

sheep
to ship
LIFE



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Report on SheepToShip LIFE socio-economic impacts



D.2 Monitoring of socio-economic impacts

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List of abbreviations

CNR IBE – Consiglio Nazionale delle Ricerche – Istituto per la BioEconomia
CNR-ISPAAAM – Consiglio Nazionale delle Ricerche – Istituto per il Sistema Produzione Animale in Ambiente Mediterraneo
DiSEA – Dipartimento di Scienze Economiche e Aziendali dell'Università di Sassari.
EAP – Environmental Action Plan
EC – European Commission
GHG – Greenhouse gas
Laore – Agenzia per lo Sviluppo in Agricoltura
Leap – Livestock Environmental Assessment and Performance
LCA – Life Cycle Assessment
LCT – Life Cycle Thinking
OECD – Organisation for Economic Co-operation and Development
PDO – Protected designation of origin
RAS – Regione Autonoma della Sardegna – Assessorato della Difesa dell'Ambiente,
StS – SheepToShip LIFE

1. Introduction

The context the project SheepToShip LIFE operates is the Sardinian sheep dairy supply chain. Sardinia is the most important Italian region for sheep milk products, which are produced by about 3 million ewes (46% of all Italian ewes). The produced sheep milk (3,178,623 liters in 2019) makes Sardinia the top producing region in the EU (ISTAT, 2021). At the same time the sheep farming in Italy emit 6 % of the enteric methane of the EUs agriculture sector. Similarly, to other Mediterranean countries, the Italian sheep sector is characterized by a fragmentation of the production units. The prevailing production system is family operated small farms with less than 300 heads of sheep. These farms are often located in marginal areas, and practice extensive or semi-extensive sheep farming (e.g. rain-fed grazing and low stocking rates per hectare). Stocking rates per hectare are higher in fertile areas where irrigation allows increasing production intensity.

The project SheepToShip (StS) LIFE was conceived with the aim of reducing 20% of greenhouse gas (GHG) emissions (nitrous oxide, methane, and carbon dioxide) from the dairy sheep sector in Sardinia within 10 years. In particular, the immediate goals of the project are to encourage the environmental improvements of production systems in the sheep sector and to demonstrate the environmental, economic, and social benefits deriving from eco-innovation in the dairy industry and sheep farming sector. Additionally, its actions promote the implementation of environmental policies and rural development, guided by the Life-Cycle-Thinking (LCT) approach, aimed at enhancing the environmental quality of local sheep's milk and cheese supply chains. Furthermore, one of the StS objective is to increase the level of knowledge and awareness of stakeholders and the public regarding the environmental sustainability of products made from sheep milk and their contribution to the mitigation of climate change. With this approach, the project expects to achieve the development of a common methodology for analyzing the life-cycle of sheep milk supply chains. This procedure will be used to determine the environmental impact of the sheep's milk business in Sardinia, including the environmental hotspots of the life-cycle of Sardinian protected designation of origin (PDO) sheep cheese, and will be tested in several case studies (sheep farms and sheep cheese factories) through the introduction of low-input techniques compatible with maintaining quality standards of products. The strategy of the project includes the dissemination of results for exchanging best practices and transferring innovative methods and technologies. Besides, an important project aspect is the engagement with stakeholders to drive eco-innovation and environmental improvement of sheep farming techniques and industrial cheese-making processes. The project is finalized with the writing of an Environmental Action Plan for the Sardinian dairy sheep sector, supported by a socio-economic feasibility study. Therefore, StS represents an effective contribution to the EU environmental policies and sustainable development strategies addressing, in particular i) the commitments taken in the framework of the international climate agreement (Paris Agreement) signed in the COP21 Paris Climate Conference (December 2015) for limiting the average global temperature rise well below 2 °C, and ii) the modernization of the European Common Agriculture Policy (CAP) as stated in the recently EC Communication COM (2017) 713 "The Future of Food and Farming" regarding the future of the CAP, where a "higher level of environmental and climate ambition, and addressing citizens' concerns regarding sustainable agricultural production" were identified as key factors for innovating and improving the CAP action.

2. Synthesis of the project

The LIFE project “Looking for an eco-sustainable sheep supply chain: environmental benefits and implications” was conceived to contribute to the implementation of the Europa 2020 Strategy (COM (2010) 2020). The project is implemented by a partnership of institutions: project leader: Consiglio Nazionale delle Ricerche – Istituto per la BioEconomia (CNR-IBE), partners: Agris Sardegna, Consiglio Nazionale delle Ricerche – Istituto per il Sistema Produzione Animale in Ambiente Mediterraneo (CNR-ISPAAM), Laore – Agenzia per lo Sviluppo in Agricoltura, Regione Autonoma della Sardegna – Assessorato della Difesa dell’Ambiente, Dipartimento di Agraria dell’Università di Sassari, Dipartimento di Scienze Economiche e Aziendali dell’Università di Sassari. Specifically, the project has prioritized the environmental and climatic objectives of the European Common Strategy (Reg. N. 1303/2013) which foresees a reduction of greenhouse gas (GHG) emissions by 20 %, and if feasible by 30% until 2030 and a near complete reduction of GHG by 80 - 95% until 2050. These goals have, in the light of the recent development in EU political strategy, been changed. Particularly with the introduction of the European Green Deal the timeline of GHG emissions reduction has shortened. GHG Emission reduction goals were set to 55% in 2030 and 95% in 2050, from the 1990 baseline (European Commission, 2021).

In general, the StS project aims at increasing the contribution of the sheep supply chain on Sardinia (Italy) to the emissions reduction targets and to mitigate climate change. Accordingly, the project develops and promotes innovative and eco-sustainable production systems and follows three main objectives:

- i. improving the environmental quality of sheep products,
- ii. defining effective environmental strategies guided by the Life Cycle Thinking and aimed to inform rural development policies,
- iii. increasing the level of knowledge and awareness of stakeholders and the general public regarding the environmental role of sustainable sheep systems.

In addition to the ambitions to contribute to the EUs general policy roadmaps, the SheepToShip LIFE project and its general objectives (i-iii) was from its inception fully aligned with the general objectives of the LIFE Programme, focusing on the sub-program “Actions for Climate” (Mitigation of climate change, Adaptation to climate changes and Governance and information of climate knowledge).

Broad objectives

Contribute in a practical way to EU objectives regarding the fight against climate change, serving as an initiative aimed at reducing emissions of greenhouse gases (GHG) from the dairy supply chain and sheep farming sectors in Sardinia. In particular, the main objective of the project is to reduce of 20% in 10 years the GHG emissions from the Sardinian livestock sector and sheep industry,

Narrow objective

- i. encouraging environmental improvements of production systems in the sheep sector and demonstrate the environmental, economy, and social benefits deriving from eco-innovation in the dairy supply chain and sheep farming sector.
- ii. promoting the implementation of environmental policies and rural development guided by the Life Cycle Thinking and aimed at enhancing the environmental quality of local sheep milk and cheese supply chains.
- iii. increasing the level of knowledge and awareness of the stakeholders and the public on the environmental sustainability of products made from sheep milk and their role in relation to the mitigation of climate change.

Expected results

a) Environmentally related results:

- i. Development of a common methodological approach for the analysis of the life cycle of the sheep milk supply chains
- ii. Determination of the impacts and the environmental hot spots of the life cycle of sheep milk production systems more common in Sardinia;
- iii. Determination of the impacts and the environmental hot spots of the life cycle of the Sardinian PDO sheep cheese;
- iv. Identification, for each type of production system, of the optimal management strategies addressed to reduce the environmental impacts.

Eco-design guidelines:

- i. Manual on good practices for sheep farming for the mitigation of the environmental impacts of the sheep sector;
- ii. Manual on good practices for dairy industries based on sheep milk for the mitigation of their environmental impacts.
- iii. Farm and industries selected as reference models:
- iv. Plan for improving the environmental performances of 10 sheep farms and 3 dairy sheep industries through the introduction of low-input techniques compatible with the standards of quality of products and the economic feasibility of the interventions
- v. 20% reduction of GHG emissions of the farms and industries selected.

b) Socio-economically related results:

The improvement of the environmental performance of agro-food farms and the promotion of agricultural production systems with an increased natural value, are considered actions with great strategic value and are promoted by the EU. In addition, these objectives are complemented with the improvement of their economic results (financial and time) on farm level. In Sardinia, the sheep milk/cheese sector has historically played a strategic role with national economic importance (68% of national sheep milk production). The main value is added through the transformation from sheep milk into "Pecorino" cheese and exported, the principal destination is the USA. By acting on environmental and economic levers the project will have direct impacts on the competitiveness and increase the profitability of a broad target group, comprised of farms (approx. 13.000) and cheese factories (approx. 70) but possibly extend to National and European contexts. The implementation of the proposed good practices (see report on Demonstrative Farms available at the www.sheeptoship.eu) will act directly on all three categories of sustainability, directly on environmental improvements and indirectly have positive repercussions on social and economic sustainability. For this reason, the project expects the following socio-economically related results:

Environmental Action Plan:

- i. Concertation with the sector operators with the purpose of defining the path towards eco-innovation and improvement, from an environmental point of view, of sheep farming techniques and industrial cheese making processes;
- ii. implementation of an Environmental Action Plan for the sheep sector.

Communication and dissemination of results:

- i. Full involvement of target groups/stakeholders: minimum number of users of the SheepToShip LIFE website: 20,000 views, 5,000 unique visitors, 2,000 downloads and an

average duration of each visit larger than 3 minutes; minimum number of users of SheepToShip LIFE Facebook page: 1,000 'I like', 3,000 'People who talk about it'; interception of the general public through videos: 200,000 people; n. 300 sheep farmers and dairy industry operators informed; n. 100,000 people informed through the press office.

- ii. Promotion of the project at eight international events.
- iii. Collaboration agreements with national and international organizations.

Major and fruitful interactions between research centers, local authorities, and private sector in the implementation and development of strategies for climate change mitigation in agriculture and in the food industry.

3. Objectives of the final evaluation

The SheepToShip LIFE project has, as established in the introduction, a strong demonstrative character, not only for the Sardinian sheep dairy supply chain but also for the Europe-wide context. This circumstance allows the results of SheepToShip to be seen as a model for intervention for climate change mitigation in the sheep sector in Europe. The final evaluation of the socio-economic impacts, together with the evaluation and monitoring of the environmental impacts (see report of evaluation of environmental impacts), offers a systemization of the project and simultaneously provides a diagnostic and informative tool for future projects. A strong focus is put on the validation and the promotion of the reproducibility of the project, which is a key process for the strengthening of sustainability of the results. The reproducibility is increased by promoting the diffusion and grounding of the knowledge on environmental, social, and economic benefits of the projects' results in the local communities. Therefore, special attention is given to the categories "impact" and "sustainability" for the validation of the development model (reproducibility).

The concrete objectives of the final evaluation of the project *SheepToShip LIFE* are defined as the following:

- i) Evaluate the *impact* of the project: estimating the introduced changes of the project, while verifying the degree of relevance and coherence of strategy of the intervention.
- ii) Development of a diagnostic and information framework for the "socio-economic monitoring and evaluation" of the project. The framework supports the evaluation of the *sustainability* and *replicability* of the development model.

4. Methodology and structure of the socio-economic monitoring

The evaluation typology was defined by considering: the chosen objectives, the available time for the evaluation and the available resources as well as logistical and operative conditions of the local context. These factors need to be considered during the evaluation phase.

For the final evaluation key indicators associated for the socio-economic benefits of the indicated environmental improvements are two categories: economic benefits measured in Euro and operational benefits measured in time. These indicators are the principally used indicators used by the project to indicate changes on demonstration farms.

Furthermore, a social indicator was introduced in form of "awareness generated". The measurement of this indicator is in this case undertaken in several forms such as: the participation in international conferences, the publication of scientific papers, publication of content (webinars, videos) and the engagement statistics on the project's website, the social media platform and other media listed below.

A factor which cannot be added to the measurement of the awareness generated indicator in the scope of this evaluation, is the creation of trust and relationships between institutions on Sardinia, with institutions from the European Union, scientific research institutes. As a proxy for these "soft" factors of socio-economic impact, agreements of cooperation between organizations (e.g., Consortia Pecorino Romano) are considered as well as recorded official meetings with institutions which are not project partners (Agricultural Ministry of Sardinia) are listed.

Evaluation methodology:

- i) Quantitative, in terms of indicators which are to be defined by the projects results (financially (in euro) and work-time (in hours)).
- ii) Qualitative, in form of document analysis and questionnaires with closed and open-ended questions distributed specifically for this study, in form of focus groups and questionnaires conducted with the main target group (farmers), in form of group discussions during a stakeholder dialogue.

- iii) Participatively, in the moment of data and information collection of perspectives and opinions of the project staff, the stakeholders and the target groups.

The criteria for the evaluation (OECD, 2021):

- *Relevance: Extent of correspondence between of the project and the priorities/necessities of the context of the target group;*
- *Coherence: Appropriateness of the applied means and methods with respect to the projects' objectives;*
- *Efficiency: relationship between achieved objectives and foreseen objectives*
- *Coincidence: incidence of external factors (negative and positive);*
- *Impact: positive and negative effect introduced by the project;*
- *Sustainability: durability of the contributed benefits after end of the financing;*
- *Reproducibility: capacity to multiply autonomously.*

5. Data collection and analysis

Principally in order to determine the socio-economic impact of the project 4 methods were used; a) Review of project documents, websites and social media websites; b) Focus Groups with mainly farmers and extension officers of the supply chain; c) Group discussions with main stakeholders; d) Self-evaluation of the project staff with a questionnaire;

a) Reviewed documents from the project:

- Report on characterization of Sardinian production systems,
- LCA studies on Sardinian dairy sheep farm systems,
- Agreements with case studies farms,
- LCA training course for LAORE technicians,
- Information and communication Plan,
- Report on network activities,
- Best environmental practices,
- Report on networking activities,
- Publications, Report on national meetings,
- Mid-Term Monitoring Report,
- Progress Report,
- Participation in events,
- Report on Demonstration Action,
- Environmental Action Plan,
- Socio-economic feasibility study

b) The project collected feedback for the eco-innovations (best practices), with a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) in four focus groups. The invitation to participate in the focus groups, was sent out by general email list, provided by LAORE, AGRIS and CNR-IBE/ISPAAM.

Participants for each focus groups are hereafter described:

Focus 1: Nurra, Sassari, 24.6.2020; 18 invited, 10 participants
Focus 2: Marghine, Macomer, 29.7.2020; 28 invited, 9 participants
Focus 3: Guilcier Barigadu, Ghilarza, 15.9.2020; 28 invited, 9 participants
Focus 4: Campidano, Lunamatrona, 24.9.2020; 25 invited, 13 participants

- c) Additionally, a multi-stakeholder process was initiated to redistribute the feedback previously collected in the focus groups and to gain insights into stakeholders' opinion and distribute information and influence therewith the stakeholders to promote climate change mitigation. Hereafter, are the participants of the stakeholder process:

Meeting 1: Regional Agencies (LAORE, AGRIS and ARGEA), 21.1.2021, 22 invited, 8 participants, duration: 120 minutes.

Meeting 2: Local Action Groups and Mountainous Community (comunità montane), 10.2.2021, 40 invited, 3 participants, duration: 90 minutes.

Meeting 3: Trade organizations and Product Protection Consortiums (consorzi di tutela), 3.2.2021 14 invited, 7 participants, duration: 120 minutes.

Meeting 4: Professional associations, 4.2.2021, invited 15, participants 6, duration: 90 minutes.

- d) Self-evaluation of the project staff

To self-evaluate the project impacts from side of the project partners a questionnaire consisting of 17 questions was distributed. Data collection method of a questionnaire was chosen, in large part because of the COVID-19 health emergency, which caused the project to have time delays in the completion of two main final deliverables (Socio-economic Feasibility Study, Environmental Action Plan). The main ambitions of the questionnaire is to verify, from a point of view from the project staff, if project objectives have been met. Furthermore, to verify to what degree negative external factors (COVID-19) have influenced the projects objectives. Therefore, at the time of writing not all processes within the project have been completed, the final environmental monitoring is ongoing, as is the process of co-designing rural development policies together with the Sardinian government. The questionnaire has been specifically developed for this occasion and has been distributed with *Google Survey*. This allowed for a fast compilation and presentation of results once all answers have been collected. The answers are provided anonymously to allow for a more objectives assessment of the project by staff members. As this represent a core objective of the project, a final assessment of reaching this objective cannot be provided. It may be possible that in the After-LIFE process of the project an assessment of changed policies due to the activities of SheepToShip can be conducted. The self-evaluation has taken this into account but still tried to estimate the projects socio-economic impacts in form of a questionnaire distributed to all personal from all project partners involved in the project. The posed questions are provided here:

- a) Document analysis

Socio-economic results of the project SheepToShip LIFE have been intended to be triangulated with several methods. As mentioned, the most directed indicator and proxies for the through the researchers involved in the project, who reported the socio-economic data in the main categories time and financial benefits (money savings).

Furthermore, it is foreseen to assess the socio-economic impact with the following performance indicators assessing their objectives with conducted activities and revising results against the original expected results:

Table 1. Objectives, Activities, Expected Results and Achieved results

Narrow objectives	Activities	Expected results	Achieved results
Encouraging environmental improvements of	Collecting of data and Conducting of Life-Cycle Assessment on farms	Life Cycle Assessment of 10 farms	Life Cycle Assessment was conducted on 18 farms

production systems in the sheep sector and demonstrate the environmental, economy, and social benefits deriving from eco-innovation in the dairy supply chain and sheep farming sector.	Developing eco-innovative techniques to address LCA-Environmental hotspots	Researching eco-innovative techniques and develop best practice manual for farms and cheese factories	Best practice manuals were delivered.
	Improving the environmental performances with the standards of quality of products and the economies feasibility of the interventions	Plan for 10 sheep test farms with low input techniques	Eco-innovations tested in 11 farms: <ul style="list-style-type: none"> - Anticipating harvests and wrapped silage (Farms: Solinas, Orritos). - Reproductive protocol (Sementusa) (Farms, Molozzu, Mura, Cugusi, Mulas). - Replacing annual forage plantations (erbaio) with permanent pastures. (Farms: Acra: 4ha, Riu: 5 ha, Cugusi: n/a, Ena: 2 ha) - Planting of sulla (<i>Hedysarum coronarium</i>) (Farms: Acra: 2 ha, Cugusi, n/a, Mulas) - Improvements of natural pastures (Farms: Manconi: 5 ha, Cugusi: n/a, Molozzu: 2 ha), - Minimum tillage technique (Farms: Cugusi: n/a, Mulas: n/a). - Feed blocks (Mura, Cugusi) - Milk recording (Cugusi)
		3 dairy sheep industries involved	3 dairy plants involved: F.Ili Riu; F.O.I.; La Concordia.
Promoting the implementation of environmental policies and rural development guided by the <i>Life Cycle Thinking</i> , and aimed at enhancing the environmental quality of local sheep milk and cheese supply chains.	<p>Creation of an <i>Environmental Action Plan</i></p> <p>Concertation with the sector operators with the purpose of defining the path towards eco-innovation and improvement, from an environmental point of view, of sheep farming techniques and industrial cheese making processes;</p>	<p><i>Environmental Action Plan (EAP)</i> is adopted by Sardinian regional government.</p> <p>By 2030, 20% reduction of GHG in the Sardinian dairy sheep supply chain.</p> <p>2 focus groups</p> <p>With together 120 participants</p> <p>4 meetings to reconstitute results</p> <p>2 discussion tables</p> <p>200 interviewed for the</p>	<p>Environmental Action Plan is under discussion and is awaiting finalization to be presented to the Regional Government.</p> <p>By adopting the EAP it is likely that the goal of emission reductions can be reached.</p> <p>For the creation of the EAP, 4 focus groups have been conducted</p> <p>Due to pandemic crisis (COVID-19), in total 4 restitution and discussion</p>

		<p>feasibility study</p> <p>200 signed agreements for the adhesion of the environmental action plan</p>	<p>meetings with in total 24 stakeholders have been organized.</p> <p>Numerous discussion meetings between the regional ministry for environment (RAS-ambiente) and the ministry for agriculture and the project partners have been held (e.g. 21.12.2020, "Visioning-Workshop, Discussion format between RAS-Ambiente, UNISS, CNR-IBE, 5.3.2021)</p>
<p>Increasing the level of knowledge and awareness of the stakeholders and the public on the environmental sustainability of products made from sheep milk and their role in relation to the mitigation of climate change.</p> <p>(Additional dissemination activities are presented in chapters 6 & 7)</p>	<p>Maintenance of Website, Active promotion of project Networking to media outlets Creation of online content (StS Webinar Series)</p>	<p>SheepToShip LIFE website: 20,000 views 5,000 unique visitors 2,000 downloads Each visit larger than 3 minutes SheepToShip LIFE Facebook 1,000 likes 3,000 'People who talk about it' interception of the general public through videos: 200,000 people 300 sheep farmers and dairy industry operators informed 100,000 people informed through the press office</p>	<p>See text below and table 3</p>
	Project related research activities		
	International promotion of the project	Participation at 8 international events	
	Collaboration with national and international organizations	Signed agreements	PDO Pecorino RomanoAgnello di Sardegna IGP Consortia
Monitoring of socio-economic impacts		5 Focus Groups	
		200 valid questionnaires	
		6 points of contact with each geographical sub-area	
		100 farmers involved	
		Level of satisfaction of the	

		stakeholder with the methods and impacts of the project		In addit
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ion to the achieved objectives Key Project indicators were considered for the evaluation of the projects impacts:

- Humans influenced by the project: 15.000, among sheep farmers and employed.
- Outreach is estimated at around 200.000 when considering social media data (see table Table 3, double counting may have occurred)
- Number of stakeholders involved by the project: 10 civil society organizations.
- Website: no. of visitors: 41.400 (from, 20/07/2019 to 30/06/2021)
- StS Facebook page has been followed by more than 1,000 accounts, received about 1,000 'I like' and more than 39,000 visits from 20/07/2019 to 30/06/2021; 64 followers of the StS Twitter account; about 400 visualization of the StS Youtube channel.
- Other tools for reaching/raising awareness of the general public: 7 Displayed information (poster, information boards); 11 Events/exhibitions; 11 media items; 6 publications and 5 reports. 2 conferences (mid-term, final), 8 webinars ¹.
- Surveys carried out regarding awareness of the environmental/climate problem addressed: about 100 people surveyed among farmers, technicians and scientific researchers.
- Members of interest groups in StS networking: 70 people, among scientific researchers, professional organisations, local policy makers, NGOs.
- Professional training or education: 50 sheep farmers.
- Jobs: 8 professionals employed as additional staff dedicated full time to the project.
- Contribution to Economic growth: Running cost/operating costs during the project: 250,257.15 euro; Grants, subsidies: 31,9341.95 euro financed by the Regional Administration of Sardinia for GA-VINO "Metodi e tecnologie per una gestione innovativa e sostenibile della risorsa idrica nel vigneto", a project about climate change mitigation actions in the viticulture sector.

b) Focus groups

As discussed in the data collection chapter (b) Focus groups were conducted in an anticipatory way. The participants of the focus groups were asked to provide insights to the individual techniques and how they could affect their farm management. The following table presents the results on one identified eco-innovation. For the most promising other eco-innovations SWOT analysis were conducted as well. The results were collected and can be reviewed in "Report finale C.4.1. progettazione Partecipata e formulazione di politiche di mitigazione" in annex to this report.

Table 2. Reproduction: Increase of reproductive efficiency.

Strength	Weakness	Barriers	Opportunity
Birth anticipation	Assistance required for the farm	Missing of trust in the discussions of the experts	Greater investment in human capital
Lengthening of lactation period	Accurate management of the farm	Little efficiency in the training programs	Capacity increase in the management of the farms
Higher price for lambs	Possibly an extension of carrying time	Little efficiency in the training programs	Capacity increase in the management of the farms
Economic efficiency			

¹ Other actions contributing to this indicator are described in Chapter 6 and 7.

Higher number of births in less time			
Group Lengthening of lactation period	Costs of the application of the protocol (5-7 €/head)	Increase in costs for the alimentation	Knowledge e technical from traditions to obtain products of quality
Less sheep per area and hectare	Cost for the app for the management of the protocol 400€/year	Price of milk is too little (50-70 cents), which are not included in the farm efforts	New supply chain
Increase of the process and the quality of the product	Insufficient communication	Little attention of the farms which produce quality	Effect the consumers, and the perceived quality
Could be a practice which could easily be widespread	Experimentation not coherent with the production reality	New competitors in the market	Differentiate the Sardinian products
Can help to overcome the production habits	Technique already in use	Instability of the market	Product quality
Stimulates the reflection about new methodologies	Limited impact to the holistic result of the farm	Finance management which often limits the development of the capacity of the farm	Use different modes apart from the protocol
Increases consistency of the production	Little oriented to the quality of the production	Necessity of assistance	
Increases the production	Not inherent system in all the farms	Cultural barriers on all levels (farms, representative bodies, political)	
Less environmental impact	Other techniques which are less costly		
Consolidation of the engagement of the farmer & breeder	Insufficient resources to affront the criticality which the farms face		
Sale of products at the best time for prizes			
Increase of pregnancies	Higher costs	Advance investment	Possibility of education of technicians
Better prevention of possible pathologies	Reorganization of the flock and the areas of the farm	Little trust of the farmer in the return of the investment	
Reproductive efficiency with better production	Tiring activity if the farmer is alone	Reference person for farmers are often other farmers/colleagues and not technicians	
Earlier lactation		Little trust in technicians and farmers	
Reduction of farmer costs			
Increase of the production of milk	Higher costs are raised with more controls	Difficulty inside the planning of the farm	Ad hoc measure in the PSR
Possibility to treat the sheep based on the results of the ultrasound (separate those with two lambs)	Necessity to increase the workforce with a higher cost for personal	Difficulty with the bargaining/negotiation in the sector	Reward those who produce quality, not everybody

Concentration on the births per group	The farmer doesn't see the benefits immediately but perceives only a cost	Little cooperation between farmers	Entrepreneurial approach
Augmenting of income		Little adhesion between the laws and the reality of a farm	
Management of the abortion pathologies		Instability of the market and an oscillation of the prices	
Control of rams			
Non-intrusive diagnosis with ultrasound			
Sale of lambs in the best time for high prices			
Increase of milk quality			
Selection of sheep which are not productive			
Longer lactation period			

c) Stakeholder meetings

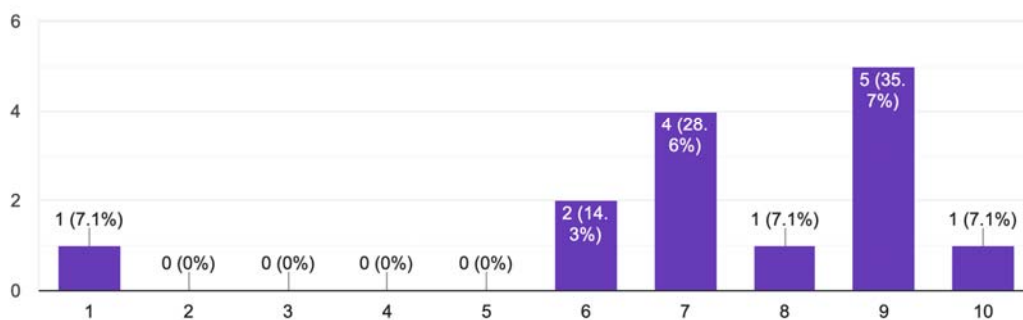
The stakeholder meeting as part of the work package for the creation of the socio-economic feasibility study as well as the environmental action plan have been documented in the Report: *Tavoli di concertazione con gli stakeholder*. The results of the discussions are summarized in the report and are considered in the results section. Due to the length of the report (40 pages) it is not included directly in this document but serves as an Annex.

d) Self-evaluation

The self-evaluation of the project staff represents a crucial step to collect the opinions and perception of the impact the project has had and in might have in the future. These insights are a valuable source for the evaluation criteria results. The data is here presented in a direct form, taken from the google survey tool. The graphics are generated automatically with the google survey tool.

1. In your assessment, to what extent did the project achieve its objectives of improving environmental quality of sheep dairy products?

14 responses



1.1 In your assessment, what factors (e.g. operational, knowledge etc.) facilitated the improvement of environmental quality of dairy sheep products?

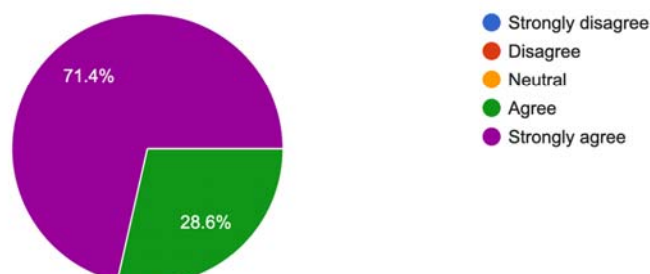
- none
- farmer's awareness
- knowledge
- Some mitigation techniques suggested by ShToSh consortium are known by farmers; They have practical skills to implement part of these techniques; techniques are sometimes cost-effective
- efficiency improvements and market conditions
- Le conoscenze messe a disposizione, sul campo, da parte dei ricercatori e la disponibilità, la volontà degli allevatori a partecipare al progetto, con l'obiettivo di migliorare la qualità ambientale dei prodotti e trarne, allo stesso tempo, benefici economici.
- Knowledge
- spreading of knowledge about eco-innovation techniques and related positive outcomes
- knowledge, operational and trust in science.
- imitation of best practices
- the development of a greater awareness of environmental problems by the farmers also due to the interaction with people trained in this sense

1.2 In your assessment, what factors (e.g. operational, knowledge etc.) posed barriers to achieve this objective?

- adoption by farmers
- inadequate policy and extension service
- operational
- Some techniques are expensive or infrastructure are inadequate for their implementation; low-emission milk is not valued; there is a low propensity to invest in new technologies due to the low farm income; some techniques could be relevant only in big farms; in general farmers are still far from the need to improve the environmental quality of their products
- socio-economic barriers
- Talvolta la praticabilità degli interventi proposti, a causa di una serie di aspetti (economici, logistici, tecnici) che ostacolavano la facile attuazione delle tecniche. D'altro canto, molte volte il fattore culturale ha rappresentato una barriera notevole per il raggiungimento di questo obiettivo: mancanza di conoscenza da parte degli allevatori, diffidenza nei confronti di tecniche innovative che differiscono dalle pratiche tradizionali, chiusura mentale e scarsa partecipazione.
- Operational
- internal factors: cultural resistance to innovation; external factors: political willingness and interest
- fattori organizzativi aziendali
- economical convenience, knowledge, trust
- knowledge transfer chain
- closed mind of farmer to be involved

2. Do you agree or disagree with the following statement: The projects objectives are aligned with European and Italian environmental and sustainability strategies

14 responses

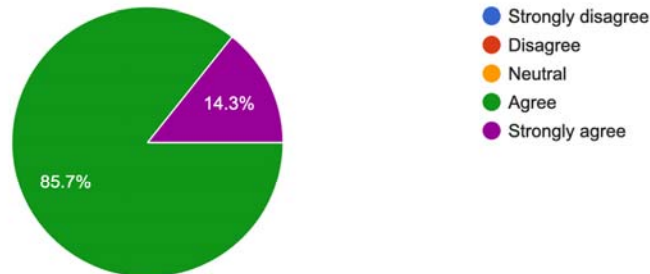


1. In your assessment, what was the projects' role in the design of rural development policies for the Regional/National Development Plan 2021-2027? Please describe in your own words.

- none yet
- It might be fundamental, if policy makers will follow the pathway
- The project involved the Regional institution to promote the knowledge of good practises that should be taken into account by policy makers.
- Provide a strategy and a portfolio of techniques that can be converted into programmes and measures
- Put the greening in the core of the agenda in two ways: mitigation action and ecosystem services valorization
- Fornire dati, elementi e informazioni utili per: i) fare un quadro generale del settore in termini di impatti ambientali, con rilevazione dei processi meno virtuosi all'interno del ciclo di vita di latte e formaggio, descrivendo la variabilità e le particolarità dell'intero comparto (CONSAPEVOLEZZA); ii) capire quali potrebbero essere (alcune del) le tecniche e quale effetto possano avere (quantificazione) nel migliorare la qualità ambientale dei prodotti lattiero-caseari ovini a seconda del contesto in cui si opera, producendo delle risposte specifiche e non generaliste (OPPORTUNITA'); capire quali sono i vincoli e gli ostacoli (BARRIERE) che impediscono il percorso di miglioramento, come elemento utile sul quale lavorare per poter far esplicitare le potenzialità delle opportunità suddette.
- The project provided policy makers with important information on the environmental impact of sheep livestock system and possible mitigation techniques.
- The project furnished valid instruments and solutions (the eco-innovation techniques and not only) for achieving a sensible reduction of GHG emissions of the Sardinian dairy sheep sector by 2030. On a practical implementation level and at policy level the project didn't get to the stage where solutions are really being adopted as part of a planning document but the hope is that the Environmental Action Plan will be taken in consideration as framework document for the development of further actualization documents pushing in this sense policy makers in the expected direction.
- Supporto scientifico di supporto ai decisori politici
- To reach efficiency goals, supporting with tailored goals for farm's system, through a designed framework of measures, or path, concerning training, farm decision supporting system, tutoring and a concrete accountability of economical convenience, as professional "credit" (better than just subsidies) to be coupled just after this align, with environmental payments
- Don't know
- contribute in an operational way and with concrete examples to the current debate on sustainability and climate change and the related actions to be carried out
- Questions and answers

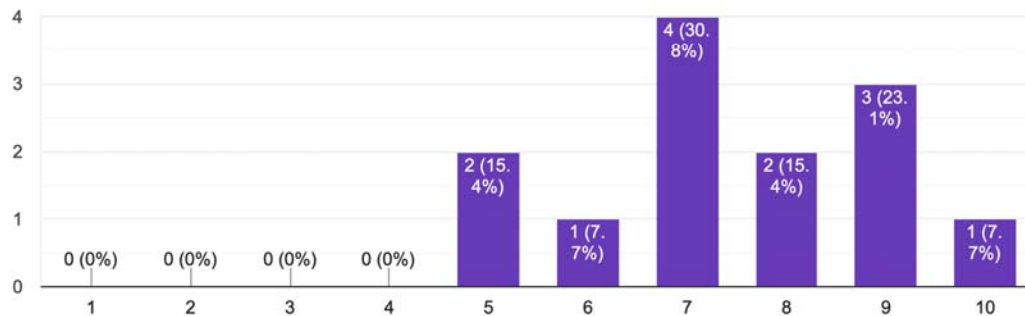
3.1 Do you agree or disagree with the following statement: the project was able to reach the correct audience and stakeholders to increase awareness of the environmental role of sustainable sheep farming.

14 responses



3.2 How do you rate the projects capacity to engage with stakeholders (farmers, cooperatives, sheep dairy factories, ecc.)?

13 responses



2. In your experience in the project, do you estimate that the engagement will lead to positive or negative change? Please explain

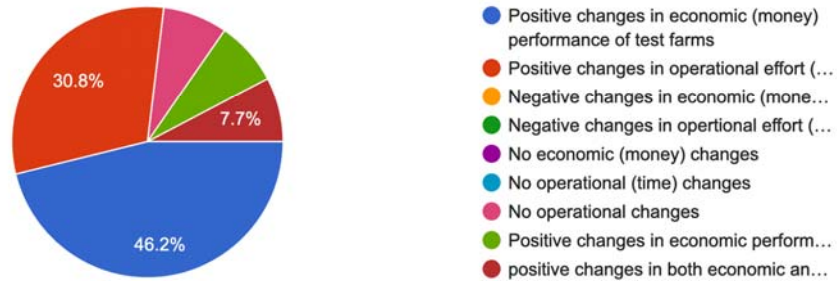
- Hard to say, as change does depend on a lot of other factors
- It will lead to positive changes only if all the actors involved will work to reach the shared goal of reducing the environmental impact of dairy sheep chain
- The engagement of stakeholders led to an improvement of awareness
- Positive changes are possible if the implementation of mitigation techniques is duly supported by public funds (if economically neutral) and by public+private advisory services
- Both but with a clear prevalence of positive change. The stakeholder engagement is essential to push Policy initiatives
- Il progetto non contribuirà, a mio avviso, a cambiamenti negativi del settore. Da un punto di vista pessimistico, al massimo il suo contributo potrebbe essere trascurabile. Realisticamente penso che apporterà benefici, perchè il lavoro fatto ha avuto impatto a vari livelli: sia sul campo (allevatori StS e non solo) sia sui tavoli della Regione (decisori politici). Il progetto ha attirato l'attenzione di molti attori della filiera, e ora è importante che sia dia continuità e seguito al lavoro fin qua svolto.
- I think the stakeholder engagement lead positive change because of their practical experience

- I think that some changes might appear consequently to the implementation of SheepToShip LIFE activities as an important part of stakeholders were involved in the different stages of the project
 - Il progetto ha sensibilizzato un vasto pubblico soprattutto tecnici, alla tematica del cambiamento climatico
 - Positive: all stakeholders engage, even skeptical, started an awareness of economic and environmental issue, concerning their farming approach, first step to move forward a behavioral farming and cultural change.
 - It will be positive as where mitigation strategies were adopted it brought to substantial improvement of shepherd daily lives
 - The project certainly contributes positively, stimulating debate and presenting case studies and concrete results. This will definitely lead to a positive change
3. Do you see room for improvement concerning communication channels, strategies and content for awareness raising? Please describe in your own words.
- Plenty of scope, especially better engaging extension officers more
 - Yes I do, I see a general mobilization of the sector towards the final goal, such as happened with organic farms, sustainable production chains, animal welfare and other challenges developed in the last 40 years. In all these cases, communication and extension service were fundamental
 - There is a need to share knowledge and communicate with stakeholders, still a lot to do in this way
 - Yes, more you tube presentation of techniques from A to Z can help. Governance should be improved as well, increasing the awareness/responsibility of all actors involved
 - An important communication channel will be the word-of-mouth between farmers
 - Sicuramente si, però non sono in grado di suggerire qualche possibile canale o strategia di miglioramento della comunicazione, non ho abbastanza esperienza. Se può essere d'aiuto, penso che per poter arrivare agli allevatori e sensibilizzarli su determinati aspetti e argomenti, sia necessario "parlare la loro lingua, e renderli partecipi e consapevoli delle potenzialità delle loro quotidiane attività in termini di sostenibilità e mitigazione dei cambiamenti climatici.
 - Yes I do, probably with some well-done TV documentary
 - Yes, communication channels and strategies need to be more and better targeted in respect to the identified stakeholders and final beneficiaries
 - Dare continuità al progetto con particolare attenzione alla fase di trasferimento dei risultati tramite i tecnici aziendali
 - Participative and demonstrative approach could make the difference: Farmers of demonstrative farms, in particular, could be effectively the right "influencer" of StS best practices of eco-innovation by a peer dissemination of results.
 - Need improvement of public technical agencies
 - not known
4. In your assessment, how did the pandemic health emergency (COVID-19) affect the projects objectives?
- Some delays in data collection
 - No effects
 - The covid-19 didn't affect the project since almost all activities were already completed when the pandemic started
 - It had some drawbacks, reducing demonstration on-field work. However, this gave the opportunity to have more frequent meetings among the partners, lowering their cost and associated emissions
 - It reinforced the need to address global challenges with a scientific approach and the full collaboration of all people

- Penso che la pandemia non abbia influito significativamente sul raggiungimento degli obiettivi del progetto. La pandemia ha rallentato leggermente le attività, ha modificato i metodi di lavoro, ha influenzato i rapporti tra ricercatori e tra ricercatori/tecnici e allevatori, ma dopo un primo periodo di disorientamento, ci siamo adattati e abbiamo ripristinato il metodo e il sistema di lavoro/contatti.
 - Probably only reducing in-person relationships
 - The pandemic didn't affect too much the project except as concerning the implementation of some foreseen in presence activities which had to be organized virtually
 - Ha limitato fortemente la fase di divulgazione dei risultati
 - It hel the project team in explore chances to reach goals alternatively, first those concerning communication and dissemination. Personally, through on-line events (conferences, meetings, webinars, other) we reach much more stakeholders than by presence all over Sardinia and Mediterranean region.
 - Pandemic emergence reduced possibility to share experiences among various stakeholders.
 - It did not affect the overall objectives, the pandemic has slowed down and maybe favored the comparison between stakeholders
5. Reflecting on the SheepToShip project, what are strengths to maintain for future projects?
- Interdisciplinary engagement
 - The inclusion of stakeholders into the global scale, abandoning local visions and sharing info at global level
 - Relationships with farmers
 - Multi-disciplinary, multi-actor collaboration should go on in the project follow-up
 - LCT and inclusive approach
 - L'approccio collaborativo e multidisciplinare tra i vari partner, e soprattutto l'analisi bottom-up della problematica, con coinvolgimento attivo degli attori locali della filiera, che sono i maggiori responsabili del potenziale miglioramento futuro della qualità dell'ambiente e della sostenibilità.
 - Stakeholder engagement and results dissemination
 - The community built, identified best practices and results to be capitalized
 - la collaborazione tra ricerca, amministrazione regionale e agenzie
 - Many: frequent exchange among the working groups within the project; cross fertilization between technical agricultural and zoological aspects and market and economic aspects.
 - interdisciplinarity
6. Reflecting on the SheepToShip project, what are areas for improvement for future projects?
- Field trials and better communication
 - Carbon farming and Ecosystem Services payments
 - A better division of tasks between all partners is needed
 - Advisory services could play a more relevant role in the dissemination.
 - Include Civil Society Organizations and private companies in the partnership
 - Migliorare l'approccio e il dialogo con gli attori locali: sono necessari degli specialisti (es: figure come geografi) che studiano e indicano quali sono le modalità, i metodi e gli approcci ottimali per poter dialogare con loro, al fine di ricavare la maggior parte delle informazioni (e problematiche), diffondere conoscenza e attuare percorsi di miglioramento.
 - The economic area and also the environmental social role of farmers
 - I thing more emphasis should be given to the last step which concerns the involvement of policy makers and their committment for making the change happen
 - approfondire le indagini sul sequestro del carbonio nel suolo sia nelle colture foraggere sia nei pascoli naturali
 - Communication, training, Involvement of stakeholders engaged by meantime, strong support of a political vision of the sector, its improvement both in environmental and economic terms.
 - need for more sharing of in progress work.

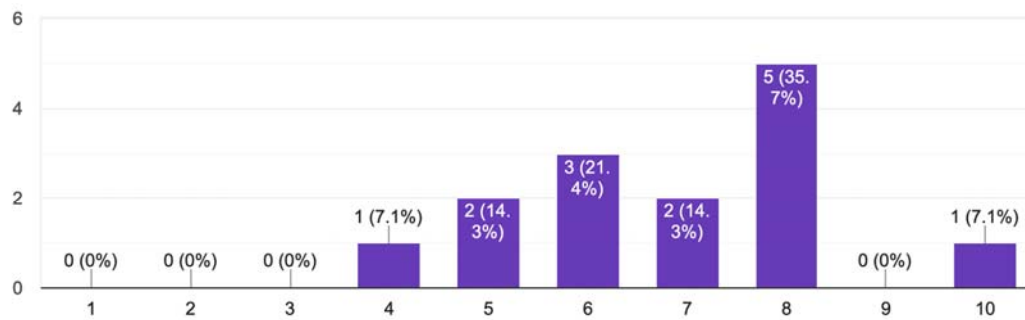
8. In your assessment, what changes do you expect on test farms after the project?

13 responses



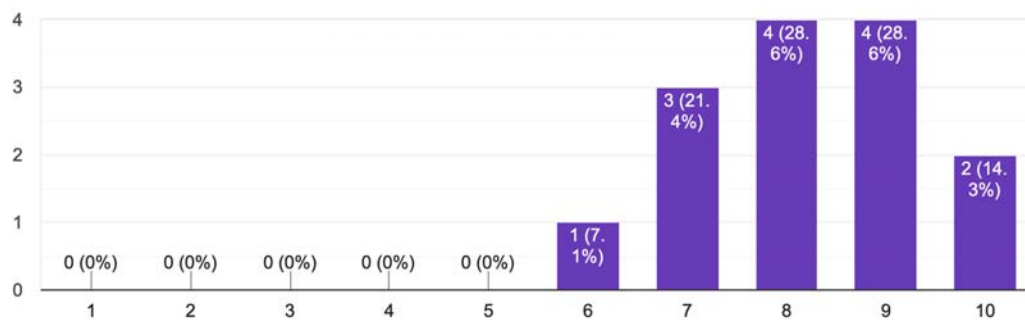
9. In your opinion, do you think the project SheepToShip will have a long lasting effect on the Sardinian dairy sheep sector?

14 responses



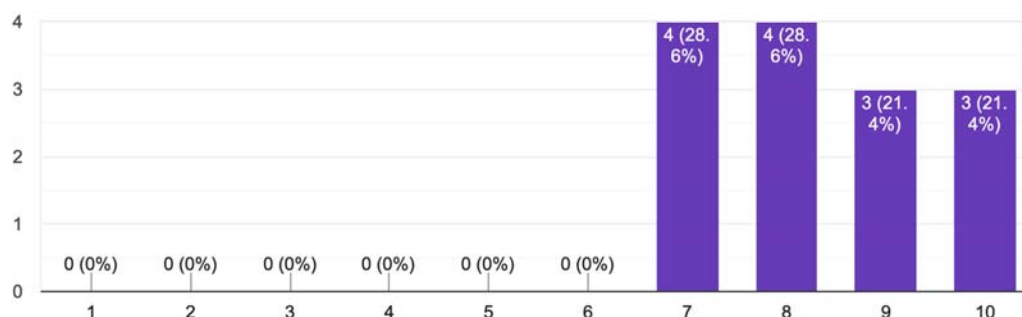
10. On average, how do you rate the communication between project partners?

14 responses



11. In your assessment, please rate the overall cooperation quality between the project partners.

14 responses



6. Communication, Outreach, and Scientific activity

Considering one of the main objectives of the SheepToShip LIFE project “Increasing the level of knowledge and awareness of the stakeholders and the public on the environmental sustainability of products made from sheep milk and their role in relation to the mitigation of climate change” various activities have been conducted to meet this objective.

At local and national level, several institutions, professional associations, and research centers, involved in developing the project themes, expressed their support to the StS LIFE initiative:

- 6 policy makers in Sardinia (two regional ministers and two high ranking officials of the regional Departments for Agriculture and Environment, as well as two members of the regional parliament) were actively involved through direct contacts;
- an informal agreement with the Director of the Environmental Certification Department of the Ministry of the Environment of Italy;
- 1 public presentation of the project at the General Assembly of the Italian pastoralism network ‘Rete Appia’ was held in Rome, 23 February 2018; Contacts for future cooperation with stakeholders in Tuscany have already been established through the participation in the Congress of Rete Italiana LCA and direct contact with representatives of the Agriculture and Rural Development Department of the Tuscany Region;
- The project was presented at the ‘Isola della Sostenibilità’ in Rome, from 30 November to 3 December 2017, a national initiative attended by 9000 people to educate young generations on environmental issues and sustainability;
- 2 meetings were held with Italian research centres (Agri-food LCA Lab of University of Milan and ENEA);
- The project themes were included and illustrated in the educational workshops addressed at young farmers organized by the Agency Laore;
- 3 videos, targeting both the general public and institutions/sector operators, were produced by internal staff and published on the project website.
- 1 professional video (8 minutes) was produced, with the main project partners input on different

topics as well as testimonies from farmers.

At European level, the following indicators were met:

- StS took part in the 3rd Annual Meeting of the multi-stakeholder initiative 'Livestock Environmental Assessment and Performance' (LEAP);
- 1 public presentation of the project at the Asociación Nacional de Criadores de Ganado Ovino Selecto de Raza Manchega (A.G.RA.MA) in Albacete (Spain);
- An international scientific network has been launched, with about 500 invitations sent to join in, obtaining a satisfactory response;
- Informal agreements have been established with scientific institutions and research centres in Greece, France, Romania and Spain to collaborate in dissemination activities.
- A considerable part of international stakeholders - numbered in some thousands – were reached, estimated considering audiences reached through papers, posters and presentations at conference, presence at national and international meetings, social networks, online presence, etc.
- 23 followers on Researchgate
- The professional video production has been postponed until the full implementation of demonstration activities at farms, since they are a relevant component of the promotional video content. For the moment, we published 3 self-made promotional videos on the StS website.

The main events in which StS took part are the following (the whole collection of events are reported in deliverable "E.2.1 Report on participation in events"):

International events:

- 19th Symposium of the European Grassland Federation, Alghero, Italy, 8-10 May 2017
- Joint Seminar of FAO-CIHEAM Network 'Innovation for Sustainability in Sheep and Goats', Vitoria-Gasteiz, Spain, 3-5 October 2017.

National events:

- Forage4Climate KOM – Reggio Emilia 16.09.16;
- SIA – Oral presentation - Sassari 21.09.16;
- Congress of the Italian Association of Animal Science and Production (ASPA) - 2017, Perugia, Italy, 13-16 June 2017;
- XI Congress of Rete Italiana LCA 'Resource Efficiency e Sustainable Development Goals: il ruolo del Life Cycle Thinking', Siena, Italy, 22-23 June 2017;
- V Annual Conference of the Italian Society for Climate Sciences 'Climate action in support of the Paris Agreement', Bologna, Italy, 26-27 October 2017;
- Final workshop of the 'AGFORWARD: AGroFORestry that Will Advance Rural Development' project, held in Sardinia the 20 December 2017;
- LLHAM EC Erasmus+ Project training, held in Sardinia from the 22th to the 26th of January, 2018.
- Knowledge transfer by SheepToShip nell'ambito del progetto SheepToShip, presso l'azienda sperimentale di Agris Sardegna, a Bonassai - Sassari, speaker anche il Dr. S.Y. Landau, ricercatore presso l'Agricultural Research Organization (Bet Dagan, Israel),
- SheepToShip a Parigi! Una delegazione SheepToShip LIFE ospite dell'Institut de l'Elevage (Idele), la principale organizzazione francese per la Ricerca & Sviluppo nel settore zootecnico.

Media coverage:

Over the course of the project media attention has been high since the beginning, already in the beginning a launching campaign for the project's kick-off meeting (held in Cagliari, Italy – 28th July

2016), led to 11 news stories and a press release from the Italian Press Agency (ANSA). Additional coverage:

La pastorizia per la mitigazione dei cambiamenti climatici: il progetto "SheepToShipLIFE"(11.8.2020).www.ruminantia.it, <https://www.ruminantia.it/la-pastorizia-per-la-mitigazione-dei-cambiamenti-climatici-il-progetto-sheeptoshiplife/?fbclid=IwAR3vdWtznLuqbCffojKIQOVmK2HG88LDL89XunojfFJvm3R617NIPt9cQY>

Francesca Malaguti Enrico Vagnoni – RAI Radio1 Interview.

The following works based on the SheepToShip LIFE initiative have been formally accepted and are were presented at national/international conferences:

- "Climate change implications of sheep farming system extensification: A LCA case study", at the 20th Meeting of the FAO-CIHEAM Mountain Pastures subnetwork, 9-12 September 2018 – Lofoten Island, Norway;
- "Dealing with the environmental characterization of the Mediterranean agri-food supply chains: the CNR-IBIMET experience in LCA applications", at the 5th edition of the Institute for Biomolecular Chemistry (ICB) national meeting, 19-21 September 2018 - Sassari (Italy);
- "The effect of carbon sequestration on the environmental implications of a Pecorino Romano PDO sheep supply chain", at the 11th International Conference on Life Cycle Assessment of Food 2018 (LCA Food) which takes place on 17-19 October 2018 in Bangkok (Thailand).

Multiple scientific publications have been published during the SheepToShip project and its data:

- Environmental profile of Sardinian sheep milk cheese supply chain: A comparison between two contrasting dairy systems. *Journal of Cleaner Production*, 2017;
- Facing carbon emission mitigation of dairy sheep supply chain: estimation of a baseline trend. *Proceedings of the 2nd Congress of the Association of Animal Science and Production*, 2017;
- Eco-sustainable dairy sheep production: an LCA approach from Sardinia, Italy. *Proceedings of V Annual Conference of the Italian Society for Climate Sciences*, 2017;
- Environmental Implications of Different Production Systems in a Sardinian Dairy Sheep Farm, *Proceedings of 'Innovation for Sustainability in Sheep and Goats' Joint Seminar of FAO-CIHEAM Network*;
- The environmental profile of Pecorino Romano PDO. A case study. *Proceedings of XI Congress of Rete Italiana LCA*, 2017.
- Transition among different production systems in a Sardinian dairy sheep farm: Environmental implications. *Small Ruminant Research*, 2018.
- Concu, G. B., Atzeni, G., Meleddu, M., & Vannini, M. (2020). Policy design for climate change mitigation and adaptation in sheep farming: Insights from a study of the knowledge transfer chain. *Environmental Science & Policy*, 107, 99–113.
- Atzori, A. S., Bayer, L., Molle, G., Vannini, M. Cocco, G., Usai, D., Duce, P., Vagnoni, E. 2020. Looking for sustainable food production and climate change mitigation. The case of the Sardinian dairy sheep sector within the framework of SDGs of 2030 Agenda. *Integrated Environmental Assessment and Management (IEAM)*.

Networking:

A networking platform of European actors was defined by a wider stakeholder mapping, initially focused in the main region/countries where sheep farming represents a significant sector. Then, about 50 institutions between research centres, professional association, etc., were selected and reached in order to cooperate in synergic initiatives. In particular, informal understanding were

established with several key actors both at local and international level, namely: Imperial College London, Centre for Environmental Policy (CEP), Centre for Energy Policy and Technology (ICEPT) (UK); Red Española de Queserías de Campo y Artesanas – QueRed (Spain); Agricultural University of Athens (Greece); Université de Corse Pascal Paoli (France); CITA - Agro-food research and technological centre of Zaragoza (Spain); Department of Agricultural Science of University of Milan (Italy). Memorandum of Understanding were signed with i) the already mentioned Sardinian PDO/PGI Consortia, ii) A.G.RA.MA farmers association (Spain), and iii) Italian pastoralism network 'Rete Appia'.

A strong collaboration has been undertaken with the following European projects:

- Forage4Climate LIFE (LIFE 15 CCM/IT/000039), with which SheepToShip LIFE took part in the Demoday Forage 4 Climate, held on June 19, 2018, in Bauladu (Italy). Moreover, a joint networking meeting was held on June 20, 2018, in Sassari;
- The H2020 projects i) SheepNet (Sharing Expertise and Experience towards sheep Productivity through NETworking), and ii) Inno4Grass (Shared Innovation Space for Sustainable Productivity of Grasslands in Europe).
- DairyClim LIFE (LIFE14 CCM/BE/001187) project, for sharing methodological and technical data and information.
- Life Under Griffon Wings (LIFE14 NAT/IT/000484) project, for sharing information and ideas as well as to involve the SheepToShip LIFE case study farms in this Life initiative.

Moreover, an effective cooperation was established with the Imperial College of London to start an international project on “assessing and mitigating Indirect Land Use Changes of biofuel technologies at project level”.

University activities:

In order to capitalize on the benefits of this activity and to effectively pass on the intervention model to other European countries, informal meetings and involvement in project's activities have taken place with 4 institutions engaged in sustainable small ruminants production :

- Agricultural University of Athens (Greece);
- the A.G.RA.MA. farmer association (Spain)
- the CITA - Agro-food research and technological centre of Zaragoza (Spain);
- The 'Institut de l'Elevage' (Idele, France);
- Science and Veterinary Medicine "King Michael I of Romania" (Romania).

These institutions have already given an informal confirmation of their participation in the project and their willingness to provide support with awareness-raising among local stakeholders (farmers, associations, political institutions and Civil Society organizations).

Replication efforts:

During the reporting period the following initiatives, inspired by the StS experience and in line with its principles, were carried out for increasing the efforts to combat climate change:

- In cooperation with other groups, the leading beneficiary CNR IBIMET is working on several projects with an approach similar to that of StS. In particular, CNR IBIMET i) is implementing a project financed by the Regional Administration of Sardinia about climate change mitigation actions in the viticulture sector, ii) submitted a project proposal to the first call of PRIMA – Partnership for Research and Innovation in the Mediterranean Area, about water use efficiency, iii) submitted a project proposal to the 2018 Call of LIFE Climate Action sub-programme and another one is under construction, both projects concern the environmental improvement of traditional agri-food chains;
- in cooperation with Italian and French local Administrations, the leading beneficiary, CNR IBIMET, submitted a project proposal to the Interreg Cooperation Program IT-FR Maritime about the valorisation of local agri-food markets, where climate change mitigation activities were included;

- CNR IBIMET participated in a local “learning and working” project for secondary schools, promoting the climate change mitigation theme and discussing the environmental implications of agricultural activities;
- CNR IBIMET participated in the event “The Isle of Sustainability”, December 2017, in Rome, dedicated to some of the *Sustainable Development Goals - Agenda 2030*, contributing to the dialogue on sustainable production and consumption;
- CNR IBIMET participated in the Erasmus+ EU's programme hosting two beneficiaries (from Hungary and Germany) which integrated the StS staff of Implementation activities.
- Agris submitted a project to the first call of PRIMA sustainable goat farming under extensive conditions;
- Agris is submitting a couple of project proposals at regional bids focused on the sustainability of sheep and goat farming, which include the evaluation of the environmental impacts of the production systems.
- The University of Sassari participated in the EU Erasmus+ Training mobility program hosting a PhD student of the University Pasquale Paoli of Corse and agent of LRDE of Corte.

7. Conferences, Webinars and Social media activity

In the light of the COVID-19 pandemic, activities on social media were increased, especially *Facebook* and to smaller degree *LinkedIn* were used as presentation platforms.

Table 3: Social Media activity and Webinars

	Data from Facebook on the 5.6.2021				
	Date	Like	Share	People reached	Views
SheepToShip Facebook					
SheepToShip-Web Conference: Low Carbon Sheep Farming: from innovation to practice	26.6.2020	3	7	1328	102
Sheep for Future: la neutralità climatica in agricoltura	9.10.2020	10	3	374	
2° Webinar Fridays For Future Sheep: Il futuro dalle orme del passato: il miglioramento dei pascoli	13.11.2020	13			366
3° Webinar - Fridays for Future -Sheep: La qualità dei foraggi: obiettivi presenti e futuri per le produzioni ovine sostenibili	27.11.2020	36			1100
4° Webinar - Nessun Pastore è un'isola	11.12.2020	15			424
5° Webinar - Fridays for Future Sheep: Efficienza nella gestione del gregge	15.01.2021	99			5900
6° Webinar Fridays for Future-Sheep: Dalle buone pratiche agli strumenti di Governance per la sostenibilità ambientale della Sardegna	13.3.2021	14			365
7° Webinar Friday for Future-Sheep: Tradizione e innovazione: aspetti tecnici e socio-culturali nella pastorizia sarda	30.4.2021	32			1000

8. Results

8.1 Relevance

The SheepToShip LIFE project has been designed to act specifically on policy targets set out by the EU and by the Italian government – (emission reduction targets, see introduction and synthesis of the project). Furthermore, the StS LIFE project is in line with other projects with similar goals (DairyClim LIFE, Carbon Dairy LIFE) and funding sources (EASME). of the LIFE program were addressed through the projects capacity to demonstrate that mitigation on sheep farms is possible, by combining a precise assessment (LCA) and development and application of agronomic solutions. The project was able to address the governance and information ambition of the LIFE with the numerous outreach activities (see chapters 6 & 7), and the strong institutional ties which have been created between the project partners but also with regional governing institutions. The project SheepToShip LIFE has from its inception goals oriented on strategies and has been adaptive to include green deal and farm to fork objectives. Moreover, Carbon sequestration has been included as an example of keeping up with an evolving policy dynamic.

Foremost the Sardinian Ministry of Environment (RAS) and the Sardinian Ministry of Agriculture have been actively involved in the process of the project. The ministers from both ministries have on several occasions visited the managing partner institute (CNR-IBE) and expressed their support. Support was discussed in form of a so-called *delibera di giunta*, to be introduced to the governing council, by RAS. High-level policy discussions have also taken place on several occasions between project staff and government officials to facilitate a science-policy interface and a knowledge transfer. Furthermore, in joint sessions, between project partners and stakeholders from the supply chain discussions were held to elaborate the projects results, create awareness about the positive and negative environmental roles sheep dairy systems play in Sardinia and to design socially sustainable solutions to strengthen positive aspects of sheep dairy production while mitigating negative ones (see project report “Tavoli con gli stakeholder”).

The economic, and environmental as well as social context the project has found itself in, has over the last 5 years changed dramatically. During the planning phase 2014-2015, leaving the debt and euro crisis had played a major while at the same time facilitating economic growth which could meet GHG emission reduction targets by the EU (20%) by 2020. Politically, the project started in a context in which the Paris Agreement on Climate Change and the Sustainable Development Goals had recently been agreed upon. Limiting Global warming to 1,5 degrees Celsius and establishing 17 globally desirable goals to be implemented in regional and local context. Goal 13, mitigating climate change, directly addresses the main goal of SheepToShip LIFE, while the Paris Agreement is designed to reduce GHG emissions. Economically, the Sardinian sheep dairy sector has experienced a drastic fall of milk prices due to the price deterioration of the main product of the value chain (Pecorino Romano) in 2017. Leading to protest in Sardinia by the sheep farmer and pastoral community. SheepToShip LIFE offers, with its strong focus on efficiency increases (see Environmental Action Plan) in the production phase of milk (the main source of GHG emissions (see LCA report on sheep milk and cheese), a viable strategy to increase the income of farmers by reducing costs. Thereby addressing the main concern of the demonstrating farmers in 2017, economic stability. In that sense, the project manages to increase the resilience of individual farms against fluctuations on the global cheese markets. The objectives of the project and its implementation proposals (eco-innovations) were additionally verified by involving, participatorily, farmers and cheese factories – two important stakeholders. Towards the end of the project, a discussion table in cooperation with Minister of Environment of Sardinia was organized and held jointly to discuss pathways to implement the projects results from a governance perspective.

During the project time, the climate awareness escalated around the world, especially visible in the “Fridaysforfuture” demonstrations by mainly high school students. The project, already aligned to the demands of the demonstrations with its mitigation goals, facilitated an online-seminar FutureSheep! And participated in an activity for sustainable development in Rome, Italy. To promote the solutions to a wider audience. As a result to the ongoing demonstrations the mitigation goals on EU have been raised to 55% by 2030 – from previously 40%.

In 2020, the COVID-19 pandemic posed an unforeseen organizational challenge for the project. In a matter of days and weeks, all project staff transferred to home working conditions for most of the remaining project time. Politically, 2020, challenged especially the European institutions to provide funding for recovery funds from the economic fallout of the health crisis and the subsequent economic and social lockdowns. As a result of the deliberation process a recovery fund, with reiterates in large parts the project goals and demands high investments in climate change mitigation actions.

The changing political, social, and economic context over the duration of the project, made action on the existing goals of the project even more evident, in addition to the already existing scientific consensus in the climate change research community. The ongoing support and high engagement rates of the project contents nationally and internationally, carry this assessment.

8.2 Coherence

The focus of the project with its main goal of climate change mitigation and hence the aim of reducing greenhouse emissions, has on a regional level a full coherence with the Sardinian government. The Sardinian government has, for example, signed the “Memorandum of Understanding” (MoU2), for the average temperature rise target of 2 Degree Celsius, in the Paris Agreement of 2015 on climate action. Recent initiatives which were supported by the regional government included the LIFE projects forage4climate, Masteradapt, UnderGriffonWings. Forge4climate focused on feeding techniques for sheep in Sardinia, Master-Adapt on adaptation measures to climate changes, UnderGriffonWings focused on the stabilization of the Griffon (*Gyps fulvus*) population on Sardinia.

Synergies between the projects is especially noteworthy between Master-adapt and Forage4Climate. Master-Adapt resulted in the comprehensive adaptation plan to climate for Sardinia. SheepToShip LIFE proposes to consider part of the eco-innovations (especially more resilient pastures and maintaining of eco-system services) to increase the adaptation potential as well as to mitigate climate harmful emissions over the course of the next decades. Forage4Climate with its specific focus on the provision of feed to increase production of dairy sheep, shares in part the eco-innovative strategies of SheepToShip.

On a regional level, the Sardinian Regional Development Plan 2013-2021, provided one specific measure (Measure 14) for which targets the livestock and sheep sector directly. The goal of this measures is to improve the health of the animals, introduced after the blue tongue disease epidemic in the early 2000s.

General training measures of technical staff of the development agencies (AGRIS and LAORE) are also provided, however, have been largely considered to have much room for improvements in the focus groups. Special mention found the knowledge sharing approach, which seems in most cases to be a frontal teaching method. It has also been reported that an understaffing of the agencies has led to insufficient policy implementation regarding training of farmers.

The project has demonstrated internal coherence with its governmental partner, the Environmental Ministry, and its policy plans, the Sustainability Strategy as well as its Adaption to Climate Change Strategy (SRACC). The implementation possibilities of the projects outcomes and policy recommendation remain however, limited for the Environmental Ministry. The capability to address the Sardinian pastoral policy and influence the regional development plan, lies to a not negligible degree within the decision power of the Agricultural Ministry of Sardinia. An internally coherent translation of project outcomes has therefore seen, to a certain degree, a mismatch of *roles* and *capabilities*. This contextual element has to do with broader consideration of the placement of sustainability strategies within public administrations and their relative power towards established departments. These held “historically” the majority of decision-making options, with the introduction of environmental policy integration (EIP) as well as sustainability targets, a redefinition of *roles* has resulted in temporary mismatches when considering the “correct” addressee for scientific results of projects. The relevance of cross-government coordination becomes an integral part of systemic and coherent thinking about wicked problems (climate change).

8.3 Efficiency

The evaluation has seen that the project has had to extend the duration of its foreseen timeframe by 1 year. The reason for this extension was the time intensive collection of data for the LCA, which was also increased as the visited farms were doubled from 10 to 20. A step necessary to provide valid scientific results for all geographic regions of Sardinia.

Due to the COVID-19 pandemic, and the work *modus operandi*, deliverables especially the socio-economic feasibility study and the environmental action plan were finished with 3 month's time delay. The reason behind the delay is the increased coordination time with project partners who now had to meet online, as well as the mobilization of stakeholders in the Sardinian territory. While this adjustment period led to delays, it could be noticed that a more diverse group of stakeholders could be reached at once, as they were not bound to in-person meeting with long travel times. It also facilitated the discussion between stakeholders, which under non-pandemic circumstances might not have had the opportunity to exchange ideas and discuss. These factors might have contributed to a positive dynamic in the final stages of the project.

8.4 Impact

The main impact of the demonstration actions of the project in terms of time and money, have been collected through the auto-evaluation questionnaire and through ongoing monitoring of the scientific partners in contact with farmers. The result for the tested eco-innovations have been positively recognized by farmers (see Table 1, column: achieved results). Testimonies have been voiced, that for example the change in pasture (to improved pasture) has led to 20% increase in milk production on test sites. The auto evaluation of staff members, who consistently monitored the implementation of the eco-innovations also shows that 92% of respondents answered that introduced changes were either economically or operationally positive, or both.

The main impacts that the project has introduced, in terms of long transformative effects can be divided into 4 main categories: Scientific research results, Outreach and awareness raising campaign, Networking creation, Development policies on Sardinian, National, European level.

The efforts to promote the scientific research methodologies nationally and internationally create an environment for an exchange of knowledge between individual research but also between research institutions. The numerous publications and participation in conferences add to the discourse on the topics of sustainable livestock management and climate change mitigation strategies from a disciplinary and especially interdisciplinary viewpoint. Especially highlighted in the questionnaire were the bottom-up methodology for knowledge generation (participatory involvement of farmers, technical agencies, etc.). In the next years the critical reception by the scientific community will determine what effects can be expected on this level.

The research activities were also a key facilitator for an internal strengthening of project partners – as indicated in the auto evaluation questionnaire – the project partners were overall content with the inter-organizational cooperation. The constructed transdisciplinary (researchers from various fields and in addition practitioners are involved in the knowledge creation), community around the issue climate friendly farming can be regarded as an impact. Answers from the questionnaire show, that especially this point should continue into the follow-up (After-LIFE) of the project and builds a fertile ground for future projects. Apart from the scientific efforts, a wide communications campaign was orchestrated using (due to the pandemic situation) live-streamed webinars (see Table 3), in addition to the projects mid-term and final conference. The expectation from the listed activities (see chapter 6) and the publication campaigns showed that interest in complex topics could be raised across relevant stakeholders. In cooperation with RAS a webinar was organized in the context of the Regional Sustainability Strategy. SheepToShip was in this context promoted as a catalyst for action on Goal 13 of the UN - Sustainability Goals.

In addition, two networks could be created through the project. Firstly an “internal” network consisting of the project partnership. This network relies on direct personal relationship between actors to speak with a unified voice and agree on common problem definitions from which solutions are developed. Secondly an external network, consisting out of non-SheepToShip farms, employees of the technical agencies, which have not been involved with the project initially, the interviewed stakeholders in the discussion tables. The created network is especially relevant, as information travels especially well in rural communities through *mouth-to-mouth* transmission. The effect in this

regard may mature over the next 10 years to reach the projects long term goal. Nonetheless, from a planning for sustainability perspective networking activities, are a key factor for successful governance changes and a prerequisite for policy acceptance.

Policy impacts represent a higher-level effect, which might materialize at the same time (30.6.2021) as the project conclusion, as this represents the deadline for the . The project sought to scale-up its scientific research and demonstrated benefits with financial instruments from the Sardinian regional development plan for the period 2021-2027. As this represents an ambition goal, for which many underlying causes remain unknown in the decision-making process, the impact remains a hypothetical at the time of writing. Simultaneously to the activity on the regional level, the project has on numerous occasions sought contact to European decision-makers and its financing sources, to feedback its experiences and results for supranational solutions which may benefits multiple regions within the EU (see also results on reproducibility and sustainability).

8.5 Effectiveness

The project SheepToShip LIFE has been set up to support the current policy landscape of the European Union and the Italian national context. Hence it has in its steps towards its goals, constantly intended to reassess its path towards the overall mitigation targets and its narrow objectives. The demonstrating of the usefulness and the spread of knowledge on the life cycle approach and thinking has been achieved on various occasions (e.g. stakeholder dialogues, conferences, scientific papers). The project has in this sense found a favorable context and the initiative has raised interest across a variety of different stakeholders and the socio-institutional context on Sardinia. The favorable surrounding might ultimately promote the adoption of rural development policies based on the life cycle thinking results. As key indicators for the effectiveness of this last point, is the political support the project has acquired from the Minister of Environment and the Minister of Agriculture of Sardinia.

8.6 Sustainability

The continuity and the sustainability of SheepToShip LIFE can on the hand be increased by communication activities during the After-LIFE part of the project, which foresees networking and communication activities. The main driver for the dissemination of results depends however strongly on the initiation of a virtuous loop in the medium/long-term future. If rural development strategies see an integration of climate change concerns, in the sense of a valuation of climate net-positive or neutral production systems then synergies may arise. Synergies may form in the SheepToShip context by increasing competitiveness and creating correlations with environmental performances of companies and farms. A pull factor may manifest when environmental certifications are established, and the promotion of green markets is underway. The socio-economic benefits which derive from the eco-innovations and from the production systems outweigh the directly occurred costs of the project in the long term. In this sense the sustainability of the project relies on the adoption of the eco-innovations. The project articulated a pathway towards this goal through the socio-economic feasibility study and the derived environmental action plan.

In terms of likelihood of continuing benefits, the project has through its networking activities created a stable position in the stakeholder context on Sardinia. Therefore, with continuing efforts and monitoring activities of the implementation of the eco-innovations, it may be possible to determine the progress. One possibility of the spread of the eco-innovations is through the inclusion in the regional development plan of Sardinia, which is expected to increase adoption rates almost immediately. Secondly, the mouth-to-mouth spread of information between farmers and companies through the created network has and will continue to contribute to long lasting effects of the project, as information has now been introduced into the system and will spread within it. Thirdly, targeted projects especially for information and governance campaigns to directly spread the demonstrated and socio-economic feasible eco-innovations may further support adoption rates of innovations. Fourth, a remuneration of voluntary sustainability agreements or carbon credits (as described in the

Environmental Action Plan and Socio-Economic feasibility study) represent an opportunity for change but largely depends on EU political decision-making.

A virtuous loop towards to increasing overall sustainability of the production system has already been initiated by the projects partnership. As problem definitions are shared between stakeholders and agreement on the actual problem within the system is found, a societal and/or governance solution may realize itself over the next 10 years to lastingly decrease the greenhouse gas emissions by 20%. For this reason the LCAs which were conducted during the project.

8.7 Reproducibility

In addition to the sustainability evaluation, the reproducibility of the project in either different geographical contexts or on Sardinia plays an important role. As the financing of the project is provided by the LIFE program, lessons learned from the empirical reality on Sardinia are transferred to the supranational EU-level. This circumstance may facilitate the reproduction of the projects methodology in (sheep) cheese industries in different European regions. Solutions (eco-innovations) may then be adopted accordingly to specific regional needs. The “open-laboratory” character of Sardinia was highlighted during the project, as different topographical and climate regions are present in a relatively small area. The laboratory character was facilitated with a participatory methodology which allowed for the determination of socio-cultural and economic barriers and overall suitability of the eco-innovations for different context. The ambitions of the project could therefore be tested under various circumstances, adding validity to process. It is, for this assessment, necessary to consider long time horizons, as best practices and knowledge transfer are known to need time to spread, therefore, reproducibility may also take place through the scientific community. This not only would replicate the implementation of eco-innovations in other contexts but would also add scientific consensus (or disagreement) on the produced project results. Nonetheless, the projects ambitions need to fall on fertile political grounds, to be able to reproduce themselves autonomously. If political support is not guaranteed, a route to establish autonomously is to follow the methodology of the project in different contexts.

9. Discussion and conclusion

The SheepToShip LIFE project has been a project which has shown great impacts in various fields: interinstitutional cooperation, demonstrating benefits of agro-environmental innovation, participatory governance design and science – policy knowledge interface. These impacts may have lasting effects on the production system of sheep milk and cheese in Sardinia. The auto-evaluation has shown that project staff, partners and stakeholders believe that the project and its result have the potential to improve the environmental and socio-economic situation of Sardinian sheep farmers and cheese factories but also in other context the methodology of the project can easily be adopted and deployed. Noteworthy is the positively perceived cooperation between partners (Question 10). The average answer of all asked respondents, on the question whether the project will have a lasting impact on the dairy sheep sector lies at 6,9 (out of 10). As absolute certainty about the future is an impossibility, the staffs' positive attitude about the future impacts reflects a collection of built expectations during the stakeholder dialogues and the received positive feedback on the project. Nonetheless, the answers to the questionnaires also bring to light remaining room for improvement in the organizational capacity of the project to maximize its operational capabilities. This can be seen in statements such as "A better division of tasks between all partners is needed", "Advisory services could play a more relevant role in the dissemination", "I think more emphasis should be given to the last step which concerns the involvement of policy makers and their commitment for making the change happen", "need for more sharing of in progress work." The benefits, which should be transferred for to the next project in the context are seen by statements: "Interdisciplinary engagement", "Stakeholder engagement and results dissemination", "The community built, identified best practices and results to be capitalized", "interdisciplinarity".

On a methodological level, it appears that transferring experiences and insights from a participatory approach (bottom-up – focus groups) to policymakers (traditionally top-down) has, at the time of the evaluation, successfully led to an integration of knowledge and may influence change on a political level. The project has especially with this part of its methodology been able to attract the attention of government officials and has had the advantageous position to have the Sardinian Environmental ministry as a partner organization. This interinstitutional set-up has facilitated the access to key policy makers. The early outreach to the consortia of Pecorino production and the continuous stakeholder dialogue, has made it possible to introduce and strengthen climate change mitigation considerations into the supply chain. These considerations were built on valid, peer-reviewed scientific evidence in form of Life-Cycle-Assessments, representative of the Sardinian milk and cheese production systems (respecting geo-topo and farm management variations). Concludingly, the project has overall seen a validation of its methodological approach, which may be replicated in different contexts. Referencing the project will also play a role on Sardinia and serve as a reminder if political activity falls short of commitments made during the discussion process of the project.

10. Recommendations

Content of project

- Carbon farming and Ecosystem Services payments.
- Field trials and better communication.
- The economic area and also the environmental social role of farmers.

Organizational

- Advisory services could play a more relevant role in the dissemination.
- Include Civil Society Organizations and private companies in the partnership
- I emphasis should be given to the last step which concerns the involvement of policy makers and their commitment for making the change happen

- Communication, training, Involvement of stakeholders engaged by meantime, strong support of a political vision of the sector, its improvement both in environmental and economic terms.
- Need for more sharing of in progress work.

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