



INNO
ECOFOOD



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Foreward

As INNOECOFOOD reaches the end of its first year, we reflect on a period marked by challenges that initially set back our timelines but have ultimately strengthened our determination. With the commitment of our partners KMFRI, TAFIRI, CSIR-FRI, and CLAR, construction of the EcoHubs is now well underway and we are on track to complete all four EcoHubs, aiming to begin production by early next year. The development of the living labs is also advancing, as partners finalize the installation of the remaining components to initiate full operations.

Our technology partners, ISE, INNOTECH, and SPARKY, are managing equipment-related needs to ensure a smooth setup process.

Meanwhile, FSPN-A, in close collaboration with B2E, is assembling the training materials for our ToTs, preparing to launch training as soon as the EcoHubs are operational.

As we speak, BMAEU is on-site, sampling spirulina from Kenya, Tanzania, Ghana and Egypt, to take back to Turkey and start working on the optimization of spirulina strains for mass production at the EcoHubs. ICIPE has commenced mapping local feeding substrates for insects and is refining protocols for insect rearing, harvesting, and processing.

To mitigate the impact of early delays, several partners have initiated trials on added-value products using locally available resources. MAKERERE, CSIR-FRI, UNAM, JKUAT, and PECHE are already exploring product development, including biscuits, porridge, and snacks. Other partners will follow the example. NKSJ and CIIMAR are preparing two critical manuals: one on product development, characterization, and functionality, and another covering chemical and nutritional composition, quality, and safety. These resources will support partners in the processing of fish, insects, and spirulina, helping to ensure consistency and quality.

In extraction research, ICIPE and BMAEU are working on insect and spirulina oil extraction, respectively, while CIIMAR focuses on sourcing fish oil. CIIMAR also sources raw materials from imported catfish and local tilapia byproducts to produce hydrolysates and peptides. This strategy will expedite our production start when the EcoHubs are fully operational.

Despite the progress, much work lies ahead. The upcoming year, 2025, will be critical for INNOECOFOOD, but with the continued effort and commitment of our consortium, we are confident in our success. This project is bold in ambition but it holds transformative potential for local communities.

Thank you to everyone for your dedication and hard work!

António Marques,
Project Coordinator

Ana Faria,
Project Manager

INNOECOFOOD in Numbers

Notable Events and Achievements

INNOECOFOOD Kickoff Meeting at CIIMAR, Matosinhos, Portugal.

February 6th to 8th, 2024 FSPN Africa Team got the opportunity to attend The INNOECOFOOD Project kick-off meeting at the CIIMAR headquarters in Matosinhos, Portugal organized by CIIMAR.

Funded by EU under The Horizon Europe Programme, the project is devoted to the create innovative production/business ECOHUBS and the improvement of local aquaculture farms in six African countries through the integration of AI and IoT technologies.

Comprising partners from diverse regions including Europe (Portugal, Germany, UK, and Turkey), East Africa (Kenya, Uganda, and Tanzania), Southern Africa (Namibia), West Africa (Ghana), and Northern Africa (Egypt), the consortium's coordinating institution is CIIMAR in Portugal.

The project, which comprises a consortium of 20 partners from Europe and Africa, aims to equip rural farmers, youth, and women with the skills to innovatively produce and process nutritious aquaculture catfish and tilapia, blue-green cyanobacteria spirulina, and insect value chains that will be processed into certified marketable human food products and feed.

The specific objectives are to:

- Conduct scoping of aquaculture practices (living labs) and establish four sustainable and innovative agribusiness rural ECOHUBS using renewable solar/wind energy for the production, processing, and marketing of aquaculture value chains (fish and Spirulina) and insects in diverse African countries, to address AU and EU green deal and trade.
- Optimize the production of eco-farmed fish, spirulina, insects, sustainable feeds, and post-harvest processing technologies using sensors, AI, and IoT technology in aquaculture ECOHUBS and living labs sites.
- Scope suitable plant products; upcycle fish waste nutrients and make novel products from fish and co-products, spirulina, and insects by solar-powered drying and extrusion processing, using AI sensors and IoT.
- Validate nutritional and sensory quality, microbiological and chemical safety, consumer acceptance, life cycle analysis impact, and implement certification schemes for fish, spirulina, and insect processing and products, for consumption, marketing, and trade.
- Create a database and train locally 120 youth and 120 women in the ECOHUBS and 5000 rural workers.



INNOECOFOOD Gets Warm Reception by Got Osimbo Community in Siaya County, Kenya.

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INNOECOFOOD Gets Warm Reception by Got Osimbo Community in Siaya County, Kenya.

INNOECOFOOD was set rolling on 14th to 16th May 2024 in the selected project areas in Homa Bay and Siaya Counties in Kenya respectively, with a series of aquaculture cage visits and an engaging inception workshop. These activities were spearheaded by Kenya Marine and Fisheries Research Institute (KMFRI) alongside other partners in Kenya, ICIPE, JKUAT, Peche Foods, TECAFILI and Food Security and Poverty Alleviation-Kenya (FOSAPA), a community based organization.

The workshop and the project area visits aimed at introducing the project to the beneficiaries and engaging with them in person on what the impact of this initiative looked like and collaborative role each one will play to achieve the expected outcomes.

This transformative 3-year initiative is revolutionizing aquaculture by establishing ECOHUBs and integrating advanced technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT). It goes beyond fish farming, focusing on the production of innovative value chains, including Spirulina, catfish, tilapia, and insects, to create certified food products and fish feeds.



Group photo of Kenyan Partners and Community Members from the Ecohub and Living Labs during the INNOECOFOOD Project Inception Meeting held at Ugunja, Siaya County Kenya.

Rio Fish Limited Visit

A visit to Rio Fish Farm in Rasira, Homa Bay, highlighted the potential for empowering youth and women in aquaculture. Speaking with the Farm Manager, Ninvah Ondieki, the farm owns over 10 cages with varying sizes and capacities. The largest cages accommodate 30,000 fish, followed by those holding 18,000 fish and 10,000 fish respectively.

With such capacity the farm provides stable

employment and economic opportunities to youth and women. This has demonstrated to shield vulnerable women from sexual exploitation because they have been enabled to co-own cages through the income they generate.

However, they face a myriad of challenges of high cost feeds, lack of precision in feeding patterns, colluded quality and market flooding. To overcome these hurdles, INNOECOFOOD will integrate IoT-based monitoring systems,

enhancing efficiency and sustainability. Similarly, the project's operations at Usenge Beach involve collaborative farming with local community-based organizations like FOSAPA.

Rio Fish Limited Visit

During an inception workshop held in Ugunja Subcounty, stakeholders discussed project implementation outcomes with community members and The workshop, led by Dr. Peter Odote, Principle Investigator from KMFRI, underscored the project's commitment to combating food insecurity through community-driven solutions and the economic value it will bring to the community members in area.

Key innovations include Recirculating Aquaculture Systems (RAS), Spirulina cultivation, and insect farming, all powered by green energy. These efforts will introduce sustainable protein sources such as Black Soldier Fly and crickets, which can be

used in food and feed products like cricket porridge, biscuits, and Spirulina capsules.

The project prioritizes empowering women and youth, equipping them with skills to establish viable businesses in aquaculture. By leveraging digital tools, beneficiaries will gain real-time access to knowledge and markets, enhancing production and economic opportunities. INNOECOFood's eco-friendly practices aim to protect Lake Victoria's ecosystem, ensuring environmental sustainability alongside economic growth.

The initiative received robust support from the local community, county governments, and political leaders, all committed to its success. Plans for scalability include supportive policies and guidelines to ensure long-term sustainability and broader impact. With strong backing from donors and partners, the project is set to make a lasting difference in the region. Stay tuned for more updates as this transformative journey unfolds!



INNOECOFood consortium partners, Kenya at Rio Fish Farm at Rasira, Homa Bay County May 2024.

Makerere University Team Assesses Potential sites for Hosting the Mini Living Lab & Fish Processing Unit.

Site Assessments for Fish Processing and Living Lab Facilities

As part of its ongoing implementation, the MAK-INNOECOFOOD project team conducted a comprehensive evaluation of potential spaces for a fish processing unit at Makerere University on March 18, 2024. The assessment focused on

identifying suitable areas within the Department of Zoology, Entomology, and Fisheries Sciences to support the project's work packages 6 and 7. The team reviewed laboratories, storage facilities, and open spaces to ensure they met the infrastructure, accessibility, and capacity needs of the planned fish processing activities.



Makerere University Team at Kamos Fish Farm in Buikwe district, Uganda. Photo: Makerere University.

On March 19, 2024, further evaluations were conducted across four potential sites in Mukono and Buikwe districts. These included two locations in Namumira Anthony Ward, Mukono Municipality, and sites at Kikuba and Kamos Fish Farm in Buikwe. The assessments considered topography, logistics, and feasibility for setting up a mini living lab and fish processing unit.

At Kamos Fish Farm, the team explored constructing experimental cages and ponds for cultivating tilapia and catfish. These facilities aim to establish controlled environments for studying fish growth rates and feed efficiency. Discussions with the farm owner also addressed cost estimates and logistical considerations for these experimental setups.

6 Month INNOECOFOOD Coordination Meeting at Burdur Turkey

The INNOECOFOOD 6-Month Coordination Meeting occurred on July 2nd to 3rd July, 2024, at Burdur Mehmet Akif Ersoy University in Turkey, and brought together 21 consortium partners to discuss project milestones and address challenges. This hybrid event highlighted key progress across nine work packages, focusing on joint efforts in sustainable aquaculture, agroecological food and feed production, and waste upcycling technology.

Progress on ECOHUB building in partner nations was reported. Despite procurement delays and inflationary pressures, ECOHUBS in Kenya, Ghana, Egypt, and Tanzania are expected to be online by October 2024. Aquaculture, insect farming, and spirulina production progressed, with partners overcoming logistical and regulatory challenges.

The meeting also highlighted significant strides in training and dissemination. The project aims to use educational videos which are being developed, as well as community virtual hub, to enhance capacity building of women and youth in the project areas. Additionally baseline and consumer studies were to be carried to assess the community socio-cultural drivers and demographics for beneficiaries selection from the ECOHUB areas.



INNOECOFOOD consortium partners at Burdur Mehmet Akif Ersoy University in Turkey June 2024 during 6 Month meeting.

Tropical Summit 2024 at Lisbon Congress Centre, Portugal.

The Global South is advancing in economic growth and innovation, yet climate vulnerabilities, inequality, and environmental challenges persist. Despite increasing contributions to global development, tropical regions remain underrepresented in global decision-making.

The Tropical Summit aimed to empower these regions by promoting climate-resilient agri-food systems through multilateral collaboration. It spotlighted local innovations, case studies, and measurable indicators to enhance food security, sustainability, and equity.

INNOECOFOOD Project got an opportunity to be featured in the Tropical Summit on 6th July 2024 at where Ana Faria, Project Manager from Interdisciplinary Centre of Marine and Environmental Research (CIIMAR) made successful presentation on the innovative work the project is doing under the thematic area; **Building Climate-Resilient Agri-Food Systems: Case Studies and Indicators.**

This initiative underscores the need for inclusive strategies to harness the tropical regions' potential in addressing global challenges and driving sustainable growth.



Photo source: Tropical Summit

Updates From Our Work Packages

Work package WP1: Project Management

Under WP1, Project Management focuses on coordinating day-to-day operational and administrative tasks. Following our in-person kick-off meeting in February at CIIMAR, we held quarterly online WP leaders' meetings to monitor activity progress, address major setbacks, and propose solutions. Additionally, several smaller, targeted meetings were organized to focus on specific WPs.

The first semester of INNOECOFOOD was characterized by several key deliverables from the coordination team, including:

- An Action Plan on Ethical, Environmental, and Gender Issues,
- A Progress Report,
- Identification of established collaborations beyond the project but aligned with its scope,
- Appointment of an external independent Ethics Advisor, and
- Financial reporting.



INNOECOFOOD Meeting Prof. Nazlin Howel speaking during 6 Month at Burdur Turkey July 2024.

At M6, we convened in person at BMAEU, successfully addressing and resolving the primary obstacles encountered during the early stages.

The first year of the project was marked by delays in the construction of the EcoHub, necessitating a

report to the Project Officer of the European Commission. A revised deadline for its completion was set for M12. Despite these delays, other WPs successfully implemented alternative strategies to maintain progress without depending on EcoHub's production.

Finally, we took the opportunity to present INNOECOFOOD at the Tropical Summit (Lisbon, PT), an event that gathered hundreds of participants, mainly from Africa and South America countries, that met to discuss challenges and uplifting opportunities in the tropics.

Work package WP2: Establishing ECOHUBS and living lab cages in African countries.

Under this work package, scoping of aquaculture practices in Lake Victoria (Kenya, Uganda and Tanzania), Lake Volta (Ghana), Katima Mulilo Area-I-Shams Farm, and River Nile (Egypt) and selection of cages and groups of fishers to be supported by INNOECOFOOD project has been undertaken or is being done in some partners in African Countries. This is to be followed by the installation of ECOHUBS using prefabricated materials sourced from the identified service provider in each ECOHUB country based on specified layout and dimensions.

Already the Namibian ECOHUB has been installed, and once installed in other project partners of Kenya, Tanzania and Egypt, it will involve the local communities especially women and youth who will benefit from training and its use.

The ECOHUBS will install a standard off-grid system, utilizing solar panels and batteries, to support mass production of Catfish, Tilapia, and Spirulina. IoT and AI sensors will monitor temperature, dissolved oxygen, and pH, and processing rooms and classrooms will be installed for value addition and training initiatives.



Cage Farming at Rio Farm in Rasira, Homa Bay County Kenya. INNOECOFOOD in partnership with Rio Farm Limited will utilize the farm as one of the Living Labs where the community around will benefit as a resource centre. Photo taken during visit by Kenya Partners.

Work package WP3 ECOHUBS eco-farmed fish, feed and post-harvest technologies and living lab cages

The INNOECHOFOOD project activities include conducting a baseline survey in each country that has an Echohub. The CLAR team completed the baseline survey with the targeted community in the Echohub village, Abbassa, and conducted Focus Group Discussions (FGDs) in two regions where the majority of people are involved in the seafood business.

The enumerators interviewed a variety of community representatives, including women and youth. Afterward, the team headed to Kafr El-Sheikh and Behera governorates, where most of the fish and seafood are produced, to conduct the required number of FGDs. They faced some difficulties convincing stakeholders to participate in the FGD sessions, but they managed to overcome this challenge with the help of some well-known extension key persons within the community. The results of both the baseline survey and FGDs have been submitted to the activity specialist for processing and reporting.



Work package WP4: Optimization of production of selected spirulina species and processing

Kenya Fieldwork Advances Spirulina

From October 14-21, Dr. Seyit Yuzuak, Work Package Leader visited Kenya to advance eco-innovative food production technologies. Samples of Spirulina and lake water were collected from alkaline lakes, including Lakes Simbi, Nakuru, and Elementeita, with support from local guides and park officials. Visits to Spirulina farms, at Keriko High School and IIMSAM near Kisumu, yielded critical samples. Key water parameters were analyzed, and strains were isolated for study. Despite challenges, three strains successfully adapted to laboratory conditions in collaboration with Kenya Marine and Fisheries Research Institute (KMFRI) and Kenya Wildlife Research and Training Institute. This highlights Kenya's pivotal role in advancing sustainable agroecological innovations.



Sampling locations and farms visited in Ghana.

Eco-Innovative Progress in Ghana

As part of the INNOECOFOOD initiative, a team visited Ghana from November 27 to December 1, 2024. Collaborating with CSIR-Food Research Institute and CSIR-Water Research Institute in Ghana, they conducted fieldwork at Lake Volta and agro-facilities in Sogakope. Key activities included collecting Spirulina and water samples, measuring environmental parameters, and engaging with local researchers and facilities. The samples are now undergoing adaptation studies in the home laboratory. This mission highlights the project's commitment to sustainable agroecological advancements in Africa.

Work package WP5: Optimization of selected insect species production and post-harvest

Detailed mapping of agricultural by-products or organic waste necessary for optimal and mass production of black soldier fly (BSF), crickets and locusts has been completed. Major organic waste streams like market waste [fruit and vegetable waste], animal manure, brewery waste, waste from food processors and others in the Western Kenya have been characterized and evaluated for their suitability for commercial BSF production.

Artificial diets made from agricultural byproducts have been formulated for large-scale cricket production.

The organic waste recipes for locusts and crickets have been transformed into powder and pelletized forms for on-site adoption in the eco-hub.

Consultative arrangements have been established with partners in target countries, and rearing facilities have been designed. The demonstration and learning sites to be established in the eco-hub will be adapted to optimal rearing conditions.

Also, ICIPE has designed low-cost and effective traps for mass harvesting of edible insects such as locusts or grasshoppers from the wild. Arrangements to pretest these traps under field conditions to validate their sustainability are being undertaken. Similarly, these mass harvesting technologies will be extended to other implementing countries where necessary.





Work package WP6: Up-cycling waste nutrients from fish by-products, spirulina and insects.

The aim is to use fish co-products from WP2 to reduce waste and contribute to the circular economy. Recovered fish flesh (Catfish and Tilapia) from frames is being processed to make traditional food products like porridge, biscuits, soups and infant foods, in combination with local staple plant products (cassava, sweet potato, millet) and novel products like spirulina and insects.

NKSB purchased NUTRICALC software which is being used to design new products, calculate nutritional values, and create food labels by 9 partners.

Several drying and chilling technologies are being developed using green technology and AI / IoT.

These include a multipurpose drier for the Ecohubs in Kenya and Ghana and a cheaper solar-powered Sparky drier with AI sensors.

Peché, JKUAT, UNAM, and CSIR-FRI have trialed (preliminary) products like porridge, biscuits, soups, and snacks using locally sourced materials and are awaiting consumer and quality analysis. CLAR, MAKERERE, and TAFIRI will begin trials shortly.

Non-conventional value-added products like gelatin and hydrolysates from fish, by-products like skin, and minerals from bones are in the experimental stages CIIMAR, CSIR-FRI and KMFRI.

Eventually, high-protein spirulina and insect powders from the Ecohubs will be encapsulated. Experimental studies on the extraction of phytonutrients and oil from spirulina for human food or as supplements have commenced at BMAEU.

Work package WP7: Validation of quality, acceptance, LCA and certification of products

The project led by CIIMAR; has developed a draft quality manual for testing novel ingredients and products on basis of sensory testing, nutrition and acceptability, Consumer surveys and socio-economic analysis and Consumer acceptance. The exercise of testing is led by CSIR-FRI.

With ethical approvals being a prerequisite, most partners have already gone through the process and have received approval (For Ghana, Egypt Tanzania, Kenya) and the remaining partners are at the final point of receiving the approval.

Moreover, the project focuses on environmental assessment led by CIIMAR, with keen interest on Life Cycle Assessment (LCA). Significant progress has also been made with the Aquaculture Stewardship Council (ASC) and HACCP pieces of training on the Certification program led by

Work package WP8: Training and Dissemination

To advance the mission of the INNOECOFOOD project—sustainably improving food and nutrition security through innovative aquaculture, spirulina, and insect value chains—the critical contributions of rural women and youth are front and centre. Despite their pivotal roles in agriculture, these groups face challenges, including limited skills and knowledge to adapt to climate change and enhance productivity.

This three-year initiative will empower 240 youth and women across six African countries through targeted training on production, processing, and marketing within these value chains, while also focusing on reducing carbon footprints for environmental sustainability. These trained trainers (ToTs) will cascade their knowledge, reaching 5,000 rural farmers.

FSPN-Africa is leading the training and dissemination activities in close collaboration with B2E and NKSb. To ensure developed training materials address real gaps in the target



Rebecca Kathambi, Project Coordinator at FSPN Africa and Work Package 8 Leader presenting during INNOECOFOOD inception Workshop in Kenya, May 2024.

communities, a baseline study is ongoing to understand the knowledge, attitudes, and practices around the production, processing, marketing and use of fish, spirulina, and insect products and by-products in all six project sites. Training modules will then be co-created with the ECOHUB leaders and select stakeholders including community members to address gaps in knowledge. Training will be offered physically in the ECOHUBs in Egypt, Ghana, Kenya, and Tanzania, supported virtually via the Community Virtual Hub.

While the project is still ramping up due to minor delays, dissemination efforts by consortium partners, on the project website and social media platforms are underway. Highlights include the project Kickoff workshop at Matosinhos, Portugal; the inception Workshop in Ugunja - Kenya; the Fisheries and Aquaculture Research Conference in Tanzania; and the Tropical Summit in Lisbon. Future dissemination activities, including webinars and publications, promise greater impact—stay tuned!

Learn more on [INNOECOFOOD website](#)

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Work package WP9: Ethics requirements

WP9 addresses the ethics requirements critical to the INNOECOFOOD project. Several ethical concerns were identified, namely the involvement of vulnerable people (including children) in developing countries, the risks associated with staff handling pathogens, as well as the planned experiments on animals. Given the complexity and sensitivity of these issues, the project assigned an external, independent Ethics Advisor.

Following a thorough external consultation process, Dr. Anna Olsson was appointed to this role. Dr. Olsson is a researcher and Group Leader at the Institute for Molecular and Cell Biology (I3S), University of Porto. She brings extensive expertise in ethics, particularly in the area of animal welfare. Dr. Olsson will be supported by Dr. Susana Magalhães, the coordinator of the Responsible Conduct in Research Unit (URCR) at I3S. Dr. Magalhães has significant experience in bioethics, research ethics, and integrity, further strengthening the project's ethical oversight.

This collaborative approach ensures that INNOECOFOOD adheres to the highest ethical standards throughout its activities.



INNOECOFOOD Inception Meeting at CIIMAR Centre, Matosinhos, Portugal

What the Community is Saying

Work package WP1: Project Management



On behalf of the entire community, Mr. Opiyo Ondai (Farmer) thanked the Principal Investigator for bringing forth this transformative project, which holds promise for the people of Got Osimbo and Kenya as a whole and appreciated his commitment to improving the lives of the community through innovative solutions.

He also expressed his gratitude to all the collaborators who have contributed their expertise and resources to develop innovative solutions aimed at making a positive impact on the community.

Upcoming Events

