Multi-objective optimization for sustainable insect chains

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When considering an optimized insect production chain for food and feed, there is no single best solution: multiple conflicting objectives need to be balanced and assessed. Such objectives include economical assessments (costs for energy and feed, capital expenditure, annual production,etc), sustainability (consumption of water, use of chemicals, production of wastewater, GHG emissions, etc.) and societal impacts (number and quality of new jobs created, safety measures for employees, societal acceptance of insect farming, etc.).

Rather than aggregating all optimization objectives into one, for example by using a classical weighted sum, a more unbiased approach is multi-objective optimization (MOO). MOO algorithms are able to deliver, instead of a single solution, a set of different compromises, each one favoring some objectives against others. By showing the possible optimal trade-offs to human experts, MOO makes it possible to explore different scenarios and ultimately making informed choices, being aware of what can be gained and lost by choosing one particular solution over others.

In order to apply MOO to sustainable insect chains, we identified several objectives for which either computer/mathematical models are readily available, or for which machine learning models can be inferred from data collected by partners in the project. The long-term objective is to provide both private and public stakeholders with different possibilities for the configuration of modern insect production chains.