



BBioNets

Boosting the adoption
of Bio-Based Technologies

Cross-Fertilisation Meetings

Bio-Based Practices on Farms & Forests

“Innovations in Nutrient Recovery”

Integrating Biochar in Swine Feed: A Sustainable Approach to Enhancing Livestock Production and Environmental Management

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- Introduction: Overall approach
- Methodology:
 - Biomass potential surveying through UAVs
 - Biochar production process
 - Pilot use of biochar as pig feed supplement
- Potential benefits of biochar as pig feed supplement
- Added value of the ongoing research

- Greek pig farming is one of the most dynamic branches of development of the country's agricultural economy.
- Despite significant improvements in recent years, all pig farms show weaknesses, which are mostly related to the farm feed supplied (such as the cost of rearing and poor quality feed).
- Feeding of untested and poorly targeted agricultural feed to pigs leads to significant problems related to:
 - the performance of the livestock unit (low rate of weight gain of the animals),
 - the well-being of the animals (frequent food poisoning due to toxins or pathogens found in the feed),
 - the operation of the livestock facility (increase of greenhouse gases (GHG) from animal faeces due to poor digestion), and
 - the quality of the final product (pathogens or antibiotics administered end up in pork and from there to the consumer).
- Aim of this research is to utilize agricultural biomass by-products to create a new (low-cost) feed supplement based on biochar, which will lead to a significant improvement in the quality of pig feed, and, consequently, in increasing the competitiveness of Greek pig farming internationally.



BioAnimalChar

Bioeconomy – More than Circular Economy

Bioeconomy – More than Circular Economy

Renewability
Saving fossil resources
Climate friendly
Improve productivity and sustainability

Bioinnovation Products
new functionalities & properties

Chemicals & Materials

Bio-based products

share maintain reuse redistribute

Processing

Cascading Remanufacture Recycling

Food & Feed

Bioenergy & Biofuels

Bioinnovation Smart Processing
higher efficiency
less energy

Bioinnovation Food & Feed
food quality and safety
functional food ingredients

Organic recycling

Organic recycling

Agriculture & Forestry

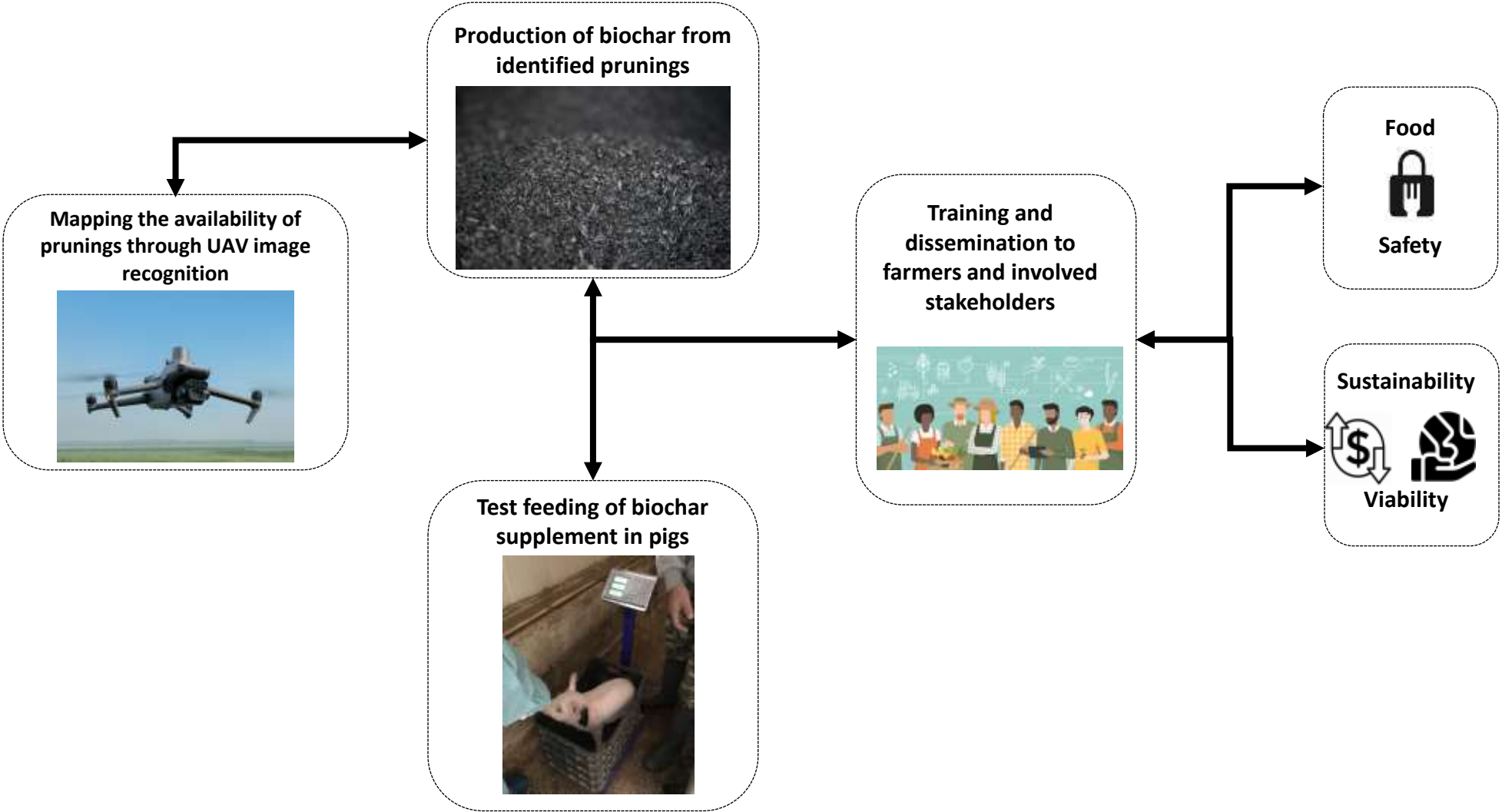
Biomass

Bioinnovation Agriculture & Forestry Smart Farming

Legend:
● Bioeconomy
■ Circular Economy

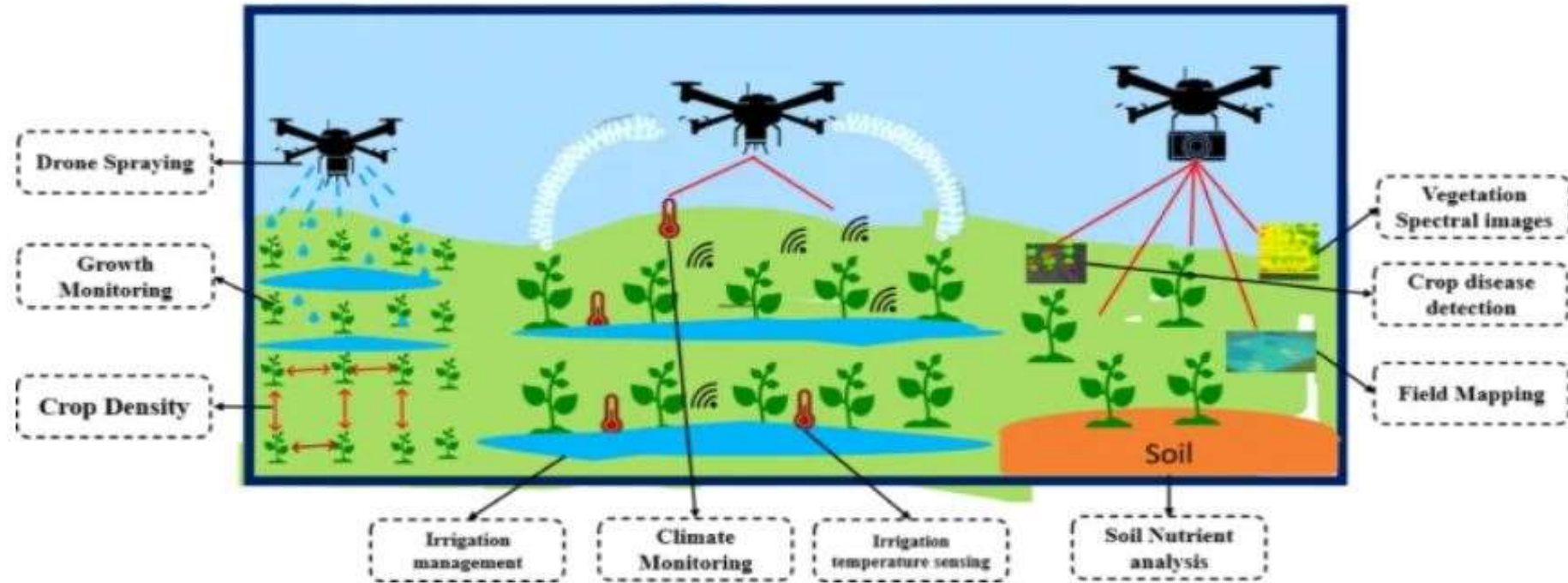


Overall approach





UAVs in Agriculture – smart agriculture **BioAnimalChar**





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BioAnimalChar

Test field

18/12/2025

Bio-Based Practices





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On-site use of UAV for biomass estimation **BioAnimalChar**

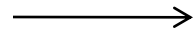




Methodology

- Collection of imaging data
- Image processing steps (image alignment and feature matching)
- Generation of a 3D point cloud representing ground and object surfaces
- Creation of the Digital Surface Model (DSM) and Digital Terrain Model (DTM)
- Production of the Orthomosaic





DJI Mavic 3 Pro



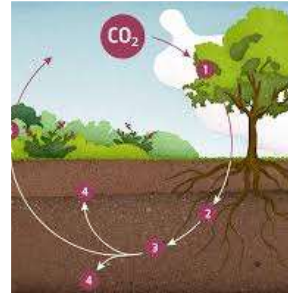


Soil amendment

- Increased water and nutrient retainment

Carbon Storage

- Curve CO₂ emissions



Feed supplement

- What BioAnimalChar does!

Pyrolysis

- Thermal treatment to produce biochar



Biochar Production



Biochar production process

Receipt and transport of raw materials for the production of biochar

- Communication with the producers' cooperatives to determine the time of gathering the prunings, after the end of the winter pruning of the vines.
- Conversion of prunings into wood chips (chips), to reduce their transport volume.
- Packaging of the raw material (chips) in big-bags
- Receiving the shaped biomass (chips) on an agreed date.
- Transport of biochar raw material (chips) to the production facility.

Biochar production

- Disinfection of the production area
- Transport of raw material to the production site
- Placing the raw material on a conveyor belt, to be transported to the first rotary kiln. Pyrolysis of the biomass at 880°C.
- Reprocessing of flue gases in a second furnace at 1200 °C.
- Duration of the process is ~4.5 hours.
- Biochar is collected from the furnace and stored in new big-bags, placed in a disinfected storage area.

Storage and shipment of finished product

- Biochar is stored in new (pathogen-free) bags.
- Placing the packaged biochar in a place where no other product will be stored for a period of 1.5 months to sanitize the product.
- Loading onto a decontaminated truck, which would be via a route that has been decontaminated, without placing the bags outside of the storage area where they are already located.
- Shipping to the pig farm and delivery of the biochar as dictated by the legislation.



Pilot use of biochar as pig feed supplement

Receipt and storage of biochar

- Receiving biochar from the production facility according to farm manager instructions, to ensure all hygiene rules and avoid possible contamination of the farm.
- Store the product in a place where it will be protected from high temperature, humidity, insects and rodents.



Feeding the pigs

- Separation of two groups of fattening pigs (10-20 animals) of the same age.
- Feeding a group with feed containing biochar based on the feeding protocol to be established.
- Feeding the other group with food that does not contain biochar.



Testing procedure

- Weighing of pigs at regular intervals based on protocol.
- Constant health check of the pigs, to establish their normal development.
- Biochemical analysis on the meat products to determine if there is an improvement in the final product characteristics.

- Beneficial features of using biochar in pig farming:
 - Increase in animal weight with the use of 1% biochar in pig feed
 - Improvement of feed to animal weight conversion index
 - Improving the composition of fatty acids in the animal's flesh (increasing unsaturated and decreasing saturated fatty acids)
- Reduction of pathogenic bacteria in animal manure.
- Reduction of triglycerides and urea in the blood of animals.
- Weight gain and better functioning of the immune system with the use of 0.3%-3% biochar in animal nutrition.
- Biochar has a mycobinding effect, reducing the concentration of fungi in animal feed

Added value of the ongoing research **BioAnimalChar**

- Address significant challenges in livestock farming due to uncontrolled feed administration, utilizing biochar-based feed supplements to enhance pig farming—reducing toxins, improving digestion, and increasing feed use efficiency.
- Promote lower greenhouse gas emissions from pig manure, transforming agricultural prunings from waste to valuable products.
- Establish a unified communication language between agricultural feed providers and livestock feed recipients, fostering better operational harmony and efficiency.
- Target a market worth €180 million/year in primary pig production, expecting to cut pig-raising costs by 25% and increasing the value of pig meat by 10% through healthier, environmentally friendly products.
- Projected outcomes include healthier pig meat with less saturated fats and heavy metals, contributing to a reduced carbon footprint and advancing sustainability in the agricultural sector.



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CERTH in brief...

BioAnimalChar



ITI



IBO



CPERI



Hellenic Institute
of Transport

HIT

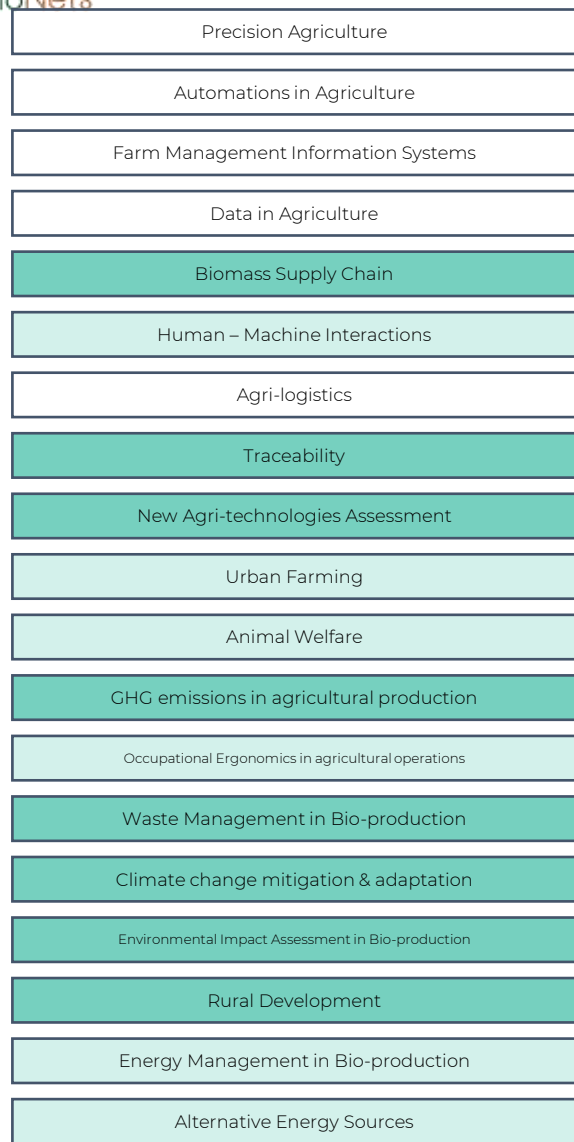


INAB



Institute Structure & Scientific Approach

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Sectors -
Laboratories

Application Domain



AGRI-TECHNOLOGY SECTOR

Agri-Robotics & Artificial Intelligent
Agro-Informatics
Controlled Bio-production Systems

BIO-ECONOMY SECTOR

Environmental Engineering & Sustainability
Ergonomics in Bio-production Systems
Bio-production Energy Systems

BioAnimalChar



AGRICULTURE

ENVIRONMENT

ENERGY

QUALITY OF LIFE

POLICY SUPPORT & ENTREPRENEURSHIP





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Institute for Bio-Economy
and Agri-Technology



Institute for Bio-Economy and Agri-Technology

Laboratory of Environmental Engineering and Sustainability



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CENTRE FOR
RESEARCH & TECHNOLOGY
HELLAS



Thank you!

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