



## Partners connection process and geography of innovation: new insights from a comparative inter-organizational partnerships analysis

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**SUMMARY** This paper attempts to give new explanations of the spatial patterns of collaborations focusing on the partners' connection process. Taking into account actors are embedded in an historical and socio-economical space, we first consider organizations can construct a new collaboration or renew an old one when they decide to build a research project with a partner. Then, going back to the moment when they initially connect with their partners through the analysis of the genesis of collaborations, we assume that they can turn to their interpersonal ties or to coordination resources. This process of connection may influence the spatial dimensions of collaborations regarding notably the literature linking the use of social ties and the spatial proximity effects observed in innovation activities. We test empirically these theoretical propositions through the collection of individual data about more than 200 histories of inter-company (IC) and science-industry (SI) partnerships. The qualitative and quantitative treatments of these data reveal the way partners connect each other and the spatial patterns of collaborations are significantly dependant to the nature of the partnerships. A strong regularity is nevertheless highlighted: for both partnerships (IC and SI ones), actors renewed prior collaborations in 57% of the total of studied partnerships.

**KEY WORDS** Collaborations, Embeddedness, Spatial patterns, Social ties, Coordination

**JEL** O33, O31, O12

## I. INTRODUCTION

Given the strong polarization of innovation activities (Puga, 1999; Caniëls, 1997, etc.), an abundant literature has developed, particularly over the last twenty years, around the question of the geography of innovation. This issue is given to the foreground with the generalization of territorialized policies that promote innovation. To go a step further through this discussion, we propose to explore the spatial dimensions of the research collaborations, the major part of the innovation projects being nowadays built up with partners (Godin and Gingras, 1999; Wagner and Leydesdorff, 2005; Hagedoorn and Roijackers, 2006; Ferru, 2009). Authors have generally focused exclusively on one stage of the collaboration process: the achievement of joint projects. They consider that the exchange of tacit knowledge between partners during this step is crucial and required face to face interactions (Feldman, 1994; Foray, 1995; etc.). Thus, regarding the dominant thesis, partnerships are more likely to be built up locally (ie. between partners located in a same city, county or region). In this paper, we assume that the prior stages - the formation of the collaboration and notably the connection process of partners - also imply coordination problems that are necessarily prior to the exchange of knowledge and could also affect the spatial patterns of partnerships. The choice of the partner and its location depend indeed of this moment of collaborations formation and could thus explain the spatial proximity effects observed in the innovation activities.

We concentrate here on the connection process between organizations-partners that is relatively underexplored as Thune (2007) underlined: “research focusing on process of forming, developing and coordinating university-industry collaborations has been fairly absent” (p.159). Even less authors link the formation process of partnerships with the spatial dimensions of collaborations: only few authors interestingly show the importance of “star scientists” relationships in the genesis of research collaborations built up at the local level (Zucker et al., 1998; Almeida and Kogut, 1999; Singh, 2005; Breschi and Lissoni, 2011), assuming that the spatial proximity of the innovation activities results from interpersonal relationships. These scholars mainly focus on the role of interpersonal ties in the formation of local partnerships and leave aside a great range of the collaborations: those created without going through social relationships and those built up at the non local level, however major nowadays (Hagedoorn, 2002; Giuri et al., 2006; etc.). In addition, these researches confront to an empirical problem: « most of existing contribution on this matter lacks data at the individual level » (Giuri et Mariani, 2007). Thus, « a growing number of studies use patent information to apply social networks analysis (...) assuming relations between inventors who jointly worked on patents (Cantner et Graf, 2006). Social ties are identified through their results (co-patent, publications) but « this usual procedure is not appropriate » (ibidem). The goal of our paper is to deepen and enrich these researches at the theoretical and empirical levels 1) by analyzing widely and precisely the methods of linkage between two organizations-partners, 2) by exploring how this process of connection can participate to the local dimensions of collaborations and affect more generally the spatial patterns of partnerships.

To fulfill these intentions, we first propose a theoretical analysis of the process of partners’ connection and its spatial impact on the geography of collaborations. Taking into account that actors<sup>1</sup> are embedded in a historical and socio-economic context, we first consider that organizations can decide to construct a new collaboration or renew a previous one. Coming back to the moment when

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<sup>1</sup> By actors, we mean organizations or individuals since the connection process between partners combines and mixes these two levels of analysis (cf. infra).

they initially connect with their partners (ie. the genesis of new and renewed collaborations), we then assume that they can turn to their interpersonal relationships or to more classic forms of mediation - we called here resources of coordination - such as the Internet, transfer centers, conferences, etc. Our theoretical analysis has to explain how the use of these two different connection modalities can affect the spatial dimensions of collaborations and how it contributes (or not) to the existence of spatial proximity effects. We will be able to test if the recourse to one particular modality of connection favors local (or non local) partnerships.

We need to create an empirical methodology consistent with this theoretical grid that can help us to observe the formation of collaborations and its impact on the geography of partnerships. Hence, individual data was collected through semi-structured interviews with R&D managers directly involved in research partnerships. This method provides a vast amount of information about more than 200 pairs of collaborations: the history of the collaboration (new vs. renewed), the modalities used to connect a partner (interpersonal relationships vs. coordination resources), the spatial dimensions of the collaboration studied (local vs. non local) and the scientific domain or economic activity of the partners. Among the cases studied, 130 deal with science-industry (SI) collaborations and 93 with inter-company (IC) collaborations. A comparison of these two types of inter-organizational partnerships is thus possible. This has been rarely built up until now, except Ponds et al. (2007) that observe that spatial proximity is more important for SI collaborations than IC ones. We will be able to confirm (or not) these results and more generally explore the formation and the geography of inter-organizational collaborations in two different contexts. From a methodological standpoint, our analysis of collaboration stories combines qualitative and quantitative methods to answer several questions such as: Do the organizations renew collaborations in the major cases? What is the respective weight of interpersonal relationships and coordination resources in the connection process of two organizations-partners? Does the use of interpersonal ties lead necessarily to spatial proximity effects? More generally, does one particular modality of connection foster the local collaborations or the non-local ones? And finally, do these results differ according to the type of partnerships?

The paper is organized as follows: the second section presents our theoretical grid and deduces propositions concerning the link between the modalities of partners' linkages and the geography of collaborations. The empirical work is introduced in a third section with a description of the method used to collect qualitative data about the genesis of collaborations. The fourth section gives the results of our empirical study. We finally conclude and discuss our main results in a last section.

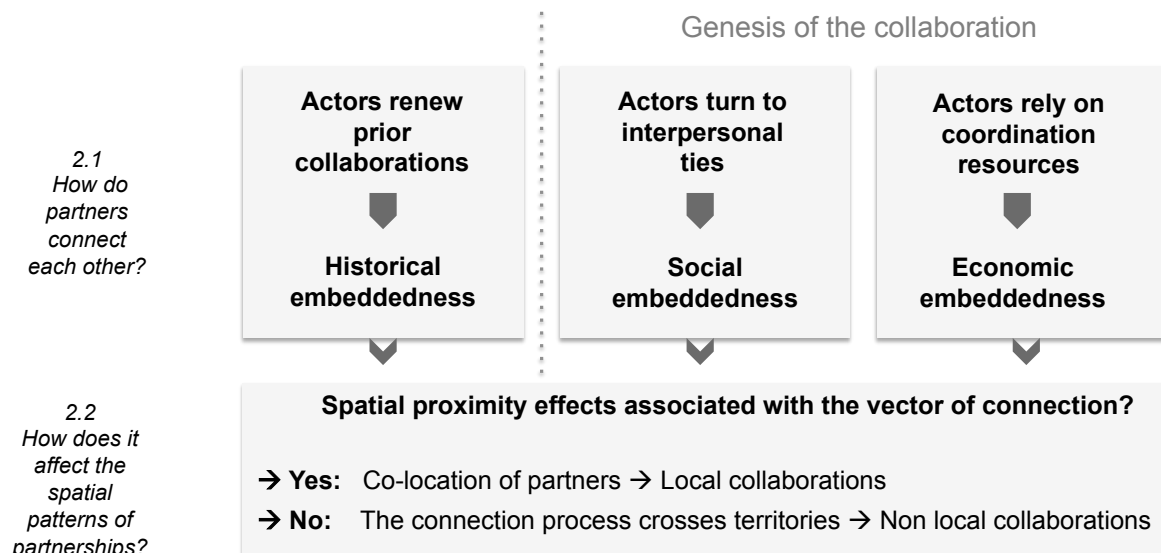
## II. THEORY AND PROPOSITIONS

Collaborations are increasingly crucial in the innovation process of companies (Godin and Gingras, 1999; Wagner and Leydesdorff, 2005; Hagedoorn and Roijackers, 2006). Hence, studies have been developed around this theme. They have mainly focused on the achievement of the partnership, considering the knowledge exchange during this stage as a crucial step and facilitated by the spatial proximity between partners (Feldman, 1994; Foray, 1995, etc.). This thesis gives an explanation to the spatial agglomeration of innovation activities observed for some years and to the success of clusters such as the Silicon Valley. Some authors in the nineties, mainly from United States, like Powell on biotechnologies in California (Powell and Brantley, 1992; Powell and Smith-Doerr, 1994) or Almeida and Kogut (1997) or Zucker et al. (1998) observed the important role of interpersonal ties of star-scientists in the establishment of the local collaborations studied. More recently, Breschi and

Catalini (2010) or Breschi and Lissoni (2011) confirm the important role of author-inventors in the networking between academic and innovation circles. They conclude that the local dimension of collaborations result partially from the use of interpersonal relationships tied locally and they give an alternative explanation to the polarization of innovation activities. These scholars underlined implicitly the importance of the connection process between the partners. Nevertheless, they focus exclusively on interpersonal ties and they consider them as the only way of connecting. Moreover, these analyses are focused on local territories. Thus, they failed to address a great range of collaborations cases, those created without going through social ties and those built up at the non-local level.

Our work is in line with these latest studies but seeks to complete them through an enlarged analysis of the connection process of partners and thanks to the integration of the non-local partnerships. For this purpose, we propose, first, to “decrypt” the connection process of the organizations-partners by taking into account the embeddedness of actors and, then, we deduce how this formation of partnerships affects the spatial dimensions of collaborations. We detail this theoretical grid of analysis sum up in the next figure.

**Figure 1 : Theoretical grid of analysis**



### 2.1. How do the partners really connect each other?

Scholars dealing with the formation of research collaborations are fewer even though this stage constitutes a key stage in the collaboration process by determining the choice of the partner and hence the partner localization. Some scholars shed light on the reasons and motives of these partnerships; others studied the partner choice (Gulati, 1999; Ahuja, 2000; Tether, 2002; Miotti and Sachwald, 2003; Giuliani and Arza, 2009; etc.) and analyse the formation of collaborations (Kreiner and Schultz, 1993) but nobody has given a precise understanding of the genesis of the inter-organizational collaborations and really explain the connection process of the partners.

Regarding the literature about inter-organizational collaborations, the concept of social ties is increasingly used to show their embeddedness in interpersonal relationships and their advantages in terms of information access, reliability and trust. The embeddedness concept, however relevant, is nevertheless limited to the social context of actors and “it is crucial to bring history and complex social structures back into the analysis of socioeconomic phenomena such as inter-firm partnerships”

(Hagedoorn, 2006). We propose to take into account that actors are embedded in a social, economic and historic context (through the terms of historical, economical and social embeddedness) to better understand the connection process between research partners.

**Historical embeddedness: the renewed partnerships.** By focusing on the moment when the organizations build up their research project and their collaboration, we can easily consider that they do not search necessarily a new partner, they are able to turn to a former partner and renew a previous partnership, revealing the importance of the historical embeddedness of actors. The existence of renewed collaborations has been already underlined by Gulati (1995) in a longitudinal analysis of partnerships: “prior alliances play an important role in shaping future alliance formation” (p.620). “The specifics of the partnering history of companies jointly affect their future partnerships formation” (Hagedoorn, 2006, p.674). Thune (2007) recognized empirically that “direct experience can lead to the development of trust between the parties and a reputation for being trustable and reliable which as seen as vital resources for formation of further collaborative relationships” (p.156). The information that the previous alliances provide counterbalances the risks associated to alliances. In addition, through prior collaborations the partners learn about each other’s needs, capabilities, know-how and might manage easily the relationships (Thune, 2007). Mutual knowledge gained through past interactions is the basis of “learning by co-operating”, which allows these partners to be relatively more effective than others when working together because everyone knows the expectations, capabilities and methods of the other (Brousseau, 2000). In sum, the renewal of previous collaborations brings benefits in terms of trust (Granovetter, 1985), transaction costs (Williamson, 1985) and learning (Dosi et al., 1990). Hence, given the costs of finding new partners, one can expect the company to first consider organizations with which it has shared a common partnerships experience. This result already showed by Thune (2007) -“the large majority of the University-Industry collaborations investigated have been initiated and formed through the use of already established contacts”- and corroborated by other data sources (Schartinger et al., 2002). Based on these scholars, we formulate a first proposition:

*(P1) Organizations renew partnerships in the major cases whatever the nature of the collaboration.*

Such repetitive behavior results from the establishment of routines. This highlights the inertial behavior of organizations and their dependence on the past trajectory of their learning (Maskell and Malmberg, 1995), as well as the existence of « lock-in » (Arthur, 1989) or over-embeddedness effects (Uzzi, 1996).

**Economic and social embeddedness: interpersonal ties vs. resources of coordination.** What is even more underexplored and crucial in the formation of collaborations is the genesis of partnerships, the very first stage when partners initially connect with each other. We have to identify the key element allowing the organizations to build the partnership with this partner for the first time.

We can consider first, in the light of the approach developed by Granovetter, that organizations are embedded in interpersonal ties. In a famous article published in 1985, Granovetter defended the thesis that economic activities depend on interpersonal relationships in which the actors are involved. He called this dependence embeddedness. Thus, relying on a study by Eccles (1981), Granovetter shows that relations among companies (prime manufacturers and subcontractors in the construction field) are underlain by interpersonal relationships. By integrating the social

embeddedness of actors in our analysis, we want to take into account the borders porosity of organizations from the individual exchanges (Grossetti and Bès, 2003): “Behind the formal ties [ie. the collaboration] we find informal relations that give them life, support them and frame their development” (Powell and Smith-Doerr, 1994, p.384). We thus need to analyze the inter-organizational collaborations at the individual level and we approach the social embeddedness by measuring the place of direct and indirect interpersonal ties in the formation of pairs of collaborations. Thus, we do not search to reconstruct the whole social network structure of the organization involved in the partnership and we use a restrictive definition of social ties compared to authors interested in social network<sup>2</sup> since we consider dyadic inter-personal ties only. Authors that underlined interpersonal exchanges in the formation of partnerships neglect more classic form of coordination (Bouty, 2000; Hansen, 1999).

Organizations are indeed not only embedded in a social context but also in an economic one. Hence, when they are not connected by interpersonal relationships, they can use material or cognitive resources that serve to mediate between the players and facilitate the bringing together of partners. The very first contact between organizations can result from a meeting in exhibitions, conferences or from public information through the Internet, through public resources dedicated to making links (for instance in France, the *centres de ressources technologiques* (CRT) and the competitiveness clusters). Eom and Lee (2010) have notably already underlined the effect of technology transfer centres. These various resources of coordination correspond to a continuum ranging between the two extreme forms of market and hierarchy (see list 1). A connection of partners through these resources has to be differentiated from a connection through interpersonal ties. When using a coordination resource such as reputation, there is not a real interpersonal relationship that linked the two organizations but an impersonal structure that mediate them. And even, when an individual actor is involved, through a conference or an exhibition for instance, this latter behaves under the auspices of the organization and the connection does not depend on one particular individual.

**List 1: Coordination resources**

Public institutions (CRT, CVR, D2RT, Oséo, etc.)
Private structure, experts
Professional organization (club, technological associations, commissions of specialists)
Projects (“competitiveness clusters”)
Congress, scientific or professional meetings, etc.
Medias (press, internet, publications, etc.)
Reputation
Training period market
Market (invitations to tender)

Relying on these resources facilitates the partners’ connection while reducing various transaction costs. Like interpersonal ties, they limit the uncertainty in the selection process of a partner and the risk of opportunism of this latter (Williamson, 1985) since they give a framework to the economic action, set rules of interaction and are sources of information considered reliable.

Finally, we consider that the very first connection between the two organizations is achieved by a key modality: it could be a chain of interpersonal relationships or a coordination resource. This analysis

<sup>2</sup> The term of « interpersonal ties » is privileged to the “social network” one to reduce ambiguity. Our analysis is nevertheless in the line of Granovetter’s (1985) and Wellman’s (1996) studies since they have been also interested in dyadic ties.

of the genesis of inter-organizational collaborations involves the mixing and matching of the individual and organizational levels to identify the key modality of linkages between partners.

Regarding the theoretical literature, collaborations through coordination resources and notably those that are close to the market can be less used than interpersonal ties since « new knowledge creation goes along with uncertainty and opportunism, markets often cannot offer this because it would involve too high transaction costs » (Boschma, 2005, p. 65). We thus formulate a second proposition:

*(P2) Partners are more likely to turn to interpersonal relationships than coordination resources.*

By integrating the socio-economic and historic context in which actors are embedded, we have reported the existence of renewed collaborations, on the one hand, and of two modalities of connection, on the other, in the formation process of collaborations. We need to determine now the spatial effects resulting from this process.

## **2.2. How does the connection process affect the spatial patterns of partnerships?**

We search to know if one particular modality of connection fosters the local collaborations or the non-local ones. As explained before some authors linked the spatial proximity effects observed in the innovation process to the use of interpersonal ties (Powell and Brantley, 1992; Almeida and Kogut, 1997; Breschi and Catalini, 2010; etc.). This thesis is reinforced by the scholars that show the local dimension of interpersonal ties (Fischer, 1982). Relationships are assumed to be tied more easily in the neighbourhood: “the greater the distance, the less contact and support” (Mok et al., 2007, p.434). Some empirical studies - Wellman (1996) on a sample of residents of Toronto, Fischer (1982) on the population of San Francisco and Grossetti (2007) on Toulouse - confirm that personal ties include a large share of local relationships. This is also the case in studies directly inspired by the new economic sociology (Saxenian (1994), Ferrary and Granovetter (2009), etc.). Economists and geographers observe that strong and weak ties exist between agents in a limited area, describing this situation as “local buzz” (Bathelt et al., 2004; Thune, 2009). We thus formulate a third proposition:

*(P3) The use of Interpersonal ties leads to the formation of local partnerships.*

On the contrary, coordination resources that may be similar to institutions are assumed to have national characteristics (Lundvall, 1992; Amable et al., 1997, Bathelt et al., 2004) although they seem to grow more and more at a sub-national level (decentralization), as well as on a supranational (eg. European) scale. Considering the previous studies, we propose the following proposition:

*(P4) The use of coordination resources fosters national partnerships.*

Finally, we can consider the renewal of prior partnerships determines at least a part of the dynamic of the spatial patterns of collaborations: it participates to its spatial concentration (if the players renew mainly local collaborations), its spatial dispersion over time (if the players renew essentially non-local collaborations) or to its spatial inertia (if the players renew their collaborations at the same scale). With regard to the existing literature that assumes the higher efficiency of spatial agglomeration of innovators (see Krugman (1991) for instance), we can deduce that partners are more likely to renew local partnerships than non-local ones. Hence, we formulate a fifth proposition:

*(P5) The renewal of prior partnerships favors the spatial agglomeration over time.*



### III. DATA, METHOD AND FIRST DESCRIPTIVE STATISTICS

We need to test the five theoretical propositions by exploring in detail how collaborative projects emerged. With this perspective, a set of qualitative data is collected through interviews involving the reconstruction of histories of collaborations. The codification of this information enables the building of a qualitative database sufficiently consistent for statistics tests.

#### 3.1. COLLECT OF QUALITATIVE DATA: RECONSTRUCTING COLLABORATION STORIES

Empirical data is qualitative and is collected through semi-structured interviews. More specifically, we selected researchers or R&D managers who held scientific responsibility for research contracts achieved with a partner and we asked them to tell us about these projects. It is crucial to have a sufficiently sound method for obtaining relevant information about the formation of partnerships and revealing the modalities of connection between partners. To identify interpersonal ties, the relational chains method is used. Famous examples of this method utilization are the survey by Milgram on "small worlds" (1967) and that by Granovetter on access to employment (1974). In this method, it is not a matter of analyzing static structures but rather of recourse to interpersonal relations in order to access resources. Interpersonal relationships actually mobilized to connect a partner are taken into account (and not the whole social network of the organization studied). Applied to the case of collaborations, this method consists of reconstructing the histories of various couples of collaborations. The interviews each lasted about 90 minutes and were recorded and transcribed after each interview. More than 95% of them were conducted face to face between 2007 and 2008. These interviews give precise information we could not have with statistics or even questionnaires. We manage to avoid as much as possible the potential bias linked to this method (problems of incomplete memories of interviewees, or false re-constructed memories that are not reflecting the real process, etc.) thanks to complementary sources of information (documents in local media or local organizations) and cross-referenced interviews (conducted by phone in the major cases and lasting an average of 40 to 45 minutes). In addition, to be as neutral as possible and not influence the interviewed person, we let her/him explained in detail the research project from the beginning to the end. To obtain precisions about the linking of partners, questions can be raised: "With whom did you collaborate to implement this project?", "Is it the first innovation project with this partner?", "How did you find this partner?", etc<sup>3</sup>. We are thus able to determine if the partners build a new partnership for the research project studied or renew an old one. We can also identify the genesis of the collaborations (new and renewed ones) and determine if organizations have collaborated for the first time through interpersonal relationships (or coordination resources. We also obtain information about the spatial dimension of the collaboration studied and the scientific domain/economic activity of the two partners.

In the interviews, the unit of analysis is the collaboration that corresponds to any research projects built up with one other organization, with or without success. Data collection involves formal collaboration contracts (either under way or completed) between a laboratory and a firm or between two companies. Innovation partnerships between firms, by definition, consist of bringing together partners from the same milieu - as opposed to SI collaborations.

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<sup>3</sup> We never use explicitly during the interview the terms of "interpersonal relationship" or "coordination resource" to avoid any biases. We search to understand precisely how the first collaboration happened and reinterpret thereafter according to our theoretical grid.



The construction of the overall sample relies on two databases: one covers all of the information collected by the research development unit of Poitiers and relating to the contracts signed by Poitiers University academics from 2004 to 2007 (about 300 with companies). The other, a public directory, brings together all of the information about companies located in the Châtelleraudais area. Finally, we have been able to reconstruct 203 collaborations stories. 115 concern contracts made by the laboratories of the University of Poitiers - a relatively large and multidisciplinary university - with a company. 88 collaboration stories deal with contracts made by companies located in Châtelleraudais - a French average-sized area historically industrial and specializing in sectors of medium-low technology - with another company. Unlike previous works which were generally focused on large urban high-tech agglomerations, considered as the main driver of innovation, the two sites studied here are located in Poitou-Charentes, covering areas of average size, adding another perspective to the existing literature.

### **3.2. CODING AND TREATMENT OF QUALITATIVE DATA**

Key information relating to the formation process is extracted and coded (according to theoretical typology previously presented) to build a database. All the information is turned into a dichotomous or a polytomous variable.

Data about the collaborations stories indicate the history of the collaborations (*RENEWED* = 1 if the organization has renewed an old collaboration, 0 if the organization built a new partnership), the modalities of connection (*TIES* = 1 if the organization initially relied on interpersonal ties to connect with its partner, 0 if the organization initially had recourse to a coordination resource), the nature of the collaboration (*IC\_COLLAB*= 1 if the collaboration is achieved by a Châtelleraudais firm with another company, 0 if the collaboration is established by a laboratory of the University of Poitiers with a firm). We also include measures of the interviewed partner specialization: the scientific domain of the laboratories of Poitiers (Engineering Sciences (*ES*), Chemical Sciences (*CS*) Physical Sciences (*PS*), Biological Sciences, Humanities and Social Sciences, Information Technology (*OTHER*)) and the sectoral activity of the Châtelleraudais companies (Chemical industry (*CHEMIC*), Advices and assistance (*ADV*), Household equipments (*HOUS*), Electric and electronic equipments (*ELECT*), Mechanical equipments (*MECA*), Food industry (*FOOD*), Automotive industry (*AUTO*), Metallurgy (*METAL*)) involved in the collaborations studies.

Our analysis of the collected data combines qualitative and quantitative methods. A qualitative study gives, first, precisions about the formation of collaborations and determines the role of past and the weight of each modality of connection. By cross-tabulating the two modalities of connection (interpersonal ties vs. coordination resources) with the economic/scientific specialization of the interviewed partners, the nature and the spatial dimensions of the partnerships, we give descriptive statistics. Independence tests and notably  $\chi^2$  tests are done to give more rigorous testing of these links. We can verify whether the characteristics of the actors involved in the collaborations and the nature of the partnership influence recourse to one particular modality of connection. Thus, we can deduce if the way that partners connect is empirically stable. Moreover, we test the dependence between each modality of connection and the spatial dimensions of the collaborations. Hence, we verify whether the interpersonal tie is significantly associated with the local collaborations and the coordination resources with the national ones (P3 and P4). We also check if the renewal of previous partnerships leads to spatial agglomeration effects (P5).

### **3.3. SAMPLE AND FIRST DESCRIPTIVE STATISTICS**

The table below presents the data. We give first descriptive statistics about our sample and we notably describe the scientific / economic specialization of one of the partners as well as the spatial patterns of the studied partnerships.

**Table 1: Data and first descriptive statistics**

Variable	Procedures	Number (out of 203)
<b>Type of partnership</b>	IC collaborations	88
	SI collaborations	115
<b>Scientific / sectoral specialization of partner</b>	Engineering sciences	66
	Chemical sciences	32
	Physical sciences	8
	Biological sciences, humanities and social sciences, information technology	8
	Chemical industry	7
	Advices and assistance	11
	Household equipments	12
	Electric and electronic equipments	9
	Mechanical equipments	21
	Food industry	7
	Automotive industry	6
	Metallurgy	15
<b>History of collaborations</b>	Renewed partnerships	115
	New partnerships	88
<b>Initial modalities of Connection</b>	Interpersonal ties	20
	Coordination resources	68
<b>Type of inter-personal ties</b>	Non professional ties	11
	Professional ties	34
	Teaching ties	21

*Total number of observations=203*

**Specialization of the partners involved.** Among the academic partners, a great part is specialized in the engineering or chemical domains (in 57% and 28% of the interviewed laboratories respectively). Among the industrial partners, they are generally large-sized firms (72% of the interviewed companies have more than 250 salaries) and belong to a group (67% of the companies) and to the construction of automotives, other vehicles or R&D (12%, 19% and 11% of the companies respectively).

In relation to the IC collaborations, the partners located in the Châtelleraut area are mainly specialized in the mechanical and metallurgy industries, since these two sectors constitute more than 40% of the total. The over-representation of these industries is representative of the sectoral specialization of the studied area.

**Localization of partners and spatial patterns of partnerships.** In the collaborations studied, at least one of the partners is located in Poitou-Charentes. This region has a great endowment in terms of R&D thanks to the University of Poitiers<sup>4</sup>. Nevertheless, the region is quite small (regarding different size indicators) and is the 15th out of the 22 regions in France. It gathers a fewer number of companies (mostly SME's specialized in low-medium technology) and the private R&D expenses are

<sup>4</sup> The University of Poitiers is one of the older in France and in Europe: it gathers 24 000 students or so and 934 researchers.

lower compared to other regions. Poitou-Charentes present an ambiguous situation: it is the fifth most important region in France regarding the public research expenses and the weight of public researchers whereas it is the 18th in terms of private researchers.

The partners of the company or the laboratory located in Poitou-Charentes are located within or outside the partner's region. They are not concentrated in one particular area revealing the multi-scalar character of inter-organizational partnerships. The extra-regional collaborations, however, appear largely dominant, in particular those established at national level, since more than 60% is established at this level (see table above). The local dimension is quite low: less than one fourth of the partners are located within Poitou-Charentes. The international level is even lower, a foreign partner being involved in only 14% of the studied collaborations. We can nevertheless observe specificities according to the nature of the partnerships: for IC ones, the local dimension appears more important (almost 40% of the partnerships are made within the region) whereas for SI collaborations, we note the hypertrophy of Ile-de-France (more than half of all French contracts being established with a firm located in the capital region). These results are close to those obtained in previously conducted studies (see notably Giuri et al. (2006)) but the number of contracts with the Ile-de-France is however relatively higher and the local collaborations are fewer (notably for SI collaborations) in our empirical study. This difference between our results and those from previous studies may be explained, at least in part, by the structural characteristics of the area under investigation and, in particular, by its economic specialization and its relatively low industrial density. As said previously, the studied area is mainly composed of small unit of production without R&D center. The industrial specialization of these companies is moreover hardly compatible with the scientific expertise of the laboratories of the University of Poitiers. These structural effects play a structuring role in the spatial patterns of the collaborations have already shown (Ferru, 2010; Bouba-Olga et al., 2011)

#### IV. RESULTS

The following paragraphs detail the main results that emerge from the qualitative and statistical treatments of the collected data. We first give precisions about the formation of partnerships before analyzing the impact of each modality of connection on the spatial patterns of collaborations.

##### 4.1. EMBEDDEDNESS OF ACTORS AND MODALITIES OF CONNECTION WITH PARTNERS

Taking into account the historical and socio-economic context in which actors are embedded when they connect with a partner, we analyze the 203 collaboration stories and test the two first propositions introduced in our theoretical grid.

First, in 57% of the studied collaborations, project leaders have renewed past partnerships. Hence, as predicted (P1), in most cases, actors have renewed their previous collaborations to achieve their collaborative project, in both partnerships the SI and IC ones (57% for each). A great number of partnerships exist for a long time since project leaders have a preference for a former partner: *"renewed collaborations are really easy, we know each other"* commented a researcher. The interviews confirm the renewal of partnerships gives advantages in terms of trust and learning, reducing transaction costs. They also interestingly show that the research of the two partners is defined according to their respective needs in some "historical" partnerships. These historical partnerships are considered to be necessary for the organizations with a high turn-over of scientific leaders because *"the laboratory constitutes the memory of the research of the firm"*. This result confirms that history matters and it emphasizes the inertial behavior of the players concerned and

the path dependant innovation trajectory. Secondly, the analysis of the genesis of collaborations reveals that partners use their interpersonal ties in 33% to connect for the first time with their partner and their coordination resources in 67%. Contrary to P2, interpersonal ties are not the major modality of connection. Interpersonal ties are even less used in our study than in previous investigations about the genesis of SI collaborations. Based on Granovetter's methodology (1973), Grossetti and Bès (2003) latter observed that interpersonal ties are used in 44% to find their partner.

Taking into account the nature of the partnership, we add some precisions: the recourse to one modality of connection differs whether the partnership is IC or SI. Social ties are even less mobilised in IC collaborations, the use of interpersonal ties is the exception and the linking occurs more often through a coordination resources with about 85% of project leaders relying on such a procedure to construct the partnership initially. These modalities and notably the conference meetings are essential. Industry becomes familiar with research undertaken by laboratories on specific themes. One scientific leader of an automotive company explained he went to a conference in relation to an item that the firm was interested in and met researchers who presented their research. The scientist responsible was impressed by the results of one researcher of a laboratory of Poitiers. As a result, the project leader of the company discussed with this researcher to know whether the laboratory of Poitiers would be interested in working with his company in relation to the research he presented.

The interpersonal ties and notably the teaching ties are over-represented in SI collaborations (relatively to the intercompany partnerships). The relationship with former doctoral students is a recognized as a source of partnerships these last years (Fleming and Frenken, 2006; Thune, 2009; Bozeman and Mangematin, 2004). It facilitates the reconciliation of two worlds relatively distinct and separate, as is the case for science and industry, through their knowledge of these two fields. In our interviews, one researcher states that *"They are a key means"*, while another adds that *"They make the contact easier with the manufacturer, because they are familiar with the laboratory's know-how"*. One researcher explains that one of his collaboration with a foreign firm would not have been possible without this relation associated with education: before this former doctoral student was recruited into the company, the laboratory was already interested in the firm's know-how and wanted to collaborate with it; it had tried to contact it via the internet to propose collaborative projects, but the firm had never followed up.

The khi<sup>2</sup> test confirms the significant ( $p=0,000$ ) dependence between the modality of linkage and the nature of the partnership (see table 2). The statistic Cramer's V that measures the strength of association or dependency between the variables is around 0.32 indicating the high degree of dependency<sup>5</sup>.

**Table 2: Dependence between the modalities of connection and the nature of partnerships**

	IC	SI	Total	Results of khi <sup>2</sup> tests
<b>Coordination resources</b>	75 (85%)	62 (54%)	137 (67%)	<b>X<sup>2</sup>=20.87</b> <b>p=0.000</b> <b>Dependence</b>
<b>Interpersonal ties</b>	13 (1%)	53 (46%)	66 (33%)	
<b>Total</b>	88	115	203	

NB: X<sup>2</sup> corresponds to the sum of the differences between the theoretical values and the observed values, and p corresponds to the likelihood of an associated error.

<sup>5</sup> The value of the contingency coefficient confirms this result.

The cross-tabulation of the modalities of connections with the other characteristics of the partners and the  $\chi^2$  tests associated reveal that the recourse to one modality of connection does not depend significantly of the scientific or sectoral specialization.

#### 4.2. SPATIAL PATTERNS OF PARTNERSHIPS

The table 3 gives some results about the modality of connection used and the spatial patterns of the collaboration.

**Table 3: Formation and spatial patterns of partnerships**

	Interpersonal ties	Coordination resources	Renewed collaborations
Local <sup>a</sup>	1	16	30
Non local	19	52	85

<sup>a</sup>The collaboration is qualified as local when the two partners are located in the same region.

First, we cannot conclude that interpersonal relationships are necessarily linked to the local dimension contrary to P3 and the literature that highlights the positive effects of the “local buzz”. Ties can emerge and can increasingly be kept at a distance through ICT as assumed Lorentzen (2007). Thus, the use of interpersonal relationships does not necessarily lead to local collaborations. The structural characteristics of the Poitou-Charentes region (where one of the partners is located) can explain a part of this result: its low industrial and scientific density limits the opportunities for local ties and notably those related to education since the recruitment of former doctoral students in the region is really low.

Secondly, it appears that the use of renewed partnerships is not linked to the local dimension and thus the renewal of partnerships does not favor the spatial agglomeration of collaborations over time. This result contradicts P5 and the existing scholars that underline the higher efficiency of co-location of innovators. The dependence of actors on the past collaborations leads mostly to the strengthening of the existing geography of partnerships over time.

Thirdly, we observe that the recourse to the coordination resources to connect a partner is generally associated to the non-local collaborations, confirming P4. The interviews also revealed that the public coordination resources created to facilitate the linking of regional partners (such as CRT in France) are rarely used.

These results differ again according to the nature of the partnership. The cross-tabulations and the  $\chi^2$  tests summarized in the table 5 reveal the significant relation of dependence between the nature of the partnerships and its spatial patterns. The IC collaborations are over-represented within the region and it seems that collaborations with a partner that belongs to the same milieu (industry) favour the co-location of partners contrary to Ponds et al. Our result could be explained by the low level of skill/education of workers that gives to these latter a lower spatial mobility and a lower capacity of absorption. It thus leads to the construction of collaborations at a more local level. The partner searched in the IC collaborations is also less specific and could be found in various places and hence more easily in the region. The values of the Cramer’s V (between 0.17 and 0.32) indicate also the important degree of dependency.

**Table 5: Nature of the partnership and its spatial patterns**

	SI collaborations	IC collaborations	Results of Khi <sup>2</sup> test
<b>Local</b>	12%	25%	X <sup>2</sup> =5,6287 p=0,017 <b>Dependence</b>
<b>Non local</b>	88%	75%	

NB: X<sup>2</sup> corresponds to the sum of the differences between the theoretical values and the observed values, and p corresponds to the likelihood of an associated error.

## V. DISCUSSION AND CONCLUSION

This paper has searched to give new explanations of the spatial dimensions of collaborations focusing on the formation process of partnerships. Taking into account that actors are embedded in an historical and socio-economical space, we first consider that when organizations decide to build a research project with a partner, they can construct a new collaboration or renew an old one. Then, going back to the very first moment when partners connect to each other - through the genesis of new and renewed collaborations - we assume that they can turn to their interpersonal ties or to coordination resources. We believe that the way that organizations form their partnership can influence the spatial patterns of the partnership created. We have thus proposed a theoretical analysis of this connection process between partners and its spatial impact. We have then verified the validity of this theoretical grid through the collection of individual data from more than 200 accounts of SI and IC partnerships.

The qualitative and quantitative treatments of these data have revealed several interesting results. First of all, in a large majority of collaborations, organizations have renewed prior collaborations whatever the form of the partnership (SI or IC). Secondly, interpersonal ties are not the major modality to access a partner for the very first time. They are even less used in IC collaborations, revealing differences in the connection process according to the nature of the partnership. Our data also qualifies the dominant literature that associates interpersonal ties to the spatial proximity effects: interpersonal ties are underrepresented when partners are co-located. Finally, dependence tests highlight differences in the spatial patterns of partnerships according to the nature of the collaborations: those built up between companies are deployed more frequently at a local level than is the case for SI collaborations, which may merely reflect the importance of the partnership nature.

**Scope and limitations of our findings.** Our results cannot be generalized and are not widely-applicable. They are context sensitive: the structural characteristics of the studied area, Poitou-Charentes (at least one partner belongs to this region), have to be taken into account. The low local dimension observed in our empirical study can be explained by the relatively lower density of this region, a factor which greatly reduces the possibilities for local relationships and collaborations (Ferru, 2010; Bouba-Olga et al., 2011). The structural specificities of Poitou-Charentes could explain our findings contradict the previous ones. The investigations by Grossetti and Bès (2003) about the genesis of SI partnerships in five French agglomerations with the same methodology gave different results and confirmed the spatial proximity effects generally associated to interpersonal ties. As explained in the previous section, according to the industrial and scientific density of the territory studied, opportunities for partners to tie local relationships (related to education notably) differ.

**Implications.** By shedding light on the importance of renewed partnerships and on the weakness of local collaborations, our results challenge the clusters policies that promote local collaborations and

want to foster them. Organizations are more likely to renew a previous partnership regardless where the partner is located. Our study reveals also the diversity of situations according to the nature of the partnerships. This result is important as it sheds light on the necessity to qualify what the literature show when it tends to generalize its results. It also sets new challenges for policy makers who have to integrate this complexity.

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