



Rural and agri-entrepreneurial networks: A qualitative case study

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ABSTRACT

The *Queijo Serra da Estrela*, DOP is the oldest Portuguese cheese recognized internationally. The objective of this paper is to analyse a rural, agri-entrepreneurial network created by a young, female, craft cheese producer located in an area of low population density in the inland central region of Portugal. For data collection, several qualitative semi-structured phone and face-to-face interviews were held with the partners of the network. This paper contributes by helping to understand how a rural agricultural network in the specific sector of a Protected Denomination of Origin (PDO) product works and what its motives, success factors and benefits are. The results indicate that trust, confidence and regular payments are essential to make this network viable and create added value for business in a traditional sector threatened by climate changes, the age of shepherds and importation of exotic breeds of sheep. Some theoretical and practice contributions will be also presented.

1. Introduction

Since ancestral days, the production of milk and its derivatives has been part of the country's economy and families' livelihood, a consequence of Portugal's climate and geography, where green pastures abound (Morais et al., 2013). Cheese is a solid food produced worldwide by the coagulation of milk from different animals, with a broad diversity in the types of cheese between and within different countries (Guiné et al., 2015). The *Queijo Serra da Estrela*, DOP (Protected Denomination of Origin - PDO) is the oldest Portuguese cheese recognized internationally for its organoleptic characteristics (Direção Geral de Agricultura e Desenvolvimento Rural, 2009).

A recent study (Zivojinovic et al., 2020) refers that globalization poses challenges to rural areas given technological advances and intensified competition in agricultural markets. According to Bonetti (2004) and Gregoric (2018), current trends point to the growth of PDO products (cherry, cheese, ham, lamb, olive oil, sausages, and so on...), with increased support from the European Union, more frequent use by producers and, consequently, increased consumption by consumers. Food quality is based on sensorial aspects, i.e., taste, flavour, smell, texture and colour, as well as on the history of its origin and culture along with the territory, and many consumers have a positive opinion of mountain products (Bonadonna et al., 2017).

In creating a dynamic process within the free economic system, the existence of a society with entrepreneurial cultures is important (Kan

et al., 2018). Over the last decades, many European farmers have started new activities on their farms, generating new sources of income, and establishing agriculture as an activity offering many services to society which go beyond mass food production (Seuneke and Bock, 2015). In Europe, farming is generally a family activity (Seuneke and Bock, 2015). Even today, most European farms are run by men, although this behaviour is changing (Adinolfi et al., 2020; FAO, 2012; Osei and Zhuang, 2020; Sachs, 1996; Seuneke and Bock, 2015).

Traditionally, agriculture is often dominated by a large number of small family businesses (Pindado and Sánchez, 2017) and is seen as a low-tech sector. Recently, this situation has changed considerably, partly because of modernisation and the need to comply with the Hazard Analysis and Critical Control Point (HACCP) rules in order to obtain PDO status. These changes have opened the door to new, innovative entrepreneurs. Research in recent years has shown that agricultural entrepreneurship has a profound effect on business growth and survival (Hron et al., 2009; Verhees et al., 2011; Lans et al., 2013). However, to survive (Despertar, 2020), internet technology (Zhao et al., 2019) and networks (Khazami et al., 2020), which can be defined as social relationships articulating the flow of information, resources and identities involved in developing rural production specifically, and 'communities' more generally (Lee et al., 2005), are a powerful mechanism for small scale, rural enterprises (Crowley et al., 2018).

The creation, development or consolidation of networks for the actors' interaction in a geographical space is therefore crucial. These

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networks, which must act as the foundations of innovation systems, should combine local and non-local scales, and private and public organizations (Espancia, 2014). Networks' significant potential in facilitating socio-economic, rural and regional development has been identified in recent artisan food studies (Ashkenazy et al., 2018). Networking is generally seen as an important mechanism for small-scale, rural enterprises to overcome their relative disadvantage by leveraging knowledge and resources. Communities of Practice (CoP) are a type of network where close relationships are developed around a shared identity and understanding (Crowley et al., 2018).

Smart, competitive supply chains are embedded in the EU Rural Development policy and food chain organization (Veerman, 2016). The key to success is to maintain a consumer-oriented focus throughout the process. Consumers may gain value via more reasonably priced healthy food, while the community may also benefit via multiplier effects which provide employment (Tudisca et al., 2014). It is only through consumers' willingness to pay (more) that the concept of added value becomes tangible (ENRD, 2016).

Portugal has an extensive and diverse range of traditional food products, associated with each of the regions of the country and the Mediterranean diet, the result of the cultural influence in the preparation of these foods, which constitute a living heritage of a unique and rich gastronomic heritage (Direção Geral de Agricultura e Desenvolvimento Rural, 2020). Quality certification systems are one kind of organisational strategy allowing potentially greater capacity for added value in local production systems (Sanz Cañada and Macías Vázquez, 2005). PDO is one of the quality certification systems for agro-food. In the agricultural sector, entrepreneurship is not widely studied (Fitz-Koch et al., 2017), although this is changing (Dias et al., 2019).

To fill this gap, this investigation aims to analyse the local and national networks that a young female producer of traditional cheese from sheep and lambs' milk has contributed to creating and is using to make her business viable. She is the owner-manager of *Casa Agrícola dos Arais* (CAA), located in the Serra da Estrela national park in Portugal. The contribution of this paper, the first in the area, lies in helping to explain how a rural agricultural network in the specific sector of a PDO product works, what its success factors are, and to understand the inter-organisational networks of *Bordaleira* sheep milk and *Queijo Serra da Estrela*, DOP producers. This paper also considers that the traditional Portuguese *Serra da Estrela*, DOP cheese sector can form a CoP where firms share a common set of problems and can deepen their knowledge of artisan cheese production.

The first part of this study presents a literature review, the second a case study, and the final considerations will indicate conclusions, limitations and future lines of investigation.

2. Literature review

2.1. Agricultural entrepreneurship

Agriculture is amongst the world's largest sectors, employing over one billion people and accounting for 3% of global GDP (FAO, 2012). Therefore, entrepreneurship and entrepreneurs play an important role in the development of each country's economy by promoting innovation, generating new jobs and creating competition (Nishimura & Tristán, 2011), but also creating added value, strengthening inter-sector relations and social benefits, fighting against poverty, and contributing to a fair distribution of income (Commission of the European Communities, 2003). Entrepreneurship research is concerned with why, when and how individuals identify and exploit opportunities (Shane and Venkataraman, 2000). In a systematic literature review, Fitz-Koch et al. (2017) found that for some farmers, entrepreneurship provides an opportunity for business development (idea and growth-oriented), while for others it represents one of the few available routes to economic survival and retaining their farm-based livelihood (need-oriented).

Women represent, on average, 43 percent of the agricultural labour

force in developing countries (FAO, 2012). Usually, farms are passed through the generations from father to son (Seuneke and Bock, 2015), with women entering the farming business through marriage (Sachs, 1996). Today this paradigm is changing, there is a growing attention and recognition of the vital role of women entrepreneurs in the socio-economic development of the global economy (Adinolfi et al., 2020; Osei and Zhuang, 2020). They play a crucial role in the family farm business (Lans et al., 2017) and their entrepreneurial activities contribute to rural poverty alleviation (Osei and Zhuang, 2020). They also are less rooted in agriculture, due to their background, and are more ready to re-develop the activity than men are (Seuneke and Bock, 2015). If women had the same access to productive resources as men, they could increase yields on their farms by 20–30 per cent (FAO, 2012).

The agricultural sector is mainly composed of small family businesses, where management and control are not separated (Pindado and Sánchez, 2017). Succession influences farm household decision-making to the point that future succession is prioritized over immediate financial success (Ilbery, Healey, Higginbottom, & Noon, 1996). In recent years, agricultural firms have been forced to adapt to new challenges such as changes in the market, changes in consumer habits, food safety, sustainability and biotechnology (Lans et al., 2017). Context influences the range of opportunities available. Thus, there is an emerging understanding that context is both an asset and liability and that contextual factors that influence entrepreneurship may in turn be influenced by entrepreneurial action (Fitz-Koch et al., 2017).

According to Hardaker (2000), agriculture can involve production, market, institutional and personal risks, in addition to those depending on the way of financing agricultural production. Similarly, Musser and Patrick (2002) classified threats to agriculture as associated with production, marketing, financial, legal issues and human resources. Nevertheless, some investigations on agricultural entrepreneurship focus on farmers' ability to generate new opportunities, organized either as new business ventures or as part of existing ones (Fitz-Koch et al., 2017). New venture activities and diversification on farms seem to be perceived as beneficial for both farmers and rural development (Grande, 2011). So resilience is an important factor to ensure the continuity of agricultural practice (Ashkenazy et al., 2018) to face economic or environmental barriers and to persist with, adapt and transform farming activity. Regarding resilience, networks are an efficient tool to reduce failure in agricultural entrepreneurship (Dias and Franco, 2018; Lambrecht et al., 2015; Lee et al., 2005).

2.2. Agricultural networks

As farms may struggle to build appropriate networks and strategic alliances to pursue new opportunities (Grande, 2011) or guarantee their survival (Dias and Franco, 2018), they need to develop appropriate capacities, learn about and integrate external resources and knowledge to be successful (Grande, 2011). Focusing on networks allows us to explore the mechanisms by which people capture or retain the benefits of development, and in doing so, allows us to emphasise the processual character of development (Lee et al., 2005). Networking is important for innovation and gives SMEs access to complementary resources that are not internally available and can bring them competitive advantage (Lambrecht et al., 2015). The competitive advantage lies in analysis of the scarcity or heterogeneity of available resources which can be tangible or intangible assets, strengths or weaknesses of a given firm (Wernwerfelt, 1984). Even more in troubled periods like the one we are currently going through with the pandemic that came to further isolate the agricultural world, virtual networks are of crucial importance (Despertar, 2020; Dhaoui et al., 2020; Rocio et al., 2020).

In last decades of the 20th century, agriculture sector was oriented to optimize production without any preoccupation with public health and environment. But, the growing consumer's interest in sustainable food, recent economic trends and globalization have created increasing complex supply chains (Dhaoui et al., 2020; Mokhtar et al., 2019).

Academic studies related to the short supply chain and its multiple impacts on the agricultural sector have been increasing in recent years (Tudisca et al., 2014). Consumers are now seen as active agents in food chain (Dhaoui et al., 2020). They are increasingly aware of the agricultural product distribution chain, fair trade (Dhaoui et al., 2020), and their behaviour at the time of purchase has favoured shorter chains (Mokhtar et al., 2019). In the same way, recognition of the network phenomenon has aroused the interest of researchers from different areas, and studies have intensified in the last decade (Azevedo et al., 2016; Levy and Lubell, 2018). However, what are networks? Business networks are an important way to organize economic activities (Sroka and Hittmar, 2013) and are considered an answer to complex and competitive changing market conditions (Besser and Miller, 2011).

In their study, Dhaoui et al. (2020) show that consumers believe that they can contribute to protect environment by using short distribution channels. But these alternative channels are sometimes difficult to reach. Public local authorities have already understood this by creating tourism itineraries (Município de Oliveira do Hospital, 2020). In rural areas, adequate public-private articulation is needed to reinforce activities around entrepreneurship and social innovation in order to meet the social needs of the population (Mora Mayoral and Martínez Martínez, 2018). To promote effective cooperation among producers, a spatial relationship between small agricultural units, neighbouring farms, is necessary (Dias and Franco, 2018) and social networks are fundamental to make cooperation between these farms viable. In regional agro-ecological systems, sustainability is promoted by social networks that facilitate information sharing, cooperation and connectivity among their specialized components (Levy and Lubell, 2018).

Good networks are inclusive, facilitating collective learning, allowing the sharing of success and generating wider social acceptance (Lee et al., 2005). Confidence and trust are major aspects in firms' relationships despite their differences (Azevedo et al., 2016; Khazami et al., 2020; Snavely and Tracy, 2002) and networks can be formal or not due to the rigour or official nature of the agreement and contracts established between partners (Dias and Franco, 2018). According to Veerman (2016), the absence of written contracts is often a disadvantage for the weaker party in a commercial transaction. Farmers should be able, under EU rules, to request and obtain a written contract.

In the organizational sphere, networks are made up of vertical (suppliers, consumers) and horizontal (peers and competitors) partners, and other entities (Fig. 1) with strategic importance for firms (Dias and Franco, 2018; Gulati et al., 2000; Lambrecht et al., 2015). Horizontal peer networking amongst firms in the same sector is deemed beneficial as it enables access to sector-specific information on regulations or consumers (Crowley et al., 2018).

Territorial-production clusters can play the role of overcoming the antagonism of interests between agricultural producers and processing enterprises (Tinyakova et al., 2020). Communities of Practice (CoP), defined by Wenger and Trayner-Wenger (2006) as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" are one example of these clusters.

Previous studies have shown that, because of their nature, CoP can help to reduce network failure (Autio, Kanninen, & Gustafsson, 2008). CoP in SME and agri-food sectors are an emerging phenomenon and their usefulness has been demonstrated (Crowley et al., 2018). Several studies (Mtika, 2015; Sonnino and Griggs-Trevarthen, 2012) have sporadically applied the CoP construct to examine inter-organisational networking in rural areas (Crowley et al., 2018). However, participants have different motivations for entering CoP, as communality does not mean homogeneity (Wenger and Trayner-Wenger, 2006).

Regional-based breakthrough SMEs/startups may raise their innovation ability by enriching their heritage-based competences through partners' experiences, a successful encounter between professionals from different contexts being the key for effective combination and mixing of ideas (Breukel and Zeegers, 2015). SMEs play a key role in providing appropriate products by responding to the most specific requirements of tourists (Novelli et al., 2006) and clients. In fact, for Lambrecht et al. (2015), vertical collaboration (with suppliers and purchasers) is more appropriate than horizontal relationships for innovation.

Local development is linked with heritage (Bessière, 1998), which is a mix of tradition and modernity as seen in Fig. 2.

In recent years, many European farmers have adopted a short supply chain to commercialise their agro-food products (Tudisca et al., 2014), eliminating intermediaries as a response to the dominant food producing system (Dias and Franco, 2018) and increasing confidence with clients. Direct agricultural markets, based on face-to-face ties between producers and consumers, are often seen as central components of local food systems. Activists and academic analysts often assume that trust and social connection characterize direct agricultural markets, distinguishing local food systems from the "global food system" (Hinrichs, 2000). According to Bonadonna et al. (2017), the implementation of a labelling system dedicated to "mountain products" or "local farming and direct sales" is no easy task, since it is difficult to understand exactly what the consumer perceives when reading the information on the packaging. Likewise, branding an agricultural product means creating a certain awareness among consumers, making it recognizable in the market (Gregoric, 2018). Branding strategies have become an accepted part of marketing activity and it is the norm for manufactured and processed food products to be offered to consumers as branded products (Pay et al., 1996).

3. Methodology

3.1. Type of study and case selection

This study used a qualitative approach. According to Aberdeen (2013), it is a linear but iterative process, one of several ways of doing social science research. Case study research is also a challenging endeavour that hinges upon the researcher's skills and expertise (Hollweck, 2016; Yin, 2015). This method provides practical and technical discussions on each of the six elements of case study research: the plan,

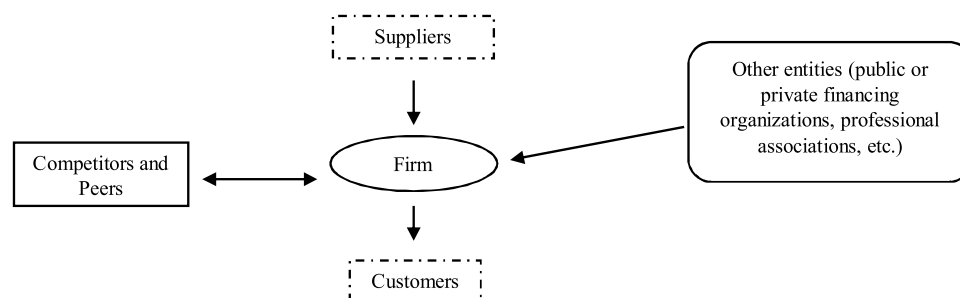


Fig. 1. Agricultural Networks dimension.
Source: Authors

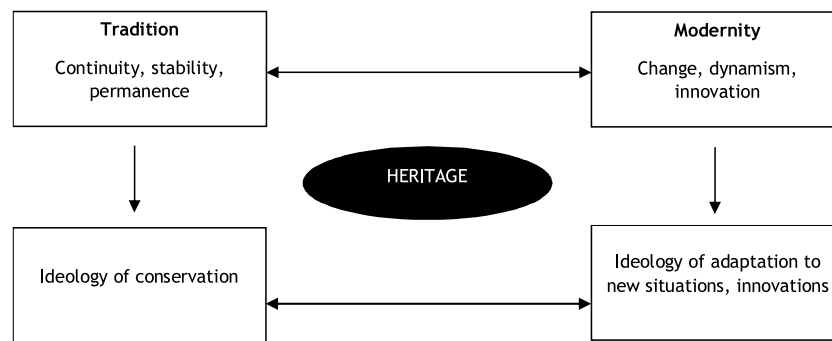


Fig. 2. Construction of heritage.

Source: Authors adapted from Bessière (1998).

design, preparation, data collection, analysis and reporting (Hollweck, 2016) and gives the researcher adaptability in data collection (Dias and Franco, 2018).

CAA's network case was selected using the following criteria: agricultural entrepreneurship is not among the topics studied extensively (Fitz-Koch et al., 2017) and the case presents a young, female, artisan cheesemaker who decided to change her life a few years ago to modernize a traditional family farm and create a dynamic rural network and employment in an area of low population density; this is the first study about craft cheese *Queijo Serra da Estrela*, DOP business networks; in the region there are small events whose role is to promote this ancestral, natural product of national gastronomy.

3.2. Data collection and analysis

Data analysis consists of matching empirically observed events to theoretically predicted events, to obtain valuable knowledge about the characteristics and strategies followed by CAA.

A first contact with CAA was established during the 40th Celorico da Beira Cheese Fair, on February 24, 2019. After verbal acceptance of the case study by the CAA's owner manager, it was decided to conduct in-depth interviews with sheep milk producers (CAA suppliers) on 12 March during a training session (importance of health, hygiene and good nutrition of sheep to produce milk of excellent quality) organized by CAA for its suppliers. As it was not possible to schedule face-to-face interviews with other actors in this network (producers' cooperative, professional association, municipality, CAA's main client: a former TV presenter), e-mails were sent and semi-structured telephone surveys were conducted (Alvesson, 2003) in March 2019 with ANCOSE (*Serra da Estrela* Sheep Breeders National Association), ESTRELACOOOP (*Serra da Estrela*, DOP producers cooperative founded in 1994) and *Tio Careca*.

The interviews were complemented with analysis of archive documents. These secondary sources provided a richer context for understanding the support organizations and artisan cheese owner-manager's responses and served as a means of triangulation, thus counteracting any anomalies, preferential hindsight or retrospective memory bias that might have arisen during the interview process (Aberdeen, 2013).

Therefore, several sources of evidence were used: documentation (newspaper articles), interviews, phone calls and direct observations.

4. Study case

4.1. Study context

In this section, the study context will characterize the geographical and socio-economic environment of the demarcated region, the *Queijo Serra da Estrela*, DOP, and *Casa Agrícola dos Arais* (CAA - the base of the network analysed).

4.1.1. Geographical and socio-economic characterization

From the north to south of Portugal, different types of high quality cheese are produced, which according to the milk used (goat, sheep and / or cow) result in cheeses with palate, fat content and consistency varying from one region to another. The Central region, in particular, due to its rugged relief, is an area of choice for breeding small ruminants, which are at the origin of the dairy industry, adding value to the region's economic and social environment. However, sheep cheese production has decreased considerably over the last few years (Morais et al., 2013), partly due to the country's economic crisis but also as a consequence of the decrease in sheep numbers (Dinis, 1998; INE, 2018). This reduction in flocks, and milk production (Morais et al., 2013), which has decreased by 14 % since 2008, despite showing a tiny growth since 2015 (Table 1), has caused the importation of exotic breeds of sheep (French Lacaune), which are better milk producers than local *Bordaleira*, but also of Spanish milk from the Assaf Israeli breed of sheep (SIC Noticias, 2019). Both aspects are real threats to this traditional activity.

Queijo Serra da Estrela, DOP cheese must be produced in the *Serra da Estrela* Region which reaches an altitude of 1993 m and covers some councils in the districts of Castelo Branco, Coimbra, Guarda and Viseu in the inland centre of Portugal (Fig. 3 – *Serra da Estrela* geographical area).

Since 2013 and the national administrative reform, Vide-Entre-Vinhas (where CAA is located) is part of the united parish of Cortiço da Serra, Vide-Entre-Vinhas and Salgueirais, in the local authority of Celorico da Beira, 25 kms from Guarda, a district capital in the inland centre of Portugal.

This parish located on the northern slope of *Serra da Estrela* has 450 inhabitants, with an area of 2305 ha. In the mountain village of Vide-Entre-Vinhas, situated between 750 and 850 m above sea level, agriculture and pasture are the traditional activities. Here, the fertile meadows and high-altitude loams are one of the secrets of the excellence of *Serra da Estrela* cheese produced in the local authority of Celorico da Beira.

Like other local authorities in the region, Celorico da Beira suffers from rural depopulation (Table 2). In less than 20 years it lost almost 20 % of its population (7116 in 2017). In 2011, the last national census registered 3135 active individuals. The ratio of active individuals to senior citizens has decreased in the last 50 years from 5,6 (1960) to 2 (2011) (PORDATA, 2011).

Like other inland authorities in Portugal, Celorico da Beira has an ageing rate (Table 3) (2851 %) higher than the national average (1554 %) (INE, 2018).

4.1.2. *Queijo Serra da Estrela*, DOP cheese

The development and spread of protected denominations for traditional products during the early 90s by the European Union has been one of the most interesting phenomena recorded, in terms of both extent (there are more than 500 protected denominations in Europe) and implications for the marketing of food products (Bonadonna et al., 2017; Bonetti, 2004).

Table 1

Evolution of Sheep Milk production for Central region of Portugal.

Source: INE									
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
22,313	20,639	21,023	19,881	18,425	18,016	17,329	17,349	18,900	19,251

**Fig. 3.** Serra da Estrela geographical area.

Source: Direção Geral da Agricultura e Desenvolvimento Rural.

Table 2

Resident population.

Source: PORDATA											
	Resident Population										
	2001	2009	2010	2011	2012	2013	2014	2015	2016	2017	Variation
Belmonte	7 561	6 995	6 915	6 843	6 766	6 698	6 625	6 554	6 519	6 483	−14,26 %
Trancoso	10 846	10 090	9 986	9 869	9 741	9 602	9 474	9 378	9 277	9 141	−15,72 %
Fornos de Algodres	5 606	5 120	5 040	4 979	4 943	4 904	4 855	4 809	4 758	4 683	−16,46 %
Figue. Castelo Rodrigo	7 134	6 427	6 333	6 253	6 193	6 118	6 033	5 956	5 882	5 789	−18,85 %
Celorico da Beira	8 818	7 925	7 796	7 666	7 560	7 458	7 362	7 284	7 207	7 116	−19,30 %
Pinhel	10 911	9 882	9 726	9 575	9 419	9 270	9 146	9 035	8 913	8 785	−19,48 %
Manteigas	4 071	3 563	3 484	3 423	3 374	3 322	3 268	3 219	3 169	3 117	−23,43 %
Mêda	6 197	5 378	5 275	5 169	5 072	4 984	4 905	4 835	4 771	4 715	−23,91 %
Almeida	8 402	7 483	7 355	7 173	6 951	6 732	6 547	6 394	6 263	6 133	−27,01 %

4.1.2.1. *A brief history.* The *Queijo Serra da Estrela, DOP* is the oldest Portuguese cheese recognized internationally for its organoleptic characteristics and was introduced to Portugal by the Romans. As early as the Middle Ages, it was mentioned in the lyrics of the poet Gil Vicente.

In 1287, King Dom Diniz created the first cheese market in Celorico da Beira. As a nutritious and sustainable food source, this cheese was taken by great explorers on their voyages. In 1885 it reached the cities of

Lisbon and Porto, increasing its fame (Direção Geral de Agricultura e Desenvolvimento Rural, 2009).

4.1.2.2. *Description and production method.* This craft cheese is made with raw milk from the *Bordaleira Serra da Estrela* and *Churra Mondegueira* breeds of sheep which have access to natural pastures. It is a cured cheese, which can present a semi-soft buttery paste in a white-

Table 3
Ageing rate inland central small municipalities.

Source: INE			
	2001	2017	Evolution
	164.6	250.2	152.00%
	184	277.3	150.71%
	247.2	281	113.67%
	195.9	285.1	145.53%
	193.5	342.5	177.00%
	148.5	358.3	241.28 %
	216.3	365.5	168.98%
	241.1	399.1	165.53%
Almeida	272.3	592.5	217.59%

yellowish shade or semi-hard to extra-hard paste in a brownish orange colour (old cheese)(Direção Geral de Agricultura e Desenvolvimento Rural, 2009).

The process of manufacturing *Queijo Serra da Estrela* begins with milking the sheep followed by filtration through muslin cloth. The milk is heated to 28–32 °C and salted. The thistle flower *Cynara Cardunculus* is added (about 0,2 to 0,3 g), after being milled and salted.

After 45–60 min the curd is cut manually and a new filtration is performed to remove the remaining serum. When the shaping, pressing and new salty processes are completed, the maturing stage follows. This consists of two phases. The first lasts until the 15–20 th day at a temperature of 6–12 °C and relative humidity of 85%–90%. The product is turned and washed daily. The second phase lasts until the 45th day at a temperature of 6–14 °C and relative humidity of 90%–95%. The turns and washes are made occasionally, depending on the aspect of the rind (Direção Geral de Agricultura e Desenvolvimento Rural, 2009).

To produce the *Queijo Serra da Estrela Velho* (old cheese), the same processes are followed, with the maturing period lasting for 120 days.

4.1.2.3. DPO certification. Geographical identification provides several advantages that protect against food fraud (Antonelli and Viganò, 2009), and can constitute a competitive advantage to ensure the development of small businesses.

The dimensions of *Queijo Serra da Estrela*, DOP are 9–20 cm in diameter, 4–6 cm thickness and weight between 0,5 and 1,7 kg. The flavour is delicate, clean and slightly acid. Regarding *Queijo Serra da Estrela Velho*, DOP its diameter is about 11–20 cm, its thickness is 3–6 cm and it weighs from 0,7 to 1,2 kg. It has a pleasant, persistent, clean, strong to slightly stronger and lightly salted and spicy flavour. To obtain DPO certification, it is submitted to a tester panel (Direção Geral de Agricultura e Desenvolvimento Rural, 2009; DRAPC, 2014).

According to ESTRELACOOP (PDO cheese producer cooperative founded in 1994), the first certification for cheese in Celorico da Beira was awarded in 1996. Nowadays there are 40 certified dairies in the demarcated region (LUSA, 2019), *Queijo Serra da Estrela DOP* annual production reaches 19,100 units in Celorico da Beira and 201,000 units in the demarcated region, representing almost 195 tons and € M 3,5 in revenue.

4.1.3. Casa Agrícola dos Arais and network story

In December 2017, a journalist from the Portuguese newspaper *Público* visited CAA (Gonçalves, 2017). The article related that in 2012, a young, female zoological engineer decided to return to the family home in Vide-Entre-Vinhas to open a dairy. Despite the relevance of women in agriculture not being recognized in terms of contribution to decision making (Adinolfi et al., 2020) and noted that women entrepreneurs mostly in developing countries are usually vulnerable and face several resource constraints (Osei and Zhuang, 2020), aged 28 at the time, she intended to continue the family tradition, but with a modern dairy to produce *Serra da Estrela*, DOP Cheese and cottage cheese. Thus was born the *Casa Agrícola dos Arais*, the first step of the network analyzed in this case study.

CAA started to produce DPO cheese with its own milk production (from a flock of about 200 sheep of the *Bordaleira* breed), and decided to buy more milk in 2013 to expand production and business because “it’s cheaper than to have more sheep”. Today, seven producers sell raw sheep milk to CAA daily. As for sales, CAA uses a local network with ESTRELACOOP (*Serra da Estrela*, DOP producers cooperative), *Solar do Queijo* (structure managed by the local authority to promote craft cheese and other local products), and direct sales. Since November 2016, *Tio Careca*, “bald uncle”, a brand created by a former TV presenter, is its major client and an important partner in the network.

With the help of her father and two other people, CAA’s owner manager works with an average of 250 L of milk per day (28%–30% own production), which is equivalent to 50 kilos of cheese. However, to her “there are things that do not change, cheese alchemy is a mystery, there are cheeses made on the same day, of the same mass and that come out differently”. Modernization does not solve everything, “it is not enough to put some powder into the milk to make the one that has already been described as the best cheese in the world”. In fact, peer advice is useful (Snavelly and Tracy, 2002), and artisan cheese production requires active steps to ensure the continuation of craft-based practices and prevent the loss of tacit knowledge (Eriksson and Bull, 2017). Fig. 4 presents the successful network model created by CAA in recent years, which will be analysed on the following pages.

4.2. Empirical evidence

4.2.1. Interviewee profile

The CAA owner manager and seven sheep milk producers / partners were interviewed during a training session, supported by CAA, on 12th March 2019 (Tables 4 and 5). All of them spoke with enthusiasm of their profession. Some (the oldest ones) more so, others less so, with a sense of tiredness. As CAA is the focus of this network, several e-mails, phone calls and conversations were made with the owner manager.

Education has a negative influence on the decision to become an agricultural entrepreneur compared to other sectors (Pindado and Sánchez, 2017). As Table 4 shows, the interviewees have mainly basic or no education, except for E4 who attended secondary school. Some interviewees, except for E2 (perhaps due to his age and limited time in the profession (6 years) compared to his peers), spoke about resilience as a regular and useful characteristic. As seen in the literature review, resilience is an important characteristic of agri-entrepreneurs (Ashkenazy et al., 2018).

4.2.2. Network motives and choice of partners

When the young, female graduate took the first step in 2012, the main motivation was a personal wish to preserve traditional family knowledge, as “*Queijo Serra da Estrela*, DOP means authenticity and exclusivity” for CAA. But other reasons led to creating the network, such as economic motives for buying milk instead of enlarging the flock.

CAA indicates that the choice of milk suppliers considered location, breed of sheep and good reputation. *Tio Careca* selected CAA as a supplier due to the product’s good reputation and also because he was interested in understanding why a young, female graduate decided to produce DPO craft sheep cheese. Suppliers indicate that the milk’s selling price is agreed with CAA and not by the producers’ association. They decided to sell the milk to CAA because of its good reputation, and also due to a better price (E3, E6 and E7). E2 said: “because CAA asked me to”. Even though contracts are not formalized, all CAA suppliers are very confident about the network. On a scale from 1 (not at all) to 5 (very much), E4 and E5 respond 4 and the other interviewees 5. All the respondents sell the milk to CAA through their own choice, in fact to the question “What would you do if you didn’t sell the milk to CAA?” all answered “I’d sell to another firm!” (Table 5).

Despite all milk producers being in favour of certification saying it represents added value for the region’s development, they recognize it implies more work, so they choose to sell raw milk instead of producing

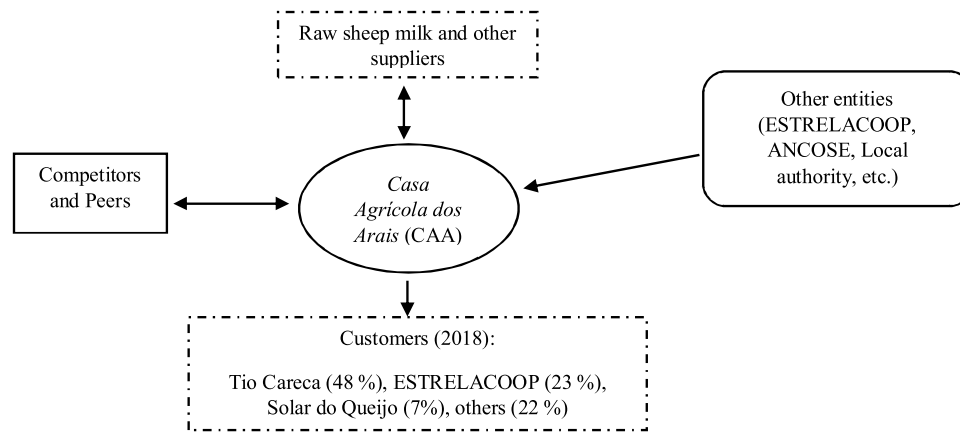


Fig. 4. CAA Network Model.

Source: Authors.

Table 4

Information about interviewed sheep milk producers and CAA.

	CAA	E1	E2	E3 ^a	E4	E5	E6	E7
Gender	F	M	M	F	M	M	M	M
Age	35	65	37	53	38	55	56	66
Education	Graduate	Basic	Basic	Basic	Secondary	Basic	Basic	None
Experience in the profession (years)	7	30	6	37	20	40	45	50
No. of sheep	200	51	80	50	150	70	100	70
Total area of pastures (ha)	66	20	50	don't know	150	18	40	12

^a Works with her husband.

Table 5

Types of interorganizational cooperation relationships.

		CAA	E1	E2	E3	E4	E5	E6	E7
Production	Informal conversations with other producers to solve problems in milk production	Y	Y	Y	N	Y	Y	Y	Y
	Applying for CAP subsidies in a producer association	Y	N	N	N	Y	N	N	N
	Applying for municipal subsidies	Y	N	N	N	N	N	N	Y
	Sharing some equipment with other producers	Y	Y	Y	N	Y	Y	Y	N
	Milk production (litres/day)	80	12	20	30	40	20	40	25
	Artisan cheese production (kg/day)	50	N	N	N	N	N	N	N
	Milk price is defined with customer/supplier	Y	Y	Y	Y	Y	Y	Y	Y
	Milk price is defined with producer association	N	N	N	N	N	N	N	N
Sales	Why did you choose CAA to sell your milk?	–	GR	CAA asked to	GR, BP	GR	GR	GR, BP	GR, BP
	Are the contracts formalized?	N	N	N	N	N	N	N	N
	Are you confident about your partnership? (1–5)	5	5	5	5	4	4	5	5
	How long have you sold the milk? (years)	–	5	5	2	3	4	5	2
	What would you do if you didn't sell the milk to CAA?	–	I'd sell to another firm						

Y: Yes – N: No.

AVR: Added Value to Region – BP: Better Price – GR: Good Reputation – GTRD: Good Thing for Region Development – WA: Work Alone.

a certified product, because they work alone. Possibly due to the small sample, it cannot be said, as in other studies (Dias and Franco, 2018) that the youngest and most educated producers are more sensitive to certification.

4.2.3. Queijo Serra da Estrela, DOP's community of practice

The association of producers leads to a chance for a more complete utilization of capacities and thereby less costs, which reduces the percentage of production risk, and the processing enterprises provide themselves with a reliable raw material base and a guarantee for the sales of finished products (Tinyakova et al., 2020). Local observation, interviews and phone survey data confirm that a *Queijo Serra da Estrela*, DOP CoP does exist. ANCOSE supports associated producers with administrative and technical skills. According to information provided about its activity, it can be classed as a CoP. This CoP is complemented by ESTRELACOOP, which provides technical support to rural producers. The cooperative carries out the HACCP analyses in the demarcated

region's farms. In Celorico da Beira a protocol with the local authority supports associated costs, so producers do not have that burden.

The written agreement between DPO producers and the local authority involves producers' participation in the annual Celorico da Beira cheese fair, sales to *Solar do Queijo* in exchange for support with the cost of the annual certification (about 1500€, half for the biggest dairies), 1500 certification labels and 1500 casein stamps.

4.2.4. Network success factors and benefits

Economic return, confidence, trust, mutual respect and resilience were the words used by those interviewed to qualify some success factors of the network and to overcome more difficult periods (Ashkenazy et al., 2018; Azevedo et al., 2016; Snaveley and Tracy, 2002). Despite the contracts' lack of formalization, all partners (CAA, milk suppliers and *Tio Careca*) are very confident in the network (Table 5). The older or less educated producers were more confident in the word given, saying they did not need a written contract.

From downstream information, CAA decided to innovate to increase sales, selling more than 50 % of the cheese production in small sizes (0,5 kg) due to the elevated price (around 16 €/kg) that used to discourage customers from purchasing. Even today, it is one of the few implementing that kind of production which requires more labour but represents strategic importance (Gulati et al., 2000; Lambrecht et al., 2015).

From observation, we find that the principal benefits of networking as identified in the literature include: risk sharing; obtaining access to new markets; speeding up the transfer of products to the market; pooling complementary skills; and acting as a key vehicle for gaining access to external knowledge (Pittaway et al., 2004).

To produce certified cheese, family heritage is not enough (Gonçalves, 2017). Experienced peer councils are fundamental, and a type of solidarity has been observed in rural communities (Snaveley and Tracy, 2002). In respect to production questions, all respondents (suppliers and CAA owner-manager) answer that they often have informal conversations with other producers (Grande, 2011; Wenger and Trayner-Wenger, 2006) to solve problems in milk production. “Things like dropping water into a cold chamber to create more humidity or reduce ventilation to increase the creaminess of the cheese was discovered by visiting neighbouring cheese farms” (Gonçalves, 2017).

Professional associations’ support is important in applying for subsidies, for example. CAA applied only once for CAP subsidies from a producer association, but (like other DPO cheese producers) often applies for local authority subsidies. Suppliers do not usually apply for CAP subsidies from a producer association and only E7 applied once for municipal subsidies.

Equipment sharing among peers is another benefit of networking (Dias and Franco, 2018), but some interviewees (E3 and E7) choose not to use that tool (Table 5).

Another network benefit, this time for the community, and confirmed by local observation concerns CAA’s maintenance (with pastures and cereals) of land not cultivated by owners themselves due to being elderly and / or non-residents (Dias and Franco, 2018), which also helps in fire prevention, for example.

4.2.5. Network performance

Since the beginning of the network, the evolution of CAA sales (Fig. 5) has been impressive with increases of 341 % from 2014 to 2015, and of 162 % and 142 % in the next two years. The decrease in sales between 2017 and 2018 is the result of the bad quality verified in some raw milk purchased, which has forced CAA to reinforce analyses to eliminate that production constraint.

In rural areas, the creation and dissemination of traditional values, based on public support and the market, cannot, by themselves, ensure sustainable development. In view of the above, innovative and proactive views, based on the redefinition of existing models with a focus on integration between sectors and available resources, are essential tools, as well as cooperation (formal and informal) between civil society players (Moruzzo et al., 2020). CAA managed to exemplify this

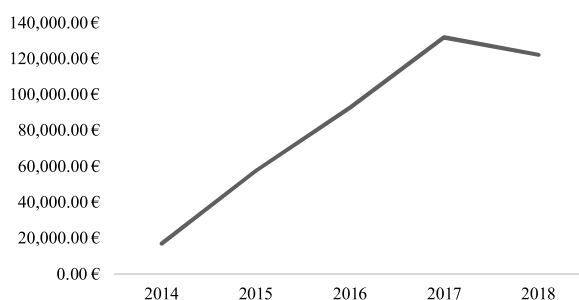


Fig. 5. Sales evolution.

Source: Authors, based on CAA documents.

statement by being able to innovate with an ancestral product in order to increase sales.

4.2.6. Promotion, sales and new markets

Since 1979, the Celorico da Beira Cheese Fair, promoted by direct broadcast of a TV programme in recent years, is the council’s biggest event to promote craft cheese and other local products. For 3 days, close to Carnival, local producers promote and sell their goods. Here, the price of cheese is defined by the organization, in an animated fair with the regular presence of local, regional and national politicians. Over several days, a gastronomic programme involves restaurants where residents and tourists can taste local delicacies. Animation is also present with music concerts, folklore spectacles, Portuguese theatre “*revista à portuguesa*”, street animation, show cooking, classic cars, or sports events: walking tours “*a rota do Borrego*” (the lamb route), “*a rota do pastor*” (the shepherd’s route).

Fig. 6 shows the CAA’s DOP cheese sales structure. Tio Careca decided to commercialize *Queijo Serra da Estrela*, DOP because he wanted to promote this endogenous product, which his grandmother used to produce when he was a child in the region of Guarda. Today, he buys more than 3000 kg per year from CAA, with around 50 % of sales being in the national market and 50 % abroad (mostly in the *mercado da saudade*, the nostalgia market).

Part of DPO cheese is also commercialized by ESTRELACOOP.

4.2.7. Results summary

Table 6 shows the network motives, success factors and benefits identified during this investigation in terms of production, sales, and for the community.

5. Conclusions and contributions

Europe is simply awash in milk. Producers across the continent are locked into a vicious cycle of overproduction that has forced prices far below the cost of making milk and put thousands out of business (Livingstone, 2016). Production of artisan cheese can be a solution for farmers to fight the overproduction of milk and low prices paid. In fact, during the early 90s the EU introduced and implemented numerous tools for the protection and enhancement of food. These tools can provide opportunities and advantages, such as the PDO label, which is an opportunity for producers to obtain a premium price, develop depressed rural areas, and even raise tourist interest (Bonadonna et al., 2017).

The objective of this paper was to analyse the local and national network that a young, female producer located in the Serra da Estrela national park in Portugal is using to make her traditional cheese-making business viable. To achieve this, a qualitative approach using a study case was chosen. This investigation, the first research in the *Queijo Serra da Estrela*, DOP network sector, makes an important contribution. It provides

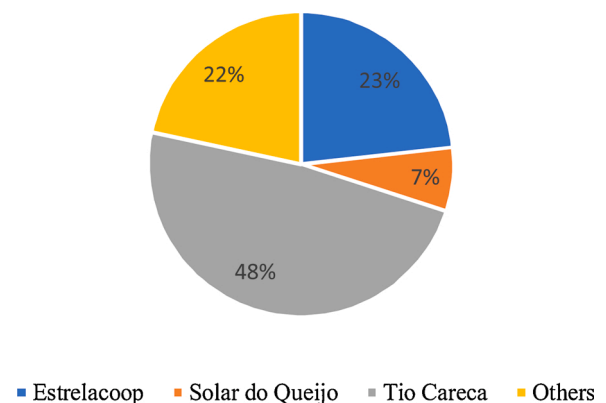


Fig. 6. Casa Agrícola dos Araís DOP cheese sales structure- 2018.

Source: Authors, based on CAA documents.

Table 6

Motives and success factors of the CAA network.

Source: Author.			
	Motives	Success factors	Benefits
Production	Location (supplier selection)		Peer advice Risk-sharing
	Experience of peers Economy of scale: purchasing milk to increase production instead of enlarging the flock	Trust, confidence, mutual respect, good reputation and regular payments	Production growth
Sales	Expand the business, enter new markets	Trust, confidence, good reputation and PDO product quality.	New markets Innovation (cheese size) Sales growth Land conservation
Community			Fire prevention

a deeper understanding of this topic and contributes to filling a gap: the absence of qualitative studies focusing on inter-organizational cooperation relationships in this traditional economic sector. In terms of practical contributions, deeper understanding reveals that partnerships are essential to maintain and develop the activity of very small businesses in a traditional sector based in areas of low population density.

The first reason for this network was to modernize a family farm, and 6 years later, other reasons led to its development with impressive economic results and job creation due to the good cooperation between partners based on confidence, trust, good reputation, quality products and regular payments.

The sheep cheese tradition and the associated ancestral knowledge in the *Serra da Estrela* region goes back hundreds of years. Local observation shows the importance of formal and informal support from the local authority to maintain this traditional activity. However, for the first time in history, its continuity is threatened by the ageing of the producers, which is a common problem of rural areas (Zivojinovic et al., 2020), prolonged droughts that reduce pastures, imported exotic breeds of sheep, which are better milk producers than local *Bordaleira*, and Spanish milk, to combat the reduction in sheep milk production.

Inter-organizational networks (horizontal, vertical and third party collaboration) have played an essential role in local small business development. The main innovation (small size cheese) was motivated by customers' wishes, a downstream vertical relation in the network's dimensions.

From local observation, it is clear that the local dairy industry presents an atomised structure of scattered farms of a low economic dimension and some structural deficiencies in complying with HACCP and environmental rules, in parallel with an industrial production structure of bigger units, besides an important number of small artisan cheese producing units. Given the physical distance between small agricultural units, social networks are fundamental in making cooperation between these farms viable.

Despite the fact that the interest in sustainable products may be growing, sustainable agri-food markets remain niche markets, attracting consumers with specific profiles (Dhaoui et al., 2020) local producers must be aware of this.

Although the findings make several important contributions, no study is without limitations that need to be considered. The main limitation of the study is the fact that only one network in a very specific sector, *Queijo Serra da Estrela*, DOP, has been analysed in a small locality of the demarcated region. Future studies can extend the investigation, or focus on DPO lamb networks in which ESTRELACOOP plays a major role: producers bill the cooperative, which bills two merchants (chosen by the producer) who pick up lambs from farms. PDO *Serra da Estrela* cottage cheese has also generated major interest in the pastry industry.

Other future studies, and based on that of Dinis (2013), could focus on the work that has to be done to promote and maintain the *Bordaleira* breed of sheep whose decrease has alerted the Portuguese government to the point of subsidizing each head of that autochthonous sheep with 34 euros (As Beiras, 2018).

These are important lines of research that can help a traditional sector in an area of low population density that also needs this industry to fight desertification through creating jobs both directly and indirectly (tourism and gastronomy).

Declaration of Competing Interest

Authors confirm that there is no conflict of interest between them.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.landusepol.2020.105117>.

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