

Prosecco has another story to tell: the coexistence of multiple knowledge networks in the same value chain

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Abstract

Purpose – This paper aims to analyze how knowledge networks can be configured within a value chain and provide evidence of the coexistence of multiple knowledge networks in the same value chain.

Design/methodology/approach – The empirical setting is the Conegliano Valdobbiadene Prosecco Superiore DOCG wine cluster in the Veneto region of Northeast Italy. Data was collected through the administration by telephone of a semi-structured questionnaire to 37 oenologists, sales managers, production managers and owners of bottling companies in the district. The authors used social network analysis tools to map knowledge networks in the Prosecco cluster.

Findings – The results shed light on the importance of singling out knowledge networks in clusters at the value chain level to aid practitioners and researchers in this field. In fact, this research proves the existence of knowledge networks specificities related to the various phases of the production process.

Research limitations/implications – This study has certain limitations. The most relevant is connected to the choice to limit the analysis to a specific cluster. Future research might extend this type of analysis to multiple clusters in different locations.

Practical implications – The authors explain that in the cluster they studied, internationalization, as a common objective, might be made easier if firms could establish a more developed sales knowledge network.

Social implications – The relational approach to value chain enables disentangling specific roles of each actors. The social dimension of the value chain is taken in consideration.



Originality/value – The authors show that a firm operating in the wine industry can have different knowledge networks in the same value chain. This work adds to previous literature on knowledge networks in clusters by shedding light on an important, but still understudied aspect in the cluster functioning. Knowledge diffusion in clusters is not only uneven but is also value chain stage specific. By intersecting literature on knowledge networks, value chain and cluster research, the authors proposed a new perspective of analysis of the wine industry.

Keywords Agri-food supply chain, Knowledge networks, Prosecco, Network of collaboration, Value chain, Cluster, Competitive strategy, Survey research, Suppliers, Network models

Paper type Research paper

1. Introduction

Research on knowledge networks in industrial clusters is not new. [Marshall \(1890\)](#) was the first to associate knowledge and territory. After his seminal work, many researchers in economic geography and management have deepened the understanding of how knowledge flows from one organization to the other in clusters, but never dedicated much attention to monitoring differences in knowledge networks within the value chain. Our study aims to contribute to this literature by answering the following research question: Can multiple knowledge networks coexist in the same clustered value chain?

In general, previous research has confirmed that knowledge is an important resource for companies because it is linked to their competitiveness ([Comner and Prahalad, 1996](#)). Suppose there is a high level of knowledge flows within a cluster. In that case, it is expected that the competitiveness of the clustered companies will be high and also higher than those companies outside the cluster ([Camuffo and Grandinetti, 2011](#); [Hoffmann *et al.*, 2013](#)).

In search of a better understanding of knowledge structures in clusters, a stream of literature dedicated to exploring the role played by different organizations emerged. [Asheim and Isaksen \(2002\)](#) claimed that knowledge networks can involve different actors, such as local organizations that support industrial activity, suppliers and even competitors. Subsequently, [Malmberg and Power \(2005\)](#) identified the mobility and sociability of individuals as means for activating knowledge ties. [Morrison \(2008\)](#) focused on the role of gatekeepers as knowledge brokers in clusters, whereas [Belussi and Sedita \(2012\)](#) distinguished between deliberate and emergent knowledge structures in industrial districts, focusing on business networks and communities of practice as different modalities to activate knowledge exchange mechanisms. Recently, [Hjertvikrem and Fitjar \(2020\)](#) identified various channels for knowledge exchange in clusters, focusing mainly on monitoring and labor mobility. Specific to the wine industry, [Mitchell and Schreiber \(2007\)](#) identified the mobility of technicians such as oenologists as knowledge networks enablers. From the reading of this stream of literature, we understand that there are different types of knowledge structures, dominated by network-specific knowledge exchange.

Knowledge networks can convey different types of knowledge, in cluster research, we find basically two types of knowledge: market-strategic knowledge and technical knowledge. Various configurations of these have been studied in clusters in both the wine industry (see, for instance, [Giuliani and Bell, 2005](#); [Giuliani, 2007](#)) and the footwear industry ([Boschma and Ter Wal, 2007](#)). [Alberti and Pizzurno \(2015\)](#) studied an Italian aerospace cluster. They found that some knowledge, such as technical knowledge is spread throughout the cluster and is available to everyone, while knowledge about markets is more selective.

However, while the idea that market and technical knowledge flows between clustered organizations in different ways and through different channels is nowadays a consolidated knowledge, very few contributions analyzed knowledge networks within a value chain perspective.

In a value chain, players can collectively participate in the process of value creation (Peppard and Rylander, 2006). This process occurs in large-scale industries such as the automotive industry (Dyer, 1996) and smaller industries such as the wine industry (Bandinelli *et al.*, 2020). Particularly in the wine industry, the supplier support can improve aspects such as quality. Ponte (2009) studied how quality in the South African wine industry is affected by supply relations and value chain governance. The attitudes of various supply chain actors can affect a more recent issue, which is ecological sustainability. Barisan *et al.* (2019) analyzed how the strategic incorporation of sustainable practices reinforced competitive advantage and shared value in the Conegliano Valdobbiadene Prosecco Superiore DOCG (Controlled and Guaranteed Denomination of Origin) district. As well as providing an overview of the Italian wine industry, Bandinelli *et al.* (2020) proposed a classification of environmental practices specific to the wine industry, whereas Borsellino *et al.* (2020) studied the profitability of modern and hybrid organizational forms compared to traditional ones in wine-making cooperatives in Sicily, Italy. Naudé and Badenhorst-Weiss (2020) studied the supply chain risks involved in wine production in the Western Cape province of South Africa. Studies of the manufacturing industry have shown that access to knowledge depends on the occupation of a firm position in the value chain (Hoffmann *et al.*, 2013). Recently, Maghssudipour *et al.* (2020) analyzed the Montefalco wine cluster in the Umbria region of Italy and explored the role of multiple ties in knowledge networks. However, they failed to establish a clear relationship between knowledge networks and the value chain.

In this context, our study aims to fill this gap by demonstrating how knowledge networks can be configured within a value chain and providing evidence of the coexistence of multiple knowledge networks in the same value chain. The wine industry is inherently clustered because the type of grape grown depends on the *terroir*, which refers to the conditions of soil, climate and geographical relief. The *terroir* is the first element that adds value to a wine (Ferreira *et al.*, 2018). Our research focuses on a specific wine cluster: the Conegliano Valdobbiadene Prosecco Superiore DOCG.

Italy is an essential player in the agri-food sector worldwide. Besides, certifications of geographical origin, such as Denomination of Origin Controlled (DOC), Controlled and Guaranteed Denomination of Origin (DOCG) and Protected Designation of Origin (PDO), based on the territorial and climatic particularities of a region attest to the superiority and uniqueness of Italian agri-food products. The establishment of several clusters made up of small companies, many of them family-owned, is particularly characteristic of Italy. Such clusters are formed by several actors, which together characterize a supply chain. They include suppliers of raw materials, products and services; producers; retailers; and centers of research (Alberti and Pizzurno, 2015). The idea of a cluster is that the actors work collaboratively to generate value in the chain, allowing the sharing of information, resources (Hoffmann *et al.*, 2017) and knowledge (Alberti and Pizzurno, 2015) to generate benefits for the entire supply chain.

The wine industry is one of the most significant sectors in Italy, which is considered the largest wine producer in the world (Bandinelli *et al.*, 2020). In Italy's north-east, many small wine producers collaborated to create a consortium to promote the sparkling white wine Conegliano Valdobbiadene Prosecco Superiore DOCG. The purpose of the consortium is to create value within the Prosecco supply chain. The consortium is a private body of public interest that brings together all categories of producers, including winegrowers, winemakers and bottlers (Consortium, 2020). It should be clarified that the same company can have different roles (e.g. as a bottler and a winegrower). This is the *locus* of our study.

We use a social network analysis (SNA) anecdotally commented on by drawing on interview data to address our research question. We adopt an inductive research design for our analysis and derive four propositions from our results. These propositions can be tested in a future study using a deductive approach. We present an empirical analysis on knowledge networks in agribusiness, specifically the wine industry, thus contributing to the previous literature, which (with few exceptions) has primarily focused on manufacturing or the high-tech sector. We show that in wine clusters each stage of the value chain gives rise to differently structured knowledge networks. Moreover, we outline some managerial implications, mainly related to companies' need to rethink, collectively, the internationalization strategies by creating a common knowledge base.

The paper proceeds as follows. Section 2 introduces the concepts of value chain, knowledge networks and clusters. Section 3 illustrates the empirical setting, while Section 4 presents the empirical analysis. Section 5 offers the presentation and discussion of the results. Finally, Section 6 puts forward some concluding remarks.

2. Literature review

We focus on constructs such as value chain, knowledge networks and clusters from a strategy perspective. However, we also draw on contributions from different perspectives, such as innovation (Asheim and Isaksen, 2002; Alberti and Pizzurno, 2015), cooperation (Kongmanila and Takahashi, 2009; Mudambi and Tallman, 2010) and ecological sustainability (Maier *et al.*, 2020). The borders between these diverse approaches are not clearly defined, so we believe that they can contribute to our understanding of the phenomenon we are studying.

2.1 Value chain concept

In general, it is common for organizations to operate within a value chain, especially smaller organizations. Porter (1985) defined a value chain concept, which relates to the activities within and around an organization, each of which may or may not aggregate value, thereby affecting the organization's competitive strength. Firms must manage individual activities and existing links among actors in the value chain to be able to generate a differential competitive advantage, which means something that consumers are willing to pay for (Porter, 1985). This concept has proved a useful mechanism for depicting the chain of activities in traditional industries' physical world (Peppard and Rylander, 2006).

Value chains can be found in all sectors. For example, an agri-food supply chain is composed of the following basic flows (Coase, 1937): upstream, on-farm, downstream and distribution and retail. The term upstream refers to off-farm actors who provide input into primary agricultural production, such as:

- biotechnology companies;
- suppliers of fertilizers, herbicides, pesticides and fungicides; and
- equipment providers. On-farm refers to producers (farmers) who use carry out production activities on their land.

Downstream actors include:

- companies or individuals who purchase and transport agricultural commodities;
- processors of agricultural food products; and
- actors involved in transport and trade for final retail and distribution.

Finally, distribution and retail involve food and beverage retailers and wholesalers who distribute the end food and beverage products to consumers.

Operations with high added value have value added to their products in all these phases (upstream, on-farm and downstream). Operations management based on this concept aims to generate high-value products suitable for market needs. This suitability is realized through a superior product, good brand, flexibility and differentiation, all of which reflect value. Final consumers intuitively assign more excellent value to products with these characteristics, generating competitive advantages for the producers (Porter, 1985; Peppard and Rylander, 2006).

In a supply chain, value is not created by a single actor but by the set of actors and companies that contribute to delivering the final product to consumers. The idea of a value chain is that every company occupies a position within the group of companies; upstream suppliers supply inputs downstream to the next link in the chain. Each player contributes until the final product is ready to be delivered to the final consumer. Thus, value is co-created by the combination of players in the chain (Peppard and Rylander, 2006).

2.2 Knowledge networks in clusters: the role of the value chain

Maier *et al.* (2020) connected the two concepts of value chain and networks to describe the relationships between beer producers and their suppliers: barley producers, packaging companies, storage suppliers and logistics companies. The production practices they investigated highlighted the intense cooperation that allowed the brewing companies to offer a product with ecological appeal and differentiated prices. In addition to the actors as mentioned earlier, the networks involve external agents, such as rural and regional development agencies and nature conservation institutions (Maier *et al.*, 2020).

The constitution of these networks reinforces the argument that, even in clusters, actors are not entirely interconnected, in the sense of everyone working with everyone (Alberti and Pizzurno, 2015; Giuliani, 2007). On the contrary, the actors can form networks that end up competing with each other (Hoffmann *et al.*, 2017; Maier *et al.*, 2020).

We know that networks can assume different configurations within a cluster (Giuliani *et al.*, 2019). These settings impact the way knowledge is shared between actors. Knowledge can be transferred vertically in the value chain (Dyer, 1996; Harryson *et al.*, 2008; Kongmanila and Takahashi, 2009; Mudambi and Tallman, 2010); horizontally between companies that are on the same link in the value chain (Dana *et al.*, 2013); both vertically and horizontally (Malmberg and Power, 2005); and even between the value chain and support institutions (Alberti and Pizzurno, 2015). However, none of these configurations is inherently superior, as their relevance depends on the context and the benefits of generating for the network members (Giuliani *et al.*, 2019). Thus, each network is uniquely organized.

It has already been demonstrated that an actor's position within the value chain is related to the access that actor has to resources (Hoffmann *et al.*, 2013). Downstream companies, who have greater power in the network, may have easier access than supplies to knowledge and other crucial resources.

Thus far, we have tried to demonstrate that networks and value chains entail knowledge exchange. Previous studies have generally regarded knowledge as being transmitted uniformly across the network. They treat knowledge as a more or less uniform set of expertise (Hoffmann *et al.*, 2013) or treat networks as unique structures in which companies get involved (Maier *et al.*, 2020), where familiarity among people results in the constitution of the network itself (Giuliani *et al.*, 2019).

Some studies of the wine industry have drawn connections between value chain, knowledge networks and clusters. According to Warman and Lewis (2019), *terroir* is

essential for adding value to wine in terms of both sensory and symbolic aspects. However, there are other aspects that are also relevant to the value of wine.

In their study of a wine value chain, Baldinelli *et al.* (2020) highlighted that information sharing regarding the steps required to provide a sustainable product is also a value source. Therefore, the management of value chain relationships, which must occur along all the supply chain, is vital for guaranteeing a superior quality product. Such relationships are essential to create and maintain market value and competitive advantages.

Another study investigated the supply chain of port wine. Having researched 136 companies, Ferreira *et al.* (2018) showed that value generation differs across different value chain models. The chain is more effective when it links local services and local product knowledge. The authors also indicated that the port wine cluster could benefit more from the transfer of technology than from the reallocation of processes (Ferreira *et al.*, 2018).

Mitchell and Schreiber (2007) studied knowledge networks in wineries in New Zealand, showing that the mobility of technicians is the preferred link to establish a network relation. In their study of the Hunter wine cluster in Australia from the period 1820-1920, McIntyre *et al.* (2013) found that informal knowledge flows were important for establishing stable cultivation of wine grapes in that region. Family ties and commercial links enabled knowledge to pass through the area and the absence of competitive pressures favored the creation of knowledge networks centered on conversations about grapes and wine among the settlers.

Casali *et al.* (2018) researched the propensity toward innovation and choice of distribution channels among small Italian wineries. The authors found a group of small companies with low levels of innovation and other groups with an orientation toward incremental and radical innovations (Casali *et al.*, 2018). They also indicated that the greater the propensity toward innovation, the more likely the company was to opt for specialized channels and wholesale. One of the implications of their study is identifying a need to foster the establishment of networks between small Italian wine companies, which would make possible the access to external to the cluster knowledge sources and the process of building a common knowledge reservoir in the cluster.

Borsellino *et al.* (2020) studied wine production in Sicily, Italy, intending to identify which cooperative model could be most profitable in an increasingly competitive market. The authors indicate that the cooperative wine production system in that region of Italy is partially or vertically integrated. Wine is sold in vats, and a strategic alliance is maintained with one of the largest wine conglomerates in Italy. Thanks to this partnership, which involves exchanging information and knowledge between the cooperative and its partner, the cooperative has managed to achieve stability in a competitive market.

Monticelli *et al.* (2018) researched the role of institutions in promoting the internationalization of Brazilian wineries through the promotion of cooperation. Their results indicate that formal institutions are the most important actors for promoting and facilitating cooperation among companies. One consequence of promoting cooperation between companies is the exchange of intangible resources, such as information, knowledge and technology.

In accordance with the previously mentioned studies, we understand a value chain as a construct connected to the concept of networks when we discuss knowledge structures (Dyer, 1996; Maier *et al.*, 2020). We also believe that access to knowledge depends on the actor's position in the value chain (Hoffmann *et al.*, 2013), that participating in a cluster can affect a firm's access to knowledge (Borsellino *et al.*, 2020; Mitchell and Schreiber, 2007), and that it is possible to find more than one type of value chain configuration in the wine

industry (Ferreira *et al.*, 2018). However, still, it is needed to reflect more upon value chain configuration and knowledge networks within clusters, especially in the wine industry.

In this context, the Conegliano Valdobbiadene Prosecco Superiore DOCG cluster represents an emblematic case, where multiple knowledge networks shape competitive and cooperative ties within the value chain. We elaborate on this argument in the sections below.

3. Conegliano Valdobbiadene Prosecco Superiore DOCG cluster

Industrial districts or clusters represent a typical organizational model in the Italian economy (Volpe, 2008), and the Conegliano Valdobbiadene Prosecco Superiore DOCG is emblematic of this model. Prosecco is a variety of wine produced exclusively in the Northeast of Italy at the boundary between Veneto and Friuli Venezia Giulia regions. The wine produced in the region can have two distinct certifications: DOC and DOCG. The basic certification is DOC, which, in relation to Prosecco, certifies that the wine has been produced within the provinces of Treviso, Venice, Vicenza, Padua, Belluno, Gorizia, Pordenone, Trieste and Udine. The Conegliano Valdobbiadene Prosecco Superiore DOCG cluster represents a region with its own microclimate, which produces a Prosecco of a higher quality and in smaller quantities than the wider DOC. The production of Conegliano Valdobbiadene DOCG wines is regulated according to a set of rules relating to the cultivation of the grapes, their fermentation and the subsequent natural “prise de mousse” (literally “foam creation”). The sparkling wines of this region are produced using the Martinotti method, which has been perfected over the years, thanks to the work of Professor De Rosa. This method calls for refermentation in pressurized tanks (autoclaves) to intensify the wines’ primary and secondary fragrances and their fruity and floral aromas while preserving their elegance, liveliness and freshness.

The district consists mainly of companies involved in the production of wine. Still, it is also enriched by activities that support the production and distribution of the product (for a complete analysis of the industry structure of the Conegliano Valdobbiadene Prosecco Superiore DOCG sparkling wines, see Pomarici *et al.*, 2019). The region has many small and large organizations offering food and hospitality, where were established mainly to service visitors to the 22,000 hectares of agricultural land wishing to taste the area’s products. It also contains many companies closely linked to the wine-growing and production chain, ranging from glass and cap producers to companies building oenological machines to marketing consultancy offices.

Prosecco first gained its prestige in 1,876 when the first Italian Oenological School was founded in Conegliano. Subsequently, in 1923, the first Experimental Institute for Viticulture was established there. The territory of the district covers approximately 5,896 hectares and is characterized by a specific microclimate. The different slopes, altitudes and exposures of the region lend different organoleptic nuances to the wines. In 2019, the Conegliano Valdobbiadene area became a UNESCO World Heritage Site, which increased its visibility worldwide.

According to Boatto *et al.* (2019), in 2018, the number of companies involved in the cultivation of vines (winegrowers) in the Conegliano Valdobbiadene Prosecco DOCG cluster was 3,486 (employing 6,325 people). The number of wineries was 428, of which 182 were sparkling wine houses. Overall, the district has 283 oenologists, accounting for an average of approximately 1.55 oenologists per company. In the previous year, Conegliano Valdobbiadene Prosecco produced 518.5 million euros worth of wine, corresponding to a

volume of 90.6 million bottles, 97% (87.88 million bottles) of which was sparkling wine (Prosecco Superiore, Rive e Superiore di Cartizze) (Figure 1).

4. Research design

4.1 Methodology

The nature of this study is exploratory; therefore, an inductive approach is appropriate. We do not test hypotheses statistically, but instead, we aim to offer some useful propositions, which we discussed in light of theory and that can be further tested using a deductive approach (Eisenhardt, 1989). The study is based on data on developing a knowledge network between the companies in the Conegliano Valdobbiadene Prosecco Superiore DOCG cluster. Previous research has confirmed that the social networks in which organizations and individuals are embedded are important knowledge sources (Granovetter, 1985; Uzzi, 1997).

A large body of literature in the field of economic geography has investigated the structure of these networks to make inferences on collective learning processes driven by embeddedness in local and non-local networks (see, for example, Bathelt and Glückler, 2011). Most studies find that companies occupying a central position in a knowledge network are more successful than those in peripheral positions (Owen-Smith and Powell, 2004). Knowledge networks are frequently approximated using secondary data, such as patent data, publications and research and development projects. Different types of sources have various advantages and disadvantages (for a review, see Hagedoorn and Cloodt, 2003). We aimed to obtain a complete picture of knowledge networks in a cluster using primary data from a survey. The information retrieved allowed us to explore knowledge networks using SNA techniques, whereby knowledge sourcing mechanisms can be investigated by identifying dyads, namely, bilateral links between knowledge sources and knowledge receivers (see also Giuliani and Petrobelli, 2011; Abbasiharofteh and Dyba, 2018).

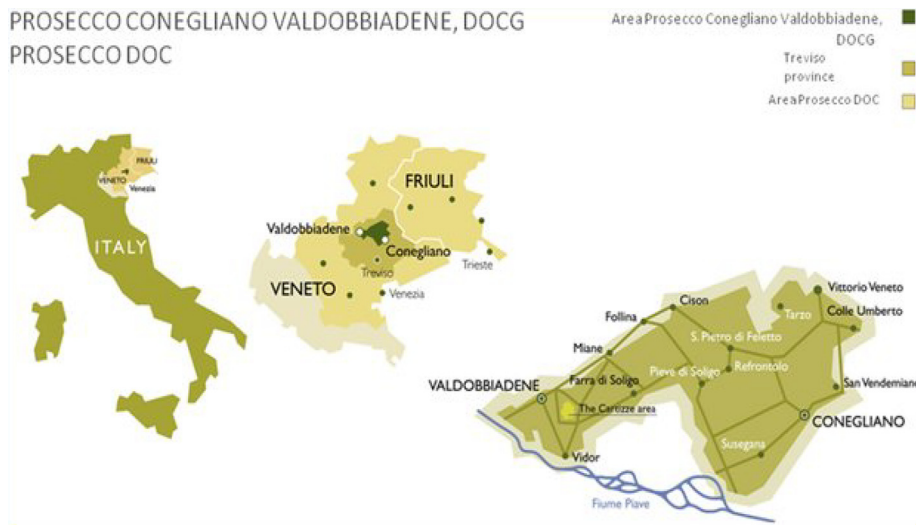


Figure 1. Conegliano Valdobbiadene Prosecco protected denomination of origin

Source: Rossetto *et al.* (2010, p. 4)

4.2 Sample and data

The Conegliano Valdobbiadene Prosecco Superiore DOCG cluster contains 184 sparkling wine houses. To build a sample, we selected from the list of companies those that are most representative based on the opinion of a panel of experts from several institutions: the Consorzio di Tutela del Prosecco Superiore di Conegliano e Valdobbiadene DOCG, the Consorzio Agrario di Valdobbiadene, the Confraternita di Valdobbiadene and two of the leading companies in the cluster. After applying this filter, we established a final sample of 37 companies. This sample enabled us to proceed with a representative set of enterprises from the total population (covering a broadly acceptable 20% of the population).

We carried out the data collection using a questionnaire administered through the Google Moduli™ platform. The questionnaire was administered in 2016 to oenologists, sales managers, production managers and owners of bottling companies in the district. It was composed of three sections (21 items overall): one (9 items) to gather general information (including size, age, turnover and specialization of the company), another (7 items) to understand the company's knowledge base (in terms of the composition of its human resources) and a final one (5 items listed below) to collect information for a relational analysis. We constructed the knowledge networks based on studies by [Giuliani and Bell \(2005\)](#), [Morrison and Rabellotti \(2009\)](#) and [del-Corte-Lora et al. \(2017\)](#). However, we extended their approach by considering each actor's specific position within the value chain. Consequently, we used a roster recall method whereby each firm was presented with a complete list (roster) of the other firms in the cluster and asked the following five questions:

- Q1. If you were in a critical situation, to whom would you go to obtain knowledge on managing the vines before harvest (e.g. plant care, pruning, maintenance of the vines, treatment of plant pathologies)?
- Q2. If you were in a critical situation, to whom would you go to obtain knowledge on the grape harvest (e.g. harvesting, processing in the cellar)?
- Q3. If you were in a critical situation, to whom would you go to obtain knowledge on the first part of the wine-making process (e.g. alcoholic fermentation, pumping over, pressing, racking)?
- Q4. If you were in a critical situation, to whom would you go to obtain knowledge on refining the finished product (e.g. bottling, the sparkling wine process, sugar dosage)?
- Q5. If you were in a critical situation, to whom would you go to obtain knowledge on selling the finished product (e.g. design labels, bottles, caps, exports, new markets)?

This method allowed us to map knowledge networks in the cluster. Each knowledge tie was activated mainly as a reply to a query on a complex problem that emerged and that the firm had to solve (e.g. how to treat a new pest or how to deal with high levels of wine acidity during fermentation). We do not distinguish here between informal and formal relationships between actors because this is out of the scope of the present work. Therefore, knowledge can be accessed alternatively through social/friendship ties or business/contract ruled ties.

We used face-to-face interviews to conduct a more detailed analysis of the companies that answered the questionnaire. Finally, we carried out semi-structured interviews with company CEOs and executives. These interviews gave us a detailed understanding of each company's activities, as well as the firm's position within the supply chain and the cluster's knowledge ecosystem.

Our analysis of the responses allowed us to map the interactions that might take place between companies concerning to specific problems that may arise during the production

process. The position of a company within the network was determined on the basis of SNA, whereby relationships between one or more actors are analyzed (Chaudhary and Warner, 2015). The nodes (i.e. the enterprises) represent the fundamental unit for representing and analyzing the network. The relations (ties) represent the connections between the various nodes and can be distinguished according to their extension and structure. The representation used in this research is defined as socio-centric because it represents the entire network. To analyze the participant companies' relational structure, we used the SNA technique included in the UCINET v.6 software application (Borgatti *et al.*, 2002). Several authors have used this technique for cluster analysis (Boschma and Ter Wal, 2007; Giuliani, 2007; Morrison and Rabbellotti, 2009; Ramirez-Pasillas, 2010; Expósito-Langa *et al.*, 2015).

5. Results and discussion

5.1 Results from a network analysis

The district's relationships were schematized according to the various phases of the production process and graphically mapped using UNICET® software. We generated four figures representing the knowledge networks between organizations in the cluster in each value chain stage.

Squares represent the bottling companies, the dimensions of which vary according to the turnover of the company declared during the interview: the larger the square, the larger the company's turnover. The colors of the squares vary in relation to the turnover class to which they belong:

- yellow = 3%–20%;
- orange = 21%–37%;
- red = 38%–54%; and
- burgundy = 55%–70%.

Collaborating companies (or bottlers not included in the sample) are represented by a triangle if they are located in the district or a circle if they are located outside the district. We did not construct a network for the grape harvesting phase because all the companies interviewed stated that they would not approach anybody for a hypothetical problem that might arise. Finally, not all the companies are represented in the figures because some of them outsource entire phases of the production process.

Figure 2 represents the knowledge network for the vine management and plant-tending phase. Here, the important role played by the Consorzio di Tutela del Vino Conegliano e Valdobbiadene (node 41) and the Consorzio Agrario di Valdobbiadene (node 40) is obvious. Although they carry out different activities – the first is a private body of public interest that deals with the protection, promotion, and sustainability of all categories of producers of Prosecco DOCG, and the second is a retailer of vehicles and products used in agriculture – they are the first two references for many companies, regardless of the volume of turnover or export. The knowledge network is, therefore, centered on these two actors (circled in red in the figure); knowledge flows from one organization to the other mainly through the interventions of these two actors, which act as knowledge brokers in this phase.

Figure 3 represents the knowledge network for the first phase of winemaking. There are 28 more actors involved in this phase than in the previous stage, creating a denser relational structure. In this phase, leadership can be attributed to one of the collaborating companies within the district (58), which has 12 links, followed immediately by a chemical analysis laboratory for oenology (44) with 11 ties and a collaborating company outside the district (59) with ten links. Two other essential laboratories (50 and 64) have many relationships

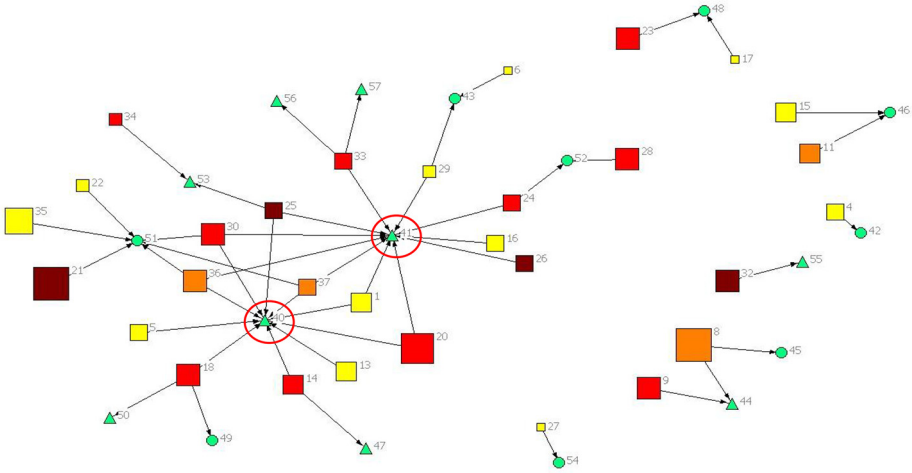


Figure 2.
Network in the vine
management and
plant-tending phase

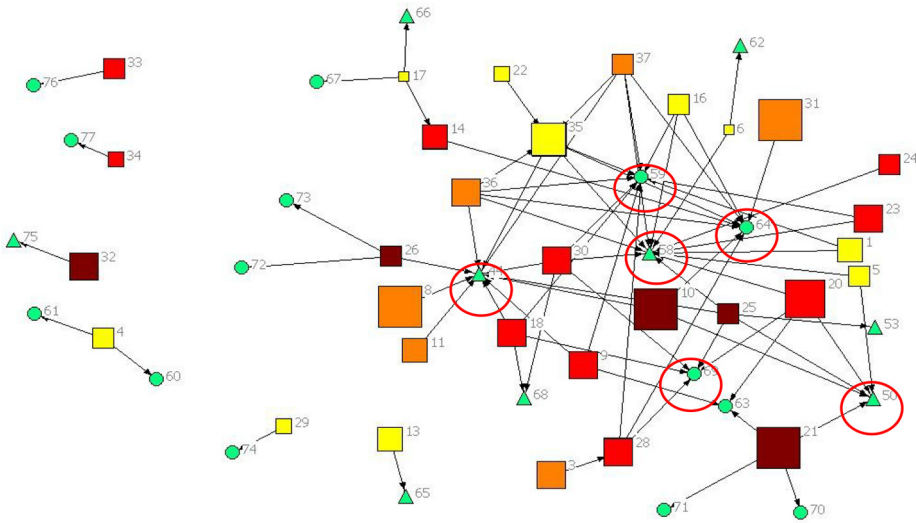


Figure 3.
Network in the first
phase of wine making

with wine bottling companies. The laboratories' main activity is to provide technical consultancy on fermentation, the action of yeasts or the acidity of the product.

However, the relationships with the bottling companies are intensified because they can provide the necessary certification to export food and alcohol products outside the Italian or European borders, which is essential to for goods leaving Italy to pass customs. Concerning the other two companies mentioned, one (58), besides carrying out chemical analysis, mainly acts as suppliers of oenological and consumer chemicals; the other (59) is a company that has been operating for over 20 years in the research and development of machinery for processing must account for wine making. Its machinery has unique technical applications, such as flotation, to clarify juices and tangential microfiltration using membranes to ensure

tartaric stability. Thus, bottling companies require a large variety of services provided by suppliers.

The interviews revealed that the laboratories did not differ significantly in terms of skills and competences. In fact, all those mentioned have reputations as leaders in their market sector, and winemakers often approached several laboratories for advice, even for the same problem. In the case of companies supplying products and machinery for oenology, the choice depends on the customer's request: about the supply of chemical products or yeasts, the differences between the products are very subtle, and there is a tendency to consider the after-sales customer relationship; in the case of machinery for winemaking or bottling, there is a more rigid selection by the consumer who, when faced with a costly purchase, must consider not only the service but also the proven functionality of the machinery. On the one hand, we observed a trend whereby small companies engage in outbound seeking in phases of the production process requiring greater more outstanding technical expertise (laboratory analysis) than is available internally from oenologists and cellarers that are too expensive to manage internally. On the other hand, companies with higher turnover volumes tend to internally manage all phases of the production cycle without seeking external knowledge or information outside, except in cases where production has to be certified by an external laboratory for export.

Figure 4 represents the knowledge network in the sparkling wine phase and includes interactions for different problem-solving activities, ranging from sugar dosage to bottling. The structure and distribution of links in this phase is very similar to the previous phase. What distinguishes this phase is that the wine undergoes a process of refermentation in a large, pressurized container (an autoclave) through the addition of yeast and sugar. The connections that occur in this phase of the production process are mostly characterized as knowledge seeking about certifications, informal technical advice on active yeasts or sugars and opinions from other bottling company owners.

Figure 5 represents the knowledge network in the last phase of the value chain, which includes packaging, marketing and the development of new commercial channels. The

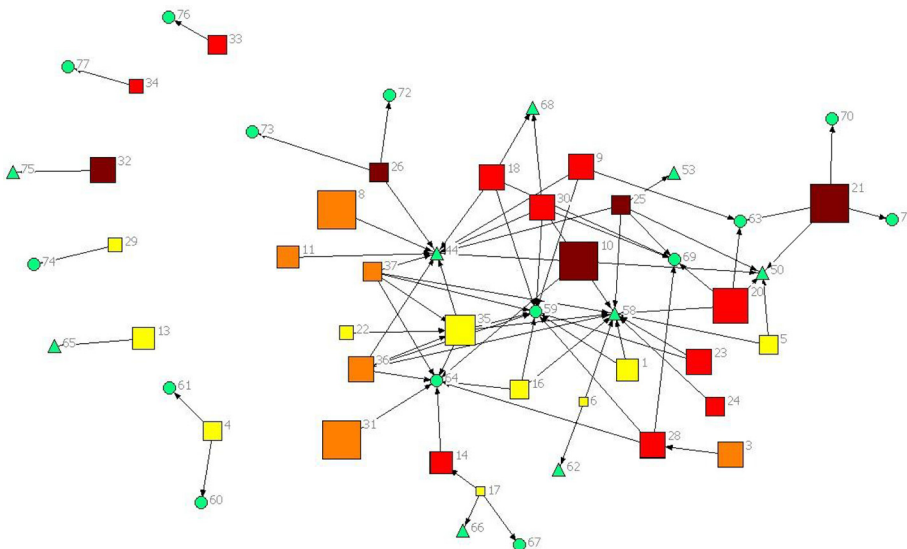


Figure 4. Network in the sparkling wine phase

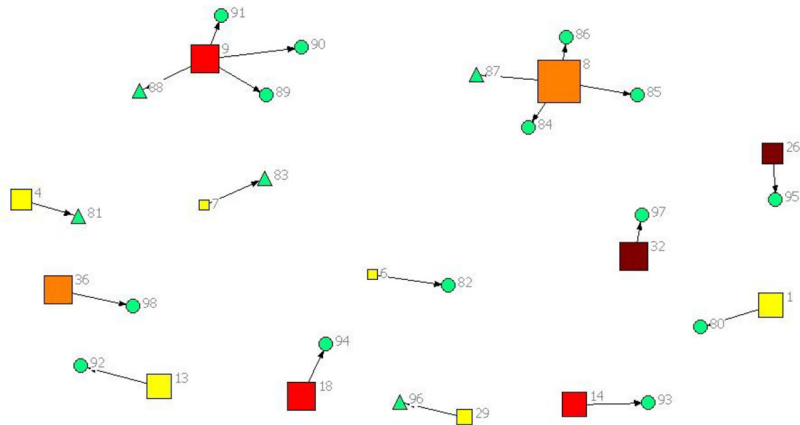


Figure 5.
Network in the sales
and marketing phase

figure provides a particularly interesting and surprising picture. Only 35% of the bottling companies reported knowledge exchange – vertical, sporadic or random – with external agencies in this network. Besides, most of the collaborating companies operating in the last phase were outside the cluster. Apart from (9) and (8), the companies mentioned were all typographical companies or graphics studios that more or less specialized in wine marketing. Collaborations were occasional and generally related to the launching of new product lines (*millesimati* or different methods of sparkling winemaking) or the changing of labels or packaging. However, owners did not favor such changes and the lack of connections might be explained by the value attached to tradition and the fact that product improvements were barely perceptible. The companies interviewed stated that they manage the entire sales flow through word of mouth with long-standing customers or, in the case of wholesalers or importers, entrust the entire sales process to third parties. This network is the sparsest, which indicates companies' reluctance to share market knowledge with other organizations within the cluster; if they need advice, they tend to approach organizations outside of the cluster.

5.2 Discussion

By analyzing the knowledge networks in the Prosecco cluster, we were able to monitor the relational structure in each stage of the value chain. As explained in section 4.2, the networks are different in each phase of the value chain.

The most important conclusion we derived from the analysis of all the networks of interactions in the different phases of the production process is that there are few ties between bottling companies. Apart from a few sporadic cases, the tendency is for the technical experts from the supplying companies and the oenologists from the bottling companies to talk to each other. Often, if there is a problem in the cellar, it is the winemakers who take care of it, and if they need help, they act as knowledge Scouters, collecting useful information to solve the problem and passing it on to the cellarers or oenotechnicians.

Thus, companies do not tend to collaborate intensively, which may be because, in contrast to [McIntyre et al's \(2013\)](#) findings, this region has intense internal competition. The main organizations that have introduced greater cohesion and knowledge flows into the network are the Consorzio di Tutela del Prosecco Superiore di Conegliano e Valdobbiadene DOCG (41) – evidenced by the numerous ties highlighted in the figures – and the Confraternita di

Valdobbiadene (40), a community of practice formed by relevant actors in the cluster. In fact, both of these act as itinerant brokers, putting two or more companies that are part of the same subgroup (bottling companies) and that share the same problems in contact with each other (Chaudhary and Warner, 2015). Mitchell and Schreiber (2007) described a similar situation in New Zealand, where technicians acted as brokers among wineries, and Maghssudipour *et al.*'s (2020) discussion of the importance of social ties in the Montefalco wine cluster generally supports this kind of relationship.

Another explanation for this lack of collaboration intensity is related to the knowledge base of the bottling companies. Data provided by the questionnaires show that only a small proportion of employees have a higher education. If we consider that the companies generally have no more than two oenologists – 51% had only one oenologist, and 20% had none – and that the average number of employees with a bachelor's degree is 2.5 per company, it is possible to deduce that the cellar oenologist monopolizes the knowledge base in the technical field and that the skills in the commercial field are concentrated in internal management, which generally consists of the owner or partners. The oenologist title is generally the result of a three-year degree course, but there are some exceptions. This is because, following the 1991/129 law that sanctioned the establishment of the course for future oenologists, this title was also assigned to oenotechnicians who applied to the inter-ministerial commission and who were able to prove that they had at least three consecutive years' experience. The small knowledge base might explain the lack of relations between bottling companies and collaborating companies (Figure 5). One of the objectives cited by 78% of the companies interviewed was to increase their exports to the USA and Canada; however, these data are in contrast with the absence of a shared knowledge base for implementing internationalization strategies.

Things are different when considering the exchange of technical knowledge through the oenologists. We should point out that while *terroir* is essential in adding value to a wine (Ferreira *et al.*, 2018), technical knowledge can also add to the value chain, as also shown by Ferreira *et al.* (2018). This is owing to the complexity of the good to be produced; the more technologies used in developing the good, the more technical knowledge is required. In the case of wine, many different technologies are used in the different phases of the production cycle (Santos *et al.*, 2020), which contributes to the creation of a product that is considered “alive” because it is constantly evolving. From the development of a new product to the step-by-step control of its production, many technologies are required to ensure stable production (Borsellino *et al.*, 2020) of a good whose simple exposure to oxygen can completely change its unique organoleptic properties. The use of the same technologies (only varying in terms of supplier) by all companies guarantees a knowledge base that is largely shared at the technical level (Ferreira *et al.*, 2018). This explains why the technology acquired by larger companies is further passed later to smaller companies (Borsellino *et al.*, 2020). As mentioned previously, there is very little collaboration between bottling companies. Instead, knowledge flows arise from certain characteristic elements of the wine market. In this sector, except where a company has sufficient resources to integrate specialized personnel into its own staff, specialized personnel (oenologists or winemakers) are hired only in a consultancy role to advise on the harvest or processing and ageing in the cellar, as explained by Mitchell and Schreiber (2007). However, when a company has a more vital partner in its own network, the company receives knowledge from that partner as well (Borsellino *et al.*, 2020). The winemakers carry out the instructions of the oenologist, who will only return to the cellar for monitoring or if problems should occur during the wine making or sparkling winemaking phase. During this process of coming and going, technicians are the main knowledge mobilizers (Mitchell and Schreiber, 2007). It is clear from the interviews that the

oenologist, unless he or she is a family member or one of the partners of the winery, is paid in accordance with the advice he or she gives. This spontaneous knowledge relationship is intensified by the fact that the oenologists of the most developed companies are also, even if only for a short part of the year and in a consultative fashion, the oenologists of the smallest wineries. The viticulture stage strongly influences the organoleptic properties of a wine, that is, the cultivation of grapes before harvesting (e.g. care of the plant, maintenance of the vines, treatment of pathologies, pruning). This stage depends very much on endogenous factors (i.e. how the plants are grown) but is also subject to exogenous factors that cannot be controlled, including the microclimate, temperatures, amount of precipitation, the number of hours the vines are exposed to the sun, the slope of the soil and the soil composition (Warman and Lewis, 2019). For issues arising in this stage, advice from an agronomist is essential and can strongly affect the vines' final yield (Mitchell and Schreiber, 2007). Such advice is knowledge that is distributed throughout the value chain, creating a territorial effect (Ferreira *et al.*, 2018). In this sense, leadership is exercised by the companies in the cluster in a democratic way through the sharing of specialized professional figures. The oenologists hired by the larger companies tend to hold several positions – sometimes even as partners – and are the main protagonists of the exchange of knowledge within the cluster. This shows both a network effect (Casali *et al.*, 2018) and represents supply chain behavior (Ferreira *et al.*, 2018).

Regarding processing in the cellar (first fermentation, pressing, racking, pumping over, sparkling wine process and sugar dosage), as mentioned previously, the various phases are managed mainly by an oenologist who also works as a consultant for many other companies, resulting in a shared *modus operandi* during the processing and ageing in the cellar. This sharing of personnel is widespread for several reasons:

- With current tax regulations, owners often do not want to have an oenologist or harvest employees with open-ended contracts. These figures are only required at specific times of the year and for short periods (cellarers aside).
- An oenologist is one of the few specialized figures who, instead of becoming more useful with the passing of years, may become harmful because the position requires objectivity; an oenologist who works in the same cellar and on the same product for a long time runs the risk of entropy, thus putting the entire production at risk.
- Finally, an oenologist who works on the same vine but for different companies can amass a more in-depth knowledge of the needs of that vine – in the present case, Glera – an effect that has been observed in the Porto wine region (Ferreira *et al.*, 2018; Santos *et al.*, 2020).

This result shows that the knowledge can be shared rapidly among the various companies that make up the cluster. It must be considered that this is an asymmetric process, as large companies tend to gain less because they already have the most consolidated knowledge, as Monticelli *et al.* has indicated (2018). However, they may gain through the development of the value chain, which is similar to what occurs in Brazil (Monticelli *et al.*, 2018).

As far as the plants' care and maintenance are concerned, the companies supplying specific materials and knowledge relating to viticulture are the first to be selected by the bottling companies as knowledge sources. In this sense, the idea of a value chain (Peppard and Rylander, 2006) merges with the concept of a network (Alberti and Pizzurno, 2015), as Maier *et al.* (2020) have shown.

In the case studied by Monticelli *et al.* (2018), the lack of trust between companies was compensated for by formal institutions' mediation. However, it is widespread to find

horizontal, structured and planned relationships involving a trusted agronomist – or agricultural expert – who regularly liaises with a company (Mitchell and Schreiber, 2007).

In our case, two consortia play such a role. The first is the Consorzio Agrario di Valdobbiadene, Conegliano and Pieve di Soligo, which provides materials and information relating to agriculture. The second is the Consorzio di Tutela del Prosecco Superiore di Conegliano e Valdobbiadene D.O.C.G., which, in addition to acting as a broker, as explained in Monticelli *et al.*'s (2018) study, provides information on vineyard management and plant maintenance through a magazine, “Bollettini Viticoli,” which contains useful information provided by the consortium’s agronomists. As far as companies’ specialization in the oenological field is concerned, the actors that stand out the most are the oenochemical laboratories. Conversely, there are no significant players in the field of marketing, promotion, external communication or market research and no collaborations have given rise to companies specialized in grape harvesting.

In the literature on the Italian wine industry (Alonso and Bressan, 2016; Borsellino *et al.*, 2020; Casali *et al.*, 2018; Maghssudipour *et al.*, 2020) although the potential of knowledge networks is recognized, only Borsellino *et al.* (2020) provides an in-depth analysis of supply chain relationships. Their study of a Sicilian cooperative finds high levels of integration, where the building of a network to add value to the product mainly occurs in the final stage of the value chain.

In this study, by contrast, we find that a value chain exists but that each stage is associated with a distinct network of relationships. Our results reflect an almost entirely contrasting scenario from that presented by Borsellino *et al.* (2020). Therefore, we propose the following:

P1. The wine companies set up different networks in each stage of the value chain.

As previously noted, both in our study and in previous works (Borsellino *et al.*, 2020; Ferreira *et al.*, 2018), knowledge and resource networks can be observed in wine clusters, but also in other sectors (Alberti and Pizzurno, 2015; Dyer, 1996). Thus, although the wine value chain is different because of the importance of the territory where the vines are produced (Warman and Lewis, 2019), the networks that are formed for sharing resources, such as information and knowledge, are similar to the networks formed in other sectors (Alberti and Pizzurno, 2015; Asheim and Isaksen, 2002; Hoffmann *et al.*, 2011; Bathelt *et al.*, 2004; Malmberg and Power, 2005; Molina-Morales, 2001). Thus, we offer the following proposition:

P2. There is no significant difference in the scope of networks in the wine industry compared to other industries.

In the wine industry, knowledge may be rooted in a *locus*, as in the case of Port wine (Ferreira *et al.*, 2018; Santos *et al.*, 2020). This knowledge can be perceived as in the air to the metaphor proposed by Marshall (1890). It can be shared between one link in the value chain and another, as shown in our study and that of a cooperative in Sicily (Borsellino *et al.*, 2020). This cooperation can take place through the sharing of technicians, as in our study and the work of Mitchell and Schreiber (2007), or through the mediation (brokerage) of institutions, as in a study of Brazilian wines by Monticelli *et al.* (2018). The difference between these processes lies in the fact that the value chains differ, that is, the modalities of value-added creation are different. Therefore, we suggest the following:

P3. In the wine industry, the configuration of the value chain determines the related knowledge network.

We already know that knowledge is not distributed to all actors in a network in the same way (Giuliani, 2007; Hoffmann *et al.*, 2013) and that networks can take different forms in a cluster (Giuliani *et al.*, 2019). We also know that very specialized local knowledge (Ferreira *et al.*, 2018) can influence the process of adding value to the wine industry. Our work shows that differences in knowledge are related to the different stages of the value chain. While technical knowledge is achieved through a broad network of relationships, the networks for sharing strategic knowledge – in the current case, market knowledge – are smaller. This is one of the most relevant contributions of this work. Thus, our last proposition is as follows:

- P4.* In the wine industry, the more strategic the knowledge, the smaller the network within which it is shared.

6. Conclusions, implications, limitations and future research

6.1 Conclusions

From our empirical analysis based on companies belonging to the Prosecco cluster we were able to identify the main features of the knowledge networks occurring in a wine cluster, which have been summarized in the propositions offered in subsection 5.2. One of the most original results of our analysis regards the discovery that we can identify specific relational structures linking companies in the cluster in each stage of the value chain. Differences in knowledge networks can be linked to the level of competition in each stage of the value chain. In the first stages knowledge appears to be more equally distributed among cluster companies, thanks to the role played by knowledge intermediaries (such as the consortium), which stimulate cooperative behavior and collective actions. In the last stage of the value chain, when companies compete for the market, the propensity to share knowledge shrinks and leaves room to individual actions.

This outcome adds to previous literature on knowledge networks in clusters by shedding light on an important, but still understudied aspect in the cluster functioning. Knowledge diffusion in clusters is not only uneven, as found by Giuliani (2007) but is also value chain stage specific. By intersecting literature on knowledge networks, value chain and cluster research, we proposed a new perspective of analysis that deserves further attention. Our propositions intend to create a venue for further research on this topic. Implications for theory and practice are listed in the subsection 6.2.

6.2 Implications

This research has theoretical and managerial implications, which we list in the following.

First, we contributed to theory building showing that a firm can have diverse knowledge networks within the same value chain and that their structures are different. Our evidence is a valuable addition to other research on knowledge networks in a cluster. Previous research did not consider differences owing to value chain phase specificities, treating all phases as the same.

Second, whereas the literature on knowledge networks is mostly focused on manufacturing and high-tech industries, we did a step forward with this study by approaching the wine industry as an alternative empirical setting, which is emblematic of low-tech industries, which characterize the majority of clusters of small and medium enterprises (SMEs) worldwide.

Third, our findings inform managers of a tool available for mapping knowledge networks, which can reveal the strengths and weaknesses of current strategies in each stage of the value chain. By analyzing the final phase knowledge network, we observe a lack of collaboration that might hinder commercial initiatives for collectively valorizing the local production. Managers could embark on joint activities for better reaching global markets, for instance by relying on shared agents or trade fairs slots. These initiatives could boost

internationalization, as a common objective, through the establishment of a more developed sales knowledge network, instead of approaching international markets individually.

6.3 Limitations

This study has some limitations. The first is its focus on a single location. It would be useful to compare our findings with research on other clusters to detect potential territorial effects. Another limitation is that we do not connect knowledge networks to innovation, even though these constructs are strongly associated in the literature.

6.4 Future research

A future study could include innovation as a dependent variable. Replicating the same qualitative study in a different country also holds promise as studies of the wine industry generally focus on a single country. Although the qualitative approach is not in itself a limitation, we recommend that our propositions be tested for generalizability in a future study using a quantitative approach.

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