

Industrial Cluster, Cooperative Ties and Innovation Performance: A Conceptual Model

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Abstract

As the process of adaptation to the requirements of a global economic environment based on knowledge and innovation, industrial clusters consisting mainly of SMEs continue to make the buzz within the academic world as well as policy makers. However, the empirical results of their effects on innovation are far from unanimous. In this context, we present a conceptual model on the basis of the literature explaining the indirect effect of clusters on innovation through the double putative mediation of inter-firms and industry-science cooperation. This model also focuses on two potential moderating effects. That of inter-organizational trust which conditions the dynamics of cooperation and that of the absorptive capacity to clarify the boundaries underlying to the transformation of cooperation opportunities (Inter-firm and industry-science) into innovation performance. This paper concludes with potential practical implications and suggestions for future research.

Key Words: Cluster, Cooperation, Trust, Absorptive Capacity, Moderation, Mediation, Innovation Performance.

Introduction

The need to adapt to changes affecting the current economic environment: emergence of major economic powers, hyper-competitiveness, rapid technological change, shorter product life cycles, and many other phenomena, gave birth to new organizational forms (Allouche et al., 1998) including industrial clusters. Defined as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities." (Porter, 2000, p. 16) clusters have become a preferred modality of several governments for national competitiveness and innovation in particular (OECD, 2005, 2007).

Despite the high popularity of clusters and the abundant literature on the competitive advantages they provide, the empirical evidence of cluster policies has questioned the postulated benefits of these devices (Suire and Vicente, 2015). According to Guillian (2005), Mitchell et al., (2010), Duranton (2011) and Terstriep et al., (2012) the positive effect of clustering on the innovation performance of cluster members remains mixed with variations that remain unexplained.

In a contribution to the understanding of the Causal Relationship between cluster and innovation, we propose a conceptual model that emphasizes the importance of interagency cooperation between cluster

members in both forms: inter-firm (customers, suppliers as well as competitors) and industry-science (linking the firms to universities and research and training organizations) for better innovation performance. These cooperative relationships are critical and widely recognized in numerous studies to be important to be able to innovate (Schmitz, 1999; mention, 2011; Beck et al, 2014; González-Sánchez, 2014). Because clusters promote cooperation between their various stakeholders (Porter, 1998; van Dijk et al., 1997; Kowalski, 2012), the focus is on the potential double mediation of inter-firm and industry-science cooperation to explain the cluster effect on innovation performance of constituent firms.

Secondly, the inconsistent results from the cluster effect on innovation suggest the existence of some moderating factors. For this purpose, we introduce two potential moderators. The first one is the inter-organizational trust that allows cluster partners to adopt an effective cooperative behavior because it provides the conditions under which this desirable behavior is likely to occur (Li, 2005). The second one is the absorptive capacity, considered as the ability of the company to benefit from external knowledge (Cohen and Levinthal, 1990). Therefore, to reap the benefits of cooperative relationships in terms of innovation, firms should be provided with adequate absorptive capacity.

This paper is organized as follows: we first present the theoretical foundations of the construct used. Then we introduce the conceptual model, and finally, we present practical implications and promising avenues for future research.

Theoretical Foundations

The Industrial Cluster

The last two decades, the organization of productive activities in clusters has attracted considerable interest both from academic research in diverse disciplines (Economics, Sociology, Geography, Strategic Management, etc.) and in terms of industrial and regional policies (Suire and Vicente, 2015). Widely popularized in both communities, Porter's cluster is defined by a concentration of interconnected companies and institutions in a particular field (Porter, 1998). It includes a constellation of actors, ranging from enterprises (customers, suppliers, and competitors) to universities, research organizations and providers of vocational training. This makes it a melting pot of tangible and intangible resources from various competitive advantages sources. According to Porter et al., (2007) location within a cluster allows companies to become more specialized, more productive and more innovative.

The multiplicity of cluster concept definitions and of various field perspectives devoted to the study of clusters has given rise to heterogeneous forms and to different logics of agglomeration (Hussler et al., 2013). Taking into account the lack of unanimity on the characteristics and constituent elements of the cluster, which vary from one context to another, proves important in comparing empirical evidence on the effect of clusters on competitiveness and performance of clustered firms.

Seen the amplification of the cluster policies around the world, in this study we distinguish cluster from the simple geographical business co-location. In the first form, members are heterogeneous and involve besides companies the research stakeholders such as universities and research organizations and training (Poivret, 2010), and deliberately choose to belong to them in order to enter spatial proximity opportunities and interaction that exist within it, while the second is due to factors external to the company (Schmiedeberg, 2010).

We based on the summary work of Van Dijk and Sverrisson (2003) and Niu et al., (2012) who presented the main characteristics of clusters reported in the literature. We added to these characteristics the relational role of networking provided by the cluster management structures that are often little understood (Bocquet and Mothe, 2008) and with a cognitive dimension of social capital 'Shared vision' which is a criterion distinguishing clustered firms from those in isolation (Molina-Morales et al., 2010). 'Shared vision' means

the collective aspirations and objectives of network members. The following table outlines the main variables that characterize the cluster and are from different theoretical current so they are the most extensive possible.

Table1. Main characteristics of clusters

Construct	Variables/Constituents	Principal authors
Traded interdependence	Contractual agreements A certain degree of specialization Technical competence of cluster members Transactional networks Widespread product imitation	Brusco (1990), Saxenian (1994), Rabelloutti (1994), Porter (1998), Visser (1996)
Non-traded interdependence	Geographic proximity Joint social history Shared cultural background Social networks that are not only based on economic transactions Common labor pool Institutions and support infrastructure Networking activities of the governance structure Shared vision of cluster members	Visser (1996), Starkey and Barnatt (1997), Knorringa (1995), Sverrisson (2000), Marshall (1919), Porter (1998), Ehlinger et al., (2007), Molina-Morales et al., (2010)

Source: Adapted from Van Dijk & Sverrisson (2003, p. 186) and Niu et al., (2012, p.137).

Inter-organizational cooperation, and unlike Van Dijk & Sverrisson (2003) and Niu et al., (2012) are not included among the features of the cluster. In this study, cooperation is perceived as the result of active, conscious and explicit behavior among economic actors. Qualified by Schmitz (1999) 'joint action' and by Nadvi (1999) with the 'active collective efficiency', inter-organizational cooperation is considered among the key determinants of performance (Bocquet and Mothe, 2008) and among the objectives assigned to cluster policies (Aranguren et al., 2014).

In line with Tallman et al. (2004) and Niu et al., (2012) we distinguish two types of characteristics that can be turned into competitive advantages for the cluster member firms. Those based on traded interdependencies (i.e., formal exchanges of value for value) and their opposites forming non-traded interdependencies (e.g., shared knowledge, customs, and culture) for which there is no market mechanism.

Cooperation Ties in Clusters such as Open Innovation Practices

According to the OECD (2005), innovation in its broad dimension is defined by "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organisation or external relations." (p. 46).

The interactive process of innovation (Von Hippel, 1988) is now widely recognized in front of a changing environment, where the sources of expertise are widely distributed. According to proponents of the evolutionary approach (Nelson and Winter, 1982; Dosi et al., 1990), the ability to cooperate with external stakeholders is at the heart of organizational routines of the company that are defined as "interaction models and which are solutions to particular problems" (Dosi et al., 1990, p. 243). Cooperation links are then guaranteeing access to resources and expertise of partners to revitalize the learning process as a source of innovation. The importance of external sources of knowledge was reinforced by the emergence of open innovation model of Chesbrough (2003). In this model, the network relationships are a source of innovation activity because they provide an opportunity for businesses to use with finality external knowledge of the other parties to accelerate innovation internally (inbound innovation); similarly, outsourcing of internal company knowledge can be exploited by others on the same principle (outbound innovation).

The cooperation with external parties in the business (from suppliers, customers, and competitors, to research institutions) form a platform for the exchange of resources and solutions that can improve business innovation performance (Belderbos et al., 2015; Huizingh, 2011). This is particularly important for SMEs because it allows them to deal with different constraints imposed by their small size vis-à-vis the large structures (Cumbers et al., 2003).

The study of open innovation in its spatial dimension within the clusters is being awarded several virtues enhancing its benefits for businesses. Indeed, the literature on clusters indicates unique opportunities to create and facilitate a variety of links and connections. These relationships are explained by geographical proximity which is part of the definition of clusters. This proximity facilitates networking opportunities, face to face and frequent interactions (Porter, 1998; Niu et al., 2008), communication and familiarity (Loilier, 2010), which promotes the development of social networks and professional informal channels used for the information exchange, tacit knowledge (Cumbers et al., 2003) and co-operation opportunities (Felzensztein et al., 2010). By grasping the importance of cooperative practices as key factors related to support the competitive advantages of the industry in the Porter's cluster approach, Cooke et al., (1997) note that the innovative cluster is where systemic exchange relations are maintained between companies and several major players for innovation, including other companies in the same sector operating in formal or informal networks and knowledge centers (universities, research institutions).

In an empirical perspective, several studies have shown a positive correlation between both the inter-firm cooperation, industry-science cooperation and the innovation. For example, Freel and Harrison (2006) in their study of innovation and cooperation of small businesses in northern Britain found that firms engaged in cooperative relationships with customers are more likely to successful product innovations, whereas firms cooperating with suppliers and universities are rather process innovators. From De Propriis (2002), based on a sample of 435 companies in the industrial region of West Midlands, found a positive relationship between cooperation with customers and suppliers on product innovation, although for process innovation only cooperation with suppliers is significant.

In the North Staffordshire industrial district of ceramic, Tomlinson (2013a) explored the impact of cooperative links upon innovation. The results show a positive correlation between the vertical cooperation and innovation performance. However, it is the strength of these ties and not only their existence that is important. Similarly, it concluded that the strong relationships with academic institutions are also likely to strengthen innovation activities.

Najib and Kiminami (2011), in a questionnaire survey conducted among five clusters of SMEs (Small-Medium Enterprises) belonging to the food industry in Indonesia has concluded with a positive association between inter-firm cooperation (with suppliers, customers and competitors) industry-science cooperation (with the university and research institutions), and innovation of SMEs of clusters (product, process and marketing innovation).

In summary, the Schumpeterian model of the innovative entrepreneur has given way to a more dynamic and interactive perspective of a constellation of actors rich in diversity that materializes in the cluster concept. Businesses, especially small ones are brought to cooperate with a variety of external actors to face the challenges of innovation (Beck et al., 2014) by entering the existing opportunities beyond their borders. However, despite the interest paid to cooperation in the development of the firm's performance and as a means of access to strategic resources such as knowledge, its importance has been the subject of controversy and debate in the context of clustering (Brenner, 2005). In order to explain the contrasting results of the cluster effect on innovation performance, we assume the existence of moderating variables that modulate the cluster effect on the dynamics of cooperation and the impact of cooperation on innovation performance. These two variables are presented thereafter are: inter-organizational trust and absorptive capacity.

Inter-Organizational Trust

Recent developments of networks and clusters in the quest for competitive advantage, suggest a high level of inter-organizational relationships and exchanges of additional resources through cooperation. This trend for the cooperation practices questioned the place and role of trust.

Approached by several disciplines, trust has become a key factor in management research, essential for understanding the actions and business performance (Zaheer and Harris, 2006). Fukuyama points out that "Trust is the expectation that arises within a community of regular, honest, and cooperative behavior, based on commonly shared norms, on the part of other members of that community." (1995, p. 26). According to the same author, the cooperative economic behavior is stimulated mainly by growing confidence.

Zaheer et al., (1998) distinguish between interpersonal trust and inter-organizational trust, and define the latter as a collective trust orientation of members of an organization toward the partner organization. Rousseau et al., (1998, p. 395) propose the following definition of trust as a "psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another."

In the academic literature, there is a broad consensus that trust acts as an effective lubricant for economic exchange and like a social control mechanism. It is mostly supposed to:

- Facilitate interaction, social exchange, and cooperation (Nahapiet, J., and Ghoshal, 1998);
- Enable transfer and exchange of tacit knowledge, confidential information and relevant resources (Molina-Morales et al., 2011);
- Lower transaction costs (Zaheer and Harris, 2006);
- Reduce goal incongruence (Wang et al., 2011) and facilitate mutual understanding (Santoro and Saparito, 2003);
- Promote the development of collective strategies (Niu et al., 2012).

Absorptive Capacity

The involvement of companies in clusters offers a range of potential benefits that could positively affect their innovative capacity (Porter, 2000). The location near a variety of players, such as the world of industry and science, specialized information-generating entities, offers special opportunities for organized innovation (Bocquet and Mothe, 2008) via active cooperation. This invites us to think of the heterogeneity of the cluster's firms with respect to their ability to recognize the value of the opportunities offered by potential cooperation in terms of information to assimilate and apply for commercial purposes (Cohen and Levinthal, 1990). This ability is linked to the concept of absorptive capacity.

Cohen and Levinthal (1990) support the idea that the company's ability to learn from its external environment is based on prior knowledge. Hence, only firms with strong internal organizational capabilities are able to recognize, absorb and exploit knowledge and opportunities of the cluster environment.

These capabilities are described by Zahra and George (2002) in four dimensions:

- The ability to recognize, develop and acquire external knowledge;
- The routines and processes that enable the firm to analyze, interpret and understand information from external sources;
- The ability of the firm to develop routines allowing it to combine internal and external knowledge, adapt and transform them into new patterns;
- Finally, the organizational capacity of the firm to exploit the skills acquired, assimilated and transformed for commercial purposes.

The Proposed Conceptual Model

Academic literature on innovation has largely brought to the forefront plan its collective and interactive feature. Innovation performance is no longer the preserve of large companies with large investments in internal R&D capabilities. Landry et al. (2002) highlight this trend in the design of innovation:

"Nowadays, innovation is rather considered as the result of a process which success rests upon the interactions and exchanges of knowledge involving a large diversity of actors in situations of interdependence" (Landry et al., 2002, p. 683).

The cluster is among the organizational models that meet the changing production processes and innovation that are likely to make the company boundaries more permeable. Indeed, among the advantages accorded to the cluster and which are related to those features mentioned above, its ability to generate and facilitate cooperation between its members (Nadvi, 1999; Porter, 1998; Preissl and Solimen, 2003; Saxenian, 1994; van Dijk and Rabellotti 1997).

Several empirical studies have shown that the innovation performance of the company, and particularly the SMEs, is being positively associated with developing inter-organizational cooperation with customers and suppliers (Tomlinson, 2013b; Freel and Harrison, 2006; Lasagni, 2012; Neyens et al., 2010) with competitors offering the same types of products (Belderbos et al., 2004; Neyens et al., 2010; Tomlinson, 2010) and with universities and research organizations that are a source of knowledge transfer and technology (Arvanitis and Bolli, 2009; Kaufmann and Tödtling, 2001; Silva Leitão, 2009; Lasagni, 2012; Belderbos et al., 2004; Neyens et al., 2010).

Consequently, it appears that the innovation performance of companies involved in a cluster can be explained by the double mediation of inter-firm and industry-science cooperation. Therefore, we suggest the following proposition:

P1. The relationship between firm's involvement in a cluster and innovation performance is simultaneously mediated by inter-firm and industry-science cooperation.

Widely cited in the literature as an important element in the cooperation (Moorman et al., 1992; Preissl and Solimene, 2003), it becomes increasingly clear that inter-organizational trust is a crucial factor affecting the actions and the performance of organizations engaged in networking relationships (Zaheer and Harris, 2006). A certain threshold of trust then proves an emergence condition of inter-organizational cooperation. Preissl and Solimene stressed that: "The search for partners to complement the resources of a company that wishes to innovate cannot always rely only on market connections, but it has to take into consideration that trust is an important element in co-operation" (2003, p. 3).

As the trust depends on the socio-cultural identity and social capital in the presence (Jiménez and Junquera, 2010) and which differ from one context to another, organizations are likely to show different degrees of cooperation.

In this study, we are interested in two types of players, one from the world of industry and another from the world of science. They each have specific characteristics, roles, objectives and different incentive structures because they belong to two 'different social systems' (Kaufmann and Tödtling, 2001; Marzucchi et al., 2015.). For this reason, we address inter-organizational trust under two perspectives: inter-firm trust (which exists between industrials), and industry-science trust (between business, universities and research and training organizations).

We assume then that the relationship between the firm's cluster involvement and inter-firm and industry-

science cooperation is strong for companies with a high level of inter-organizational trust. Therefore, the following propositions are given:

P2a. The inter-firm trust positively moderates the relationship between involvement in the cluster and the degree of inter-firm cooperation, such that the relationship is stronger for firms with high level of inter-firms trust.

P2b. The industry-science trust positively moderates the relationship between firm’s involvement in the cluster and the degree of industry-science cooperation, such that the relationship is stronger for firms with high level of industry-science trust.

Cooperation in the context of the cluster appears as a way to detect opportunities for innovation, access to new knowledge and skills held by the industrial partners and the world of research. However, only firms with strong capabilities of identification and exploitation of information from external sources via cooperation are likely to have better innovation performance. Thus we suggest that:

P3a. The effect of inter-firms cooperation on firm’s innovation performance is moderated by their absorptive capacity, such that the effect is stronger for firms with high absorptive capacity and weaker for those with low absorptive capacity.

P3b. The effect of industry-science cooperation on firm’s innovation performance is moderated by their absorptive capacity, such that the effect is stronger for firms with high absorptive capacity and weaker for those with low absorptive capacity.

The figure below shows our conceptual model that links the various associated theoretical concepts.

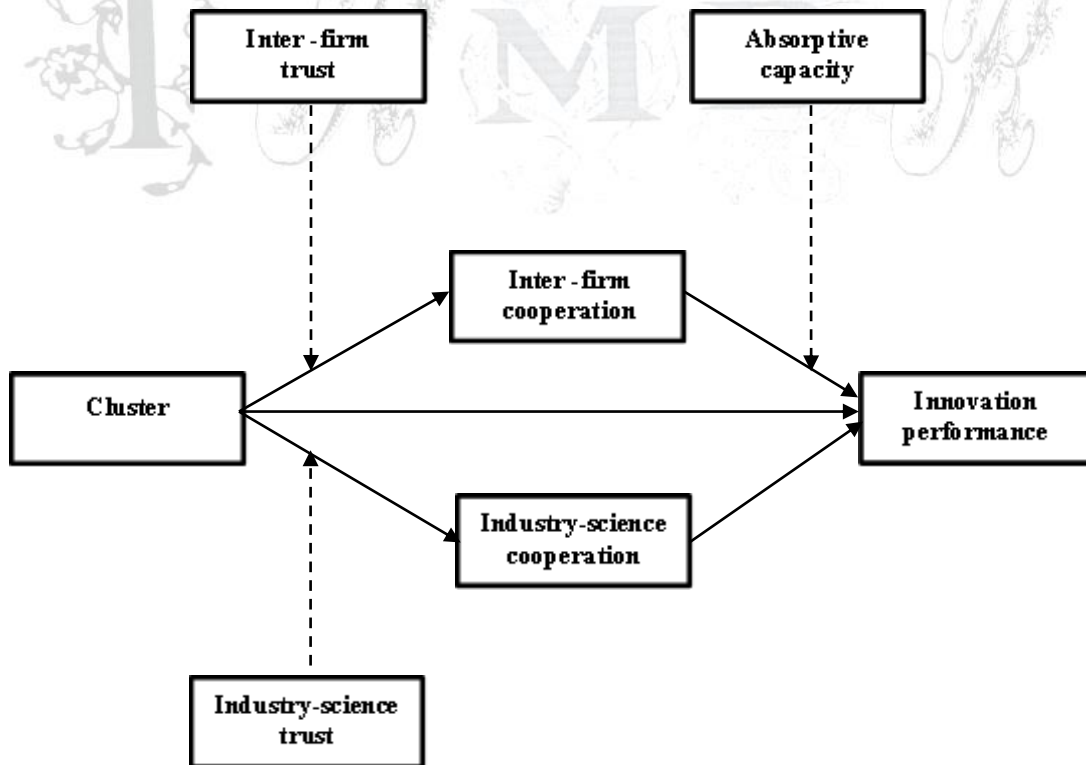


Figure 1: A proposed conceptual model

Managerial Implications and Conclusion

This research seems to have several managerial implications for researchers, policy makers and for the management of clusters. It offers insights into the importance of cooperation under both forms inter-firm and industry-science. These are identified as a bridge ensuring the passage from involvement in a cluster to better innovation performance.

Two critical conditions are raised to make a success of this passage. On the one hand, the inter-organizational trust is recognized as decisive in the success of collaborative relationships (Mora-Valentin et al., 2004). The proposed conceptual model suggests that it provides the underlying conditions for the emergence of effective cooperative behavior. On the other hand, the focus is on the relevance of developing an internal effective absorptive capacity so that the firm involved in the cluster can capitalize on the opportunities arising from the various cooperative ties and turn them into innovations. Both these conditions can sensitize the initiators of the clusters and their managements to the importance of investing in building trust among diverse and heterogeneous actors and the development of absorptive capacity, particularly for small organizations with limited competencies and resources.

This conceptual analysis also provides a platform for future empirical investigations and statistical analysis, which is a shortcoming of this study to validate this model. Future research can explore clusters from regions with different sociocultural, technological intensity and economic development. The results can reveal important explanations to the question of the impact of clusters on business innovation by exploiting the mediators and / or moderators effects analyzed in the research itself.

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