



MAINSTREAM BIO

MAINSTREAMING SMALL-SCALE BIO-BASED
SOLUTIONS ACROSS RURAL EUROPE

D4.5

Practice abstracts - Batch 2

AUP

30/06/2025



Funded by
the European Union

PROJECT INFORMATION

PROGRAMME	Horizon Europe
TOPIC	HORIZON-CL6-2021-CIRCBIO-01-08
TYPE OF ACTION	HORIZON Coordination and Support Actions
PROJECT NUMBER	101059420
START DAY	1 September 2022
DURATION	36 months

DOCUMENT INFORMATION

TITLE	Practice abstracts - Batch 2
WORK PACKAGE	WP4 Evaluation, sharing of best practices, peer-learning and knowledge transfer
TASK	Task 4.5 Production of practice abstracts, audio-visual material and contributions to the Knowledge Centre for Bioeconomy
AUTHORS (Organisation)	Agricultural University of Plovdiv (AUP) Vladislav Popov, Peter Borisov
REVIEWERS	Beatriz Deltoro (INNV) Liselotte Puggaard (FBCD) Parodos L., Tsagaraki E., Spyridopoulos G. (Q-PLAN)
DATE	30.06.2025

DISSEMINATION LEVEL

PU	Public, fully open	x
SEN	Sensitive, limited under the conditions of the Grant Agreement	
Classified R-UE/EU-R	EU RESTRICTED under the Commission Decision No2015/444	

Classified C-UE/EU-C	EU CONFIDENTIAL under the Commission Decision No2015/444	
Classified S-UE/EU-S	EU SECRET under the Commission Decision No2015/444	

DOCUMENT HISTORY

Version	Date	Changes	Responsible partner
0.1	31/01/2025	Draft version shared for quality review	AUP
0.2	07/02/2025	Draft version shared for quality review	AUP
0.3	28/02/2025	Draft version after quality review	AUP, INNV, FBCE
0.4	15/04/2025	Final version ready to be submitted	AUP
1.0	30/6/2025	Final version submitted to EC portal	Q-PLAN

LEGAL NOTICE

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

© MAINSTREAMBIO Consortium, 2025

Reproduction is authorised provided the source is acknowledged.

Table of Contents

EXECUTIVE SUMMARY	5
1. INTRODUCTION.....	7
2. TASK 4.5 OBJECTIVES AND PROGRESS AGAINST KPIS.....	11
3. TASK 4.5 APPROACH AND METHODOLOGY.....	12
4. CONCLUSIONS.....	16
5. ANNEXES	17
Annex 1. Practice abstracts Reporting Template – MIP, Denmark.....	17
Annex 2. Topics, grouping and titles of PAs – Batch 1 and Batch 2	18
Annex 3. Partners’ Practice Abstracts – 2nd Batch.....	21

TABLE OF FIGURES

Figure 1: What is a Practice Abstract?	8
--	---

LIST OF TABLES

Table 1: Progress against the KPIs	11
Table 2: Action plan for the provision of 2nd batch of the PAs.....	13

ABBREVIATIONS

AUP	Agricultural University of Plovdiv
DoA	Description of Action
EIP AGRI	Agricultural European Innovation Partnership
GHG	GreenHouse Gas
IPM	Integrated Pest Management
KPI	Key Performance Indicator
LAG	Local Action Groups
LFA	Less-Favoured Areas
M	Month
MIP	Multi-actor Innovation Platform
PA	Practice Abstract
WP	Work Package



Executive Summary

This deliverable D4.5 “Practice abstracts - Batch 2”, presents practice abstracts (PA), which were developed in the second round of the project MainstreamBIO. Deliverable D4.4 “Practice abstracts - Batch 1”, already submitted, and the present deliverable, are all produced in accordance with the T4.5 production of practice abstracts, audio-visual material and contributions to the Knowledge Centre for Bioeconomy. Both PA batches, together with the audio-visual materials addresses Task 4.5 Production of practice abstracts, audio-visual material and contributions to the Knowledge Centre for Bioeconomy.

The Practice Abstracts (PA) are proven to be efficient instruments to disseminate good practices in the Bioeconomy sectors to farmers and industry. Together with audio-visual materials (e.g. short video-films) they play a role of communication and educational materials) that can help enhance awareness and understanding of the bioeconomy, more specifically at rural and regional level.

The PAs provide practical guidelines to rural stakeholders along with lessons learnt from practice, recommendations and tools. They are perceived as helpful instruments that will help interested regional actors (e.g. clusters, innovation hubs, advisors) in adapting and adopting MainstreamBIO’s results to set up Multi-actor Innovation Platforms (MIPs) and/or better attune their innovation support towards mainstreaming small-scale bio-based solutions.

This report presents the second batch of 23 PAs of the planned practice abstracts, which were produced by the MainstreamBIO MIPs in the form of summaries for practitioners using the EIP-AGRI common format as intended in the DoA. The PA cases reflect the MainstreamBIO Work Package (WP4) aim to validate the performance and impact of MIPs services and tools, producing quantifiable evidence in the process, to be used to evaluate the project results and gain insights into what seems to be working (or not) and under what circumstances. The country- and MIP-specific PAs were selected among partners based on a set of criteria e.g. in Denmark and Bulgaria, the PAs were selected based on topics relevant to targeted farmers as well as on the MIP stakeholders’ interests to the topics discussed during the in-person events organized in the respective MIPs, e.g. mutual learning event (see Annex 2).

The PAs underline the regional stakeholders’ involvement to co-define pathways for further scaling up solutions towards the development of inclusive and circular local bioeconomy, before employing the accumulated regional experiences as a platform for cross-regional mutual learning and knowledge exchange. The PAs also contribute to the transferability of project results and data (via open access repositories) that inspire and facilitate their application in other rural areas.

The audio-visual materials were produced in a video-showcases format. They present successful examples from the project partner countries in regards to the benefits the country MIP partners (firms, organisations) have received upon the implementation of the MainstreamBIO. Instead of 7 audiovisual materials planned in the GA, total of 10 video-showcases were produced and uploaded on the MainstreamBIO web-page (<https://mainstreambio-project.eu/success-stories/>) and the YouTube channel (<https://www.youtube.com/@mainstreambioproject4093/videos>).

The practice abstracts and audio-visual material contribute to achieving the project Objective 4 (O4): *Evaluate results and use evidence to drive multi-actor dialogues, peer learning and knowledge transfer, delivering guidelines and recommendations for replication in rural areas across Europe.*

The PAs have already been published in the EU Cap Network under the EIP-AGRI Project Database and in addition, will contribute to the Knowledge Centre for Bioeconomy, other centres and networks

for dissemination of bioeconomy knowledge, 'sister' projects, education and AKIS networks, etc., along with other results and data from the project. The PAs, as well as an overview of other contributions, were prepared by AUP and all project partners are integrated into this deliverable.

1. Introduction

➤ Practice Abstracts:

Under the EIP-AGRI, Operational Groups and Horizon projects work in close synergy to stimulate knowledge exchange and spread innovative solutions across the EU. Operational Groups and Horizon projects are expected to share their results and practice-oriented solutions in concise summaries, known as '**practice abstracts**'. Practice abstracts follow the 'EIP-AGRI common format'¹ to promote a more harmonised and practice-oriented way of sharing results.

Practice abstracts in the EIP-AGRI common format:

- help projects share their results in an easily understandable way for farmers, foresters, rural communities and others from practice
- foster knowledge flows, and shares project results more widely and at a faster pace
- support the development of project proposals with added value, avoiding duplication of ongoing or completed projects
- facilitate networking by connecting project partners with farmers, foresters and others from practice
- answer to real needs from the field

The practice abstracts (PA) are among the most efficient instruments for communication and dissemination, offering practical knowledge for rural actors to better understand how they can adopt small-scale bio-based solutions. By summarising and showcasing good examples, the MainstreamBIO PAs will inspire and support a wider group of rural actors across Europe to cooperate and bring bio-based innovation to market, sustainably creating and walking down their own business model pathways.

The European Innovation Partnership AGRI (EIP-AGRI) common format is a thematic network that helps projects to work in synergy with other interactive innovation projects under the Framework Programme "Horizon". These Horizon "multi-actor projects" and "thematic networks" act at EU level and bring together partners from at least three countries. All Horizon multi-actor projects and thematic networks, as well as all EIP-AGRI Operational Groups, use the common format to provide farmers, foresters, advisers or whoever is interested with short and concise practical information (so called 'practice abstracts'). Links to audio-visual material (photos, films, etc.) are included as much as possible. The use of the EIP-AGRI common format facilitates not only the exchange of knowledge, but also the contact between potential partners in innovation projects. It contributes to building up a unique repository of practical knowledge across the EU via the EIP-AGRI project database, which supports the dissemination of results of all interactive innovation projects.

¹ https://eu-cap-network.ec.europa.eu/projects/practice-abstracts_en

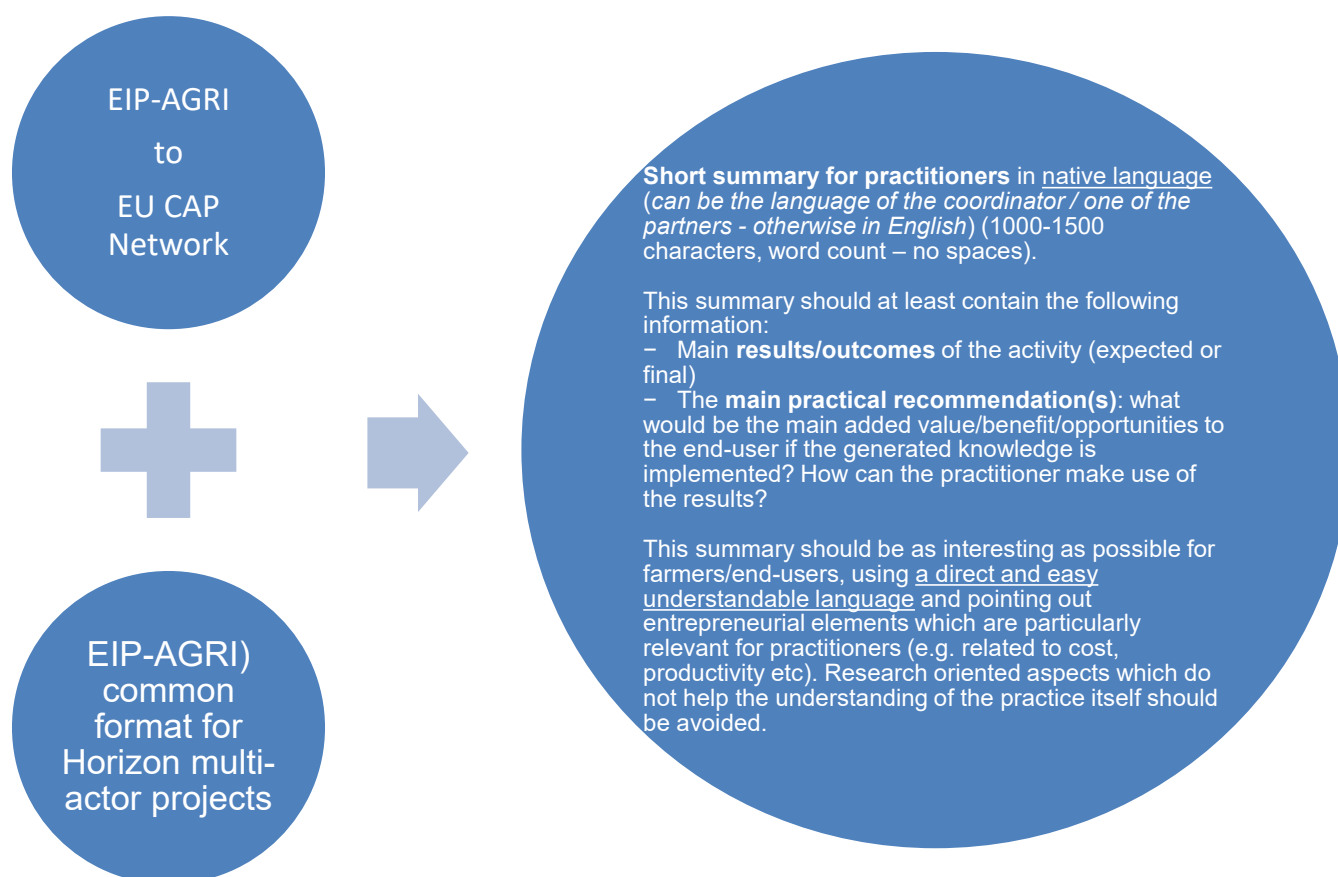


Figure 1: What is a Practice Abstract?

Within the framework of the WP4 of the MainstreamBIO, the Task 4.5 led by the AUP, observes the development of at least 30 PAs contributing to more efficient adoption of small-scale biobased solutions and nutrient recycling practices. Accordingly, the project PAs are based on cases (good practices) that are supported by MIPs in each partner country to showcase *inter alia* small-scale bio-based (digital) technologies and good nutrient recycling practices, business models, multi-actor innovation platforms or social innovations (see Annex 2). The PA content is presented using the EIP-AGRI common format (see Annex 1 of this report). Also, each MIP leader committed to preparing at least one audio-visual showcase, presenting their activities with testimonials from stakeholders. All these communication and dissemination materials, as well as an overview of the partners' contributions, should be processed and summarised by the AUP.

A structured approach has been used for the selection of the most suitable PAs. A clear selection process for PAs, based on selection criteria such as the relevance of their content regarding the four selected topics of interest (see Annex 2), has been introduced to the project partners (see Fig.2 below). The process includes also an internal quality assurance procedure for the PAs.

Selection and elaboration process of the PAs

A common process has been followed for selecting the PAs. A straightforward five-step procedure is presented in the figure that follows, outlining all steps from the identification of PAs to their delivery.

It should be noted that the selection of the PAs for the 1st batch was derived mainly from the expertise of the consortium partners since there were no evident results from the various project activities to

be highlighted at this stage. In the 2nd batch, results from specific project activities were transferred into practice-oriented PAs. Some indicative Tasks which fuelled the 2nd batch of the PAs were:

- T3.3 - Delivery of innovation support services to enhance the market uptake of small-scale bio-based solutions.
- T3.5 - Awareness raising campaigns and educational activities to enhance the understanding of bioeconomy.
- T5.4 - Business planning for the MIPs and toolkit.

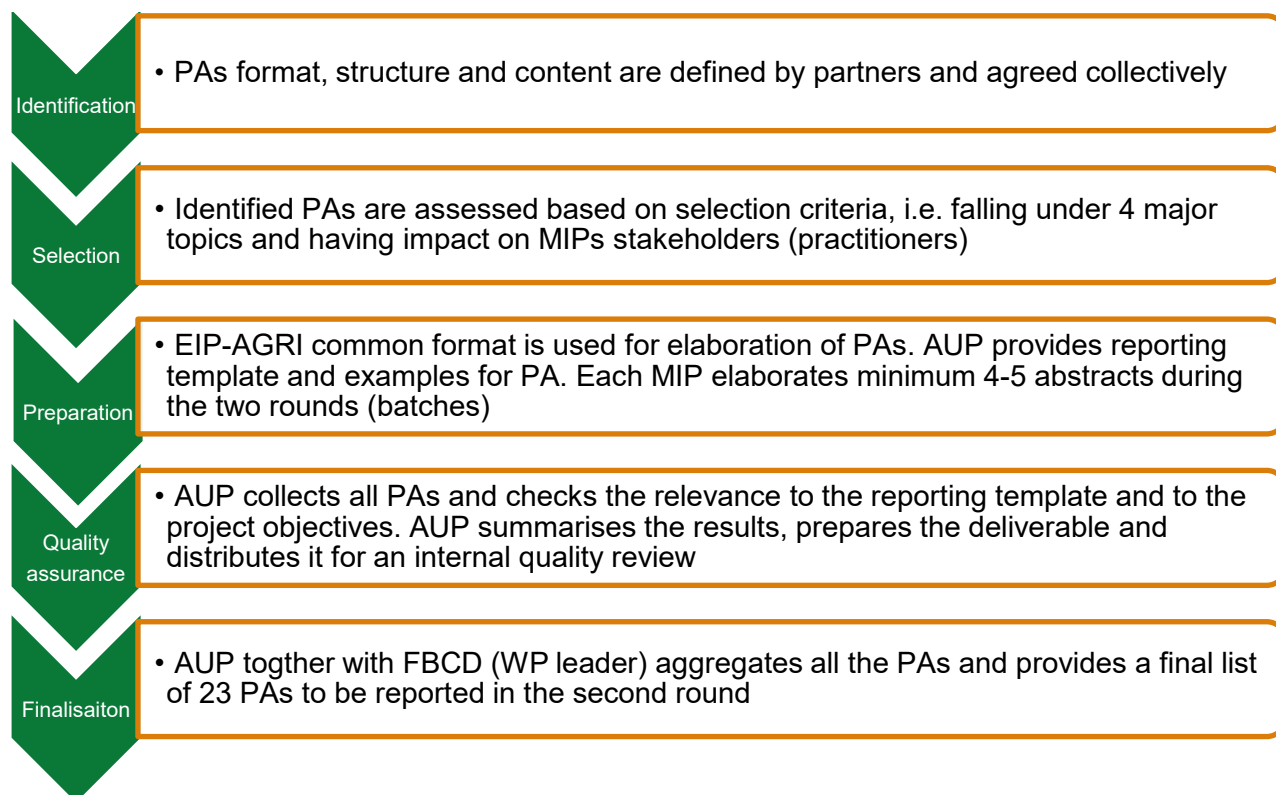


Figure 2: Selection and elaboration process of PAs

Identification. PAs topics of interest are identified collectively and agreed by partners. Each MIP provides topics and short descriptions of PAs according to the web-based form on the EU CAP Network website.

Selection. Identified PAs are assessed based on the following selection criteria: (1) relevance of PA to a small-scale bio-based solution and (2) relevance of PA to nutrient recycling practice.

Preparation. AUP provides a reporting template to each MIP in order to share and complete the selected PA. The template is based on EIP AGRI common format (see Annex 1 “Practice abstract reporting template, MIP Bulgaria). For the entire project period, each MIP should elaborate a minimum of 4 PAs divided into 2 batches. Thus, in addition to the 2nd batch consisting of 23 PAs collected during the second round (from month 13 to month 28), each MIP was responsible for delivering at least 3-4 PAs using the reporting template.

Quality assurance. MIPs are responsible for providing on time the agreed PAs to the partner AUP. The AUP checks the PAs for relevance to the EIP-AGRI format as well as to the project objectives. The AUP then distributes the collected PAs for internal quality review across project partners and

the management. The quality of PAs is checked by AUP as task leader, FBCD as WP leader, coordinator, as well as quality reviewer INNV.

Finalization. Upon completion of the quality review, all the reviewed PAs are collected by AUP which is integrated in this deliverable as well as being submitted for the EU CAP Network website.

Expected impact

The PAs are perceived as an instrument for communication and education that can help enhance awareness and understanding of the bioeconomy. Thus, the target groups to be approached are the farmers and industry, agri-food clusters, (digital) innovation hubs, rural development and innovation agencies, local agri-food decision-makers, regional and national authorities, the research community (in relevant fields of the bioeconomy domain), citizens and consumers. It is another contribution along with the project Digital toolkit, the Catalogue of small-scale bio-based technologies, business models and social innovations, the BioForum platform, and the Bioeconomy Repository. The PAs and videos from MainstreamBIO will be accessible on MainstreamBIO webpage via the digital toolkit platform and will be disseminated to other projects, networks and initiatives. All project partners commit to contribute to the Knowledge Centre for Bioeconomy, using their dissemination channels such as *inter alia* EU-CAP network, through key social media (Facebook, X, LinkedIn and YouTube), MIPs co-creation workshops, capacity building workshops, networking and demo- days, awareness raising and educational events, mutual learning workshops, etc.

Upon completion of the selection process for the PA second batch, the quality review by the MIPs partners was performed. It is remarkable to report that the project partners produced and disseminated 31 PAs in the in two batches (one more than promised), and 10 audio-visual showcases instead of 7 promised.

2. Task 4.5 Objectives and Progress against KPIs

- Objectives
 - Prepare practice abstracts and showcase for adopting small-scale bio-based solutions and nutrient recycling practices.
- Deliverables
 - D4.4 Practice abstracts - Batch 1 (M12, Report, PU, AUP)
 - D4.5 Practice abstracts - Batch 2 (M34, Report, PU, AUP)
- KPIs
 - At least 10 abstracts in M12
 - At least 20 abstracts in M34
 - Each MIP will prepare at least 1 audio-visual showcase, showcasing their activities with testimonials from stakeholders.
- Progress against the KPIs

Table 1: Progress against the KPIs

KPIs	Progress against the defined KPIs
at least 10 abstracts in M12	Delivered 8 Practice abstracts
at least 20 abstracts in M34	Delivered 23 Practice abstracts
at least 7 audio-visual showcases in M34	Delivered 10 audio-visual showcases

3. Task 4.5 Approach and methodology

3.1 The Practice Abstracts

The methodology and procedures to compile and collect the PAs have been followed by the AUP in order to address the Task 4.5 requirements. In accordance with the DoA of the GA, the consortium partners and the respective MIPs committed to prepare and present a total of 30 PAs falling under four major horizontal topics of interest related to the project objectives (see Annex 2). Each project partner (respectively the MIP leader) had to complete a minimum of four PAs during the two rounds i.e. at M12 and M34. The WP4 team opted to use the renowned EIP AGRI format and the respective guidelines for preparation of PAs as stated in the Grant Agreement. The new format for the EIP-AGRI projects facilitates a wider dissemination of the project PAs https://eu-cap-network.ec.europa.eu/projects/practice-abstracts_en. Practice abstracts follow the 'EIP-AGRI common format' to promote a more harmonised and practice-oriented way of sharing results.

Practice abstracts in the EIP-AGRI common format:

- help projects share their results in an easily understandable way for farmers, foresters, rural communities and others from practice
- foster knowledge flows, and shares project results more widely and at a faster pace
- support the development of project proposals with added value, avoiding duplication of ongoing or completed projects
- facilitate networking by connecting project partners with farmers, foresters and others from practice
- answer to real needs from the field

The MIP leaders continued the process of discussing with the stakeholders and preparing the PAs also using the outputs from the mutual learning events (T4.3). All the PAs contain a short summary of around up to 2000 characters (see Annex 1. Practice Abstracts Reporting Template) of country-specific showcases.

The information in the PAs describes a "showcase" from the respective MainstreamBIO target region falling under one of the groups of horizontal topics and sub-topics relevant at the partners' local/regional for adopting small-scale bio-based solutions and nutrient recycling practices/cases:

- ✓ small-scale bio-based technologies, business models, social innovations and good nutrient recycling practices;
- ✓ tailored business and technical services provided by experts in the bioeconomy domain;
- ✓ practical digital tools to support deployment of small-scale bio-based solutions;
- ✓ showcases describing the model-example of farmers, foresters and biomass producers, bioeconomy value-chain actors, or/and in collaboration with regional and local decision- or/and policymakers, social groups, etc.

The PA showcases relevant questions regarding MIP objectives and respective activities (see Annex 2), i.e.:

How does the MIP support small-scale bio-based technologies, business models, social innovations and good nutrient recycling practices?

- ✓ Provision of consultancy/advice on concrete technological solutions and their adaptation
- ✓ Advice on organisational and coordination aspects
- ✓ Advice and management of the IPR

How does the MIP support the provision of tailored business and technical services by experts in the bioeconomy domain?

- ✓ Approaches and instruments for transfer and/or provision of knowledge and know-how on e.g. nutrient recycling, waste biomass valorisation, renewable energy production and use, biological agricultural inputs (bio-fertilisers, bio-pesticides), biorefining, etc.
- ✓ Social innovations and tools to address, e.g. rural development of Less-Favoured Areas (LFA), approaches of Local Action Groups (LAGs), etc.
- ✓ Quadruple Helix models and MIPs as innovation brokers by using e.g. NGOs, branch associations, LAGs, municipality policymakers, industry producer groups (cooperatives), research entities, education entities, etc., for implementation of innovations.

How does the MIP support the provision, adaptation and/or adoption of digital technologies by small-scale bio-based entities?

- ✓ Practical digital tools to support the deployment of small-scale bio-based solutions e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.
- ✓ Practical description of techniques to support the deployment of small-scale bio-based solutions within e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.

Multi-actor Innovation platforms for mainstreaming bioeconomy in rural areas

The following schedule has been provided to MIP leaders:

Table 2: Action plan for the provision of 2nd batch of the PAs

#	Action Point	Who	By When
	Action to be performed	Partner/Partners	DD/MM/YYYY
1	First draft of Practice Abstract 2 nd Batch per MIP	MIPs	30/11/2024
2	D4.5 – Practice abstracts 2 nd Batch (min. 20 abstracts) M30	AUP	28/02/2025

3	D4.5 – Audio-visual showcases (minimum of 7 videos uploaded on the project website) M30	AUP	28/02/2025
---	---	-----	------------

Issues discussed

- Issue 1: Topics to be included in the Practice abstracts (PA) and the PA structure.
- Issue 2: Deadline of providing the second draft of PAs – final deadline for finished abstract by when?
- Issue 3: Allocation of PAs among the 7 MIPs.

3.2 The audio-visual materials

The audio-visual materials were produced in a video-showcases format.

The objective was to record, present and disseminate successful examples from the project partner countries and the work of their MIPs in regards to the benefits of the partners (beneficiary firms, organisations) of the country MIPs have received upon the implementation of the MainstreamBIO services.

First, the possible scenarios for the video-showcases, including the content and duration, was discussed and agreed among the MIP leaders and the WP4 members. It was followed by guidelines to the MIPs on the production process having into account the country-specific topics of interest and the expected impacts.

The short video-showcases were recorded on time by each MIP. Besides the description of the technical examples, the interviewed organisations explain the benefits from the services and results of the project in several areas: through their participation in workshops and other capacity-building events, adaptation of their knowledge in the area of small-scale application of bio-based solutions thanks to provided consultancy for (e.g. soil nutrient conservation, fertilisation, business-models, job creation, etc.) and expansion of contacts.

As a result, instead of 7 audiovisual materials planned in the GA, a total of 10 video-showcases were produced and a uploaded on the MainstreamBIO web-page (<https://mainstreambio-project.eu/success-stories/>) and the YouTube channel (<https://www.youtube.com/@mainstreambioproject4093/videos>).





Meetings performed

Most of the meetings have been performed online. They have been focusing on consultation on the format, structure, topics of PAs, their visualization and the deadlines. Other discussion topics included the distribution of the second batch PAs among the 7 partners. It was agreed that the topics of the second batch should cover, to a higher extent, a description of small-scale practices/technologies. Thus, all partners were involved in preparing the second batch of 23 PAs, i.e. one more than requested in the DoA.

In addition to consulting with the WP4 leader, there have been monthly online meetings with MainstreamBIO coordinators.

4. Conclusions

The regular meetings and discussions with partners contributed to more clear and concrete guidance on how to collect, compile and disseminate the Practice Abstracts (PAs) to facilitate the adoption of small-scale bio-based solutions and nutrient recycling practices based on the cases supported by the project MIPs.

The analysis of the second batch PAs (see Annex 2) shows that the knowledge transfer flow is executed by following ways:

- the MIP support to provide small-scale bio-based technologies, business models, social innovations and good nutrient recycling practices, e.g. waste utilization and valorization, turning residual streams (plant, animals) into higher value products and materials, insect proteins, farmers' education in natural plant protection and fertiliser applications, reduction of Carbon footprint, etc.
- the MIP support to provide tailored business and technical services by experts in the bioeconomy domain through diverse approaches, instruments methodologies e.g. research/living labs.
- Approaches and instruments for transfer and/or provision of knowledge and know-how on e.g. nutrient recycling, waste biomass valorisation, renewable energy production and use, biological agricultural inputs (bio-fertilisers, bio-pesticides), biorefining, etc.
- the MIP support to provide, adapt and/or adopt digital technologies and technical descriptions by small-scale bio-based solutions for e.g. BioRural toolkit to support small-scale bio-based solutions (IUNG).

The practice abstracts and audiovisual material thus contribute to achieving the project **Objective 4 (O4): *Evaluate results and use evidence to drive multi-actor dialogues, peer learning and knowledge transfer, delivering guidelines and recommendations for replication in rural areas across Europe.***

The second batch of 23 PAs showcase examples that could be replicated and adopted by the target stakeholders in the partner countries and rural Europe. These showcases and business models could be disseminated throughout Europe. The PAs contribute to a more efficient uptake of bio-based innovation to market, by sharing the experience and know-how of the regional specific business models by a wider group of rural actors across Europe. The PAs have been published in the EU Cap Network, contribute to the Knowledge Centre for Bioeconomy, and they are integrated in this deliverable.

5. Annexes

Annex 1. Practice abstracts Reporting Template – MIP, Denmark

Example of a PA in batch 2

Practice abstract 9:	Author: FBCD, Denmark
Title of the practice abstract in English	From waste to disposable cups - and then to nutrition
<p>Shortly describe for practitioners the main finding(s)/innovative solution(s): how the challenges /opportunities can be solved/seized? This summary should at least contain the following information (max. 2000 characters):</p> <ul style="list-style-type: none"> Objective(s): what challenge(s)/opportunity(ies) does the project address/seize that are relevant for the practitioners/end-users? Result(s) of the project related to what new knowledge/innovative solution(s) have been developed that solve the challenge(s)/seize the opportunity(ies). Practical implications/recommendations: how can the practitioners make use of the results/outcomes in practice? What would be the main costs/benefits to the end-users if the generated new knowledge / innovative solution(s) is(are) implemented? etc. <p>This summary should be as interesting as possible for farmers/foresters/other 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, benefits, productivity, etc.). Presenting research results in scientific language, which does not respond to real needs of the practitioners, should be avoided.</p>	<p>Starting in 2021, the founders of Grounded have been developing innovative solutions within the circular economy and scaling up our operations. Their extensive research on new sustainable materials has provided a foundation for selecting ingredients and developing materials for future biodegradable and compostable products. The project “From coffee waste to coffee cup” aims to transform the waste material from the coffee industry, coffee grounds, into 100% naturally compostable disposable coffee cups. This initiative represents an innovative approach to sustainability where waste becomes a resource.</p> <p>The overall goal of the project is to create an efficient and sustainable solution for handling the coffee industry's waste while producing functional and environmentally friendly disposable cups. This helps reduce the consumption of virgin materials, such as plastic and paper, and promotes a circular economy. Furthermore, the project aims to demonstrate the potential of using natural resources to create valuable products and nourish the soil.</p> <p>Grounded specializes in turning coffee grounds into 100% naturally compostable disposable coffee cups. Made from a blend of 50% coffee grounds and 50% bioplastic, these cups are designed to last a full day without getting soggy. A key feature of these cups is their ability to decompose under natural conditions in about four months, where they act as fertilizer and nutrients for the soil and plants.</p> <p>https://groundedcups.com/</p>
Title of the practice abstract	Fra affald til engangskopper - og derefter til ernæring

in native language	
	<p>Siden 2021 har grundlæggerne af Grounded udviklet innovative løsninger inden for den cirkulære økonomi og opskaleret vores aktiviteter. Deres omfattende forskning i nye bæredygtige materialer har dannet grundlag for udvælgelse af ingredienser og udvikling af materialer til fremtidige bionedbrydelige og komposterbare produkter. Projektet »Fra kaffeaflald til kaffekop« har til formål at omdanne affaldsmaterialet fra kaffeindustrien, kaffegrums, til 100 % naturligt komposterbare engangskaffekopper. Dette initiativ repræsenterer en innovativ tilgang til bæredygtighed, hvor affald bliver til en ressource.</p> <p>Projektets overordnede mål er at skabe en effektiv og bæredygtig løsning til håndtering af kaffeindustriens affald og samtidig producere funktionelle og miljøvenlige engangskopper. Det er med til at reducere forbruget af jomfruelige materialer som plast og papir og fremmer en cirkulær økonomi. Desuden har projektet til formål at demonstrere potentialet i at bruge naturressourcer til at skabe værdifulde produkter og give næring til jorden.</p> <p>Grounded har specialiseret sig i at omdanne kaffegrums til 100 % naturligt komposterbare engangskaffekopper. Kopperne er lavet af en blanding af 50 % kaffegrums og 50 % bioplast og er designet til at holde en hel dag uden at blive våde. En vigtig egenskab ved disse kopper er deres evne til at nedbrydes under naturlige forhold i løbet af ca. fire måneder, hvor de fungerer som gødning og næringsstoffer for jorden og planterne.</p>

Annex 2. Topics, grouping and titles of PAs – Batch 1 and Batch 2

Topics, Grouping and Titles of PAs	
Horizontal topics and sub-topics	Title of the PA
1. Small-scale bio-based technologies, business models, social innovations and good nutrient recycling practices. E.g. practical description of technique to support the deployment of small-scale bio-based solutions within e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.	PA9: From waste to disposable cups - and then to nutrition (FBCD)
1.1. Provision of consultancy/advice on concrete technological solutions and their adaptation	PA10: Discover Gentle Freeze-Drying with Insect Protein ApS (FBCD)
1.2. Advice on organisational and coordination aspects	PA11: Hamsa Herbs – organic production with a social element and care for nature (AUP)
1.3. Advice and management of the IPR	PA14: Mas La Llum - Showcasing and spreading the word about bioconstruction (INNV)
	PA15: Entrecabritos - Teaching about the worth of farmers in rural Spain (INNV)

	PA18: Unlocking the Potential of Miscanthus: A Renewable Resource for a Sustainable Future (FBCD)
	PA19: An innovative technological process with reduced C footprint, energy and plastics, using digital monitoring and digital traceability of the nutritional values (AUP)
	PA21: A Healthy soil full of life - Association for Reduced Tillage in Denmark (FBCD)
	PA24: Harnessing the potential of wool and sheep farming in Ireland's circular Bioeconomy (MTU)
	PA27: Turning residual streams into higher value: creating a business case for pumpkin beer as a new value chain (WR).
	PA28: The valorisation of rest streams by vinegar making (WR).
	PA29: The profitability potential of black soldier fly (BSF) larvae raised on pig manure at farm level (WR).
	PA30: Steam explosion: Efficient conversion of biomass side streams (PROC)
	PA31: Biological conversion of slurry and manure into humus activated by Quaterna® Activa 500 (FBCD)
2. Business and technical service demonstration by experts in the bioeconomy domain, e.g. research/living labs. Approaches and instruments for transfer and/or provision of knowledge and know-how on e.g. nutrient recycling, waste biomass valorisation, renewable energy production and use, biological agricultural inputs (bio-fertilisers, bio-pesticides), biorefining, etc.	PA3: A Methodology for Mapping and Analysis of Regional Bio-based Value Chains (MTU)
2.1. Approaches and instruments for transfer and/or provision of knowledge and know-how on e.g. nutrient recycling, waste biomass valorisation, renewable energy production and use, biological agricultural inputs (bio-fertilisers, bio-pesticides), biorefining, etc.	PA6: Alcarràs Bioproductors SAT - Farmers join forces and propel bioeconomy (INNV)
2.2. Social innovations and tools to address e.g. rural development of Less-Favoured Areas (LFA), approaches of Local Action Groups (LAGs), etc.	PA7: Apadrina un Olivo - Social innovation against rural depopulation (INNV)
2.3. Quadruple Helix models and MIPs as innovation brokers by using e.g. NGOs, branch associations, LAGs, municipality policy-makers, industry producer groups	PA12: Reducing the use of industry fertilizers by PLANTEO pellet production from digestate (IUNG).
	PA13: Insignes Labs- safe, affordable, and environmentally-friendly fertilizers, biostimulants and plant protection products for farmers (IUNG).
	PA17: Single-cell protein (SCP) - protein-rich microorganisms (PROC)
	PA20: Model biofarm Topolovo - turning organic animal waste into fertiliser (AUP)

(cooperatives), research entities, education entities, etc., for implementation of innovations.	PA22: Cass Materials' packaging foam – new technology to produce biobased foams from forestry, industrial and agricultural side streams (PROC)
	P23: Ireland's natural lignocellulose resources like grass and wood builds a Sustainable Circular Bioeconomy (MTU).
	P25: Promoting Anaerobic Digestion in Dingle Peninsula to Reduce Carbon Emissions and Foster Sustainable (Livestock) Farming in Ireland (MTU).
	P26: Biochar as a natural catalyst for sustainable agriculture in Ireland (MTU).
3. Digital technologies by small-scale bio-based entities. Practical digital tools to support the deployment of small-scale bio-based solutions e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.	PA16: BioRural toolkit to support small scale bio-based solutions (IUNG).
3.1. Practical digital tools to support the deployment of small-scale bio-based solutions e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.	PA1: Viticultural business face to face with digitization and science (AUP) PA5: INTER-NAW application for fertilization plan and nutrients accounting (IUNG)
3.2. Practical description of technique to support the deployment of small-scale bio-based solutions within e.g. Integrated pest management (IPM), fertiliser applications, reduction of GHG emissions, conservation tillage, etc.	PA2: Ecorobotix the future sprayer (FBCD) PA4: Anaerobic digestion (WR) PA8: HTL pilot plant (PROC)
4. Multi-actor Innovation platforms for mainstreaming bioeconomy in rural areas	
Numbers per MIP (3)	
Audio/Visual showcase material	https://mainstreambio-project.eu/success-stories/
Numbers per MIP	

Annex 3. Partners' Practice Abstracts – 2nd Batch

PA9

Title: From waste to disposable cups - and then to nutrition

Author: **FBCD, Denmark**

Starting in 2021, the founders of Grounded have been developing innovative solutions within the circular economy and scaling up their operations. Their extensive research on new sustainable materials has provided a foundation for selecting ingredients and developing materials for future biodegradable and compostable products. The project "From coffee waste to coffee cup" aims to transform the waste material from the coffee industry, coffee grounds, into 100% naturally compostable disposable coffee cups. This initiative represents an innovative approach to sustainability where waste becomes a resource.

The overall goal of the project is to create an efficient and sustainable solution for handling the coffee industry's waste while producing functional and environmentally friendly disposable cups. This helps reduce the consumption of virgin materials, such as plastic and paper, and promotes a circular economy. Furthermore, the project aims to demonstrate the potential of using natural resources to create valuable products and nourish the soil.

Grounded specializes in turning coffee grounds into 100% naturally compostable disposable coffee cups. Made from a blend of 50% coffee grounds and 50% bioplastic, these cups are designed to last a full day without getting soggy. A key feature of these cups is their ability to decompose under natural conditions in about four months, where they act as fertilizer and nutrients for the soil and plants.

<https://groundedcups.com/>

PA10

Title: Discover Gentle Freeze-Drying with Insect Protein ApS

Author: **FBCD, Denmark**

Are you in the research field, biotechnology, or involved in developing sustainable products at technical universities or companies? Do you understand the importance of preserving the quality of your biomass throughout the processing phase? At Insect Protein ApS, they recognize the significance of gentle freeze-drying. With over 6 years of continuous experience in freeze-drying a wide array of biomass - from enzymes and insects to milk, oils, meat, vegetables, and even various species of seaweed and algae - they offer expertise and equipment to companies and research institutions looking to enhance the quality of their dried products. Freeze-drying is known to be one of the most effective methods to preserve nutrients, structure, and flavor in biomass. It is an ideal solution for comparing the efficiency of different drying methods. The services offered enables you to accurately analyze and document the differences.

They can handle your biomass with utmost care. They provide not only equipment but also expertise to companies that may not have access to the necessary resources. With a well-functioning logistical setup and Danish food safety approval, they ensure hassle-free transportation and handling of your biomass to and from our facilities.

Their mission is to support sustainable research and development by offering tailored freeze-drying solutions. By choosing Insect Protein ApS as your partner, you can gain not just access to cutting-edge freeze-drying technology, but also a team of dedicated specialists ready to support your project.

Are you ready to explore how freeze-drying can improve the quality of your research? Contact them today to learn more about our services and how we can help you achieve your goals.

PA11

Title: Hamsa Herbs – organic production with a social element and care for nature

Author: **AUP, Bulgaria**

Hamsa Herbs is a small, family-owned herb farm situated in the beautiful and biodiverse Sredna Gora mountains of Central Bulgaria. The mission of this organically certified farm is to grow and produce local, handcrafted herbals, and provide a fairly-produced, high-quality, tasty products. The herbs are organically cultivated and certified, and responsibly wild-harvested in a natural environment.

Farm and Harvest Practice: Refrain from using any pesticides, herbicides, fungicides (including those that are allowed in organic farming), and artificial fertilizers, means that the farm is looking knowledge and know-how based cost-efficient practices on e.g. nutrient recycling, waste biomass valorisation, renewable energy production and use, biological agricultural inputs (bio-fertilisers, bio-pesticides), biorefining, etc. Promote local plant and insect biodiversity, recognize the complex relationships between various species and restore healthy plant communities helps to mitigate the impact of extreme temperature and water fluctuations, counter pest damage, and foster beneficial interactions between herbs and organisms rather than growing large areas of the same herb species, the farm focusses on cultivating smaller plots with a variety of different species. The farm follows the WHO's guidance on Good Agricultural and Collection Practices for medicinal plants (GACP). It uses 100 % compostable tea packaging, and re-useable glass, food grade plastic only for storing bulk herbs and tea mixtures. Social tools to address e.g. rural development of Less-Favoured Areas. Every year the farm welcomes volunteers from around the world to stay, work, and learn about the entire process of growing herbs, harvesting and processing.

PA12

Title: Reducing the use of industry fertilizers by PLANTEO pellet production from digestate

Author: **IUNG, Poland**

PLANTEO Organic fertilizer (Zielone Suszarnie company) is made from a solid fraction of digestate, produced during methane fermentation of agricultural and food waste in biogas plants. The main input for anaerobic digestion is waste biomass such as fruits and vegetables unsuitable for consumption and processing, apple pomace, waste from fruit and vegetable processing, distillery stock, beet pulp, and corn silage. The solid fraction of digestate is dried and pelletized, creating a versatile product that can be used in both agriculture and home gardening. The liquid fraction is purified and conditioned to create liquid organic fertilizer. Because plant biomass and food waste are the main substrates of the process, the final product is an eco-friendly solution and is accepted in organic farming. The PLANTEO Pellets production process is conducted using renewable energy, which makes it carbon-neutral. The fertilizer, made from 100% plant-based biomass, is rich in organic matter (over 80%), and macro- and microelements. Using this kind of fertilizer has a positive environmental effect, supports healthy plant growth, delivers high-quality, safer, and nutritious crops, improves soil quality, increases soil organic matter, and stimulates biodiversity while reducing greenhouse gas emissions, and introducing cultivated land long-term sustainability. PLANTEO Organic fertilizer use in agriculture reduces the need for synthetic fertilizers, which often have a high carbon footprint due to energy-intensive production processes. By using agricultural residues and food waste as feedstock, the process creates a closed-loop nutrient system, and minimizes waste, transforming it into valuable organic fertilizers and energy.

PA13

Title: Insignes Labs- safe, affordable, and environmentally friendly fertilizers, biostimulants and plant protection products for farmers

Author: **IUNG, Poland**

Insignes Labs offers products that support the natural immunity of plants. Their mission is to develop effective, environmentally friendly solutions that work across a range of crops and regions, providing tools for sustainable crop protection. The products support nature's own defence mechanisms to help protect plants from stress and pests. Products based on PURE technology can be used alone or in combination with other preparations, such as plant protection products, fertilizers and biostimulants, as part of integrated protection programs. These products have undergone detailed tests to ensure ecotoxicological safety. PURE technology proves that plant protection does not have to rely on the use of synthetic agents to be effective, and that the right product choices can increase yields without harming the environment. The PURE production process is optimized to minimize waste and carbon footprint. This technology significantly reduces GHG emissions and has a very low global warming potential (GWP). The main products offered by the company are:

PURE ONE activates the physiological and production processes of plants, strengthens the natural resistance of plants to changing weather conditions and pathogens, which improves the quantity and quality of the obtained crop. Microelement supplementation boosts the nitrogen management in plants, and thus the height and quality of the crop.

PURE FRUIT guarantees the continuity of the vegetation process by minimizing the effects of stress, helps increase flowering and fruit setting, increases the efficiency of nutrient use, and improves crop productivity. PURE FRUIT is recommended for the cultivation of fruit trees, berry plants and vegetables, as well as grain, rapeseed, rice and vines.

PA14

Title: Mas La Llum - Showcasing and spreading the word about bioconstruction

Author: **INNV, Spain**

Mas La Llum is a pioneering eco-social project located in Aragon, Spain, focused on sustainable rural living, renewable energy and community education and training. This initiative is centred on a fully self-sufficient straw bale house that serves as a multifunctional space for ecotourism, environmental education and sustainable agriculture. Its owners advise other initiatives in the design and implementation of their bioconstruction projects.

Main outcomes:

1. Mas La Llum integrates passive solar design and rainwater harvesting, creating a carbon-neutral living model that minimizes resource consumption.
2. The project promotes biodiversity, soil health and resilience within the local ecosystem through permaculture gardens.
3. By demonstrating a holistic approach to rural sustainability, Mas La Llum aligns with EU goals for climate action, rural revitalization, and sustainable land management, offering a replicable framework for eco-social development in rural Europe.

Practical recommendations:

- Rely on bioconstruction as a real alternative to conventional construction in both new construction and renovation projects.
- Consider the energetic and economic benefits of bioconstruction with respect to conventional construction.

- Capitalize on practical examples of bioconstruction by complementing them with awareness-raising activities on climate-smart practices and sustainable living principles, attracting wealth to rural areas.

PA15

Title: Entrecabritos - Promoting traditional ecological farming to improve biodiversity and local opportunities

Author: **INNV, Spain**

Entrecabritos is an agroecological initiative based in Teruel that performs sustainable, extensive goat farming adapted to the region's mountainous, semi-arid landscapes. They sell ready-to-eat goat meat, cold cuts and cheese, preserve local goat breeds and enhance the resilience of rural communities.

Main outcomes:

1. Through regenerative grazing practices, this project improves soil health and water retention, reduces wildfire risks, combats erosion, and mitigates the effects of desertification.
2. Apart from producing a range of goat-based products, they offer visits to the farm (lunch included) and the nearby wilderness. Since the Spanish market typically consumes goat meat only during the Christmas period, these activities provide them with stable income opportunities.
3. Entrecabritos aligns with the EU Green Deal's goals, showcasing a replicable model of sustainable livestock farming that can be scaled across Mediterranean regions facing similar environmental and socioeconomic challenges.

Practical recommendations:

- Identify which seasons are less profitable in your business. Then, evaluate which natural resources are available in that period, and brainstorm related activities that you could perform without an initially high investment. Keep in mind your clients' background (urban, rural, age bracket, tax bracket, etc.).
- Survey your clients about what they miss and map their responses with the brainstormed activities to find which of those are more likely to be well-accepted.
- Understand how your clients currently learn about you and evaluate if those channels are suitable for the new activity.

PA16

Title: BioRural toolkit to support small scale bio-based solutions

Author: **IUNG, Poland**

The BioRural toolkit is an online platform serving as a repository of bio-based solutions, providing access to the knowledge collected during the project. The toolkit also enables interaction between registered stakeholders, providing room for communication, exchange of experiences and knowledge, and seeking cooperation in selected areas of the bioeconomy.

The toolkit consists of nine sections:

Geoportal presenting the potentials of the most popular biomass types in Europe and the location of registered users.

Factsheets aiming to provide detailed information on specific bioeconomy topics and their status in a quick and easily digestible way for all stakeholders.

Bioeconomy inventories aiming to provide stakeholders with an easily searchable database/repository of rural bioeconomy research results (papers and projects), commercial bio-based solutions and funding opportunities.

Success stories providing an easily accessible overview of each success story, showcasing their innovations and factors that drove their development.

Online Tutorials disseminating knowledge on bio-based solutions from five EU online workshops with five different bioeconomy themes (food & agriculture, forestry & natural habitat, aquatic & water systems, bioenergy, biomaterials)

Bioeconomy ideas presenting the best innovative biotechnology ideas selected during the project activities.

Practice abstracts providing the inventory of practice abstracts prepared by the project partners and divided into the five categories of bioeconomy themes.

Business Blueprints offering business blueprints for rural development in each bioeconomy theme.

Policy and Research guidelines on the development of rural circular bioeconomy.

PA17

Title: Single-cell protein (SCP) - protein-rich microorganisms

Author: **PROC, Sweden**

Single-cell protein (SCP) is a high-protein biomass derived from microorganisms like yeast, fungi, algae, and bacteria. Produced on unconventional substrates such as agricultural residues, food waste, and industrial byproducts, SCP offers a sustainable, efficient, and versatile alternative to traditional protein sources.

With its rapid growth rate and minimal resource requirements, SCP has significant advantages. It provides complete nutrition, uses less land and water, and supports circular economies by converting waste into valuable protein. SCP can also reduce greenhouse gas emissions by utilizing gases like methane and carbon dioxide as substrates.

For farmers, SCP offers affordable animal feed, waste management solutions, and opportunities to diversify income by converting agricultural residues into protein. Entrepreneurs can tap into this growing market by developing SCP-based foods, animal feeds, and waste-to-protein technologies. Innovations in fermentation and bioreactor design further enhance its scalability and efficiency.

Despite challenges like public perception, regulatory hurdles, and scaling issues, SCP's potential is vast. It addresses global food security, environmental sustainability, and economic resilience. As awareness and technology advance, SCP could become a cornerstone of sustainable food systems, benefiting both producers and consumers while mitigating climate change and reducing waste.

PA18

Title: Unlocking the Potential of Miscanthus: A Renewable Resource for a Sustainable Future

Author: **FBCD, Denmark**

Miscanthus, a fast-growing and resilient perennial grass, has emerged as a versatile and sustainable resource with immense potential across multiple industries. Its ability to thrive on marginal land with minimal inputs makes it an attractive option for addressing environmental challenges and reducing reliance on fossil-based and non-renewable materials.

The unique properties of miscanthus make it suitable for a variety of applications. As a bioenergy crop, it offers a renewable and carbon-efficient alternative to traditional fuels, contributing to the global transition to cleaner energy. Its high absorbency and antimicrobial qualities position it as an ideal material for animal bedding, providing a sustainable substitute for straw. In horticulture, miscanthus fibres are increasingly recognized as

an ingredient in peat-free growing medium, supporting regenerative agricultural practices and reducing the depletion of natural peat bogs.

Beyond these uses, miscanthus is gaining attention as a raw material for innovative packaging solutions, offering biodegradable and compostable alternatives to plastic. In the construction sector, it serves as a durable and lightweight material for building materials, promoting greener practices in the industry.

The potential of miscanthus lies not only in its versatility but also in its ability to support a circular economy. By integrating miscanthus into supply chains, industries can reduce carbon emissions, minimize waste, and promote sustainable land use. As research and development continue to expand its applications, miscanthus holds promise as a cornerstone of future sustainable development.

PA19

Title: An innovative technological process with reduced C footprint, energy and plastics, using digital monitoring and digital traceability of the nutritional values

Author: **AUP, Bulgaria**

Creation of an innovative technological process including a new autoclave machine, quality monitoring through up-to-date analyses and digital traceability of the nutritional values for the production of vegetable spread "Veganitsa Markogi", enriched with natural proteins from legumes suitable for vegetarians and vegans, and for people on specific diets (as gluten free, lactose free, low fat etc.). The Agricultural University of Plovdiv Laboratory testing complex is helping with scientific part of the quality analyses of raw and finished products.

An innovative technological process for production of "Veganitsa Markogi" products reduces C footprint, energy and plastics, using digital monitoring and digital traceability of the nutritional values, and enriched with natural proteins from legumes for vegetarian customers. The factory is situated in a small village near Stara Zagora. Its employees are mainly from minority groups in the local community. The factory is a rare local alternative for employment in the rural area. Saving traditional hand-labour to save the authentic taste, but modern technology to get high quality, longer shelf life and strictly avoid preservatives. Monitoring via HACCP system for internal quality control. Natural raw materials i.e. vegetable grown under sustainable farming in Bulgaria using traditional homemade recipes with production in jars (95%) and plastic packaging (5%) reduced C footprint by 30% compared to the main competitors due to the implemented innovative technology of gentle sterilization. Social impacts: provides products for people with specific nutrition needs like patients and children and preserves traditional farming practices, traditional foods, community involvement.

PA20

Title: Model biofarm Topolovo - turning organic animal waste into fertiliser

Author: **AUP, Bulgaria**

The model biofarm is located on the land of Topolovo village, Madjarovo municipality, Haskovo region. It has been certified since 2008 and is used for demonstrations of organic farming practices and training in organic farming. It played a key role in the "New Thracian Gold" project, implemented by the Dutch Foundations Ark and Avalon, aimed to support the Eastern Rhodope region of Bulgaria by combining organic farming, natural grazing and ecotourism.

The resource saving and circular methods applied in biofarm concerns organic crop growing, including no use chemical Plant Protection Products (PPPs) and mineral fertilizers to nourish the soil, no use of GMOs, improves soil fertility with composted manure and legumes, recycles organic waste, maintains a greater diversity of plant

species and varieties providing for plants' protection from disease and insect attacks (nests of natural enemies of the pests e.g. ladybugs, lacewings, predatory mites), use of resistant varieties are used to prevent disease and compete with weeds.

It is combined with organic animal husbandry, including feeding with own certified forage, recycling the animal manure through composting with California worms and apply these in organic horticulture to obtain sustainable yields. The animals are fed on natural pastures providing expression of their natural behaviour, stress is minimal and meat and milk quality is higher. The farmer raises rare local breeds such as Krakachan sheep and Rhodopi shorthorn cattle to preserve regional genetic diversity. The breeds are resistant to local agroecological conditions, utilise the natural meadows and the residual biomass from hay and straw, produce milk and meat for stable income and provide manure for fertilisation.

PA21

Title: A Healthy soil full of life - Association for Reduced Tillage in Denmark

Author: **FBCD, Denmark**

FRDK is the association that works for a healthy soil full of life with a focus on high professionalism, biodiversity, zero tillage, conservation agriculture (CA), rain-fed agriculture and strong economy for farmers in Denmark. They promote sharing of knowledge about reduced tillage; both among members and their large network. FRDK supports and promotes research and advisory activities that develop and disseminate reduced tillage methods that improve crop production, the farmer's economy and protect the environment. FRDK works in close collaboration with research, local advisory centres and the agro-industry. Conservation agriculture is one of the most promising climate tools, which FRDK promotes via demonstrations, collaborative projects, research and knowledge dissemination and communication.

By practicing CA, carbon can be built in the soil but also prevents loss of carbon from the soil. Thus, a report states that 3.6 tons of CO₂ per hectare annually can be stored in the soil by using CA practices. Hereby a total climate effect of 2 tons of CO₂ equivalents can be achieved per hectare per year. In addition to carbon storage and less carbon loss, CA also reduces nitrous oxide emissions and saves fuel. This means that if 2/3 of the rotation area with rapeseed and cereals is cultivated according to the principles of CA, the climate impact can be reduced in agriculture by 2 million tons of CO₂ equivalents per year, corresponding to almost 25% of the total tons that Danish agriculture must reduce its emissions by 2030. In addition, conservation agriculture has several positive effects on soil health, diversity, insects, birds and animals, it minimizes the risk of water and wind erosion and thus the risk of nutrient and particle loss.

PA22

Title: Cass Materials' packaging foam – new technology to produce biobased foams from forestry, industrial and agricultural side streams

Author: **PROC, Sweden**

Cass Materials' packaging foam, Löven Foams, made from cellulose derived from forestry and agricultural side streams, is an environmentally friendly alternative to foams made from fossil-based raw materials. The packaging foam is lightweight, has strong mechanical properties, and is both compostable and recyclable, thus contributing to a circular economy and reduced environmental pollution.

Although the technology is new, the equipment and resources used are commercially available. Furthermore, it has been shown to be possible to use various types of cellulose as raw material in the foam production. By sharing information about the technology, there is the potential to produce foam packaging near where it will be used, which can reduce emissions from long-distance transportation of the packaging.

The technology is evaluated via a techno-economic analysis, which shows that the technology is feasible on an industrial scale. Additionally, the life cycle assessment indicates that Cass Materials' packaging foam has a lower carbon footprint than the fossil-based insulation foams currently on the market.

Overall, this makes the technology a promising product to sell to and implement with forestry and agricultural producers to create value from their side streams.

<https://cassmaterials.com/>

PA23

Title: Ireland's natural lignocellulose resources like grass and wood builds a Sustainable Circular Bioeconomy

Author: **MTU, Ireland**

Ireland's natural lignocellulose resources, grass and wood, are being transformed through projects like Rural BioRefineries and NXTGENWOOD. These initiatives transition traditional materials into high-value biobased applications, fostering sustainability and creating income opportunities for farmers, foresters, and stakeholders. Grass is processed into feed, biomethane, bio-based proteins, and biofertilisers, while wood supports next-generation materials with enhanced economic returns.

Main Results/Outcomes:

- Biotechnologies developed for processing grass into feed, bioplastics, and bioactive compounds, and wood into sustainable materials and chemicals.
- Ireland's first grass biorefinery established, fostering collaboration among universities, foresters, and industries.
- NXTGENWOOD promotes eco-friendly bioprocesses for next-generation wood products, enhancing climate resilience.
- Socio-economic benefits include increased returns for farmers and reduced carbon footprints.

Main Practical Recommendations:

- Engage with bio-based hubs to supply raw materials like grass and wood.
- Invest in small-scale green biorefineries and advanced wood processing to diversify income and adopt sustainable practices.
- Use funding from Ireland's Bioeconomy Action Plan to implement technologies that reduce emissions and increase profitability.
- Partner with researchers to explore sustainable alternatives to fossil-based products.

These actions unlock value from natural resources, ensuring growth and sustainability aligned with Ireland's bioeconomy goals.

PA24

Title: Harnessing the potential of wool and sheep farming in Ireland's circular Bioeconomy

Author: **MTU, Ireland**

Wool, an undervalued byproduct of sheep farming, offers significant economic and environmental benefits. Projects like The Wool Hub and Wise Wool Project are transforming wool into sustainable insulation, compostable textiles, and fertilizers. Combining wool washing with anaerobic digestion (AD) systems boosts efficiency by turning waste into energy and valuable fibres.

Ireland produces over 7 million kg of wool annually, often sold at just 5–20 cents/kg despite shearing costs exceeding €2 per sheep. Repurposing 25% of this wool could generate €15 million annually, supporting farmers and sustainability goals.

Main Results/Outcomes:

- AD systems produce clean fibres, biogas, and nutrient-rich digestate.
- New markets for insulation, compostable textiles, and fertilizers.
- Reduced methane emissions and improved water quality.
- Higher income for farmers through wool-based products.

Main Practical Recommendations:

- Train farmers on wool innovations.
- Use AD systems with funding support.
- Collaborate with research and industry for tailored solutions.
- Promote wool through cooperatives and innovation hubs.
- Access funding from Ireland's Bioeconomy Action Plan and EU programs.

Innovative wool projects reduce waste, lower emissions, and create sustainable income, making wool a cornerstone of Ireland's bioeconomy

PA25

Title: Promoting Anaerobic Digestion in Dingle Peninsula to Reduce Carbon Emissions and Foster Sustainable (Livestock) Farming in Ireland

Author: **MTU, Ireland**

Anaerobic Digestion (AD) reduces emissions and fosters sustainable farming in Ireland by converting organic matter like manure and food waste into biogas (renewable energy) and digestate (fertilizer). This dual benefit supports renewable energy production and waste management.

The MainstreamBIO project shows that small AD systems for under 400 cows are unviable in Ireland's cooler climate. However, tailored feedstock "recipes" using food waste, silage, and municipal waste boost biogas yields while addressing waste challenges. AD could meet 10% of Ireland's 2030 agricultural emissions reduction target.

Key Benefits:

- Reduces greenhouse gas emissions through controlled waste digestion.
- Digestate improves soil fertility, reduces runoff, and lowers synthetic fertilizer use.
- Diverse feedstocks enhance biogas yields and energy production.

Practical Recommendations:

- Adopt cooperative AD systems to share costs and benefits.
- Use diverse feedstocks like manure, silage, and food waste.
- Secure funding via Ireland's Biomethane Strategy and grants.
- Engage communities to build acceptance and address concerns.

AD helps Irish farmers reduce emissions, improve profitability, and support climate goals, positioning it as a cornerstone of sustainable farming.

PA26

Title: Biochar as a natural catalyst for sustainable agriculture in Ireland

Author: **MTU, Ireland**

Biochar is a natural key solution for Ireland's climate goals, locking carbon in soil and supporting biodiversity, soil health, and waste management. Produced via pyrolysis of forestry residues and agricultural waste, it enhances soil fertility, reduces emissions, and supports circular economy principles.

Main Results/Outcomes:

- Carbon Sequestration: Sequesters 2.5–3.3 tons of CO₂ per ton as a permanent carbon sink.
- Soil Health: Boosts fertility, water retention, and crop yields, enhancing resilience and biodiversity.
- Economic Impact: Cuts fertilizer costs, creates revenue streams, and scales with mobile pyrolysis systems like in the Biomass to Biochar Project.
- Reforestation: Improves soil biodiversity and carbon capture when applied to tree roots.

Practical Recommendations:

- Farmers: Use biochar to improve soil health, cut fertilizer use, and access carbon credits.
- Biomass Businesses: Invest in mobile pyrolysis for scalable production.
- Foresters: Apply biochar at tree roots to support reforestation.
- Policymakers: Include biochar in carbon funding schemes to drive adoption.

With the ability to sequester up to 3.3 tons of CO₂ per ton, biochar is critical for cutting emissions by 2030 and achieving net-zero by 2050.

PA27

Title: Turning residual streams into higher value: creating a business case for pumpkin beer as a new value chain

Author: **WR, The Netherlands**

Organic pumpkin cultivation in the Netherlands (Van de Weerd Pompoenen) results in around 1000 tons/year of rejected pumpkins, which are currently sold as cattle feed which gives low economic benefit to the biomass producer. This project investigated an alternative value-added pathway where it is used as a feedstock for brewing pumpkin beer (Brouwerij Artemis).

Main results: The project produced a business plan (value chain, organisation), information on pumpkin supply (quality, amount, cost), the brewing process (ingredients, recipe, costs) and the Dutch beer market. Three types of prospective customers were identified: beer enthusiasts, environmentally conscious customers and locally focused customers. Increased profitability of residue stream for pumpkin producer, however pumpkin beer is less profitable than traditional beer production. Pumpkin only accounts for 20% of pumpkin beer recipe. Pumpkins for beer brewing would result in additional processing steps (cutting, roasting) requiring a 3rd party (e.g. Groeneproductie Flevoland).

Practical recommendations: For consideration during scale up a risk and profit-sharing agreement should be introduced for the stakeholders. Ensure compatibility (timing and quantity) between raw material supply and production capabilities: pumpkin beer is a seasonal product (mainly autumn) while pumpkin residual flow is spread across the year, supply of pumpkin greatly exceeds the production capabilities of a smaller local brewery (multiple local breweries required to process the full amount).

PA28

Title: The valorisation of rest streams by vinegar making

Author: **WR, The Netherlands**

The province of Flevoland in the Netherlands produces large quantities of vegetable crops, however a small fraction cannot be sold because of supermarket requirements based on their shape or size. This desk-based study looked into the conversion of these streams for the production of vinegar. Several crops were considered as feedstock including carrots, onions, potatoes, cauliflower, broccoli, pumpkin, cabbage, apples, pears and beetroot. Ultimately beetroot was selected for further analysis due to its relatively high sugar content, production volume and lack of existing valorisation opportunities. Information on quantity and quality of a red beet stream was supplied by the organic vegetable growing company Van Andel Bio. The sugar from the beetroot would be converted to vinegar by a two-stage fermentation (sugar-ethanol-acetic acid). Market trends favoured high quality vinegars, with consumer preferences for products that are premium and gourmet. Other creative product applications included production of chutney, salad dressing and pickling.

Main results: suitability assessment/flowchart of crops for vinegar production, estimate of vinegar production volume, consumer preferences and trends, information on laws and regulations in the vinegar market. Additional sugar needs to be added to beetroot to achieve sufficient acetic acid percentage. Beetroot vinegar may have an earthy taste.

Practical recommendations: case study on how to identify suitable product streams to use as a feedstock for value added products (vinegar), use remaining solid waste (that is safe) as animal feed.

PA29

Title: The profitability potential of black soldier fly (BSF) larvae raised on pig manure at farm level

Author: **WR, The Netherlands**

In the Netherlands, there is an excess of manure from livestock: an average Dutch pig farm has 1671 adult pigs which produce 900 tonnes/year of wet manure. This manure contains nutrients of potential value, due to growing interest in the circularity of resources these nutrients are being considered for upcycling. Black soldier fly (BSF) larvae offer an opportunity to close the loop on agri-food chains by converting waste streams (manure) into insect biomass and frass (organic fertilizer).

Main results: Information on legality of cultivation on manure: currently it is not yet legal to raise BSF larvae on any kind of animal manure. A report on the potential profitability of BSF cultivation on pig manure under a variety of assumptions (base case/Monte Carlo approach). The process was profitable under some circumstances and key parameters which influence profitability include cost price of starter larvae, the margin of dried/live larvae, and the productivity of larvae biomass. Estimate of BSF production from an average Dutch pig farm: 90 tonnes/year of live BSF larvae resulting in 25 tonne/year of dried biomass and 170 tonnes/year of frass.

Practical recommendations: Selling live larvae is more profitable than dried larvae. If possible, at the farm level, breeding your own starter level would increase profitability. BSF processes could offer diversity to farmers income and increase the sustainability of their business. Search for pilot opportunities and continued research on safety of BSF larvae on manure for possible legislation changes.

PA30

Title: Steam explosion: Efficient conversion of biomass side streams

Author: **PROC, Sweden**

Steam explosion is a physico-chemical treatment for biomass conversion, involving short-time steam cooking at high temperature and pressure, followed by explosive decompression. This process opens fibre structures without extensive polymer degradation, improving biomass recovery, making it more suitable for processes

like hydrolysis or fermentation. Benefits include low environmental impact, low capital investment, reduced use of hazardous chemicals, high yield, and suitability for large-scale operations.

This technique is typically used on lignocellulosic biomass, but it has also been shown to have a great effect on the inner structure of feathers and the obtained keratin, enabling a greater exploitation of feather waste. It enhances keratin recovery and reduces environmental impact compared to chemical hydrolysis.

The European poultry sector generates 3.6 million tonnes of waste feathers each year, of which only around 25% are collected separately and valorised. This and other waste streams could be utilised more with the steam explosion technology. The keratin obtained from feathers has for example been tested as an additive to different biodegradable plastics to enhance the biodegradability in applications as seed trays, mulch films and hydroponic foams.

RISE Processum has a Thermochemical Pre-treatment testbed that consists of a reactor and an expansion vessel. The reactor has a volume of 40 liters and can withstand a pressure of approximately 30 bar, a maximum temperature of 225°C, and a wide pH range. This test bed can be used for any type of biomass, as for example wood chips, wheat straw, corn stalks, cacao beans etc and is open for others to try their ideas on.

PA31

Title: Biological conversion of slurry and manure into humus activated by Quaterna® Activa 500

Author: **FBCD, Denmark**

Quaterna® Activa 500 is a compost starter consisting of natural minerals and selected natural plant composts of the Marcel Mézy Technology®. The product improves the efficiency of farmyard fertilizers. Activates a rapid biological conversion of slurry and manure into humus and is approved for organic farming according to CEE 834/2007.

Quaterna® Activa 500 is a composting additive resulting in manure and slurry quickly becoming humanized and hereby improves their fertilizing effect. The mineral elements from the manure are bound to clay-humus complexes and then released to these when the plant needs them. Gaseous losses and washout losses are reduced. The plants can be nourished over the entire period according to need and in a balanced way.

The product has shown positive effects for breeders and animals (poultry and pigs) by improving the stable climate (less ammonia, less odour) and drier bedding. Quaterna treatment in pig stables also has the potential to improve daily growth, due to less feed intake and hereby reducing costs for fattening due to improved housing conditions. The product can also contribute to a better economy and improved crop production by creating better nutrient availability for the plant, replacement of mineral fertilizers and other additives and optimizing nitrogen availability. Manure treated with Quaterna® is significantly drier and composts better and significant fungal growth can be recognized. A drier manure means less fluid loss and thus fewer nutrients are washed out. Quaterna treated manure has less ammonia odour. NH₃ levels in the house air are especially important for chickens as they develop health problems if ammonia levels are too high and their quality decreases accordingly.













MAINSTREAM BIO
MAINSTREAMING SMALL-SCALE BIO-BASED
SOLUTIONS ACROSS RURAL EUROPE

The project

MainstreamBIO is a Horizon Europe EU funded project, which sets out to get small-scale bio-based solutions into mainstream practice across rural Europe, providing a broader range of rural actors with the opportunity to engage in and speed up the development of the bioeconomy. Recognizing the paramount importance of bioeconomy for addressing key global environmental and societal challenges, MainstreamBIO develops regional Multi-actor Innovation Platforms in 7 EU countries (PL, DK, SE, BG, ES, IE & NL). The project aims to enhance cooperation among key rural players towards co-creating sustainable business model pathways in line with regional potentials and policy initiatives. MainstreamBIO supports 35 multiactor partnerships to overcome barriers and get bio-based innovations to market with hands-on innovation support, accelerating the development of over 70 marketable bio-based products and services. Furthermore, the project develops and employs a digital toolkit to better match bio-based technologies, social innovations and good nutrient recycling practices with available biomass and market trends as well as to enhance understanding of the bioeconomy with a suite of educational resources building on existing research results and tools. To achieve these targets, MainstreamBIO involves 10 partners across Europe, coming from various fields. Thus, all partners combine their knowledge and experience to promote the growth of bioeconomy in a sustainable and inclusive manner.

Coordinator: Q-PLAN INTERNATIONAL ADVISORS PC (Q-PLAN)

Partner		Short Name
	Q-PLAN INTERNATIONAL ADVISORS PC	Q-PLAN
	MUNSTER TECHNOLOGICAL UNIVERSITY	MTU
	STICHTING WAGENINGEN RESEARCH	WR
	INSTYTUT UPRAWY NAWOZENIA I GLEBOZNAWSTWA, PANSTWOWY INSTYTUT BADAWCZY	IUNG
	RISE PROCESSUM AB	PROC
	AGRAREN UNIVERSITET - PLOVDIV	AUP
	FBCD AS	FBCD
	EURIZON SL	INN
	DRAXIS ENVIRONMENTAL SA	DRAXIS
	WHITE RESEARCH SPRL	WHITE

CONTACT US info@mainstreambio-project.eu

VISIT www.mainstreambio-project.eu