



D8.2

Practice Abstracts – First Batch

August 2024



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 101000395.

Deliverable 8.2	Practice Abstracts – First batch
WP	8
Deliverable lead	REV
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GA number	101000395
Funding body	H2020
Start / duration	1/9/2021 / 60 months
Type of deliverable (R, DEM, DEC, OTHER, ETHICS, ORDP, DATA) ¹	R
Dissemination level (PU, PP, RE, CO) ²	PU
Website	https://pathways-project.com/

¹ Document, report (R), Demonstrator, pilot, prototype (DEM), Websites, patent filings, videos, etc., OTHER, Ethics requirement (ETHICS), Open Research Data Pilot (ORDP), Data sets, microdata, etc. (DATA)

² Public (PU), Restricted to other programme participants including EC (PP), Restricted to a group specified by the consortium including the EC (RE), Confidential, only for members of the consortium including EC (CO)

Version	Date	Description	Author
0.1	26/07/2024	First draft	REV
0.2	01/08/2024	Review and first version	REV
1	11/08/2024	First external review	SLU
1.1	29/08/2024	Final edited version	REV

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Executive Summary

Deliverable D8.2 of the PATHWAYS project comprises the first of two batches of practice abstracts (PAs) derived from the project. Deliverable D8.2 presents the first 30 PAs, including short description of the 15 Practice Hubs and other initial results from the project while Deliverable D8.3 (to be developed by end of M58) will include additional 20 PAs with more relevant results from the project.

The inclusion of these initial 30 Practice Abstracts from the PATHWAYS project into the EIP-AGRI project database will significantly enhance the accessibility and readability of these documents. The utilization of the EIP-AGRI common format, aims to facilitate knowledge flows from project inception to completion, enables a wider audience, including farmers, advisers, researchers, and other EU actors, to engage with and benefit from the project's innovative and practice-oriented outcomes. This format not only simplifies locating key results but also promotes interaction with targeted audiences.

This first set of abstracts highlights a range of agricultural innovations and the 15 Practice Hubs organized by the project and other initial results from the project, covering topics from 100% pasture-fed dairy systems in Germany to carbon sequestration practices in France and sustainable pig farming in Denmark. Each abstract aims to outline practical approaches and collaborative efforts aimed at enhancing sustainability, animal welfare, and economic viability in the livestock industry, underscoring the project's goal of transforming creative ideas into actionable practices through effective knowledge exchange and dissemination.

The inclusion of these abstracts on the new [EU CAP NETWORK platform website](#) and their distribution via social media ensures broader reach and engagement, fostering an informed and interconnected agricultural community.

Expected impact

The incorporation of these texts into the EIP-AGRI project database will make the documents more accessible and readable to a broader audience than the deliverables alone. The EIP-AGRI common format facilitates knowledge flows on innovative and practice-oriented projects from the start until the end of the project. In this sense, the use of this format will allow farmers, advisers, researchers and other EU actors to learn more about the project and its results. It will also make the main outcomes easier to locate in addition to encouraging interaction with the targeted audiences.

Introduction

The European Innovation Partnership Agricultural Productivity and Sustainability (EIP-AGRI) interactive innovation approach fosters the development of demand-driven innovation through projects, transforming new creative ideas into practical applications through interactions between partners, knowledge sharing, and effective intermediation and dissemination. The EIP common format consists of a set of basic elements characterising the project and includes one or more 'practice abstract(s)'. The format was developed with two main objectives:

1. to enable contacting partners and incentivise efficient knowledge exchange, and
2. to disseminate the results of the project in a concise and understandable way to practitioners.

The common format allows the provision of information throughout the project's life cycle. The content in the common format can be updated at any point in the project's duration. Project information should be available at the beginning (describing the situation at the start of the project, including project title and objectives) and, at the end of the project (describing the results/recommendations resulting from the project, including a final project report and the practice abstracts).

This Deliverable D8.2 includes the first 30 Practice Abstracts (PA₁ to PA₃₀) of the PATHWAYS project. These texts represent some of the relevant outcomes of the first period of the PATHWAYS project, such as presentation text of the 15 Practice Hubs of the project in addition to other interesting results listed by the partners and developed following a "collaborative approach" by the experts in the project consortium. The main objective of this deliverable is to guarantee that the project's results are not only available on the project's website in a report format but can also be accessed by other audiences in a simpler format at the EIP-AGRI (now EU CAP NETWORK) database.

Each practice abstract is provided in the following section, using information provided by project partners.

PRACTICE ABSTRACT #1

PA1 - 100% pasture-fed cow-calf dairy systems

The Heu Milch Bauern Farmers, situated in the landscapes of southern Germany, have introduced the innovative cow-calf dairy system, featuring 100% pasture-fed dairy cows. Led by Demeter and FiBL, this collective of farmers stands out for their unique approach to dairy production, focusing on grass-based milk and keeping calves with their mothers. They prioritize animal welfare and ecological harmony, viewing their farms as organic entities that interact with nature.



Image 1. On-farm slaughter example developed by Demeter and FiBL used in the Heu Milch Bauern farm. Source FiBL.

Their commitment to providing a superior quality of life for their animals extends to their approach to slaughter. Recognizing the stress and ethical concerns associated with traditional slaughter practices, the farmers advocate for on-farm slaughter as a humane alternative. While regulatory changes in 2021 have made this feasible, logistical challenges remain, including the need to reach slaughter facilities within a strict time frame and uncertainties regarding market access.

To address these challenges, the Hub, led by Demeter and FiBL, is working to support farmers in implementing on-farm slaughter.

Together, these organisations are conducting cost analyses, collaborating with farmers already practicing on-farm slaughter, and developing a comprehensive network to facilitate the process for all farmers. Additionally, they are engaging with retailers to collectively market the meat, with the goal of not only benefiting individual farmers but also promoting ethical practices across the entire sector.

More information on the Practice Hub [here](#).

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PRACTICE ABSTRACT #2

PA2 - Dairy managing grassland for carbon sequestration



Image 2. Cows resting in Western France pastures.

Source: ACTA

This Practice Hub explores the practices and challenges encountered by Dairy Farmers operating within the grassland systems of Western France, with a specific focus on their efforts in carbon sequestration. Despite employing diverse farming techniques such as hay milk and crossbreeding, the prevailing approach among these farmers centres on grass-based systems. However, there's a concerning trend of a decreasing grassland area, gradually replaced by crops like maize.

Highlighting the pivotal role of grasslands in carbon sequestration, the urgency to preserve these ecosystems becomes apparent. A “living lab” initiative, funded by the PATHWAYS project, involves collaboration with more than ten Dairy Farmers, to gather insights into their practices. Through rigorous data collection and analysis, the objective is to compare the environmental and economic performance of grass-based systems against a national database.

Furthermore, the initiative extends beyond data analysis to advocacy. The goal is to promote the retention and expansion of grassland systems, not only among future farmers but also within local policymaking circles. To achieve this, communication events, including open-farm sessions tailored for students and policymakers, are planned. These forums will facilitate dialogue on the benefits of grassland systems for both environmental sustainability and farmers' livelihoods.

More information on the Practice Hub [here](#).

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PRACTICE ABSTRACT #3

PA3 - Dairy in agroforestry system for self-sufficiency in protein-based feed



Image 3. Foraging cows.
Source: USAMVCN

This Practice Hub introduces a group dedicated to supporting small dairy farmers operating within an agricultural forestry system, particularly in mountainous and hilly terrain regions. These farmers manage diverse landscapes comprising grasslands, orchards, pastures, and arable lands. Despite the richness of their environment, they face challenges such as low profitability and a lack of knowledge regarding the optimal utilisation of natural resources.

To address these issues, the Hub collaborates with farmers and colleagues to identify solutions that focus on enhancing product quality, improving market organisation, fostering cooperation among farmers, and diversifying their activities. By working together, farmers can potentially overcome common challenges more effectively.

One key emphasis is on the quality of products derived from these farms, particularly milk. The Hub aims to establish a "living lab" where the quality of forage and the diversity of grasslands are connected to the quality of the milk produced. This approach considers the unique cultural and social context in which these farms operate.

In summary, the presentation highlights the importance of collaboration and innovation in addressing the challenges faced by small dairy farmers in mountainous areas. The proposed initiatives aim to not only improve the economic viability of these farms but also enhance the quality of their products within their specific cultural and social environment.

More information on the Practice Hub [here](#).

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PRACTICE ABSTRACT #4

PA4 - More-from-less Dairy Systems Utilizing On-Farm Advice and Carbon Footprinting

The More-from-less Dairy Systems Practice Hub, based in Sweden, focuses on optimizing dairy production through on-farm advice and carbon footprinting tools. Collaborating with SLU Swedish University of Agriculture Sciences and Arla Foods farmers, this initiative aims to enhance sustainability and efficiency in dairy farming. Located on the western coast of Sweden, these farms are early adopters of innovative practices, emphasising a strong connection between production and consumption.

The key focus of this Practice Hub lies in marketing and intensifying mainstream production methods while addressing the importance of sustainable food production for future generations. By targeting children as the next wave of consumers, the Hub aims to educate and influence opinions on environmental sustainability and animal welfare in livestock production. Overcoming challenges related to public perceptions, the Hub seeks to bridge the gap between consumer awareness and farm practices.

One unique aspect of this Hub's activities is the creation of educational materials for children, to be used at public events on the farms, promoting understanding of sustainable farming practices. By leveraging on-farm data and developing benchmarking tools, the Hub aims to drive positive change in the dairy industry, inspiring a shift towards more sustainable and ethical practices. Through collaboration and knowledge-sharing, the More-from-less Dairy Systems Hub is paving the way for a more sustainable and consumer-conscious dairy sector in Sweden.

More information on the Practice Hub [here](#).

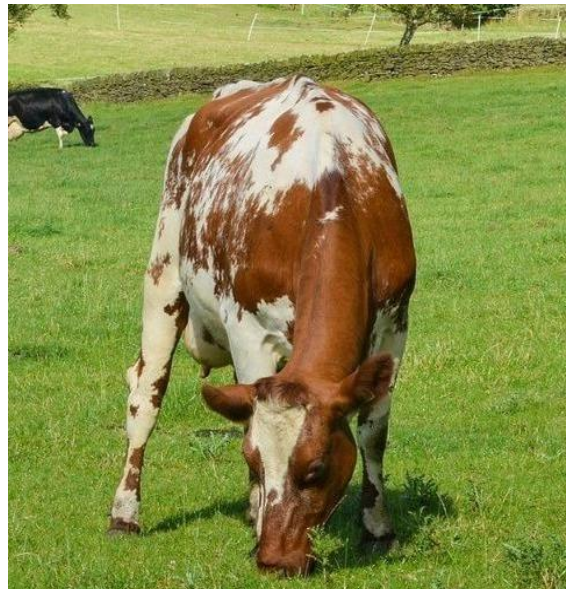


Image 4. Grazing cow. Source: SLU

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PRACTICE ABSTRACT #5

PA5 - Conventional Pig Farm Utilizing Manure for Biogas

The cooperative [Cooperl](#), operating in Britain and France, presents an innovative approach to pig farm management focusing on utilising manure for biogas production. This practice involves frequent removal of pig waste from buildings, separating liquid and solid waste, and processing the solid waste in a collective biogas unit to produce commercial fertilisers. The key innovations include establishing a circular economy, reducing emissions of ammonia and greenhouse gases, generating renewable energy and fertilisers, eliminating antibiotic use, and incorporating uncastrated males in the farming process with a low protein feeding strategy.

Challenges within a Living Lab, supported by Practice Hub 5, include finding alternatives to the V Scraper for waste removal, optimizing manual input in the biogas process, and quantitatively assessing the benefits of the circular economy approach. The uniqueness of this practice lies in its large-scale circular economy implementation, integration of new technologies like the V Scraper and biogas unit, and the utilisation of advanced processes such as centrifugation, osmosis, and ultrafiltration to recycle nitrogen, water, steam, and CO₂.

Currently, around 100 farms are participating in sending solid manure to the collective biogas unit, resulting in a 10% reduction in greenhouse gas emissions per pig and the production of 74 kg of renewable energy per pig. Future plans include conducting a comprehensive Life Cycle Assessment to evaluate the environmental, social, and economic impacts of this innovation within the PATHWAYS project. Additionally, there are plans to test individual solutions such as using robots for waste removal and implementing passive anaerobic digestion processes to further enhance sustainability and efficiency in pig farming practices.



Image 5. External pit equipped with a cover for passive anaerobic digestion.

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PRACTICE ABSTRACT #6

PA6- Green Protein for Pig Farming

The focus of this Practice Hub within the PATHWAYS project is on organic pig production in Denmark that aims to enhance animal welfare and sustainability. This small hub comprises one member from an NGO and three organic pig farmers, representing a mix of generations with a shared interest in increasing pasture access for pigs and eliminating castration while incorporating more trees into pig paddocks. Challenges in



Image 6. Piglets on the pasture. Source: ICOEL

Danish organic pig production revolves around environmental impacts, particularly nutrient leeching due to protein oversupply in pig diets without the use of artificial amino acids. The hub aims to address this issue by exploring the potential for pigs to derive protein from grass, similar to organic pregnant sows consuming grass to meet their nutritional needs. Despite the potential benefits, farmers are hesitant due to variations in grass quality throughout the year.

To overcome this challenge, a specific Living Lab from this Hub plans to develop a tailored tool to assess grass quality for pigs, considering factors like soil types and grass mixes unique to pig farming. By enabling farmers

to optimise grass consumption in pig diets, the project aims to improve farm economics, reduce environmental impact, and enhance overall sustainability in organic pig production. The ultimate goal is to integrate grass into pig feeding plans effectively, promoting a more sustainable and environmentally friendly approach to pig farming in Denmark.

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PRACTICE ABSTRACT #7

PA7 - Conventional Pig Production with Innovative Flooring and Biodiversity Focus

The Krill Varan (Krill Pig) Practice Hub in the Netherlands showcases an innovative approach to conventional pig production, focusing on enhancing animal welfare and promoting biodiversity. This hub comprises around 15 farms engaged in piglet production, breeding, and fattening, all united by their commitment to sustainable and ethical practices.

The key innovation in this system is the use of a solid floor with a thick layer of bedding material, allowing pigs to root and engage in natural behaviours. Additionally, the farms maintain larger group sizes and provide more space per pig, enabling greater social interaction and improved animal welfare. The housing design also incorporates natural lighting through ample windows, further contributing to the pigs' well-being. While maintaining a conventional production model, the Krill Varan farms have implemented a short supply chain, selling their pigs directly to butchers, enabling them to capture a higher value for their products. However, they face challenges in marketing their pigs, particularly the uncastrated males, due to potential meat quality issues.

Another unique aspect of this Practice Hub is the focus on biodiversity. The solid manure produced by the pigs is of higher quality, benefiting soil health and soil life when applied to the land. The primary challenge for the Krill Varan hub is ensuring the long-term viability of this more sustainable and ethical approach to pig production. The higher costs associated with the system need to be addressed, and the hub is



Image 7. Pigs in their new housing facility. Source: WUR

actively exploring new market opportunities, such as collaborating with butchers and developing innovative sales channels. Through this Practice Hub, the PATHWAYS project aims to demonstrate the feasibility and benefits of integrating animal welfare, biodiversity, and sustainable practices into conventional pig production, paving the way for a more holistic and environmentally conscious approach to the industry.

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PRACTICE ABSTRACT #8

PA8 - 100% Pasture-Fed Beef Systems Utilizing Holistic Planned Grazing Management

The UK-based Practice Hub for 100% pasture-fed beef systems, located in the south of England and Wales, brings together 15 farmers committed to sustainable and ethical beef production. This innovative practice focuses on producing beef from cattle fed solely on fresh or conserved pasture, utilizing holistic planned grazing management to optimise land, animal, and farmer well-being.



Image 8. Grazing cow. Photo: Radka Gromnicova / Nature Way Farm

The Practice Hub faces several challenges, including the dwindling number of small abattoirs capable of accommodating their small-scale operations, competition from cheaply produced beef that fails to account for environmental costs, and the need for consumer education on the benefits of 100% pasture-fed beef production.

What sets this Practice hub apart is its unique association with Pasture for Life, a diverse organisation comprising farmers, academics, and advocates working together to champion regenerative

farming practices. The farmers themselves bring a wide range of backgrounds, with many being first-generation farmers who have transitioned from other careers, bringing fresh perspectives and innovative approaches to their operations. Additionally, the Practice Hub boasts a significant proportion of female farmers, which is uncommon in the UK's predominantly male-dominated beef industry.

Looking ahead, the Practice Hub's living lab, recently approved for funding, aims to investigate the nutrient density of 100% pasture-fed beef compared to conventionally produced beef. By gathering empirical evidence of improved nutritional quality, the project seeks to encourage more consumers to choose 100% pasture-fed beef and more producers to adopt this sustainable approach. This shift in focus from mass or calorie production to nutrient density could have far-reaching implications for the beef industry, promoting a more holistic and ecologically responsible model of food production.

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PRACTICE ABSTRACT #9

PA9- New Breeding Methodology for "Mountain Pasture" with Own Certification/Label Development

Practice Hub 10 addresses the critical issue of non-standardized labelling. Currently, consumers face confusion and mistrust due to vague claims like "grass-fed" or "free-range," which lack standardization and verification. Within a living lab project taking place within PATHWAYS, the Associazione Italiana Alimenti Grass-Fed (Italian grassfed organisation) are developing a voluntary labelling scheme that will pave the way for a Zootechnical National Quality Standard (SQNZ). By involving farmers, regulators, industry experts, and consumer representatives, the goal is to develop a clear, credible, and verifiable labelling system that enhances transparency and trust in the meat market.

Throughout the implementation phase collaborative workshops were held with different stakeholders to define sustainability criteria and develop the labelling framework. The scheme is planned to be implemented with selected farmers to test its effectiveness and gather feedback for refinement. Finally, insights from the pilot phase will be used to draft the Zootechnical National Quality Standard (SQNZ), creating a practical standard for sustainable meat production.



Image 9. Cows in alpine pastures. Photo:UNIPG

Farmers and advisers are encouraged to actively engage in workshops and provide constructive feedback. It is essential to track changes in sales and gather feedback to evaluate the effectiveness of the scheme and make necessary adjustments. Regular audits should be conducted to uphold the integrity of the labelling system.

By adopting this labelling scheme, farmers can enhance their reputation for quality and sustainability, attract a loyal customer base, and contribute to a healthier environment.

This project sets the stage for long-term improvements in meat production standards, benefiting farmers, foresters, advisers, and the broader community.

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PRACTICE ABSTRACT #10

PA10 - Quality Assured Production System for Beef and Sheep on High Nature Value Semi-Natural Pastures Together with Label Development

The Swedish Pasture Beef and Lamb Association is spearheading a groundbreaking initiative focused on sustainable beef and lamb production in Sweden by utilizing seminatural pastures, which are essential for biodiversity and ecosystem health, showcasing the symbiotic relationship between humans, cattle, and the environment.

In Sweden, where 70% of the land is covered by forests and seminatural pastures play a crucial role. The association emphasizes the importance of responsible cattle farming practices. Their message, "It's not the cow, it's the how," underscores the significance of sustainable management rather than blaming the animals themselves.



Image 9. Mother cow with a calf. Source: NATUR

A key aspect that sets this Practice Hub apart is the successful development of a third-party certification system and a unique label for high-quality beef and lamb products. With the second-largest supermarket chain on board and a growing demand for sustainably produced meat, the association has demonstrated the viability of their approach and the positive impact of their certification system.

To achieve this success, the association focused on building credibility through certification, ensuring endurance in their efforts, and establishing a sustainable economic model for all stakeholders involved. Overcoming challenges such as extreme weather conditions and economic constraints, they have navigated the complexities of producing and marketing high-quality, sustainable products in a demanding market.

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PRACTICE ABSTRACT #11

PA11 - Agri-tech innovation for improved welfare

In the European poultry industry, producers face challenges such as market competition, environmental impacts, and fragmented operations. To address these issues, a new food traceability system utilizing advanced ICT and big data technologies is being tested within a living-lab taking place in the PATHWAYS project. This living-lab, focuses on how such system can enable the ongoing monitoring of efficiency and environmental indicators, including carbon footprint and to allow farmers to get better prices for their products.



Image 10. Chickens scratching the ground for food.

Source: IUNG

Implementing QR codes on poultry products can provide consumers with detailed information regarding environmental and social impacts, thereby demonstrating a commitment to quality and sustainability, which enhances consumer trust. By leveraging a traceability system, companies can build a reliable food brand that emphasises product transparency, improving market positioning and allowing for higher pricing. Additionally, centralising and digitising documentation will reduce paperwork and minimize errors, streamlining operations, increasing efficiency, and ensuring accurate record-keeping.

Enhancing supply chain coordination through this system can lead to better management with distributors and processors, resulting in more efficient recall processes and improved food safety. Furthermore, utilising advanced monitoring tools will support regulatory compliance by assisting authorities in tracking environmental impacts and enforcing food safety standards, ultimately fostering a more sustainable industry.

A pilot program has been testing the system with selected farms. If successful, the system could be expanded across Europe. This initiative promises to boost the competitiveness of the Polish poultry sector and provides a scalable model for sustainable practices that can be adapted in other regions.

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PRACTICE ABSTRACT #12

PA12 - Farmer Cooperative Producing and Sharing Compost from Plant-Based Litter

In a region of France with high animal density, a cooperative of 300 farmers has come together to address the challenge of managing nitrogen flows. By collecting and composting manure, they aim to maintain their agricultural activities in the area while minimising environmental impacts. This Practice Hub is unique in its focus on selecting the best litter to produce high-quality compost, considering multiple aspects including animal welfare, environmental sustainability, economic viability, and sanitary conditions.



Image 11. Fertil'Eveil's composting plant. Source: Fertil'Eveil

The farmers are interested in exploring a new type of litter, a mix of delate (a natural mineral rich in magnesium and calcium) with wood shavings, which has shown excellent results in ruminant production. They plan to conduct a multicriteria analysis of this litter in poultry production, assessing its performance across various criteria, within a living-lab taking place in PATHWAYS. If successful, they intend to promote this litter to all 300 farmers engaged in the Practice Hub, demonstrating a service designed by farmers for farmers in an integrated solution.

This cooperative approach not only addresses environmental concerns but also fosters collaboration and knowledge-sharing among farmers, promoting sustainable and responsible agricultural practices in the region. By working together to develop and share innovative solutions, these farmers are setting an example for the agricultural sector, showcasing the benefits of collective action and cooperation in achieving more sustainable and environmentally conscious farming practices.

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PA13 - Closed-Loop Egg Production Feeding Food Processing Waste and Recycling Manure



Image 12. Chicken eating a pumpkin. Source: AERES

Based in the Netherlands and led by the AERES University of Applied Sciences (AERES), is tackling two pressing issues in the poultry industry: food waste management and animal welfare. By combining these challenges, the hub has developed an innovative solution that promotes a closed-loop system for egg production.

The first problem addressed is the significant amount of food waste generated throughout the food production and processing chain, with a large portion originating from primary production and manufacturing. The second issue is the growing public demand for improved animal welfare, allowing poultry to exhibit their natural behaviours, such as foraging.

The Practice Hub's solution involves using food waste, such as vegetable trimmings and other produce unsuitable for human consumption, as environmental enrichment for poultry. By forming local communities between arable farmers and poultry farmers, the hub aims to facilitate

the strategic exchange of food waste resources, ensuring that poultry farmers have access to a steady supply of suitable materials throughout the year. The uniqueness of this project lies in its adaptability and replicability. While the specific solution is tailored to the local context, the approach of creating local communities and establishing strategic connections between different types of farmers can be applied to other regions and even other livestock species. This versatility allows the Practice Hub to serve as a model for developing closed-loop systems that address both environmental sustainability and animal welfare concerns. By implementing this innovative closed-loop egg production system, the Practice Hub has the potential to significantly reduce food waste, enhance animal welfare, and promote environmental sustainability within the poultry industry. The collaborative approach of bringing together arable and poultry farmers demonstrates the power of community-driven solutions in addressing complex challenges in the agricultural sector.

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PRACTICE ABSTRACT #14

PA14- Dehesa Mediterranean System of Sheep Rearing in Silvopasture with Different Input Levels

The PATHWAYS project is working with sheep farms in the Mediterranean Dehesa ecosystem, located in southwest Spain and Portugal. This Practice Hub, in collaboration with [CorSevilla](#), a large cooperative of 200 organic and non-organic farmers, aims to optimize sheep production in this harsh yet beautiful environment characterized by seasonal constraints, such as very dry summers, cold winters, and torrential rains.



Image 13. Iberian pigs grazing freely in a Dehesa system. Source: Susanne Schnabel / UEX

Initial work with the farmers revealed that regardless of input levels, especially feeding inputs, the main factor determining sustainability was the presence of unproductive periods primarily associated with digestive and respiratory disorders. To address this challenge, the Practice Hub is testing a range of natural phytochemicals, such as plant extracts, as partial replacements for antibiotics commonly used in the area.

The living lab linked to this Practice Hub focuses on evaluating the effectiveness of phytochemicals in improving overall efficiency, considering the different lambing periods in winter, summer, and spring. The uniqueness of this approach lies in its adaptation to the specific conditions of the Dehesa ecosystem, where management strategies must be tailored to the needs of both mothers and lambs.

By reducing the use of conventional antimicrobials, which is still high in this region, the Practice Hub aims to achieve two positive outcomes: improved overall efficiency and animal welfare, as well as a reduction in antimicrobial residues in the food chain. This innovative approach to sheep rearing in silvopasture systems demonstrates the potential for adapting natural solutions to local challenges, promoting sustainable and ethical practices in the Mediterranean Dehesa region.

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PRACTICE ABSTRACT #15

PA15 – Tool Based Decision-Making for Dairy Goats

The PATHWAYS project is collaborating with the Breeding Association of the Murciano-Granadina goat, the largest dairy goat breed in Spain and one of the most important in Europe, to develop a precision livestock farming tool for dairy goat systems. This Practice Hub aims to enhance the existing tool, which has been used for nearly a decade to collect individual animal data and provide feedback to farmers on lactation duration, insemination periods, and replacement animal selection.

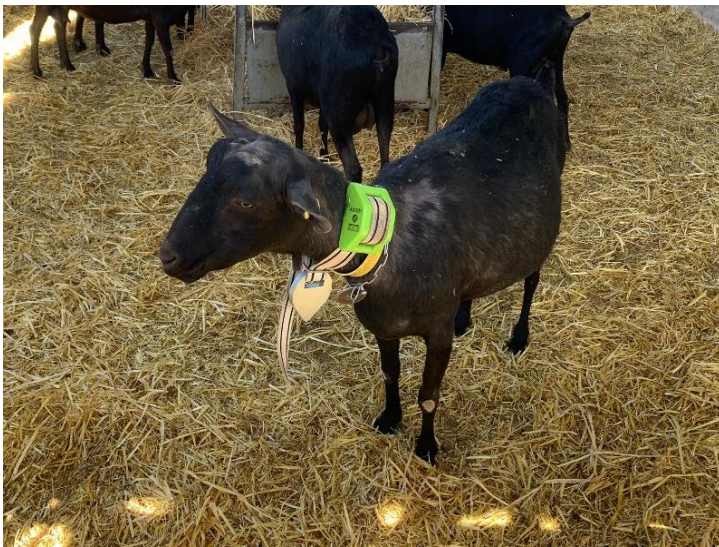


Image 14. Goat with an activity collar. Source: CSIC

The key innovation in this Practice Hub is the integration of animal welfare considerations into the precision farming tool. This addition is particularly relevant given the increasing frequency of heat waves in southern Spain due to climate change, which can have a significant impact on milk production.

Challenges faced by the Practice Hub include the varying levels of tool implementation and technology adoption among different farms, as well as the need to combine multiple sources of information, such as data from the Ruminant tool, animal welfare assessments conducted specifically for dairy goats in the PATHWAYS project, and weather condition records.

The uniqueness of this living lab lies in its use of specifically developed collars to monitor individual goat behavior in relation to heat stress events, which will be linked to the data collected from other sources. By integrating these various inputs, the Practice Hub aims to improve the existing precision farming tool by providing recommendations for enhancing animal welfare in dairy goat production systems.

Through this collaborative effort, the PATHWAYS project and the breeding association are working to develop a more comprehensive and animal-centric approach to precision livestock farming, promoting sustainable and resilient dairy goat production in the face of climate change challenges.

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PRACTICE ABSTRACT #16

PA16 - PATHWAYS Living Lab ideas

Within the PATHWAYS project, Living Labs are practical projects created by farmers across various innovation areas. It could be a production procedure, a new way of organising production, an innovative product or an innovative way of marketing. PATHWAYS collaborates with 15 groups of livestock farmers across Europe, chosen for their innovation. The groups are led by trained facilitators and have launched Living Labs. Videos describing the ideas in detail can be found [here](#).



The innovations tested in Living Labs across Europe are highly diverse, including new technology, production methods, knowledge sharing, product quality, marketing strategies and by-product use, and their results can be put into practice and potentially increase sustainability in the whole sector.

Image 15. Cows in the stables. Source: Annie Spratt / Unsplash

The dairy sector is exploring the implementation of semi-mobile slaughter facilities, promoting sustainability through grass-based systems and agroforestry while developing innovative communication methods with consumers. In the pig industry, initiatives include producing green protein from grass and clover, utilising a manure collecting robot in conjunction with biogas production, and adopting a novel marketing strategy.

The beef industry is focusing on the meat quality of pasture-fed cattle, implementing a new marketing approach, and examining the effects of winter grazing on sustainability. In poultry, both egg and meat production are benefiting from technological advancements, the introduction of novel litter materials, and the use of organic by-products. Lastly, in sheep and goat farming, there is an emphasis on preventive health management as a tool to enhance animal welfare and productivity.

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PA17 - Facilitating multi-actor stakeholder engagement

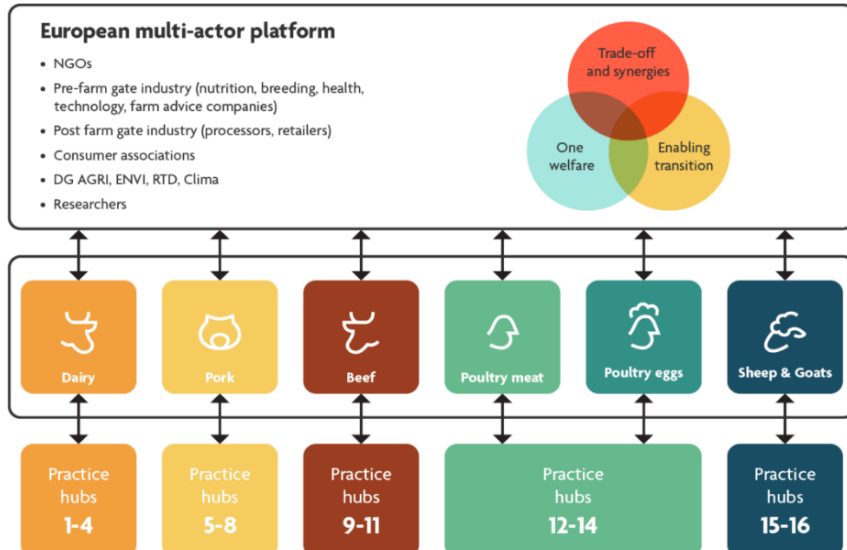


Image 16. Implementation of the MAA. Source: REVOLVE

PATHWAYS has facilitated an interactive innovation model based on the multi-actor approach (MAA), mobilizing and engaging stakeholders and actors across the supply chain with relevant expertise from farm to fork at two levels: National Practice Hubs and a European Multi-actor platform level. During this process, several practical steps for facilitating multi-actor stakeholder engagement have been identified.

First, it is essential to define the purpose by clarifying the objectives of the stakeholder engagement. Next, co-designing a toolkit in collaboration with facilitators can help develop effective session plans. Creating a safe environment is crucial for building trust and encouraging idea sharing among participants.

Additionally, providing participatory training for facilitators allows them to practice and refine their skills. Collecting feedback from stakeholders is important for adjusting processes and maintaining motivation, while encouraging facilitators to reflect on successes and areas for improvement can enhance the overall engagement experience.

The benefits of MAA are evident. For farmers, it fosters agency and practical application of new knowledge, enhancing sustainability at both farm and system levels. For industry stakeholders, engaging participants across the supply chain accelerates innovation and the adoption of new practices while fostering consensus on challenges and solutions. Lastly, for policymakers, engaging multi-actors, especially farmers, helps them understand each role in food system transformation and the feasibility of sustainable policies.

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PA18 - Policies affecting the European livestock sector

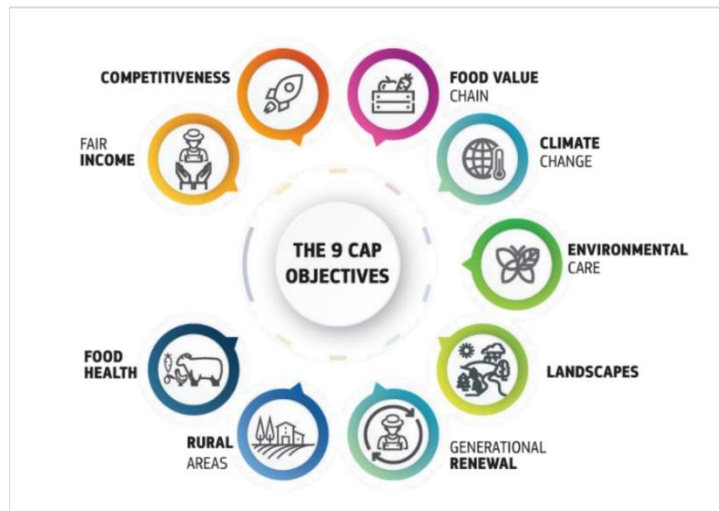


Image 17. Key objectives of the new CAP (2023-2027).

Source: European Commission

An analysis of literature and policy documents revealed several challenges for greater sustainability in the livestock sector in Europe. Environmental impacts, such as greenhouse gas emissions and water pollution, persist despite previous Common Agricultural Policy (CAP) reforms, and the review underscores livestock farmers' dependency on farm payments and their challenging socio-economic conditions. While current policies address general agricultural socio-economic issues, they do not focus on livestock farming.

Recent CAP reforms have negatively impacted livestock systems, contributing to increased intensification and simplification, increased use of external inputs, changes in grazing management, and higher stocking densities, which can have negative consequences for the environment and animal welfare. Recent reforms aim to improve sustainability but lack effective regulation, enforcement, and concrete targets. They often focus on shallow interventions like cross-compliance and agri-environmental payments, which fail to drive profound changes. This is paired with scientific analyses often focusing on single aspects, neglecting holistic approaches needed for systemic change.

The review of EU agriculture policies reveals gaps in research and policy concerning holistic sustainability concepts. It emphasises the need for integrating comprehensive worldviews into policy design and research to address the interconnectedness of human interests, nature, and farmed animals. The current limited interventions are insufficient to resolve the environmental, economic, and social challenges facing European livestock systems, highlighting the urgent need for a more profound reflection on human demands on the food system. More information on the review [here](#).

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PA19 - Storylines for sustainable livestock futures in Europe

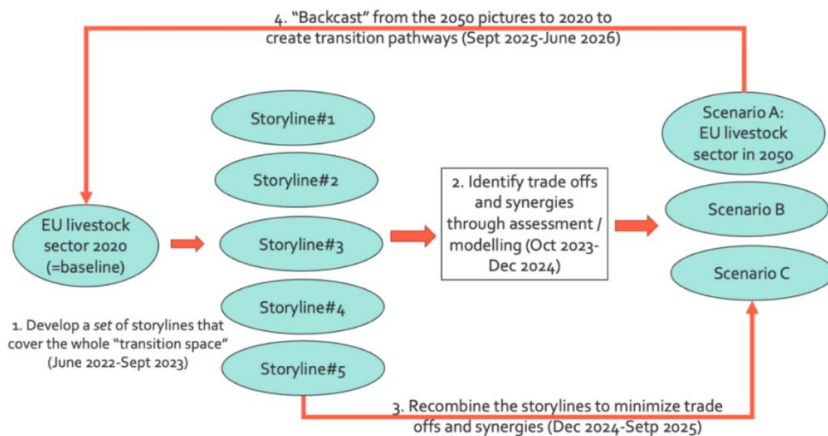


Image 18. The scenario development process in PATHWAYS. Source: UREAD

The PATHWAYS projects aim to identify scenarios of livestock futures in Europe, in which trade-offs between sustainability objectives are minimised, through a variety of modelling approaches. The formulation of policy levers and business strategies to accommodate these scenarios sits alongside this multi-dimensional assessment to support the transition of the European livestock sector to a more sustainable future. For this the project has developed five storylines,

which are based on practitioner’s future visions, that present the livestock sector following a distinct and defining “logic”. These storylines are used by the modelling teams in PATHWAYS to evaluate the impacts of such logic on several issues, incl. macro-economics, nutrition, and environmental externalities. The storylines used in this process are:

- **Feed no food** describes a future, in which the feed-food competition is reduced to a minimum, while agrobiodiversity conservation is integrated into agricultural practices as much as possible.
- **Efficiency first** focuses on the increase of the per-kg efficiency of livestock products both at the farm and industry level (e.g. kg of product out / kg of feed).
- **Rural renaissance** describes a revitalization of rural communities by enabling farmers to regain control of farming processes and being rewarded for the delivery of ecosystem services.
- **High animal welfare** aims to maximize the positive experiences of animals throughout the value chain across the Welfare Quality® principles.
- **Stock-free Europe** describes the disappearance of production-oriented livestock systems to test the implications for a diversity of environmental, social, and economic issues.

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PRACTICE ABSTRACT #20

PA20 - Development of an Animal Welfare Self-Assessment Tool in Dairy Goat Farms.

The rapid intensification and heterogeneity of management and farming practices in the dairy goat sector in Spain require an adequate evaluation of different aspects of their sustainability. The societal expectations in terms of animal welfare are growing rapidly, and the dairy goats' sector in Spain would largely benefit from having reliable data to develop sustainable farming practices and monitor the progress.



Image 19. Goats in trial sites. Source: CSIC

We conducted a study in 3 phases: i) discussed with stakeholders the specific issues they found more relevant to cover in modern dairy goat farms plus a literature review of works that addressed similar objectives; ii) then, a draft questionnaire was developed and discussed with stakeholders; and iii) finally, a selection of farms was made to test the tool.

The stakeholders involved included veterinarians, nutritionists, breeders and managers in the dairy goats' sector. The questionnaire (*Google Form*) was organized into the four main domains considered in

the Welfare Quality® protocol: good feeding, good housing, appropriate behavior, and good health, including respectively 19, 23, 14, and 3 specific questions. Most of them are answered using a 1-10 scoring system, with specific guidance for score allocation. Sixteen farms using a representation of the main feeding systems were used to run an initial test of the tool. The results showed that the categories that exhibit lower average scores and larger differences across farms were water availability and management, density of animals indoors, thermal insulation of buildings and hoof care. The rest of parameters averaged above 7-8 with very low variation across farms and no differences between the main feeding systems.

The questionnaire showed potential to be used as a tool to evaluate the animal welfare status in dairy goats' farms and identify 'hot spots' for future actions.

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PA21 - Development of a classification of European livestock systems.

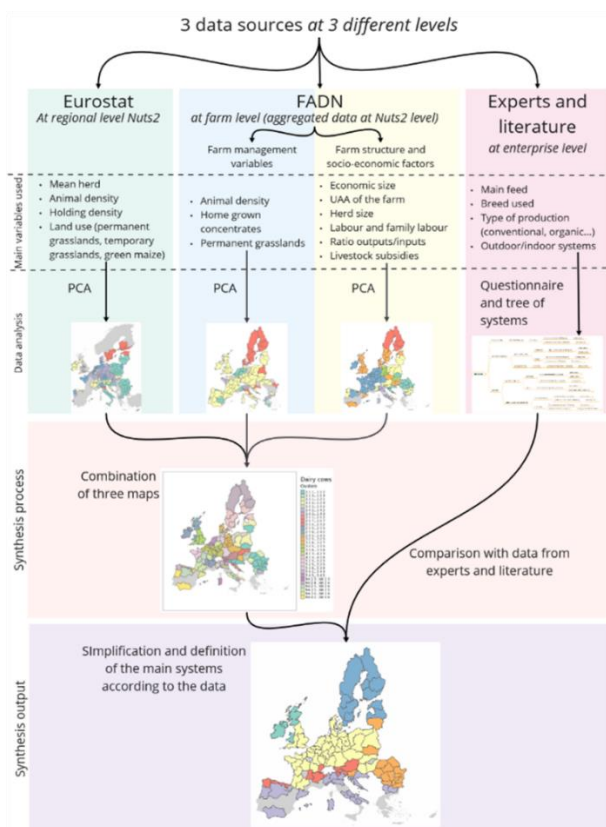


Image 20. Sources of data collection. Source: Simon Moakes

systems can vary from intensive indoor based on concentrate feeds, through to highly extensive grass-based systems. Farm size also varied considerably between large commercial to highly diverse small farms at the fringes of Europe.

This analysis highlighted the diverse nature of European livestock systems and the need to find locally relevant and adapted solutions to improve sustainability. These livestock systems have developed to reflect the local environmental and socio-economic conditions and are quite diverse, especially for ruminant systems that primarily rely on locally adapted forages for nutrition.

To assess which livestock systems should be promoted for a more sustainable future, the PATHWAYS project characterized existing European livestock systems. Literature on the characterization of livestock systems was reviewed, and a new approach was developed using both quantitative and qualitative data. There were two main data sources to identify different livestock farming systems.

- Eurostat database
- Farm Accountancy Data Network (FADN)

Data were merged into a regional database to identify areas with common and unique attributes and typical systems were identified across all relevant regions. These systems were then cross-checked with results of an expert survey, literature and a project workshop.

Overall, across the main livestock species, we identified around 60 systems (and sub-systems) which varied significantly. We found that whilst pigs and broilers are relatively uniform across Europe due to their controlled production environment, ruminant

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PRACTICE ABSTRACT #22

PA22 - Improving the estimation of enteric methane emissions in ruminants



Image 21. Goats in respiration chambers. Source: CSIC

The livestock sector significantly contributes to the emissions of greenhouse gases (GHG), enteric methane (CH₄) being one of the main sources. About 40% of the world's CH₄ emissions come from agriculture, and 70% of that is due to enteric fermentation. This process happens in ruminants' digestive systems when sugars are broken down into CH₄ and released through belching. To determine the environmental impact of ruminant agriculture and the potential effectiveness of mitigation strategies, the enteric CH₄ emissions across all ruminant species and systems need to be quantified accurately. However, an accurate estimation requires

developing emissions factors that can capture the peculiarities of the different livestock management systems (mainly diet) and animal species (dairy/beef cattle, sheep and goats).

We updated the existing emissions factors (% of the gross energy of the diet lost as CH₄) for the main ruminant species and production systems, so a direct estimation of emissions can be derived according to the system and diet. The new values were obtained using results from direct measurements in respiration chambers. The factors considered for each livestock typology were:

- Dairy cattle: milk yield, energy digestibility of the diet and fibre content (neutral detergent fibre)
- Beef cattle: forage: concentrate ratio of the diet and energy digestibility
- Sheep and goats: productivity system (low, medium, high) and energy digestibility of the diet

Using relatively basic information of the diet characteristics, good estimations of enteric CH₄ emissions from different production systems can be obtained. Further updates of the emission factors considering more details of the diet are underway.

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PA23 - EU consumers' potential for shifting to sustainable food consumption – dietary patterns and motivation levels

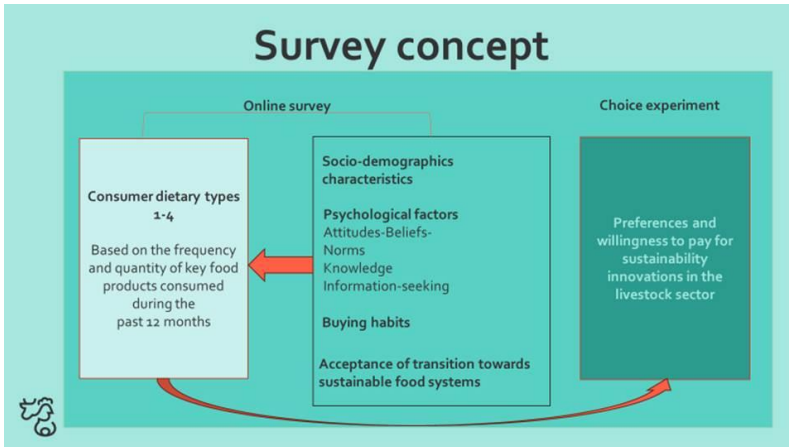


Image 22. Concept of the survey. Source: FIBL

This study identified four distinct consumer archetypes based on dietary patterns, socio-demographic characteristics and motivations for sustainable food consumption across five European countries: Germany, France, Italy, Sweden, and Romania, using an online survey. Results from the survey highlighted that a “Dairy” archetype is predominantly found in Sweden, Germany, and France, consisting of individuals who consume high amounts of dairy products. This group includes both males and females but has a

slight underrepresentation of younger consumers. Individuals with lower and medium education levels are more likely to belong to this archetype, which demonstrates moderate motivation for sustainable food consumption. In contrast, a “Starch” archetype, most common in Romania, is characterized by high consumption of starch-rich foods such as bread and pasta. This group is more prevalent among males and older age groups, typically with lower education and income levels, and exhibits the lowest motivation for sustainability.

A “Protein” archetype includes consumers with a high intake of various meats, fish, and protein-rich plant foods, as well as a significant consumption of sweets and snacks. This is the largest archetype overall, particularly common in Italy, and tends to include more males and younger consumers, who show relatively high motivation for sustainability. Finally, a “Fibre/Plant-based” Archetype focuses on fibre-rich, plant-based foods like fruits, vegetables, and salads. It is the second-largest archetype, especially prevalent in Italy, and is characterised by a higher representation of females and individuals with higher education levels. This group demonstrates the highest motivation for sustainable food consumption among the archetypes.

These archetypes provide a foundation for developing targeted strategies and policies to promote sustainable food consumption, addressing the specific needs and motivations of each group.

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PA24 - An Overview of the Nutritional database and draft web application development process in PATHWAYS



Image 23. Screenshot of the draft web application. Source: IFIP

The PATHWAYS project aims to address the growing need for sustainable nutrition by integrating nutritional and environmental data into accessible digital tools.

The project has developed a comprehensive database relying on the French *Ciqual* database, which includes key nutrients (macronutrients, vitamins, minerals) in 2500 foods commonly consumed across France and Europe. This nutritional data is associated with environmental data

from the French *Agribalyse* database, which assesses the ecological impacts of the same 2500 food products, such as greenhouse gas emissions, water usage, and land use.

A web interface allows users to create personalized dietary profiles and build food baskets, exploring the implications of their food choices on both nutrition and sustainability.

The interface provides detailed analyses and synthetic scores for nutritional adequacy and environmental sustainability, supported by visual aids.

Despite challenges like the variability in food data and environmental impacts depending on production methods, the Pathways project aims to provide consumers and policymakers with an evidence-based platform that promotes both human health and environmental responsibility.

By bridging the gap between nutrition and sustainability, this tool offers valuable guidance for making informed dietary decisions that contribute to a healthier population and a more sustainable world.

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PA25 - Summary of LCA methodologies reviewed

In the PATHWAYS project, a review of the life cycle assessment (LCA) methodologies was carried out with the aim of identifying research gaps with regards to soil C, soil N₂O emissions, manure emissions, circular economy, animal welfare, nutrition and biodiversity. This was done with a participatory approach involving different experts in Life Cycle Assessment, livestock science, biodiversity, nutritional aspects, circular economy and food-feed competitions. The group of experts also covered all the main livestock sectors including beef, dairy, pig and poultry, sheep and goats. This review and harmonization process contributed to raising awareness of the current methods available, their characteristics and limitations. It also provided a set of recommendations for LCA practitioners on how to carry out assessments depending on data availability, and expertise requirements.

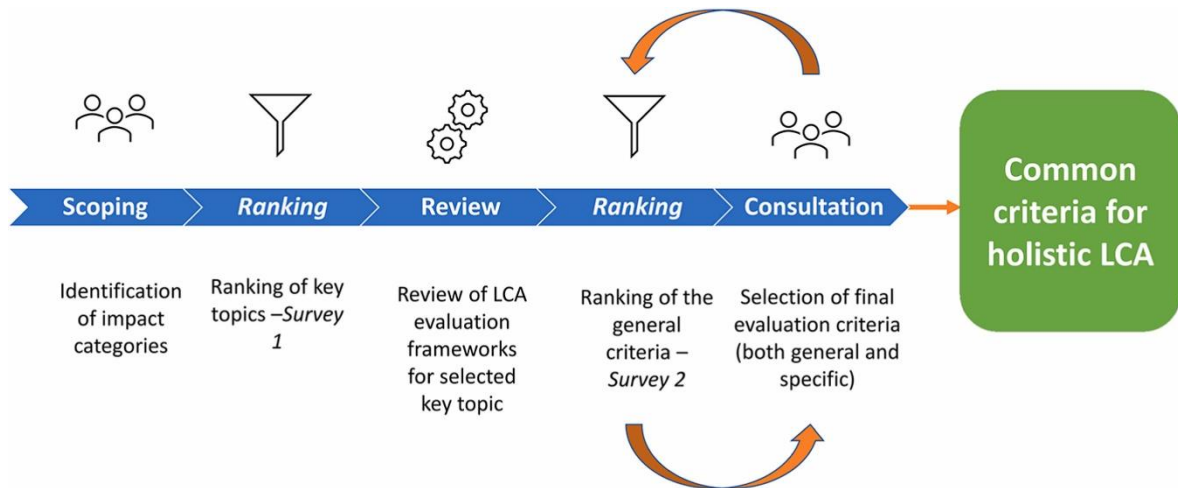


Image 24. Flow chart for the participatory approach adopted in this research for the development of common criteria for the assessment of LCA methods used for livestock systems and product. Source: UNIPG

The methodologies analysed for soil C, manure, soil N₂O emissions, manure emissions showed that depending on the objectives of the assessment different methods could be employed which have different level of accuracy. Further improvements in the LCA methodologies with regards to biodiversity, circular economy and nutrition will contribute to better capturing livestock systems characteristics. Further information can be found in the following article [here](#).

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PA26 - Sustainability assessment of innovative livestock systems in Europe – methodological approach

The PATHWAYS project works with farmer groups (Practice Hubs) in nine European countries, organised around innovative practices in livestock farming. A case study approach was adopted to assess the sustainability of these farms. The sustainability assessment of the innovative farms includes Life Cycle Assessment (LCA), Social Life Cycle Assessment (S-LCA), and an analysis of economic farm data.



Image 25. European map with PATHWAYS Practice Hubs locations. Source: REVOLVE

The selection of Practice Hubs and farms aimed for a balanced geographical spread, coverage of various livestock species, sufficient farm numbers, and high-quality data. The six Hubs included in the assessment, covering the UK, Sweden, France, Romania, Germany, and Poland, include beef, dairy, pork and broiler production systems. Per Practice Hub, data was collected from one farm that was close to the median of all farms in the group and was therefore considered “typical” for this hub.

The assessments deliver results on a farm basis. For the LCA, impacts are presented per kg of livestock product, per ha of land utilised and per unit of currency of livestock output. The reported impact categories include climate change (short term), energy use, mineral resources use, freshwater and terrestrial acidification, freshwater and marine eutrophication, and land transformation and occupation (biodiversity). The social LCA provides insight into the following categories: health and safety of workers, safe and healthy living conditions, local employment, fair competition, ethical treatment of animals. The economic assessment considers the six impact categories: profitability, value creation, number of jobs, quality of jobs, competitiveness, and markup.

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PA27 - The importance of grasslands and livestock systems to stakeholders

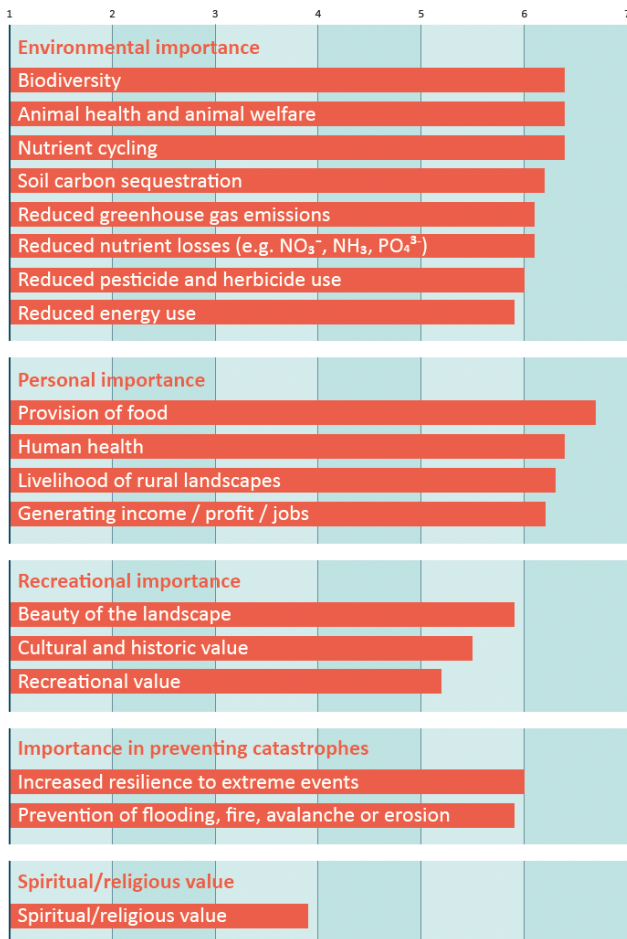


Image 26. Importance of benefits that livestock production and grassland bring to society on a scale of 1 (very unimportant) to 7 (very important). Source: REVOLVE

To reduce environmental impacts while meeting societal demand for safe, nutritious and affordable meat and dairy products, the Horizon 2020 project PATHWAYS aims to identify and promote sustainable practices in supply and production chains within the European livestock industry.

One of the goals of PATHWAYS is to identify and rank the benefits that livestock production brings to society. Previous studies have shown that grasslands offer many of these benefits. To understand how important these benefits are to various stakeholders, we conducted an online survey in 2022.

The survey was shared through the networks of all involved partners. The 896 responses were analysed to see what benefits people associate with livestock production and grassland. The role of respondents had minimal influence on their answers, leading to the emergence of five main themes: environmental importance, personal importance, recreational importance, the importance of preventing catastrophes, and spiritual or religious value. Overall, the survey clearly showed the importance of different benefits of livestock production and grassland to various stakeholders.

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PA28 - The journey toward a novel metric to assess the socioeconomic sustainability of the livestock value chain.

Work-package seven’s goal is to develop impact metrics on the socioeconomic sustainability of livestock value chains. The complication, however, is being able to have a holistic assessment of sustainability at value chain level. Through the literature review on methods and frameworks for assessing the sustainability of the livestock sector, we tried to understand current gaps and misalignments to construct a novel metric.

Among the 111 frameworks and tools obtained from the literature, only nine resulted in embracing a value-chain approach, three of these were excluded because they did not satisfy the condition of explicitly addressing the socioeconomic dimension of sustainability and other two were delated because their objective does not completely match with measuring sustainability.

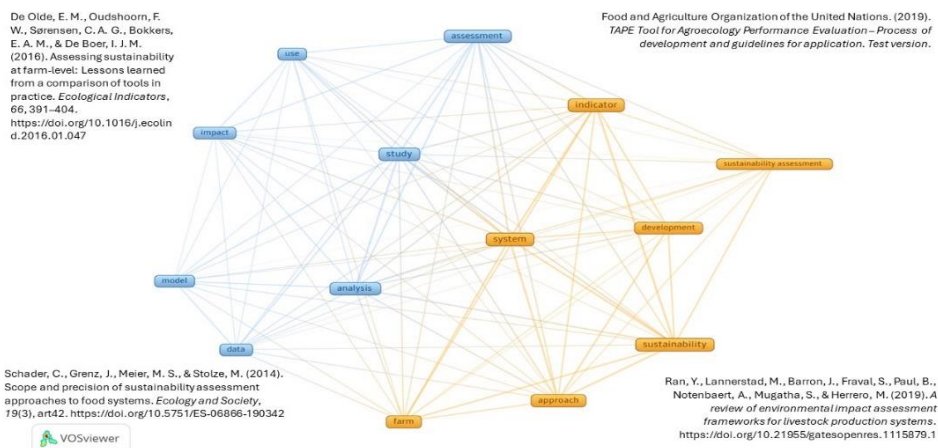


Image 27 Relationships and keywords Among the Chosen Frameworks. Source: UNIPI

The inventory exercise, with no claim to completeness, was the first step in the process of reflection and selection of suitable indicators. The novel metric will be created using an online two-rounds Delphi analysis, involving experts in the livestock value chain.

The result will be a multi-scale scoring method, which can advise on what needs to be changed to improve value chains’ sustainability both in the short and long run, at different scales. The element of novelty pursued is the integration of this transformative thinking into a recognised sustainability assessment metric.

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PRACTICE ABSTRACT #29

PA29 - The role of livestock in the circular bio-economy.

Livestock plays a crucial role in the circular bioeconomy by effectively closing the nitrogen cycle at various levels. At the agricultural system level, livestock provide manure, a valuable bio-fertilizer that reduces reliance on synthetic fertilizers. The nitrogen found in manure originates from feed that is not fully absorbed by the animals, making livestock an efficient means of transferring nitrogen into the food system. In organic farming systems, where synthetic fertilizers are avoided, livestock are essential for transferring nitrogen from nitrogen-deficient grasslands to croplands. At the food system level, livestock contribute to recycling agricultural by-products and waste, transforming materials such as oilseed cakes and low-grade wheat into high-value, nutrient-dense food. This practice reduces land and resource use in livestock production.

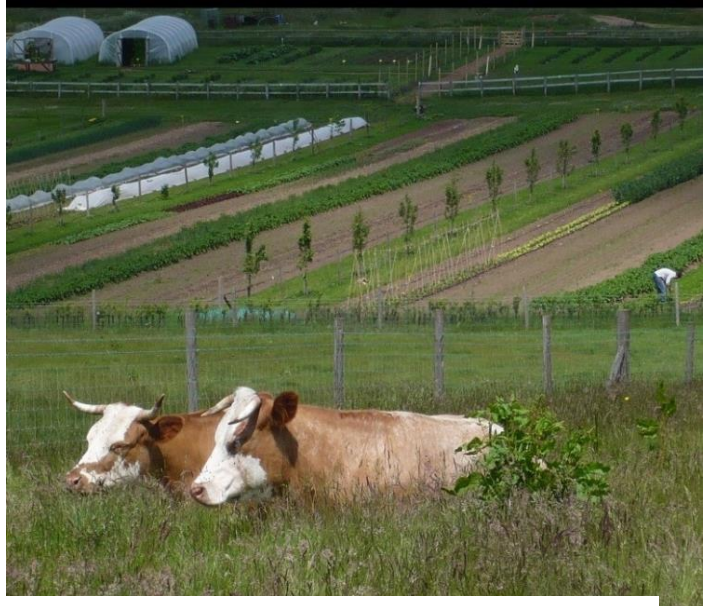


Image 28. Cows on the field. Source: FiBL

Additionally, in the bioeconomy, manure serves as a feedstock for biogas production, generating energy and producing digestate that can be utilized as bio-fertilizer while also mitigating methane emissions from manure management. This exemplifies the biomass cascade, where biomass is reused multiple times to create various valuable products. While livestock is essential for operating within planetary boundaries, this is contingent upon aligning livestock numbers with the principles of circularity. Preliminary results suggest that the optimal livestock population could be significantly lower than the current numbers observed in Europe.

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PRACTICE ABSTRACT #30

PA30 - Optimizing protein production from livestock while reducing feed-food competition

In today's food system, livestock production often competes with human nutrition by relying on feeds that humans could consume directly. This is an inefficient use of our resources as livestock require more nutrition than they provide us through meat, milk, and eggs. One solution to significantly reduce the overall footprint of our food system is to only feed livestock with feed that does not compete with human food, such as grass and agri-food waste. In such a scenario, grassland would become the primary source of feed in Europe.

Milk has a higher protein conversion ratio from grassland compared to meat, making dairy cows an



Image 29. Cows on the field. Photo: Alisa Matthews / Unsplash

inherently more efficient choice for grass-based livestock systems. In addition to milk production, dairy systems contribute significantly to meat production. This occurs not only through the slaughtering of older dairy cows but also by raising calves that are surplus to the needs of the dairy sector. This practice becomes particularly advantageous when employing dual-use cattle breeds or incorporating meat genetics during the insemination of dairy cows whose calves are not destined for dairy replacement. These calves can be efficiently raised for beef, serving as an alternative to suckler cows, which generally require more resources.

Preliminary modelling results show that few European countries, like France, Sweden, or Romania, could produce more bovine protein than today while relying only on grassland, reducing the feed-food competition.

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Summary and next steps

This report presents the first 30 Practice Abstracts which are concise summaries developed using the 'EIP-AGRI common format' to facilitate the sharing of knowledge derived the PATHWAYS project. The format has been designed to streamline the presentation of both intermediate and final project outcomes, making key insights readily accessible and fostering engagement with the project's target audiences. The initial collection of abstracts highlights a variety of agricultural innovations, and the 15 Practice Hubs established by the project, addressing a wide range of topics from agri-tech innovation for improved welfare in Poland to the establishment of a third-party certification system for high-quality animal products in Sweden. These abstracts emphasize the (potential) benefits of implementing innovative practices and collaborative efforts aimed at improving sustainability, animal welfare, and the economic resilience of the livestock sector. The overarching goal is to transform innovative concepts into actionable practices through efficient knowledge dissemination.

Moving forward, these resources will be made available on the [EU CAP NETWORK platform](#) as well as the [PATHWAYS project's](#) website, enhancing their visibility and accessibility to these knowledge products. Additionally, they will be actively shared across PATHWAYS's social media platforms to reach a broader audience and encourage greater engagement. This strategy is intended to cultivate a more informed and connected agricultural community by increasing awareness of these innovations and promoting interaction among stakeholders.