Interactive Effects of Internal Brokerage Activities in Clusters: The Case of the Spanish Toy Valley(*)

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Abstract

This study focuses on how different brokerage roles affect innovation by co-located firms. The study takes into account interaction effects between brokerage activities and the firm's absorptive capacity and extra-cluster openness, and also evaluates synergies derived from the simultaneous development of two different brokerage profiles. Comprehensive fieldwork in the Toy Valley cluster in the Valencia region (Spain) showed that intermediating between firms that are differently positioned in the local value system unevenly affects the broker's innovation capability. Furthermore, for roles with a high impact on innovation, the broker's absorptive capacity and extra-cluster connections moderate network position effects.

Key words: brokerage roles; innovation performance; Spanish Toy Valley; absorptive capacity.

JEL classifications: O32, R12

(*) A previous version of the paper had been presented at the Geography of Innovation 2014 Conference. Utrecht (Netherlands), January, 2014

Financial support provided by the Spanish Ministry of Economy and Competitiveness is gratefully acknowledged (Research Project Number ECO2012-32663 and Research Project Number ECO2010-20557).

INTRODUCTION

Proximity among local firms may promote flows of information through formal and informal networks (DEEDS *et al.*, 2000), which present a territorial dimension (LORENZEN, 2007; MARTIN, 1994; STABER, 2001). The network approach elucidates how these flows and innovation processes in geographical clusters take place (LISSONI, 2001; GIULIANI and BELL, 2005; MALIPIERO *et al.,* 2005; BOSCHMA and TER WAL, 2007). One of the most promising network research approaches focuses on knowledge brokerage by firms and organisations; but, in spite of notable exceptions (particularly at the micro-level; see HARGADON, 1998; JENSEN, 2008), many issues remain to be properly addressed (STAM, 2010).

In the literature on clusters, scholars have examined how gatekeepers generate novelty by drawing on local and external knowledge (GRAF, 2011; GRAF and KRUGER, 2011; MORRISON, 2008). Specifically, GIULIANI and BELL (2005) analysed at length the advantages of clustered organisations as information brokers, while GRAF and KRUGER (2011) extensively observed the performance implications of gatekeeper positions. MCEVILY and ZAHEER (1999) and MOLINA-MORALES (2005) studied cluster supporting organisations connecting internal and external actors. Although GIULIANI and BELL (2005) have addressed the potential roles of knowledge brokers, the effects of different brokerage roles on innovation by clustered firms still need to be evaluated, in light of scholars' growing awareness of the need to understand how knowledge is distributed in networks and how it affects innovation in these local systems (GIULIANI, 2007a; MORRISON and RABELLOTTI, 2009).

Grounded in this theoretical framework, which assumes that knowledge brokers influence knowledge diffusion in clusters, the present study focuses on how different brokerage roles affect innovation by co-located firms. Since the effects might be contingent on the focal firm's capabilities (ZAHEER and BELL, 2005), the analysis takes into account the firm's absorptive capacity and extra-cluster openness, and also evaluates synergies derived from the simultaneous development of diverse brokerage profiles. Specifically, the study examines the effects of liaison and coordinator brokerage roles on the innovation performance of clustered firms in the Spanish toy industry: effects that, according to theory, should be moderated by the firms' absorptive capacity and external openness.

This paper makes two major contributions. First, it demonstrates that firms combining both brokerage roles achieve higher innovation performance. Second, it demonstrates that firms with higher internal cognitive attributes and extra-cluster connections obtain an additional benefit from the liaison broker role. In sum, while access to external resources through brokerage activities is associated with a better innovation performance, this relation is moderated by the internal and external conditions of the clustered firms. The paper first presents a theoretical framework and justification for the hypotheses, and then describes the empirical study, explains the results, and suggests conclusions and contributions.

THEORETICAL FRAMEWORK

Networks in clusters

According to the network perspective, interorganisational relationships affect firm outcomes (GULATI *et al.,* 2000), particularly by conferring access to external resources (MCEVILY and MARCUS, 2005). One category of network is contexts of geographical proximity such as industrial clusters. Relational resources indubitably have a territorial dimension (MARTIN, 1994; STABER, 2001), and territorial considerations are important to a full understanding of the relational perspective (BELL and ZAHEER, 2007; KONO *et al.,* 1998). It can be said that the cluster defines a network within a production context inside a geographically defined area (BRANSTON *et al.,* 2005; PARRILLI and SACCHETTI, 2008). Geographical proximity among firms and other participant organisations implies interconnections and interactions between actors in the network (SORENSON, 2003), and these interactions are critical for the existence of knowledge flows (LI *et al.,* 2013; ROSENKOPF and ALMEIDA, 2003). The network actors include final product firms, suppliers, customers, service providers, policy agents, and others.

Proximity among similar organisations favours diverse forms of social capital (MCEVILY and ZAHEER, 1999) and, in these bounded contexts, explains the potential advantages of clustered firms (COOKE, 2002). Proximity provides better access to knowledge sources and represents an advantage for companies in their capacity to innovate (CAPELLO, 1999). Moreover, proximity enables, face to face contacts and consequently the transmission of tacit knowledge (UZZI, 1996; ALMEIDA and KOGUT, 1994; TALLMAN *et al.,* 2004).

A step forward in the research on clusters involves the heterogeneity of internal network structures. GIULIANI and BELL (2005) found that firms can transfer knowledge asymmetrically, that is, without reciprocity . Recent literature provides strong evidence that knowledge associated with innovation is distributed in a selective, uneven manner (e.g., GIULIANI, 2007b), and knowledge flows are restricted to a closed group of local producers that are distinct from the rest of the cluster members (MORRISON and RABELLOTTI, 2009). In summary, knowledge access is usually restricted to subgroups within the cluster network (BOSCHMA and TER WAL, 2007; GIULIANI and BELL, 2005; LISSONI, 2001; MALIPIERO *et al.,* 2005).

What mechanisms explain this internal heterogeneity? The present study suggests that heterogeneity may come partly from the different brokerage roles played by clustered firms. Brokerage activities give actors power and control of information. A broker can negotiate the amount, the quality, and the sources of the knowledge that s/he gets from and distributes to partners. These advantages could result in uneven access to information for the whole cluster network. In other words, the distinctive patterns of brokerage relationships of the individual firms in networks can explain the heterogeneity of cluster firm performance (MCEVILY and ZAHEER, 1999).

Brokerage activities

A brokerage activity can be understood as a relation involving three actors, two of whom are the actual parties to the transaction while the third is the intermediary, or broker (MCEVILY and ZAHEER, 1999). Brokerage is a process by which intermediary actors facilitate transactions between other actors (MARSDEN, 1982). A knowledge broker connects different communities, thus generating flows of knowledge between them (BOARI and RIBOLDAZZI, 2010; HARGADON, 1998).

Within a cluster, certain firms and organisations act as connectors between subclusters. MCEVILY and ZAHEER (1999) proposed that heterogeneity in firms' networks of ties is an important source of differences in their competitive capabilities. Similarly, MOLINA-MORALES (2005) analysed the role played by local supporting organisations as brokers between the cluster's external and internal networks. Firms also can act as gatekeepers introducing external technological novelties into the cluster and enabling new knowledge production at the local level (MALIPIERO *et al.*, 2005).

According to the network literature (GALUNIC and RODAN, 1998; HARGADON and SUTTON, 1997; HARGADON, 1998), innovativeness is a function of network position. Brokerage can increase the broker's capacity for innovation. BECKER (1970) argued that actors positioned in a preferred location in the network receive innovation-related information that other firms might miss. The importance of knowledge brokers in generating innovation has been widely demonstrated (BOARI and RIBOLDAZZI, 2010; UZZI and SPIRO, 2005).

However, the effect and importance of brokerage activities can be expected to depend on who the actors are. Network actors can be grouped in different manners. GOULD and FERNANDEZ (1989) categorise them into five subgroups, of which the present study focuses on two, with differing broker roles (Figure 1): (1) the *Coordinator*, which is a member of the same group as the principals, so that the brokerage relation is completely internal to the group; and (2) the *Liaison*, which is an outsider with respect to both the initiator of the brokerage relation and the receiver of the relation. This actor links distinct groups without having prior allegiance to either. In accord with previous research (GRAF and KRUGER, 2011), this distinction accommodates different brokerage contexts and goals.

Figure 1 about here

In industrial clusters firms acting as brokers connect groups located in different phases of the cluster's value system. The resulting triads represent contexts through which brokers may access specific information related to the main purpose underlying the creation of these inter-organisational structures. The broker can create horizontal ties with actors belonging to the same position in the value system (rival firms), and/or vertical ties with actors belonging to different positions (complementary firms). Theory suggests that horizontal and vertical ties both increase innovation, but in different ways. The coordinator role involves knowledge access from horizontal relations, while the liaison role involves knowledge access from vertical relations.

HYPOTHESES

Previous research emphasized the effect of vertical relationships with suppliers and customers on competitiveness and particularly on innovation. Knowledge acquisition from customers favours new combinations and in addition speeds and simplifies innovation (VON HIPPEL, 1977; YLI-RENKO *et al.,* 2001). Interacting with suppliers also accelerates the transfer of knowledge, favouring growth and innovativeness (LORENZONI and LIPPARINI, 1999). For instance, car manufacturers can improve product-development coordination by interacting with their suppliers (DYER and NOBEOKA, 2000).

The effect on innovation of horizontal relations between competitors has received less attention from researchers. In industrial clusters these relations have particular relevancy, as authors like BOARI and colleagues (2003) have observed. Firms in clusters compete more intensely than companies not located in spatial agglomerations (BECATTINI, 1990; DEI OTTATI, 1994). PORTER, for example, considers that localization amplifies domestic rivalry, which becomes key for competitive advantage (PORTER, 1990, 1998; PORTER *et al.*, 2000). Spatial proximity to rival companies can increase the richness and depth of information; in fact, local competition facilitates the adoption and transfer of best practices within an industry (PIORE and SABEL, 1984). Finally, geographic location plays an important role in determining what companies can observe and also in strategy (BOGNER and THOMAS, 1993).

Together, these arguments imply that brokers focused on both horizontal and vertical relations will acquire more diverse information and as a result will be more innovative. Accordingly,

H_1: *Cluster firms combining liaison and coordinator roles will reach higher innovation.*

Interactive effect of absorptive capacity

Firm-specific factors enhance innovative capacity and help explain variance in firm performance (ZAHEER and BELL, 2005). Network structure influences firm outcomes, but these effects may be contingent on the focal firm's capabilities (ZAHEER and BELL, 2005). Firm-specific capacities can act as complementary resources. The firm may possess internal characteristics (such as a strong R&D team, internal organisational structures, and organisational culture) that make it more innovative than others (ADLER and KWON, 2002). Scholars interested in absorptive capacity, which is defined as the firm's capability to exploit knowledge obtained from external sources (COHEN and LEVINTHAL, 1990, 1994), have analysed at length the strong relation between innovativeness and R&D effort. Furthermore, R&D effort will intensify the relation between brokerage activities and innovation; that is, firms with a relatively higher R&D effort are better able to benefit from their brokerage position. Therefore,

H_2: R&D effort moderates the effect of coordinator brokerage activities on the innovation performance of clustered firms.

H_3: R&D effort moderates the effect of liaison brokerage activities on the innovation performance of clustered firms.

Connections with external knowledge sources are clearly critical to innovativeness, particularly if the information received is exclusive (BATHELT *et al.,* 2004; GIULIANI, 2013). For instance, MALIPIERO and colleagues (2005) showed that gatekeeper firms in industrial clusters introduce external technological novelties into the cluster and enact new useful knowledge production at the local level. The intermediary or gatekeeper's function can also be filled by public supporting organisations, which can be particularly important in lagging regions that typically lack the large firms that often fill this role in advanced regions. The transferred knowledge is absorbed, especially, by private firms that do not engage in interregional research and development cooperation (KAUFFELD-MONZ and FRITSCH, 2013).

Such external sources of knowledge interact with brokerage activities inside the cluster and may affect the firm's innovation. In other words, firms that are more open to interactions outside the cluster are better able to benefit from their brokerage position. Therefore,

H_4: Ties outside the cluster moderate the effect of coordinator brokerage activities on innovation by clustered firms.

H_5: Ties outside the cluster moderate the effect of liaison brokerage activities on innovation by clustered firms.

THE STUDY SETTING

The Toy Valley cluster

Increasingly characterised by a structural adjustment of markets and relocation of production centres to emerging developing economies, the toy industry is a symbol of globalisation. The sector is subject to low barriers and entry cost, while its dynamics are explained by the nature of competition, the product life cycle, and customer demands. Today, the global toy industry is concerned about new consumption trends such as the declining child population and the need to enlarge the age brackets of customers; educational and health aspects of the rise in popularity of video games; safety and security;

and manufacturing efficiency (because of competitive pressure and exploration of alternative distribution channels).

While Spain is not a major player in the international arena, it still has ties dating from its former solid position. The sector encompasses a large number of companies whose activities are mainly focused on design, quality, and educational values in order to remain competitive. A total of 170 firms with approximately 5,000 employees compose the Spanish toy industry. Small and medium-sized enterprises (SMEs) account for 96.47% of all businesses, while providing 64.36% of the employment and 61.3% of the total revenues of the sector. The Valencia region and Cataluña account for 69% of the manufacturing activities, especially the Valencia region, where 41.3% of jobs and 38.4% of sales are generated. Over 378 million euros' worth of toys are sold abroad by 61% of these manufacturers, mostly to developed countries like France, Italy, the U.S., and particularly Russia. Despite these internationalisation efforts, imports exceed exports by 99.2%. Low-cost producers in the Far East and recently Eastern Europe have emerged as the most relevant suppliers.

Within the leading region of Valencia, the Toy Valley cluster agglomerates 76% of the companies and accounts for 98% of the regional production. This industrial system comprises four cities (Ibi, Onil, Castalla, and Tibi), and is the only geographical concentration of this sector in Spain. Specialised suppliers in the area not only support local production, but also make a crucial contribution to dispersed manufacturers, making the cluster important at both national and European levels. The geographical proximity of a large number of SMEs, specialised in different stages of the same manufacturing cycle, makes possible a 'factory without walls' that favours collective efficiency and innovation.

The industry emerged in the Valley as a result of a bottom-up process when craftsmen decided to redirect activities from pottery to toys because of external stimuli. Over the years, Onil and Ibi became the backbone of this productive system. The availability of raw materials and skilled artisans impelled the manufacture of dolls in Onil, while two families of entrepreneurs (Paya and Rico) started to produce toys (e.g., miniature cars) in Ibi. During the late 1950s, the replacement of traditional materials (porcelain, tin, or cardboard) by plastic induced structural changes. For instance, 23 small doll manufacturers merged into one large corporation, Fabricas Agrupadas de Muñecas de Onil (FAMOSA), which still plays a crucial role in the area. Over decades, countless entrepreneurs launched projects and successful trademarks, but as tariffs were dismantled, global offerings (e.g., Mattel's Barbie) dethroned local products, and multinationals (e.g., Hasbro) took over cluster companies. Since then, the expected industry dynamics have been confirmed: China appears as the top global producer, offshoring is common, licenses or video games have colonised crucial segments, and key distribution channels are controlled by large corporations. As a result, flagship factories have closed, local productive activities have declined, and many toy firms have disappeared (the regional Chamber of Commerce reported a decline of 21.9% in active units during 1996–2005). Recently, this negative trend has ceased and the population of toy manufacturers has stabilised.

In order to deal with such a complex environment, many firms opt for more flexible and specialised productive structures or higher innovation efforts. Thanks to geographical proximity and the appropriate institutional support, Valley firms have overcome their lack of resources to build technological competences and innovation capabilities (ALBADELEJO, 2002). Both AIJU (a toy technological institute) and AEFJ (a business association) are examples of fruitful institutional support. The technological institute not only provides technical services to toy-related SMEs at moderate cost (HOLMSTRÖM, 2006), but also offers information (market and technical), assistance in product development and manufacturing, training, etc. AIJU is a pivotal actor fostering firms' capabilities, lowering barriers to innovation, and stimulating the cluster's competitiveness (HOLMSTRÖM, 2006). In sum, a dynamic innovative atmosphere has been generated around the Valley, propelled by new technical solutions, social and pedagogical investigation, professional training, and novel business strategies (YBARRA and SANTA MARÍA, 2008).

The questionnaire

Population, sample issues, and research approach

No existing databases contained the information necessary to test the hypotheses stated above. Therefore, a large questionnaire was designed to collect micro-level data regarding firm characteristics (size, performance, innovativeness), relational characteristics (profile of interorganisational relationships, information shared), resources and capabilities (human capital, management systems), and business strategy (market segments, internationalisation).

For network data, the 'roster-recall' method was used to identify interfirm relationships at the cluster level (GIULIANI and BELL, 2005; BOSCHMA and TER WAL, 2007; MORRISON and RABELLOTTI, 2009). Top-level managers were asked to specify their relations, in terms of business information and technical knowledge, with manufacturers and suppliers listed in the roster as well as other firms not mentioned in the list. The population size and data collection process made this method suitable (GIULIANI and PIETROBELLI, 2011; TER WAL and BOSCHMA, 2009).

One of the biggest challenges of studying relational behaviour at the firm level (e.g., its causes and consequences) is the availability of reliable and suitable sampling frames. In this case, a reliable dataset of both toy manufacturers and related suppliers obtained from AIJU identified firms to which the survey should be submitted. Although AIJU files compile information about a large number of toy manufacturers and potential suppliers, information from AEFJ and SABI was used to complete and refine this comprehensive list. Cluster providers operating in different sectors, identified through primary sources (directories, web pages), were excluded before the roster was integrated into the questionnaire.

Data collection

From the universe of local firms mainly involved in the toy business, companies that design, produce, or sell toys were selected for interview. Subsidiaries of multinational corporations that carry on some stages of the of the value chain within the cluster were also considered. Later, pre-identified suppliers and those identified through the recall process were surveyed. Finally, a total of 75 firms belonging to these categories agreed to participate in 2011, yielding a response rate of 95%, appropriate for a whole-network approach (WASSERMAN and FAUST, 1994). Peer debriefing by AIJU's experts confirmed that very few firms were missing and all of the most important local players were considered.

A trained interviewer with large professional experience on innovation projects in the Valley administered the structured questionnaire, which took 45 to 50 minutes. His personal profile and background acquired in a former position in AEFJ equipped him with the skills to obtain robust responses and enrich the study's final results. In an attempt to improve reliability, business owners and top managers who were not working for the companies during the years considered were persuaded to attend the meeting with somebody else who was employed. Table 1 presents descriptive statistics on firm characteristics: size, decade of creation, legal structure, international operations and ownership (whether foreign or domestic), membership, main business activities, and detailed geographical location inside the cluster.

Table 1 about here

Two questions devoted to relational data captured the perceived importance of each partner (rated 0–3) in 2010: (a) With which of the following firms on the list did you regularly during the last three years exchange technological information? (b) With which of the following firms on the list did you regularly during the last three years exchange business and market information? From this relational information, two different directed networks with 75 actors were constructed. Since networks needed to be binary for further analysis, the perceived values were collapsed into two categories: 0 (no tie exists) and 1 (including values 1–3; a tie does exist).[1]

Empirical analysis

Variables

Dependent variable

The dependent variable, labelled Business Innovation, is a composite of two indicators designed to capture the firm's innovativeness: (a) organisational innovation and (b) marketing innovation. These two indicators were obtained by factor analysing with varimax rotation responses to questions about each type of innovation independently. A Kaiser-Mayer-Olkin (KMO) sample of adequacy over .5 (p-value< .01) and reliability analysis (Cronbach's alpha .68 and .70 respectively) indicate the internal reliability of the constructs. Afterward, a new factor analysis targeting these two indicators yielded a unique business

[1] In undirected networks, there is no difference between the edge from node A to node B and the edge from node B to node A. Conversely, in directed networks, difference between edges exist.

innovation index that explained 62.8% of the observed variance, with KMO>.5 (p-value>.01).

Independent variable

Local firms may use their situation as an opportunity not only to mediate between disconnected but similar firms, but also to bridge gaps between unrelated firms belonging to different groups within a network. Subgroups within the Toy Valley cluster value system include (a) toy manufacturers, (b) mould and tooling companies, (c) producers of chemicals and related products; (d) assemblers and plastic furnaces; (e) others. This grouping permitted an analysis of how some participants mediate through multiple channels across the cluster. The binary relational matrix was analysed using the brokerage routine of the SNA software package to find the standardised brokerage scores by vertex.[1] Considering that brokered exchanges involve three actors, two of whom are the actual parties and one of whom is the intermediary (an intransitive triad), GOULD and FERNANDEZ (1989) identify five types of roles according to the direction of the linkages and the groups that the actors belong to. When 'a' has a tie to 'b,' which in turn has a tie to 'c,' but 'a' and 'b' remain unconnected, the potential roles are as follows: *coordinator* (all actors belong to the same group); *itinerant broker* ('a' and 'c' belong to the same group, while 'b' belongs to a different one); *gatekeeper* ('a' and 'b' belong to the same group, while 'c' belongs to a different one; *representative* ('b' and 'c' belong to the same group, while 'a' belongs to a different one); *liaison* (all the actors belong to different groups). Although standardised scores for all five roles were obtained, only the coordinator and the liaison were used in the present research. See Table 2 for a detailed description of these two independent variables.

Table 2 about here

The proxy for absorptive capacity was built by combining information on the frequency and implementation of ten different activities whose aims are to improve the firm's resources and capabilities. Answers ranged from 1 (not implemented) to 3 (systematically implemented). Briefly, the questions asked whether the firm has performed internal R&D; whether the firm has performed external R&D; whether the firm has acquired machinery and equipment; whether the firm has acquired hardware and/or software; whether the firm has purchased external knowledge (e.g., patents or trademarks); whether the firm has organised training programs; whether the firm has implemented internal design and engineering activities; whether the firm has executed internal policies focused on organisational changes (e.g., new coordination techniques); whether the firm has internal policies focused on the introduction of new products or markets; and whether the firm has employed external consultants. Again, factor analysis with varimax rotation (KMO>.50 and p-value<.01) verified the reliability of the construct (alpha=.78).

Because a single indicator of firm size, such as employees, sales, or assets, may not reflect the real size, a composite indicator was created, using information provided by respondents about number of employees, sales figures, and total financial assets during 2010. The factor obtained gives a precise idea of the real size of the company (KMO>.500 and p-value<.01).

Extra-cluster connections were evaluated with a set of items capturing the existence of nonlocal relations with suppliers, customers, competitors, and research organisations. Each item takes value 0 or 1 depending on the local/nonlocal (national, European, or extra-European) character of the relationships. Responses from participants were accumulated in a single independent variable ranging from 0 to 4.

Econometric analysis

For clarity, Table 3 summarises the construction of the dependent and independent variables. Additionally, Table 4 gives summary statistics and correlations for the factors obtained. The largest correlation coefficient, between the liaison role and extra-cluster relationships, has an absolute value of .27. The remaining correlation coefficients had low magnitudes, ranging from .04 to .21. Therefore, there was no reason for concern about multicollinearity.

Tables 3 and 4 about here

Two linear regression models were run to elucidate the contribution of each independent variable to business innovation. The endogenous variable is the measure of innovation performance, subscript 'i' denotes firms, and ε is the error. The first model includes only the intercept and size, extra-cluster linkages, and absorptive capacity as explanatory variables. The second model includes two more variables, coordinator and liaison, to account for the main effects of roles. The models are expressed as follows:

(1) Business Innovation= $\alpha + \beta_1$*Size + β_2*Extra-cluster Relationships + β_3*Absorptive Capacity $+\varepsilon_i$

(2) Business Innovation= $\alpha + \beta_1$*Size + β_2*Extra-cluster Relationships + β_3*Absorptive Capacity $+ \beta_4$*Coordinator + β_5*Liaison + ε_i

Following methodological procedures previously detailed by LANE and colleagues (2001) and HERVAS-OLIVER and ALBORS-GARRIGOS (2009), additional specifications were implemented in models 3 to 5 in order to test the interaction effects suggested in the hypotheses. The five interaction variables were created by (a) taking the product of the coordinator and liaison roles; (b) multiplying the absorptive capacity by the coordinator and liaison roles; and (c) multiplying each brokerage activity by the extra-cluster relationships. As LEE and colleagues (2001) recommend, variables used to test interaction effects were introduced one by one in order to minimise multicollinearity, avoid spurious variables, and enhance the global robustness of the results. As the hypotheses predicted, variants of the initial models that include interactions provide higher explanatory power.

(3) Business Innovation= $\alpha + \beta_1$*Size + β_2*Extra-cluster Relationships + β_3*Absorptive Capacity + β_4*Coordinator + β_5*Liaison + β_6*Coord*Liais + ε_i

(4) Business Innovation= $\alpha + \beta_1$*Size + β_2*Extra-cluster Relationships + β_3*Absorptive Capacity + β_4*Coordinator + β_5*Liaison + β_6*Abs.Cap*Coord + β_7*Abs.Cap*Liais + ε_i

(5) Business Innovation= $\alpha + \beta_1$*Size + β_2*Extra-cluster Relationships + β_3*Absorptive Capacity + β_4*Coordinator + β_5*Liaison + β_6*Extra.Clus*Coord + β_7*Extra.Clus*Liais + ε_i

The baseline model (Model 1) reflects the impact of absorptive capacity and extra-cluster linkages on innovation performance, while the second regression reveals the influence of the two brokering roles. The F-test in each model endorses the explanatory power of the independent variables (p-value$<$ .01). Indeed, the adjusted R^2 coefficients, .457 and .455 respectively, indicate that the models explain an important part of the variability in innovation. The most relevant variables in both regressions are absorptive capacity and extra-cluster relationships, which are significant at p-value$<$ .01. Surprisingly, neither the coordinator nor the liaison roles achieves statistical significance.

The first set of variables, from β_1 to β_3, includes controls for absorptive capacity and extra-cluster relationships. The second group of variables, β_4 and β_5, measures the main influence of brokerage roles. Coefficients β_6 and β_7 test the influence of the interaction terms. The interaction effect in Model 3 indicates that combined coordinator and liaison roles exercise a positive and synergic effect on innovation, providing support for H_1 at p-value< .1. Model 4 adds variables configured by multiplying absorptive capacity and the brokerage roles; the results partially confirm H_2, as only the interaction effect Abs.Cap*Liais was positive and significant (p-value< .1). Model 5 was run with the preliminary variables plus two interaction effects between extra-cluster relationships and the brokerage roles. Again, only the variable Extra.Clus*Liais was positive and statistically significant (p-value< .1), partially supporting H_3.

As AIKEN and WEST (1991) recommend, graphical procedures were applied to the significant interactions noted above. Figure 2 shows the effect of the brokerage roles on business innovation at varying levels of the three moderators, namely one standard deviation below and one standard deviation above the mean. Clustered firms outperform similar firms when they simultaneously play the liaison and coordinator roles at high levels. Figure 3 demonstrates that the influence of acting as a liaison on innovation is positive and stronger when the firm possesses higher absorptive capacity. For low absorptive capacity, the slope reverses sign and the impact of the liaison role becomes slightly negative. Figure 4 reveals that a similar relationship also holds for extra-cluster linkages: connecting firms from different groups appears to be much more critical to innovation if brokers have wide access to external repositories of knowledge. Conversely, acting as a liaison harms innovation to the extent that nonlocal linkages decrease.

Figures 2, 3, and 4 about here

DISCUSSION, CONCLUSION, AND IMPLICATIONS

This study examined the effects of liaison and coordinator brokerage roles on innovation. These outermost roles were selected because they neatly represent the vertical and horizontal cooperative dynamics characterizing industrial clusters. In our view, the discard of the three hybrid brokerage roles allowed highly apparent and robust results. The main findings show that the two roles do indeed function differently. In clusters internal broker activities connecting firms belonging to the same phase of the value system need to be combined with vertical relations to affect innovation positively. In contrast with most of the previous literature, which has primarily addressed technological knowledge networks, the present study focused on business information and on innovation performance indicators related to such information. The findings confirm that the cluster firms vary in resources and network positioning (GIULIANI, 2007). Both the firm's internal absorptive capacity and its external openness are key factors for innovation.

Liaison and coordinator roles singly, without any additional factor, are not enough to generate or improve innovation. In other words, merely acquiring and moving knowledge does not generate advantages. Probably a single source is not enough; in contrast, the combination of diverse knowledge that comes from diverse brokerage positions offers synergies and advantages for firms (CAPALDO, 2007).

Access to knowledge provides advantages when the firm possesses a wide base of resources allowing it to elaborate and internalise this knowledge. However, the characteristics of the incoming knowledge varies according to the precedence,, affecting the richness novelty, and behaviour of actors. Knowledge acquired from more different and cognitive distant sources (see the liaison role) seems more valuable compared to insights from similar (see the coordinator role) in order to innovate. Important synergies derive from combining knowledge from outside the cluster with that from different groups of firms inside the cluster. Several authors have noted the importance of resources beyond the cluster (BATHELT *et al.,* 2004; GIULIANI, 2013). With respect to internal resources, GRAF (2011) found that a higher absorptive capacity is more important than size to identify brokers. Similarly, GIULIANI and BELL (2005) found that knowledge in clusters flows within a core group of firms characterised by an advanced absorptive capacity.

This study has two main limitations that suggest new directions for further research. First, the specific features, inherent to a sole case, of the empirical setting make it necessary to extend the study to other contexts, and second, a longitudinal analysis could expose the dynamics of these clusters and transcend the static vision offered here.

References

ADLER P. S. and KWON S.-W. (2002) Social capital: prospects for a new concept, *Academy of Management Review* **27(1),** 17–40.

AIKEN L. S. and WEST S. G. (1991) *Multiple Regression: Testing and Interpreting Interactions*. Sage, Newbury Park.

ALBADALEJO M. (2002) Enhancing innovation capabilities in SME clusters: evidence from a service centre in Spain, in VAN DIJK M. and SANDEE H. (Eds) *Innovation and Small Enterprises in the Third World*. Edward Elgar, Cheltenham, UK.

BELL G. G. and ZAHEER A. (2007) Geography, networks, and knowledge flow, *Organization Science* **18(6),** 955–972.

ALMEIDA P. and KOGUT B. (1994) *Technology and Geography. The Localization of Knowledge and the Mobility of Patent Holders*. Working Paper. Wharton School of Business, University of Pennsylvania.

BATHELT H., MALMBERG A. and MASKELL P. (2004) Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation, *Progress in Human Geography* **28,** 31–56.

BECATTINI G. (1990) The marshallian industrial district as a socio-economic notion, in PYKE F., BECATTINI G. and SENGENBERGER W. (Eds) *Industrial Districts and Local Economic Regeneration*. International Institute for Labor Studies, Geneve.

BECKER M. H. (1970) Sociometric location and innovativeness: reformulation and extension of the diffusion model, *American Sociological Review* **35(2),** 267–282.

BOGNER W. C. and THOMAS H. (1993) The role of competitive groups in strategy formulation: a dynamic integration of two competing models, *Journal of Management Studies* **30,** 51–67.

BOARI C. and RIBOLDAZZI F. (2010) Innovare nei cluster geografici: origine e sviluppo di un knowledge broker, in C. BOARI (Ed) *Dinemiche evolutive nei cluster geografici di* *emprese*. Il Molino, Bologna.

BOARI C., ODORICI V. and ZAMARIAN M. (2003) Cluster and rivalry: does localization really matter? *Scandinavian Journal of Management* **19,** 467–489.

BOSCHMA R. and TER WAL A. (2007) Knowledge networks and innovative performance in an industrial district: the case of a footwear district in the south of Italy, *Industry and Innovation* **14(2),** 177–199.

BRANSTON J. R., RUBINI L., SUGDEN R. and WILSON J. R. (2005) Healthy governance: economic policy and the health industry model, in DI TOMMASO M. R. and SCHWEITZER S. O. (Eds) *Promoting High-Tech Industries: Can Growth Lead the Way?* pp. 45–58. Edward Elgar, Cheltenham, UK.

CAPELLO R. (1999) Spatial transfer of knowledge in high technology milieux: learning versus collective learning processes, *Regional Studies* **33(4),** 353–365.

COHEN W. M. and LEVINTHAL D. A. (1990) Absorptive capacity: a new perspective on learning and innovation, *Administrative Science Quarterly* **35(1),** 128–152.

COHEN W. M. and LEVINTHAL D. A. (1994) Fortune favors the prepared firm, *Management Science* **40(2),** 227–251.

COOKE P. (2002) *Knowledge Economies: Clusters, Learning and Cooperative Advantage.* Routledge, London.

DEEDS D., DECAROLIS D. and COOMBS J. (2000) Dynamic capabilities and new product development in high technology ventures: an empirical analysis of new biotechnology firms, *Journal of Business Venturing* **15,** 211–229.

DEI OTTATI G. (1994) Co-operation and competition in the industrial district as an organizational model, *European Planning Studies* **2,** 463–485.

DYER J. and NOBEOKA K. (2000) Creating and managing a high performance knowledge-sharing network: the Toyota case, *Strategic Management Journal* **21(Special Issue 3),** 345–367.

GALUNIC C. and RODAN S. (1998) Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian innovation, *Strategic Management Journal* **19(12),** 1193–1201.

GIULIANI E. (2007) The selective nature of knowledge networks in clusters: evidence from the wine industry, *Journal of Economic Geography* **7,** 139–168.

GIULIANI E. (2013) Clusters, networks and firms' product success: an empirical study, *Management Decision* **51(6)**.

GIULIANI E. and BELL M. (2005) The micro-determinants of meso-level learning and innovation: evidence from a Chilean cluster, *Research Policy* **34,** 47–68.

GIULIANI E. and PIETROBELLI C. (2011) Social Network Analysis Methodologies for the Evaluation of Cluster Development Programs, Inter-American Development Bank. Technical Notes IDB-TN-317.

GOULD J. and FERNANDEZ J. (1989) Structures of mediation: a formal approach to brokerage in transaction networks, *Sociological Methodology* **19,** 89–126.

GRAF H. (2011) Gatekeepers in regional networks of innovators, *Cambridge Journal of Economics* **35(1),** 173–198.

GRAF H. and KRÜGER J. (2011) The performance of gatekeepers in innovator networks, *Industry and Innovation* **18(1),** 69–88.

GULATI R., NOHRIA N. and ZAHEER A. (2000) Strategic networks, *Strategic Management Journal* **21(3),** 203–215.

HARGADON A. (1998) Firms as knowledge brokers: lessons in pursuing continuous innovation, *California Management Review* **40(3),** 209–227.

HARGADON A. B. and SUTTON R. I. (1997) Technology brokering and innovation in a product development firm. *Administrative Science Quarterly* **42(4),** 716–749.

HERVAS-OLIVER J. and ALBORS-GARRIGOS J. (2009) The role of the firm's internal and relational capabilities in clusters: when distance and embeddedness are not enough to explain innovation, *Journal of Economic Geography* **9(2),** 263–283.

HOLMSTRÖM M. (2006) Globalisation and good work: IMPIVA, a Spanish project to regenerate industrial districts, *Economische en Sociale Geografie* **97(5),** 491–502.

JENSEN M. (2008) The use of relational discrimination to manage market entry: when do social status and structural holes work against you? *Academy of Management Journal* **51,** 723–743.

KAUFFELD-MONZ M. and FRITSCH M. (2013) Who are the knowledge brokers in regional systems of innovation? A multi-actor network analysis, *Regional Studies* **47,** 669–685.

KONO C., PALMER D., FRIEDLAND R. and ZAFONTE M. (1998) Lost in space: the geography of corporate interlocking directorates, *American Journal of Sociology* **103(4),** 863–911.

LANE P. J., SALK J. E. and LYLES M. A. (2001) Absorptive capacity, learning, and performance in international joint ventures, *Strategic Management Journal* **22,** 1139–1161.

LEE C., LEE K. and PENNINGS J. (2001) Internal capabilities, external networks, and performance: a study on technology-based ventures, *Strategic Management Journal* **22,** 615–640.

LI W., VELIYATH R. and TAN J. (2013) Network characteristics and firm performance: an examination of the relationships in the context of a cluster. *Journal of Small Business Management* **51(1),** 1–22.

LISSONI F. (2001) Knowledge codification and the geography of innovation: the case of Brescia mechanical cluster, *Research Policy* **30,** 1479–1500.

LORENZEN M. (2007) Social capital and localized learning: proximity and place and technological and institutional dynamics, *Urban Studies* **44(4),** 799–817.

LORENZONI G. and LIPPARINI A. (1999) The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study, *Strategic Management Journal* **20(4),** 317–338.

MALIPIERO A., MUÑARI F. and SOBRERO M. (2005) Focal Firms as Technological Gatekeepers within Industrial Districts: Knowledge Creation and Dissemination in the Italian Packaging Machinery Industry. DRUID Working Paper No. 05-05.

MARSDEN P. V. (1982) Brokerage behavior in restricted exchange networks, in MARSDEN P. V. and Nan L. (Eds) *Social Structure and Network Analysis,* pp. 201–218. Sage, Beverly Hills, CA.

MARTIN R. (1994) Economic theory and human geography, in GREGORY D., MARTIN R. and SMITH G. (Eds) *Human Geography: Society, Space and Social Science,* pp. 21–53. MacMillan, Basingstoke, UK.

MCEVILY B. and MARCUS A. (2005) Embedded ties and the acquisition of competitive capabilities, *Strategic Management Journal* **26(11),** 1033–1055.

MCEVILY B. and ZAHEER A. (1999) Bridging ties: a source of firm heterogeneity in competitive capabilities, *Strategic Management Journal* **20,** 1133–1156.

MCEVILY B. and ZAHEER A. (2005) Does trust still matter? Research on the role of trust in inter-organizational exchange, in BACHMAN R. and ZAHEER A. (Eds) *Handbook of Trust Research,* pp. 2–42. Edward Elgar, Cheltenham, UK.

MOLINA - MORALES F. X. (2005) The territorial agglomerations of firms: a social capital perspective from the Spanish tile industry, *Growth and Change* **36(1),** 74-99.

MORRISON A. (2008) Gatekeepers of knowledge within industrial districts: who they are, how they interact, *Regional Studies* **42,** 817–835.

MORRISON A. and RABELLOTTI R. (2009) Knowledge and information networks in an Italian wine cluster, *European Planning Studies* **17(7),** 983–1006.

PARRILLI M. D. and SACCHETTI S. (2008) Linking learning with governance in networks and clusters: key issues for analysis and policy, *Entrepreneurship & Regional Development* **20(4),** 387–408.

PIORE M. and SABEL C. (1984) *The Second Industrial Divide: Possibilities for Prosperity.* Basic Books, New York.

PORTER M. E. (1990) *The Competitive Advantage of Nations*. Free Press, New York.

PORTER M. E. (1998) Clusters and the new economics of competition, *Harvard Business Review* December, 77–90.

PORTER M. E. (2000) Location, competition and economic development: local clusters in a global economy, *Economic Development Quarterly* **14(1),** 15–34.

ROSENKOPF L. and ALMEIDA P. (2003) Overcoming local search through alliances and mobility, *Management Science* **49(6),** 751–766.

SORENSON O. and BAUM J. A. C. (2003) Editor's introduction - Geography and strategy: the strategic management of space and place, in SORENSON O. and BAUM J. A. C. (Eds) *Advances in Strategic Management*. JAI Press, Amsterdam.

STABER U. (2001) Spatial proximity and firm survival in a declining industrial district: the case of knitwear firms in Baden-Württemberg, *Regional Studies* **35,** 329–341.

STAM W. (2010) Industry event participation and network brokerage among entrepreneurial ventures, *Journal of Management Studies* **47(4),** 625–653.

TALLMAN S., JENKINS M., HENRY N. and PINCH S. (2004) Knowledge, clusters, and competitive advantage, *Academy of Management Review* **29,** 258–271.

TER WAL A. L. J. and BOSCHMA R. A. (2009) Applying social network analysis in economic geography: theoretical and methodological issues, *Annals of Regional Science* **43,** 739–756.

VON HIPPEL E. (1977) Has a customer already developed your next product? *Sloan Management Review* **18(2),** 63–74.

UZZI B. (1996) The sources and consequences of embeddeness for economic performance of organizations: the network effect, *American Sociological Review* **61,** 674–698.

UZZI B. and SPIRO J. (2005) Collaboration and creativity: the small world problem, *American Journal of Sociology* **111(2),** 447–504.

WASSERMAN S. and FAUST K. (1994) *Social Network Analysis: Methods and Applications.* Cambridge University Press, New York.

YBARRA J. and SANTA MARÍA M. (2008) El distrito de juguete de la Foia de Castalla y su evolución, *Mediterráneo Económico* **13,** 409–431.

YLI-RENKO H., AUTIO E. and SAPIENZA H. J. (2001) Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms, *Strategic Management Journal* **22(6–7),** 587–613.

Table 1. Sample descriptive statistics

Characteristics	Number of firms (%)
Size (employees)	
Micro	36 (48)
Small	29 (38.7)
Medium	8 (10,7)
Large	2 (2.7)
Ownership	
Domestic	72 (96)
Foreign	3 (4)
Year of creation	
Up to 1970's	18 (23.9)
1980's	17 (22.7)
1990's	23 (30.7)
2000's	17 (22.7)
International operations	
Exporters	16 (21.3)
Exporters/Importers	23 (30.7)
Business activities	
Toy manufacturers	39 (52)
Auxiliary industry	30 (40)
Input providers	3 (4)
Others	3 (4)
Legal structure	
Corporation	15 (20)
Limited liability	59 (78.7)
Others	1 (1.3)
Local organisations membership	
AIJU (Toy institute)	58 (77.3)
AEFJ (Toy business association)	34 (45.3)
City	
Castalla	6 (8)
Ibi	31 (41.3)
Onil	37 (49.3)
Tibi	1 (1.3)

Table 2. Model variables: description and reliability analysis

Variable	**Description**	**α Cronbach**
Business Innovation	Organisational innovation and marketing innovation factor analysed with varimax rotation.	
Organisational innovation	Answers to questions about the implementation during the last three years of (a) new business practices in work organisation or company procedures; (b) new methods of organising workplaces in your company with the aim of a better distribution of responsibilities and decision-making; (c) new methods of managing external relations with other firms or public institutions; (d) new knowledge management systems to improve the use and exchange of information, knowledge, and skills within your company or to gather information outside your company (Y/N)	.70
Marketing innovation	Answers to questions about the implementation during the last three years of (a) significant changes in product design or packaging of goods or services; (b) new techniques or channels for product promotion; (c) new methods for product positioning in the market or sales channels; (d) new methods for setting prices of goods or services (Y/N)	.68
Absorptive Capacity	Answers about the implementation during the last three years of (a) internal R&D; (b) external R&D; (c) acquisition of machinery and/or equipment; (d) acquisition of hardware and/or software; (e) acquisition of other external knowledge; (f) professional training; (g) internal design and engineering; (h) internal organisational changes; (i) internal policies related to development of new products and/or markets; (j) consultancy and advisory services (Likert 0–3).	.78
Extra-cluster relations	Answers about the existence of nonlocal relations with suppliers, customers, competitors, and other organisations (universities, research centres, etc.), aggregated into one variable (range 0–4).	
Size	Total sales, employment, and financial assets in 2010. Factor analysed with varimax rotation.	
Coordinator	Standardised score for the coordinator role obtained by dividing the raw coordinator score by the expected coordinator score predicted under a random model.	
Liaison	Standardised score for the liaison role obtained by dividing the raw liaison score by the expected liaison score predicted under a random model.	

Table 3. Correlations and descriptive statistics

Size	1				
Extra-cluster relations	.137	1			
Absorptive Capacity	.073	.185	1		
Coordinator	.084	.085	.070	1	
Liaison	.050	.270	.146	.215	**1**
Mean	0	1.946	0	-.479	**-.500**
Sd	1	1.025	1	2.187	**2.468**

Table 4. Estimation results

	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	***-.558	**-.512	**-.605	***-.625	***-.732
Size	.042	.045	.036	.046	.046
Extra-cluster Relationships	***.287	***.271	***.286	**.295	***.343
Absorptive Capacity	***0.564	***.542	***.531	***.608	***.554
Coordinator		-.024	-.055	-.032	-.084
Liaison		.053	.031	.015	-.125
Coord*Liais			*.015		
Abs.Cap*Coord				-.001	
Abs.Cap*Liais				*.072	
Extra.Clus*Coord					.017
Extra.Clus*Liais					***.078
R^2	.479	.492	.515	.521	.527
Adj. R^2	.457	.455	.472	.471	.477
F-Statistic (p-value)	***21.73	***13.36	***12.04	***10.39	***10.67

Signif. codes: '***' 0.01 '**' 0.05 '*' 0.1

Figure Captions

Fig. 1. Brokerage roles

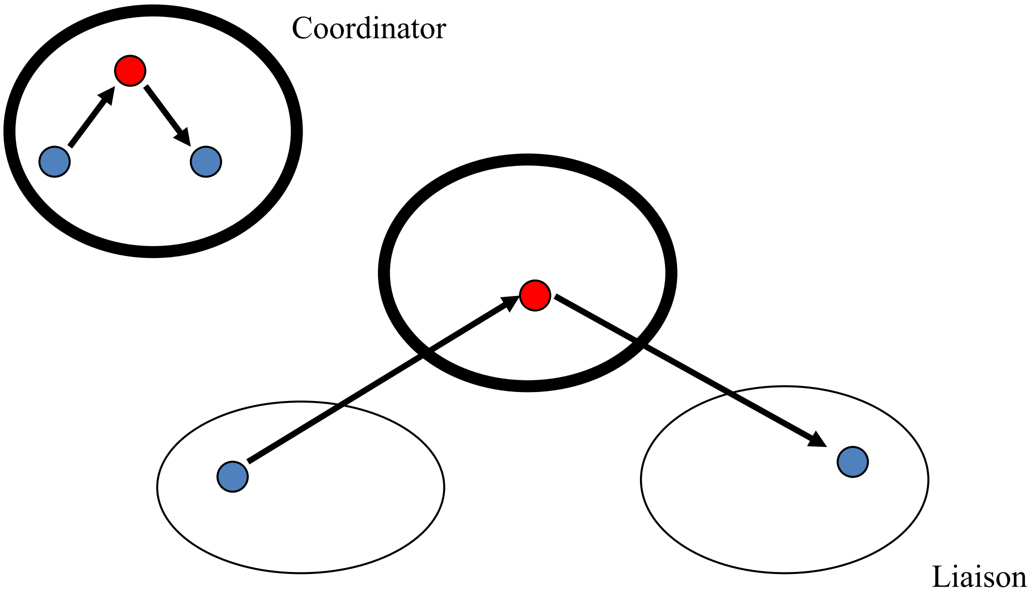


Fig. 2. Moderating effect of coordinator on the relationship between liaison and business innovation

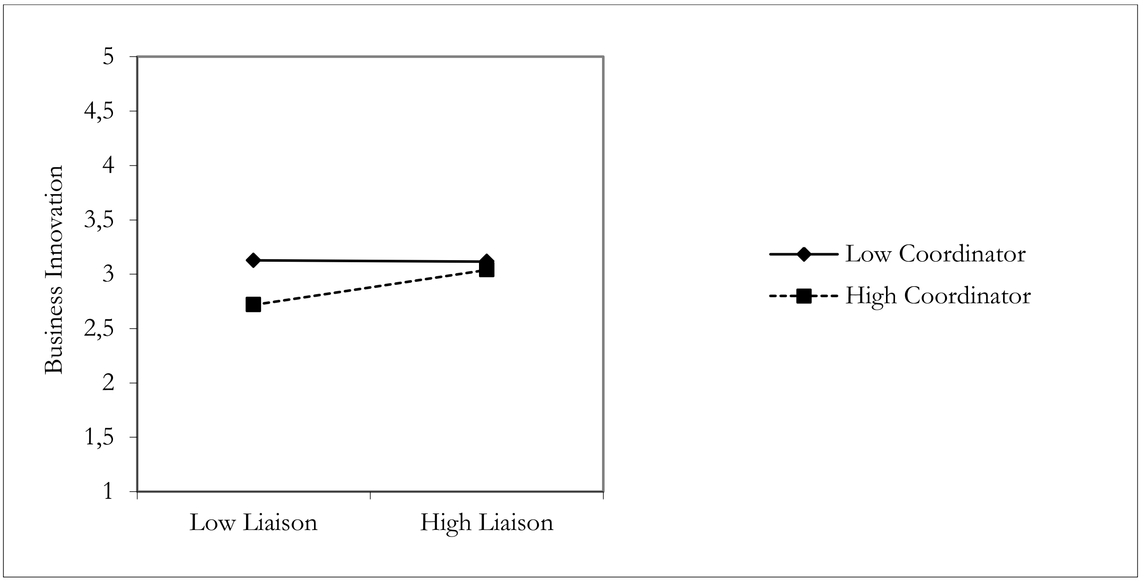


Fig. 3. Moderating effect of absorptive capacity on the relationship between liaison and business innovation

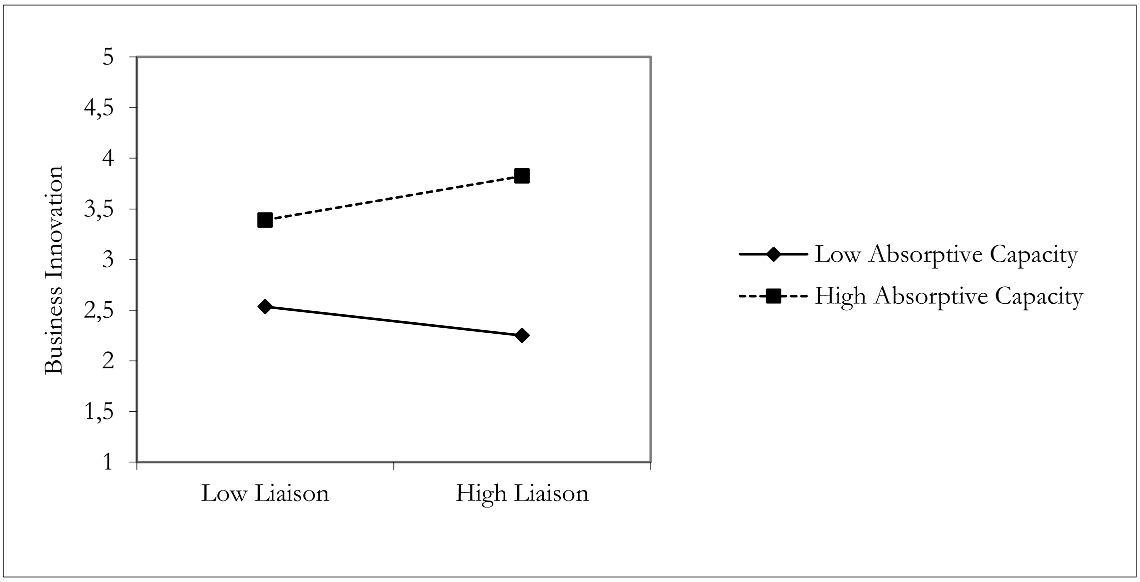
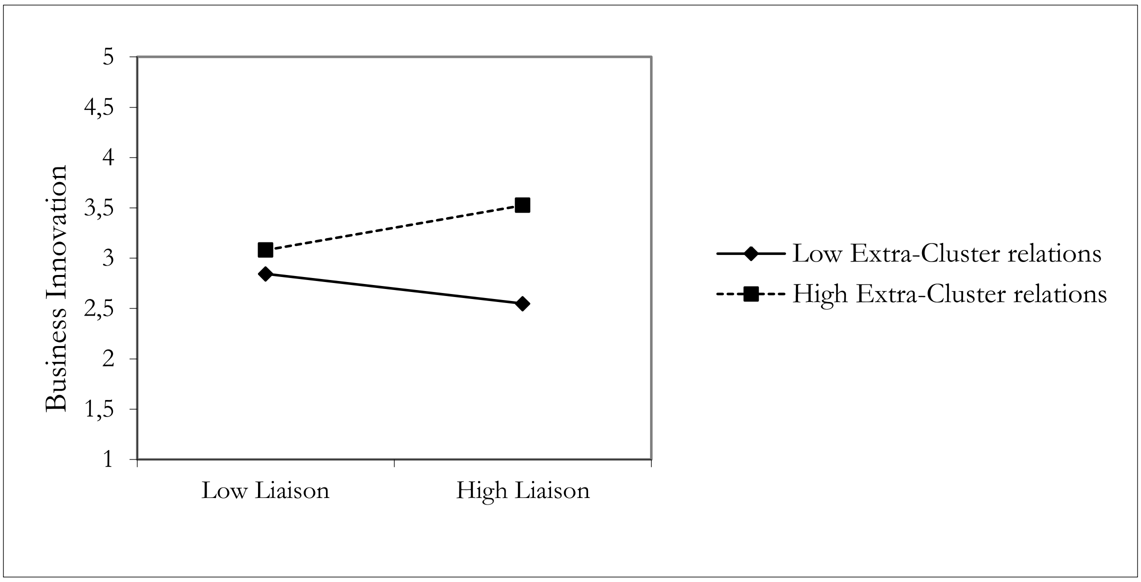


Fig. 4. Moderating effect of extra-cluster linkages on the relationship between liaison and business innovation



NOTES

[1] GOULD and FERNANDEZ (1989) proposed this version of brokerage measures, which standardises for size by dividing the raw brokerage scores by the scores that would be predicted under a random model. This procedure avoids potential bias, as actors in larger groups have a greater chance to mediate. Globally, both brokerage measures identified the same top mediators.