

## PhD Project Advertisement

**Project title:** Substituting soy with insects in UK poultry production: a holistic evaluation of sustainability impacts and trade-offs

**Project No:** FBS2024-025-Pexas-cr

**Lead supervisor:** Georgios Pexas, School of Water, Energy and Environment, Cranfield University

**Email:** georgios.pexas@cranfield.ac.uk

**Co-supervisors:**

Yiorgos Gadanakis, University of Reading

Ilias Kyriazakis, Queen's University Belfast

### Project description:

This is a great opportunity to tackle two major challenges to global sustainability: environmental degradation and feed and food security.

Livestock protein feed production (i.e., oil crops), and more specifically deforestation-associated soy, accounts for the majority of environmental impacts associated with livestock production globally (1). Past research has identified the capacity for several local, circular, and soilless alternative protein feed ingredients to offer potential sustainable solutions to substitute soy in livestock diets (2). Among such alternatives, insect meals present significant potential to sustainably provide protein feeding various livestock species. However, important gaps in quantitative information regarding the specific performance insect-feed production across environmental, economic, and social indicators, hinders its commercial implementation at large scales.

To address these gaps, the project will investigate insect meals as protein sources in poultry diets and assess their potential and limitations for sustainability improvement through a holistic Consequential Life Cycle Assessment (CLCA) modelling framework. The student will work alongside UK-based insect-feed manufacturers, poultry farmers, and animal nutritionists to develop baseline and alternative production scenarios around several innovations across the feed production & supply chain. In this way, the student will contribute significantly to the establishment of novel, granular life cycle inventory data, information for sustainability hotspot identification, and evidence towards optimisation of insect-feed production and use by poultry systems through various system configurations. Environmental and economic impacts and trade-offs associated with such scenarios will be assessed through the modelling framework, and related uncertainties will be addressed using Bayesian statistical methods. Further to environmental performance and cost-effectiveness, the CLCA approach will allow for a quantitative assessment of indirect, unintended negative consequences and knock-on effects on vital resources (e.g., land, energy, water) that may arise from the commercial implementation of insect feeds. Ultimately, the project will synthesise recommendations and pathways towards sustainable development in the livestock sector through key circular agriculture pathways, and by freeing up valuable resources that can be used directly for human food production (e.g., land, water) thereby enhancing overall global sustainability and food security.

The overarching hypothesis to be tested is that emerging alternative livestock diets and specifically local, circular, and soilless protein feed production methods can contribute significantly to the reduction of negative environmental impacts associated with UK livestock production, while securing system profitability.

The specific objectives of the project will be:

- The development of novel diet formulations through the incorporation of insect-based feeds that substitute soy without sacrificing animal performance, as well as scenarios around the use of different waste substrates for production of insect feeds and around different supply chain configurations.
- The development of a novel mechanistic CLCA model to evaluate environmental and economic impacts of the alternative diet formulations in UK poultry production systems.
- The comparison of insect-based diets against diets that incorporate deforestation-associated soy and other oil

crops as key protein sources.

- The generation of new primary data for a comprehensive LCI that describes different insect-based feed production & supply methods.
- The evaluation of production & supply scenarios against extreme environmental, macroeconomic, and geopolitical disruptive factors.
- The assessment of issues of social acceptability around different insect-based feed production methods and willingness-to-pay for “soy-free livestock products fed insect-based feeds” at consumer / retailer level.
- The assessment of sustainability trade-offs and synthesis of future recommendations for alternative protein feed solutions to support sustainable, resilient, and socially acceptable livestock production.

The project is supported by INSPRO ([www.InsPro-uk.com](http://www.InsPro-uk.com)), which will enable access to a great network of stakeholders including poultry production systems, livestock product retailers and consumers, industry-based researchers and policy-makers within the business / commercial environment. This will enrich the student’s experience and run alongside training in generic and project-specific skills from Cranfield, Reading, and Queen’s Belfast Universities.

#### **Training opportunities:**

The student's comprehensive training program will encompass Environmental Life Cycle Assessment, Life Cycle Costing, Environmental Valuation methods, and fundamental modelling and Bayesian statistics principles. Their modelling capabilities will be enhanced through specialised training in LCA tools such as Simapro and OpenLCA, as well as proficiency in open-source big data handling and modelling tools like Python and R. This training will be enriched by a diverse array of expertise in LCA from Cranfield, Reading, and QUB. Additionally, the student will receive in-depth knowledge of animal nutritional requirements and diet formulation through QUB and a valuable partnership with INSPRO. The training for Cranfield PhD students goes beyond technical skills to include project management, data management, security, statistics, and effective writing and presentation skills—essential components for successful PhD-level research. A wide range of MSc modules is available to the student in all three Universities.

INSPRO's support for a prospective professional placement provides a unique opportunity for the student to gain invaluable insights into real-world commercial requirements while actively gathering primary data. The student will play an integral role in trading operations and will lead the development of innovative business models aimed at revolutionising the use of alternative protein meals within the poultry industry.

#### **Student profile:**

The student must have a background in agricultural–environmental sciences, be highly numerate, and have some familiarity with socio-economic sciences or a strong willingness to learn about it. They must be confident with basic mathematical modelling and statistical modelling principles. They should be motivated towards improving agri-food sector sustainability through science across its three pillars environment, economy, society. The student should have good abilities in engaging diverse stakeholders and an interest in collaborating with industrial partners.

The studentship will consider students without all the desired attributes, should the weight of their current attributes and the student’s potential seem likely to compensate.

#### **Stipend (Salary):**

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this is £18,622 and it will increase slightly each year at rate set by UKRI.

#### **Equality Diversity and Inclusion:**

The FoodBioSystems DTP is committed to equality, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#).

In accordance with UKRI guidelines, our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

## References:

(1) Food and Agriculture Organisation (FAO). Global Conference on Sustainable Livestock Transformation: better production, better nutrition, better environment, better life. September 2023. Rome, Italy.

(2) Pexas, G., Doherty, B., & Kyriazakis, I. 2023. The future of protein sources in livestock feeds: implications for sustainability and food safety. *Frontiers in Sustainable Food Systems*, 7, 1188467.  
<https://doi.org/10.3389/fsufs.2023.1188467>

**For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).**