A niche strategy for geographical indication products, by valorising local resources: the Greek cheese Ladotyri Mytilinis

Maria Spilioti* and Spiros Stachtiaris

Department of Agricultural Economics and Rural Development,
Agricultural University of Athens, Greece
Email: spimaria1@gmail.com
Email: spiros.stachtiaris@gmail.com
*Corresponding author

Antonios Kominakis

Department of Animal Science and Aquaculture,
Agricultural University of Athens, Greece
Email: acom@aua.gr

Pavlos Karanikolas and Konstantinos Tsiboukas

Department of Agricultural Economics and Rural Development,
Agricultural University of Athens, Greece
Email: pkaranik@aua.gr
Email: tsiboukask@gmail.com

Abstract: This study aims to develop a niche strategy for the Greek geographical indication (GI) product Ladotyri Mytilinis, through the valorisation of local resources, especially the local livestock breed. The strategy emphasises the quality, production methods, and regional identity of this product. Data were collected through a thorough literature review and field research. The specifications of the product and the valorisation of local resources can utilise the local sheep breed, its nutrition, the habitat in which it lives, the quality of its products, and the breeding system. The product is integrated into markets in multiple ways. The milk of the local breed is used in three different GI products. The governance of this geographical indication is characterised by concentration, lack of coordination and absence of a specialised collective structure. Various elements of value chain governance through contracting, network governance, and informal relationships have been identified.

Keywords: geographical indications; local breed; Lesvos Island; niche strategy; value chain; governance.

Reference to this paper should be made as follows: Spilioti, M., Stachtiaris, S., Kominakis, A., Karanikolas, P. and Tsiboukas, K. (2022) 'A niche strategy for geographical indication products, by valorising local resources: the Greek cheese Ladotyri Mytilinis', *Int. J. Agricultural Resources, Governance and Ecology*, Vol. 18, Nos. 1/2, pp.160–181.

Biographical notes: Maria Spilioti is an agronomist, and she has a Master's in Entrepreneurship and Advisory in Rural Development from the Agricultural University of Athens. She is a PhD candidate in the Department of Rural Economics and Development at the same University. She coordinates Business Plans' Development and Advisory Services in Agricultural University of Athens (AUA) for the program 'New agriculture for a new generation' funded by Stavros Niarchos Foundation. She has participated in the teaching of Agricultural Policy Course at the AUA. She has attended a series of seminars on various issues regarding agricultural marketing and entrepreneurship. Her research interests concern the field of sustainability, entrepreneurship, local development of rural areas, marketing of innovative products and techniques to improve the economy of livestock farms. The researcher has participated in many conferences in Greece and abroad on the agri-food sector.

Spiros Stachtiaris is a graduate of the Department of Food Science and Technology of the Agricultural University of Athens. He holds a Master's in 'Business Administration' and 'Integrated Rural Development and Management' and PhD on the topic of consumers' willingness to pay (WTP) to participate in the market for quality products. He holds an ISO 9000: 2000 Quality Assurance Systems Inspector Certification from the International Inspection Certification Authority [IRCA/IATCA and RAB (USA)]. He currently works at ELGO DIMITRA as the General Director of Agricultural Vocational Education and Training. He has taught the course 'Marketing Management' and 'Total Quality Management' at the University of Patras and the University of Piraeus. His scientific interests are in the fields of marketing management, rural entrepreneurship and quality assurance management.

Antonios Kominakis is a graduate of the Agricultural University of Athens (AUA). He earned his PhD in Animal Breeding from the University of Hohenheim (Germany). He is an Associate Professor of Animal Breeding in the Department of Animal Science in AUA. His research interests comprise various aspects of animal breeding such as estimation of genetic parameters and breeding values in livestock animals, design of selection schemes in livestock populations and genome-wide association studies (GWAS) aiming at the detection of functional candidate genes for quantitative traits. He is a scientific advisor of Sheep Breeders' Associations, and the author of more than 60 scientific papers in peer-reviewed scientific journals.

Pavlos Karanikolas is an Associate Professor in the Department of Agricultural Economics and Rural Development, Agricultural University of Athens. He teaches the undergraduate courses: Introduction to Economic Theory, Introduction to Agricultural Economics, Political Economy of the Agri-Food Sector, Agricultural Economics and Policy. He also teaches the graduate courses: EU Agricultural and Rural Development Policies, Development Planning and Program Evaluation. His research interests and published work include food security, transition to sustainability, agricultural economics, rural development policies, and the political economy of agriculture. He has taken part in numerous European and Greek research projects.

Konstantinos Tsiboukas is a Professor of the Laboratory of Agribusiness Management, Department of Agricultural Economics and Rural Development in the Agricultural University of Athens. He is a graduate of the Agricultural University of Athens. He has an MSc from the Mediterranean Agronomic Institute of Montpellier, DEA and a PhD in Agricultural Economics of Montpellier III University, France. He teaches farm management and economics of animal production at the undergraduate level and at the postgraduate level. His research interests focus on the techno-economic

analysis of agricultural production systems and on farm-level decision-making. He participates in research projects concerning the economic analysis of agricultural production systems and economic viability at the farm level.

This paper is a revised and expanded version of a paper entitled 'Advancing the value of local livestock breeds: the case of Greek cheese Ladotyri Mytilinis' presented at 9th International Conference on Information and Communication Technologies in Agriculture, Food and Environment (HAICTA 2020), Thessaloniki, Greece, 24–27 September 2020.

1 Introduction

Conventional economic theory usually sees products with a protected geographical indication (GI) status as a particular form of club goods (Arfini et al., 2019). However, during the last years, a growing body of literature analyses GI products by emphasising their unique identity, emanating from the nature and specificity of the resources (both human and natural) used in the production process (Belletti and Marescotti, 2009; Belletti et al., 2012). In this context, a series of significant issues come to the fore, among other things, the strategies of the relevant stakeholders, the governance of GIs, and the upgrading of the value chains of these products (Belletti et al., 2017; Carbone, 2017). A substantial part of GI products is of animal origin; therefore, local animal genetic resources play a central role in an effort of adding value to a GI product, in the management of the environment, as well as in the culture and history of their regions (Ligda and Zjalic, 2011).

Nowadays, health-conscious consumers are becoming more mindful about their food choices, seeking eco-friendly products derived from sustainable and fair food systems (Chaturvedi et al., 2021; Davies, 2020). A niche strategy can help develop foods with such product specifications (Cappelli and Cini, 2020). The niche marketing approach is a specific advertising strategy that focuses on a unique target audience, offering high-added-value products to it (Parrish, 2010); thus, it can serve as a powerful tool in an effort of valorising a GI product.

As it is well known, the COVID-19 pandemic has dramatically changed consumers' buying behaviour (Hobbs, 2020). According to Accenture (2020), after months of lockdown and social distancing, consumers tend to make more sustainable, ethical, and healthy food choices, focusing on environmental protection. Changes in consumers' eating habits are expected to be sustained in the long run (Kaiser et al., 2021). Nevertheless, as a recent study points out (EU, 2021), consumers in some EU countries have a low awareness and understanding of the GI schemes, while the EU framework does not effectively provide clear information to consumers about GIs.

As for the policy dimension, except for the existing legislative framework, various policy initiatives may impact the status of GI products. For example, the EU's biodiversity strategy for 2030 highlights the value of ecological restoration of agricultural land, recognising farmers' ability to protect and restore local breeds and crop varieties (European Commission, 2020). Likewise, the 'farm to fork' strategy and the new Common Agricultural Policy (CAP) will hopefully enhance sustainability practices, such as low-intensity grasslands and animal welfare. On the other hand, the EU legal framework for GIs does not include environmental sustainability and animal welfare

issues. However, it seems that recently such issues have started to be integrated into GI product specifications, albeit quite slowly (EU, 2021).

Therefore, there is ample scope for integrating local resources (including local breeds) into GI products and policy measures and raising awareness about these products.

Ladotyri Mytilinis is one out of 23 Greek Protected Designation of Origin (PDO) cheeses (hereafter: LM PDO) that could achieve a higher market share in niche markets (eAmbrosia – EU, 2021). This cheese is produced in a traditional manner, exclusively in Lesvos, a North Aegean Island of Greece, from the local sheep breeds milk. This breed grazes throughout the year in pastures, olive groves and marginal areas of the island (European Commission, 1994). Even though over the last years, this cheese has shown a growth trend in production and exports (ELGO DIMITRA, 2019), it does not seem to have gained the expected reputation and PDO label recognition, compared to other cheeses in Greece, such as Feta and Graviera (ICAP, 2019). This situation can be significantly improved if LM PDO is presented as a high-quality, differentiated cheese through a new strategy, focusing on niche markets, contributing to preserving the local sheep breed and protecting the natural environment.

This study aims to formulate a strategy for GI products in niche markets through the valorisation of local resources, especially the indigenous livestock breeds. LM PDO is selected as a case study because it is a high value-added product with close anchorage to a specific area and local animal genetic resources. The study's theoretical framework draws mainly on the recent literature on GI governance and connection with local resources, as well as on the field of Niche Agricultural Marketing. The article uses primary and secondary data collected after a thorough literature review and field research. The study comprises seven sections; after the introduction, the theoretical framework and methodology are exposed, followed by the case study analysis, the recommended strategy, the discussion, and conclusions.

2 Theoretical framework

Nowadays, niche markets for several livestock products are constantly growing (Hamlin et al., 2015). A niche market fulfils different needs, while the niche product must be sufficiently diversified to meet consumers' current needs adequately. Niche strategy can improve communication between producer and consumer through increased market transparency, identifying the latter's needs (Marsoner et al., 2018). Small or medium-sized enterprises usually implement niche strategies, although small producers have limited access to financial resources, and it is not easy to compete with large companies that achieve economies of scale (Lev and Gwin, 2010; Oberholtzer et al., 2014). Nevertheless, niche markets usually permit higher prices than mass markets because customers are willing to pay more to enjoy a specialised and differentiated product. The development of niche marketing requires small funds but specialised knowledge (Mathias et al., 2010; Shukla, 2014).

In order to carry out a niche strategy for LM PDO, we draw our theoretical framework on the existing literature concerning the optimisation of a GI product in terms of origin-linked quality (FAO, 2012; Barjolle et al., 2017; Vandecandelaere et al., 2021). Integral parts of such a strategy are the objectives to be achieved, the roles to be played by each stakeholder, the resources to be mobilised and a 'regional' manager who will

supervise the implementation of the strategy. Two other elements are of paramount importance in our study: first, the link of the GI product with the local resources, especially the local breed; second, the governance of both the local breed management and the GI product.

Developing specialised quality food products, which promote the conservation and protection of local animal breeds, can improve farms' economic performance and regional competitiveness. Farmers in remote rural areas can add value to their products by emphasising quality, production methods, and regional identity. This endeavour has to acknowledge that a local breed is characterised by a geographical specificity and strong relation with specific production systems. Therefore, any effort to valorise it through a GI product implies, *inter alia*: a thorough analysis of the specific characteristics of the natural environment in which the breed is raised; its production and management system; and detailed information on the quality of milk and its properties for cheese production (Ligda and Casabianca, 2013).

In addition, the promotion strategy of local breeds should focus on their role in managing natural pastures, which will relate to the preservation of biodiversity and the history and culture of a specific area. Additional elements of this strategy are the nutrition of the local breeds, which is usually based on grazing (Derkimba et al., 2008), as well as the development of breeding programs and appropriate performance-recording systems, which can enhance the value of local breeds by strengthening some of their characteristics (Derkimba et al., 2013). However, niche livestock production requires a strong commitment to overcome the expansion of high production foreign breeds and the lack of infrastructure and control mechanisms (Ligda and Casabianca, 2013).

Therefore, in trying to formulate such a strategy, we identify, firstly, some gaps that exist in the applied practices, such as at the breeding system of the local breed. Secondly, some long-term goals, e.g., the development of a collective structure, are having as the main vision the integrated promotion of LM PDO through a new dimension: the utilisation of local resources with emphasis on the strategic resource of the local breed.

Furthermore, the study of governance has to be an integral part of this theoretical framework, relating to the above complex issues and the presence of multiple actors in the LM PDO value chain, who often have different conflicting interests. According to Alvarez et al. (2010, p.166), network governance can be defined as 'the set of mechanisms that supports and sustains cooperation among participating organisations to enhance the likelihood of achieving network-level goals'. Finally, we derive valuable insights from Trienekens et al. (2017), who have elaborated a refined framework for analysing value chain governance through network governance, contracting, and informal relationships.

3 Methodology and data

Initially, a detailed literature review and desk research was conducted, which captured the product's current state, collecting secondary data. The primary data were collected through face-to-face interviews with the main players in the value chain (three heads of livestock cooperatives, three dairy owners, and twelve farmers); the research is still ongoing. The selection of these players was random and based on their role and participation in different value chain stages. In March and September 2020, the interviews took place in Lesvos Island using a detailed questionnaire allowing a thorough

techno-economic analysis at the farm/enterprise level. Different types of questionnaires were used for each level of the value chain, including custom questions about the field of the activity. The questionnaires included open-ended and closed-ended questions. The meeting was arranged by phone a week earlier. The questionnaire was first sent electronically so that the participant had the necessary time to prepare. Each interview lasted approximately three hours. As a strategic planning tool, a SWOT analysis was used, presenting the LM PDO's strengths, weaknesses, opportunities, and threats.

4 Case study analysis

4.1 Ladotyri Mytilinis PDO: the link with local resources

- *Basic Data:* Greece accounts for 9.5% of total PDO cheeses sales in the European Union, ranking fourth after Italy, France and the Netherlands (European Commission, 2020). In 2018, Greek PDO cheeses' production represented 64% of the total cheese production by industrial enterprises, with Feta cheese holding the first place, Kasseri the second and Kefalograviera the third. LM PDO ranks ninth among the 23 Greek PDO cheeses in production volume (ICAP, 2019; ELGO DIMITRA, 2019).

  Besides LM PDO, two other PDO cheeses are produced in Lesvos Island, i.e., Kasseri PDO and Feta PDO. According to ELGO DIMITRA (2019), a total amount of 342 tons of LM PDO were produced in 2018, while the production amounted to 460, 365 and 432 tons in 2017, 2016 and 2015, respectively. LM PDO's estimated exports amounted to 17.2, 17.7, 22.0 tons and 9.7 tons in 2018, 2017, 2016 and 2015, respectively (ICAP 2019; ELGO DIMITRA, 2019).

- *The history of the product:* the examined cheese achieved the PDO certification in 1996, ensuring that its production will be limited within Lesvos Island's geographical limits, utilising the local raw materials and the region's know-how. LM PDO is a traditional hard cheese with yellow colour and sharp taste, made from local sheep breed's milk or a blend with sheep's and goat's milk. Goat's milk must not exceed 30% of the total amount of milk used to make the cheese (European Commission, 1994). The island's goats do not belong to any specific local breed (Greek Ministry of Rural Development, 2015). Based on personal communication with the main players of the value chain, milking takes place twice a day and within 48 hours, the dairy undertakes the cheese-making. The milk coagulation for the cheese-making is achieved using rennet, either traditional animal type or vegetarian ones (Independent Authority for Public Revenue, 2020). It is worth mentioning that the specifications of the cheese allow its preparation with raw milk. According to Sossidou et al. (2013), the LM PDO they examined, was made with raw or pasteurised milk and had no pathogens. However, the authors refer that the animals must be healthy and hygienic conditions and maintenance time have to be observed. In practice, LM PDO is made mainly from pasteurised milk to ensure human health. The salting of the cheese is done with sea salt from the bay of Lesvos, named 'Kaloni'. The maturation of the cheese lasts for three months on wooden shelves (Qualigeo.eu, 2020; Interview with Ioannis Hadjigeorgiou, Agricultural University of Athens, 16 June 2021). The name of the cheese derives from the way it was

preserved in the past; the cheese was stored in clay pots filled with local olive oil from Lesvos (Walker, 2003). Nowadays, few dairies use olive oil as a means of preserving cheese. Due to the mass production and standardisation of cheese, the oil has now been replaced by paraffin wax. In the cheese specifications, there is no reference to olive oil or paraffin regarding the preservation of the cheese. The cheese is made strictly according to the specifications of PDO. LM PDO is marketed mainly in vacuum packages of 1 kg, 500, or 300 grams and less in glass containers or vacuum packages with olive oil. Owners of retail stores pointed out that the consumer price for pared-down LM PDO ranges from 12 Euros to 14 Euros per kg, while the price for LM PDO with olive oil ranges from 15 to 16 Euros per kg, while the price for LM PDO with olive oil ranges from 15 to 16 Euros per kg. There are rarely premium packages of the latter category of cheese; in that case, the price reaches 37 Euros per kilo. The packaging with olive oil seems to be preferred by high-income consumers looking for fine products.

- *The local breed:* about 394,970 sheep are raised on Lesvos Island, with 95% belonging to the local breed (Ministry of Rural Development and Food, 2015). Lesvos sheep breed is well adapted to the hot and dry Mediterranean climate and is suitable for exploiting mountainous and semi-mountainous pastures, poor in vegetation (Sossidou et al., 2013). The specific breed has good enough milk production, ranging from 140 to 286 kg per ewe per year (Lesvos Sheep Breeders Association, 2020). Local sheep breed's milk has an average of 7.6%–6.4% fat content (Rogdakis, 2002). The great variation in milk production owes to the applied breeding system. Improving husbandry systems, feed rations, and implementing genetic improvement can positively affect milk production. The local sheep flocks' yields have significantly improved after genetic improvement (Lesvos Sheep Breeders Association, 2020).

  It is worth mentioning that this breed is included in action '10.2.1' of the national Greek Rural Development Program concerning the preservation of Genetic resources in Livestock to enhance biodiversity. A small number of farmers have imported highly productive sheep of foreign breeds. However, the foreign breeds of sheep are not fully adapted to the environment of the island. As a result, they are often more sensitive and sicker in comparison with the local breed. Thus, foreign breeds are not raised by many farmers in Lesvos, and their milk is not used in LM PDO cheese-making procedure (Hellenic Ministry of Rural Development and Food, 2021). On the contrary, farmers produce yogurt from foreign breeds or use this milk for self-consumption.

- *The pastoralism and flora of Lesvos:* sheep breeding is one of the most essential and traditional sectors of animal husbandry in Greece. Nowadays, Greek sheep farming consists of small-scale family farms, whose sheep graze in pastures. The seasonal movement of the flocks characterises extensive farming to the resorts (mountain pastures) during spring and return to the lowland pastures during the winter (Hadjigeorgiou, 2011; Gkoltsiou, 2011). In Lesvos, local sheep breed is raised in a semi-intensive production system, satisfying part of its nutritional needs through grazing in pastures or olive groves, which takes place throughout the day. More specifically, the sheep graze in the olive groves after the period of the olive harvest and when there are olive branches in the ground (Interview with Ioannis

Hadjigeorgiou, Agricultural University of Athens, 16 June 2021). It should be noted that the sheep, by grazing in the olive groves, remove the weeds from there, thus facilitating farmers in doing their cultivation work more efficiently. Leading players in the value chain, such as cooperative presidents, farmers and veterinarians, said that animals' nutritional requirements by grazing are estimated to be covered by only 10% to 20% (Hadjigeorgiou et al., 2005). The rest nutritional needs of the animals are covered through the provision of complementary feeding, including concentrated feed and hay during winter. In spring, the producers do not provide hay because it increases the cost of nutrition, and at the same time, the animals' needs of coarse fodder are covered from the pastures and olive groves. Some of the concentrated feed is introduced from the neighbouring island of Lemnos and the country's mainland. Thus, this feed is expensive due to the high transportation costs.

The total area of Lesvos is 163,900 hectares, of which 78% is the utilised agricultural area; 40.7% of this land is pastures. It is worth-mentioning that 83.6% of natural pastures are privately owned, while 16.4 % belong to the local communities (Tzanni, 2005). Farmers without owned pastures usually rent them for a year. In Lesvos, some of the pasture owners are not farmers and often live abroad (Tzanni, 2005). Moreover, a part of Lesvos' pastures is characterised as low productivity and grazing capacity. In these landscapes, the dominant plant species are Poterium spinosum and Cistus creticus. These plants have developed protection mechanisms against the sheep, having thorns and essential oils, and thus their population is increased in overgrazed areas (Tzanni, 2005). Most sheep live in the northwestern part of the island, contributing to soil erosion and desertification (Symeonakis et al., 2014; Hadjigeorgiou, 2016). Besides, a large part (55%) of the cultivated area is covered by olive groves (Tzanni, 2005) whose cultivation takes place on terraces. Lesvos belongs to the Network of Protected Areas 'Natura 2000' (Lesvos Island-UNESCO – Global Geopark, 2021), while Lesvos' flora includes more than 1,400 species and subspecies of plants, such as olives, pines, oaks, chestnuts, and various Medicinal and Aromatic Plants.

4.2 The value chain of Ladotyri Mytilinis PDO

In order to describe the value chain of LM PDO in detail, we have distinguished three main levels: farms, cooperatives and dairies.

- *Farms:* today, in Lesvos, there are 2,237 livestock farms (ELGO DIMITRA, 2019), while, in 2005, 3,273 holdings were recorded, of which 64% is small (< 100 animals), 25% is medium (101–200 animals), 8% is large (201-300 animals), and 3% is very large (301–800 animals) (Loumou, 1998; ELGO DIMITRA, 2019). As highlighted by the main players in the value chain, most farmers are part-time in animal husbandry (64%), as they often possess olive groves, tourist facilities, or taverns. The largest farms are located in the northwestern and northeastern parts of the island. Most farms use makeshift buildings of wood or sheet metal. Over recent years, modern sheep farms have increased due to investment aids from the Ministry of Agricultural Development and Food. The buildings are made from stone, cement blocks, or bricks. Most of the ewes are hand-milked, while only a limited number of farms have milking machines. In addition, some farms do not have ice basins.

- *Cooperatives:* The presidents of the cooperatives referred that six cooperatives have formed the Breeder's Association of the Lesvos sheep. One cooperative has over 300 members, while three cooperatives have over 200 members, and two cooperatives have about 100 members. It is worth noting that two cooperatives have set up their own cheese factories. Also, most recently, eight producer groups have been set up on the island, with a total membership of 350 farmers, producing about 7,000 tons of milk.
- *Dairies:* there are nine private and two cooperative cheese factories responsible for the cheese-making of LM PDO. On average, each year, the three largest cheese factories produce more than 60,000 kg of LM PDO, the five medium-sized cheese factories' production ranges from 14,000 kg to 24,000 kg, while the three small cheese factories produce 3,000 kg to 7,500 kg (ELGO DIMITRA, 2019). The three largest cheese factories control 70% of the total milk production of the island. Recently, a new dairy was established on the island, a subsidiary of a large cheese factory based on the mainland of Greece. Its production in LM PDO has not started yet.

4.3 The governance of Ladotyri Mytilinis PDO

4.3.1 Governance of local breed selection scheme

The Ministry of Agricultural Development and Food applies since 1988, a milk performance recording program in the Lesvos sheep. The recorded population in 1988 was 5,500 sheep, while in 1991 it increased significantly to 11,800 and then decreased to about 3,000 animals. Nowadays, 40,000 ewes are officially milk recorded (using the A4 method) through six livestock Cooperatives. On the island, there are 260,000 purebred animals (Mastranestasis et al., 2016). The local Animal Genetic Improvement Centre runs the program through the Regional Directorate of Agricultural Development and the Union of Agricultural Cooperatives of Lesvos. According to the national legislation (Law 4015/2011), in 2011, all Unions of Agricultural Cooperatives had to be transformed into either Primary Agricultural Cooperative Societies or limited liability companies. Specifically, the Union of Agricultural Cooperatives of Lesvos has been transformed into a limited liability company, which is now active in the processing of olives and the production of olive oil and soap.

The general breeding objective is to increase milk produced per ewe and year (Nikolaou et al., 2005). Selection of animals may extend from correction of milk yield on systematic effects to estimation of breeding values using best linear unbiased prediction (BLUP). At the same time, the effect of using marker assisted selection (MAS) has also been investigated (Mastranestasis et al., 2016). Natural mating remains the main way of using selected rams.

4.3.2 Governance of the GI

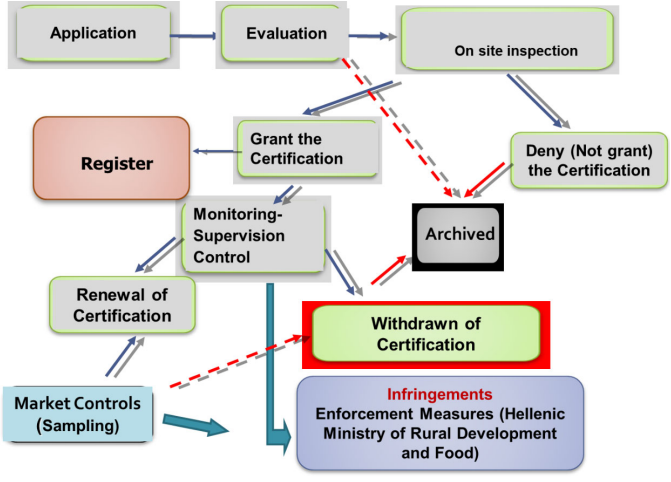
In Greece, the governance of GI products is centralised to a large extent, as there are no special collective bodies for the governance of any of these products. The EU regulation 1151/2012 sets the framework and the general objectives for protecting GIs, but eventually, each country adopts its procedures and specific national legislation for this

matter separately. So, the governance of LM PDO follows the same methods as for any other GI product in Greece, which are then specified at the regional and local levels.

Two major public players are involved in the whole procedure, supervised by the Ministry of Rural Development and Food (MRDF): the Greek Agricultural Organisation ELGO DIMITRA, and the Hellenic Food Authority (HFA). In collaboration with regional units, these nationwide organisations carry out the essential tasks for the governance of GI products.

More concretely, ELGO DIMITRA is responsible for the reception of the initial application of interested companies, the organising, and implementation of controls to comply with and ensure compliance with the specifications before the product is placed on the market. Also, it controls the correct use of the name and indications in the wholesale and retail labels (i.e., after the product is placed on the market), the granting of Certification, as well as the maintenance-publication-updating of the 'Register of Approved companies and beneficiaries of the use of GIs', etc. The Milk Quality Testing Laboratory of Lesvos, which belongs to ELGO DIMITRA, checks the quality of milk for each farmer; more specifically, it checks the total microbial flora, at least twice a month, and the percentage of lipoproteins and adulteration, at least once a month. Figure 1 summarises the procedures for the control and certification of products. The Rural Development Directorates of Regional Units participate with relevant personnel in controls performed by ELGO DIMITRA.

Figure 1 Control and certification procedure for PDO and PGI product (see online version for colours)



On the other hand, HFA carries out systematic inspections of food businesses (food production, marketing, and distribution firms), checking compliance with good hygiene practices, good manufacturing practices, hazard analysis, and critical control point system (HACCP).

Furthermore, a series of contracts are concluded among the various players of the LM PDO value chain. The contracts between dairies and cooperatives are formal. Nevertheless, some livestock breeders deliver their milk individually to the dairies; in this case, the contracts between dairies and breeders can be either formal or informal, the

latter being based on trust. In the value chain of LM PDO, some forms of vertical integration have been observed since some farmers have established their own dairies.

The dairies also control the milk quality, at least twice a month, considering the same quality features as ELGO DIMITRA. Then the cooperatives inform their members throughout the production period about the findings of milk quality. If the milk does not meet the quality standards, the dairy makes recommendations for compliance. In case that the breeder does not repeatedly comply with the accepted quality limits, the dairy can reduce the price of milk on an individual level; however, there are no other incentives to breeders to produce quality milk. Moreover, a few seminars are held annually for the breeders to improve the applied breeding conditions.

Another significant issue is the formation of producer prices for sheep milk. Various factors affect these prices, such as:

1 the supply and demand conditions in the main sheep milk-producing regions of the country, especially Thessaly

2 the market conditions and trends concerning Feta cheese (the flagship of all certified Greek cheeses), which exhibits a dynamic course over the last years; it has to be recalled that besides LM PDO, Feta PDO cheese and Kasseri PDO are also produced in Lesvos Island,

3 feed prices, especially those that are bought from other areas of the country

4 the structure of the local value chain of sheep milk and market power of the players participating in it.

Additionally, the cooperatives negotiate the price of milk with the dairies annually, whereas the livestock breeders are paid both in cash and in-kind, e.g., through the provision of feed. It is worth mentioning that the producer milk price is uniform, regardless of the cheese in the production of which it is used; thus, the milk used to make PDO cheeses has no different price. The specifications of the three PDO cheeses produced on the island are the same concerning the milk production conditions. Therefore, the dairies are not required to separate the milk that comes from the local sheep breed. However, the milk of the foreign breeds is separated. Also, the producer price can increase by 0.10 Euros, if the milk is processed within the island, thus qualifying for the subsidy of 'quality withholding', which is related to the stimulation of regional dairy processing and the promotion of local dairy products in Lesvos (Hellenic Ministry of Rural Development and Food, 2021).

An older study (Vallerand and Kazakopoulos, 2005) has shown that the market integration of LM PDO is attained through various channels:

1 18% of the produced quantity is sold directly from the farmer to consumers

2 20% is sold to the consumer from the cheese factories

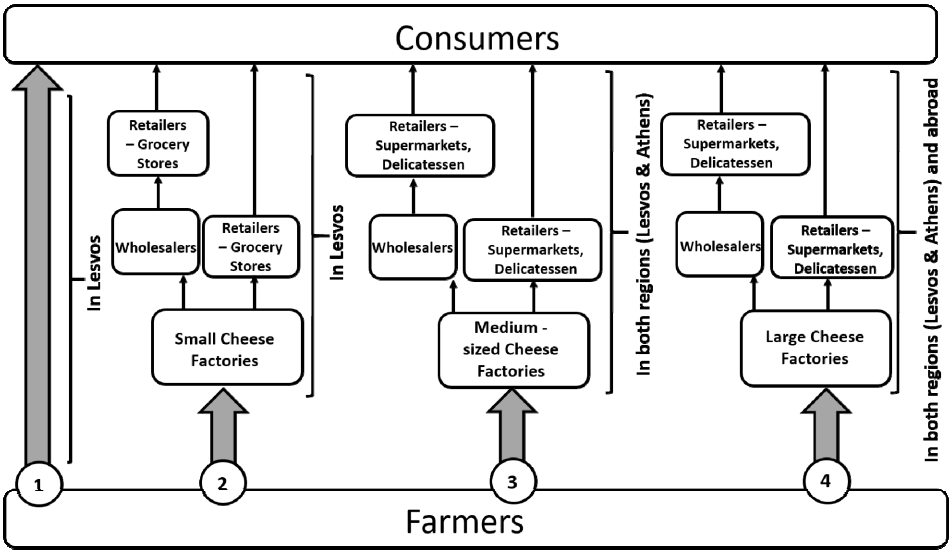
3 19% is traded through a network of commercial enterprises, whose owners come from the island

4 43% is distributed through supermarkets in Mytilini and other cities.

Our findings from field research in 2020 reveal that small cheese factories sell their products directly on the island's markets through wholesale or retail stores, such as grocery stores. Medium-sized cheese factories, including cooperative ones, sell the

examined cheese in local supermarkets, wholesalers, and delicatessen in the capital city of Athens. In addition, cooperative cheese factories sell the cheese through their own retail outlets. The large cheese factories sell the cheese exclusively in shops in big cities (mainly in Athens) outside the island. Besides, the latter category of cheese factories exports through integrated food distribution networks. As far as the packaging of LM PDO with olive oil is concerned, it is usually sold directly from dairies to retail stores. Cheese factories and wholesalers build up long-standing business relations. Wholesalers typically pay the cheese factories every three months. Livestock farmers produce a small amount of LM PDO, which they distribute through informal networks to their customers, taverns, and tourist accommodations, as well as to relatives and friends (Figure 2). Also, the farmers who live in tourist areas of the island are usually small-hotel owners. There is no collective structure on the island to facilitate trade and cheese distribution.

Figure 2 Current distribution channels of Ladotyri Mytilinis PDO



According to Belletti et al. (2017), GI products are not only closely linked to a value chain but to society as a whole through a variety of daily activities, such as gastronomy, food festivals, and consumption habits. Belletti et al. (2020) claim that the links between the generations can affect the management of local resources. In our case study, the local community of Lesvos carries out a series of actions to make a common heritage the examined resources used for the preparation of LM PDO. For example, the Region of North Aegean, in collaboration with the Chamber of Lesvos, through its website, promotes LM PDO and at the same time participates in gastronomy exhibitions, advertising the local products. Moreover, the chamber organises tourist reception events on the island, where the tourists can taste local delicacies, including the LM PDO. Sometimes, in these actions, the Lesvos Municipality, the Lesvos Hoteliers Association, the Travel Tourism and Shipping Agents Union of Lesvos, and journalists participate to better disseminate local products. In these efforts, a great reference is made to the local sheep breed and the island's flora (Chamber of Lesvos, 2021).

In addition, five of the dairies mentioned above have been included in the local development program 'CLLD/LEADER' within the Rural Development Program 2014–2020, specifically in action 19.2.3 called 'horizontal support in the development/improvement of entrepreneurship and competitiveness of the application area'. Also, 'horizontal processing, marketing, and development of Agricultural products to serve the objectives of the local strategy' constitute a part of this specific action. These companies joined the specific program with the aim to modernise or expand or establish dairies for the production of PDO dairy products (Region of North Aegean, 2021). Moreover, LM PDO is included in all the restaurants' menus on the island; some hotels on the island are certified by the Hellenic Chamber of Hotels for their breakfast, which includes LM PDO. Last but not least, the recipe of LM PDO at the family level is passed down from generation to generation. The contribution of the milk of the local breed and the flora of the island to the special characteristics of the cheese has been recognised from the past until today.

5 Recommended strategy

For a better strategy design, a SWOT analysis was carried out. Results of SWOT analysis derived from the 'internal' and 'external' environment and trends of the product are presented in Figure 3.

Figure 3 SWOT analysis for Ladotyri Mytilinis

Strengths	Weaknesses
• Protected designation of origin (PDO) cheese • Use of traditional methods • Animal recording and genetic improvement of the local sheep breed • Existence of collective structures • Increasing volume of production • Increase in exports • High adaptability and resilience of local breed	• High feed cost (dependence on imported animal feeds) • Lack of suitable livestock farming facilities • Grazing pressure, poor pasture quality and abandonment of pastures
Opportunities	**Threats**
• Consumers are interested in animal welfare • Increased demand for eco-friendly products, with significant symbolic value • Establishment of cheese inter-professional organisation, which can help farmers to acquire more fair prices, better access to inputs and services • Back to the origins: LM in olive oil in a modern package	• Massive introduction of foreign high yielding breeds of sheep

The proposed strategy is as follows: The LM PDO value chain must be able to confirm the typical characteristics of the product. For many years, the main aspect/criterion of economic efficiency at the farmer level has been milk yield. Yet, the breeding objective should incorporate aspects of milk quality as well (fat and protein contents), as the selection on only higher milk yield will lead to deterioration of milk quality due to antagonistic genetic correlations between the traits. Increasing the active population size

and/or the wider use of AI rams to disseminate genetic progress achieved in the active population remains a possible strategy to achieve higher milk yield while maintaining milk quality. Nevertheless, as stated before, having a higher active population size is associated with organisational and cost problems while wide application of AI remains a practical problem in sheep.

As noted above, the animals graze all day in pastures and olive groves, affecting the organoleptic characteristics of milk. The improvement of pastures is crucial to cover a more significant percentage of the nutritional needs of sheep. Rotational grazing and re-grass are some steps towards sustainable pasture management. An additional measure to this effort is the increase of cultivated areas with animal feed. According to Hadjigeorgiou et al. (2017), the degraded pastures of Lesvos can be renovated by growing legume mixtures in order to produce feed. In the recent past, there have been successful efforts in this respect (Hadjigeorgiou et al., 2008), whose results seem to be encouraging (Interview with Ioannis Hadjigeorgiou, Agricultural University of Athens, 20 September 2021; Hadjigeorgiou et al., 2005). Incentives should also be provided to protect pastures, to avoid undesirable effects such as cessation of grazing and their conversion into wild landscapes, which will be prone to fires.

As farmers are primarily responsible for milk production, we recommend as a complementary measure to existing seminars, the provision of technical advice to them to improve breeding conditions. The introduction of organisational and functional improvements such as proper ventilation of farm facilities, hygiene of high quality, systematic monitoring of animal health, and balanced ration are some of the factors that can improve breeding conditions (Hovi et al., 2004). Furthermore, installing new infrastructures, such as milking machines, will increase milk quality. At the same time, the use of milking machines can improve each farmer's working conditions and help better manage the herd (health, yield), reducing milking time (Sinapis, 2005; Laga et al., 2010). In any case, mechanical milking alone cannot ensure the high quality of milk. Breeders must observe hygienic conditions so as for the milking parlour to be clean. In order to make extensive use of milking machines on the island, a number of parameters must be taken into account, such as animal nutrition, the shape of the sheep's breast, and animal behaviour. In particular, the morphology of the breast of the local sheep breed is satisfactory, allowing mechanical milking. Besides, the behaviour of the local breed is gentle, so they can easily accept mechanical milking. Concentrated feed is usually given to the sheep during this process, keeping them calm (Zygogiannis, 1999). In addition, producer groups and cooperatives should further expand their membership and range of activities to strengthen the links between breeders and consumers and increase the bargaining power of the former within the broader value chain.

Nowadays, milk is valued mainly based on the dairies' industrial criteria, and often the agricultural practices are not as important as they should be (Millet and Casabianca, 2019). The great experience of the farmers concerning the management of the local sheep breed and the development of fine LM PDO according to the tradition could be utilised to improve the final product further, enhancing its typical characteristics. For this reason, breeders could play an active role in shaping the best breeding conditions, contributing to the production of quality milk, and finally, creating a product of high added value. Dairies can more accurately define milk quality; the Research and Development Department of dairies could propose some changes to the breeding conditions, which would impact milk. In fact, in the transition to a model of sustainable breeding, the

provision of technical support from dairies to farmers could prove vital. Therefore, communication between cheesemakers and farmers must be two-way.

It is of paramount importance to create a collective structure for the governance of LM PDO with players from all levels of the examined value chain. This organisation will be responsible for collecting, processing, and maintaining market information and knowledge, helping players to adapt to new consumer trends. The horizontal and vertical communication between all the value chain players will contribute to creating a long-term vision for the product, which will satisfy the needs and interests of all participants. In this structure, the main decision-makers may be representatives from dairies, cooperatives, and farmers, as well as ELGO DIMITRA and HFA. Other central actors can participate in this collective effort, such as the Region of North Aegean and the Chamber of Lesvos. In addition, the University of the Aegean could connect academic research with the market, enhancing the product's unique characteristics through modern methods while, at the same time, maintaining tradition. In this context, the information will be disseminated to each level of the examined value chain to take corrective actions where needed.

All the above efforts should be reflected in a thorough product labelling, informing about this differentiated product. Last but not least, the cheese industry should integrate the cultural heritage and know-how, e.g., by creating on a larger scale, packaging of LM PDO with local olive oil. Thus, the product will maintain its unique traditional characteristics.

The main ingredients of the proposed strategy are presented in Figure 4.

Figure 4 The main ingredients of the proposed strategy

- The LM PDO value chain must be able to confirm the typical characteristics of the product, with the breeding objective including both increases of milk yield and upgrading of milk quality.
- Fulfilling more nutritional needs of sheep from grazing, through the improvement and protection of pastures. The increase of cultivated areas with animal feed. Provision of technical advice to farmers, introduction of organisational and functional improvements in sheep raising, and installation of new infrastructures, such as milking machines, which will increase milk quality.
- Producer groups and cooperatives should further expand their membership and range of activities to strengthen the links between breeders and consumers and increase the bargaining power of the former within the broader value chain.
- Utilization of the valuable experience of farmers concerning the management of the local sheep breed and the development of fine products.
- The creation of a collective structure for the governance of LM PDO with players from all levels of the examined value chain. This organisation will be responsible for collecting, processing, and maintaining market information and knowledge, helping players to adapt to new consumer trends. The horizontal and vertical communication between all the value chain players will contribute to creating a long-term vision for the product, which will satisfy the needs and interests of all participants.
- A thorough product labeling, and integration of the cultural heritage and know-how, e.g., by creating on a larger scale, packaging of LM PDO with local olive oil.

6 Discussion

According to Nori et al. (2016), local collective products result from interactions among many players who participate in complex value chains. The value chain of LM PDO is a perfect illustration of this. To produce the cheese, breeders, cooperatives, dairies, retail and wholesale companies, institutions, and authorities interact. Utilising GI products can be a powerful tool for conserving and protecting local resources. However, according to Casabianca et al. (2010), in some cases, the requirements of PDO products are not sufficient to protect the environment. In the examined case study, the large sheep population on the island has already caused some signs of desertification. Thus, other interventions in the examined value chain are required, e.g., better management of pastures, given their overgrazing.

Cooperation among various actors of the LM PDO value chain is an imperative, yet diverging views hamper it: breeders focus on increasing their profit from the quantity of milk produced, while dairies are interested in the volume of milk they receive but also in its quality so that they have more added value in the final product; consumers, on the other hand, want to buy a quality and environmentally friendly product. Ligda and Casabianca (2013) have drawn similar conclusions when examining other agri-food value chains in Europe.

We have identified various elements of value chain governance through contracting, network governance, and informal relationships (Trienekens et al., 2017). Different types of contracts are met in the examined case study, either formal (dairies-cooperatives, dairies-individual breeders) or informal (dairies-individual breeders), the latter being based on trust (Wever, 2012). Also, the establishment of own dairies by two cooperatives and some breeders is a form of vertical integration; on the other hand, breeders' cooperatives, producer groups, and the establishment of a dairies' association are manifestations of horizontal integration. However, the lack of frequent communication and consultation between chain actors points to the absence of 'shared governance'. Also, there is no 'intelligence generation', especially concerning market research for the product, consumption trends, consumer perceptions, etc. In addition, we have identified some informal relationships, such as those between cheese factories and wholesalers, who build up long-standing business relations.

As we have seen in Section 4.3.2, Greece has already built a network for the governance of GI products. However, this is a single network covering all GI products of the country, including LM PDO, with two nationwide organisations playing a central role and regional/local entities contributing to control tasks in contrast to network governance, described by Alvarez et al. (2010). According to ELGO DIMITRA, this system allows disseminating information and the flexibility of the control system between the central government and the regional units.

The main obstacle to network governance is likely to be the different and conflicting interests of each member. However, the formation of a common sustainable vision could overcome this difficulty;. This vision could focus on promoting LM PDO, utilising local resources and especially the local breed, creating social, economic, and environmental benefits for all participants. Nowadays, the legal framework of Greece seems to favour the development of collective organisations since some interprofessional organisations have already been established in the primary sector.

Milk is the main product of the local breed, which is used as an input in the production of three different GI products in Lesvos (the PDO cheeses LM, kasseri, and Feta). It is worth noting that the farmers do not know what product is produced after delivering their milk to the cheese factory. The case of cooperative cheese factory is the exception to the rule (Kizos and Vakoufaris, 2011). This possibility for alternative uses of the sheep milk not only allows for diversification on behalf of the dairies but could also explain the variation in the volume of LM PDO produced from year to year (see Section 4.1). On the other hand, the increased demand for milk derived from the local breed could increase the producer price. However, this trend is partially offset, firstly, by the oligopolistic/oligopsonistic nature of the value chain in the island, and secondly, by the dominant role of other regions of the country (Thessaly) in the formation of the prices for sheep milk.

As it is well known, farmers do not have a strong position in the value chain and usually have difficulties maintaining viable distribution channels, which large companies typically control. In this respect, the participation of breeders in cooperatives and producer groups and their own production of LM PDO and direct sales to consumers, undoubtedly exert a form of countervailing power within this value chain.

From the preceding analysis ensues that incentives need to be given to producers to improve their infrastructures. In addition, technical support to farmers can contribute to better management of the local sheep breed (Ligda and Casabianca, 2013). Our suggestion is in accord with previous research on evaluating the main features of sheep and goat farming in Lesvos (Sossidou et al., 2013).

7 Conclusions

This study aims to contribute to formulating a strategy for GI products in niche markets, utilising the value of indigenous livestock breeds. We have tried to develop a niche strategy by emphasising the quality, production methods, and regional identity of the GI product LM PDO.

LM PDO is a high-quality product with close anchorage to its place of production, as it uses some local resources, which are integrated into a specific production process. We consider some of these local resources as strategic, mainly the local sheep breed and secondarily the pastures. These resources have a significant contribution to LM PDO, as shown in the product specifications. In the context of the proposed niche strategy, we identified the above resources because they seem to be able to meet the needs of consumers who want to buy products that are considered environmentally friendly. We also have identified and tried to address some gaps in the applied practices, such as at the breeding system of the local breed.

The examined cheese is produced from the milk of the local sheep breed, which grazes throughout the year in pastures and olive groves of the island. The local sheep breed, its nutrition, the habitat in which it lives, the quality of its products, and the breeding system are some elements that can be utilised to valorise local resources and, consequently, formulate a strategy to promote GI products in niche markets. Thus, we do not explicitly propose the re-definition of the ‘official’ specifications of LM PDO, as this would require a more thorough and far-reaching analysis, which is beyond the scope of this article.

Despite the existence of genetic improvement programs for the local breed, there are no incentives for the constant upgrading of the quality of the milk in the functioning of the value chain. Also, the PDO certification provides an important protective shield against the risk of standardisation and devaluation of local livestock breeds' value, verifying sustainability in the production process (Verrier et al., 2011; Lauvie et al., 2014; Belletti et al., 2020).

The niche strategy facilitates the re-sharing of the value chain profits, favouring smallholders. Hopefully, it will upgrade the LM PDO value chain, ensuring a fair distribution of the main actors' profits and preserving natural resources for current and future generations (Berti, 2020). Yet, successful niche marketing strategies entail horizontal and vertical synergies, enhancing the dynamics of value chains (Hamlin et al., 2015).

Our analysis has shown that the governance of the GI of LM PDO is characterised by concentration, lack of coordination, and absence of a special collective body. Central (national scale) organisations undertake key roles through cooperation with public agencies at the regional/local scales, but with a low degree of coordination among them. The development of a collective structure can act as a catalyst for the promotion of LM PDO through a new dimension: the utilisation of local resources with emphasis on the strategic resource of the local breed. In addition, this structure for the governance of LM PDO could take on critical roles, such as coordination among actors, targeted research, knowledge generation, horizontal and vertical learning, and leadership. This need is also underlined by the fact that in our case study, the local breed is connected to more than one GI product.

Lack of a collective body for the governance of LM PDO and other deficiencies identified are partially offset by the existence of multiple ways of market integration of LM PDO to local, national (and international) markets. Direct marketing and the presence of various marketing and distribution channels, which are owned either by breeders or by cheese factories of all sizes can act as valuable ingredients of a new strategy. Collective action and institutional support can remedy the weak position of farmers within the value chain. Particular emphasis should be placed on farmers, as suppliers of raw materials, to ensure the quality of the product from the beginning, as they are positioned at the closest level to the value chain in terms of local resource management. Incentives need to be given to producers to improve their infrastructures. In addition, technical support to farmers can better manage the local sheep breed (Ligda and Casabianca, 2013). Generational renewal can achieve the repositioning of farmers, based on the proposed strategy. In this context, incentives should be given to young people to take up the profession of a farmer. The further education of the breeders can work synergistically in the strengthening of their existing position.

Governance of the value chain from end to end can help the market orientation of LM PDO and collaboration between value chain actors, helping to achieve common goals (Trienekens et al., 2017). However, cooperation between players from different levels of the value chain is not an easy task, as there are diverging and opposing interests.

References

Accenture (2020) 'COVID-19: how consumer behavior will be changed, fast-changing consumer behaviors influence the future of the CPG 'industry', *Now Next*.

Alvarez, G., Pilbeam, C. and Wilding, R. (2010) 'Nestlé Nespresso AAA sustainable quality program: an investigation into the governance dynamics in a multi-stakeholder supply chain network', *Supply Chain Management: An International Journal*, Vol. 15, No. 2, pp.165–182.

Arfini, F., Gozzi, E., Mancini, M., Ferrer-Perez, H. and Gil, J. (2019) 'Are geographical indication products fostering public goods? Some evidence from Europe', *Sustainability*, Vol. 11, No. 1, p.272.

Barjolle, D., Quinones-Ruiz, X.F., Bagal, M. and Comoe, H. (2017) 'The role of the state for geographical indications of coffee: case studies from Colombia and Kenya', *World Development*, Vol. 98, No. C, pp.105–119.

Belletti, G. and Marescotti, A. (2009) 'Supporting local qualification processes of origin products in the perspective of sustainability: legitimacy and role of public 'policies', *Colloque International UNESCO 'Localiser les produits: une voie durable au service de la diversité naturelle et culturelle des Suds*?, Paris.

Belletti, G., Casabianca, F. and Marescotti, A. (2012) 'Local food quality and local resources', in Arfini, M., Mancini, C. and Donati, M. (Eds.): *Local Agri-Food Systems in a Global World: Market, Social and Environmental Challenges*, p.71, Cambridge Scholars Publishing, Newcastle Upon Tyne, UK [online] https://hal.archives-ouvertes.fr/hal-01354016 (accessed 5 June 2021).

Belletti, G., Casabianca, F. and Marescotti, A. (2020) 'Local food quality and local resources', in Arfini, M., Mancini, C., Donati, M. (Eds.): *Local Agri-Food Systems in a Global World: Market, Social and Environmental Challenges*, p.71, Cambridge Scholars Publishing: Newcastle Upon Tyne, UK [online] https://hal.archives-ouvertes.fr/hal-01354016/document (accessed 5 June 2021).

Belletti, G., Marescotti, A. and Touzard, J. (2017) 'Geographical indications, public goods, and sustainable development: the roles of actors' strategies and public policies', *World Development*, Vol. 98, No. C, pp.45–57.

Berti, G. (2020) 'Sustainable agri-food economies: re-territorialising farming practices, markets, supply chains and 'policies', *Agriculture*, MDPI, Vol. 10, No. 3, p.64.

Cappelli, A. and Cini, E. (2020) 'Will the COVID-19 pandemic make us reconsider the relevance of short food supply chains and local productions?', *Trends in Food Science & Technology*, Vol. 99, pp.566–567, DOI: 10.1016/j.tifs.2020.03.041.

Carbone, A. (2017) 'Food supply chains: coordination governance and other shaping forces', *Agricultural and Food Economics*, Vol. 5, No. 3, pp.1–23.

Casabianca, F., Maestrini, O., Franci, O. and Pugliese, C. (2010) 'Are PDO projects adding value to local breeds? Comparing two case studies, Nustrale and Cinta Senese pig breeds', in *Abstracts of the 61st Annual Meeting of the European Association for Animal Production*, Crete, Greece.

Chamber of Lesvos (2021) [online] https://www.lesvos-chamber.com/articles/displayArticles/51 (accessed 15 September 2021).

Chaturvedi, A., Chand, R.M. and Rahman M. (2021) 'Impact of the COVID-19 on consumer behavior towards organic food in India', *Predictive and Preventive Measures for Covid-19 Pandemic*, pp.127–148, Springer, Singapore.

Davies, A.R. (2020) 'Toward a sustainable food system for the European Union: insights from the social 'sciences', *One Earth*, Vol. 3, No. 1, pp.27–31.

Derkimba, A., Lauvie, A. and Verrier, E. (2013) 'How the development of products valorizing local breeds changes breeding goals: examples from French cattle breeds', *Animal Genetic Resources*, Vol. 53, pp.135–140, DOI: 10.1017/S2078633612000768.

Derkimba, A., Verrier, E. and Casabianca, F. (2008) 'PDO project for Corsican pork as an innovation for the whole marketing 'chain', *New Trends for Innovation in the Mediterranean Animal Production*, Vol. 129, Wageningen Academic Publishers, The Netherlands.

eAmbrosia – EU (2021) [online] https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/# (accessed 1 December 2020).

ELGO DIMITRA (2019) *Geografical Indications Register and Beneficiaries of Use Animal Origin Products* [online] https://www.elgo.gr/index.php?option=com_content&view=article&id=824&Itemid=1269 (accessed 30 November 2019).

EU (2021) [online] *Evaluation Support Study on Geographical Indications and Traditional Specialities Guaranteed Protected in the EU*, DOI: 10.2762/891024, ISBN: 978-92-76-23867-6 [online] https://op.europa.eu/en/publication-detail/-/publication/c1d86ba1-7b09-11eb-9ac9-01aa75ed71a1/language-en (accessed 25 June 2021).

European Commission (1994) *Ladotyri Mytilinis PDO Registration Dossier* [online] http://www.minagric.gr/images/stories/docs/agrotis/POP-PGE/Official_Journal_L148_1996.pdf (accessed 1 December 2020).

European Commission (2020) *Factual Summary of the Public Consultation on the Evaluation of the Geographical Indications (GIS) and Traditional Speciality Guaranteed (TSGS)* [online] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/2029-Evaluation-of-Geographical-Indications-and-Traditional-Specialities-Guaranteed-protected-in-the-EU/public-consultation_el (accessed 1 December 2020).

FAO (2012) *Identification of Origin-Linked Products and their Potential for Development*, Rome.

Gkoltsiou, A. (2011) *Routes of Transhumance*, CANEPAL.

Greek Ministry of Rural Development (2015) *Indigenous Sheep and Goat Breeds List* [online] http://www.minagric.gr/index.php/el/for-farmer/animal-production/sheep-and-goats/1075-autofilesaigoprobaton.html (accessed 13 June 2021).

Hadjigeorgiou, I. (2011) 'Past, present and future of pastoralism in Greece', *Pastoralism*, Vol. 1, No. 1, pp.1–22.

Hadjigeorgiou, I. (2016) *Final Report for the Project: Pasture Reclamation Program – Creation of Meadows on the Islands of Lesvos, Chios, Ikaria, Kea and Rhodes funded by the Fund for Agriculture and Livestock of the Ministry of Rural Development and Food*, Agricultural University of Athens.

Hadjigeorgiou, I., Fortatos, S. and Chatzigeorgiou, T. (2017) 'Renovating grazing lands on the Greek islands through the introduction of forage 'legumes', *Proceedings of the 19th Symposium of the European Grassland Federation*, Italy.

Hadjigeorgiou, I., Kosmas, K. and Papavasileiou, D. (2005) *Feed Resources*, Hellenic Society of Animal Production, pp.27–30.

Hadjigeorgiou, I., Vaitsis, T., Laskaridis, G. and Tzanni, C. (2008) 'Restoring semi-arid rangelands on a Greek Aegean Island', *Options Méditerranéennes: Série A*. Vol. 79, No. 1, pp.33–36.

Hamlin, R., Knight, J. and Cuthbert, R. (2015) 'Niche marketing and farm diversification processes: insights from New Zealand and Canada', *Renewable Agriculture and Food Systems*, Vol. 31, No. 1, pp.86–98.

Hellenic Ministry of Rural Development and Food (2021) 'Support measures for the small Aegean islands' [online] http://www.minagric.gr/index.php/el/for-farmer-2/animal-production/milk-dairy/1231-eidiko-kath-nisia-agaiou (accessed 1 December 2020).

Hobbs, J.E. (2020) 'Food supply chains during the COVID-19 pandemic', *Canadian Journal of Agricultural Economics*, Vol. 68, No. 2, pp.171–176.

Hovi, M., Sundram, A. and Padel, S. (2004) 'Organic livestock farming: potential and limitations of husbandry practice to secure animal health and welfare and food quality', *Proceedings of the 2nd SAFO Workshop*, Witzenhausen, Germany, 25–27 March.

ICAP (2019) *Sectoral Study – Cheese Products* [online] https://www.icap.com.cy/2019/04/13/the-total-domestic-consumption-of-cheese-products-in-greece-rose-in-the-period-2017-2018-according-to-the-latest-sector-study-of-icap/ (accessed 1 December 2020).

Independent Authority for Public Revenue (2020) *Article 83 – Dairy Products* [online]https://www.aade.gr/sites/default/files/2020-03/83-iss3.pdf (accessed 1 February 2021).

Kaiser, M., Goldson, S., Buklijas, T., Gluckman, P., Allen, K., Bardsley, A. and Lam, A. (2021) 'Towards post-pandemic sustainable and ethical food systems', *Food Ethics*, Vol. 6, No. 1, p.4.

Kizos, T. and Vakoufaris, H. (2011) 'What is the extent of short food supply chains in Greece? Evidence from the cheese supply chains in the North Aegean Region', *International Journal of Agricultural Resources, Governance and Ecology*, Vol. 9, No. 1, pp.48–67.

Laga, V., Skapetas, V., Sinapis, E. and Katanos, I. (2010) *Mechanical Milking of Sheep and Goats in Greece, Current Situation and Prospects*, Hellenic Society of Animal Production, Special Edition 36, p.77.

Lauvie, A., Nathalie, C. and Verrier, E. (2014) 'No development, no conservation: elements from the conservation of farm animal genetic resources', *Society and Natural Resources: An International Journal*, Vol. 27, No. 12, pp.1331–1338.

Lesvos Island-UNESCO – Global Geopark (2021) [online] https://www.lesvosgeopark.gr (accessed 10 January 2021).

Lesvos Sheep Breeders Association (2020) [online] https://www.provatolesvou.gr (accessed 18 January 2021).

Lev, L. and Gwin, L. (2010) 'Filling in the gaps: eight things to recognize about farm-direct marketing', *Choices*, Vol. 25, No. 1, pp.1–6.

Ligda, C. and Casabianca, F. (2013) 'Adding value to local breeds: challenges, strategies and key factors', *Animal Genetic Resources*, Vol. 53, pp.107–116, DOI: https://doi.org/10.1017/S207863361300026X.

Ligda, C. and Zjalic, M. (2011) 'Conservation of animal genetic resources in Europe: overview of the policies, activities, funding and expected benefits of conservation activities', *Animal Genetic Resources*, Vol. 49, pp.75–86, DOI: https://doi.org/10.1017/S2078633611000075.

Loumou, A. (1998) 'The financially of sheep and goat farming in Lesvos prefecture', *Minutes Development Conference Sheep breeding*, Kaloni, Lesvos, North Aegean.

Marsoner, T., Egarter Vigl, L., Mank, F., Jaritz, G., Tappeiner, U. and Tasser, E. (2018) 'Indigenous livestock breeds as indicators for cultural ecosystem services: a spatial analysis within the Alpine Space', *Ecological Indicators*, Vol. 94, No. 2, pp.55–63.

Mastranestasis, I., Kominakis, A., Hager-Theodorides, A.L., Ekateriniadou, L.V., Ligda, C. and Theodorou, K. (2016) 'Associations between genetic polymorphisms and phenotypic traits in the Lesvos dairy sheep', *Small Ruminant Research*, Vol. 144, pp.205–210, http://dx.doi.org/10.1016/j.smallrumres.2016.09.020.

Mathias, E., Mundy, P. and Kohler-Rollefson, I. (2010) 'Marketing products from local livestock breeds: an analysis of eight cases', *Animal Genetic Resources*, Vol. 47, pp.59–71, DOI: https://doi.org/10.1017/S2078633610001001.

Millet, M. and Casabianca, F. (2019) 'Sharing values for changing practices, a lever for sustainable transformation? The case of farmers and processors in interaction within localized cheese sectors', *Sustainability*, Vol. 11, No. 17, p.4520.

Ministry of Rural Development and Food (2015) *Lesvos Breed* [online] https://www.minagric.gr/images/stories/docs/agrotis/Aigoprobata/FilesAigoprobaton/fililesbou.pdf (accessed 1 June 2021).

Nikolaou, M., Kominakis, A. and Rogdakis, E. (2005) *Genetic Improvement of Lesvos Sheep Breed*, Hellenic Society of Animal Production, pp.41–47.

Nori, M., Ragkos, A. and Farinella D. (2016) 'Agro-pastoralism as an asset for sustainable Mediterranean Islands', in Jurcevic, K., Lipovcan, L.K. and Ramljak, O. (Eds.): *Imaging the Mediterranean: Challenges and Perspectives*, Institute of Social Sciences Ivo Pilar. Vis.

Oberholtzer, L., Dimitri, C. and Jaenicke, E.C. (2014) 'Examining US food retailers' decisions to procure local and organic produce from farmer direct-to-retail supply chains', *Journal of Food Products Marketing*, Vol.20, No. 4, pp.345–361.

Parrish, E. (2010) 'Retailers' use of niche marketing in product development', *Journal of Fashion Marketing and Management*, Vol. 14, No. 4, pp.546–561.

Qualigeo.eu (2020) [online] https://www.qualigeo.eu/en/prodotto-qualigeo/λαδοτύρι-μστιλήνης-dop/ (accessed 15 February 2021).

Region of North Aegean (2021) [online] https://www.pvaigaiou.gov.gr/ (accessed 10 September 2021).

Rogdakis, E. (2002) *Indigenous Sheep Breeds: Description, Phylogeny, Genetic Improvement, Conservation*, Agrotypos, p.208.

Shukla, K.A. (2014) 'Niche marketing: fray for frame of mind of customers', *Journal of Management Value & Ethics*, Vol. 4, No. 1, pp.83–86.

Sinapis, E. (2005) *Mechanical Milking of Sheep and Goats*, Hellenic Society of Animal Production, pp.49–54.

Sossidou, E., Ligda, C., Mastranestasis, I., Tsiokos, D. and Samartzi, F. (2013) 'Sheep and goat farming in Greece: implications and challenges for the sustainable development of less favoured areas', *Animal Science and Biotechnologies*, Vol. 46, No. 2, pp.446–449.

Symeonakis, E., Karathanasis, N., Koukoulas, S. and Panagopoulos, G. (2014) 'Monitoring sensitivity to land degradation and desertification with the environmentally sensitive area index: the case of Lesvos Island', *Land Degradation & Development*, Vol. 27, No. 6, pp.1562–1573.

Trienekens, J., Velzen, M., Lees, N., Saunders, C. and Pascussi S. (2017) 'Governance of market-oriented fresh food value chains: export chains from New Zealand', *International Food and Agribusiness Management Review*, Vol. 21, No. 2, pp.249–268.

Tzanni, C. (2005) *Sheep Farming in Lesvo*', Hellenic Society of Animal Production, pp.5–10.

Vallerand, F. and Kazakopoulos, L. (2005) *Typical Products and Local Resources: The Case of Lesvos*, Hellenic Society of Animal Production, pp.69–73.

Vandecandelaere, E., Samper, L.F., Rey, A., Daza, A., Mejía, P., Tartanac, F. and Vittori, M. (2021) 'The geographical indication pathway to sustainability: a framework to assess and monitor the contributions of geographical indications to sustainability through a participatory process', *Sustainability*, Vol. 13, No. 14, p.7535.

Verrier, E., Tixier-Boichard, M., Bernigaud, R. and Naves, M. (2011) 'Conservation and value of local livestock breeds: usefulness of niche products and/or adaptation to specific environments', *Animal Genetic Resources*, Vol. 36, pp.21–31.

Walker, H. (2003) 'The fat of the land: proceedings of the Oxford symposium on food and cooking', *Oxford Symposium*.

Wever, M. (2012) *Chain-Wide Consequences of Transaction Risks and their Contractual Solutions – Managing Interdependencies in Differentiated Agri-Food Supply Chains*, Wageningen University, Wageningen, the Netherlands.

Zygogiannis, D. (1999) 'Sheep keeping', *Modern Education*, in Greek, Thessaloniki, Greece.