



Policy Brief

The European Beef Sector On the road to enhanced sustainability

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Executive statement:

The European beef sector faces many sustainability challenges. However, it can form part of a sustainable food system. Solutions have already been identified, and many are being implemented on farms across Europe. BovINE, the EU funded multi-actor network project, has collated many of these innovations and on-farm good practices, demonstrated their feasibility on commercial beef farms and developed accessible, audio-visual and supportive materials to aid implementation. The role of the farmer as a change agent is highlighted by BovINE, together with the challenges, opportunities and synergies associated with further rollout.

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1. The Context

The European beef sector is of significant economic importance. It is valued at €30 bn. per annum and accounts for 7.2% of total agricultural output. Additionally, it is fundamental to the economic prosperity of rural communities throughout Europe, providing income to many rural households, including 385,000 farms that are specialised beef rearers and finishers.

However, it is a low margin enterprise with many farmers dependent on off-farm employment and Common Agricultural Policy (CAP)-based income supports. Additionally, there are concerns about the sector's environmental impact together with the challenges raised by citizens and consumers relating to animal, human and planetary health, and overall sustainability.

The sustainability challenges of the beef sector need to be urgently addressed to enable it to be part of the solution to such challenges, and contribute to delivering a sustainable food system.

European policies are grappling with the same issues. The European Green Deal, the Farm to Fork and the EU Biodiversity strategies aim to address issues relating to greenhouse gases, animal welfare, biodiversity, the provision of safe and nutritious food, and fair economic returns. BovINE, a multi-actor thematic network funded by the EU sets out to develop solutions for European beef farmers to address these sustainability challenges. Through direct engagement with such farmers, the project identified the farmers' needs and went on to identify solutions ready for implementation.

The solutions identified were drawn from two core sources:

- (1) Research Innovations (RIs) from literature that have not yet been put into practice. BovINE network partners tested some of the RIs with farmers across Europe to identify the barriers and potential enablers to implementation.
- (2) Good Practices (GPs) that are already being implemented on farms.

2. The BovINE Process

Using participatory methods within online and face-to-face workshops, BovINE undertook an annual cycle of needs identification with beef farmers across Europe, managed country by country. The needs addressed are presented in Table 1 below. Further details on the process are available in Lynch et al. (2022).

This activity was followed by solutions identification (through consulting academic and grey literature and from knowledge of on-farm good practice) and ultimately via feedback to farmers on those solutions that were identified as relevant to their needs.

Solutions were identified across four thematic areas - socio-economic resilience, animal health & welfare, production efficiency & meat quality, and environmental sustainability.

Table 1. European Farmers’ Identified Sustainability Needs Addressed in BovINE

Year 1	Year 2	Year 3
Long term business planning approaches	Initiatives to improve beef image, break trend of consumption decline	Methods to ensure a fairer distribution of the final price along the supply/food chain
Tools & strategies to manage price volatility and cash flow	Examining economically efficient housing systems for beef cattle	The use of alternative feedstuffs to reduce the high costs of raw material for feeding
Health & welfare of new born calves on suckler farms	Simple labour-saving tools to measure & communicate high animal welfare standards	On farm health check of young stock prior to sale/purchase including vaccination status
Lameness of finisher bulls	Management, housing, & envt. factors that affect animal welfare in rearing and finishing units	Training in animal welfare for operators/farmers, stress-free drive systems during weighing & transport
Animal monitoring tools in the fattening phase	The effect of animal nutrition on meat quality	Tools to evaluate the carcass and meat quality prior to and in the slaughterhouse
Use of data to improve carcass & meat quality	Optimising the interval between calvings in suckler beef herds	On-farm strategies to increase marbling/ tenderness/colour in beef meat
Strategies to reduce the enteric emission of beef cattle	Reward schemes for farmers for environmental objectives -C, biodiversity, water, soil, air quality	Tools for calculating & improving environmental sustainability on beef cattle farms
Reduction of nutrient & pesticide leaching to improve quality of surface water	Carbon sequestration methods (grassland, simplified cropping, potential agroforestry)	Methods to enhance biodiversity on beef cattle farms without the need for large investment

3. BovINE Results

The BovINE process as introduced above has resulted in 340 solutions focused on the 24 needs listed above. These solutions are available in the form of 340 practice abstracts, and accessible on the BovINE Knowledge Hub (www.bovine-eu.net). They are supported by 12 webinars, 8 animations, multiple videos, presentations, and a range of other accessible materials available on the Hub and accessed via the project website. It can be noted from the broad range of materials available that one of the core strengths of BovINE has been the ability to leverage the knowledge from those regions that successfully addressed several of the key targets set out in the Farm-to- Fork strategy.

96 of BovINE’s 340 solutions have been selected and submitted to EIP-Agri for upload to their own online portal extending the reach of this material.

A selection of the solutions and innovations are provided in Table 2, linked to the policy target they have the potential to support. Also included are factors that enable their uptake and rollout amongst beef farmers, together with the main outputs/results of their adoption. Finally, potential policy actions are indicated that could enable adoption that is more widespread across EU member states.

Based on knowledge within the network, BovINE analysis highlights the potential for solutions within particular thematic areas to support and/or hinder sustainability objectives within and across areas. Findings of this analysis of the combined impact of good practices and research innovations suggest that many synergies exist. Hence, it is possible to address different priority topics and different sustainability objectives simultaneously. However, these synergies do not arise by definition, and it largely depends on the specific good practices and research innovations that are adopted. Moreover, good practices and research innovations that create synergies across sustainability objectives in one sector/region may lead to trade-offs when out-scaled to another sector/region, or even when out-scaling from one farm to another in the same sector/region.

Table 2. Target actions as set out in the Farm-to-Fork strategy and selected innovations generated by BovINE to support implementation

Target action	Supporting Innovation	Country	Enabling factors	Results/outputs	Additional actions
Increasing organic production	Terraprima- Sowing of Biodiverse Pastures	PT	Admin. and technical assistance, tiered payment with highest level for early adopters	1000 farmers, 50,000ha sown and a reduction of 1 m tonnes of CO ₂ . Improves Biodiversity	Additional and user-friendly methods to quantify CO ₂ reduction, link with market demands; communication
Increasing organic production	Holistic Management Practices for Grassland: planned rotational grazing using short grazing & long rest period	PT	Awareness and capacity building. Clarity and simplification	Increased profitability, better soil health, increased biodiversity	As the whole farm system needs to be changed, technical support is needed.
Increasing organic production	Red clover scheme	IE	Consultation with farmers' cooperatives and agri-retailers as well as farmers groups, advisory services, and seed suppliers	Delivers up to 12-16t/DM per ha, crude protein levels 16% - 20%, annual Nitrogen fixation level of 150-200 kg/ha	
Increasing organic production	Alternative feedstuffs	ES	Localised research, capacity building	Reduced feed costs, contribution to circular economy and waste reduction, reduced digestive disorders in fattening animals, source of antioxidants in meat	
Increasing organic production	Reducing fertiliser usage through the use of a nutrient management plan	IE	National strategic approach incorporating researchers and advisors. Development of monitoring and supporting software	Improved soil health, reduced carbon footprint, improved farm profitability	
Increasing organic production	Farmer to farmer trading contracts	IT	Third party to monitor contract. Structured templates with flexibility to take price variations into account	Income stability	
Increasing biodiversity	Grassland management techniques: Rotational grazing	FR	Capacity building of farmers and advisors,	Increased profitability, better Soil health, increased biodiversity	Knowledge and support are important. Virtual fencing may be useful.
Increasing biodiversity	Hessian Program for Agri-environmental and Landscape Management Measures (HALM)	DE	Capacity building of farmers and advisors, Financial Incentives	Increased societal acceptance of agricultural products,	
Increasing biodiversity	Hedgerow management through Teagasc Signpost programme	IE	Capacity building of farmers and advisors, Financial Incentives, Cooperation between research and advisory services	Improves water quality and biodiversity, reduces GHG and improve farm margins	

Increasing biodiversity	Establishing Beetle banks/insect hotels/wildflower borders	DE/ES	Research support, Capacity building of advisors	Increase of global biodiversity, grassland and crop productivity and lowering the need of pesticides.	
Increasing biodiversity	Cattle Breeds of Intangible Cultural Heritage	IE	Ratification of the convention by the Heritage and Culture Ministry; establishment of National Inventory and appointment of an expert group. Linkage with breed societies and establishment of promotional campaigns	Opportunities to link with highly regarded organisations, brands and initiatives, Collaborative initiatives amongst different actors, verification of the wider benefits of cattle production to society, Native breeds particularly suited to harsher environments	
Reducing GHG	Life Beef Carbon	FR, IE, IT, ES	Research supported initiative; technical assistance and support at regional level; knowledge transfer to farmers	reduction in GHG emissions of 119 000 tonnes equivalent CO ₂ on farms involved: a 15% reduction over 10 years in the beef carbon footprint of the four participating countries	
Reducing GHG	Carbon measurement tools (TEKLA/Bovid CO ₂ /CAP2ER)	DE, ES, FR	National strategic approach incorporating researchers & advisors. Development of monitoring & supporting software that can measure CO ₂ eq. on farms and suggest abatement strategies	Reduction in GHG emissions; increase in farm profitability on farms using tools	Validation and accuracy of these tools is important. Uniformity in estimation of certain factors, transparency on methodology or assumptions used in the tools
Reducing GHG	Feed Additives	PT, BE	Research trials on efficacy; technical guidance by advisory services; financial supports to purchase feed additives	Reduction in Carbon footprint: 3NOP = 15%, Linseed = 10%, Seaweed (<i>A. taxiformis</i>) = 38-98%	Validation of reduction % in different management conditions, with different breeds and in combination with different diets.
Reducing GHG	Low Emission Slurry Spreading (LESS)	BE, IE	Incorporated into agri-environmental schemes as a financial rewarded payment. Capacity training of advisors.	Spring application of cattle slurry by LESS of 33m ³ /ha supplies additional 23 kg N/ha compared to summer application with splash plate. Saving (€20/ha) in chemical farm fertiliser requirements, more efficient use of N in cattle slurry while reducing ammonia losses.	

Reducing GHG	Agroforestry/Silvopasture	BE, IE	Capacity training of advisors to enable technical support for farmers. Financial support for establishment.	Enables sequestration of Carbon and reduction of nutrient leaching. Can increase farm profitability.	
Reducing GHG	Environmental Reward Schemes	EE, FR, BE, ES	Consultation with farmers' cooperatives, research, and advisory services in planning stage. Incorporation of financial incentives/ action-based payments	Can reduce GHG emissions; reduce nutrient leaching; improve biodiversity; increase farm profitability	
Communicating & promoting sustainable beef image	Promotional Campaigns- (Made in Viande, Fans del Vacuno, Sustainable Meat Project,)	FR, EE, IT, ES	Podcasts, Farm Open Days and Retailer buy in		Need for budget for ongoing promotion
Communicating & promoting sustainable beef image	Quality Labels- Label Rouge, Bord Bia, Qualità Verificata, PDO, PGI	FR, IE, PT, IT	Supply chain protocols. producers in quality system have access to subsidies at slaughter premia or to funds from Regional and National Development Plans	Help to restore consumer confidence and improve the image of meat.	Standard protocol required, need for strategic plan
Communicating & promoting sustainable beef image	Educational programmes	EE, DE	Cooperation between educational bodies and farmers	Educates public on sustainable systems on beef farms to restore confidence and improve image	
Communicating & promoting sustainable beef image	Animal Monitoring Tools (Boviwell)	FR	Research driven monitoring tool; Cooperation between processor and retailer to add certification and thus premium to beef products	Improved awareness of significance of animal health and welfare on beef farms. Improved return on farm for certified beef	
Ensuring fair economic returns	Remunera Score	FR	Research driven scoring criteria; Ministry backed innovation (Egalim law); retailer buy in.	Increased transparency along the supply chain; diversified product selection for consumers	
Ensuring fair economic returns	Beef Price Tracker App	IE	Multi-stakeholder involvement in App development	improves beef price transparency	
Ensuring fair economic returns	Direct Sales approach	BE	Advisor capacity building to provide farmer guidance & technical support. Regional development grants through e.g. LEADER for business feasibility testing, product design and start-up/marketing	Improves price transparency and can increase farm incomes	

Ensuring fair economic returns	Contract Pricing	IE	Buy in from processors; well-developed contract structure	Enables better long-term financial planning and can improve economic performance	Regulation
Improving animal health and welfare	Rubber mats	IE	Research supported evidence; Pillar 2 funding	Reduces lameness; improves farm productivity (ADG) and hence profitability	
Improving animal health and welfare	Low Stress Weaning Protocols	EE	Capacity Building of advisors to provide guidance and technical support to farmers. Financial aids to upgrade animal housing	Reduces stress on animals; reduces incidences of sickness; improves ADG of weaned animals and thus farm profitability	
Improving animal health and welfare	Welfare Standards in transportation of Beef Animals	DE	Research support, Capacity building of advisors, buy-in from supply chain actors, training for transporters and handlers	Reduces stress on animals; reduces incidences of sickness; improves farm profitability	
Improving animal health and welfare	Animal health and welfare training programmes	DE, IE, BE	Capacity building of animal handlers, transporters and contractors; support of regional farm representative bodies	Reduces incidences of poor animal health and welfare	
Improving animal health and welfare	Health protocols prior to sale or purchase of young stock	All regions	Research supported protocols; Capacity building of advisors, supply chain actors, training for transporters and handlers	Improved animal performance; lower incidences of young stock mortality; improved economic performance	
Improving animal health and welfare	Neonatal score for new-born calves	FR	Research support to develop scoring criteria; Capacity building of advisory services to implement tool on farms	Improved animal performance; lower incidences of young stock mortality; improved economic performance	
Improving animal health and welfare	Facilities for optimal cattle handling	PT	Technical guidance from advisory services; Financial aids to upgrade animal handling facilities	Reduces stress on animals; reduces incidences of injury; improves farm profitability	
Improving animal health and welfare	Novel rearing system in calf fattening	DE	Research support to develop rearing system; Capacity Building of advisors to provide guidance and technical support to farmers	Reduces use of antibiotics; healthier animals; reduction of mortality; economic gain; increased animal welfare	

4. Focus on Environmental Sustainability

Different measures can be taken to improve the environmental impact of the beef sector and help to meet the targets set by the European and global agreements. To start, a good picture of the current situation on the farm is important. A range of tools already exists to calculate the environmental impact of the farm. Those tools can be developed locally or at the national level, or can be adapted to general beef production systems and be used in many regions. Tools developed locally are adapted to regional conditions and can have the advantage of calculating impacts more accurately.

In the BovINE project, we tackled four strategies to enhance the environmental impact of beef production: Strategies to reduce enteric emissions, Strategies to increase carbon sequestration, Methods to improve biodiversity, and Reduction of nutrient leaching and identified specific actions that could be undertaken. Their deployment can be supported by a range of policy measures as suggested in this illustration.

4.1 Strategies to Reduce Enteric Emissions

Through changes in feed management, a rapid reduction of enteric methane (CH₄) emissions can be achieved. Feed ingredients like linseed or rapeseed in combination with brewery grains showed great potential in research, with a reduction of 8-9% in the CH₄ emissions. Next to feed ingredients, feed additives also show great potential. The best-known additives are Bovaer (commercially available for dairy cattle) and nitrate. Bovaer has a reduction potential that varies between 15% and 40% per cow, depending on the animal's ration and the amount of methane inhibitor administered, and nitrate has a reduction potential of 8%. Some of these strategies can be widely implemented, while others are more locally oriented, as feed sources may vary between regions. For widespread deployment, it is important to reach consensus on the reduction potential and to define the preconditions that may also influence this reduction rate (e.g. dosage, ration, and management).

Changes in farm management have a slow impact on CH₄ emissions, but the reduction is sustainable. By genetic selection (linking CH₄ emission to different phenotypes) a selection index can be developed for a farmer. Using this index can decrease emissions of the herd over time. Optimal young stock rearing allows the farmer to aim for a lower calving age, reducing the proportion of breeding animals on the farm. By aiming for a younger but responsible calving age, breeding animals will be non-productive for a shorter period. This results in a lower proportion of breeding cattle, which will reduce the farm's emissions. The production system also influences emissions. On the one hand, intensive systems have lower CH₄ emissions per kilogram of meat because the feed is more concentrate based and animals produce more meat on a shorter live span. The side note here is that high concentrate-based rations may contain soy, which has a high environmental impact. On the other hand, more extensive grass-based systems may score well on aspects like C-sequestration and biodiversity, but extensive grassland is high in fibre and is linked to higher CH₄ emissions.

4.2 Carbon Sequestration

Plants can capture Carbon (C) and store it into the soil; thus, planting hedges and trees in and around the field helps to capture and store C. Additives like biochar or organic waste also help to promote the formation of humus in the soil. This increases the health of the soil, which improves the storage of C, increasing C-sequestration. It is also possible to change the whole farm management to a more holistic approach, to farm more nature-based and focus on a low climate impact. Smaller changes in farm management, like permanent grassland, also have a positive impact on C-sequestration, as these grasslands have a same underground/soil storage potential as forests.

4.3 Methods to Improve Biodiversity Without Major Investments

Different measures are possible to improve biodiversity. Adding bee/insect hotels, bird nests and planting flower zones are examples of small changes but have a big impact on the local biodiversity.

In addition, using biostimulants instead of fertilisers, planting mixed cropping systems, or using biological crop protection will impact biodiversity positively.

4.4 Reduction of Nutrient Leaching to Improve the Quality of Surface Water

Nutrient leaching is an important source of contamination of the environment and different measures can be taken to address it. Changes in manure application like using a trailing shoe will decrease the overload of nutrients. Adapting the timing of manure application is also useful, e.g. applying manure just before the rain will increase nutrient leaching. Other examples that decrease contamination are using cover crops during wintertime, composting manure, adding other crops in the rotation, and the use of a nutrient management plan.

Of course, many of these measures take time and come with a certain cost. Therefore, it is good to consider reward systems for the farmer. It is not easy for all farmers to make small or big changes, even if the enthusiasm is there. Reward systems may help cover some of the costs and can convince them to make changes on their farm. Figure 1 underneath shows different possibilities for the farmer to get financial support. Further information on all the information presented here is available on the BKH.

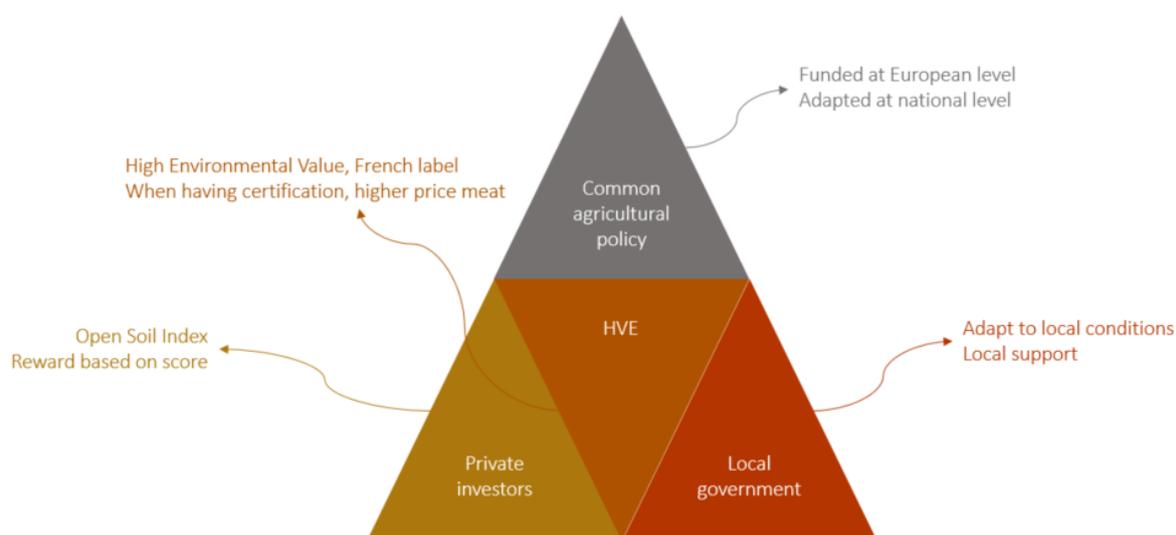


Figure 1. Different reward systems to support adoption of environmental measure by farmers

5. The BovINE Innovation Process

BovINE is a large-scale multi-actor network that was established to address the sustainability challenges of the beef sector in Europe. It acted as a systemic innovation broker, creating structures to enable the exchange of knowledge amongst diverse actors, at both regional and transnational levels, across diverse themes relating to sustainability. Using a demand-driven innovation approach, it showed that many solutions to the sustainability challenges facing the sector already exist.

The project's process also demonstrated that the BovINE approach could identify such solutions rapidly and effectively, complementing existing structures in this area. Moreover, it identifies farmers as agents of change, and important sources of innovation and experience. It indicates an underexploited role for different types of innovation intermediaries (actors who have some brokerage functions, but it may not be a core objective) in the innovation process.

6. Multi-actor Collaboration

BovINE experience highlights the importance of engaging other actors along with farmers, advisors and researchers in implementing solutions (e.g. agricultural/rural professionals, other supply chain actors), underlining the value of a multi-actor approach in addressing sustainability challenges. Moreover, it indicates a diverse range of policy interventions that may support scale up.

Whilst solutions were relatively easily transferred across some contexts, for example, health protocols prior to sale or purchase of young stock), others were not, reflecting the diverse nature of beef production systems across Europe. Therefore, the potential for replication or scale up of these solutions is not currently clear. Nonetheless, it is clear that farmers are interested in knowing how farmers operate elsewhere, and use this knowledge to reflect on their own practices.

7. Recommendations

1. Continue to support initiatives whereby farmers are directly involved in identifying solutions to the sustainability challenges they face, for example Operational Groups (OGs) where research institutes/universities collaborate together with farmers to implement and foster innovations. In the next programming period of the CAP, new OGs need to be set up in order to continue this fruitful collaboration. Within such structures, it is important to ensure that any measures are assessed in terms of their impacts on a range of aspects of sustainability, i.e. within and across economic, social and environmental factors.
2. Support and incentivise innovation intermediaries to facilitate interaction and network linkages, and thus function as conduits to the identification of innovation **needs** as well as sources of potential solutions.
3. Adopt a systemic approach to research and development funding, policy design and extension and advice to exploit potential synergies and prevent, is so far as possible, the occurrence of trade-offs across different sustainability objectives. More specifically:
 - a. Related to research & development, we recommend that public funds be directed to projects that take a systemic approach to farming systems. This will support identification of possible synergies and trade-offs across sustainability domains, and enable farm- and sector-specificity to be taken into account. Further, research regarding the combined impact of good practices and novel technologies on all sustainability objectives should be encouraged.
 - b. Related to extension and advice, we recommend that public extension agencies adopt a systemic approach when providing guidance and when developing materials to assist farmers to improve the sustainability of their production processes. Further, we suggest that governments should stimulate private advisory companies to organise their business using interdisciplinary teams and possibly to provide financial support to farmers to seek such holistic whole-farm advice. Both public extension and private advice should also move from merely disseminating good practices to disseminating approaches to help decide on the

good (combination of) practices for a specific farm, such as whole-farm coaching and decision support tools.

- c. Related to policy design, we recommend to focus on policy mixes – rather than on single policy instruments – that accommodate a systemic view of farming systems and create room for flexibility and diversity. For instance, the further spread of results-based schemes that allow flexibility in how farmers achieve the results can enable the potential for synergies and trade-offs within and across different aspects of sustainability and related policy objectives be taken into account.

8. Concluding remarks

This policy brief will be uploaded to the BovINE website. BovINE project partners will share and discuss the updated version with policy makers and agencies at national level. Furthermore, its availability will be highlighted to members of the BovINE network across Europe, inviting them to use it. While everyone is welcome to use and share the brief, it would be appreciated if BovINE is credited when doing so.

9. References and Useful Resources

Lynch, R., Henchion, M., Hyland, J. and Gutiérrez, J. A. (2022) Creating a rainbow for sustainability: the case of sustainable beef, Sustainability. 14 (8), 10.3390/su14084446

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