Review of the measurement of dynamic capacities: a proposal of indicators for the sheep industry

Revisión de la medición de capacidades dinámicas: una propuesta de indicadores para el sector ovino

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Abstract

The sheep industry is one of the leading sectors in the Castilla-La Mancha economy in Spain. It occupied the fourth position in the European context in 2017. The income of this sector stems mainly from the sale of milk and derived products with PDO (protected designation of origin) as the “Manchego cheese” that generated 61.21% of the economic value of the PDO products in Spain during 2016. However, nowadays these farms need to develop management skills to improve their competitiveness as they suffer from lack of adequate managerial performance. These circumstances joined to the fall in the prices of milk used for PDO and the increase in the cost of animal feed is generating viability problems. Considering the above, the aim of this research consisted in identifying a group of indexes that allow measuring dynamic capabilities in the sheep industry. From the methodological perspective, a revision of the academic literature in dynamic capabilities was carried out, and specific potential indicators for the sheep management industry have been identified to measure these capabilities. As a result, 54 indicators have been identified and justified to measure different kinds of capabilities. To conclude, it should be noted that these indicators constitute a standard for managers to measure, diagnose and make decisions focused towards improving farm management.

Keywords: dairy farms, innovation, management, milk products, sheep

Resumen

El sector ovino es uno de los principales sectores que impulsan la economía en Castilla-La Mancha. Así, en 2016 la denominación de origen protegida (DOP) “queso manchego” generó el 61,21% del valor económico de los productos con denominación de origen en toda España. Sin embargo, actualmente las explotaciones adolecen de un adecuado desempeño gerencial que, unido a la caída en el precio de la leche destinada a la DOP y el aumento en el coste de alimentación del ganado, está generando problemas de viabilidad. Teniendo en cuenta esta problemática, el objetivo de este trabajo consiste en identificar un conjunto de indicadores que permitan medir capacidades dinámicas en el sector ovino. Desde la perspectiva metodológica, se ha realizado una revisión de la literatura en capacidades dinámicas y se han determinado potenciales indicadores propios de la gestión ovina que permitan medir dichas capacidades. Como resultado, se han identificado y justificado 54 indicadores para medir los distintos tipos de capacidades. A modo de conclusión, estos indicadores constituyen un referente para que los gerentes puedan medir, diagnosticar y tomar decisiones de mejora en la gestión de sus granjas.

Palabras clave: granjas lecheras, gestión, innovación, ovinos, productos lácteos
Introduction

The sheep sector is a strategic sector in Spain, and in particular in Castilla-La Mancha, where the Manchega sheep plays a fundamental role since it contributes to the sustainability of the population and the development of these rural areas (Ministerio de Agricultura, Pesca y Alimentación [Mapama], 2015). More specifically, the dairy sector in which this revision work is centered is continuously evolving; from January 2010 to January 2018, there has been a decrease of 19.99% in reproduction farms for milk production and mixed breeding throughout Spain. Furthermore, the number of sheep heads in Castilla-La Mancha has also been reduced by 29.9% between November 2009 and November 2017 (Ministerio de Agricultura, Pesca y Alimentación [Mapama], 2018). According to the data provided by this same source, the price of milk with protected designation of origin (PDO) in this region has fallen by 5.29% between 2016 and 2017, while the mean cost of a full animal ration in Spain has increased by 4.49% between the months of December of those same years.

Despite this adverse situation, the production of sheep milk in Castilla-La Mancha (in thousands of liters) in 2016 increased by 15% compared to the previous year (2015), and milk deliveries increased by 5.07%, being the second Autonomous Community that carries out most of the deliveries in Castilla y León. The liters of sheep milk declared as a direct sale by the producers in Castilla-La Mancha have increased by 14.13% between 2016 and 2017; “The agricultural, livestock, forestry and fishing activities contributed 6.63% to the regional GDP in 2015. In the period from 2008 to 2015 these activities have grown economically and in productivity. Further, these are specific activities with national representativeness” (Castilla La-Mancha [CLM], 2018, page 23); this same source considers PDO products as a strength for the internationalization of products and services of Castilla-La Mancha. The response of producers to this crisis has been very different. The changes have been aimed at increasing production, skilled labor, the use of technologies, and the progressive reduction of grazing (Angón et al., 2015). These structural changes imply a risk in the viability of livestock farms since they generate an impact on their multifunctional nature and reduce the degree of complementarity existing between different activities (Ryschawy, Choisis, Choisis, Joannon, & Gibon, 2012, 2013). Hence, the implementation of process management programs (PMP) in reproduction and genetic improvement has become one of the main actions of this industry (Milan, Caja, González-González, Fernández-Pérez, & Such, 2011). In agreement with the results obtained by Morantes et al. (2017) in a study on management performance in production systems with sheep in Castilla-La Mancha, in these farms, there is a low management performance. In recent years, several studies have been conducted in this sector from different points of view. Thus, the impact of different technological packages (Rivas, Perea et al., 2015) and the influence of managerial performance (Morantes et al., 2017) have been analyzed.

According to the theory of dynamic capabilities (Teece & Pisano, 1994; Teece, Pisano, & Shuen, 1997), the deployment of these capabilities allows the development of a sustainable competitive advantage. Therefore, the aim of this work is to conduct a review of the literature on the measurement of these capabilities to identify indicators specific for sheep farms. The measurement of these capabilities will allow obtaining knowledge on the situation of each operation compared with the average and with the best practices.

Materials and methods

From the methodological perspective, a review of the literature aimed at identifying dynamic capabilities and indicators that measure these in the sheep sector has been carried out. The bibliographic sources reviewed include articles and
books located in the databases ABI, Scopus, Econlit and Web of Science from the period between years 2001 and 2017.

Besides, a review of the variables used by producers and managers of sheep farms in Castilla-La Mancha was carried out to establish an analogy with the information obtained during the assessment. These variables were justified by the review and are considered as indicators of different types of capabilities. For the analysis of the variables, the database generated between June and September 2012 was used (Rivas, Perea, et al., 2015).

Results and discussion

Dynamic capabilities

Teece et al. (1997) defined dynamic capabilities as follows:

The ability of an organization to integrate, build and reconfigure internal and external competencies to address exceedingly changing environments. A capability to be strategic, it must cover a customer need (so there is a source of income), it must be unique (so the products/services produced can be assigned a price without considering too much the competition), and difficult to replicate (so the benefits will not have competition). The key feature of a distinctive competence is that there is no market for it, except, possibly, through the business unit market. Therefore, competencies and capabilities are attractive assets that must be built because they cannot be bought (p. 516-518).

Since this term emerged, different authors have conducted research that provides new points of view. Currently, there is a consensus regarding the definition of dynamic capabilities. However, there is no consensus among different researchers concerning the types of dynamic capabilities (Monferrer, Blesa, & Ripollés, 2013) and the indicators to measure these (Wang & Ahmed, 2007).

Therefore, in this research work, the types of dynamic capabilities established by De-Pablos and López Berzosa (2012) have been adopted:

- Detection capability. Ability to detect the environment and understand the customer's needs better than the competitors (Amit & Schoemaker, 1993).
- Absorption capability. Ability to recognize the value of something new, assimilate the information and apply it for commercial purposes (Cohen & Levinthal, 1990).
- Integration capability. Ability to integrate diverse patterns of interaction through contribution, representation, and interrelation (Ohnoysen & Eisenhardt, 2002).

Measurement of detection capability

Access to adequate information is fundamental for organizations as it allows them to be in a better position to achieve a competitive advantage (Collins & Clark, 2003), by obtaining better results when identifying changes in the market and being able to respond adequately to these; hence, external social relationships of managers directly influence the detection capability (Nieves, 2014).

In this sense, the ownership of the PDO “queso manchego”, as well as the incorporation of unified feeding systems or by-products as feed for animals that allow optimizing the diets, are considered indicators of the detection capacity given that they access timely and adequate information to achieve the strategic objectives of livestock farms.

Guerras-Martín and Navas-López (2015) point out that products of companies can be described by the needs of the clients they cover and by the
technology they employ, while the markets are described by the needs they satisfy and by their target customers. Therefore, the commercialization of products such as lambs, rams, live females, live males, cheese, wool, manure or different varieties of cheese implies that a niche of customers that demanded these products has previously been detected. The same applies to direct purchase to the consumer or the wholesaler, since an opportunity has been detected through the expansion of the clients to whom it is directed and, therefore, of its field of activity.

A similar situation is what happens with agricultural products; the diet has changed, and the weight of products from agriculture has increased due to changes in the culture of society (Alfonso et al., 2001, Cussó, 2005), so those farms that have a surface for agricultural use and employ it for food production are responding to a need detected in society. In previous cases, the ability to understand the environment and the needs of customers has been developed (Amit & Schoemaker, 1993).

Rubino, Pizzillo, and Masoero (2010) relate the intrinsic quality and nutritional content of milk and cheese with the type of management and establish that it is higher in the case of grazing animals without supplements compared to stabling animals with supplements.

Although the operations assessed in this work do not have modern information systems such as Big Data that allow these to conceive new businesses according to customer needs (De-Pablos, López-Hermoso, Martín-Romo, & Medina 2013), the availability of records provides them with sufficient information regarding which products have a higher demand and how their demand evolves. This allows them to analyze the information and detect niches of customers whose needs have not been met.

Through planning, organizations seek to adequately use their resources to meet the needs of customers (Guerras-Martín & Navas-López, 2015). Carrying out reproduction planning involves an analysis of the market and, in this way, establish how many animals will be needed to satisfy the demand or what quality features the animals must meet so that the customers value the final product. Thus, the planning of the reproduction would facilitate the adaptation of the operation to the future needs of the customers. The planning of any organizational process is based on the initial detection of needs, in order to achieve the strategic objectives of the organization (Araya-Leandro, 2017). Table 1 shows the detection capability indicators proposed and the authors that support these.

**Measurement of absorption capability**

The measurement of absorption capability has largely been studied. Several authors such as Aragón and Rubio (2005), Minbaeva, Pedersen, Bjorkman, Frey and Park (2003) and Murovec and Prodan (2009) conclude in their research that the level of absorption capability improves with human resources management practices, e.g., training.

Likewise, the studies carried out by Rasli, Madjid and Asmi (2004, cited by González and García-Muñá, 2011) and Aragón and Rubio (2005) show that recruitment and selection processes are decisive in the absorption capability of organizations.

Authors such as Li (2007), Easterby-Smith and Lyles (2011), Ebers and Maurer (2014) and González-Campo and Hurtado (2014) emphasize that access to external information sources is directly related to the absorption capability, as it allows organizations to gain access to valuable external knowledge. Therefore, access to external information sources (e.g., livestock farmers, guilds, professionals) and the use of advisors on essential aspects of their activity, the conditions of such advisory services and the frequency of these, are indicators of absorption capability in livestock farms. Table 2 shows the indicators of absorption capability proposed and the authors that support these.
### Table 1. Detection capability indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement scale</th>
<th>Autores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the sheep farm belong to the PDO?</td>
<td>0: No / 1: Yes</td>
<td>Amit and Schoemaker (1993), Collins and Clark (2003), Nieves (2014)</td>
</tr>
<tr>
<td>Do you use unifeed as an integral feeding system?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you use by-products as animal feed?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you sell directly to the consumer or the wholesaler?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you sell different varieties of cheese?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you sell lambs?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you sell rams?</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>sold per farm, 4 quartiles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>are established, and numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4, 3, 2 or 1 are assigned</td>
<td></td>
</tr>
<tr>
<td></td>
<td>according to the amount</td>
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<tr>
<td></td>
<td>in the first (largest sale)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or fourth quartile (lowest</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sale)</td>
<td></td>
</tr>
<tr>
<td>Male_sale_life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese_sold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wool_sold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manure_sold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you take advantage of the natural resource through grazing? What type</td>
<td>0: No / 1: Yes</td>
<td>Rubino, Pizzillo and Masoero (2010)</td>
</tr>
<tr>
<td>of grazing do you use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have an area for agricultural use? Is agriculture used for food</td>
<td>0: No / 1: Yes</td>
<td>Alfonso et al. (2001), Amit and Schoemaker (1993), Cussó (2005)</td>
</tr>
<tr>
<td>production?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the reproduction planned?</td>
<td>0: No / 1: Yes</td>
<td>Araya (2017), Guerras and Navas (2015)</td>
</tr>
<tr>
<td>Do you maintain records?</td>
<td>0: No / 1: Yes</td>
<td>De-Pablos et al. (2013)</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors
Table 2. Absorption capability indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement scale</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you carry out training?</td>
<td>0: No / 1: Yes</td>
<td>Aragón y Rubio (2005), Minbaeva et al. (2003), Murovec y Prodan (2009)</td>
</tr>
<tr>
<td>Do you select personnel?</td>
<td>0: No / 1: Yes</td>
<td>Aragón and Rubio (2005), González and García-Muiña (2011)</td>
</tr>
<tr>
<td>Do you employ advisors?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Type of advisors</td>
<td>0: None / 1: Reproductive and genetic / 2: Sanitary / 3: Genetic</td>
<td></td>
</tr>
<tr>
<td>Advisory conditions</td>
<td>0: None / 1: Partnerships / 2: Commercial / 3: Undefined</td>
<td></td>
</tr>
<tr>
<td>Do you belong to a guild?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors

Measurement of integration capability

As De-Pablos et al. (2013) stated: "knowledge is the information set in the context of an experience, which can be personal or collective" (p 43). Bravo-Ibarra and Herrera (2009) considered that knowledge management and organizational routines establish the company's integration capability and point out that good practice is the use of technology to transfer knowledge. Currently, information technology systems provide mechanisms for strategic management decisions (Petter, Delone, & McLean, 2012; Shahbazi, Haghshenas, Nasiiriyan, & Sadeghzadeh, 2016) and to integrate external knowledge into the activities of organizations (Materia, Pascucci, & Dries, 2017).

Consequently, an event registration system in livestock farms can be considered as a database that stores relevant information in the operating process of these types of operations. This database allows the use and exchange of information through employees (Bravo-Ibarra & Herrera, 2009) and, subsequently, it can be used for decision making; this information becomes part of the operation, not of the individual, and can lead to changes in existing organizational routines or the design of new ones. The use of this information increases its efficiency,
which gives rise to a better understanding of what
would be provided by each of the activities of the
livestock operation value chain separately.

The planning process refers to the definition of
the company’s objectives and the most appropriate
means to achieve them (Araya-Leandro, 2017;
Guerras-Martín & Navas-López, 2015); that
is, it includes making decisions in the present
about the future of the company, which translates
into an organizational capability of the company
(Byrd & Davidson, 2003). Managers need to
know the existing resources in the company, a
situation that impacts on the development of
dynamic capabilities (Dancels, 2010), and must
also understand the organization as a whole, as
well as its relationship with the environment
(Guerras-Martín & Navas-López, 2015), which
facilitates the coordination of employees and the
development of behavior patterns.

In this sense, the use of the technological capacity
installed in the milking room supposes a global
vision of the operation, given that information
about the number of sheep in the farm that provides
milk, the periodicity with which they must be
milked, and the available technological capacity
must be known.

For this reason, and in this research, it is interesting
to use the variables referring to the planning, plans,
and use of the technological capacity installed in
the milking room as indicators of the integration
capability.

The use of milk control as a management strategy
allows livestock farms to differentiate their
livestock by production and allows them to select
those sheep that best fit the characteristics that
milk must meet to make Manchego cheese. Also,
this strategy facilitates their comparison with
other farms to know in what situation they are.
To the extent that the farms use this management
strategy, they will integrate the knowledge acquired
about their position compared to other farms and
the features of their dairy production with the
internal knowledge they already have, and adapt
their organizational routines as a result of this
integration, through simple formal interventions,
which will make decision-making easier for
decision-makers (Bravo-Ilbarra & Herrera, 2009;
Okhuysen & Eisendhadt, 2002).

In this sense, the adaptation of the diet to the
productive state of the animals, the use of
minerals and food supplements, or the use of
food conservation methods such as silage or
haymaking to provide quality feed to livestock
at times when there is no fresh food available,
favor that the cattle operations reach efficiency
in their productive processes.

The use of ultrasound scans to identify non-
productive animals as well as the andrological
evaluation of the rams involves the integration of
that knowledge with the one that the operation
itself already has, allowing the management to make
decisions about how to use these non-productive
animals efficiently. Likewise, the use of management
strategies such as livestock, fences, rotational
or deferred grazing, among others, integrates
ecological knowledge in the improvement of
sustainable pasture management (Caballero, 2009).

With regard to the selection of animals, since 1988
a program to improve the Manchega breed is in
force aiming at “increasing milk production per
sheep and lactation, which will establish an increase
in economic profitability and sustainability of the
exploitations” (Ministerio de Medio Ambiente, y
Medio Rural Marino [MARM], 2011, p.7). Thanks
to this program, a significant increase in milk
production has been obtained (Arias et al., 2016).
In this way, the selection of the most suitable
animals for dairy production allows the farms to be
more efficient.
In all the indicated cases, it can be affirmed that these methods, techniques, and strategies are the result of the knowledge integration capability into new knowledge because it has been developed within the operation or acquired through relationships with other breeders or associations and with the existing knowledge within the operations. Further, this facilitates this knowledge becoming explicit through organizational routines (Huang & Newell, 2003). Table 3 shows the indicators of integration capability proposed and the authors that support these.

**Table 3. Integration capability indicators**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement scale</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have an event registry system (births, deaths, sales, coverage, among others), or do you consider its incorporation important?</td>
<td>0: No / 1: Yes</td>
<td>Bravo-Ibarra y Herrera (2009), De-Pablos et al. (2013), Materia et al. (2017), Petter et al. (2012), Shahbazi et al. (2016)</td>
</tr>
<tr>
<td>Do you use the information for decision making?</td>
<td>0: No / 1: Yes</td>
<td>Petter et al. (2012), Shahbazi et al. (2016)</td>
</tr>
<tr>
<td>Do you carry out the planning of the operative processes (reproduction, feeding, and health, among others)?</td>
<td>0: No process / 1: One process / 2: Two processes / 3: More than two processes</td>
<td>Araya-Leandro (2017), Byrd and Davidson (2003), Daneels (2010), Guerras-Martín and Navas-López (2015)</td>
</tr>
<tr>
<td>Do you carry out the integral planning of different areas?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you carry out a genetic improvement plan for the herd?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Is the technological capacity installed in the milking parlor fully utilized?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you carry out a primary health plan?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you carry out a hygiene plan for all areas of the farm?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Do you perform dairy control as a management strategy?</td>
<td>0: No / 1: Yes</td>
<td>Bravo-Ibarra y Herrera (2009), Huang y Newell (2003), Okhuysen y Eisendhardt (2002)</td>
</tr>
</tbody>
</table>

(Continue on next page)
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Is the diet of animals adjusted to the productive or physiological state of the animals? Do you use feed according to the animals’ productive level? 0: No / 1: Yes


Do you include the use of minerals? 0: No / 1: Yes

Do you use supplements? 0: No / 1: Yes


Do you conserve forage surpluses using silos or making hay? 0: No / 1: Yes

The use of ultrasound is a routine procedure and aimed at identifying non-productive animals? 0: No / 1: Yes

Are andrological evaluations carried out on the breeding rams in order to guarantee the fertility and capacity of the mounts? 0: No / 1: Yes

Caballero (2009), Huang y Newell (2003)

Do you establish a grazing management strategy (livestock, fences, rotational grazing, deferred, among others)? 0: No / 1: Yes

Arias et al. (2016), Huang y Newell (2003), MARM (2011)

Animal selection 0: No / 1: Yes

Source: Elaborated by the authors

Measurement of innovation capability

The establishment of strategies to improve water use efficiency and soil conservation implies the introduction of innovative processes (Deeds et al., 1999; Delmas, 1999; Lazonick & Prencipe, 2005; Petroni, 1998; Tripsas, 1997; Wang & Ahmed, 2004, all cited by De-Pablos & López Berzosa, 2012) in livestock operations, aiming at being more efficient and reducing production unit costs, so it can be considered as an indicator of innovation capability.

To the extent that livestock farms incorporate the prevention of other pathologies according to the epidemiology of the operation, they will include
improvements in the food, management and health areas (Molina, Yamaki, Berruga, Althaus, & Molina, 2010) and therefore, in processes whose purpose is the improvement of quality and production.

Arias et al. (2016), in their study on the integral quality of the manchego sheep milk, analyzed various livestock aspects and concluded that the presence of somatic cells affects the clotting time and hardness of the curd in milk. This has a direct influence on milk quality, as, at higher somatic cell count, the coagulation time is longer, obtaining lower hardness that reduces milk quality.

Based on the above, the establishment of a health control program of the udder and the milk quality introduces significant changes in the process of obtaining milk, to improve its quality and therefore, it is an indicator of innovation capability.

One of the most important aspects about the health of the sheep udder is mastitis, particularly clinical mastitis, which has the greatest impact on the profitability of livestock, as it causes a reduction in milk production and increases production costs by reducing the shelf life of the sheep. Therefore, it is necessary to increase the replacement rate of animals (Acero, 2009). Through the employment of techniques such as the drying treatment (Gonzalo, Tardaguila, De la Fuente, & San Primitivo, 2004) and the disinfection of the teat after milking as part of the cleaning protocol (Torre, 2003), the appearance of mastitis is reduced. For that reason, the introduction of these techniques is considered as process innovations.

Arias et al. (2012) analyze the impact of the lack of milking hygiene on the appearance of germs and butyric spores in milk, which affects the quality of milk and causes late swelling in cheeses. The introduction of automatic cleaning systems for milking equipment and the compliance with a cleaning protocol for the milking parlor area reduces the problems described above. Moreover, this implies an improvement in the process and are therefore included as an indicator of innovation capability.

Parasites have a negative effect on the development of sheep since they can cause diseases that also have a negative influence on the products obtained from sheep (Rodríguez-Vivas, Cob-Galera, & Domínguez-Alpizar, 2001). For that reason, the introduction of parasite controls is considered an innovation in the process to improve the performance of the entire operation.

As indicated by Rivas, De-Pablos-Heredero, Rangel and García (2015), the artificial breeding of lambs is an innovation that has not been adopted much. It is considered, therefore, that the variable “Do you have a room and equipment for artificial lamb breeding” is an indicator of innovation capability. Gibbons and Cueto (2008) pointed out that artificial insemination allows "conserving the genetic variability of the species subject to a continuous breeding process of its productive characteristics" (p. 3), which means the introduction of substantial changes in the productive process. For this reason, the variables “Do you use reproductive techniques” and “Do you implement the use of artificial insemination” will be used to measure innovation capability.

Callejo-Ramos (2001) indicates that adequate milking installations influence the maximization of milking performance and, therefore, the reduction in costs. To the extent that the provision of the milking parlor and, by extension, of the different areas of the farm facilitates animal flow and the more effective implementation of activities —and takes into account the appropriate dimension of the milking rooms as well as the dairy and refrigeration tank rooms—the costs incurred will be lower compared to those farms that have not considered this. Table 4 shows the indicators of innovation capability proposed and the authors that support these.
Table 4. Innovation capability indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement scale</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you incorporate the prevention of other pathologies according to the epidemiology of the operation?</td>
<td>0: No / 1: One pathology / 2: Two pathologies / 3: Three pathologies / 4: More than three pathologies</td>
<td>Molina et al. (2010)</td>
</tr>
<tr>
<td>Do you carry out a program to control the health of the udder and the quality of the milk?</td>
<td>0: No / 1: Yes</td>
<td>Arias et al. (2016), Molina et al. (2010)</td>
</tr>
<tr>
<td>Do you apply any drying treatment?</td>
<td>0: No / 1: Yes</td>
<td>Acero (2009), Gonzalo et al. (2004), Torre (2003)</td>
</tr>
<tr>
<td>Do you propose the use of teat disinfection after milking?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
<tr>
<td>Is the cleaning system of the milking equipment fully automatic, and is a cleaning protocol for the milking parlor area implemented?</td>
<td>0: No / 1: Yes</td>
<td>Arias et al. (2016)</td>
</tr>
<tr>
<td>Do you control internal and external parasites in the herd?</td>
<td>0: No / 1: Yes</td>
<td>Rodríguez-Vivas, Cob-Galera and Domínguez-Alpizar (2001)</td>
</tr>
<tr>
<td>Do you have a room and equipment for artificial lamb breeding?</td>
<td>0: No / 1: Yes</td>
<td>Rivas, De-Pablos-Herederro, et al. (2015)</td>
</tr>
<tr>
<td>Do you use reproductive techniques (male effect, flushing, hormonal treatments, among others)?</td>
<td>0: No / 1: One technique / 2: Two techniques / 3: Three techniques / 4: More than three techniques</td>
<td>Gibbons and Cueto (2008)</td>
</tr>
<tr>
<td>Do you implement the use of artificial insemination as a tool to enhance genetic improvement?</td>
<td>0: No / 1: Yes</td>
<td></td>
</tr>
</tbody>
</table>

(Continue on next page)
Conclusions

Although there is consensus in the academic literature on the importance of the development of dynamic capabilities to achieve sustainable competitive advantages over time, this review carried out on the measurement of dynamic capabilities reveals the diversity of studies in this field, without having defined indicators to measure these capabilities in practice.

In this work, applying the concepts of different types of dynamic capabilities of the sheep sector, 54 indicators were identified as adequate to perform this measurement. Therefore, this study offers a useful tool for the academic sector and the market that allows farms to measure their dynamic capabilities and compare them with other farms. This measurement will help them to develop active process improvement strategies to raise their market detection, absorption, integration and innovation capabilities, and in this way, improve their managerial performance and seek a better positioning in the sector.

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Disclaimers

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