Innovation for Sustainable Sheep and Goat Production in Europe

# iSAGE Newsletter

Summer 2019

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# Introduction

The iSAGE project has now entered its final year and significant work regarding key issues on sustainability, competitiveness and resilience of the European Sheep and Goat sectors, has been or is close to completion. iSAGE continued to build on excellent participatory research between farmers, cooperatives, companies and academics addressing major issues of socio-economic, demographic, ecological, and market challenges as well as issues of animal genetics and climate change. This newsletter highlights five main areas of iSAGE activities: (1) sustainability assessments of sheep and goat farms across Europe, (2) quantitative surveys of farmers about the future of small-ruminant sector (3) a holistic model to redesign small ruminant production systems, (4) a collaborative multi-stakeholder analysis of the challenges of the sheep and goats sector and (5) assessments of phenotypically and genetically characterized traits indicative of animal resilience, adaptability and sustainability to future climatic, environmental and socio-economic circumstances. The work highlighted in the newsletter starts with the sustainability assessment of sheep and goat farms within Europe that helped to identify the strengths and weaknesses of diverse production systems. To this end a series of qualitative surveys across sheep and goat production systems in Europe showed that market and performance issues represented the most relevant concern for most farmers. In iSAGE we had the opportunity to assess first-hand the diversity of sheep and goat systems in Europe and the level of existing innovations. Such information has subsequently formed the basis of a multi-stakeholder analysis of challenges of the sector. The latter together with the ongoing research on genetics is expected to produce new knowledge which finally will be combined to develop and design a holistic model that can be incorporated into practice.

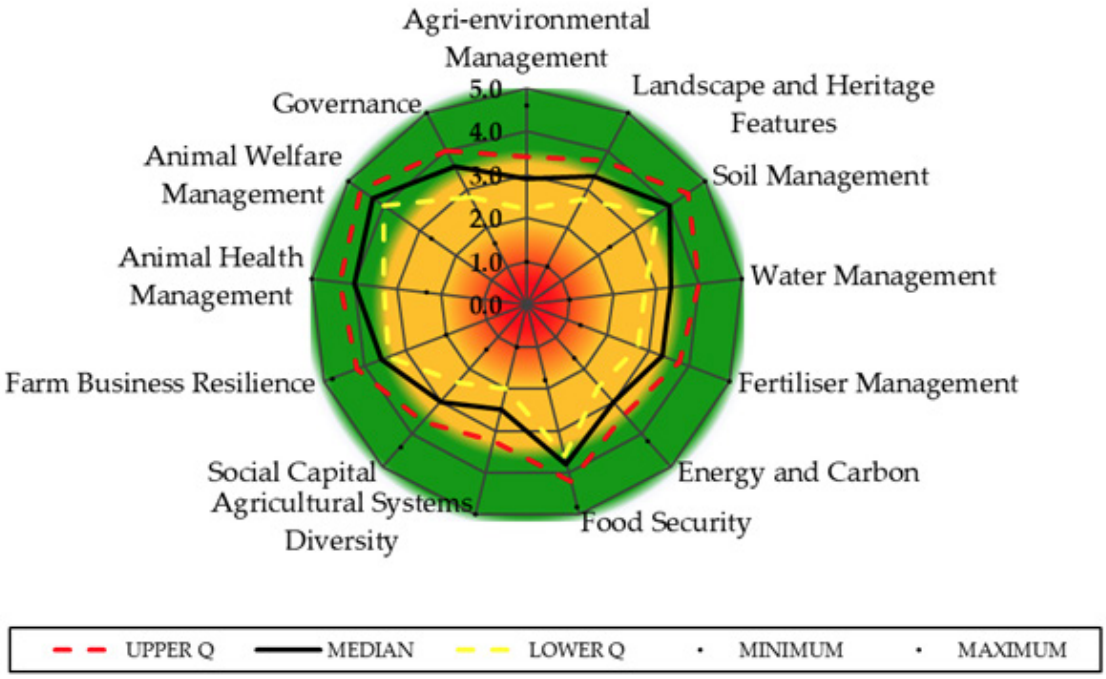
**Georgios Arsenos, iSAGE coordinator**

# Sustainability Assessments of Sheep and Goat farms across Europe.

**Marion Johnson (ORC)**

There has been an overall decline in the numbers of farmed sheep and goats across Europe in the past two decades, drawing the sustainability of the farms into question. There are many sustainability assessment tools available but frequently they only examine one aspect of the societal impacts of farming systems, to understand the complex interactions, synergies and trade - offs between different sustainability objectives it is important to integrate all categories of sustainability in one assessment.

To this end the iSAGE project conducted a holistic sustainability assessment of 206 sheep and goat farms within Europe using the adapted Public Goods (PG) Tool. The adapted PG Tool provides a simple and quick estimate of the sustainability of a small ruminant farming enterprise. The results are presented in a non-confrontational manner, depicted in a radar diagram that is simple to interpret and provides a perfect catalyst for discussion (see below example for sheep farms).




The results show a wide variation in scores between farms. On an individual farmer basis, the tool provides information, provokes questioning and the development of solutions to sustainability issues. In general, more sustainable farms rely less on external inputs and public subsidies and appear not to be particularly affected by environmental-related variables such as rain or non-

renewable energy consumption. High dependence on concentrates reduces the overall sustainability as does increasing intensity in terms of grazing livestock units/ha.

The use of Life Cycle Analysis will add a further dimension, providing an in-depth review of the effect of innovations on environmental impacts. It is clear a single innovation does not occur in isolation but rather has ramifications across the farm.

Importantly the collection and reporting of these results will raise the profile of the complex issues and dilemmas facing small ruminant producers in Europe.

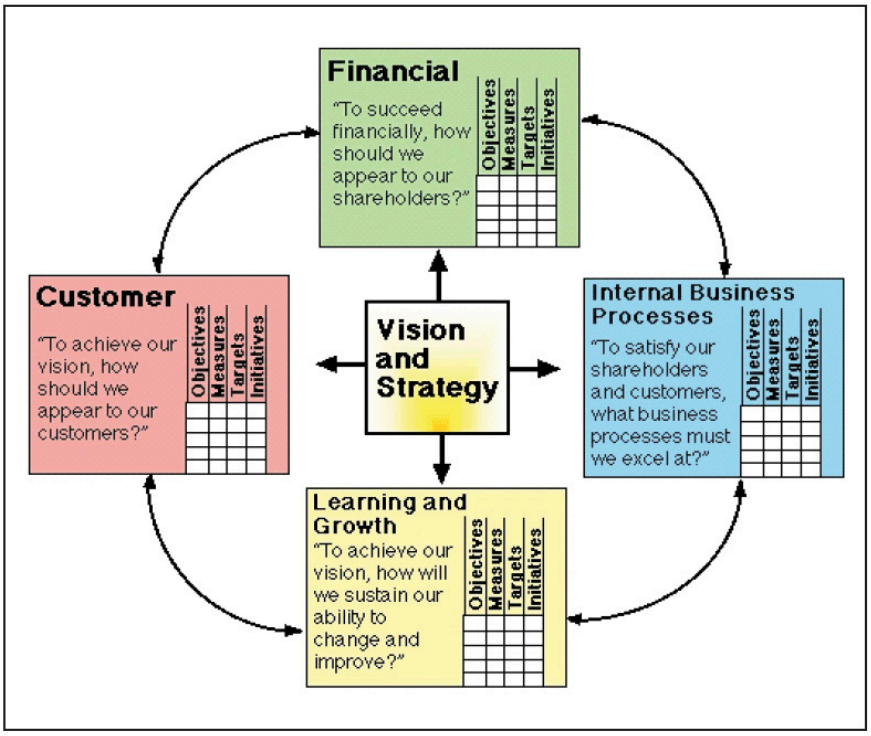
## Farmers are optimistic about the future of small-ruminants sector performance, but they do not prioritize innovation

**Raffaele Zanoli (UNIVPM) and Stefano Orsini (ORC)**

A preliminary qualitative survey of 33 sheep farmers and 14 goat farmers across Europe showed that market and performance issues represented the most relevant concern for most farmers.

A second quantitative survey was done on 144 sheep farms and 81 goat farms in Finland, France, Greece, Italy, Spain, Turkey, United Kingdom. The 225 case-study farms were selected based on the typology established in WP1. The survey focused on the 4 dimensions of sustainability.

Figure 1 - The four perspectives of sustainability (Source: Norton & Kaplan (1996))



Results show that:

1. The farmers gave low priority to reinvesting part of the turnover into the farm. This is an indicator of the lack of self-sufficiency and entrepreneurship of the small ruminant sector and its inherently low sustainability.
2. Similarly most farmers give low priority to innovations and generally believe that they already perform above average on all multidimensional indicators.
3. The case-study sheep farmers think they perform better than the rest of the sector. Goat farmers have a significantly less optimistic view of their past performance but also of the future outlook.
4. The intensity of production seems to be associated with a higher confidence on the farm performance and sustainability in the long-run. However, whilst this may be true at scale/construct level, it is not the case for all measurement indicators (item level).
5. In general, all the small-ruminant farmers that participated in the survey appear optimistic that their performance will increase in the future, along their sustainability. However, they seem to give low priority to those factors (investment/innovations) that are actually the key drivers for future growth.

# A new holistic model to redesign terrestrial small ruminant livestock systems

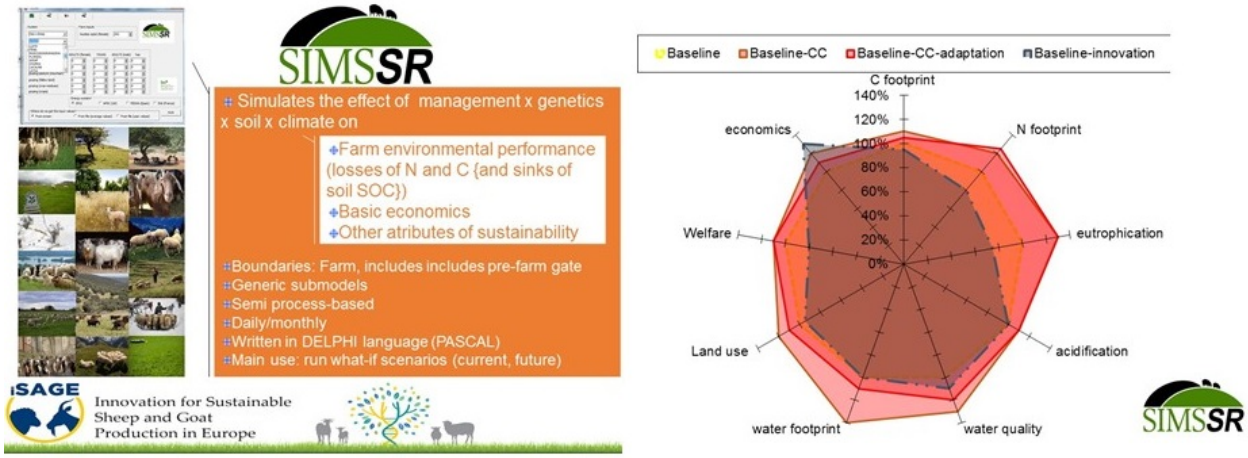
**Agustin del Prado (BC3), Inmaculada Batalla (BC3), Guillermo Pardo (BC3), Asma Jebari (BC3), Athanasios Ragkos (AUTH), Alexandros Theodoridis (AUTH) and Georgios Arsenos (AUTH)**

A new modelling framework comprising 2 models (SIMSSR + ISAGE LP) has been developed to identify what will make small ruminant farms sutainable in the future. The whole framework uses the characteristics of a virtual farm representing a particular farm typology and including the main typical features of a farm in a particular context. The framework can mimic how changes aimed at optimising one farm component (e.g. genetics at the animal level) can affect the overall farm results (e.g. GHG, labour requirements, profit). A number of scenarios comprising combination of systems (dairy sheep, dairy goat, meat sheep), breeds (e.g. Chios, Latxa, Rasa-aragonesa, Lacaune) and locations (e.g. Spain, Greece, UK and France) are currently being tested.

iSAGE aims to analyse potential future trajectories in relation to future challenges such as climate change, novel subsidies rules or price shocks for example. Within these scenarios, the framework is used to analyse the scope of current or theoretical innovations and changes in farm management in order to achieve more sustainable farms.

Typical outputs include environmental (e.g. GHG) and economic annual farm results from an optimised farm typology under specific climatic and site conditions.

Figure shows main characteristics of SIMSR model and an illustration of comparative results from different scenarios under climate change (non-adapted, adapted and using an innovation) vs. current climate.




# A collaborative multi-stakeholder analysis of the sheep and goat sector challenges

**David Yañez-Ruiz (CSIC), Alejandro Belanche (CSIC), Ian James Rose (AUTH) and Daniel Martín-Collado CITA)**

In this study 90 stakeholders were surveyed in a participatory multi-disciplinary approach in which the main challenges that sheep and goat sector were first identified and then each challenge was analysed in terms of i) relevance; ii) easiness to address and iii) the stakeholders needed to address each challenge.

A total of 30 challenges were identified for further assessment. iSAGE developed a survey to assess the differences in the relevance and ease to address the challenges comparing between products (dairy vs meat), species (sheep vs goats), production system (intensive vs semi-intensive vs extensive), geographical region (Southern vs Central-Europe) and type of stakeholder (private vs public sector). A priority for action index, which combines high relevance and easiness to address, was calculated to identify the challenges most feasible to address.

There was a wide variation in the perception of the challenges. The main differences were found between regions (Southern vs Central Europe). The type of product and farming system explained moderate differences between challenges whereas species explained little differences.

The top 10 challenges for prioritization included 5 internal weaknesses

1. Low promotion of local breeds;
2. Poor business management training;
3. Low professionalization;
4. Slow adoption of innovations;
5. Low adaptability of high producing breeds)

and 5 external threats

1. Low consumer education;
2. Low consumer knowledge on farming;
3. Researchers not addressing real problems;
4. Unfair trade,
5. Lack of traceability;
6. Poor recognition of public services.

Internal weaknesses need more action from the sector itself (farmers and associations), while external threats require action from governments in collaboration with the sector.

# Phenotypically and genetically characterised traits indicative of animal resilience, adaptability and sustainability to future climatic, environmental and socio-economic circumstances

**M.J. Carabaño (INIA), A. Triantafyllidis (AUTH), M. Ramón (AGRAMA), V. Tsar (AUTH), D. Hazard (INRA), H. Larroque (INRA), M. Serrano (INIA), C. Díaz (INIA), V. Kapsona (SRUC), G. Banos (SRUC)**

Data provided by iSAGE industry partners from productive and functional recording for nearly one million sheep from 5 dairy sheep and 9 meat sheep breeds and close to 200,000 goats of 5 dairy goat breeds spread across northern and southern EU countries have been analysed to characterise a list of traits relative to:

(i) adaptation to climate (Rate of change in animal performance between comfort and heat or cold stress ),

(ii) plasticity to produce across environments characterised by a number of sustainability indicators and typologies of production, and,

(iii) sustainability, characterised by health related indicators (faecal egg count, immune status), welfare (female longevity and progeny survival), feed intake, growth, meat quality and functional milk production (udder health, persistency of lactation).

In addition, blood biomarkers of body reserves mobilisation have been determined in three populations of meat and dairy sheep in order to propose a fourth category of novel traits relative to:

(iv) resilience to harsh conditions of production measured through changes in body condition and in levels of blood biomarkers across productive cycles.

All the traits showed variability and are amenable to improvement via genetic selection. Antagonistic relationships were detected between tolerance to extreme weather events and productive levels, which should be taken into account in the design of selection indices. Small genotype-environment interaction (performance of animals is not expected to differ across environments) for productive traits (milk, fat and protein) and more substantial for health traits (somatic cell counts, udder health indicator) have been found.

Furthermore, genotypes from 23,380 animals have been used together with the characterised phenotypes in order to scan the whole genome of sheep and goat breeds for genomic associations to identify genetic loci and genomic regions "responsible" for the resilience, adaptability and sustainability traits. The genomic wide association analysis has revealed a set of SNP markers that could be utilized as initial genomic tools into the selection process. For example, the genomic profile of Scottish and Spanish sheep breeds, belonging to extensive as well as intensive production systems, was significantly associated with sustainability and adaptation to climate traits. These preliminary results are the starting point to develop selection tools for the European industry sector of small ruminants considering the future climate change issues.

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