# Innovation capability of clusters: understanding the innovation of geographic business networks

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## Abstract

**Purpose** – This paper aims to explore innovation in geographic business networks and to propose a model of cluster innovation capability. The premise is that innovation is a necessity for firms and inter-firm relationships is an option for it to occur. Among these relationships, clusters stand out, with studies showing that firms in clusters tend to be more innovative.

**Design/methodology/approach** – Thus, we conducted an exploratory study of two clusters: the emerging cluster of *Alto do Camaquã*, in Brazil, and growing cluster of *Sisteron*, in France. The cases were analyzed based on elements previously established in the literature: context; collective strategy; public policy; commercialization; pro-activity; external relationships; transmission; collaboration; assimilation, transformation, and application of knowledge; governance; infrastructure; financial and human resources.

**Findings** – We obtained a model of cluster innovation capability, composed of strategic management, relationships and learning, technological and marketing development, and operational management.

**Originality/value** – The proposed model is a dynamic model as capabilities vary in their intensities according to the development stage of the cluster and its maturity time.

**Keywords** – clusters, innovation capability, business networks.

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## 1 Introduction

Innovation is increasingly regarded as a matter of survival and not merely a choice for firms (Bessant, 2003; Chesbrough, 2003; Freeman & Soete, 1997; Gnyawali & Srivastava, 2013). An alternative approach used to stand out in this dynamic environment derives from interorganizational exchanges, as firms have knowledge gaps that can only be filled through these interactions (Powell, 1990). In this context, clusters are strongly related to firms' innovative potential (Lai, Hsu, Lin, Chen, & Lin, 2014).

Several studies show that companies belonging to these geographic business networks tend to be more innovative and achieve superior economic performance in comparison with isolated ones (Audretsch & Feldman, 1996; Bell, 2005; Capello & Faggian, 2005; Giuliani, 2010; Marshall, 1920; Saxenian, 1994). It is understood that many facets are considered in order to better understand the innovative potential of clusters. However, the reasons why some business networks are more innovative than others are still under debate, thus instigating further exploration of their capabilities.

In a cluster, although the companies belong to the same sector and are grouped together, they have a heterogeneous and asymmetric distribution of knowledge (Giuliani, 2005). This disparity between clusters makes studying them even more complex and challenging, requiring research on the reasons why some clusters stand out from others. In this respect, the question arises regarding which capabilities make some clusters more innovative.

Capabilities depend on the set of tangible and intangible skills and resources (Zen & Fracasso, 2012) derived from the knowledge base (Giuliani, 2007). The knowledge and capacities required to develop and disseminate innovations are more easily acquired in clusters (Porter, 2000). The subject of innovation capability has attracted interest from several researchers (Guan & Ma, 2003; Lawson & Samson, 2001; Yam, Lo, Tang, & Lau, 2011; Zawislak, Zen, Fracasso, Reichert, & Pufal, 2013), although the literature is still incipient with relation to this topic. This gap is even greater in regard to the

innovation capabilities of clusters. Therefore, this research specifically seeks to answer the following question: *how is the innovation capability of clusters developed?* Thus, this study aims to understand the innovation capability of clusters. For this, an exploratory study was conducted of two clusters: the emerging cluster of *Alto do Camaquã*, in Brazil, and the growing cluster of *Sisteron*, in France.

As main contributions, this study provides an understanding of the elements that make up a cluster and develops a model of cluster innovation capability, which was possible based on a comparison between clusters from different contexts (countries) and at different stages of development. As a managerial contribution, we seek to help cluster managers to understand and maximize the innovation of geographic business networks and to assist public managers in the development of policies focused on regional development.

In addition to this introductory section, this article is divided into four parts. Initially, the theoretical literature review is presented, covering clusters, innovation capability, and the innovation capability of clusters. Subsequently, the methodological procedures used are presented. Next, the data, analysis, and results are discussed. The paper ends with the final remarks on the research.

## 2 Literature Review

### 2.1 Clusters

Clusters can be defined as geographic concentrations of interconnected companies and institutions in a particular field (Porter, 1990). The pioneering work on the subject derives from Marshall (1920), who introduced the concept of industrial district, an agglomeration of small businesses in the same locality.

The theme has grown in relevance, gaining more prominence after it was realized that the geographic agglomerates are generators positive externalities (Becattini, 1990; Porter, 1990). In addition, it is possible to perceive a strong relationship between innovation and clusters, since

the companies operating in these clusters tend to be more innovative when compared to isolated ones (Audretsch & Feldman, 1996; Bell, 2005; Giuliani, 2010; Marshall, 1920). For researchers, knowledge and skills are more easily acquired and innovations are more efficiently developed and disseminated within clusters (Basant, 2003; Dahl & Pedersen, 2004; Porter, 2000).

Despite the various studies, there is still a lack of consensus on the reasons that make cluster environments more innovative. Lawson (1999) and Maskell and Malmberg (1999) argued that what determines the innovation within a cluster is its location. However, more recent studies argue that it is not the location, but rather the network formed by the cluster (Owen-Smith & Powell, 2004; Singh, 2005; Whittington, Owen-Smith, & Powell, 2009). Identifying how knowledge transfer flows in these networks is crucial to understanding how innovation happens (Giuliani, 2005). However, it should be noted that clusters do not influence their firms in a homogeneous manner (Zen, 2010).

Although recent research reinforces the idea that the local factor is not a determinant of the innovation capacity of a cluster (Tallman & Phene, 2004), it is impossible to deny its importance. The context surrounding the cluster and the company influences their capacities, even more so when very different realities are concerned. In the last decades, this has been proven by studies carried out in developed and developing countries (Silvestre & Silva, 2014).

Another factor worth mentioning in regard to the innovation capacity of a cluster concerns its stage of development. According to the stage of its life cycle, a cluster exhibits a set of characteristics that affect its innovation and its relationships with the companies (Menzel & Fornahl, 2010). Presutti, Boari, and Majocchi (2013) provide a model for different sectors, defining clusters as emerging (few interactions and innovations) or growing (different interactions and innovative recognition).

Finally, it has been noticed that clusters play an important socio-economic role due to the exchanges of knowledge and the high

innovation potential of the firms operating in these geographic business networks. However, there is no consensus yet as to what differentiates these firms from isolated ones. It has been verified that there is heterogeneity in firms and in clusters, which may be related to their context and their stage of development. Therefore, it is important to understand more about innovation capability, which is the theme of the next section.

## 2.2 Innovation capability

Although there is a consensus about the importance of innovation in terms of a company's competitiveness (Cassiolato & Lastres, 2000; Dodgson & Rothwell, 1994; OCDE, 2005), the reasons that lead some companies to innovate and others not to are still being discussed. In light of these questions, several studies converge towards the affirmation that firms have a set of capabilities that make them innovative. Thus, innovation capability would be the ability of those companies to generate and manage the implementation of technological and/or organizational innovations, including the ability to relate to others in the value chain (Bell, 2006).

Capabilities emerge from a combination of assets, people, cultural values, and operational processes in companies, which include the ability to know how to do things at low cost (efficiency) and what to do (effectiveness) (Zen, 2007). For Teece, Pisano, and Shuen (1997), the term "capability" emphasizes the fundamental role of strategic management in adapting, integrating, and reconfiguring organizational skills (external and internal), resources, and functional competencies to meet the demands of a dynamic environment.

In the competitive context in which firms operate it is important that they develop certain capabilities to stand out from competitors. Such capabilities, as well as their combination, can provide the possibility of promoting innovations, whether in products, processes, the market, or management. Several authors have conducted studies to understand the innovation capabilities of firms (Lawson & Samson, 2001, Guan & Ma,

649

Review of Business Management, São Paulo, v.21, n.4, p.647-663, oct/dec. 2019.

2003, Yam *et al.*, 2011, Zawislak *et al.*, 2013). These researchers have highlighted different innovation capabilities of firms in their studies.

Lawson and Samson (2001) define innovation capability as the firm's ability to uninterruptedly transform new ideas and knowledge into new products, new processes, and systems that will benefit both the company and its stakeholders. On the other hand, Zawislak *et al.* (2013) understand that the sources of innovation come from four essential capabilities that together form innovation capability: technological capability, managerial capability, operational capability, and transactional capability.

Yam *et al.* (2011) understand that there are seven capabilities that determine the success of a company: research and development (R&D) capability, resource allocation capability, learning capability, manufacturing capability, organizational capability, marketing capability, and strategic planning capability. Similarly, Guan and Ma (2003) present seven main capacities to explain companies' competitive success: learning capability, R&D capability, production capability, marketing capability, organizational capability, resource exploitation capability, and strategic capability.

From the proposals presented by the authors it can be seen that there is still no consensus on the subject. It should also be noted that the studies presented focus on a firm's innovation capability, and there is no understanding of the innovation capability of clusters. Thus, the next section will address issues that touch on this topic.

## 2.3 Innovation capability of clusters

The positive relationship between companies operating in a cluster and their high capacity for innovation has attracted interest from several scholars. Nonetheless, no consensus has yet been reached on why these firms are more innovative than isolated ones. Recent studies indicate that innovation does not occur in a homogeneous way within these interactions, due to the different capabilities of the firms and clusters, their pool of resources and their trajectory (Giuliani, 2007; Lai *et al.*, 2014; Pe'er & Keil, 2013).

Innovation capability is the answer that several researchers (Lawson & Samson, 2001; Guan & Ma, 2003; Yam *et al.*, 2011; Zawislak *et al.*, 2013) have given to the question: why are some firms more innovative than others? In this field of study, two main approaches are highlighted: technological and dynamic capabilities. Technological capabilities prioritize changes in the company's technological bases to maintain some competitive advantages (Bell & Pavitt, 1995; Lall, 1992), while dynamic capabilities involve constant changes in which firms must regularly reinvent themselves to maintain a competitive edge (Eisenhardt & Martin, 2000; Teece, 2007; Teece, Pisano, & Shuen, 1997; Winter, 2003).

There are still few studies in the specialized literature on this subject, and there are even fewer related to clusters. Therefore, it is necessary to seek specific approaches geared towards the innovation capacities of clusters, in order to understand the particularities of these geographic business networks. There have been few studies on the innovation capabilities of clusters in recent years, and there are few approaches that provide more details on this subject (Damanpour & Wischnevsky, 2006; Forsman, 2009; Lai *et al.*, 2014; Wu, Gu, & Zhang, 2008)

Regarding clusters, innovation capability is closely related to absorptive capacity (Cohen & Levintal, 1990). Absorptive capacity is the ability to recognize the value of new information from external sources, with a view to assimilating and applying it, considering that the ability to evaluate and use external knowledge occurs by connecting it to the background knowledge (Camargo & Meirelles, 2014; Zahra & George, 2002). For that reason, extra-cluster relationships are important in the search for a wide range of knowledge, so that it can be disseminated it within the cluster, thus promoting its absorption and stimulating its use by the firms.

Seen in these terms, it becomes crucial to identify the elements that make up the innovation capability of clusters. Based on this, this study sought to understand the characteristics of clusters that stimulate innovation in the agglomerations and the firms operating in them, in order to identify its key elements.

Initially, one factor of extreme relevance is the **regional context** in which the cluster operates (Grillitsch, 2014). The resources and region's trajectory form the reputation that influences the companies that form part of the cluster (Zen, 2010). In addition to resources developed internally, a company can access resources through interorganizational relationships and interaction with other organizations within the same geographic territory (Zen, Fensterseifer, & Prevot, 2014). **Collective strategy** is also crucial for innovative clusters. A regional innovation policy is based on the idea of constructing a regional advantage (Asheim, Boschma, & Cooke, 2011). Herrmann, Gassmann, and Eisert (2007) emphasize the importance of an innovation-oriented culture, which includes a customer orientation and technological innovation. In addition, there are **public policies** that the cluster can achieve through its mobilization. As a result of their positive externalities, governments implement policies focused on regional economic development and incentive plans for companies in geographic business networks (Wegner, Costenaro, Schmitt, & Wittmann, 2004; Lai *et al.*, 2014). Having public policies and a collective strategy based on the regional context gives the cluster inputs that facilitate the **commercialization** of the products it makes internally, generating a significant benefit to the firms included in the agglomeration (Morosini, 2004; Wonglimpiyarat, 2010).

For that to occur, concrete actions taken by the cluster are required in order to search for new processes and technologies that provide a competitive advantage for the companies, which is an element that can be called **proactivity** of the cluster in relation to innovation. The **external relationships** of the cluster play an essential role in absorbing knowledge and, consequently, increase the innovative capacity of the geographic agglomeration (Giuliani, 2005). However, obtaining external knowledge it is not enough, and thus the internal **transmission** of knowledge to acquire a superior innovation capacity is necessary (Giuliani, 2005). In order for this to happen, intracluster **collaboration** is essential (Vicente, Balland, & Brossard, 2011). Collaboration and cooperation among actors contributes to conflict reduction by creating an understanding that there are mutual benefits to be gained (Leite, Lopes, & Silva, 2009).

In addition to dissemination, mutual assistance and a cooperative relationship between actors belonging to the same agglomeration create advantages that lead to a greater innovative capacity. Based on this, it is crucial to transform the knowledge acquired by the cluster into products or solutions for the companies involved. As such, the next elements are related to knowledge **assimilation, transformation, and application** in commercial efforts and/or concrete benefits for the companies (Cohen & Levinthal, 1990; Wu, Gu, & Zhang, 2008).

To operationalize all these elements, the importance of **governance** is highlighted in the specialized literature on clusters (Dyer & Singh, 1998). Cassiolato and Lastres (2003) point out that governance is an essential factor for innovation development. Governance and trust represent two main mechanisms for reducing the threat of cheating (Deboça & Martins, 2015). Together with governance, other relevant elements are the hallmarks of a cluster's innovative capacity: the availability of **infrastructure** and **financial** and **human resources**. For several authors, lower transaction costs, shared infrastructure costs, and access to a skilled workforce are among the main benefits provided by clusters to companies (Bathelt *et al.*, 2004; Marshall, 1920; Maskel & Malmberg, 2007; Lai *et al.* 2014). From this, a list was obtained of the elements that influence the development of the innovation capability of clusters, as can be observed in Table 1.

651

Review of Business Management, São Paulo, v.21, n.4, p.647-663, oct/dec. 2019.

Table 1

**Elements of the innovation capability of clusters**

| Elements | Autors |
|---|---|
| Regional Context | Grillitsch (2014); Zen (2010) |
| Collective Strategy | Asheim, Boschma, & Cooke (2011); Herrmann *et al.* (2007) |
| Public Policies | Wegner *et al.* (2004); Lai *et al.* (2014) |
| Commercialization | Morosini (2004); Wonglimpiyarat (2010) |
| Proactivity | Buysse & Verbeke (2003) |
| External Relationships | Giuliani (2005) |
| Transmission | Giuliani (2005) |
| Collaboration | Vicente, Balland, & Brossard (2011); Leite, Lopes, & Silva (2009) |
| Knowledge Assimilation, Transformation, and Application | Cohen & Levinthal (1990); Wu, Gu, & Zhang (2008) |
| Governance | Dyer & Singh (1998); Cassiolato & Lastres (2003); Deboça & Martins, (2015). |
| Infrastructure and Financial and Human Resources | Marshal (1920); Bathelt *et al.* (2004); Maskel & Malmberg (2007); Lai *et al.* (2014) |

Finally, it is observed that these elements can be more or less developed according to the cluster analyzed; however, their existence must be kept. Thus, they will serve as the basis for identifying the innovation capability of a cluster and to verify how it is developed. The methodological procedures section will provide more details on the present research.

**Methodological Procedures**

The research was developed based on a qualitative exploratory approach. To carry out the research, two clusters operating in different contexts and at different stages of development were selected. The comparison aimed to understand how to develop the innovation capability of clusters.

To select the cases, we sought clusters in a sector that was important for the countries studied, where the territory had an impact on its actions, and where the innovation had a direct influence on its competitive advantage. Thus, the agribusiness sector was selected because it has a high social and economic impact in Brazil and France, because it is dependent on the territory (region where it is located), and because it is considered a low tech sector, with a low technological intensity, and so innovations tend to have an even greater impact on the firms that

generate new value. In agribusiness, the sheep industry was selected as a result of the segment experiencing crises and, recently, seeking a differential in its agglomeration strategy. Because of this, the segment is particularly interesting to analyze and for understanding how to develop the innovation capability of clusters. Thus, we chose the following two clusters: the growing cluster of Sisteron, in southern France, and the emerging cluster of Alto do Camaquã, in southern Brazil.

Data were collected between 2015 and 2016 using desk research, based on data collected on the internet and provided by actors in the clusters (for example, strategic plans and reports on the sector), non-participant observation, in four sector events and in on-site visits to organizations belonging to the clusters, and 32 semi-structured interviews with sheep industry experts from Brazil and France, representatives of public and research institutions, universities, associations, cooperative, government, distributors, merchants, and rural producers in both countries, lasting approximately 45 minutes each.

The elaboration of the instrument for data collection established as dimensions the elements of innovative capacity within clusters identified in the theoretical framework: regional context, collective strategy, public policies, marketing, proactivity, external relationships, transmission,

collaboration, assimilation, transformation, and application of knowledge, governance, infrastructure, financial and human resources. The data analysis was performed through triangulation using different sources: desk research, observation, and interviews. We compared these three sources to understand how to develop the innovation capability of clusters.

The treatment of the data of this research was based on content analysis as according to Bardin (2006), transcriptions of the interviews recorded with the previous consent of the interviewees, as well as a comparative analysis of the data obtained through observation and the data derived from the documents. The categories of analysis used were based on the literature review, as already presented in Table 1.

## 3 Discussion and Results

### 3.1 Cluster presentation and comparison

The Sisteron cluster is located in southeastern France. It was observed that the chain is highly organized, with about 270 producers, organizations and associations of commercial producers, several cooperatives (market leaders), slaughter and marketing companies and partner research and teaching institutions. Beginning in the 1930s, the region has adopted a strategy based on differentiation, with geographical indications and specific labels that support the quality of the product and generate business value for all actors, as verified in the strategic plan of the cluster.

The Alto Camaquã cluster is located in southern Brazil. The region is responsible for a large portion of Brazilian production, and contains about 3 million sheep. In 2008, the cluster began to be formally structured, in order to promote regional development using a territorial approach. Several initiatives involving government, cooperatives, associations, research and teaching institutions and companies from the sector have developed collective strategies in order to consolidate this cluster, ensuring benefits for those involved and the region.

The first difference observed between the two clusters relates to the period when they were organized and recognized. Although in both cases the regions already had a long-standing tradition in the activity, the clusters were organized later, with the French cluster being recognized in 2003 and the Brazilian one in 2015. The organizational model was also different, greatly depending on the institutional framework and the local culture. In Sisteron, an organization called CESAR coordinates the interactions between actors and takes on a more political role, while the association, Bergers du Soleil works more strongly with producers and the operation of the cluster. In Alto do Camaquã, there is a cluster manager company, ADAC (Association for the Sustainable Development of Alto Camaquã), which assumes not only the political role, but also the operational role, as the producers are divided into 24 associations, which greatly decentralizes all actions. In addition, we could perceive in their meetings that the network of the cluster's partner institutions actively cooperates, although some activities are not established yet, thus complicating the understanding of each one's responsibilities.

Another difference is that in France, the cluster has an established chain; in other words, production, slaughter, processing, distribution, and marketing processes are well defined. Based on these steps, institutional actors operate according to their knowledge, as we could observe in events that we participated in. In Brazil, there is not yet a complete chain organization. There was an attempt to set up partnerships for slaughtering, distribution and marketing, which failed due to a lack of a basic structure. The interviewee from ADAC told us that the cluster has sought to systematize a support process for producers and establish new partnerships to control the chain, such as the relationship established with the Producers' Center and the Municipal Cold Storage.

These contrasting scenarios are evidenced by the very nature of the cluster's organization. While in Sisteron the intention was to improve

653

Review of Business Management, São Paulo, v.21, n.4, p.647-663, oct/dec. 2019.

the existing structure in order to generate more value for those involved, in Alto do Camaquá the initial aim was to value the local characteristics and develop the region, which was still unfamiliar with new technologies and processes, as we noted from ADAC's plans. Thus, the path taken by the Brazilian cluster is even more exceptional, as it begins by dealing with the producer's low self-esteem. Moreover, in the French case, sheep farming is the sole economic activity of the producers from the region, which consider it as a source of income and livelihood. In the Brazilian case, sheep production is usually considered a secondary activity, and does not receive the necessary attention for its development, since it is not perceived as a profitable source of income. "Sheep farming is just another activity," one farmer told us.

## 3.2 Analysis of the clusters

In terms of the **regional context**, both cases show a propensity towards activity and geographical similarities. However, the French cluster presents the *transhumance* (flock displacement in winter due to climatic conditions) tradition and a high cost of production. "We were forced to add value to our products because of the high production costs," the French farmer reported. Meanwhile, the Brazilian one evidences the need to preserve the biome, as well as social issues and chain disorganization. Regarding the **collective strategy**, although both have built a collective brand, Sisteron already has labels and indications of origin, while Alto Camaquá aims to promote the alignment between actors and increase self-esteem. On the **public policies** issue, we noticed that the producers from the growing cluster have access to benefits because they are included in the agglomeration. In the emerging cluster, the governance is seeking policies for the sector, such as *Rota do Cordeiro*, to bring improvements to the region as we could observe in its documents. Within the **commercialization** area, demand is perceived in both locations, but the French cluster operates on the basis of value generation for those involved, while the Brazilian

cluster consolidates and seeks alternatives to start selling the products. "We tried to market at the beginning, but we could not maintain the quality and quantity of production," said the president of one producer association.

Regarding **proactivity** for innovation, we observed that the French actors have more assets, highlighting that the cooperative that encourages innovation is one of its strengths. In the case of the Brazilian actors, due to the fact that the cluster has an active network of partners, the search for innovation appears to be more passive. This is likewise reflected in the **external relationships**, which are indirect; in other words, they are established through the institutions or as a result of the existing recognition. On the other hand, in Sisteron there is a greater commitment to engage with actors from outside the region and the country, which may be undertaken by those belonging to the cluster, or simply because of the larger stock offered and exposure generated by the organization of the sector in the country. "We interact a lot with organizations outside the region in events and congresses," said the coordinator of the French cooperative. In relation to **knowledge transmission**, both clusters have a very similar scenario, with decentralization of responsibilities, thanks to the presence of different actors in regular meetings. Regarding **collaboration**, this similarity between the clusters was not observed, since even though there is resistance in both cases, France is more favorably geared towards exchange than Brazil.

A common concern is **assimilation, transformation, and application of the knowledge** acquired by the properties, which in both situations came about through practical meetings and solutions. It is important to mention initiative of UEPAs in Brazil, which took place within the properties and has been suspended, but will be resumed later on. Moreover, the follow-up plan of these organizations is already implemented in the French scenario, and will also soon be available in Brazil. In relation to **governance**, the two clusters are highly organized, but in different ways: in Sisteron, with the presence of CESAR and the support of the cooperative; and in Alto do Camaquá, with ADAC, 24 associations, and

institutional actors that meet and give their opinions on a regular basis.

In the French cluster, the **infrastructure** is superior to that of the Brazilian one, because the headquarters of the cooperative is designed as a multidisciplinary area with a meeting room, store, and machinery, besides the cold storage and CESAR headquarters, while in Brazil, the headquarters are itinerant and the relationship with the cold storage is still being set up, and there is only what is offered by institutional partners, as far as we could observe. Finally, comparing **financial and human resources**, it is possible to observe a similarity in terms of the rural exodus of young people and the availability of people (linked to institutional actors) to perform the activities, and there is also an imbalance in relation to the provision of financial benefits: in Sisteron, there is a supply of resources and available credit, unlike what is observed in Alto do Camaquã.

### 3.3 Construction of a model of cluster innovation capability

The basic idea is that companies belonging to clusters tend to be more innovative than isolated ones (Giuliani, 2010); however, it is understood that the set of skills that provide such innovation to these organizations is still a matter for debate. There is no consensus on what cluster innovation

capability really is. As in companies, many authors point out that a cluster's innovation capability is a set of capabilities (Zawislak *et al.*, 2013). From this perspective, and complementing the existing models disseminated by Damanpour and Wischnevsky (2006), Forsman (2011), Lai *et al.* (2014), Wu, Gu, and Zhang (2008), and Silvestre and Silva (2014), which are more connected to absorptive capacity (Cohen & Levinthall, 1990), and taking into account the research carried out in the clusters of Sisteron and Alto do Camaquã, the present study intended to identify a model of innovation capability for clusters.

It is understood that the innovation capability of a cluster is a set of skills that enables the companies in it to renew themselves, restore something, or introduce a new feature that has a perceived value (Tidd, Bessant, & Pavitt, 2008). The aim is to determine what the capabilities are that together provide such benefits to the organizations/agglomeration. Thus, elements identified in the literature review and validated in the field research were used in this research. Subsequently, these elements were grouped in capabilities that together depict the innovation capability of the cluster. Figure 1 below shows the model developed for the innovation capability of clusters.
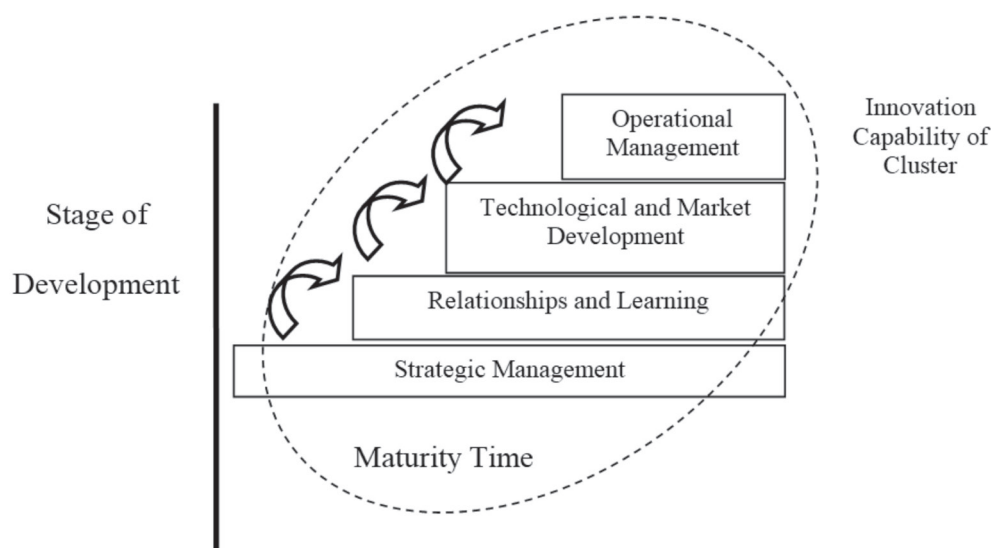


**Figure 1.** Model of cluster innovation capability

655

Review of Business Management, São Paulo, v.21, n.4, p.647-663, oct/dec. 2019.

According to what was observed in the analyzed clusters and the specialized literature, **strategic management** would be a necessary tool to adjust and promote novelties that lead to value creation (innovation). This capability is related to the ability to understand the **regional context** in which the cluster is operating, seeking a **collective strategy**, capable of involving and engaging different people and organizations, thus aligning local skills and values. It is necessary to centralize the cluster using an established **governance** structure that is able to manage the cluster as a whole, in order to achieve the established objectives. Following this line of thinking, the identity of the agglomerate is established, enabling the search for, access to, and construction of **public policies** for the region.

To promote the convergence between local actors and collective goals, the cluster must have the **ability to develop relationships and to learn**. The main goal of this ability is to encourage **proactivity** in organizations that search for innovations, which in many cases is related to the opportunity to engage in **relationships outside the cluster** in order to acquire new knowledge. However, such encouragement must also be in line with the concern about **knowledge transfer** to other cluster members, ensuring a culture of exchange and **collaboration**, since these are the primary factors for innovation.

For such processes to take place, a skill that is capable of promoting the **assimilation** of knowledge by the cluster towards the companies becomes fundamental. With this they can **transform** the knowledge obtained and **apply** it in a new tool that creates value and, thus, perceive and deliver this value to the market through a **commercialization** process. It is up to the cluster to have a **technological and market development capability**, providing strong encouragement and the accomplishment of this innovation process.

The cluster must also have an **operational management capability**. This makes it possible to guarantee what is necessary for the actors and the knowledge absorbed and generated by the cluster. To operate properly, the cluster is expected to provide a suitable **infrastructure** for the generation of innovations. The aforementioned ability also tends to offer or indicate **financial and human resources**, which may be cluster actions or positive externalities caused by it.

Together this provides a model of cluster innovation capability. This model seeks to combine the elements indicated by the specialized literature with the capabilities perceived in the field research. It is worth mentioning that the capabilities that were identified are present in all clusters, and may vary in intensity according to their stage of development. From this set of capabilities, benefits are derived in order to stimulate innovation.

### 3.4 Discussion of results

The term "capabilities" was coined by Richardson (1972), which he defined as a firm's knowledge, experience, and skills. In terms of innovation capabilities, the main studies involving the subject are related to technological capability (Lall, 1992), dynamic capability (Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000), and absorptive capability (Cohen & Levintal, 1990).

Although the subject has attracted the interests of many authors (Lawson & Samson, 2001; Guan & Ma, 2003; Yam et al., 2011; Zawislak et al., 2013), the discussion about innovation capability is incipient. This gap is even greater in regard to the innovation capability of clusters. In addition, existing models disseminated by Damanpour and Wischnevsky (2006), Forsman (2011), Lai *et al.* (2014), Wu, Gu, and Zhang (2008), and Silvestre and Silva (2014), are connected to absorptive capacity (Cohen & Levinthall, 1990) and fail to explain the phenomenon in its entirety.

The innovation capability of clusters has to take into account the particularities of these geographic business networks. Thus, elements such as regional context, collective strategy, and governance must be considered in this capability. The models proposed are restricted to the flow of

knowledge among participants. This is only one of the stages promoted by innovation capability. The ability of clusters to innovate involves other elements ranging from their strategic management to the operationalization of the innovation itself.

It is understood that this set of capabilities (strategic management, relationships and learning, technological and marketing development, and operational management) is able to promote innovation for clusters and for the firms in them, explaining the reason why they are strongly related to innovation. Combining the four capabilities allows a cluster to create novelties that add value from conception to operations and commercialization.

The proposed model of cluster innovation capability presented in Figure 1 is a dynamic model, as capabilities vary in their intensities according to the development stage of the cluster and its maturity time. Depending on their stage of its development, clusters present a set of characteristics that influence their innovation and relationships with the firms and with the region in which they operate (Menzel & Fornahl, 2010). It was identified that the innovation capability of a cluster is not the same since its emergence; it is built as the cluster develops.

Menzel and Fornahl (2010) point out that the emergence phase is difficult to detect because the cluster is not really a cluster; however, it is at this stage that the bases and growth processes are formed. An emerging cluster is characterized by few companies and synergies (Menzel & Fornahl, 2010). Thus, at this stage, the cluster needs strategic management in order to develop a common purpose, one that enables more organizations to join the agglomeration.

After strategic management is developed, the cluster is able to attract participants. Partnerships and learning relationships are formed to stimulate the innovative potential of organizations. In the case of clusters, geographical proximity provides a knowledge-exchange relationship and the creation of alliances and partnerships (Wu, Gu, & Zhang, 2008) that are

distinct from in isolated organizations. Moreover, the importance of open innovation for exchanging knowledge and experience among those involved is emphasized (Chesbrough, 2012).

From these interactions, knowledge begins to be constructed and leads to innovation. This process of assimilation, transformation, and application of knowledge can be linked to the absorptive capacity and to the models presented by Damanpour and Wischnevsky (2006), Forsman (2011), Lai *et al.* (2014), and Wu, Gu, and Zhang (2008).

Finally, in the growth stage of development, the cluster needs to operationalize this innovation in order to reach the market. Thus, a series of resources and infrastructure need to be developed and offered to the participants. According to Giuliani (2005), infrastructure such as education and scientific and technological institutions can encourage and strengthen an agglomeration.

## 4 Conclusion

This research aimed to answer the following question: *how is the innovation capability of clusters developed?* To carry this out, two clusters operating in different contexts and at different stages of development were selected: the growing cluster of Sisteron, in southern France, and the emerging cluster of Alto do Camaquá, in southern Brazil.

Regarding the analysis of the innovation capability of clusters, the literature is still very incipient and relates only to knowledge transfer. Thus, the most relevant elements that represent the main characteristics and influences of clusters in relation to the innovations proposed for the firms involved were defined: context; collective strategy; public policy; commercialization; proactivity; external relationships; transmission; collaboration; assimilation, transformation, and application of knowledge; governance; infrastructure; financial and human resources.

According to what was observed in the analyzed clusters and the specialized literature, this study identified the set of capabilities that form the innovation capability of clusters.

657

Review of Business Management, São Paulo, v.21, n.4, p.647-663, oct/dec. 2019.

Thus, Strategic Management, Relationship and Learning, Technological and Marketing Development, and Operational Management capabilities are the components of a cluster's innovation capability. They are linked to the elements described in the literature and generate benefits for the agglomeration and for the organizations capable of promoting innovation.

The proposed model facilitates, in a simple and objective way, the understanding of the innovation capability of clusters. By means of it, it is possible to systemically understand how these agglomerations innovate; in the literature, the proposed models are restricted to knowledge transfer and do not consider aspects related to the strategic and operational management of clusters.

The proposed model differs from the others because it takes into account the particularities of geographic business networks, involving different elements. In addition, it is a dynamic model because it shows that the capabilities vary according to the development stage of the cluster. With this, the study intends for the specialized literature to view the innovation in the geographic agglomerations in a more comprehensive and dynamic way.

One of the main contributions of this research is the exploration of the subject of innovation capability of clusters, which is still very incipient in the specialized literature. In addition, this study identifies the elements that form clusters and enables us to understand how these business networks are organized. The research proposes a model composed of four capabilities (strategic management, relationships and learning, technological and market development, and operational management) that aims to explain what makes these agglomerations potential tools for innovation. This model was constructed based on the literature review and the comparison between two clusters at different stages of development and located in different contexts.

The relevance of the research is confirmed since geographic business networks have frequently been used as public policies for the development of regions. In addition, there is a continuous search for innovation. It is therefore expected that the design of the proposed model will help managers to understand the importance and influence of each element listed for cluster innovation. In addition, by characterizing the relationship between clusters at different stages of development, it is expected that these managers will be able to identify which situation is being experienced and operate in search of a greater capacity for innovation. Finally, the paper aims to stimulate public policies geared towards the development of the innovative capacity of clusters, thus maximizing their innovations.

One limitation of this research is the focus on only one sector (agribusiness) and the restriction to one cluster per stage of development. Thus, we suggest conducting new studies on clusters from other sectors, analyzing a higher number of firms, a comparison between firms participating in the collective strategy and others that are not, and also quantitative research in order to validate the proposed model. It would be also interesting to understand how firms benefit from cluster innovation capability throughout the development stages.

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| **1.** Definition of research problem | √ | √ | √ |
| **2.** Development of hypotheses or research questions (empirical studies) | √ | √ | √ |
| **3.** Development of theoretical propositions (theoretical work) | √ | √ | |
| **4.** Theoretical foundation/Literature review | √ | √ | |
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663

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