



## INNOECOFOOD - Eco-innovative technologies for improved nutrition, sustainable production and marketing of agroecological food products in Africa

Grant Agreement no: 101136739

### Deliverable D8.4

#### INNOECOFOOD first batch of practice abstracts

**Due date of deliverable: 30/06/2025**

**Actual submission date: 25/07/2025**

**Start date of the project: 01/01/2024**

**Duration: 36 months**

**Organisation name of lead contractor:** CIIMAR - Centro Interdisciplinar de Investigação Marinha e Ambiental

**Revision: V1**

<b>Project co-funded by the European Commission within the Horizon Europe Programme</b>	
<b>Dissemination Level</b>	
<b>PU</b> Public	X
<b>SEN</b> Sensitive, only for members of the consortium (including the Commission Services)	

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## Summary

This Deliverable presents the first batch of Practice Abstracts (PA) produced within the framework of the INNOECOFOOD project. The PA are short, practice-oriented summaries designed to facilitate the transfer of knowledge and innovation to relevant practitioners, such as producers, farmers or end-users. Each abstract is focused on practical outcomes, recommendations, and potential applications. The current Deliverable includes eight PA developed during the first 18 months of the of the project (01/01/2024 to 30/06/2025). The content is based on the results obtained by the project partners during the development of the project tasks, as result of the activities, fieldwork, and scientific experiments.

The deliverable was prepared in an Excel template, but to make it easier to read, the texts will be copied as plain text instead of as a graphic copy of the Excel document.

## Objective

The objective of the PA is to facilitate knowledge transfer from the project partners to stakeholders, end-users, and practitioners, providing clear information on the main achievements of the project after the first 18 months of execution. Each PA points out the elements related to the improvement of costs, productivity and activities that are particularly important for practitioners.

## Project Information

**Title:** Eco-Innovative Technologies for Improved Nutrition, Sustainable Production and Marketing of Agroecological Food Products in Africa

**Geographical location:** Country – PT; CAP Strategic Plan – 2023PT06AFSP001 Portugal; Main geographical location (NUTS3) – PT11A Área Metropolitana do Porto

**Cross-border/transnational OG:** Transnational

**Editor:** FSPN-Africa

**Project Coordinator:** Name – Centro Interdisciplinar de Investigação Marinha e Ambiental; Address - Avenida General Norton de Matos, S/N, 4450-208 Matosinhos, Portugal; Email – amarques@ipma.pt; Telephone: 00351 213 027 000

**Project period:** starting date – 2024; end date – 2026

**Project status:** ongoing

**Additional funding source:** Horizon Europe and NKSB (NK Sustainable Bioproducts Ltd)

**Total budget:** Total contribution – 7002420.00 EUR; EARFD contribution – 0.00 EUR; National co-financing – 0.00 EUR; Additional national financing – 356825.00 EUR; Other – 0.00 EUR



**Objective:** The project objectives are: i) conduct scoping of aquaculture practices and establish 4 sustainable and innovative agribusiness ECOHUBs to produce fish, spirulina and insects; ii) optimize the production using AI and IoT; iii) scope suitable plant products, up cycle fish waste nutrients and make novel products from fish and co-products, spirulina and insects; iv) validate nutritional and sensory quality, food safety, consumer acceptance, life cycle analysis, and certification; v) create a database and train locally youth and women; in 6 African countries.

**Short summary on the findings (expected or final):** By the end of the project, the INNOECOFOOD will have four rural ECOHUBs where youth, women, science community, value chain actors and policy makers will have access to climate smart and farm to fork technologies, safe, nutritious products and innovations for sustainable products, certification, marketing and consumption of aquaculture fish, selected spirulina and insect species. The immediate results from the ECOHUBs that will contribute to project's socio-economic, climate and scientific impact areas are: i) eco-farmed fish production, ii) spirulina production and iii) insect production. It is also expected to promote circular system of food production and upcycle waste for novel products.

**Description of project activities:** The workplan comprises 8 work packages (WP) to cover the objectives of the project. WP1 - Project Management; WP2 - Scoping aquaculture practices in lakes and rivers (living labs) and the establishment of 4 sustainable and novel agri-business ECOHUBs in rural areas in 6 African countries (Kenya, Uganda, Tanzania, Namibia, Ghana and Egypt); WP3 - Optimization of the production of eco-farmed catfish and tilapia, sustainable feeds and post-harvest technologies in the 4 ECOHUBs; WP4 - Optimization of the sustainable production of selected spirulina species and post-harvest processing in 4 ECOHUBs; WP5 - Optimize the sustainable production of selected insect species using fresh agricultural plant waste products sourced locally; WP6 - Up cycling waste nutrients to make novel products from fish co-products, spirulina and insects using solar powered drying and extrusion process controlled by AI sensors and IoT; WP7 - Validation of nutritional and sensory quality, microbiological and chemical safety, product acceptance and LCA (CO<sub>2</sub>) impact of the fish, spirulina and insect products, and ASC certification, marketing and consumption; WP8 - Training a total of 120 young and 120 women in person as trainers of trainers and 5000 in person/online in the 4 ECOHUBs and living labs; WP9 - Addressing the ethical issues in the project with an external independent ethics advisor.

**Description of the context of the project:** World population will reach 9.7 billion people by 2050, requiring a 70% increase in agricultural food production. Therefore, resources and global climate change demand innovative and sustainable agricultural practices. The change of production towards diversified and nutritionally balanced foods, can reduce malnutrition and obesity and associated socio-economic long-term consequences. Africa has a population of 1.2 billion and 250 million people go hungry. In Sub Saharan Africa, 20% of the population are undernourished and 413 million people live on less than \$1.90 a day. Hunger is increasing, compounded by conflict, drought, economic problems and extreme weather. Across East Africa, 7 million people are at risk of starvation and another 33.8 million face acute food insecurity and at least 12.8 million children are acutely malnourished. Aid is not a long-term solution. The common goal is to produce nutritious food sustainably and cheaply to mitigate hunger and malnutrition globally, whilst tackling climate



change, creating employment and improving livelihoods of rural people. The practice has been to feed a fast-growing population and focus on rapid economic urban development which damages health and environment globally and particularly in Africa. By employing social and behaviour change communication strategies, INNOECOFOOD addresses these issues with agro-ecological approaches coupled with AI and IoT technologies and certification to ensure safe, nutritious and marketable food supplies in six African countries. Based on ancient family farming practices, agro-ecology deals with local challenges. Integrating ecological and social aspects with design and management of food and agricultural systems, optimizes interactions between plants, animals, humans and the environment to achieve sustainable and fair food systems. INNOECOFOOD will construct four innovative and cost-effective rural agri-business ECOHUBS with state-of-the art technology for water and energy provision and AI and IoT technology for sustainable aquaculture (fish and spirulina) and insect farming.

## Cross-border, Transnational

### Required information:

Which Member State/region coordinates and encodes the project in SFC2021 (main MS)

Portugal
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Which other Member State(s)/region(s) form part of the OG project (NUTS3)?

DE
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Budget per Member State(s)/region(s) which form part of the project (EUR)

MAIN MS (NUTS0)	PT
MAIN Region (NUTS3)	PT11A Área Metropolitana do Porto
Total contribution	680250
EARFD contribution	
National co-financing	
Additional national financing	
Other	

If other, please specify which type of financing

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MS (NUTS0)	DE
Region (NUTS3)	DE112 Böblingen
Total contribution	398468.75
EARFD contribution	
National co-financing	
Additional national financing	
Other	

If other, please specify which type of financing

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MS (NUTS0)	DE
Region (NUTS3)	DE212 München, Kreisfreie Stadt
Total contribution	448802.5
EARFD contribution	
National co-financing	
Additional national financing	
Other	

If other, please specify which type of financing

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## Partners

	Name	Address	Type of partner
Project coordinator	Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR)	Porto, Portugal	6. Researcher or research organisation
Project partner	Kenya Marine and Fisheries Research Institute (KMFRI)	Mombasa, Kenya	6. Researcher or research organisation
Project partner	Tanzania Fisheries Research Institute (TAFIRI)	Dar Es Salaam, Tanzania	6. Researcher or research organisation
Project partner	Makerere University (MAKERERE)	Kampala, Uganda	6. Researcher or research organisation
Project partner	Council for Scientific and Industrial Research - Food Research Institute (CSIR-FRI)	Acra, Ghana	6. Researcher or research organisation
Project partner	University of Namibia (UNAM)	Namibia	6. Researcher or research organisation
Project partner	Central Lab for Aquaculture Research (CLAR)	Egypt	6. Researcher or research organisation
Project partner	University of Dar es Salaam (UDSM)	Dar es Salaam, Tanzania	6. Researcher or research organisation
Project partner	Jomo Kenyatta University of Agriculture and Technolog (JKUAT)	Nairobi, Kenya	6. Researcher or research organisation
Project partner	Burdur Mehmet Akif Ersoy University (BMAEU)	Burdur, Turkey	6. Researcher or research organisation
Project partner	Denizli Governorship (DENIZLI)	Denizli, Turkey	12. Public authority
Project partner	The International Centre of Insect Physiology and Ecology LBG (ICIPE)	Nairobi, Kenya	6. Researcher or research organisation
Project partner	B2E Associação para a Bioeconomia Azul - Laboratório Colaborativo (B2E)	Leça da Palmeira, Portugal	7. Educational or continued professional development organisation (including vocational trainers)
Project partner	Sparky Social Enterprise Limited (SPARKY)	Kampala, Uganda	9. Service providers other than advisors
Project partner	Food Security for Peace and Nutrition Africa (FSPN-AFRICA)	Nairobi, Kenya	7. Educational or continued professional development organisation (including vocational trainers)
Project partner	Innotech Ingenieursgesellschaft mbH (INNOTECH)	Leonberg, Germany	9. Service providers other than advisors
Project partner	Fraunhofer Gesellschaft Zur Forderung der Angewandten Forschung (ISE)	Munchen, Germany	9. Service providers other than advisors
Project partner	Centro de Investigação Interdisciplinar em Sanidade Animal (FMV)	Lisboa, Portugal	6. Researcher or research organisation
Project partner	Mayfair Holdings Ltd (PECHE)	Kisumu, Kenya	9. Service providers other than advisors
Project partner	NK Sustainable Bioproducts LTD (NKSB)	United Kingdom	6. Researcher or research organisation



## Keywords

Keyword – category 1 - 8. Aquaculture

Keyword – category 2 - 16. Climate change (incl. GHG reduction, adaptation and mitigation, and other air related issues)

Keyword – category 3 – 18. Agro-ecology

Keyword – category 4 – 22. Circular economy, incl. waste, by-products and residues

Keyword – category 5 – 27. Food security, safety, quality, processing and nutrition

Keyword – category 6 – 28. Digitalization, incl. data and data technologies

Keyword – category 7 – 29. AKIS, incl. advice, training, on-farm demo, interactive innovation projects

## CSP Objectives & Union Strategies of the Deliverable

### **Project contribution to CAP strategic objectives:**

1. Ensuring a viable income
2. Increasing competitiveness
3. Rebalancing power in the food chain

### **Project contribution to Union strategies:**

3. Organic farming and/or organic aquaculture, with the aim of increased uptake

## Audiovisual Material

*Audiovisual material which is useful and attractive for practitioners.*

**Title/description:** INNOECOFOOD Project animation video

**URL:** <https://we.tl/t-w8miQxthwj>

**Additional comments:** Created by B2E

## Websites

*Links to other website(s) hosting information on the project (results) that are available after the project has ended, by preference using the existing local/regional/national communication channels that practitioners most often use.*

**Title/description:** INNOECOFOOD Project website

**URL:** <http://innoecofood.eu/>

**Additional comments:** Created by FSPN-A

**Title/description:** Community Virtual Hub (e-learning platform)

**URL:** <http://innoecofood.eu/>

**Additional comments:** Developed by FSPN-A

## Practice Abstracts

The instructions to fulfil the practice abstracts were as follows:

*Short summary for practitioners in English on the (final or expected) outcomes (800-1000 characters, word count - no spaces).*

*This summary should at least contain the following information:*

- Main results/outcomes of the activity (expected or final)*
- The main practical recommendation(s): what would be the main added value/benefit/opportunities to the end-user if the generated knowledge is implemented? How can the practitioner make use of the results?*

*This summary should be as interesting as possible for farmers/end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, productivity etc.). Research oriented aspects which do not help the understanding of the practice itself should be avoided.*

### Practice Abstract 1

Within WP2, four sustainable and innovative agribusiness ECOHUBS are being constructed in rural areas nearby satellite villages in Ghana, Kenya, Egypt and Tanzania and involving the local communities. The ECOHUBS will combine the production and processing of nutritious food and feed (catfish/tilapia, spirulina and black soldier fly/crickets) nearby with innovative renewable technology (including innovative solar drying and cooling processing technologies), and involving training of rural farmers in the ECOHUBS including women and youth to improve employability and address the inequalities resulting from a lack of rural training institutions. ECOHUBs follow Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) from recycled cost-effective prefabricated building materials, powered by hybrid renewable solar, and a fresh water supply using a bore hole. The ECOHUBS are at different levels of installations and is anticipated to be complete end of November 2025.

INNOECOFOOD

WP2: Installation of 4 ECOHUBS in diverse African countries

Installation of four ECOHUBS in African rural areas in in Ghana, Kenya, Egypt and Tanzania with involvement of communities (Women and youth)

ECOHUBS will combine production and processing nutrition food and feed using renewable energy in drying and cooling technologies





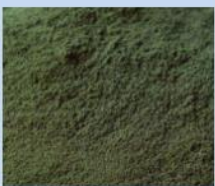


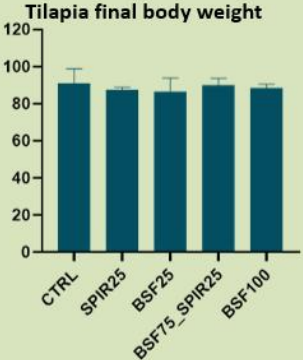

ECOHUBS are at different levels of installations and anticipated to be complete by end November

ECOHUBS Practices

Good Hygiene Practices

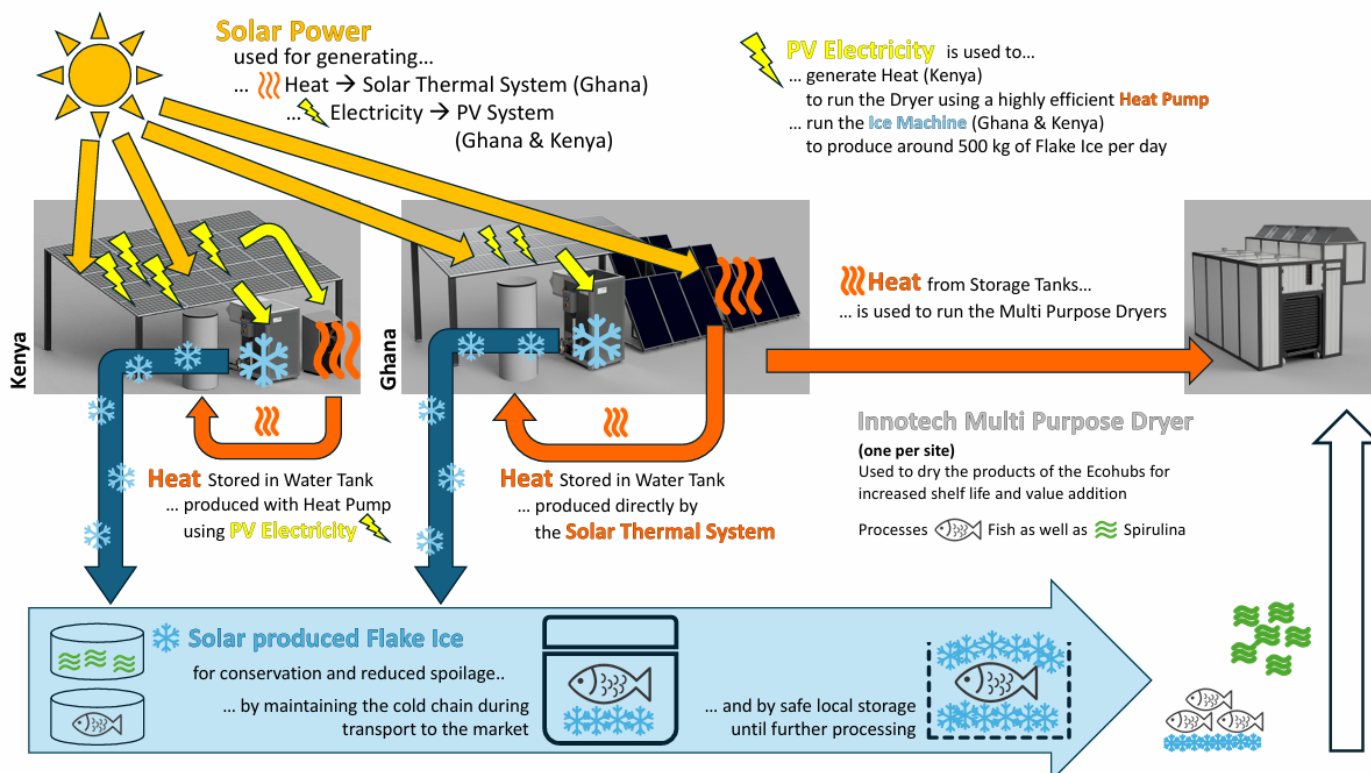
## Practice Abstract 2

Within Task 3.2 a fish feed trial for tilapia was conducted in an attempt to find sustainable alternative protein sources able to replace fish meal. A 71 days trial evaluated protein sources produced locally within ECOHUBS, including Spirulina and black soldier fly (*Hermetia illucens*) larvae meal (BSFLM) as alternatives to fishmeal. Five practical diets were formulated (35% crude protein, and 8% crude lipids). A control diet contained 5% fishmeal (FM), while for the other experimental diets, FM-protein was partially (25%) replaced by either BSFLM, or spirulina, or totally (100%) by a combination of 75% BSF and 25% spirulina, or 100% BSF. The findings revealed the feasibility of replacing FM with spirulina and BSFLM as innovative feed sources in diets for Nile tilapia, without compromising growth, feed efficiency, fillet quality, or digestive health. The initial trials were conducted at CIIMAR in Portugal, and a similar approach is on-going in Kenya for catfish, and the optimized feeds will be validated at ECOHUBS and aquaculture commercial sites in Uganda, Tanzania and Egypt.

AIM	METHODOLOGY	RESULTS																						
<p>INNOECOFOOD project aims to develop alternative protein sources in fish feed in place of fish meal (FM) protein using spirulina and Black Soldier Fly (BSF) for Tilapia and Catfish</p>     	<p><b>Tilapia Test Diets</b></p> <p>CTR: Control diet with 5% FM protein  <b>BSF25:</b> 25% of FM-protein replaced by BSF  <b>SPIR25:</b> 25% of FM-protein replaced by Spirulina  <b>BSF75_SPIR25:</b> Total replacement of FM, 75% FM replaced by BSF and 25% Spirulina  <b>BSF100:</b> Total Replacement of FM by black Soldier fly meal</p> <p><b>Catfish Test Diets</b></p> <p>CTR: Control diet with 10% FM protein  <b>BSF 50:</b> 50% FM replacement by BSFLM+corn meal+DCP  <b>SPIR 50:</b> 50% FM replacement by Spirulina+corn meal+DCP  <b>BSF_SPIR 100:</b> 100% replacement by BSF+Spirulina+corn meal+DCP</p>  	<p><i>Tilapia:</i> Growth performance and feed utilization showed no differences among feeds</p> <p><b>Tilapia final body weight</b></p>  <table border="1"> <caption>Tilapia final body weight (g)</caption> <thead> <tr> <th>Diet</th> <th>Final Body Weight (g)</th> </tr> </thead> <tbody> <tr> <td>CTRL</td> <td>~90</td> </tr> <tr> <td>SPIR25</td> <td>~88</td> </tr> <tr> <td>BSF25</td> <td>~88</td> </tr> <tr> <td>BSF75_SPIR25</td> <td>~90</td> </tr> <tr> <td>BSF100</td> <td>~88</td> </tr> </tbody> </table> <p><i>Catfish:</i> Growth performance and feed utilization was significantly higher in the fish fed on the Spirulina at 50% (SPIR_50)</p> <p><b>Cat fish final body weight (g)</b></p>  <table border="1"> <caption>Cat fish final body weight (g)</caption> <thead> <tr> <th>Diet</th> <th>Final Body Weight (g)</th> </tr> </thead> <tbody> <tr> <td>Control</td> <td>~42</td> </tr> <tr> <td>SPIR_50</td> <td>~60</td> </tr> <tr> <td>BSF_50</td> <td>~32</td> </tr> <tr> <td>BSF_SPIR 100</td> <td>~58</td> </tr> </tbody> </table> <p><b>Further trials to be conducted in the ECOHUBS when construction is done</b></p>	Diet	Final Body Weight (g)	CTRL	~90	SPIR25	~88	BSF25	~88	BSF75_SPIR25	~90	BSF100	~88	Diet	Final Body Weight (g)	Control	~42	SPIR_50	~60	BSF_50	~32	BSF_SPIR 100	~58
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### Practice Abstract 3

Within T3.3, the ECOHUBS in Ghana and Kenya are being equipped with a solar powered ice making machine and a solar multipurpose drier, each. The dimensioning of the equipment is resulting from the specific requirements and adjusted between the project partners. The energy demand of each application is analyzed, and photovoltaic for electricity production will be used, while providing heat for the drying processes for fish, spirulina and insect processing is more challenging. Different approaches are being followed for Ghana and Kenya: a solar thermal collector system will be installed in Ghana and heat pumps will be used in Kenya for heat production. Whole or filleted fish will be chilled using flake ice, produced with solar energy. The flake ice will be used to reduce spoilage and fish waste, either by local storage and/or to keep the cooling chain to the market. The ice production capacity in Ghana and Kenya will be 300 kg and 650 kg of flake ice within 8 h of operation per day, respectively.



### Practice Abstract 4

Within T3.4, aquaculture farms in Lake Victoria (Uganda and Tanzania), Lake Volta (Ghana) and Lake Liambezi (Namibia) were selected for INNOECOFOOD as Living Labs for training of rural farmers aided by artificial Intelligence (AI) sensors and IoT to monitor on real-time the quality of water, fish health and welfare and use automatic feeders to reduce waste and pollution that otherwise undermine fish health. These sensors will generate information on salinity, pH, dissolved oxygen, temperature, nitrates, nitrites, ammonia, phosphorus, plankton turbidity, chlorophyll and light intensity that will be added to a cloud, studied and shared via a web-server for training and optimizing the production. The same approach is being implemented in the ECOHUBS fish, spirulina and insects' production and processing units to monitor the ECOHUB functioning efficiency, optimize energy management, product performance and for quality monitoring and control.

## Task 3.1 Progress: Tilapia & Catfish Production Across ECOHUBs

### Site-by-Site Progress

Egypt (CLAR) • Kenya (KEMFRI) • Tanzania (TAFIRI)



#### CLAR – Egypt

- System: In-Pond Raceway System (IPRS)
- Engineering layout approved (3 units in 1-feddan pond)
- Tender finalized, contractor selected
- Equipment delivered: pumps, sensors, blowers, diffusers
- Excavation completed
- Fingerlings prepared for stocking

#### KMFRI – Kenya

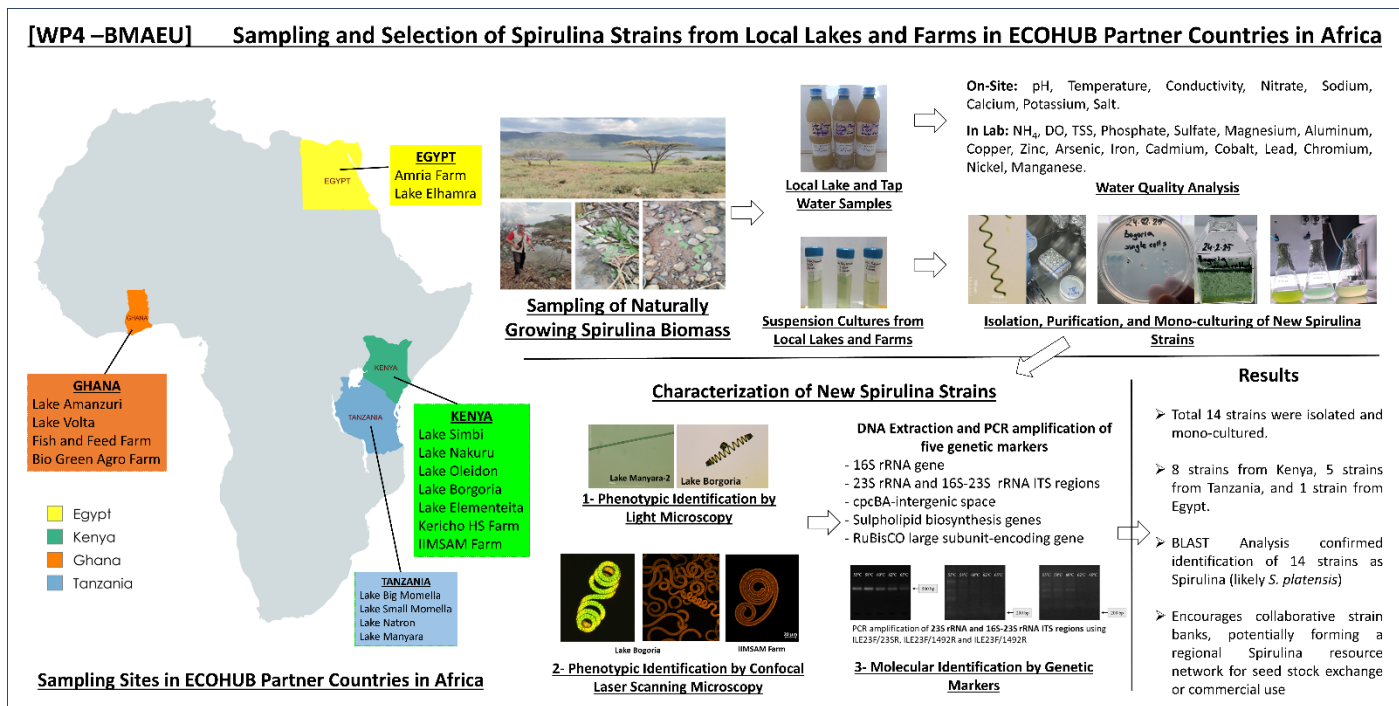
- System: Recirculating Aquaculture System (RAS)
- Suppliers identified
- Broodstock & fingerlings from Sagana
- Tender advertised post-budget revision
- Equipment ordered, partial delivery received
- Infrastructure ready and construction started

#### TAFIRI – Tanzania

- System: ECOHUB (layout in progress)
- Site identified and visited and found suitable
- Layout sketches developed
- Suppliers shortlisted
- Excavation tender announced
- Delays due to heavy rain & waterlogged soil
- Admin issues with digital procurement uploads

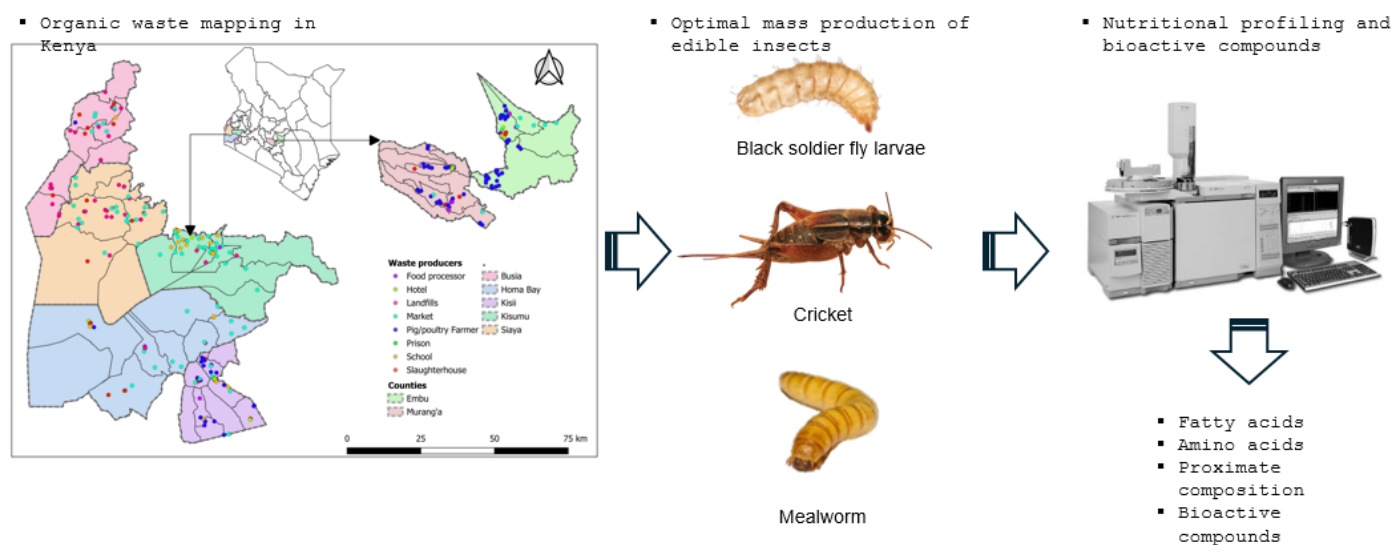
## Practice Abstract 5

Within WP4, samples from lakes in Kenya, Ghana, Tanzania and Egypt to isolate local spirulina strains. After water quality and toxicity analysis, 11 Spirulina strains were phenotypically isolated and monocultured - five from Kenya, five from Tanzania, and one from Egypt. No strains were found in Ghana. Light and confocal laser scanning microscopy (CLSM) were used for morphological characterization. Molecular analysis enabled robust species classification and identification. *Arthrospira platensis* and *Limnospira fusiformis* were consistently detected, confirming successful isolation of Spirulina strains. Currently, the isolated strains are being cultivated and their optimum growth conditions and performance are being assessed. Afterwards, nutritional composition, micronutrients and bioactive compounds will be characterized in order to select the best strains to be produced in each ECOHUB. The final results are expected by October 2025.



## Practice Abstract 6

Within WP5 a detailed mapping of agricultural by-products or organic waste for optimal and mass production of black soldier fly (BSF), crickets and mealworm has been developed. Major organic waste streams like market fruit and vegetable waste, animal manure, brewery waste, waste from food processors have been characterized and evaluated for their suitability for commercial BSF production. For cricket and mealworm, artificial diet comprising agricultural by-products, particularly weeds, have been formulated and validated as a powder and pelletized for large scale production to maximize growth and reduce feed intake, thus making them cost-effective and ready for on-site adoption particularly in the ECOHUBS. The best substrates have been identified for BSF, crickets and mealworm. These diets have demonstrated their effectiveness in enhancing the growth performance, survivorship, and reproductive capacity of these insects. The nutritional profile of the insects harvested after feeding on these recipes have been evaluated.



## Practice Abstract 7

Within T6.1, novel nutritious food products from fish, crickets and spirulina, have been identified by partners and developed with local farmers using local ingredients. A baseline survey of popular ingredients, and recipes have been undertaken in Kenya, Egypt, Ghana, Tanzania, Uganda and Namibia. The partners have produced innovative novel low cost, nutritious products, using nutritional software NUTRICALC. A range of high protein products have been trialed: a) dried cricket powder (Kenya), biscuits containing crickets, spirulina and fish (Kenya, Ghana, Uganda), high protein nutrient bars containing cricket powder and fish (Uganda), bread and scones containing cricket powder (Kenya), dried instant packaged soups (Ghana, Uganda), fried snacks (Ghana), and extruded snacks and porridge containing crickets, spirulina and fish (Namibia, Kenya). Preliminary results indicate that these products are highly acceptable in terms of taste, texture and nutritional quality.



## Task 6.1.1 – Solar dried and extruded food products

- Single screw extruder in **UNAM** was used for development work on extruded snacks and instant porridge including spirulina with staples.



Pearl millet Sorghum Maize



Extruded snacks and porridge powder containing spirulina

**JKUAT** has used their small twin screw extruder to make cricket powder and porridge (finger millet, cricket and white maize) for consumer trials by PECHÉ and MAKERERE



### Bakery products:

Biscuits and bread rolls containing cricket powder (PECHÉ)



Bread with 0, 5 and 10% locust flour (ICIPE)

Biscuits with Potato/cassava/sweet potato and Cricket, fish and spirulina powders (CSIR-FRI)



a) Cricket b) Fish powder c) Spirulina



**Nutrient bars with Tilapia fish powder, sweet potato flour or cricket powder (MAKERERE)**



**Instant porridge flour with cricket/Tilapia/maize /sweet potato (MAKERERE)**

**Cricket porridge made with dried, roasted, germinated and fermented millet or amaranth flours (ICIPE)**

**Novel corn sticks snack (Adunle):**



(Maize adunle, A - raw, B - cooked)



(Cricket adunle, A - raw, B - cooked)



(Spirulina adunle, A - raw, B - cooked)



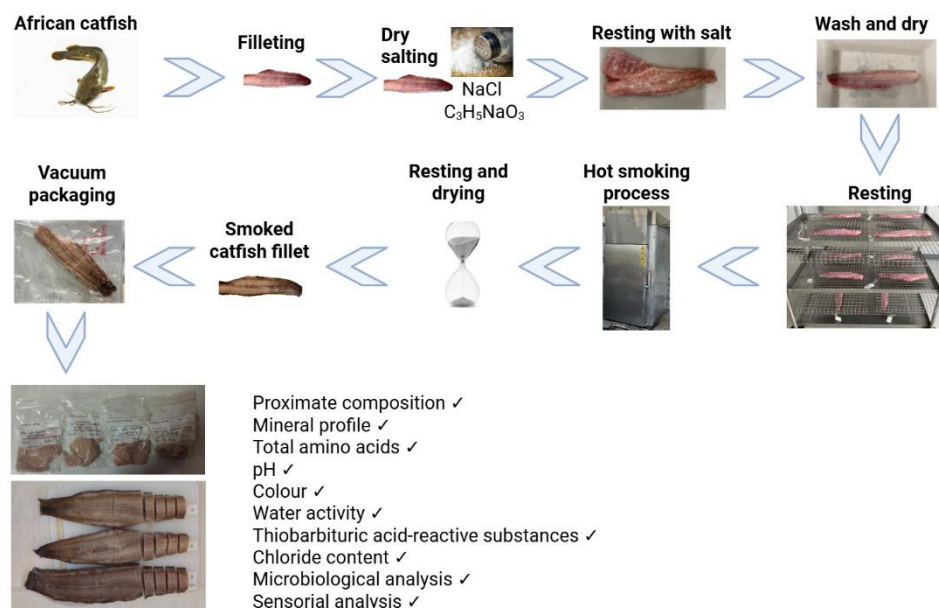
(Spirulina + Cricket adunle, A - raw, B - cooked)



**Novel corn snacks (adunle) containing maize, cricket or spirulina by CSIR-FRI**

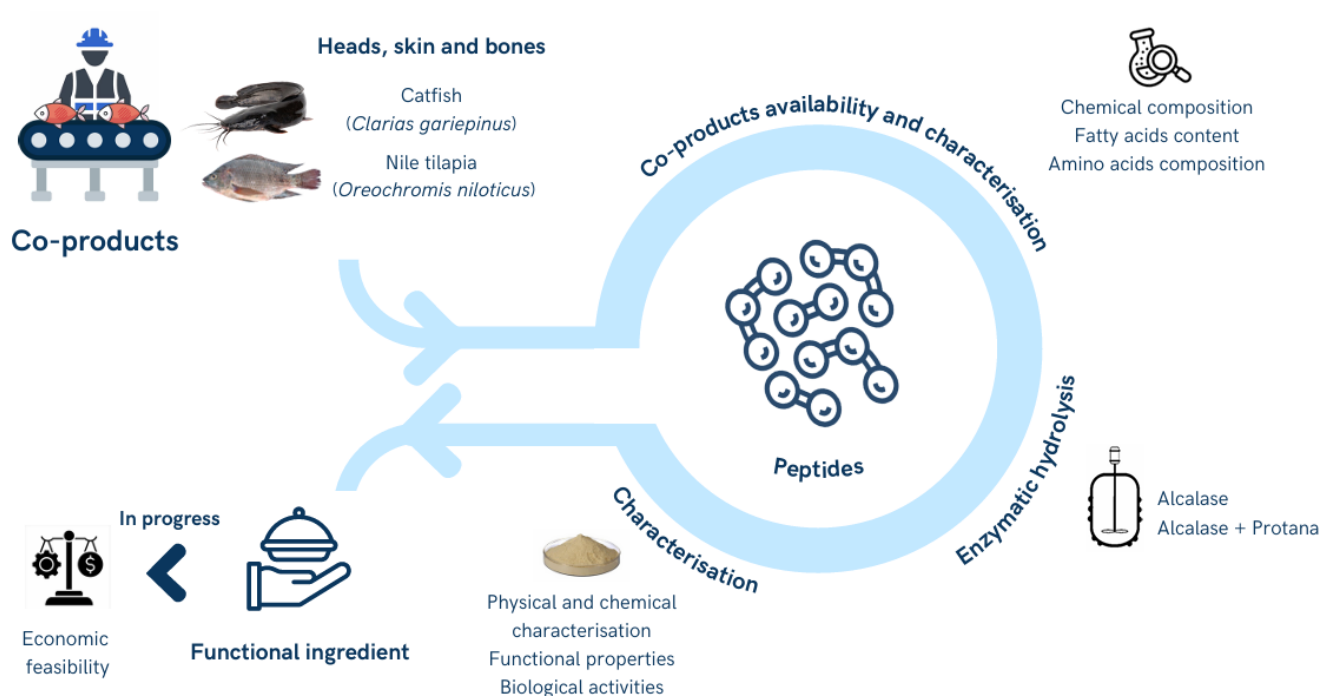
## Practice Abstract 8

Under Task 6.1, significant progress has been achieved to replace the traditional fish smoking process (direct smoking, which leads to high amounts of CO<sub>2</sub> and polycyclic aromatic hydrocarbon – PAHs - contaminants that are carcinogenic and dangerous to the consumers), which hinders producers' access to the international export market. Indeed, many countries do not allow the importation of fish that has been traditionally smoked. To solve these problems, a hot smoking approach was optimized using a smoker in which there is no contact between the product and the combustible material. Additionally, in a way of extending the shelf life of the smoked products, sodium chloride and sodium lactate mixtures were used. The results revealed good sensory and chemical acceptability, and chemical safety of all products (PAHs, Enterobacteriaceae, Listeria monocytogenes lactic acid bacteria and total aerobic mesophilic bacteria). A second phase is now underway intending to assess the shelf life related with each formulation to choose the most suitable to be used by African countries.



## Practice Abstract 9

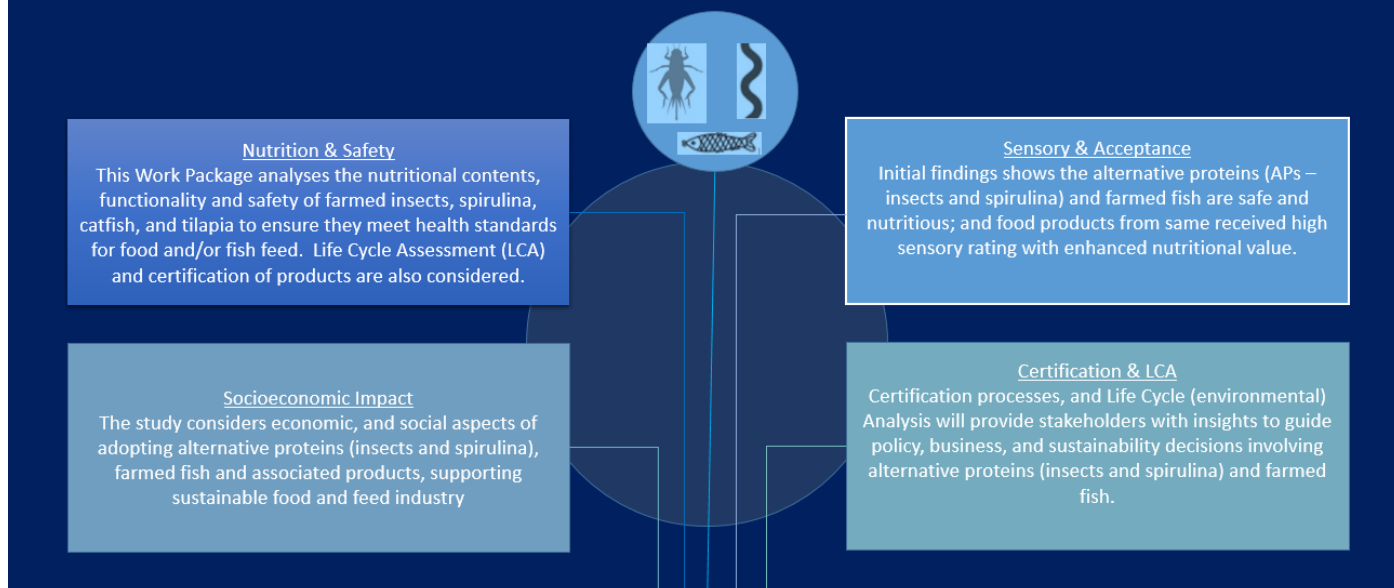
Under Task 6.2, progress was done to transform coproducts from Nile perch (*Lates niloticus*), catfish (*Clarias gariepinus*) and Nile tilapia (*Oreochromis niloticus*) processing into high value-added ingredients. The goal was to promote the sustainable use of these coproducts (that have up to 20% of proteins, fresh weight) through the production of safe and functional fish protein hydrolysates (FPHs), with potential applications in the food and feed industries. In the first stage, the chemical composition of these co-products was characterized and the processes for preparing FPHs optimized using Alcalase and Alcalase+Protana as promising enzymes. The evaluation of the physical, chemical, functional and biological characteristics revealed interesting properties for a potential utilization. A second phase is now in progress to find out the quantities of co-products available and the storage conditions in each ECOHUB, as well as the economic feasibility of this approach locally. Alternatively, the use of these by-products in the form of silage and fermentative hydrolysates are being evaluated.



## Practice Abstract 10

Within WP7, quality, safety, sensory attributes, and consumer acceptance of the new food and feed products using alternative proteins (AP) from farmed insects, spirulina, and fish produced at the ECOHUBS and used in the other WPs are being assessed with validated methodologies. A Manual with harmonized validated methodologies have been produced. Furthermore, the consumer acceptance and socioeconomic factors associated with the marketing of the new products are being addressed, together with certification of ECOHUBS from the good manufacturing and good hygiene practices, as well as the environmental footprint assessment of the different components of ECOHUBS production and processing. Initial findings show that the AP are safe and nutritious, and food products using AP received high sensory rating with enhanced nutritional value. Overall, the outcome will provide valuable insights for stakeholders to make informed economic, nutritional, and environmental decisions regarding the farming, business start-ups, policy, etc. on the inclusion of the new AP in food and feed products, based on both market demand and sustainability.

## Validation of Quality, Acceptance, LCA and Certification of Insects-, Spirulina-, and Fish-based Products



### Practice Abstract 11

Within WP 8, a Joint Cluster Conference was organized by INNOECOFOOD, entitled Enhancing Sustainable and Resilient Agroecology, together with two cluster project AGROECOLOGY-TRANSECT and D4AgEcol. The online event was held on the 27th May 2025 between 8.00 and 14.00 GMT via Zoom. It was attended by 70 people and 22 speakers gave informative talks related with the cluster projects. Concrete examples of project results were given in: a) Session 1: Sustainable Approaches in Agroecology and Food Processing; b) Session 2: Digitalization Tools for Sustainable Agri-food Systems; and c) Session 3: Strengthening Community and Stakeholder Involvement in Sustainable Agri-Food Development. Roundtable discussions allowed the active participation by other attendees, including from those outside the 3 projects. This successful conference was excellent to promote the collaboration between EU cluster projects, paving the way for future innovative joint projects in different areas. The Conference Programme details and links to the video recordings are available on the project website.

**Enhancing sustainable and resilient agroecology:  
Joint Cluster Projects Conference**

**27 May 2025**

**Online**

8.00 to 13.00 GMT (10.00 to 15.00 CEST,  
11.00 to 16.00 EAT)

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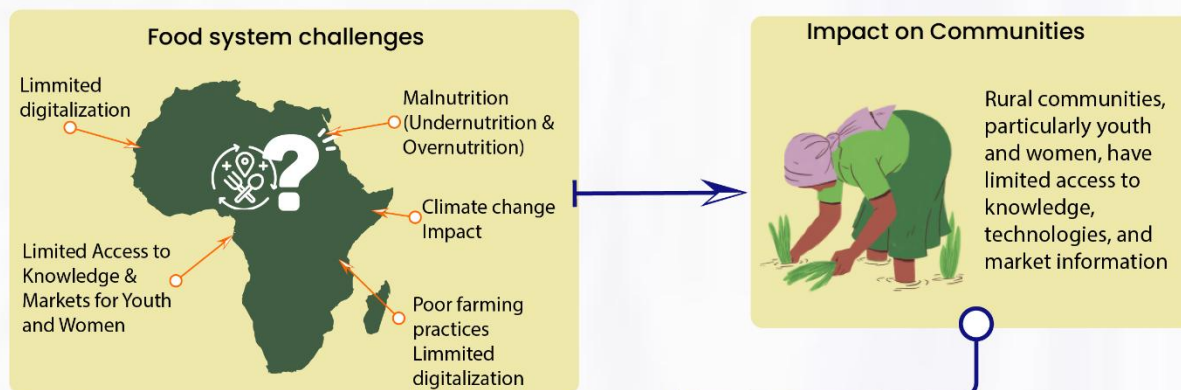
UK Research and Innovation

Logos: INNO ECOFOOD, D4AgEcol, agroecology transect

## Practice Abstract 12

Within T8.3, attention is paid to train the local communities, as Africa faces multiple challenges in its food systems, including undernutrition, overnutrition, climate change, poor farming practices and limited digitalization. Rural communities, particularly youth and women, have limited access to knowledge, technologies, and market information. The ECOHUBS offer a unique opportunity to train rural communities using climate-smart digital learning modules covering the existing knowledge gaps and integrating agroecological practices with AI, IoT, and certification to enhance the sustainable production and processing of fish, spirulina, and insects. Four training modules have been developed for the Community Virtual Hub (CVH). A total of 181 trainers from Egypt, Ghana, Kenya, and Tanzania will be trained digitally and in person, equipping them to educate other farmers. Additionally, a digital aquaculture marketplace on CVH will help farmers and product developers to access better markets, reduce supply chain inefficiencies, and promote inclusive economic growth.

## Practice Abstract 12 - Empowering Rural Communities through ECOHUBS



### The ECOHUB Solution: A Center for Learning & Innovation

