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Abstract

This document describes the activities undertaken in Task 2.1 (preliminary qualitative farmer survey) and Task 2.2. (quantitative farmer survey) under WP2. The aim of Task 2.1 "Preliminary qualitative farmer survey" was to better understand the interaction between socio-economic, environmental and policy issues relating to the sheep and goat sector in the seven countries involved, i.e. Finland, France, Greece, Italy, Spain, Turkey, United Kingdom. This task was mostly exploratory, and the outcome was used to prepare the more extensive and quantitative farmer survey in Task 2.2 and to inform the strategy development in WP4 and WP5. The aim of Task 2.2. "quantitative farmer survey" was twofold: classify small ruminant farms using multiple bottom-up participatory indicators; and identify which farm characteristics and geographic, demographic and other socio-economic changes in sheep and goat farming communities are most likely to constrain or favour the development and the multidimensional sustainability of sheep and goat sector.

A variety of data collection methods have been used in this study, from qualitative personal interviews to quantitative surveying via both an online survey instrument and a spreadsheet-based tool (the PG Tool) developed for WP1. Preliminary survey data have been analysed qualitatively (SWOT analysis), while the quantitative farmers' survey data have been analysed by multivariate statistical tools: descriptive statistics, classical statistical test of hypotheses, Importance-Performance Analysis, and confirmatory factor analysis.

Results on the limited case study farms across Europe show that:

1. The limited perceived relevance of, and the low priority attributed to, reinvesting part of the turnover on the farm is an indicator of the lack of self-sufficiency and entrepreneurship of the small ruminants' sector and its inherently low sustainability.
2. A similar result was found for the innovation (learning and growth) dimension: 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 interviewed self-report themselves as performing 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 ruminants' 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.

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Introduction

Small ruminants constitute just a small share of the total EU livestock output in terms of value added. According to the latest EU statistics (EC, 2015), in 2015, the value of EU sheep and goat meat production accounted for about 5.5 billion euros (3.6% of the total value of meat production in EU). In many EU member states, sheep and goat milk account for a minor part of the total agricultural output. In France, Italy and Spain it ranges from minimum of 0.9% to a maximum of 1.8%, while in Greece sheep and goat milk contributes about 9% (Pulina et al., 2018). Nonetheless, the 86 million sheep and 12.5 million goats (Eurostat, 2017) spread across Europe utilise a significant amount of the agricultural land, particularly in the United Kingdom and in the European Mediterranean basin.

According to Eurostat (2017), the largest numbers of sheep are found in UK, Spain and Greece (27%, 19% and 10% of the EU total population respectively), while Greece and Spain together hold more than 50% of the EU total goat population (32% and 22% respectively). In these countries, sheep and goats are often reared in marginal and economically vulnerable areas, where they are an essential part of the agro-ecosystems and play a special role in the provision of ecosystem services to society (Rodriguez–Ortega et al., 2014). These can range from the provision of food (meat and cheese) and fibre (wool) to the "non-marketed" services such as the regulation of climate systems (e.g. flood prevention, water purification) and the support of local cultural heritage.

Nevertheless, in the last two decades, the EU sheep and goat sector has experienced economic and structural difficulties, which has led to a consistent decrease in livestock numbers. The meat production sector in particular is characterised by a fall in total production, correlating with a fluctuating farm gate price and an increasing import from non-EU countries. The dairy sector is also characterised by a reduction in the number of flocks, but the drop is less marked than the meat sector. In the last decade, the total number of animals has fallen by 2% for sheep and 6% for goats, with substantial differences from county to country (Eurostat, 2017). Between 2010 and 2017, in Spain, Greece and France sheep numbers have declined by about 14%, while in Italy the decrease was approximately 9%. Unlike other countries, in the same period, the UK the total number of sheep and lambs increased by 9%. For goats, the situation is quite similar: in the period between in 2010 and 2017, in France and Greece, the number of goats decreased by 16%, while in Italy and Spain numbers remained stable (Eurostat, 2017).

The socio-economic environment in which European sheep and goat farms operate has become increasingly complex and many authors have tried to explain the reason behind the vulnerability

and sensitivity of the sector. In many European countries, the income of sheep and goat farms is declining and is usually lower in comparison to other types of farming (Dubeuf et al., 2014). This lower income is the reason that sheep and goat farmers were among the first to receive direct subsidies from the CAP to compensate for falls in income (Milàn et al., 2003). Direct subsidies often represent the majority of the net farm income on sheep and goat farms, and this is particularly true for those farms located in less favoured areas (Dýrmundsson, 2006).

To address this, organic farming appears to be a promising option. Despite the viability of organic farms still depending a lot on the subsides provided by the RDP agri-environmental measures, in many cases being organic can guarantee a higher level of revenue compared to a non-organic system (Toro-Mujica et al., 2016; Toro-Mujica et al., 2011; Tzouramani et al., 2011). On the demand side, however, the European market for organic milk and meat is still not well developed and most organic producers are selling their products to the non-organic market, therefore missing the benefit of the premium price and its contribution to farm profitability. Very few studies focused on the demand for organic goat and sheep meat and cheese in Europe. Naspetti et al. (2012) found that among the characteristics of 'pecorino' (sheep milk) cheese, consumers assign the greatest importance to animal welfare, origin, and production process. Similarly, Napolitano et al. (2010) investigated sensory acceptability of sheep cheese in Italy as affected by organic certification. They concluded that information about organic farming can be a strong determinant of consumer willingness to pay, thus providing a potential tool for product differentiation, particularly for small scale and traditional farms in mountainous and less favoured areas.

The economic sustainability of sheep and goat farms in Europe may benefit from the role of RDP to support new on-farm activities. Farm diversification is an important way to ensure an appropriate level of income for the sheep and goat farmers irrespective of year-specific conditions. Analysis conducted in marginal and less favoured areas of the Mediterranean basin demonstrate that the development of the sheep and goat sector is conditioned by the ability of the farms to generate revenue from other business activities, such as agri-tourism and other on-farm activities (Sossidou et al., 2013). The development of the sector in marginal areas could also benefit from the implementation of policy measures addressing both the improvement of infrastructure in mountain areas (e.g. community pastures and common land) and remuneration for potential ecosystem services delivered by the sheep and goat farmers to society (Sossidou et al., 2013; Dýrmundsson, 2006).

Limited innovation ability as well as limited investments in developing and testing innovations, are other important factors that may challenge the sustainability of goat and sheep farms in Europe (Dubeuf et al., 2014). The improvement of farm technology, as well as boosting innovations in farm practices, process and products is considered one of the main strategic priorities for the sheep and goat sector, and particularly at the farm level. Relative to other agricultural sectors, technology and innovation in the sheep and goat sector has remained relatively stagnant and neglected by both the supply chain actors and mainstream research (Martin-Collado et al., 2017).

The ageing farming labour force, together with the lack of intergeneration transfer of farms, is another problem facing the sheep and goat sector in Europe. There are few published studies on this subject for the sheep and goat sectors (see among others Theodoropoulu et al., 2000; Truchero, 2011) and many of these are not recent. In one example, Truchero (2011) investigated intergenerational transfer in dairy sheep farms in Spain. The results show that there are many reasons that could explain the decision to accept or not the intergenerational transfer of the goat or sheep farm, namely young farm family members social profiles and discourses.

Finally, a few studies exist that have focused on the complex issue of supply chain structure and performance. Camanzi et al. (2018) report a number of issues concerning dairy sheep supply chain in southern Europe; nevertheless, collaboration amongst supply chain actors and correct alignment between supply chain and demand appear to be the most important. This result is in line with other findings (see among others Farrell, 2005 and Naspetti, 2011), who point out the role of trust and collaboration, particularly between farmers and processors, as a key factor in order to obtain collaborative paths along the agri-food supply chain.

This deliverable reports the results of both the preliminary qualitative farmer survey (Task 2.1) and those of the quantitative farmers' survey on the iSAGE case study farms (Task 2.2).

Objectives

The overall aim of this part of the iSAGE project was to gather insights as to which farm characteristics and which geographic, demographic and other socio-economic changes in sheep and goat farming communities are most likely to constrain or favour the development and the multidimensional sustainability (MDS) of the sheep and goat production sector.

Specifically, the aim of the qualitative farmers' survey (Task 2.1) was to provide a better understanding of farmers' views on socioeconomic aspects, policy development, farm management and environmental issues relating to sheep and goat farming in Europe. This would serve as a basis for the construction of the quantitative farmers' survey in Task 2.2 and inform the strategy development in WP 4.

The aim of the quantitative farmers' survey was then to collect relevant information needed to make a statistical classification of goats and sheep farms and to identify factors that may favour or constrain the development of the sheep and goat sector. The first task was data collection through the administration of a questionnaire to case-study sheep and goat farmers. The objective was to obtain a dataset that integrated the data and information specifically collected for this task with those collected, on the same case study farms, by Task 1.3. Particular attention was paid to indicators concerning the economic and managerial performance and the context where the farmers operated. Participatory bottom-up approaches were used for data collection, making use of relevant industry partners in the selected countries: ES, FI, FR, GR, IT, TR, UK. All the main types of sheep and goat farms were considered: dairy/meat/dual purpose production, intensive/extensive management, and organic /low input/conventional farming.

The participatory, multidimensional perspective has informed the entire study, from data collection to the analyses.

Methods

The preliminary qualitative survey was conceived to better understand the interaction between socio-economic, environmental and policy issues related to the sheep and goat sector in the seven countries studied (i.e. ES, FI, FR, GR, IT, TR, UK). The survey was mostly of exploratory nature and the outcome was focused on preparing the quantitative farmer survey. The preliminary interview was divided in two main parts: the first part consisted of questions on farm structure (e.g. farm size, breeds, labour, history of the farm, on-farm diversification activities), while the second consisted on questions related to "current situation" and "future opportunities and threats" with respect to the following topics: environment, farm/livestock management, technical issues, socio-economics, market and supply chain, policy. The identified topics in the interview guide were based on the feedback provided by the industrial partners involved in WP2 during the iSAGE meeting in Zaragoza. The interviews were conducted with a small number of farms for the specific farm typologies developed in Task 1.1. The selection of farms was based upon previous contacts with the industrial project partners and in order to cover, whenever possible, farms with different characteristics.

The information gathered was first analysed qualitatively to identify *themes* – e.g. decrease in lamb meat consumption or "lack of farm successors" or "lack of available land, drought" etc. A SWOT analysis to identify strengths, weaknesses, opportunities and threat to the farm businesses was also performed. Once the project partners had conducted the interviews and produced their reports, ORC summarised the overall results in a draft report which served to prepare questions for Task 2.2. A list of relevant innovative practices (see Appendix II) identified by the farmers during the interviews was also produced and circulated to the WP leaders to complement the innovation list identified in Task 4.1.

The aim of the Task 2.2 was to collect the relevant information needed to make a statistical classification of goats and sheep farms and to identify factors that may favour or constrain the development of sheep and goat sector. The first task was data collection through the administration of a questionnaire to a sample of sheep and goat farmers. The objective was to obtain a dataset that integrated the data and information specifically collected for this task with those collected, on the same case study farms, by Task 1.3. Particular attention was paid to indicators concerning the economic and managerial performance, and the context in which farmers operate. Participatory bottom-up approaches were used for data collection involving relevant industry partners in the

selected countries: ES, FI, FR, GR, IT, TR, UK. All the main types of sheep and goat farms wee considered: dairy/meat/dual purpose production, intensive/extensive management, organic /low input/conventional farming.

The goal of this part of the study was to gather insights into which farm characteristics and which geographic, demographic and other socio-economic changes in sheep and goat farming communities are most likely to constrain or favour the development and the multidimensional sustainability of the sheep and goat production sector.

The participatory, multidimensional perspective have informed the study in its entirety, from data collection to analysis. Soft data on farmers' assessment of and expectations for their farm's performance where collected alongside with 'hard' data on their input use, costs and revenues.

Multivariate statistical analysis allowed the integration of different measurement indicators into multidimensional factors/constructs that synthetically represent latent dimensions required to model the performance and socio-economic sustainability of sheep and goat farms.

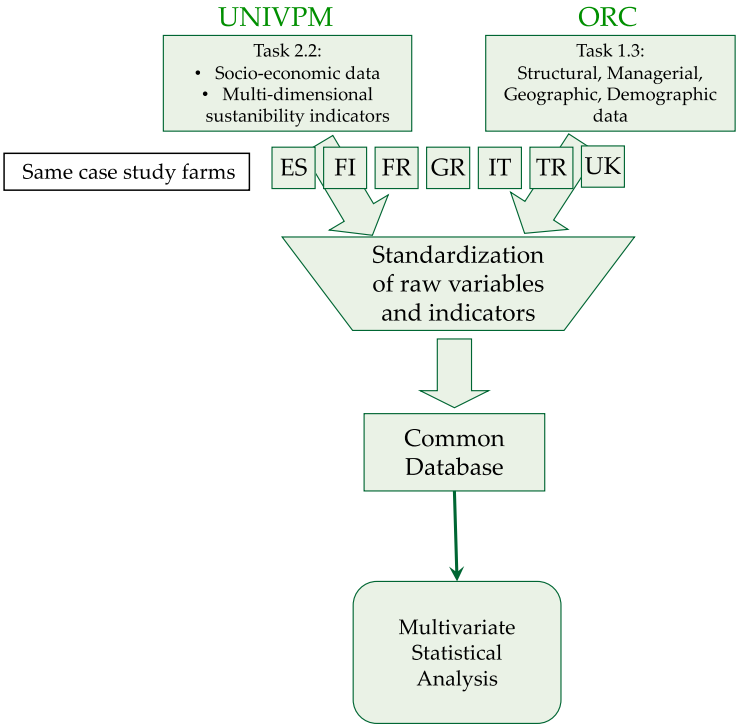
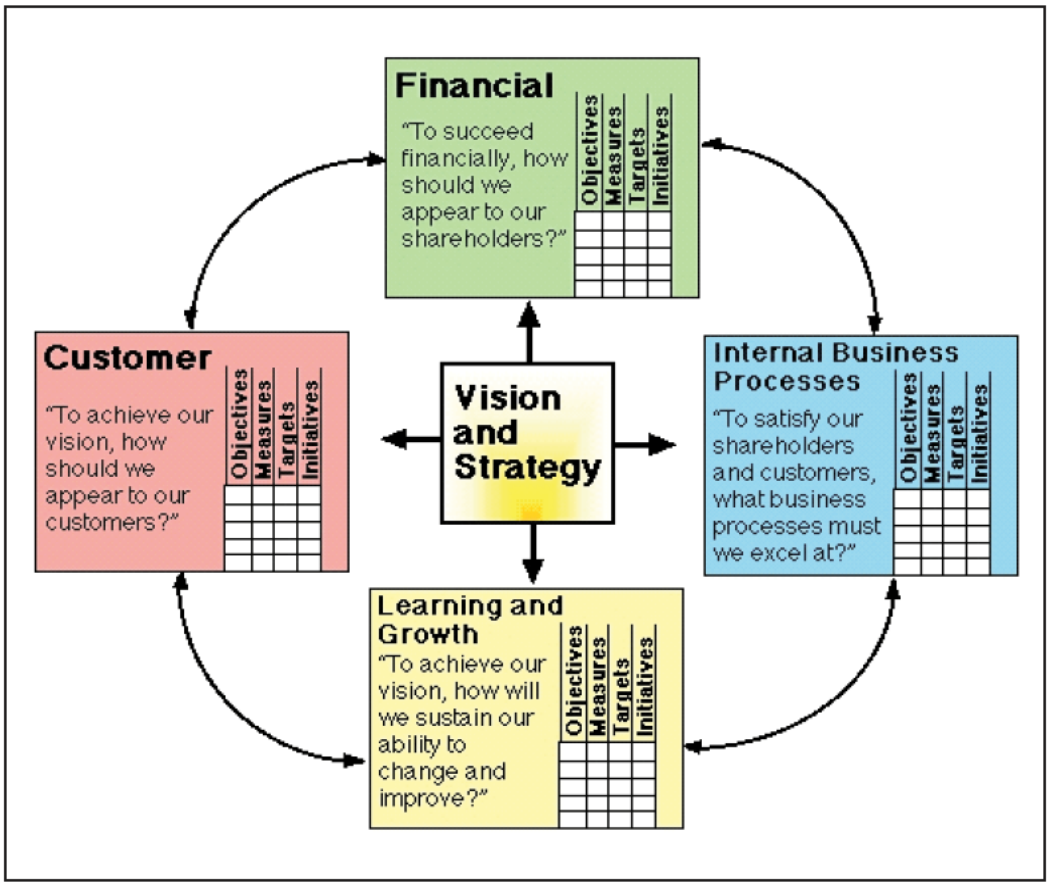


Figure 1 - Flowchart of data collection and analysis

Measurement of multidimensional sustainability

Literature was reviewed to provide, in addition to the results of the qualitative survey, an overview of the potential farm performance and farm development indicators to be included in the farmer's survey to assess the multidimensional socio-economic sustainability of the goat and sheep sector. The approach used in this work to identify the farm performance indicators was based primarily on the "balanced scorecard" (BSC) evaluation developed by Kaplan and Norton (1992; 1996) in the early 1990's to measure an organisation's performance. We chose the BSC as a reference model as it is currently one of the most cited multidimensional performance measurement models.



Source: Norton & Kaplan (1996)

Figure 2 - The four perspectives of the Balanced Scorecard (BSC)

Furthermore, BSC is of specific interest for our purposes, since it is designed to find a balance between the assessment of past firm performance and the prediction of future firm performance (Van Looy and Shafagatova, 2016). The concept of the BSC was developed with the aim of enabling organisations to measure not only the financial performance, but also other non-financial

performance dimensions such as customer relations, organisational structures and internal skills and competencies. The scorecard is in this sense "balanced", since all measurement items aim to provide a complete description of what the firm need to know about their business performance (Chavan, 2009).

The four main performance dimensions of the original BSC, as developed by Kaplan and Norton (1992), can briefly be described as follows:

(i) **financial perspective**. This evaluates the organisation's profitability element. Typical financial indicators are return on investment (ROI), profit margin, cash flow and shareholder value.

(ii) **Market/customer perspective**. This evaluates the company's success in the relevant market segments. Typical indicators are product quality and customer satisfaction;

(iii) **internal and business perspective**. This evaluates the organisation's skills, competencies and technology that matter in the specific business (i.e. labour force skills, level of technology utilisation);

(iv) **learning and growth perspective**. This evaluates the organisation's capabilities to improve and adapt its products and processes. Some examples of this perspective are product innovation capability, employee alignment and staff engagement.

Though BSC is an extensively researched topic, only few examples of its adoption in the agri-food sector exists. Furthermore, most of the examples are among large supply chain businesses and farms (see among others Bigliardi and Bottani, 2010; Lourenzani et al., 2005; Cardemil Katunaric and Shadbolt, 2005). In work conducted by Noell et al. (2002) for a case study in Denmark, the relevance of applying the BSC concept to the Danish farmers is discussed and a modified version of BSC is proposed for the Danish dairy farms. Byrne and Kelly (2004) developed and applied BSC to Irish dairy farm managers. Further attempts at applying the concept of BSC in agriculture were implemented by Lissitsa (2005) and Paustian et al. (2015), who adapted the BSC to the needs of arable farm managers in Ukraine and Germany respectively.

To the best of our knowledge, there are no specific studies applying the BSC approach for measurement of goat and sheep farms' economic performance and long-term development and sustainability. In the present study, the perspectives included in the classic BSC approach were therefore adjusted to allow for a multidimensional view of the goat and sheep farm business process.

The measurement items were defined by consulting both the literature on the subject and the results of the preliminary qualitative survey developed in Task 2.1. Besides the literature on firm performance measurement and applications of BSC in the agri-food sector discussed previously, the relevant literature on economic and social sustainability of farms was consulted to develop the final list of measurement items (see among other Darnhofer et al. 2010; Darnhofer, 2014; Poulton et al., 2010; Craig et al. 2007).

Many of the studies on the measurement of an organisation's performance rely on objective measures or on a mixed model encompassing both objective and subjective measures. However, in the case of small or medium goat and sheep family farms, data is often not available, and respondents are generally reluctant to release objective records. In these cases, subjective measurement can be a feasible alternative for measurement of multidimensional performance (Wall et al., 2004). According to Love et al. (2002), when the availability and reliability of objective data is scarce, performance measurement through self-assessment by the respondents can be even more relevant and accurate than objective measurement.

A set of indicators was therefore developed to allow for a subjective multidimensional measurement evaluation of the social and economic sustainability of the sheep and goat farms. We refer to these indicators as multidimensional-sustainable (MDS) indicators. Farmers were asked to rate the past (last five year) and future (next five year) performance for each indicator, on the basis of their own knowledge of their own farm performance with respect to the average industry performance. All answers were on a 7-point Likert scale, running from 1 (worst in sector) to 7 (best in sector). Farmers were also asked to assess the level of importance of the same set indicators for their current business, using a 5-point Likert scale scoring from 1 (unimportant) to 5 (very important). The indicators were validated for readability, clarity and content validity through personal interviews with experts and industry partners involved in the Task 2.2. The comments from the experts and the industry partners were considered when revising the scale and their suggested changes to the indicators were implemented. Table 1 reports the BSC constructs, their definition, their reference sources and the measurement items which were included in this study. All of the measures for the study constructs were drawn from previous literature on BSC and multidimensional performance and sustainability of farms and were adapted for the specific application to small ruminant husbandry.

Following Kenny's (1979) rule of thumb and for parsimony in the administration of the questionnaire, each construct was initially specified by three to five indicators. Internal Business

Process was divided in two subscales: perceived business process quality; and perceived availability & quality of services and fixed inputs.

The whole questionnaire for data collection is presented in Appendix III.

Table 1 - Multidimensional farm sustainability framework for goat and sheep farms

CONSTRUCT	SOURCE	DEFINITION	MEASUREMENT ITEMS
Financial performance	*Laitinen and Chong*, 2006; *Vij and Bedi, 2016; Forker et al., 1996; Joshi et al., 2011*	The perceived level of farm profitability and financial performance	Prices paid on sales (prices per kg/lt) Farmer's share of the retail price Sales growth Gross margins per kg/lt Percentage of turnover reinvested on-farm
Learning and growth (Innovation)	*Calantone et al., 2002; Joshi et al., 2011; Clauss, 2017; Craig et al., 2007*	The perceived level of commitment to learning & growth in terms of innovation	Product innovation Process innovation Marketing innovation
Customer/ Market	*Vij and Bedi, 2016; Babakus et al. 1996; Poulton et al., 2010; Forker et al., 1996*	The perceived level of access to market information and product conformance to customer expectations	Level of market knowledge Product quality Customer satisfaction
Internal business process	*Rahaman et al., 2015; Clauss, 2017; Van Looy and Shafagatova, 2016; Zulkiffly et al.,, 2017*	The perceived level of internal business process quality	Labour force skills Farmer's quality of life Cooperation with other farmers
	Darnhofer, 2014; Van Looy and Shafagatova, 2016; Rahaman et al., 2015	The perceived level of availability & quality of services/ fixed inputs	Quality of veterinary services Quality of advisory services Availability of land for pastures/feed crops Availability of animal housing Quality of animal housing

The survey instrument was piloted with the help of industry partners in two Italian farms in May 2017. Pilot tests were required in order to examine the degree of comprehension and interpretation of the survey, and to avoid vague or unsuitable questions. After minor changes, an English version of the questionnaire, cover letter, guidelines and recommendations were sent to each project partner involved in this task (see Appendix B). Project partners were specifically recommended to administer the extra questions enclosed in the Task 2.2. farmer survey to the same farms where they performed the sustainability assessment using the PG tool (WP1).

The surveys were administered mainly by industry partners in their respective countries from June 2017 to July 2018, though some interviewers only entered the data in the survey online reporting tool by the end of September 2018. The selection of case study farms for Task 1.3 and Task 2.2. was largely based on the feedback provided by the project partners, in particular the industry partners, at the iSAGE meeting held on June 2017 in Edinburgh. The main criterion for selection of the farms was that these farms had to be representative of the ten mutually exclusive farm types identified in Task 1.1 and listed below:

1. Sheep: Intensive dairy farms (e.g. high input of purchased feedstuff)
2. Sheep: Semi-intensive or extensive dairy farms (e.g. normally pasture fed animals)
3. Sheep: Intensive meat farms (e.g. high input of purchased feedstuff)
4. Sheep: Semi-intensive or extensive meat farms (e.g. normally pasture fed animals)
5. Sheep: Dual-purpose farms (farms where the farmer sees value in two or more different products e.g. meat and wool, meat and dairy)
6. Goat: Intensive dairy farms (e.g. high input of purchased feedstuff)
7. Goat: Semi-intensive or extensive dairy farms (e.g. normally pasture fed animals)
8. Goat: Intensive meat farms (e.g. high input of purchased feedstuff)
9. Goat: Semi-intensive or extensive meat farms (e.g. normally pasture fed animals)
10. Goat: Dual-purpose farms (farms where the farmer sees value in 2 or more different products e.g. meat and wool, meat and dairy).

As required by the project, more than half of case study farms have been selected in less favoured areas (LFA). For each country, project partners were instructed to select farms that represented what they considered to be the prevailing farm types within their national farming systems.

Exploratory and confirmatory factor analysis

Exploratory factor analysis (EFA) is a multivariate statistical technique, originally proposed by Spearman (1904), aiming at reducing data complexity to allow an easier interpretation of a system measured through a wide range of variables. For an introduction to EFA see, among others, Afifi et al. (2012) and Kim et al. (1978). The data reduction is performed by estimating new variables, called factors, that are linear combinations of the original variables. EFA is based on the assumption that observed variables share latent factors that condition a common response. Latent factors can be considered as non-measurable, multidimensional concepts, conditioning the pattern of observed variables. For instance, soil quality may be considered a latent (i.e. not directly measurable) factor conditioned by soil texture, soil acidity, etc. In this sense, EFA assumes that groups of observed variables are "caused" by two components: common factors; and a random component that accounts for statistical errors. Given K variables, v_i, measured on a sample of N individuals, factor analysis considers that a limited number, q, of factors may be sufficient to linearly reconstruct v_{ij}:

$$v_{ij} = F_{i1}b_{1j} + F_{i2}b_{2j} + \ldots + F_{iq}b_{qj} + e_{ij} \qquad i=1,\ldots K;\ j:1\ldots,N$$

where F are the q factors, b_{ij} are the factor loadings and e_{ij} is a residual term that measures the "uniqueness" of each variable - that is, the amount of variance of the variable that is not explained by the q factors. Uniqueness should be maintained <0.6 in order to be considered as just measurement error.

The stochastic nature of factors as latent variables clearly differentiates EFA with respect to Principal Component Analysis (PCA). PCA is a data reduction technique in which each principal component is simply defined as a linear combination of observed variables. A major concern with PCA is that it tries to account for all the variance and covariance of the set of items rather than the portion of the covariance that the items share in common (Acock, 2013).

In EFA, given a dataset of K variables, K latent factors (hereafter factors) can be extracted, each "explaining" a certain percentage of the total variance of the original variables. Factors can be ranked according to the share of explained variance and according to the value of the associated eigenvalue. An eigenvalue equal to one accounts for as much as variance as a single variable. Once

factors are estimated, they should be interpreted according to their factor loadings, i.e. the coefficients that relate the single observed variables with each factor. Factor loadings may be interpreted as standardised regression coefficients or correlation coefficients and range between -1 and +1. Interpretation is of course a subjective procedure and may be complex when the same variables load into different factors. Factor rotation may be considered as an option to facilitate the interpretation of the factors. Different approaches to rotation may be used, mainly orthogonal and oblique rotations, each using a range of specific methods. Orthogonal rotations have the advantage of assuring the orthogonality among factors. Note that rotation techniques do not improve the explanatory power of factor analysis, rather they just provide a different perspective to factor loading interpretation, usually yielding a more definite attribution of variables to each factor.

Confirmatory Factor Analysis (CFA) is technique which analyses a priori measurement models in which both the number of factors and the correspondence with the indicators or measurement items are explicitly specified (Kline, 2011). In other words, CFA is used to assess the measurement properties of latent variables of constructs or scales that represent multidimensional concepts measured by a series of indicators or items. In EFA, all indicators are allowed to load on every factor, since EFA tests unrestricted factor models, which are generally not identified. In other words, there is no single, unique set of parameter estimates for a given EFA model and indeed, an EFA solution can be rotated an infinite number of ways (Kline, 2011).

The standard representation of a CFA model is:

$A \rightarrow X_i \rightarrow e_i$

meaning that each indicator has two causes: the underlying latent factor A that is reflected in the true score of X_i and the (random) measurement error e_i, which is normally distributed with a mean of zero across all cases.

Another way to put this is that X = B + E, where B is the true score represented by the factor loading and E is the measurement error.

The multidimensionality of the measurement is reflected by the fact that each indicator could be caused by more than one latent factor, as well as that the measurement errors of different indicators could be correlated. An error correlation reflects the assumption that the two related indicators share something in common that is not explicitly taken into account in the model.

Given we started with the theoretical BSC model to identify and test the factors that could impact on the long-term development and sustainability of sheep and goat farms, confirmatory factor analysis was used in this study.

Importance-Performance Analysis

Importance-Performance analysis (IPA) was originally proposed by Martilla and James (1977). It was then widely applied in the tourist and leisure sector, in the banking sector, in health care and in other sectors due to the simplicity of the method and the effectiveness of the interpretation of results (see Sever, 2015, among others). IPA is based on the theory of customer satisfaction and compares measures of importance and performance for a set of indicators in a two-dimensional space. Measures of performance and importance are usually defined on Likert scales. Importance and performance must be measured for the same set of indicators, which allows for a direct pairwise comparison of importance and performance scores. Results of matching are classified referring to a crossing point, such as the scale mean, the sample mean or the sample median. The choice of the type of crossing point is not neutral for the interpretation of the results. Martilla and James (1977) suggest the use of the sample median in cases of limited variance, while Haemoon (2001) recommends the use of the scale mean, which facilitates interpretation and comparison of results, but also considers the use of sample means as a possible extension. For a detailed description of the issues related to the selection of different types of crossing point, see Sever (2015). Results from IPA classify each item in four IPA categories, usually labelled as: "Keep on", "Concentrate here", "Over performance" and Secondary importance". These are defined as follows.

- "Keep on" refers to indicators (e.g. "farmers' quality of life" or "sales growth" in our dataset) with both importance (I) and performance (P) > than the respective cross points (CP). This category therefore identifies areas where good practices should be maintained;
- "Concentrate here" refers to indicators with I> CP and P<CP. This category is the most critical, as it indicates situations where the performance obtained is not adequate compared to the importance attributed to the indicator. It identifies areas where intervention is needed;
- "Over performance" refers to indicators with I<CP and P>CP. This category indicates an over-performance of indicators, given their limited importance and identifies areas where we can look for resources to be redistributed;

- "Low priority" refers to indicators with I<CP and P<CP. This category refers to cases where the performance is limited but in a context of limited importance. This may refer to cases of secondary relevance. However, caution is needed if classifications in this category result from an underestimation of the importance: in this case, the correct classification should be "Concentrate here", which is the most critical group.

A graphical representation of the classifications may help the interpretation and synthesis of outcomes and is usually provided as a result.

Data

For the qualitative farmers' survey, a total of 33 sheep farmers and 14 goat farmers were interviewed in the six countries involved in this task, as detailed in Table 1 below.

Table1. Number of sheep and goat farmers interviewed by country

Country	n. of sheep farmers interviewed	n. of goat farmers interviewed
Finland	5	0
France	4	2
Greece	4	3
Italy	5	2
Spain	10	6
United Kingdom	5	1
Total	**33**	**14**

Interviews for the quantitative farmers' survey were conducted with 225 sheep and goat farms in the seven countries involved, i.e. Finland, France, Greece, Italy, Spain, Turkey, United Kingdom. Table 2 and 3 show the number of sheep and goats farms interviewed respectively, divided by farm type and country.

Table 2. Number of sheep farms interviewed by farm type and country

Country	Number of sheep farms					Total n. of farms per country
	Intensive		Extensive		Dual Purpose	
	Milk	Meat	Milk	Meat		
Greece	4	0	4	1	6	15
Finland	0	2	0	5	3	10
France	0	3	10	5	0	18
Italy	0	0	4	3	4	11
Spain	11	0	7	9	0	27
Turkey	1	10	9	6	15	41
UK	1	4	1	12	4	22
Total n. of farms per type	**17**	**19**	**35**	**41**	**32**	**144**

Table 3. Number of goat farms interviewed by farm type and country

Country	Number of goat farms					Total n. of farms per country
	Intensive		Extensive		Dual Purpose	
	Milk	Meat	Milk	Meat		
Greece	3	0	4	1	2	10
Finland	0	0	0	0	0	0
France	3	0	4	0	0	7
Italy	2	0	7	0	1	10
Spain	12	0	4	4	0	20
Turkey	6	0	8	2	11	27
UK	2	0	2	3	0	7
Total n. of farms per type	**28**	**0**	**29**	**10**	**14**	**81**

Once farmer surveys and the sustainability assessments were completed, all the data were combined into one common data base. After merging the two datasets, a procedure for checking the consistency and plausibility of the data was applied. aAt the end of the process, about 23 records were deleted, due to a mismatch between the Task 2.2 survey data and the data from the PG Tool (Task 1.3). For these farms, important characteristics included in the PG Tool were identified as missing or not reliable. As a consequence, the final dataset consists of 202 observations and about 70 variables and indicators. Each variable in the dataset was unambiguously identified by a name and a label and provided with an explanation. The data set provides information at the farm level on structural and managerial characteristics, as well as information on farm multidimensional sustainability. The data considered in our analysis are classified as follows:

Socio-demographic data

Age: farmer's age in year.

Gender (dummy variable): farmer's gender (male).

Education (dummy variables): farmer's level of general education. The four mutually exclusive categories considered are: no formal education; up to 13 years of formal schooling; university degree; doctoral degree.

Agricultural education (dummy variable): if the farmer has formal education related to agriculture or animal production (e.g. professional training or higher education)

Experience: Farmer's number of years in agriculture.

Experience goat/sheep: Farmer's experience in small ruminant (goat/sheep) production, in number of years.

New entrant (dummy variable): if the farmer is a new entrant (i.e. the farmer's family had not been in farming in the past)

Table 4. Descriptive statistics for socio-demographic characteristics considered in the analysis.

Variable	Mean*	Standard deviation	Min	Max
Age (year)	45.99	10.360	23	74
Gender (male)	0.88	-	0	1
Education				
no formal education	0.11	-	0	1
up to 13 years	0.61	-	0	1
university degree	0.27	-	0	1
Ph.D.	0.01	-	0	1
Agricultural education	0.64	-	0	1
Experience in farming (years)	21.45	12.415	1	65
Experience in goats and sheep husbandry (years)	21.31	12.982	1	65
New entrant	0.27	-	0	1

**Means and standard deviations are provided for continuous variables only; relative frequencies are provided for dichotomous variables.*

Table 4 shows that the vast majority of the goat and sheep farmers were well educated, relatively young males. However, around one out of ten farmers surveyed had no formal education. The breakdown of the educational qualifications of the respondents shows that more than half of them had completed high school, while a little more than on fourth had attained a degree. Most of the farmers exhibited long-lasting farming experience, most of which is specifically in goat/sheep husbandry. Only less than one third of the respondents reported themselves to be a new entrant in the sector (first generation farmer), the majority had a family background in farming.

Geographic and site-specific data

Less favoured area (dummy variable): if at least 50% of the farmland is located in an area classified as Less Favoured.

Nitrogen vulnerable zone (dummy variable): if at least 50% of the farmland is located in an area classified as Nitrogen Vulnerable.

Rainfall: mm of rainfall per year

Farm altitude: average farmland altitude, measured in metres above sea level.

Bad weather conditions (dummy variable): if the farmer declares the presence of weather conditions which could negatively affect the farm management (e.g. drought, heavy rain, flooding)

Presence of predators (dummy variables): if the farmer declares the presence of predators on the farm that could have implications for farm management (e.g. wolves, bears, other predators).

Table 5. Descriptive statistics for geographic and site-specific characteristics considered in the analysis.

Variable	Mean*	Standard deviation	Min	Max
Less Favoured Area	0.68	-	0	1
Nitrogen Vulnerable Zone	0.36	-	0	1
Rainfall (mm/year)	543.52	387.79	0	1 733.30
Farm altitude (m.a.s.l.)	514.73	528.15	0	2 800.00
Bad weather conditions	0.83	-	0	1
Presence of predators	0.40	-	0	1

**Means and standard deviations are provided for continuous variables only; relative frequencies are provided for dichotomous variables.*

As are most sheep and goat farms in Europe, the majority of the farms considered in the survey were located in less favoured areas (Table 5). Due to the wide geographical distribution, both the altitude and the average precipitation show a high degree of variability among the farms. The rainfall ranged from 0 to 1,733 mm/year, as expected given the high variation across countries. The vast majority of the goat and sheep farmers stated they had problems with specific weather conditions, such as drought and heavy rain, while less than half of the farmers declared to have problems with predators (mainly wolves).

Structural data

- *Farm size:* total agricultural area in hectares (includes land owned or rented by the farm plus the common land). Breakdowns are also provided for the following categories: (i) total owned/tenanted agricultural area, which includes: total arable area (arable used for forage production and arable used for other crops) and permanent pasture; (ii) common land.
- *Land use indicators:* other farm size and land use indicators considered in the dataset are the following: (i) share of arable area over total agricultural area (%); (ii) share of common land over total agricultural area (%).
- *Herd size (LU):* farm number of goat and sheep livestock units;
- *Transhumance (dummy variable)*: if the farm practices transhumance or other pastoralism activities.
- *Ownership (dummy variable)*: if at least 50% of the farmland is owned.
- *Agricultural labour units* (number) employed in the farm (farmer and farmer's family are included). One ALU corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis (i.e. 2 200 hours/year);

Table 6. Descriptive statistics for structural and managerial characteristics considered in the analysis.

Variable	Mean*	Standard deviation	Min	Max
Total agricultural area (ha)	368.12	*1061.90*	0	8 300.00
Total owned/tenanted area (ha)	109.57	*263.92*	0	2 111.27
Total arable area (ha)	40.34	*84.29*	0	733.75
Arable area – forage (ha)	28.97	*140.08*	0	1 920.00
Arable area – other (ha)	11.36	*145.91*	0	508.00
Common land (ha)	258.68	*1.033.05*	0	8 000.00
Arable area (% of total agr. area)	37.28	*42.01*	0	100.00
Common land (% of total agr. area)	29.11	*41.53*	0	100.00
Area used for fodder purpose (ha)	78.80	*243.11*	0	2 111.00
Herd size (LU)	61.16	*65.74*	2.65	371.52
Transhumance	0.31	-	0	1
Ownership	0.82	-	0	1
Agricultural labour units	1.94	-	0	12

**Means and standard deviations are provided for continuous variables only; relative frequencies are provided for dichotomous variables.*

Table 6 reports the main structural and managerial characteristics of the case study farms. The average total agricultural area of the farms included in the survey is above 350 hectares, but the case study farms were highly heterogeneous with a standard deviation which is almost three times the mean. More than eight out of ten farmers owned more than half of the land they farm. Common land represents more than 2/3 of the total agricultural land, with about one third of farms having access to common land for grazing. As for the herd size, the average number of animals per flock is 412. No substantial differences were found between sheep and goat farms in term of herd size distribution. Around one third of the farms practice transhumance or other pastoral activities. On average, each farm had 2 full-time-equivalent workers, including both labour supplied by family members and hired labour.

Managerial data

- *Organic (dummy variable):* if the farm participates in the organic certification scheme.
- *Other certification (dummy variable)*: if the farm participates in one of the EU certification schemes (i.e. PDO, PGI, and TSG).
- *Agri-environment (dummy variable)*: if the farm participates in one of the RDP agri-environmental scheme's measures.
- *On-farm processing (dummy variable)*: if the farm has processing activities such as cheese making or meat processing.

- *Lambing frequency (dummy variables)*: the average lambing or kidding frequency. The three mutually exclusive categories considered are: once a year; three times every two years; twice a year.
- *Lambing system (dummy variables)*: lambing/kidding system adopted by the farm. The three mutually exclusive categories considered are: lambing/kidding in the shed; lambing/kidding on pasture; mixed lambing/kidding system.
- *Production equipment (dummy variables):* if the farmer uses specific production equipment on his farm. The equipment considered are: mechanical milking; automatic feeding; artificial suckling; artificial insemination; embryo transfer; none).
- *Type of market outlet for processed products (dummy variables)*: the categories considered are: i) direct sales, ii) small shop, iii) big retail company, iv) online sales, v) other.

Table 7 - Descriptive statistics for managerial data considered in the analysis.

Variable	Relative frequency of the X=1 outcome
Organic	0.20
Other certification	0.21
Agri-environment	0.80
On-farm processing	0.38
Type of market outlet	
direct sales/farmer's market	0.53
small shops	0.13
contract with retail company	0.23
on-line sales	0.08
other (e.g. cooperatives)	0.29
Lambing frequency	
once a year	0.69
three times every two years	0.19
twice a year	0.12
Lambing system	
lambing in the shed	0.82
lambing on pasture	0.10
mixed (pasture and shed)	0.07 work on farm

The vast majority of case-study farmers participate in agri-environmental schemes; of these, only one out of five are currently managing their land according to the EU organic regulation (Table 7).

On farm processing (e.g. cheese making; on farm meat processing) is diffused. However, the majority of those who process milk on farm do not implement any EU quality schemes related to the origin of the products. The adoption of EU quality schemes, such as the PDO, PDI and TSG, is relatively low on all farms surveyed represent the vast majority. As for the type of market outlet for processed products, about half of the farmers reported using either direct sales on farm or farmers' markets, while sales through other channels such as farmer's cooperatives were used by around one third of the respondents. Other sales channels were more uncommon. With respect to the lambing system, only about 1 out of three farms practiced the accelerated lamb production, which consist in lambing more than once a year (i.e. three time every two year or twice a year), while the majority of farmers practiced the regular annual lambing system (once a year). The great majority of the farms raise their sheep and goats in farm flocks where shed lambing is the norm, while about one out of ten adopt a pasture lambing and only 7% a mixed lambing system (shed and pasture). A large

number of sheep and goat dairy farms adopted mechanical milking, though still one third milk their flock by hand. Automatic feeding, artificial suckling and artificial insemination were used by intensive dairy farms mainly.

Economic data

- *Revenues*: total revenue in euros per year. Breakdowns are also provided for the following revenue categories: revenue from goat/sheep activities, revenue from CAP, revenue from other farm enterprises. Revenues in local currency (Pounds and Turkish lira) were converted to euros using the official BCE exchange rate (average over the previous year);
- *Costs:* total costs for feeding in euros per year, total cost for veterinary services in euros per year. Costs in local currency (Pounds and Turkish lira) were converted to euros;
- *Purchased concentrate* (tonnes/year): the total amount of concentrate purchased by the farm over the period considered, in tonnes per year;
- *Purchased forage* (tonnes/year): the total amount of forage purchased by the farm over the period considered, in tonnes per year;
- *Fuel consumption* (litres/year);
- *Electricity consumption* (kWh/year);

Table 8. Descriptive statistics for economic and marketing information considered in the analysis.

Variable	Mean*	Standard Deviation	Min	Max
Total revenue (euros/year)	157 612.30	*228 088.60*	4,366.80	2 058 472.00
Revenue from goat/sheep (euros/year)	100 705.10	*154 021.30*	0	1 088 529.00
Revenue from CAP (euros/year)	29 963.42	*62 494.59*	0	581 304.00
Revenue from other farm enter. (euros/year)	11 685.64	*37 726.11*	0	354 500.00
Total costs for feeding (euros/year)	35 008.60	*63 810.89*	0	367 000.00
Total cost for veterinary services (euros/year)	3 301.16	*7 519.76*	0	60 424.31
Purchased Concentrate (tons/year)				
Purchased Forage (tons/year)				
Fuel consumption (litre/year)	2 673.47	*4 455.18*	0	28 245.00
Electricity consumption (Kw/year)	11 168.45	*26 743.05*	0	200 000.00

**Means and standard deviations are provided for continuous variables only; relative frequencies are provided for dichotomous variables.*

The average total agricultural yearly revenue of the farms surveyed was relatively high, but with high variability: case-study farms included part-time farmers whose revenues amounted to few thousand euros, to large farms with thousand heads and with revenues above one million per year. Income from goat and sheep livestock formed the major source of farm household income for most

of these farms. The average revenue from CAP subsides amount to little less than 30 thousands euro per year, while average revenue from other sources was quite low. Table 8 shows the other economic indicators used in this study, including economic data concerning input consumption and costs, such as the total amount of purchased feed (concentrate and forage) and the total amount of fuel and electricity consumptions.

Results

Results of the qualitative analysis

The results of the interviews show that the **improvement of the market** for sheep and goat products was the most common priority that was identified by the interviewed farmers, across the board. On-farm diversification, in particular processing and direct selling, seem to represent a valuable source of income for most farmers, helping them to continue the agricultural production activity. Interestingly, many farmers consider increasing training opportunities as crucial for postproduction operations, including processing and marketing. Training in livestock and farm management was of secondary importance. Also, as suggested by the farmers there is a strong case for more investments in the wool sector as a response to the decrease in lamb meat consumption which is occurring in most of the countries involved.

With respect to **farm and livestock management**, on the one hand extensive and organic producers frequently reported low production costs and good animal health. On the other hand, a number of sheep farmers who used to farm extensively in the past, related their decision to switch to intensive production to a lack of available land for outdoor grazing mainly. Overall, no patterns could be discovered emerging from crossing the other themes brought up by the respondents and the farm types (extensive/intensive systems).

A number of **environmental issues** emerged during the interviews, mainly related with predators and climate change. Predators seemed to represent a problem for farmers in all the countries where interviews were carried out, although with differences: farmers in the UK stated that their flock have been suffering from an increase in dog attacks and are not particularly worried about other predators, whereas wolves, foxes, bears, badgers, buzzards, ravens, crows represent a reason for concern for farmers in Finland, France, Italy and Greece. This has sometimes implications for farm management, for example some interviewed Finnish farmers have started keeping their flock inside during the summer and/or building fences.

The climate change issue is framed by the interviewed farmers in different ways. Farmers relate climate change (CC) with a number of different environmental/management problems, especially water scarcity, flooding, increased animal diseases, and manure management issues. A few interviewees believe that research could have a key role, but none of them mentioned any specific adaptive or mitigation measures that could be adopted on farm. Other farmers do not have a strong idea about CC, as they either believe that climate goes in cycles or have not observed any significant change over time.

Other relevant themes that emerged during the interviews are reported in Table 9 below, which summarises the main results from the SWOT analysis.

The above outcomes were used to narrow down the environmental and farm management issues that impact on economic sustainability and socio-demographics of the sheep and goat production sector and were also used to prepare the more extensive and focused quantitative farmer survey.

Moreover, the list of potential innovative practices identified by the farmers during the interviews and reported in AppenDix II was used to complement the list of innovations identified under Task 4.1. These innovative practices were also submitted to consumer evaluation during the focus groups in Task 2.3 (see Deliverable 2.2) and provided further information to define the design and test of innovative management practices in WP4 as well as input for the simulations to be run in WP5 on breeding strategies.

Table 9 - Results from the SWOT analysis

Strengths	**Weaknesses**
• Good technical and veterinary services • Good animal heath and welfare (extensive and semi-extensive farms, local breeds) • Low production costs (extensive farms) • Farmers' livestock management skills • Product quality, related with sustainable management practices such as grazing (especially extensive farms, organic farms)	• High labour requirements • Low margins from a supply chain perspective • High production costs (intensive farms) • Low farmers' marketing skills/knowledge • Lack of available land for grazing and new entrants • Predators (dogs, wolves, bears, badgers, buzzards, ravens, crows) • Climate change for some farmers (especially water scarcity and flooding)
Opportunities	**Threats**
• Alternative food chains and food labelling • Farm diversification (e.g. tourism) • Good market opportunities for the dairy sector • Valorisation of wool production • Being part of cooperatives and associations • Contribution to local development and to environmental conservation • Genetic improvement • Training • Increased farm self-sufficiency through on-farm production of inputs • Migrants: increase in labour availability and meat consumption	• Lack of generational turnover • Environmental campaigns and misconceptions from the public about sheep/goat farming • Urban encroachment /land being used for leisure activities • Decrease in lamb meat consumption • Decrease in farm subsidies

Farmers' development expectations and Importance-Performance Analysis

The analysis of individual MDS indicators have focussed on two aspects:

- analysis of the farmers' development expectations, in terms of changes in their perceptions of past vs future performance for each MDS indicator;
- IPA aiming to classify the MDS indicators in terms of "Keep on", "Concentrate here", "Low priority", "Over perform".

The distribution of scores for the MDS indicators in terms of past-future(expected) performance, and importance, are shown in Figure 3-5.

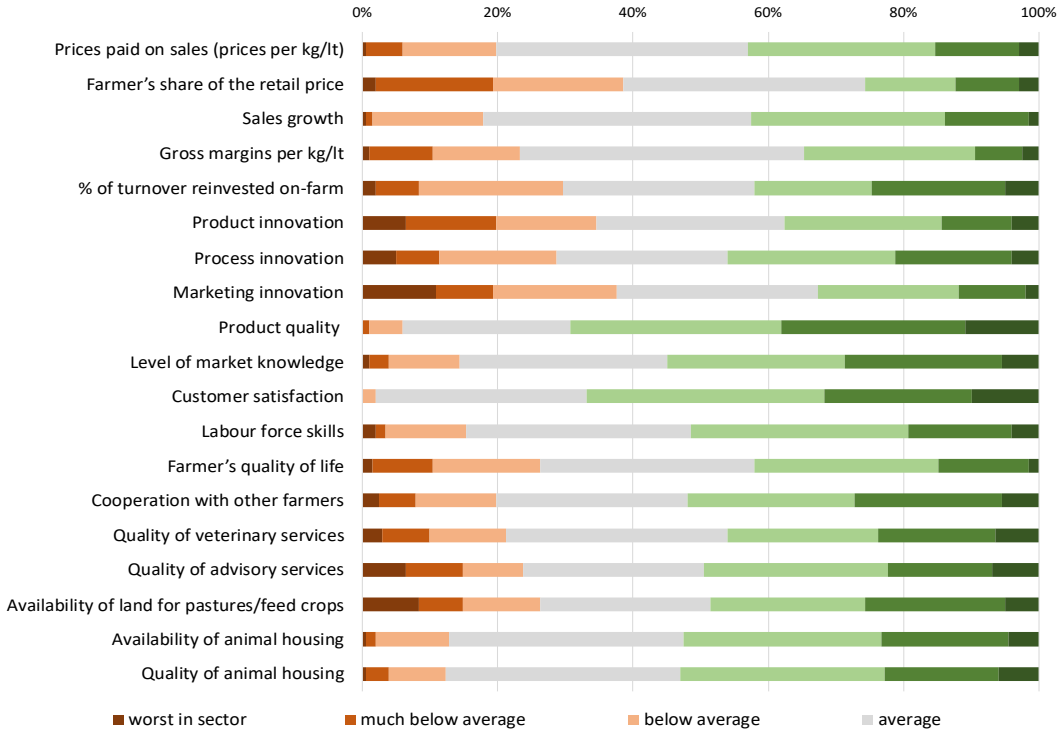


Figure 3 - Descriptive statistics for managerial data considered in the analysis.

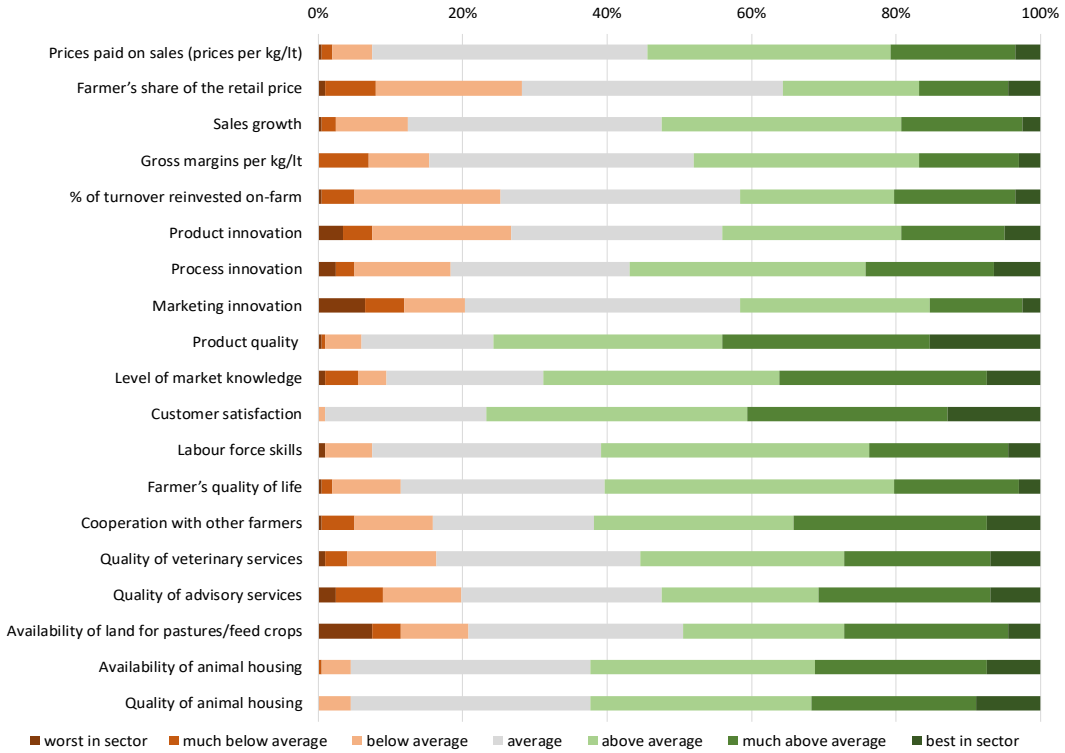


Figure 4. Distribution of farm performance scores by indicator: expected future (next five years)

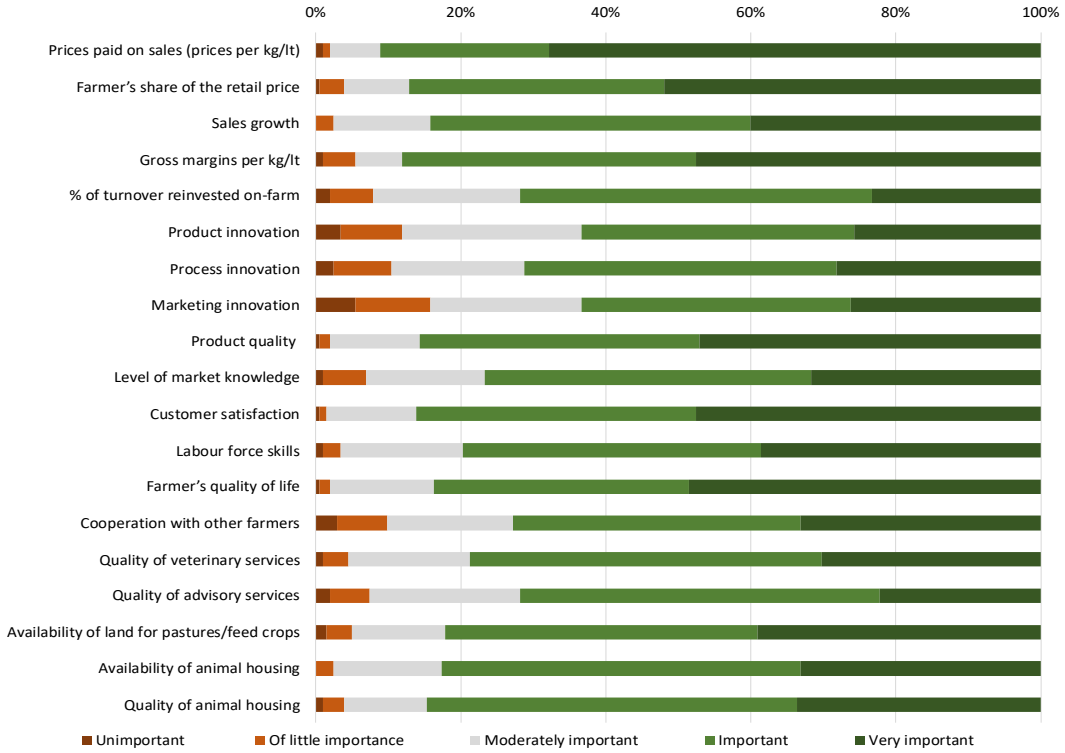


Figure 5. Distribution of importance scores by indicator

One way to analyse these scores is by performing paired t-tests for mean difference for:

1. future performance - past performance scores;

2. past performance - importance scores;

3. future performance – importance scores.

The first analysis tests if future expectations of performance are higher than the past performance.

The second tests if the past performance is higher than the importance attributed to each MDS indicator. This is basically a statistical version of Importance Performance Analysis (IPA: see below) and allows checking for statistically significant areas of improvement in the performance.

The third analysis repeats IPA on expected future performance. It tests which indicators need to be improved in the future.

Results of the t-tests are shown in Table 10.

With respect to future performance vs. past performance, all differences are positive and highly significant, with the exclusion of the last financial indicator *Percentage of turnover reinvested*, showing a general positive attitude towards the future: the performances are expected to increase in all but one area of MDS.

On the contrary, all differences with Importance scores are negative and significant. The farmers believe they are underperforming on all areas of MDS and this will continue in the future, even if they expect it will bring an increase in performance.

Table 10. Paired t-test for mean difference across indicators

Indicator	Future-Past performance	Past performance - Importance	Future performance - Importance
Prices paid on sales (prices per kg/lt)	0.34***	-1.99***	-1.65***
Farmer's share of the retail price	0.39***	-2.21***	-1.82***
Sales growth	0.21***	-1.44***	-1.24***
Gross margins per kg/lt	0.34***	-1.82***	-1.48***
Percentage of turnover reinvested on-farm	0.03	-0.96***	-0.93***
Product innovation (new product development)	0.36***	-1.16***	-0.80***
Process innovation (new production methods)	0.36***	-1.04***	-0.68***
Marketing innovation	0.42***	-1.24***	-0.82***
Product quality	0.16***	-0.84***	-0.68***
Level of market knowledge	0.27***	-.081***	-0.54***
Customer satisfaction	0.23***	-0.91***	-0.68***
Labour force skills	0.26***	-1.17***	-0.91***
Farmer's quality of life	0.50***	-1.74***	-1.25***
Cooperation with other farmers	0.28***	-0.85***	-0.57***
Quality of veterinary services	0.26***	-1.13***	-0.87***
Quality of advisory services	0.25***	-0.93***	-0.68***
Availability of land for pastures/feed crops	0.12**	-1.43***	-1.31***
Availability of animal housing	0.31***	-1.05***	-0.74***
Quality of animal housing	0.34***	-1.05***	-0.72***

*** P-value<0.01 **P-value<0.05 *P-value>0.1

Another way to analyse the scores is by Importance Performance Analysis (IPA).

In this study IPA was performed considering as crossing points the three main options: the scale-mean, the sample-mean and the sample-median. The Likert scales for importance indicators have been rescaled in order to be directly comparable with those of the performance scores. In general, scores for importance in our dataset are larger than those for performance, and in most of the cases are classified with a score > 4 i.e. above the crossing of the 7-points Likert scales used for evaluating the items. This result is also confirmed by the t-test comparison between the performance and importance scores: the importance scores result being statistically higher for all MDS indicators. Such a situation has a direct implication on the choice of the crossing point for IPA. The results of the IPA based on the scale-mean show a very limited differentiation, causing all the cases to fall into two categories only: "Keep on" and "Concentrate here". The IPA based on sample-mean and sample-median on the other hand yield a more diversified picture. Median and mean values, for both importance and performance scores do not show significant deviation and yield very similar results for IPA. Therefore, to avoid redundancy, the study only reports results based on crossing points defined as sample means. Table 11 show the results of IPA for the "Total" sample, and for a selection of sub-samples that were used to classify the MDS indicators according to main farms' typologies: production purpose ("Dual purpose"; "Meat"; "Dairy"), species ("Goats"; "Sheep"), and production system ("Intensive"; "Extensive"). Figures 6 to 13 provide a graphical representation of the results grouped in their dimensions (Financial performance; Customer/Market, Learning & Growth; Internal Business Process: for better readability, the analysis of the dimensions of market/customer and innovation have been merged into one).

The most relevant IPA categories to consider are "Concentrate here" and "Keep on", respectively referring to critical situations where particular attention is needed to solve for inadequate performance, and to situations where good practices should be maintained and possibly reinforced.

The "Concentrate here" cases in our sample mainly refer to MDS indicators of Financial performance. In particular, "Gross unit margins" and "Farmers' share of the retail price" show a critical situation in the total sample and in all the sub-samples considered in the analysis. "Price paid on sales" and "Sales growth" are also classified as critical indicators, though with some differences across sub samples. In particular, "Sales growth" is critical for the sub-samples "Sheep" and "Dual purpose", but shows better performances for the other sub-samples considered. Among the IPB indicators, "Farmers' quality of life" and "Availability of land for pasture/feed crops" are

classified as "Concentrate here": the former for the total sample and all the sub-samples considered, and the latter for the total sample, and two sub-samples only (namely "Dual-purpose", "Sheep"). Note that the only two indicators ("Sales growth" and "Price paid on sales") classified as "Keep on" in Table 11 11 lay just slightly above the crossing point threshold, i.e. just above the "Concentrate here" quadrant (Figure 6)

"Product quality" and "Customer satisfaction" show the best scores for composite Market/Customer/Learning &Growth dimension, as they are classified as "Keep on" in the total sample and in all the sub-samples. "Labour force skills", "Availability of animal housing" and Quality of animal housing" are also reported in the "Keep on" category for the total sample, though with some differences among them. "Labour force skills" in particular is classified as "Overperform" in almost all other sub-samples, showing a general positive situation in terms of performance for this indicator. The exception is represented by the "Dual-purpose" category, in which it is classified as low priority, hence showing lower-than-mean scores in both performance and importance. A similar situation is shown for "Availability of animal housing" and "Quality of animal housing", with the "Dual-purpose" farms performing worse than the other sub-samples again.

Three items are classified as "Overperform" for the Total sample, namely "Level of market knowledge", "Cooperation with other farmers" and "Quality of veterinary services".

Finally, the IPA label "Low priority" refers mainly to the Learning and Growth dimension, and to a lesser extent to the Internal Business Process. In fact, "Product innovation", "Process innovation" and Marketing innovation" are almost always classified as "Low priority". Note that these items are among the very few that, when considering the scale mean as a crossing point, turn their classification into "Concentrate here", while the majority of the other items turn their classification into "Keep on". This is due to the joint effect of low performance scores, ranking below both the sample and the (most conservative) scale mean, and the lower than average scores of importance (scoring above scale mean, but below the sample mean).

"Percentage of turnover reinvested on farm" is also classified as "Low priority" for the "Total" sample, and for "Meat", "Sheep" and "Extensive" sub-samples. With the exception of the "Intensive" farm type, for the other classification criteria, this indicator is labelled as "Overperform", confirming the limited importance attributed to this indicator for most of the farm types.

Similarly, the indicator "Quality of advisory services" is classified as "Low priority" for the "Total" sample and for "Meat", "Sheep" and "Extensive" sub-samples, and as "Overperform" for the remaining ones. This result is evidence of the limited importance paid by farmers to this indicator.

In terms of farm type classification, results show that the "Dual-purpose" farms have lower performance scores than the "specialised" farms (Figures 6-9), particularly for factors that influence the financial indicators ("Gross unit margin") and the IPB indicators ("Availability of land for pasture and fodder" and "Quality of animal housing). When comparing the results by species, sheep farms perform slightly better for many of the MDS indicators (Figures 9-10). Finally, intensive farm systems show generally better results in terms of IPA (see the highest share of indicators in the "Keep on" quadrant). This result could be attributed to the higher importance scores of MDS indicators. For the extensive case, many indicators are classified as "Overperform". However, two relevant financial indicators ("Farmers' share of retail price" and "Gross unit margin") have much lower performance score for the intensive than for extensive farms.

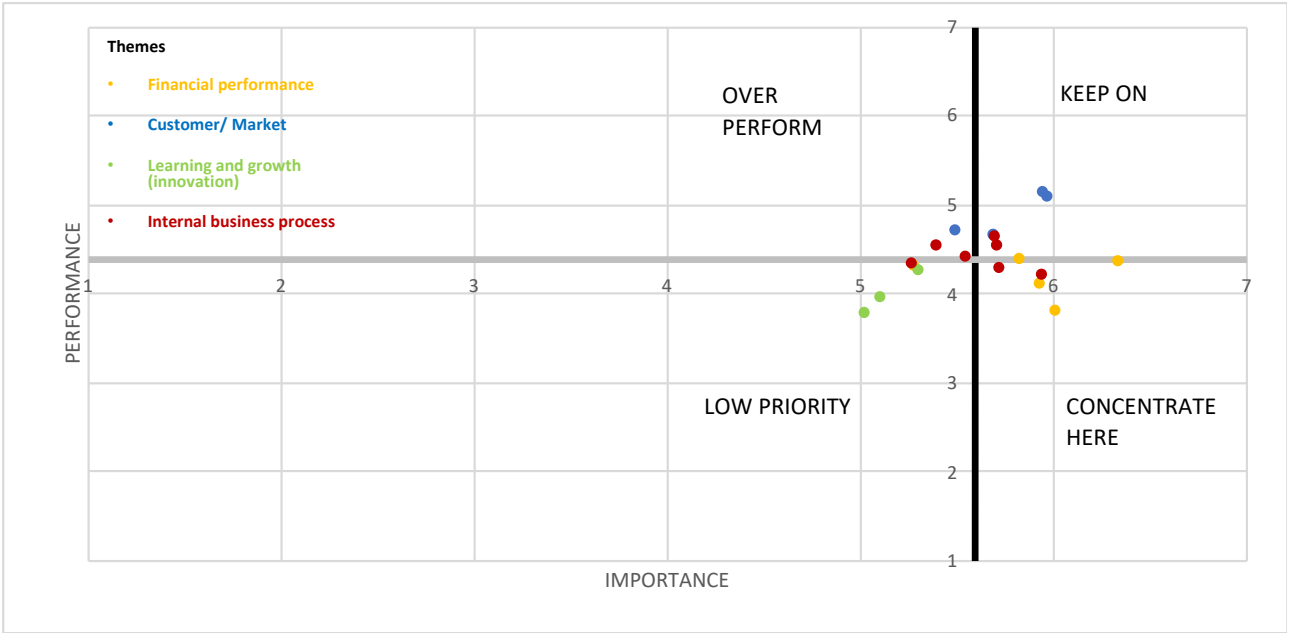


Figure 6. Importance – Performance Analysis: Total sample

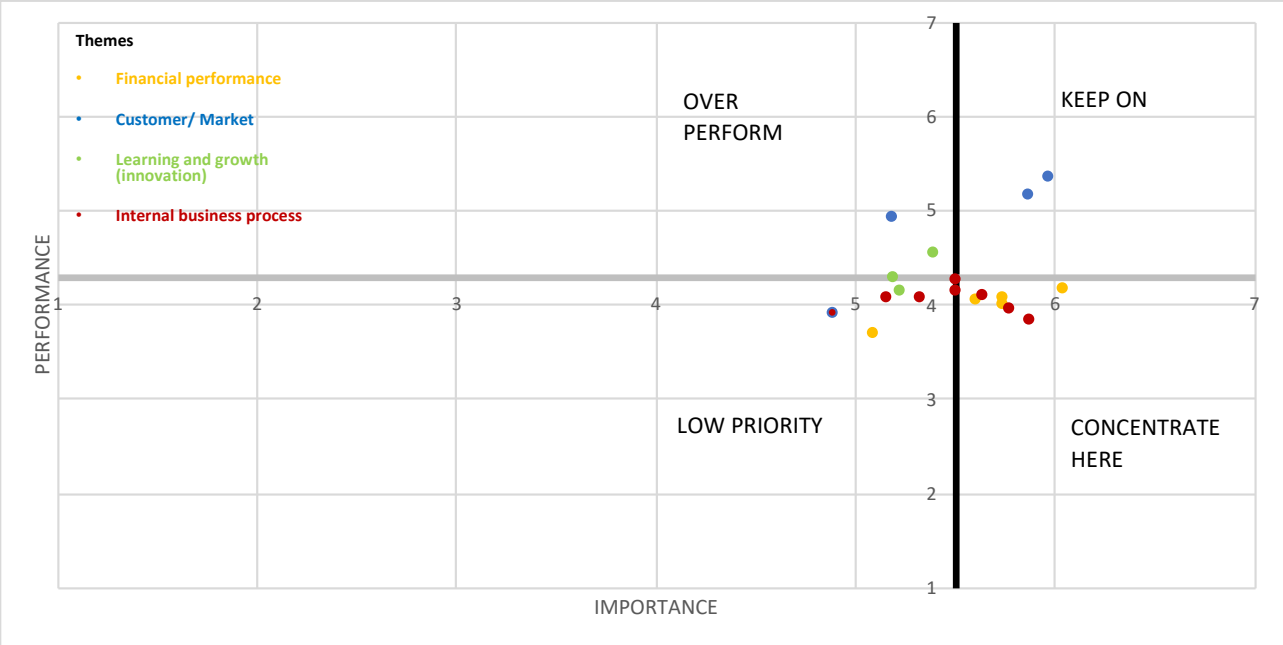


Figure 7. Importance – Performance Analysis. Sub sample: Dual purpose

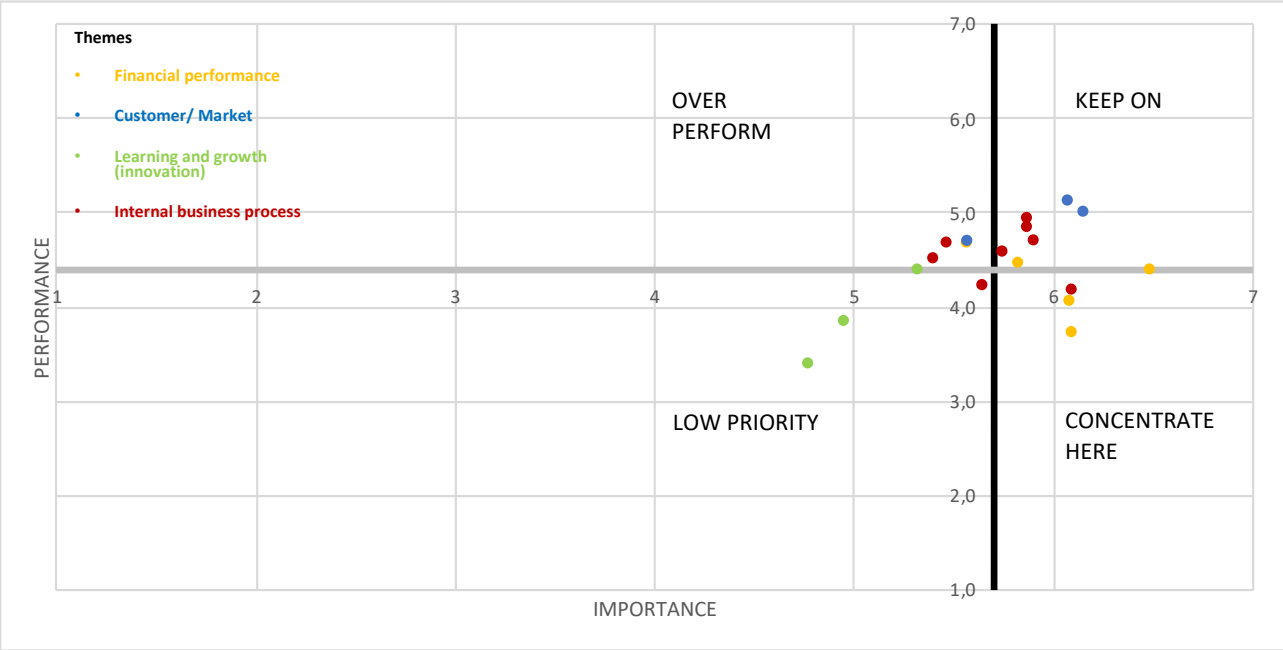


Figure 8. Importance – Performance Analysis. Sub sample: Dairy

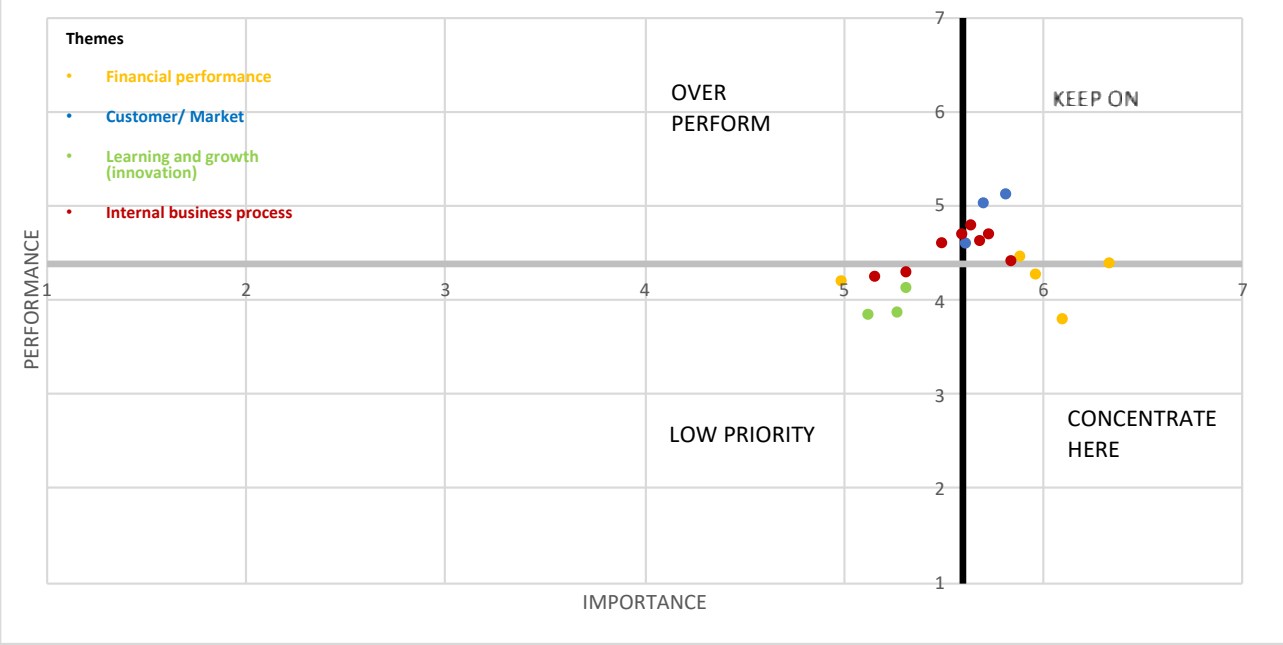


Figure 9. Importance – Performance Analysis. Sub sample: Meat

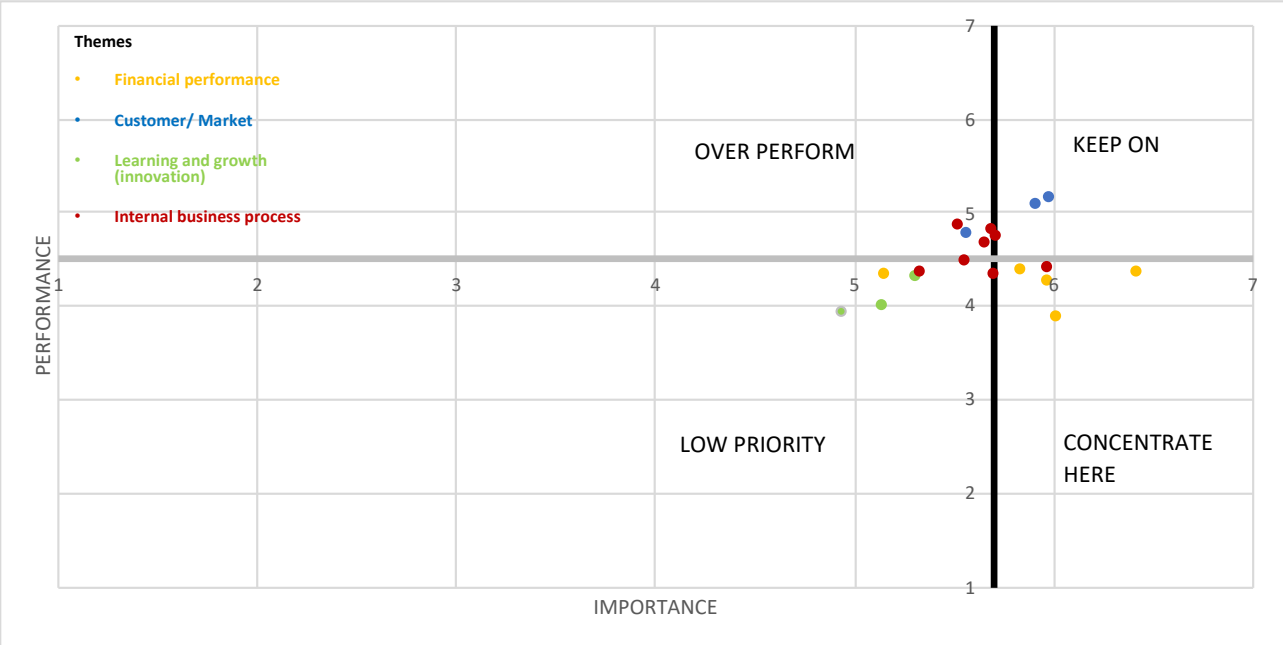


Figure 10. Importance – Performance Analysis. Sub sample: Sheep

Figure 11. Importance – Performance Analysis. Sub sample: Goats

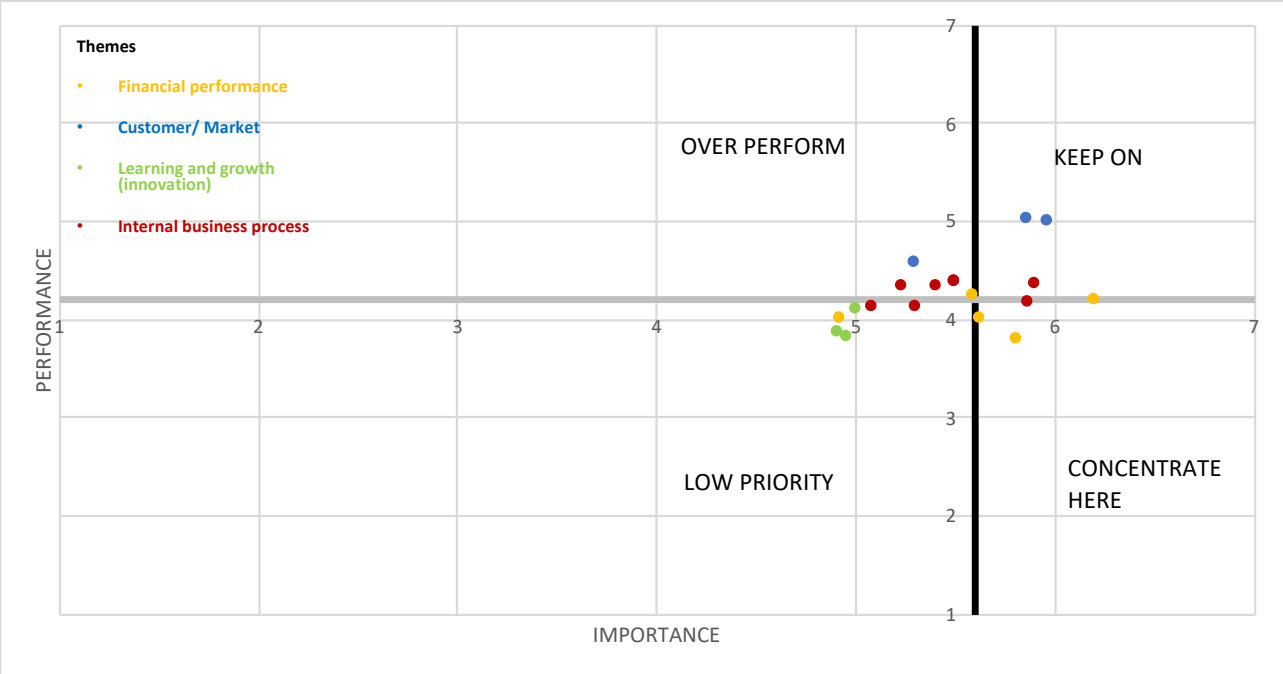


Figure 12. Importance – Performance Analysis. Sub sample: Extensive

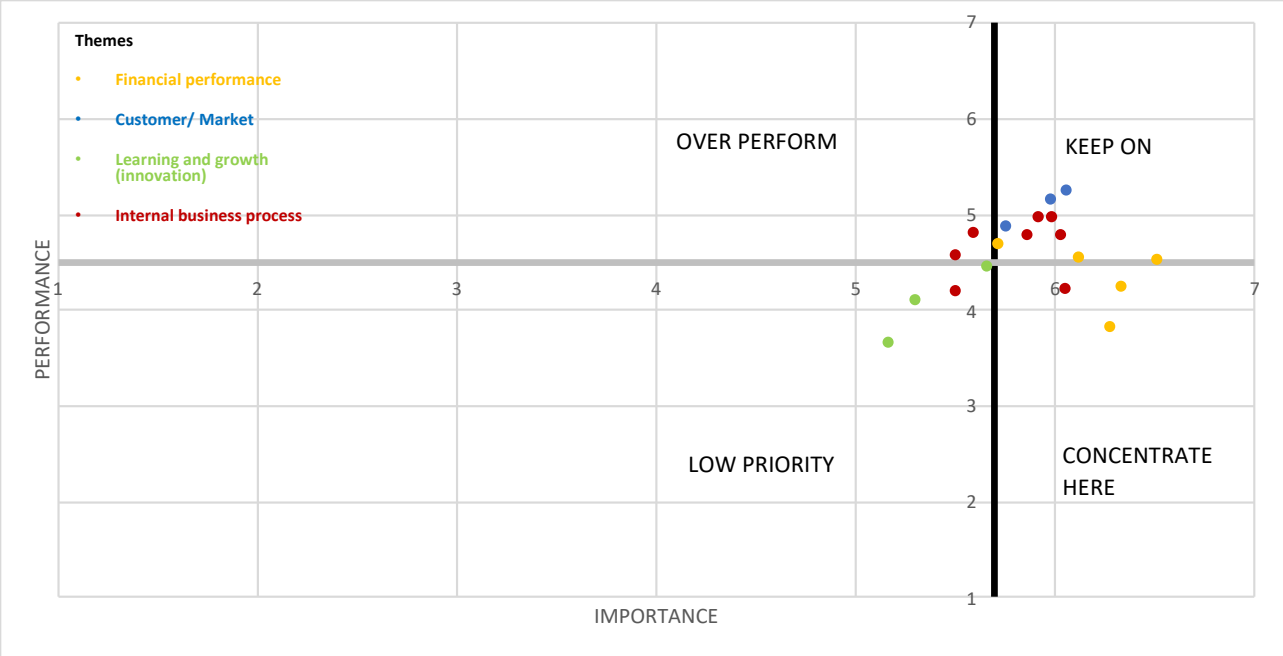


Figure 13. Importance – Performance Analysis. Sub sample: Intensive

Table 11. Importance - Performance analysis on MDS indicators (cross-point for classification: sample mean)

Theme	Indicator	Total Sample	Sub sample: Purpose			Sub sample: Species		Sub sample: System	
			Dual Purpose	Dairy	Meat	Goat	Sheep	Extensive	Intensive
Financial	Prices paid on sales (prices per kg/lt)	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Keep on	Concentrate here	Keep on	Keep on
	Farmer's share of the retail price	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here
	Sales growth	Concentrate here	Concentrate here	Keep on	Keep on	Keep on	Concentrate here	Overperform	Keep on
	Gross margins per kg/lt	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here
	Percentage of turnover reinvested on-farm	Low priority	Low priority	Overperform	Low priority	Overperform	Low priority	Low priority	Keep on
Learning&Growth (Innovation)	Product innovation	Low priority	Overperform	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority
	Process innovation	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority
	Marketing innovation	Low priority	Overperform	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority
Customer/Market	Product quality	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on
	Level of market knowledge	Overperform	Overperform	Overperform	Keep on	Overperform	Overperform	Overperform	Keep on
	Customer satisfaction	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on	Keep on
Internal Business Process	Labour force skills	Keep on	Low priority	Keep on	Keep on	Keep on	Overperform	Overperform	Keep on
	Farmer's quality of life	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here	Concentrate here
	Cooperation with other farmers	Overperform	Low priority	Overperform	Keep on	Low priority	Overperform	Overperform	Overperform
	Quality of veterinary services	Overperform	Overperform	Keep on	Low priority	Overperform	Low priority	Low priority	Keep on
	Quality of advisory services	Low priority	Low priority	Overperform	Low priority	Overperform	Low priority	Low priority	Overperform
	Availability of land for pastures/feed	Concentrate here	Concentrate here	Low priority	Keep on	Keep on	Concentrate here	Keep on	Low priority
	Availability of animal housing	Keep on	Low priority	Keep on	Overperform	Keep on	Keep on	Overperform	Keep on
	Quality of animal housing	Keep on	Concentrate here	Keep on	Overperform	Keep on	Overperform	Overperform	Keep on

Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was conducted on multi-item scales of MDS as derived from the BSC framework scales: financial, market/customer, learning and growth (innovation), internal business process (IBP, divided in two subscales). 13 out of the 19 original items were retained. The 4-factors final measurement model had close fit (χ^2 = 84.58, degrees of freedom [*df*] = 54, $p < 0.005$; Root Mean Square Error of Approximation [RMSEA] = 0.055, [C.I. 90%: 0.030–0.076]; Comparative Fit Index [CFI] = 0.955; Standardised Root Mean Square Residual [SRMSR] = 0.055). Although a 5 factor (with IBP divided in two subscales) model also had a good fit, we preferred a 4-factor model for parsimony. The second-order confirmatory factor analysis model confirmed the factorial validity of scores from the BSC-based measuring instrument (χ^2 = 88.25, degrees of freedom [*df*] = 56, $p <$ 0.004; Root Mean Square Error of Approximation [RMSEA] = 0.055, [C.I. 90%: 0.032–0.076]; Comparative Fit Index [CFI] = 0.952; Standardised Root Mean Square Residual [SRMSR] = 0.055).

Measurement reliability and validity were evaluated. Cronbach's alpha provided strong evidence of measurement reliability for all constructs, apart IPB whose alpha = 0.67 is just acceptable but above the minimum threshold of 0.63. (see Table 11 for measurement properties)

Convergent validity is supported by the high and significant standardised loadings for the measures (Anderson et al., 1988).

Multiple-group measurement invariance was tested only for two dichotomous groups, due to degree of freedom issues (there were only 190 out of 202 case study farms data with complete survey entries):

Goat (n. 66) vs. Sheep (n. 124) farms: The model exhibited good fit for configural invariance (RMSEA = 0.064 [C.I. 90%: 0.036–0.087]) and construct-level metric (equal factor loadings: RMSEA = 0.061 [C.I. 90%: 0.034–0.084]) across the two groups. The Wald chi-square (9df) = 8.69 was not statistically significant (p>0.05). Therefore, we cannot reject the hypothesis of same factor loadings for the sheep and goat farms (partial measurement invariance).

Extensive (n. 107) vs. Intensive (n. 83) farms: The model exhibited good fit for configural invariance (RMSEA = 0.064 [C.I. 90%: 0.036–0.088]) and construct-level metric (equal factor loadings: RMSEA = 0.060 [C.I. 90%: 0.033–0.083]) across the two groups. The Wald chi-square (9df) = 5.76

which is not statistically significant (p>0.05). Therefore, we cannot reject the hypothesis of same factor loadings for intensive and extensive farms (partial measurement invariance).

Table 12 - Measurement properties for the multi-item constructs: Confirmatory Factor Analysis (CFA) results.

Construct	Standard Loading	Mean	S.D.	Cronbach's Alpha
Financial performance				0.83
Price paid on sales	0.81 ***	4.35	1.15	
Farmer's share of the retail price	0.69 ***	3.81	1.35	
Sales growth	0.63 ***	4.38	1.01	
Gross unit margins	0.82 ***	4.11	1.58	
Learning and growth (Innovation)	0.59 ***			0.79
Product innovation	0.87 ***	3.95	1.51	
Process innovation	0.75 ***	4.26	1.45	
Customer/Market				0.74
Level of market knowledge	0.87 ***	5.11	1.11	
Customer satisfaction	0.66 ***	5.06	1.00	
Internal Business Process				0.67
Labour force skills	0.38 ***	4.54	1.17	
Farmer's quality of life	0.59 ***	4.20	1.25	
Cooperation with other farmers	0.51 ***	4.54	1.37	
Quality of veterinary services	0.55 ***	4.42	1.41	
Quality of advisory services	0.48 ***	4.30	1.60	

*** $p < 0.001$.

Unfortunately, for many other groupings (e.g. organic vs conventional; one lambing per year vs more than one lambing per year; farm situated in less favoured areas or not; purpose: dairy, vs. meat vs. dual purpose; geographic area; nomad vs. resident farms; owners vs. tenants; experienced vs. new entrant farmers; direct-selling vs other channels; on-farm vs. third-party processing; etc.) the measurement invariance could not be established (most likely due to degree of freedom issues) so no further testing of mean structure was possible. However, with reference with species, intensity of production method and marketing strategies, we can conclude that the tested BSC measurement model of multidimensional sustainability is not just specific to a group of farm but holds for all different groupings. In addition, these test show that the perceptions of MDS do not significantly differ between sheep and got farmers, between intensive and extensive farmers, and between those who rely on conventional whole-sale marketing channels and those who attempt to increase their economic sustainability by direct sales of their products.

For parsimony, only the tests on *past* performance perceptions were reported in the text, though future performance perceptions exhibit the same measurement properties and invariance.

Tests of latent means differences showed that:

1) sheep farmers, on average have a higher perceived MDS in all the four performance dimensions of the BSC, though the latent means where significantly different in statistical terms only for the Internal Business Process scale.

2) similarly, intensive farmers, on average, have a higher perceived MDS in all the four performance dimensions of the BSC than extensive farmers. Specifically, they exhibit statistically significant higher perceived financial performance ($p<0.06$), they feel more innovative ($p<0.08$), and have perceptions of higher IBP ($p<0.01$) than extensive farmers.

Treating past and future perception rating of the MDS indicators as repeated measures, it is possible to test if farmers, on average, have a significantly higher outlook for the future in all constructs.

The test answers the following question: "How much does the population of farmers differ with respect to average performance measures across conditions (past 5yrs/expected in the next 5yrs)?".

As was discussed when analysing individual indicators and t-tests, farmers, on average, believe they will increase their performance in all dimensions, especially in term of innovation (effect size=0.43) and finances (effect size=0.41) followed by IPB (effect size=0.38) and customer/market (effect size=0.26). These results are statistically significant, while model fit is close with the exception of IPB where the fit is just acceptable ($\chi^2 = 78.546$, degrees of freedom [*df*] = 35, $p < 0.000$; Root Mean Square Error of Approximation [RMSEA] = 0.08, [C.I. 90%: 0.057–0.105]; Comparative Fit Index [CFI] = 0.941; Standardised Root Mean Square Residual [SRMSR] = 0.108).

Conclusions

The IPA results show that the situation for the sheep and goat case study farms surveyed is generally positive with respect to the available resources, particularly in terms of skills of the labour force, availability of land, and availability and quality of animal housing facilities. However, negative results are reported for the availability of land for pasture or fodder crops. Positive outcomes are also recorded from the evaluation of some marketing themes, such as the quality of products, the knowledge of the market and the customer satisfaction. In other words, the general context, particularly in terms of farmers' skills facilities and the quality of the products, can be considered as positive for the case study farms.

However, this context is not sufficient alone to assure a sustainable financial and economic development for the sector. The worst results of our analysis are those referring to farmers' prices quota and gross margins: these are perceived as too low to ensure an adequate farm profitability. In general, the results for most of the economic indicators are characterised by low performance scores. Similarly, the indicators referring to innovation show low performance and importance scores. Process and product innovation, marketing innovation are considered as secondary importance factors. The picture emerging is that farmers do not consider these aspects as relevant, and therefore do not invest sufficient resources and managerial efforts on them.

The low priority given to the percentage of resources reinvested in the farm confirm this result. In fact, small enterprises in general, and farms in particular have limited access to external financial sources and should rely more on own resources for supporting investments and innovation processes. The low priority scores attributed to the quality of the advisory services seems to support the idea that more efforts are needed in order to stimulate farmers to adopt a more active management that could lead to fair prices and ultimately to better profitability and quality of life.

These results are confirmed by the statistical analyses. Paired t-tests confirm that the MDS and performance of case study farm is far from optimal. While the future outlook and "sentiment" of surveyed farmers is optimistic, even the perceived future performances will not match the importance that farmers attribute to each MDS indicator. In the case of investments, farmers don't seem to believe that the future will bring an increased performance. The lack of consciousness of

the urgency of increasing the share of turnover reinvested on farm, may hamper future innovation capacity and future growth. Indeed, the limited perception of the relevance of and the low priority attributed to reinvesting part of the turnover on the farm is an indicator of the lack of self-sufficiency and entrepreneurship of the small ruminants sector, and its inherent low sustainability.

The lack of sufficient data does not allow the researcher to draw statistical-sound conclusions at the country or farm-type level. However, as already mentioned, confirmatory factor analysis has shown the sheep farmers perceive their performance better than the goat farmers, and the same applies for farmers applying more intensive husbandry methods.

This study has at least two obvious limitations: it is based on a convenience sample of exemplary case study farms. Although the farms were chosen to represent broadly the various classes of the typology developed earlier in the iSAGE project (10 farm types: Task 1.1), the lack of random sampling does not allow extension of the results to the universe of goat and sheep farms. A connected drawback is the limited sample size and the many missing data. Although precise guidelines were given to data collecting partners, the objective difficulties of getting accurate responses on certain issues by farmers may constitute a partial explanation for this.

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Appendix I – Interview guide (Task 2.1)

1. Can you tell us how you happened to become a sheep/goat farmer?

Probes:

- Dig into personal and family history, if does not emerge spontaneously
- Relevance of specific events, people, institutions, and other influencing factors
- Family of origin and current family involvement in the farm
- Level of satisfaction in the farming business
- If organic farmer, explore timing of conversion and motivations behind the choice

2. Can you tell us how the local area/environment has changed since you run your farm?

Probes:

- Predators
- Pastures & forest growth, forest management, deforestation, fires
- Water management
- Soil, availability of land
- Climate change

3. How this has affected your farm and business over time?

Probes:

- Dig in: we want to know personal anecdotes, stories, relevant "real world" events, etc.

4. Can you please tell us in what you feel strong as a goat/sheep farmer? And in what weak?

Probes (be sure ALL these themes are touched upon by the farmer):

- Any special skill/ability lacking?
- Research and innovation needs (dig in: be specific)
- Training and technical advice needs

5. Can you please tell us what the main constraints for the development of your farm are?

Probes (be sure ALL these themes are touched upon by the farmer):

- Socio-economic factors: e.g. prices (of products, of feed), subsidies, consumer demand, yields, quality of meat/milk, marketing channels, age/gender/nationality of farmer, etc.
- Structural factors: e.g. availability of land, labour and other inputs, finances, training, etc.
- Supply-chain issues e.g. on-farm processing, access the market, availability of processors/jobbers, cooperation, etc.
- Farm management: pasture management, animal nutrition/feeding, animal health, diseases, vet services, etc.

6. How do you see the future of the sheep/goat farming in relation to the constraints identified before?

Probes:

- Dig in, eventually recap the constraints the farmer has identified before
- Is there something that should be done at or beyond the farm level in order to reduce these constraints and improve the overall performance of your sheep/goat farm?

7. Thinking about your future, what opportunities you see for your farm?

Probes (explore various courses of actions and their likelihood):

- Market opportunities
- Technical opportunities
- Financial opportunities
- Policy opportunities
- Natural environment opportunities

- Other

8. Thinking about your future, what threats you see for your farm?

Probes (explore various courses of actions and their likelihood):

- Market threats
- Technical threats
- Financial threats
- Policy threats
- Natural environment threats
- Other

9. Please tell us if there are any remaining issues relating to different aspects of sheep/goat farming which you think needs to be improved or studied?

(This and the following questions are just to probe if there are any further topic the farmer thinks are relevant for this study and that **have not already been mentioned before in the interview)**

10. Do you have any other thoughts?

(If yes, probe and dig in further. We don't want anything potentially relevant being missed).

11. Do you have any questions for me?

Appendix II – List of innovative practices (Task 2.1)

The following innovative practices were identified by the farmers during the interviews. This list complements the innovations identified under Task 4.1, and was circulated to the project partners before the iSAGE meeting held in Rome on 26th October 2016. The following innovations identified in Task 2.1 were also ranked by consumers during the focus groups in Task 2.3.

- Implement recording programmes and data collection gadgets for animals, economic data and sustainability assessment
- Develop new vaccines
- Reduce the use of antibiotics
- Improve pasture quality, e.g. through legumes and new sward varieties
- Develop easy programmes for checking relationships between animals, including inbreeding software for predictions, in order to reduce inbreeding
- Develop new breed traits to increase fertility, productivity and health in flocks
- Develop updated farm and livestock management handbook at regional/national level
- Training for post-production operations, including in particular processing, online selling and marketing
- Activate RDP measures to support structural changes including modernisation/enlargement of holdings for agricultural-related uses such as livestock and machinery shelters
- Reduce restrictions for post-production operations which are undertaken at farm level, including processing and direct selling (especially for small-medium farms)
- Extension of home-slaughtering (not only for own consumption) for small-medium farms
- Support and promote direct sale channels, including farmers markets, consumers groups and online selling
- Greater product differentiation on the market according to origin, production method and product characteristics
- Use milk products for cosmetics and probiotics
- Target market to consumers who do not tolerate cow milk
- Use/implement automatic milk machines (similar to robot used in dairy cattle)
- Breeding programmes to improve meat quality in order to make it more uniform, lean and tender
- New meat cuts, meat products: for example use more lamb meat in ready meals, new recipes

Appendix III: Farmers' survey (Task 2.2)

INSTRUCTIONS TO THE INTERVIEWER:

You can use this web application to collect data directly on a computer or tablet connected over the Internet.

In case you are collecting the data using the paper-and-pencil version of the survey, please then just copy the data here on the Qualtrics website: **http://tinyurl.com/iSAGE2-2**

All assessment questions should reflect the farmer's answers and judgement and not the interviewer's.

Partner's and interviewer's information

Partner organisation	
Interviewer's name	
Interviewer's phone	
Interviewer's e-mail	
Date of the interview	

Farm basic data

Country (farm)	

Farm type (using iSAGE typology)

☐ Sheep: Intensive dairy farms (e.g. high input of purchased feedstuff)
☐ Sheep: Semi-intensive or extensive dairy farms (e.g. normally pasture fed animals)
☐ Sheep: Intensive meat farms (e.g. high input of purchased feedstuff)
☐ Sheep: Semi-intensive or extensive meat farms (e.g. normally pasture fed animals)
☐ Sheep: Dual-purpose farms (farms where the farmer sees value in 2 or more different products e.g. meat and wool, meat and dairy)
☐ Goat: Intensive dairy farms (e.g. high input of purchased feedstuff)
☐ Goat: Semi-intensive or extensive dairy farms (e.g. normally pasture fed animals)
☐ Goat: Intensive meat farms (e.g. high input of purchased feedstuff)
☐ Goat: Semi-intensive or extensive meat farms (e.g. normally pasture fed animals)
☐ Goat: Dual-purpose farms (farms where the farmer sees value in 2 or more different products e.g. meat and wool, meat and dairy).

Name of the farm	

A – Socio-demographic characteristics (in case of cooperatives, the President)

Q1. Farmer's year of birth ____
Q2. Farmer's gender ☐ male ☐ female
Q3. Farmer's level of general education ☐ No formal qualification ☐ Up to 13 years of formal schooling ☐ University degree (Bachelor or Master) ☐ Doctoral degree (PhD)
Q4. Farmer's formal education related to agriculture or animal production ☐ professional training ☐ University ☐ other (please specify)_____☐none
Q5. Years in farming _____
Q6. Farmer's experience in small ruminants (goat/sheep) production? (years) _____
Q7. Farmer's agricultural background ☐ farmer's family has been in farming in the past ☐ new entrant (first generation farmer)

B – Marketing characteristics

Q8. Type of market outlet for processed products (if any) ☐ direct sales/farmer's market ☐ small shops ☐ contract with retail company ☐ on-line sales ☐ other (please specify)_____

C – Geographic characteristics

Q9. Weather conditions which (could) affect the farm management

	Now	In the future
none	☐	☐
drought	☐	☐
heavy rain	☐	☐
flooding	☐	☐
other (please specify) _____	☐	☐
other (please specify) _____	☐	☐
other (please specify) _____	☐	☐

Q10. Predators that have implications on farm management at present

☐ wolf ☐ bear ☐ other (please specify)_____ ☐none

Q11. Does the farm practice any transumance/pastoralism activities?

☐ yes ☐ no

D– Farm management practices

Q12. Lambing / Kidding system – frequence

☐ once a year

☐ three times every two years

☐ twice a year (accelerated)

Q13. Lambing / Kidding system

☐ lambing in the shed ☐ lambing on pasture ☐ other (please specify)_____

Q14. Use of production equipment

☐ mechanical milking ☐ automatic feeding/round feeder

☐ artificial suckling ☐ artificial insemination ☐ embryo transfer

☐ other (please specify)_____ ☐none

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E– Farm performance

ASK THIS QUESTION TO THE FARMER USING EXACT WORDING **"Please rate the following performance aspects while thinking to your own farm relative to the average industry performance:"**	**Performance in the last five years compared to the goat/sheep sector***							**Expected performance in the next five years compared to the goat/sheep sector***							**Importance for your current business**				
	Worst in sector	Much below average	Below average	Average	Above average	Much above average	Best in sector	Worst in sector	Much below average	Below average	Average	Above average	Much above average	Best in sector	Unimportant	Of little importance	Moderately important	Important	Very important
Prices paid on sales (prices per kg/lt)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Farmer's share of the retail price	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sales growth	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gross margins per kg/lt	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Percentage of turnover reinvested on-farm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Labour force skills	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Farmer's quality of life	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Product innovation (new product development)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Process innovation (new production methods)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Marketing innovation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Product quality	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Level of market knowledge	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Customer satisfaction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cooperation with other farmers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Quality of veterinary services	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Quality of advisory services	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Availability of land for pastures/feed crops	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Availability of animal housing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Quality of animal housing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

*** select goat or sheep as appropriate**