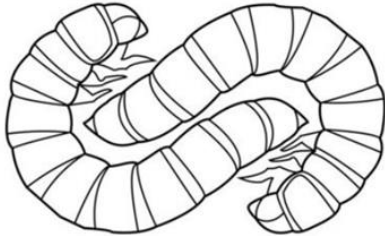
COPENHAGEN BUGFEST



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inVALUABLE

inVALUABLE (Insect Value Chain in a Circular Bioeconomy) is the largest innovation project concerning insects as feed and food in Europe to date. The vision is to create a sustainable resource-efficient industry for animal protein production based on mealworms. The goal is that inVALUABLE can facilitate Danish and European industrial insect production over the coming years and be an enabler of new market opportunities for insects as feed, food and other high-value components.




inVALUABLE


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THANK YOU FOR YOUR ATTENTION!



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