

**UNITED WE STAND, DIVIDED WE FALL? CLUSTERED FIRMS'  
RELATIONSHIPS AFTER THE 2008 CRISIS**

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**Abstract**

Research on clusters or industrial districts, with various schools of thought, focuses on the relationships between clustered firms. We observed that the territory can produce sources of advantage for firms, but also disadvantages. The aim of this work is to determine what happened in the Spanish ceramic tile industrial district firms relationships after the 2008 crisis with a exploratory and qualitative approach. The analysis has been performed in three of the dimensions in which these connections can take place: cooperation, knowledge transfer and

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supporting institutions, along with innovation as a measure of performance. In order to examine these shifts, members of the firms and institutions in the cluster were interviewed, resulting in eight propositions for changes that may take place when the competition is intensified within a cluster which demand future researches.

**Keywords:** Ceramic tile industrial district, cooperation, knowledge transfer, local institutions, innovation, Inter-organizational relationships.

## **1 INTRODUCTION**

Research on territorial clusters has evolved in a multidisciplinary fashion, with various schools of thought (Bahlmann & Huysman, 2008). In particular, the discussion on the relationship between clustered firms began with Marshall (1919). This author introduced the concept of industrial districts, where economies of scale due to specialization and access to raw materials and other inputs could be found, together with specific knowledge of the industry. While the author indicated this effect on companies' choices in terms of processes, it became evident that these environments can foster both specialization, achieved by repetition of the process, and complementarity, derived from each company's decision to focus on specific phases rather than on the full industrial process (Marshall, 1919). Such specialization would be a source of advantage for local firms, while complementarity would be a condition of exposure to risk derived from the behavior of others (Williamson, 1981). Thus, this complementarity ended up creating the need for closer relationships between firms, although Marshall (1919) did not stress very much this fact.

Complementarity certainly allows dependence to arise between firms, which may lead to increased transaction costs (Williamson, 1981). The antidote to the increase in costs would be vertical cooperation, which would reduce information asymmetry and the consequent risk inherent in the transaction (Williamson, 1981). It should be noted that such cooperation seems more reasonable, since, as claimed by Lydeka and Adomavicius (2007), cooperation between

competing firms, even clustered firms, is more difficult and unstable, and its results are not always predictable. In the particular case of clusters, the work of Castro, Bulgacov and Hoffmann (2013) showed that competing firms that were cooperating were typically distant from one another. This means that close territorial proximity had the effect of discouraging cooperation between firms, rather than increasing it.

We must take into account that the territory could also be a key source of knowledge for businesses (Hoffmann, Bandeira-de-Mello & Molina-Morales, 2011; Malmberg & Power, 2005). However, Belussi, Samarra and Sedita (2010), on addressing relationships that support innovation, showed that extra-regional relationships have a greater impact on patents than local ones. However, this is not a closed issue, since using local knowledge does not exclude the use of external knowledge, as shown by Asheim and Isaksen (2002).

Studies addressing knowledge transfer have demonstrated the major role played by supporting institutions, both in brokering relationships between firms (Hoffmann et al., 2011; Hoffmann, Lopes & Medeiros, 2014) and in providing services to local firms at a lower price than they would pay if they had to internalize such services (Brusco, 1993). In this respect, the presence of non-business players, or at least not being focused on financial performance within the territory, would result in another advantage for local firms, or even a condition for innovation, as studied by Asheim and Isaksen (2002).

Thus we note that the territory is not only an environment where firms' competitiveness may increase, but it can also produce relationships that are so redundant that they can lead to a process of entropy, such as those described by Lazerson and Lorenzoni (1999) in the watch industry of the Jura Valley in Switzerland, or in the silk industry in Bologna, Italy. Similarly, Molina-Morales and Martínez-Fernández (2009) showed that increasing intensity in relationships does not lead to the same level of intensity in the companies' performance, in terms of innovation. Rather, these authors demonstrated that it

followed a quadratic curve, in which the positive impact on performance is observed up to a certain point, after which losses occur, as the relationships between companies are intensified. Thus, it is understood that for companies, joining a cluster does not necessarily entail advantages (Hoffmann et al., 2014) or positive impacts in terms of performance (Krafft, 2004).

We observed that the territory can produce sources of advantage for firms on the one hand, such as cooperation, knowledge transfer and access to supporting institutions, but also disadvantages, such as increased competition and entropy. What nearly all these studies have in common, although there are few exceptions, is that they depict clusters in normal competitive conditions. That is, all the studies focus on what happens when competition is not intensified. Some research indicates that the greater the competition is, the fewer conditions for cooperation there will be (Lydeka & Adomavicius, 2007), but also shows that they are not mutually exclusive (Park, Srivastava & Gnyawali, 2014). Thus, what happens in cluster firms relationships when external pressure for competitiveness become stronger?

To answer this question, it seems that two conditions need to be put in place: i) the territory must have suffered for strong external pressure for competitiveness; and ii) the territory must have a positive record for the existence of cooperative relationships among firms before experiencing such new high external pressure. To meet these two requirements, we selected the industrial district of the ceramic tile industry in Castellón, Spain. Since 2009, Spanish industry has suffered strong pressure for competitiveness. One of the sectors that experienced a significant pressure was the ceramic tile industry, whose production dropped by almost half between 2006 and 2009. Moreover, this industry has been studied by many researchers, and almost all the studies have revealed the existence of high cooperation among the clustered firms (Molina-Morales, 2001; Molina-Morales, Lopez-Navarro & Guia-Julve,

2002; Hoffmann, 2011). In a way, this industry seems to meet the two requirements necessary to conduct this research.

We have divided the paper into four parts. In the introduction, we provide an overview of the topic and the problem that we will study. In part two, we will present our theoretical framework, focusing on cooperation, knowledge transfer, role of institutions, and innovation, as a measure of performance. In part three, we describe the procedures included in the method, with the qualitative approach followed and a brief description of the case study. In the final part, we discuss our results and present some conclusions.

## **2 THEORETICAL FRAMEWORK**

As indicated by Belussi (2015), industrial districts (ID) and clusters can be accepted as synonyms, which is how they are treated in this text. Becattini (1990, p. 39) defined an ID as a socio-territorial entity characterized by the active presence of a community of people and a population of businesses in a naturally and historically delimited area. In the initial years, the Becattini (1990) definition, based on the analysis of specific historical contexts, and his early work, permeated with prevailing ideological aspects, contributed to limit the scope of studies that were not Italian. As argued by Zeitlin (1993, p. 366), in the light of these difficulties, the Italian model became too "dense and closed". A more "tenuous and open" model was necessary for the understanding of a greater observable variety. The author claims that this model could be based on the definition of ID put forward by Marshall (1919) as a "productive system geographically located and based on extensive division of labor between small and medium sized businesses specialized in different phases of a common industrial sector" (Zeitlin, 1993, p. 366). To this definition, we add the fact that an ID is not only an economic

phenomenon, but also a social one (Paniccia, 1998; Belussi, 2006; Molina-Morales et al., 2002).

To understand district evolution, we must accept the hypothesis that the performance of firms operating in an ID may be affected by the environment. As claimed by Eisingerich, Bell and Tracey (2010), an environment's uncertainty has a potential moderating effect on the performance of firms located in a given territory. By studying eight clusters in two different countries and in different industries, the authors found this effect very significant in four of them, and partly significant in other three. The work of Molina-Morales et al. (2015) showed that in an industrial district, high cognitive uniformity, and institutional proximity, produces a negative impact on the forming of ties. Bengtsson and Sölvell (2004) indicated that, in a given territory, depending on the conditions of competition or cooperation under which the local firms operates, companies will have more or less incentives to innovate. Moreover, geographical proximity of firms does not guarantee for the open access to companies resources, because often only firms responsible for the final step (assemblers) are able to accumulate and use the district resources (Hoffmann et al., 2014).

Our study focuses on three dimensions of the firms relationship existing in an industrial district, previously studied in the literature: cooperation among firms (Arranz & Arroyabe, 2008; Becker & Dietz, 2004; Bengtsson & Sölvell, 2004; Kongmanila & Takashi, 2009; Lazerson & Lorenzoni, 1999); relations linked to knowledge transfer (Bahlmann & Hysmann, 2008; Hoffmann et al., 2011; Hoffmann et al., 2014; Kongmanila & Takashi, 2009; Malmberg & Power, 2005), and relations developed with local supporting institutions (Benton, 1993; Kongmanila & Nagai, 2009; Hoffmann et al., 2011b; Hoffmann et al., 2014; Malmberg & Power, 2005). We take innovation as a proxy for overall business performance, as already used by Eisingerich et al. (2010), Becker and Dietz (2004), Hoffmann et al. (2011b), Kongmanila and Takashi (2009), and Molina-Morales et al. (2015).

## **2.1 Cooperation**

Cooperation can be studied in different ways, but here we will focus on establishing a link between cooperation and firms' performance . This approach is more related to firms' strategy and includes studies which have measured this phenomenon using a large set of variables. As Saxenian (1994), Dakhli & De Clercq (2004), and Bahlmann and Hysmann (2008) have discussed, districts are composed by a multidimensional reality, which involves both the dimensions of cooperation and learning among different players.

Firms success in industrial districts has been often associated with this mix of ties, based on cooperation (trusted ties), promoting efficiency and knowledge absorption, through the access to novel and varied knowledge sources (Molina-Morales, Martínez-Fernández & Torlo, 2011). Some level of inter-organizational trust is essential for innovation in network-based contexts (such as industrial districts), since geographical proximity enhances firms' ability to exchange relevant information and tacit knowledge, and thus increases their opportunities to access valuable new combinations of resources (Lindelöf & Löfstein, 2004; Felzensztein et al., 2010).

The work of Becker and Dietz (2004) highlights the importance of cooperation for fostering research and development (R&D) activities. Felzensztein et al. (2014) have shown that cooperation also in different district characterised by the same industry can take place between different players. In their study of the wine industry in four different countries, they have highlighted different modalities: in Argentina and Chile cooperation took place mostly between firms and customers, in New Zealand, it developed mainly between firms and their business associations, and in Australia it appeared to be more prominent among firms and their competitors.

We will now address our attention to horizontal and vertical cooperation.

*Horizontal cooperation.* Horizontal cooperation has been largely discussed in the district literature (Maskell, 2001; Belussi and Pilotti, and Kongmanila and Takashi (2009). In districts it exists among players working in the same phases of the productive process, but it also involves relationships with local or regional institutions (Cook and Morgan, 1994; Cook et al., 1997).

Since in this paper we will treat institutions as a separate category, we will focus, here, on the horizontal cooperation which occurs between competitors. Horizontal cooperation is suitable for solving common problems (Molina-Morales et al., 2015), for establishing agreements (Arranz & Arroyabe, 2008), for accessing specific knowledge on the market, for promoting products jointly (Kim et al., 2010), for organizing collective participations to fairs and business missions (Felzenstein et al., 2014). However, horizontal cooperation is not as common as vertical cooperation. Some reasons why companies have difficulties to cooperate with competitors were identified by Lydeka and Adomavicius (2007) in relation with the issue of lack of confidence and inability to see the benefits that could be obtained through cooperation, or because divergent firms' property structures. Trust may be considered to be a pre-condition for cooperation. When two partners begin to trust each other, they are more likely to share resources without worrying for opportunistic behaviors (Uzzi, 1996), thus facilitating innovation and learning (Meeus et al., 2001). Bengtsson and Sölvell (2004) added that cooperation is more common when firms are not placed in a symmetric competition, when geographically clustered firms operate in the same market segment. Regarding this aspect, we draw attention to the empirical work presented by Boari, Odorici and Zamarian (2003), which shows that spatially clustered firms consider as rival only a small number of competitors. Analyzing seventeen entrepreneurs belonging to the Italian packaging district, located near Bologna, they discover that a group of nearly fifty firms, the



participating in the study were identifying on average only about five competitors as rivals. This means that in districts competition is perceived not as competition of all against all.

*Vertical cooperation.* Several studies have pointed out cooperation which is taking place within the clustered firms' value chain, in different countries. This can be observed in Sweden (see the study of Bengtsson and Sölvell, 2004), in Italy (Camuffo, and Grandinetti, 2011), and in Spain (as reported in the case of the Castellón district studied by Molina-Morales, Martínez-Fernández and Torlo (2011), as in emerging countries (see the work of Kongmanila and Takashi (2009) on the garment industry in the Vietnamese Lao cluster ).). Kongmanila and Takashi (2009) found that cooperation with international buyers and subcontractors was greater than with local suppliers. . Also Becker and Dietz (2004), observed more frequently the existence of vertical cooperation among local large businesses exporting in foreign market. However, they were less innovative in products than the local small firms, because large business was participating to more standardized global supply chains. The work of Kim et al. (2010), exploring clusters in the telecommunications industry shows that reciprocal relationships are associated with high levels of cooperation. Technological uncertainty may discourage cooperation, but there are different implications depending on the position of firms in the supply chain and on their strategy. Faced with technological uncertainty, firms may choose, for instance, to strengthen or weaken cooperation, depending on factors such as the availability of alternative suppliers, or the amount of sunk investment made in the past. Cooperation may exert a positive influence on innovation as it has been studied by Molina-Morales, Martínez-Fernández & Torlo (2011) and Padula (2008).

## **2.2 Knowledge Transfer**

Belussi and Caldari (2009), in their article on the origin of the industrial district concept, put in evidence that Marshall since the beginning was referring to industrial districts

as areas of learning of specific knowledge, populated by e skilled workers, and where good ideas were adopted promptly, thanks to the social interactions existing among the local people, Knowledge transfer within an industrial district is strongly connected to the other dimensions above discussed. Hoffmann et al. (2011b) have shown that cooperation among firms, local mobility of the workforce, and the presence of supporting institutions are directly linked to knowledge transfer. Also Padula (2008), Hoffmann et al.(2014.), Malmberg and Power (2005), Mitchell et al. (2014), and Powell and Giannella (2009) have pointed out that supporting institutions such as trade and professional associations, government agencies, and research institutions favour a variety of knowledge flows among the district firms. The sources of such knowledge can vary greatly (Mitchell et al., 2014;) also because, for instance, the importance of scientific knowledge, is different for each type of industrial district, depending from the technological opportunities open to firms (Belussi et al., 2010).

As argued by Powell and Gianella (2009), technological transfer can also occur in one specific area by the means of dismantling large firms' laboratories stemming from their high costs, or because local firms adopt new governance rules which encourage open innovation strategies. In this paper, we will address three ways for knowledge transfer to take place in a cluster, as follows.

*Knowledge transfer by workforce mobility.* Workforce mobility, within the firms belonging to a specific industrial district appears to be an important activator of knowledge transfer, as clearly discussed by Marshall (1919), already more than 100 years ago. The presence of skilled workers can also attract new companies to join a cluster. Workers tend to move among firms in the same industry, considering that their specific knowledge, in most cases, is related to the predominant industrial processes operated in the cluster. Thus, workforce mobility within a cluster is one of the most diffused source for exchanging new ideas and knowledge (Power & Lundmark, 2003). Mitchell et al. (2014) reported in their

study of Hunter Valley, a cluster of wineries in Australia, that the mobility of local technical workers and oenologists has facilitated the dissemination of two types of knowledge: i) external, deriving from the access of new scientific sources linked to the network of contacts outside the cluster built by the various individuals; and ii) local and related to the cluster context, acquired by experience, in a process of trial and error . In this particular case As these professionals are employed by more than one company, they end up transferring knowledge from one business to the other.

*Knowledge transfer through social contact.* A more unplanned mechanism is that one of involuntary knowledge transfer (market knowledge or technical knowledge) throughout the frequent social encounters outside the workplaces, in social or religious events, or because workers attend the same local clubs and associations (Molina-Morales et al., 2002; Krafft, 2004).

*Knowledge transfer by direct contact among firms.* Clusters and industrial districts can increase the potential for knowledge sharing between companies (Mitchell et al., 2014). According to Krafft (2004) and Kongmanila and Takashi (2009) the dynamics of knowledge creation, coordination, and dissemination, are heterogeneous, and affected by the specificity of each area. Moreover, these dynamics are not a process with immediate effects, but they take place step by step, and each step generates effects that may be irreversible for the next period, which further benefits businesses.

### **2.3 Local Institutions**

Many works that deal with knowledge transfer in clusters have also discussed the role of local institutions (Cooke & Morgan, 1991; Ybarra et al., 1996). The works of Hoffmann et al. (2011b), Rowley, Behrens, & Krackhardt (2000), and Krafft (2004), have looked at institutions as one of the players responsible for generating local knowledge in the cluster. Moreover, institutions in a cluster are important for the type of services they can provide

locally and the impact they can have on businesses, such as encouraging them to be engaged in R&D projects with external funding (Becker & Dietz, 2010), helping to generate innovation (Molina-Morales et al., 2011), and, thus, affecting their performance (Kongmanila & Takahashi, 2009).

*Type of institution and service provided.* The discussion about the type of service depends on determining what kind of organization can be a supporting institution. According to Brusco (1993), it may be linked to the public sector or be an agency specialized in providing services to the local industry. Such institutions may be research institutes (Krafft, 2004; Padula, 2008), universities, vocational training centers (Becker and Dietz, 2010; Hoffmann et al., 2014; Kongmanila & Takahashi, 2009; Padula, 2008), business associations (Eisingerich et al., 2010; Krafft, 2004; Padula, 2008), funding bodies (Eisingerich et al., 2010), and/or government agencies (Padula, 2008). These institutions provide services, in exchange for payment, with “goods and services they need, rather than handing to them money to buy these goods or services on the market” (Brusco, 1993, p. 248). Such services include transformation of scientific knowledge into technological knowledge (Krafft, 2004), contacts with the international market and foreign exhibitions, as described by Kongmanila and Takahashi (2009), information sharing (Becker & Dietz, 2010; Kongmanila & Takahashi, 2009), financial help for the creation of start-ups, or the attraction of new businesses into the cluster (Krafft, 2004).

*Impact of institutions.* Eisingerich et al. (2010) acknowledged that institutions are key factors in a cluster’s performance. Because of their diversity, and the countless services they can provide, institutions can have very different impacts on firms. Becker and Dietz (2010) showed that they increase the likelihood of new product development. By maintaining contact with institutions such as research centers, barriers to knowledge transfer between SMEs are reduced (Krafft, 2004). Another key aspect is the existence of business clubs and associations,

which spread information during their interactions with local companies. Finally, Kongmanila and Takahashi (2009) found a positive association between cooperation with institutions and small businesses performance.

## **2.4 Innovation**

Clusters are not always very innovative, neither they only contains Schumpeterian innovators (Belussi et al., 2003).. Innovation can take different paths, depending on the innovativeness of local firms , the type of players involved, and other choices (Krafft, 2004; Arranz & Arroyabe, 2008; Belussi et al., 2010; Hoffmann et al., 2011b; Kim et al., 2010; Arranz & Arroyabe, 2008). Belussi et al. (2010) have also demonstrated that extra regional relationships were positively related to patenting. Kim et al. (2010), demonstrated the advantage for clusters in being integrated into a single system under certain common standards.

Although Arranz and Arroyabe (2008) did not address only clustered firms They pointed out that innovation in manufacturing in Nordic countries is mainly a cooperative process among innovative businesses working in cooperation with other companies or organizations (this percentage was 71% in Finland; 59% in Sweden; 57% in Denmark, and 49% in Norway), while in southern European countries (e.g., Spain, Italy) they found the presence of less cooperative behaviors.

*Innovation as a result.* When innovation is achieved from the joint effort of more than one local player it can bring advantages, since it becomes more economical and the risks involved are shared more equitably, as indicated by Powell and Gianella (2009). Arranz and Arroyabe (2008) claimed that sectors that demand more complexity in terms of generating innovation and, as a result, more investment, also appear to benefit more from cooperation. Krafft (2004) pointed out that interactions among companies with innovative behavior, relationships with academic infrastructure, and public centers at the local level leads to

superior performance in the cluster. Confronting clustered and non-clustered firms, Broekel, Fornahl and Morrison (2015) discovered that territorially clustered companies are more innovative and they tend to participate more in public funded projects.

### 3 METHOD

An exploratory and qualitative approach is adopted in this research. The design of the method we explain as follow.

#### 3.1 Definition of variables

This study has used four different variables (cooperation, knowledge transfer, local institutions, and innovation), and seventeen sub-variables, as described in Table 1. To answer our research question we studied in detail the role of trust, workforce mobility, social contact, and local services together with the impact of the different types of innovation: product, process, new market discovering, and organizational innovation/marketing.

**Table 1: Research Variables**

Variables	Ex ante and ex post Sub-variables	References
1) Cooperation	(Horizontal) 1) Existence of trust 2) <i>Existence of barriers to cooperation</i> 3) <i>Existence of attitude to coordination and sharing common goals</i>	Arranz & Arroyabe (2008); Molina-Morales et al., (2015); Felzenstein et al. (2014); Kim et al. (2010)
	(Vertical) 4) <i>Importance of Flexibility/integration</i> 5) <i>Importance of out-of-the district relationships</i>	Becker & Dietz (2004); Bengtsson & Sölvell (2004); Kim et al. (2010); Kongmanila & Takashi (2009)
2) Knowledge Transfer	6) By workforce mobility	Power & Lundmark, (2003); Mitchell et al. (2014)
	7) By social contacts	Krafft (2004); Molina-Morales, López-Navarro & Guia-Julve (2002)
	(Among companies) 8) <i>Among competitors</i> 9) Among suppliers 10) <i>Low appropriability (No existence of secrets)</i>	
3) Local Institutions	11) <i>Importance of local public support</i> 12) <i>Importance of the relationship of local institutions with local companies</i>	Becker & Dietz (2010); Eisingerich et al. (2010); Krafft (2004);

		Kongmanila & Takahashi (2009)
	13) Importance of provision of local services	Becker & Dietz (2010); Krafft (2004); Kongmanila & Takahashi (2009)
4) Innovation	14) New products 15) New processes 16) Discovering new markets 17) Organizational innovations/New marketing strategies	Arranz & Arroyabe (2008); Broekel et al. (2015); Krafft (2004); Oslo Manual (2005); Powell & Gianella (2009)

We also include in our analysis eight other sub-variables were drawn from analysis of content from respondents (*ex-post* sub-variables): *i) existence of barriers to cooperation, ii) existence of attitude to coordination and sharing common goals, iii) importance of flexibility/integration, iv) importance of out-of-the district relationships, v) the knowledge transfer among competitors, vi) low appropriability (no existence of secrets), vii) importance of local public support, viii) importance of the relationship of local institutions with local companies*

### 3.2 Case Selection

The choice of the case selected needed to answer to our analytical frame, in which we wanted to be able to study the reaction of district firms in terms of changing their cooperative behaviors facing a competitive shock. *External pressure for competitiveness*. Between 1990 and 2006, Spain became the world's first ceramic tile producer, and 90% of this production is concentrated in the industrial district of Castellón (IDC). Between 2005-2006, the IDC produced up to 610 million square meters (8% of world production). In that period, global competition started to grow with the entry of new emerging countries producers (Brazil, China, Turkey, Mexico and Indonesia). The response was to improve the product in an attempt to add value. The 2008 crisis was strongly felt by the firms of the IDC, which reached the end of 2009 with a production of 324 million square meters: nearly half of the production volume of 2007. Despite a partial recovery (production of 420 million square meters) occurred during 2013, the Castellón share in world production dropped to 3.53%. Between

2008 and 2013, the number of jobs also dropped by about 8,000 (Ascer, 2015; Ivex, 2013). Regarding the number of companies, there were 201 in 2000 and 127 in 2013 (Sabi, 2015).

To confirm this scenario, we asked our respondents an introductory question, in order to understand their perception of the impact of the crisis, because by so doing we could feel whether the respondent was qualified to participate in the survey. With few exceptions, the crisis brought about losses calculated between 40-50% of production (and, consequently revenue) according to the institutions surveyed (Isnt3; Isnt4; Isnt5). Respondents confirmed that the crisis hit them harder, because the industry experienced strong growth in the previous decade, of 10-15% per year, based on expansion of the domestic civil construction market (Inst5). The crisis affected most companies that had entered financing contracts, that were active in the domestic market, and/or that produced products for more sophisticated markets, according to Inst1; Firm13; and Firm14, i.e., ceramic manufacturers. Suppliers, such as paint or gas suppliers, were less affected (Inst4).

In some cases, the reduction in production and sales has led to the closure of business activities in the district. The existence of high competitive pressure meets our first condition, which is to conduct an analysis on a cluster that has suffered particularly for strong local competitiveness.

*Cooperation prior to the crisis.* Several studies indicate that the Castellón ceramic district operated until 2008 with a good level of cooperation among the local actors and firms. All existing research shows that such cooperation was horizontal and vertical, involving also local institutions (Molina-Morales, 2001; Molina-Morales et al., 2002; Hoffmann et al., 2011a).

Molina-Morales et al. (2002) indicated that local institutions had the ability to seek exogenous knowledge, transferring and internalizing it in the cluster. These institutions can play the role of structural holes to benefit private firms in the district. The ties of individual firms



with these local institutions may produce similar benefits to those generated by direct links of local firms with outside to the district firms.

The work of Hoffmann et al. (2011) which compared the IDC with two Brazilian districts, belonging to the ceramic tile industry, confirmed that cooperation levels and knowledge transfer in Castellón were high, and even higher than in the other two, Brazilian districts. However, they found a similar level of involvement of local institutions and of knowledge transfer through workforce mobility.

### **3.4 Data Collection**

Data were collected through semi-structured interviews, drawing on the variables shown in Table 1. We interviewed seven managers of six local institutions supporting the ceramic activity, and twelve other entrepreneurs with different company sizes and in distinct stages of the productive process. The seven institutional interviews were scheduled in advance in each organization. The other interviews were conducted during a trade show held in February 2015, in connection with the ceramics industry in Valencia, Spain, which facilitated access to the respondents. In that event, the more accessible respondents were chosen, and, to obtain the twelve interviews, we contacted sixty participating companies. The interviews lasted about 90 minutes each.

### **3.5 Data treatment**

In treating the data, we used the theoretical saturation methodology, with a variation explained by Glase and Strauss (1967). Since there were time restrictions to collect data related to the companies, all the interviews were conducted at the initial stage of the work. Then the respondents were divided into two groups: institutions and companies. Each respondent received an identifiable number, related to the sequential ordering of the interviews. For each institution, we randomly selected two companies, in order to intersperse the respondents. From this stage on, all interviews were transcribed and analyzed manually,

based on the variables presented in Table 1, following the order of the draw. The analysis of the responses revealed eight new sub-variables, as pointed out earlier (Table 1).

Saturation happened in the 12<sup>th</sup> interview and, following the recommendation of Glaser and Strauss (1967), we continued the analysis until the 14<sup>th</sup> interview. Five interviews were left out of the analysis (Firm7, Inst7, Firm5, Firm9 and Inst6, according to the order of the draw). Table 2 presents the respondents and their contributions in terms of new content for research in relation to the variables investigated, where the theoretical saturation we explained is apparent. The next step was to contrast the responses based on the variables.

**Table 2: Contribution of each subject interviewed for the analyzed variables.**

Variables	In 3	Fr 12	Fr 1	In 2	Fr 10	Fr 4	In 1	Fr 2	Fr 8	In 4	Fr 13	Fr 14	In 5	Fr 3
Impact of the crisis	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooperation	1	0	0	1	0	0	1	1	1	1	0	0	0	0
Knowledge transfer	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Institutions	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Innovation	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	5	1	1	2	0	0	1	1	1	1	1	0	0	0

Note: This table states whether, for each of the variables, the interviews with the respondents, both Institutions ("In") and Firms ("Fr"), added content to the research ("1") or not ("0").

## 4 RESULTS

### 4.1 Cooperation

Table 3 presents the evidence on cooperation. An overview of the responses reveals that horizontal cooperation between companies did not increase. There were some joint

actions, with a specific focus, on the issue of product commercialization or joint production. In other words, in our opinion, if there was an increase in horizontal cooperation, it happened in isolation, among some companies targeting mostly the domestic and small-volume market.

**Table 3: Evidence of cooperation**

<p><b>Cooperation</b>            (Inst3) - There were some joint purchase and sale projects among companies.            (Firm8) - The companies with the highest performance in the domestic market had to undertake more collaborative action due to the major difficulties they faced.            (Firm13) – Local entrepreneurs developed more linkages .            (Firm14) - Relationships deteriorated very fast with the crisis.            (Inst5) - Small companies started to produce for large companies that had easier access to foreign markets.</p>
<p><b>Trust</b>            (Inst2) - One reaction was increased hostility between companies. And there were also some experiences of joint production in a single manufacturing plant and closure of others.            (Firm4) - Before the crisis, there was more trust. Thus, finished materials become a form of payment. This makes suppliers feel safer.            (Inst1) - Entrepreneurs do not trust each other.            (Inst4) - Trust has decreased greatly.            (Inst5) - There was no major change in trust. It existed alongside people’s individualism.</p>
<p><b>Barriers to cooperation</b>            (Inst1) - All businesses have losses, and the market is shrinking . There, are many indebted companies and cooperation is decreasing.            (Inst4) - Agreements that used to be for five years are now quarterly, and you can end them earlier.            (Firm13) - You can no longer be friendly with customers, because then you lose authority.            (Firm14) – Imitation of competitors’ products has increased.            (Inst5) - The individualism of entrepreneurs prevents cooperation and joint activities for internationalization.</p>
<p><b>Coordination and sharing common goals</b>            (Inst3) - There was no significant collaboration among companies since the beginning.            (Firm2) - The crisis contributed to a situation in which companies no longer see themselves as competitors, but as companions in the same boat. Thus, some companies came together to realise joint efforts.            (Inst4) - There have been some indirect initiatives, such as producers’ consortia. There was no joint action.            (Firm14) - There was very little collaboration among the companies. The crisis forced increased collaboration between them.            (Inst 1) - The crisis has changed the priority of companies but a common agenda was not created.</p>
<p><b>Increased flexibility</b>            (Firm1) - The specialization has led to an increased cooperation, since these specialized companies have to rely on other companies for the supply of specific materials and goods.            (Firm4) - Suppliers are being paid with finished products. This is due to lack of liquidity in the sector, forcing this type of operation.            (Firm14) - As there was no money, they made payments in products.            (Inst5) - The atomized powder manufacturers received finished products for payments. This is the biggest difference that took place.</p>
<p><b>External-to-the-district relationships</b>            (Firm13) – There are Chinese companies producing for first-line Spanish companies.            (Firm14) - Many entrepreneurs bought Chinese products to place them in the market, but this strategy did not work very well due to difficulties in the logistics.</p>

There was also a reduction in trust, which even affected the type of contracts between companies. Products imitation during the years of downturn increased, because companies should survive, even adopting an opportunistic behavior. The third subcategory, the existence

of more coordination and the sharing common goals did not appeared widely adopted by the local firms.

Vertical cooperation increased in the cluster. This was due mainly to issues concerning the pursuit of lower costs and shortage of liquidity. One aspect that resulted to be very important in terms of adopting cooperative behaviors was the habit of paying suppliers with finished products. The explicit motivation for this was the lack of liquidity resulting from the crisis (Firm4; Firm14; Inst5). This helped indebted companies to remain on the market.

Firms followed a strategy of cost reduction, shifting towards a higher specialization (Firm1), which resulted in greater interdependence. In addition, some companies tried to subcontract some labor-intensive phases (or basic products) to Chinese companies, though that did not generate the expected savings for all contracting companies (Firm14).

## **4.2 Knowledge Transfer**

Table 4 presents the evidence drawn from interviews about the process of knowledge transfer. Workforce mobility was considered by nearly all interviewed as an important mechanism of knowledge transfer. The crisis increased workers mobility (Inst3, Inst4, Inst5), and many people who had specific knowledge began to apply for new position in other companies of the district, and so they took their knowledge to other companies (Inst3). The fact that the number of freelance workers in the district has increased may also have contributed to higher flows of knowledge transfer.

The interviews revealed that knowledge transfer through social contacts continued to take place, also in a period of crisis. The typical social life of an industrial district remained unchanged, even under greater competitive pressure, so that also friendly relations allowed higher levels of knowledge transfer claimed by Inst5.

**Table 4: Evidence of knowledge transfer.**

<p><b>Workforce mobility</b>          (Inst3) - There was a lot of workforce mobility. If I work in a company and then I go to another, I take my knowledge with me. With the mobility of technical workers, there was some progress in terms of cooperation among companies.          (Inst2) - There are more freelance workers, with different employment contracts.</p>
<p><b>Social Contacts</b>          (Inst3) - Knowledge transfer took place at lunches, bars, weddings, communions, baptisms, local parties, since everyone knew each other.          (Firm14) - Secrets were at the bar because friends, after finishing their work go to have a drink together.          (Inst5) - There was no change in relationships due to the new technology. Since the companies that developed it were already in the area and have local managers who maintain friendly relations with other entrepreneurs. Here, technology transfer happens in the bars. People who know each other get together and talk about their problems.          (Inst5) - Companies are family companies, and the family is important. There are two businessmen living in my building who are friends of mine from school.</p>
<p><b>Among competitors</b>          (Firm10) - Among some companies, such cooperation is above all informative. There is knowledge transfer, especially in the ceramic [end companies].          (Inst4) - Decreased trust leads to decreased knowledge transfer.          (Inst5) - In the region, relations among competitors have always been very good at the technical level.</p>
<p><b>Among suppliers</b>          (Inst3) - The transfer of knowledge is informal, among suppliers and customers. These are the players that make innovation.          (Inst5) - In the area of paints and glazes, knowledge transfer has decreased. There are confidentiality agreements for everything.          (Firm13) - Today suppliers have to be more open.          (Firm14) - All R&amp;D results are transferred from the ceramic industry to the paint industry.</p>
<p><b>Low appropriability. No existence of secrets</b>          (Inst3) - In a place like this [cluster], it is impossible to keep secrets about products or whatever.          (Inst1) - The homogeneity of the product does not allow having secrets.          (Inst4) - All developments were taking place inside the factory itself.          (Firm14) - Secrets do not exist. But the commercial side has always been a bit more closed than the technical side.          (Inst5) - The paint and glaze manufacturers are more closed. But not because of the crisis, but because of the new technologies. Where there is money, people become more closed. The core business is not shared.          (Firm10) - The crisis did not cause major changes in the level of these transfers [of knowledge], even though each firm keeps its secrets.</p>

On the other hand, according to the respondents, knowledge transfer among competitors was not so common, but among the companies that were already doing so it continued. In contrast it appeared that knowledge transfer is particularly strong in relation with the firms' suppliers, given that R&D was largely taken over by them. At the same time, glaze and pigments suppliers tried to protect better their accumulated knowledge and their technological secrets recurring to formal contracts. It seems that some secrets were preserved within the companies, particularly secrets about the production processes (Inst4; Firm10).

Thus, also in an industrial district, specialized firms maintain at a high level the appropriability of their knowledge

### 4.3 Local Institutions

In Table 5 we analyze the role of local institutions. We found that their role was not relevant in order to mitigate the impact of the crisis. On the one hand, there was less funding from the public administration for sponsoring new research activity, and on the other hand, the decreasing financial support for projects from local companies caused a reduction of staff and support capacity. The priority of the institutions was to survive and pay their own bills.

**Table 5: Evidence on local institutions.**

<p><b>Importance of public support</b></p> <p>(Inst3) - There was a decrease in self-funding of institutions and the government did not offset this decline. Thus, institutions decreased their staff. That is, the institutions are trying to survive.</p> <p>(Firm1) - The government supported sectors other than the ceramic one, such as the automobile and the footwear industries.</p> <p>(Inst2) - There was not enough support from the government, and thus the institutions had a less important role. Some supporting institutions are struggling to pay their bills. Without this support, technological research centers played a minor role.</p> <p>(Firm4) - Sectors such as the automobile and footwear sectors had different types of incentives, but the ceramic sector did not receive any.</p> <p>(Firm14) - The Valencian Community has always supported exports above the average. And Castellón, even more so. Ivex has always been highly regarded for it.</p> <p>(Inst5) - The Valencian government invests in sector institutes like ours. These investments have dropped between 45/50%, which led to layoffs of 30% to 40% of staff.</p>
<p><b>Importance of the relationship of local institutions with local companies</b></p> <p>(Firm1) - The institutions kept out of the discussion.</p> <p>(Inst2) - The institutions play an important role, but did not have the strength to put together an agenda for the companies.</p> <p>(Firm10) - The institutions played no significant role during the crisis.</p> <p>(Firm4) - The associations end up favoring large companies due to image issues, technological issues. Manufacturers have to look for ways to survive on their own.</p> <p>(Inst1) - The institutions were expecting to have their own problems solved.</p> <p>(Inst4) - There was a reduction in the importance of institutions. Some did not have the speed of the companies.</p> <p>(Firm13) - The institutions did not cooperate much with companies. (Inst5) – Local institutions decreased the number of employment. An example is the Ascer, which went from 20 people to 7. Agreements are made via Ascer: setting of gas prices, standards, and sectorial representation.</p>
<p><b>Importance of provision of local services</b></p> <p>(Inst2) - The new technologies make companies more dependent on research or technology institutes.</p> <p>(Firm14) - Almost every company had to close its internal laboratories and use the University more.</p>

This implied a deterioration of the relations with local companies. Little was said about the importance of services provided by the institutions, as only Firm14 pointed out that companies are now using more activities provided by the university.

**4.4 Innovation**

Considering the innovation activity (Table 6) we noted that, most companies innovated in terms of new products, some choosing to increase quality and others to reduce costs. We also observed a reduction in the life cycle of new products (in some firms now every six months new products are introduced). Digital printing appears to be the most important process innovation widely adopted by the district firms. This confirms that also during longstanding crisis global leading districts can maintain their technological leaderships, as it has been demonstrated for Detroit by Hannigan et al. (2014). During the crisis local firms have also , as well as cut non essential expenditures like marketing and/or R&D costs, outsourcing them externally at lower costs. This has increased their cooperation with involved suppliers.

**Table 6: Evidence on innovation**

<p><b>Discovering new markets</b> (Firm12) - We operate in a sophisticated market that has kept us out of the price war, and we are directing our products to the architecture market, which is more sophisticated.(Inst2) - In the ceramics industry, innovations are driven by the manufacturers. (Firm2) - We had to look for new markets and new products for these markets. Before, we did not seek new markets because there was no need. (Inst4) - Most companies attempted only to reduce costs, without looking for new markets. (Inst5) - The glaze and paint industries in Spain are among the world's best firms. They are internationalized.</p>
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**Organisational innovation/ new marketing strategies**

(Inst3) - There were cuts in marketing and R&D spending.

(Firm10) - With the crisis, companies looked for more technological support and flexibility . This led to an improvement in product quality and more efficient operation of the commercial areas.

(Firm4) - The manufacturers' marketing strategies became much more aggressive, creating messages that turned customers into participants, with a voice and an opinion.

(Inst1) - The sector is focused on products and sales, without changes with respect to marketing.

(Firm8) - The price war is harmful, with prices dropping, and no-one knows when they are going to rise again.

(Inst4) - Some companies are leading in volume with low prices, while the others try to keep up by practicing the same prices. There was no change with respect to markets' niches.

(Firm14) - We had to dismantle all our R&D and marketing structure due to the crisis. Thus we lose the brains of our business.

(Inst5) - There were no brand investments.

**New products**

(Firm12) - We have lines of coverings and porcelain, and started production of 20mm and porcelain laminates so that our catalog would not be only finishing and traditional coverings.

(Firm1) - Companies increased their specialization levels, remaining in their production niches.

(Inst2) - More than new technologies, it was about product redesign. There have been more changes in products than in processes. Product innovation has less value. The technology comes from the suppliers.

(Firm10) - The products are the same, but improved.

(Firm4) - Some companies increased the quality of their products and others were more careless about their products in order to reduce costs and achieve cost competitiveness.

(Inst1) - There is a high degree of specialization. New business models were not created, since it is the rationale of production and not of marketing.

(Firm2) - Product development increased greatly. Before, a line could last 10 years. Now, every 6 months we have to make new launches with large quantities. We constantly seek new pigments, designs, and effects.

(Inst3) - There is more added value in the business of glazes. The paints were more expensive but with the need for flexibility, the cost of paint dropped to 75% of the cost in 2011.

(Firm14) - The crisis forced a set-back in the level of quality of Spanish ceramics due to the decision to manufacture low-cost products.

(Inst5) - There are different strategies. Some companies fight for the quality of their products and innovation, and others that emerged during the crisis work with low-cost products. Those that remained in between, because they were not big enough or don't have a name, suffered most in the crisis.

**New processes**

(Inst3) - There is a continuous improvement coming from suppliers and some manufacturers that incorporate new knowledge into the process.

(Firm1) - The cost of deploying these technologies is very high, but production costs arising from the use of these technologies are decreasing.

(Inst2) - Technological innovations came from the glaze companies and machinery.

(Firm4) - Digital printing machines and ceramic support such as porous material, which saves materials, have reduced the costs.

(Firm2) - We went from flat bases to rollers and now digital injection, which has allowed for far more modeling. But this was not due to the crisis. The industry had to take this step. This was necessary even before the crisis. The crisis only accelerated the future.

(Inst4) - There was a reduction in setup time, due to the use of new types of paint. This brought on more flexibility. But the use of recycled material involved a high investment in engineering and decreased on average the product quality.

(Firm14) - Technology has homogenized product quality. Standard differences were reduced.

(Inst5) - The inkjet allowed the use of inorganic paints on machines that worked with organic paints. The new technology was extremely expensive, but very advantageous.

## **5 DISCUSSION, CONCLUSIONS AND IMPLICATIONS**

According to Paniccia (1998), we cannot take as granted that in industrial districts firms develop with the other co-localized actors and firms high levels of cooperation. In our study, horizontal cooperation was modestly present. While all firms were touched by the 2008 crisis, i.e., only few develop significant levels of horizontal cooperation (Molina-Morales et al., 2015 also in the joint promotion of products (Felzenstein et al., 2014). May be the reasons behind the lack of horizontal cooperation, i.e., can find a clear explanation in the “competition symmetry” factor indicated by Bengtsson and Sölvell (2004): firms are too similar, and they perceive themselves as rival in the same market niche. .. Respondents claimed that innovation in products was often realized with the help of suppliers, and so vertical cooperation was more spread among the interviewed district firms. . Firms heterogeneity is perhaps responsible for the choice to cooperate less, in accordance with the findings of Lydeka and Adomavicius (2007). That is, even confronting common problems, individual firms are following individual solutions, reinforcing a tendency to reduce the levels of cooperation with the other firms.

Vertical cooperation took a different path. The examples cited reveal that cost reduction and shortage of liquidity were sufficient motives for companies to establish vertical cooperation. As mentioned above, vertical cooperation is not an isolated fact in this industry, but is present in other sectors and other countries (Bengtsson & Sölvell, 2004; Kim et al., 2010; Kongmanila & Takashi, 2009). Kim et al. (2010) state that in the telecom industry, technological uncertainty can lead companies to increase or decrease investment in inter-organizational relationships. In our study, we noted only one of these choices, perhaps because the Castellón companies have less variety in terms of number of suppliers, contrary to what Kim et al. (2010) reported. These findings underscore what was pointed out by

Paniccia (1998), i.e., external factors and behavioral deviations can create a context of relationship between the companies.

At a time of trouble, companies decreased their cooperation, and each one turned to its own problems. The novelty revealed by our study is that both motivations were due to the crisis that hit the industry, that is, the need to reduce costs and increase liquidity sufficed to encourage vertical cooperation, but did not produce the same effect on horizontal cooperation. Thus, in our preliminary study the crisis did not have the same effect on all inter-company relationships. So we propose for the future researches:

***PI.1:** In a context of an environment with increased competition, companies present in a cluster tend to decrease their horizontal cooperation.*

***PI.2:** In a context of an environment with increased competition, companies present in a cluster tend to increase their vertical cooperation*

Regarding knowledge transfer, it became clear that the crisis did not affect negatively the intensity of technicians mobility (as recorded by Mitchell et al., 2014), while it affected the mobility of blue collar workers, since there were not so many new jobs for workers to move into. Thus, the cluster continued to allow exchanges of ideas and knowledge (Belussi & Caldari, 2009), as a work environment (Power & Lundmark, 2003).

Our interviewed reported that social interactions did not decrease. They were maintained, and the exchange of knowledge between people continued to take place in this environment of greater competition. This reinforces the definition of an industrial district as an economic space (Marshall, 1919) but also as a social space, where interactions have an impact on local economic activity (Kraft, 2004; Molina-Morales et al., 2002). This is due to exchange of information, more technical than commercial, as indicated (Firm14). This seems

natural, since people, even if their companies are not doing so well, remain in the area and maintain the same social interactions.

As to knowledge transfer between companies, we detected two paths: one in which the transfer occurs and it is mainly vertically, and another in which the transfer does not occur and companies are able to protect their useful information and knowledge. Thus, flows of knowledge in the district are not so freely, as hypothesized by Marshall, but not so limited as hypothesized by others researchers (Giuliani, 2005 and 2007; Boschma and ter Wal, 2006). The transfer of knowledge mainly took place between suppliers and final producers (end-producers). Similarly to Kongmanila and Takashi (2009), we found that knowledge transfer occurred vertically, and intentionally.

Considering that the sources of knowledge are very diverse, as Powell and Giannella (2009) wrote, some are not affected by the crisis, like those related to the mobility of technical workers, to social interactions and to vertical cooperation. So we contribute for next studies proponing:

***P2.1:** In a context of an environment with increased competition, there will be knowledge transfer between the companies present in a cluster via workforce mobility.*

***P2.2:** In a context of an environment with increased competition, there will be knowledge transfer between the companies present in a cluster via social contact.*

***P2.3:** In a context of an environment with increased competition, there will be knowledge transfer vertically between the companies present in a cluster.*

Except for one respondent (Firm13), all the others agreed that the role played by institutions was smaller than it could have been. They also agreed that this was due mainly to lack of public support in terms of funding, coupled with the decrease in the planning of new projects from companies. Our results indicate that local businesses suffered for a negative

impact of the crisis on their relationship with local Only university services were considered relevant to one of the companies interviewed. The university may have been the institution that suffered less impact from the crisis, while at the same time maintaining its provision of services.

We concluded that, at a time of crisis, local institutions could have their role decreased, due to the fact that they are local players dependent on local resources. This means that, with the end of support from the local government, funding should have come from companies, which did not happen. Companies suspended or reduced their R&D activities, and liquidity issues prevented them from seeking support from local institutions, so they turned to their suppliers. This leads us to propose for the next studies:

*P3.1: In a context of an environment with increased competition, the importance of these institutions in a cluster depends on their sources of funding.*

*P3.2: In a context of an environment with increased competition, service delivery by institutions present in a cluster depends on their sources of funding.*

When we studied the resulting innovations, the most common were related to products and processes. In both cases, there was participation from suppliers. Powell and Gianella (2009) indicate that one of the reasons for companies to seek partners to carry out their innovations is companies' having to shut down their R&D centers, which we also noted in this study as an effect of the crisis. The decline of markets for companies entailed a reduction in the products' life cycles. This generated greater R&D efforts. The difference between expanding the supply of new products on the one hand, and lowering R&D investment on the other hand, was offset by the participation of glaze suppliers and in some cases machine suppliers, which fostered innovation in products. Innovation started to be fostered by the suppliers rather than by the manufacturers. Perhaps this is an effect of the industry itself,

already observed in other studies (Arranz & Arroyabe, 2008; Belussi et al., 2010; Hoffmann et al., 2011b; Kim et al., 2010), but it became clear that this event was accelerated by the crisis. Some companies made market innovations, and there are almost no accounts of marketing innovation. Thus, we conclude that a cluster's potential to generate innovation, indicated by Broekel, Fornahl and Morrison (2015) and Krafft (2004), was diminished by the crisis, due to the impact suffered by the local institutions. Thus, our proposition for future studies is:

*P4: In a context of an environment with increased competition, companies present in a cluster develop innovations in cooperation with other local players.*

There are some implications connected to our study. From the academic point of view, we believe that, since it is limited to an industry and a country, it needs to be complemented by verifying this effect in other industries and countries. In addition, our choice of an exploratory approach can be in future be used to make several proposals, but we need a larger study, with the same focus, in order to test some proposals. From the point of view of the companies, we clearly observed that they could be seeking some joint action, such as exercising political action, to garner public support for their demands, given that this support was provided in other industries. With regard to the local government, our study found that it was absent, not providing the necessary financial support at a time of great stress for companies, and this support could have been important, since the local industry's structure was diversified in terms of providing services to businesses, and this local structure was undermined by the crisis.

As for other contributions, we point out that this study sheds light on an important economic fact, addressing the theme from the point of view of relationships between the various players present in a territory and their performance in terms of innovation,

cooperation, knowledge transfer, and impact of local institutions. Furthermore, we demonstrate that when competitiveness increases, the effect is not the same on horizontal and vertical cooperation, on knowledge transfer or on the role played by the institutions. We show that the competition symmetry cited by Bengtsson and Sölvell (2004) seems to have a moderating effect on horizontal cooperation. We also observe a moderating effect of funding sources on the role played by the institutions present in a cluster, and on the services they provide. Additionally, we note that in a cluster, where there is more demand for competition, companies resort more to their vertical networks, which seem to play a decisive role in companies' performance, in this context.

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