

Why Are There Still Proximity Effects in Innovation Processes?

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Abstract: Empirical studies show that innovation activity is highly agglomerated within space. This stylized fact is often explained by the necessity for the actors of co-localizing with a view to benefiting from tacit knowledge which, by definition, cannot spread easily across the territories.

In this article, we propose another reading of the phenomenon. We especially intend to show that the actors are faced with coordination problems resulting from the setting up of a knowledge-based division of labour. The latter solve these problems by relying on the prior existence of socioeconomic proximity relations: relational proximity (role of social networks) on the one hand; mediation proximity on the other hand. In some cases, the socioeconomic proximities and spatial proximity overlap, thus giving rise to the formation of a localized productive system. In other cases, the socioeconomic proximities go through territories, thus giving rise to the development of transterritorial productive networks.

In this perspective, the tendency to the agglomeration of innovation activity would be explained less by the tacit nature of knowledge than by the localized nature of certain mediation resources and, especially, of an important part of social relations.

“With the Internet having connected the world together, someone’s opportunity is not determined by geography”.
Bill Gates, *Financial Times*, 2006.

1. Introduction

With all due respect to Bill Gates (a good manager can be a bad economist, and vice versa), despite the deepening of globalization, despite the development of information and communication technologies, despite the dematerialization of economy, all available empirical materials show that economic activity, and innovation activity even more, are highly localized within space and tend to agglomerate more and more.

The main explanation of this apparently paradoxical phenomenon is supplied in a complementary way by geographical economy and the evolutionary theory of innovation. By laying down the hypothesis of local technological externality, geographical economy reveals the strong tendency to the agglomeration of activities: the centripetal forces (local technological externalities) would be supplanting the centrifugal forces (the transaction costs supposed to be an increasing function of distance). The evolutionary literature provides a second decisive explanatory element by setting out theoretically the hypothesis of the localization of technological externalities: the firms’ core competitive advantage would be made up of the subset of tacit knowledge which, by definition, cannot but spread with difficulty within space and time. Only face-to-face interactions, in spatial proximity, would therefore permit to have such knowledge at disposal.

Unfortunately, this explanatory sequence does not quite stand up to the test of facts: the PatVal-EU survey (Giuri et al., 2006), which questions the inventors of more than 9,000 patented inventions in Europe, shows for instance that: “Surprisingly, interaction with geographically close individuals in other organizations is the **least** important form of collaboration”. The authors of this survey further specify: “This is puzzling given the emphasis in the literature on the importance of geographical proximity for collaboration and knowledge”. Hagedoorn (2002) also reveals that out of all the R&D partnerships he listed over the period 1960-1998, more than half are international relations (the weight of these relations diminishes over that period, but rather slightly). Along the same lines, a survey conducted by the French Ministry of Economy and Finance (Sessi, 2005) shows that only 10.8% of the relations to innovate deploy on a local scale, 18.9% on a regional scale, against 41.2% on a national scale, and 20.9% on a European scale (the remaining 8.2% corresponding to the relations with the rest of the world). If the local scale counts for innovation, it actually seems that other spatial scales also come into play...

In this article we propose to develop an analysis that is more in line with the observed stylized facts: tendency to the agglomeration of innovation activity **and** coexistence of local and non-local relations. To that end, we set out to develop a thorough analysis of the innovation process implemented by the actors, basing ourselves on the evolutionary theory of innovation, on the economy of proximities, as well as on the recent developments in economic sociology. We particularly show that the actors are faced with coordination problems arising from the setting up of a knowledge-based division of labour. The latter solve these problems by relying on the prior existence of socioeconomic proximity relations: relational proximity (role of

social networks) on the one hand; mediation proximity on the other hand. In some cases, the socioeconomic proximities and spatial proximity overlap, thus giving rise to the formation of a localized productive system. In other cases, the socioeconomic proximities go through territories, thus giving rise to the development of transterritorial productive networks.

2. Knowledge-Based Division of Labour

To innovate, companies must combine efficiently a set of heterogeneous complementary resources. But, with the speeding up of technical change and the increasing complexity of the knowledge and expertise developed by the actors, a given company has less and less often at its disposal, within its own structure, all the resources it needs. In view of this situation, it needs to coordinate efficiently with other actors having resources complementary to its own, thus reinforcing the tendency to the knowledge-based division of labour.

A first determinant of this tendency is the development of intellectual property systems which, for instance, give a creator the possibility to prevent (temporarily) the use of his invention by another actor. So, a company that needs a patented component to manufacture an innovative product will have to enter into negotiations with the patent holder, either to buy the component in question or to procure a manufacturing licence. On that subject, Cohen et al. (2000) show that the increase in the number of patents registered in the United States is explained less by the growth of newly developed knowledge than by the innovative firms' will to negotiate licence agreements (especially cross-licence agreements). The second determinant, which has been widely analysed by the evolutionary theory of innovation (Nelson and Winter, 1982; Dosi et al., 1988, ...), results from the difficulty, and even the impossibility, for a given company, to develop efficiently, in-house, resources that are too different from those which it has at its disposal: the tacit nature of knowledge, its accumulation in organizational routines, the importance of the effects of apprenticeship that are at the root of their improvement, ... direct the firms towards specific technological trajectories which reduce their absorptive capacity (Cohen and Levinthal, 1989) of resources that are too different. These firms are thus compelled to embark on a course of cognitive specialization. In general, the tendency to the knowledge-based division of labour therefore depends on the degree of knowledge appropriability, which itself depends, on the one hand, on the quality of intellectual property systems and, on the other hand, on the degree of knowledge intrinsic reproducibility (tacitness) (Teece and Pisano, 1994).

Empirical studies clearly attest to this tendency to the knowledge-based division of labour: Hagedoorn (2002) thus shows that the annual number of R&D partnerships went from only a few units in the sixties and seventies up to about 500 per year in the nineties. The PatVal-EU survey (2006) reveals that only a third of inventions are developed by only one individual. According to the Sessi survey (2005) on French industry, 18% of the companies declare they collaborate to innovate, this proportion increasing with technological intensity: the proportion of collaborating companies goes from 11.9% for low technology up to 17.8% for medium-low technology, 28.4% for medium-high technology, and 34.2% for high technology. The increase in technological complexity (supposing that technological intensity is a good indicator of this complexity) reinforces clearly the incentive to cooperation. This tendency may be observed even in the case of the creation of innovative companies: Barthe et al. (2006), who have conducted thorough studies into fifty or so cases of such creations,

point out that the actors who initiated the various projects under examination mobilized from 2 to more than 30 collaborations, with on average 15 collaboration episodes per story. The Schumpeterian entrepreneur-innovator is not an autonomous individual.

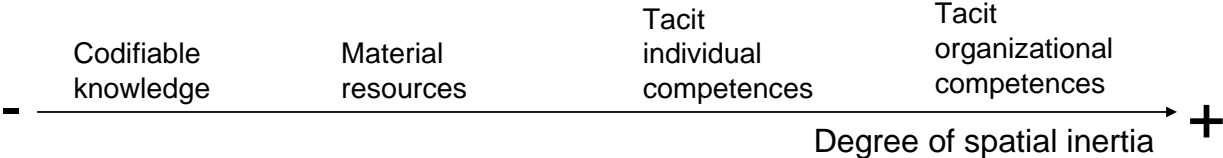
These first elements of analysis imply that innovative companies are faced with two problems. A cognitive problem first: what are the resources needed? Who has them? Is it possible to develop them internally or is it necessary to appeal to an external partner? The second problem is one of coordination: how is it possible to coordinate efficiently the complementary competences involved in the productive process?

3. The Geography of Resources

The location choices of innovative firms depend, to a large extent, on the answers that may be brought to these two problems, and so, on the geography of resources in the first place. At least if these resources are spatially unmovable... Indeed, on the reverse assumption, if the resources are perfectly movable, any place is eligible as it is just a matter of getting them sent to the firm’s premises. This takes us back to a series of questions: where are the resources we need located? What is their degree of spatial inertia? What are the determinants of this inertia?

In some cases, the complementary resources to be mobilized are codifiable knowledge developed by other actors, which are possibly protected by patents or under trade secret law. If access to the resources may be problematical (necessity of negotiating licences or of developing classic market relations [purchase/sale of the patented good], and, in the case of trade secret, necessity of resorting to industrial espionage), the fact that these resources are spatially distant is not a problem in itself. In the case of patents, for instance, access to the base of patents registered is enough to have them at disposal. Other things being equal, there is, therefore, no spatial proximity constraint. When the resources are material (intermediate goods or equipment manufactured by the companies), their accessibility is also quite high, depending however on the existence of transport infrastructures, means of transport, costs, times of delivery and transport quality.

Figure 1: Nature of Resources and Degree of Spatial Inertia



In other cases, the resources that are searched for are tacit individual competences. They are in the hands, rather than in the head, of some individuals. Only the recruitment of these persons will permit to have their competences at disposal. The problem of access to these competences is therefore most of all a problem of labour mobility, which we know is stronger in some territories than in others, and is organized along more or less structured migration networks.

Another category of resources corresponds to tacit competences too, but which cannot be acquired through the simple recruitment of some key individuals. We refer here to organizational competences accumulated in certain organizations. Any firm looking for such competences will therefore have to coordinate with them in a more or less frequent and close way.

4. The Modes of Coordination

The companies that launch into an innovative project are also faced with coordination problems. Transactional problems first: we refer here to the questions relating to information collection, negotiation and contract supervision (Coase, 1990). Cognitive problems then: how is it possible to ensure the dynamic compatibility of the complementary competences involved in the project?

In order to solve their coordination problems, the actors may rely on two fundamental forms of coordination (Bouba-Olga and Grossetti, 2006). The first of these forms of coordination is constituted by the social networks: the structure formed by the aggregation of personal relations influences the exchanges and the possibilities of coordination. Here are found all the contributions of economic sociology on the place of networks in economic action. The position of the various actors in the networks defines what we call a **relational proximity**.

But the actors do not only coordinate through social networks. They may also rely on systems which permit to exchange without mobilizing relational networks. That is what we call **mediation resources**¹, thus taking up a denomination stemming from the sociology of innovation², more particularly the works of Franck Cochoy on “market mediations” (Cochoy, 2002). Taken as a whole, these mediation resources structure what we shall call **mediation proximity** here.

Let us note that in both cases, we base ourselves on the idea that the actors do not take all possibilities into consideration: they act in terms of limited rationality by opting for the solution they consider satisfactory (Simon, 1959). More precisely even, they « build their decision-making process on the basis of the information they are likely to collect in their neighbourhood » (Pecqueur and Zimmermann, 2004, p. 22). In other words, they act in terms of **situated rationality** by relying on the proximity relations (relational proximity and mediation proximity) which they have with other actors. The definition of the innovative projects, the identification of the complementary resources that need to be mobilized, the identification of the partners who may potentially be mobilized, the way to coordinate with them, ... all depend on the actors' **situation**.

Let us add that this situation is not an objective fact which forces itself on the analysed entities: it is subjectively perceived by them, it is the product of their own story (our argument here is closely akin to the notion of quasi-routine or dynamic routine as developed by the evolutionary literature).

Another essential point is that these two basic forms of coordination do not relate to the same level of action: relational proximity concerns the individuals, and only them. Mediation proximity, however, may concern individual entities, but also, of course, collective entities like companies, groups, intermediary collectives (shareholders, managers, salaried employees, ...), etc. We set out to take into account, to distinguish and link up the various levels of action. To do so, we propose to confine ourselves to the individual and collective levels, for simplification's sake. In

¹ That is what we could also call institutions if we decided to go by the latest works of economy. But this would call for a more thorough discussion of the two terminologies.

² By this word, we refer to the works initiated by Bruno Latour and developed, among others, by Michel Callon, Antoine Hennion (who theorized the notion of mediation), Madeleine Akrich and various other authors who are members of the Centre for Sociology of Innovation or who are close to that team.

this way, it will then be possible for us to study some essential elements of the organizations' dynamics, which are at the root of the switch from one level of action to another.

The distinction between relational proximity and mediation proximity may be illustrated by the classic example of the labour market. A recurrent result of the research studies carried out in that field is that an important proportion of employments are found through networks of personal relationships. In his work on a population of Boston suburban executives, Granovetter assessed that proportion at 56% (Granovetter, 1974). In a supplementary analysis of the INSEE's employment surveys, Michel Forsé assessed that proportion at 35% for a representative sample of the French population. Relational proximity therefore plays a significant part in access to employment. But it is not sufficient. Another part of employments are found through unsolicited applications, job advertisements, recruitment agencies, etc. To send an unsolicited letter of application, it is necessary to have a minimum of information on the company, which can be found by word of mouth (relational proximity again), but also in directories or in the press. Job advertisements are managed by newspapers. Recruitment agencies spend their time putting in touch future employers and employees who were not in contact before. The newspapers, directories, means of communication (Internet, telephone, post office, etc.), the human intermediaries of recruitment and employment agencies constitute, in our eyes, mediation resources.

On a subject closer to ours, Grossetti and Bès (2001) find similar results. They have conducted a survey on the genesis of the relations between public research laboratories and private companies on the basis of interviews relating to 130 science-industry collaboration stories. They grouped together the various cases they had found into 3 main categories: i) first contact through social networks; ii) first contact through intermediary organizations; iii) first contact through mediation resources. We mean to group together here the two latter categories, which correspond to two possible forms of what we described above, in a more general sense than Grossetti and Bès, as mediation resources. In 44% of cases, the actors get in touch through a relational proximity. In 56% of cases, it is a mediation proximity that is activated. In 80% of cases, the social relations were struck up within the education system (relations between students or between students and teachers) or within the professional world (former colleagues), the balance corresponding to family or friendly relations. In another study turning on the creation of innovative companies (analysis of 40 company creation stories), Grossetti et al. (2006) show that, to have access to the resources necessary for the development of their project, the people who set up companies use their social network in 55% of cases, and mediation resources in 45% of cases.

5. The Articulation of the Various Forms of Proximity

The two basic forms of socioeconomic proximity (relational proximity and mediation proximity) are not necessarily of spatial essence. Following the analyses in terms of proximity (Pecqueur and Zimmerman, 2004; Gilly and Torre, 2000, ...), we consider, on the contrary, that an essential methodological issue of spatialized analyses is not to postulate a priori an overlapping of the various forms of proximity, but to identify the conditions of their overlapping or their disjunction.

In some cases, the effective implementation of the innovative project goes through the activation of the social networks. The geography of innovation then depends

strongly on the geography of the social networks. If the latter are localized (overlapping of the relational and spatial proximities), there will be the development of localized technico-economic relations. If, conversely, the social networks go through territories (disjunction between the relational and spatial proximity, like in the case of diasporas for example), the innovative projects will be transterritorial. In other cases, the implementation of the project goes through the resort to mediation systems. This time, it is the spatial expanse of these systems that counts. Some of them permit to get in touch with actors situated in the same city, others with actors situated in the same region, and some others with actors of the same country, etc... In all cases, we understand that the geography of innovation depends fundamentally on the underlying geography of the coordination systems: geography of the social networks on the one hand, and geography of the mediation resources on the other hand.

What do empirical studies teach us on that subject? Concerning the social networks first, most studies emphasize their highly localized nature: the proportion of local relations (less than an hour's drive between the locations of both protagonists) goes from 67% in Fischer's study (1982) on the Californian population up to 83% in a study carried out in Toulouse under the same methodology (Grossetti, 2002). That proportion is of 75% in Wellman's earlier study (1979) on a sample of Toronto inhabitants. Social networks are largely local so that the probability of relations between socially-embedded organizations being local is very strong. Concerning the mediation resources, to our knowledge, there is no empirical study assessing the respective weight of the local, regional, national resources. We know that these resources may potentially go from a local scale (local newspaper) to a global scale (Internet directories), but we do not know their respective weight and we do not know either whether the systems implemented on a given spatial scale permit to get in touch with other actors/resources situated on the same scale only, or whether they have a broader sphere of intervention. In the case of European countries, we may put forward the hypothesis of the predominance of the national scale owing to the setting up of numerous systems, on that scale, between 1945 and 1975. This is actually the hypothesis which Lundvall sets out (1992) to justify the analysis of **national** innovation systems. Other essential mediation resources in the innovation process tend to deploy on a local scale, as Saxenian shows (1994) in his study on the Silicon Valley. The politicians' craze for district logics or, more recently, for cluster logics, probably tends to reinforce the weight of the local or regional systems.

Grossetti and Bès (2001), in their study on the genesis of the relations between public research laboratories and private companies, put forward more precise results. In addition to the distinction between relational proximity and mediation proximity, they have classified the spatial expanse of the relations into 3 categories depending on whether the two entities were located in the same region (case 1); whether one entity was located in a region and the other in the Paris area (case 2); or whether both entities were located in two different regions (or countries), outside the Paris area (case 3). Here we propose to group together cases 2 and 3 which correspond to the development of relations without spatial proximity (spatial proximity being defined by the fact of belonging to the same region). We finally obtain a cross results table showing spatial proximity (strong or low), relational proximity and mediation proximity, as follows:

**Table 1: The Spatial Scale of Science-Industry Relations
(Source: Grossetti and Bès, 2001)**

Number of Relations		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	24	16	40
	Low	24	46	70
Total		48	62	110

Row Percentage		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	60%	40%	100%
	Low	34%	66%	100%
Total		44%	56%	100%

Column Percentage		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	50%	26%	36%
	Low	50%	74%	64%
Total		100%	100%	100%

Several results are worth underlining: i) Local relations count, but they have a significantly lower weight than non-local relations (36% against 64%); ii) Relational proximity and mediation proximity both count in the fact that the actors get in touch, with a slightly higher weight for mediation proximity (56% against 44%); iii) The mediation proximity/spatial proximity overlapping is less frequent than the relational proximity/spatial proximity overlapping (26% against 50%).

The other study which has already been quoted (Barthe et al., 2006) on the creation of innovative companies shows the following results:

**Table 2: The Spatial Scale of Relations for the Creation of Innovative Companies
(Source: Barthe et al., 2006)**

		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	258	194	452
	Low	75	75	150
Total		333	269	602

		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	57%	43%	100%
	Low	50%	50%	100%
Total		55%	45%	100%

		Relational Proximity	Mediation Proximity	Total
Spatial Proximity	Strong	77%	72%	75%
	Low	23%	28%	25%
Total		100%	100%	100%

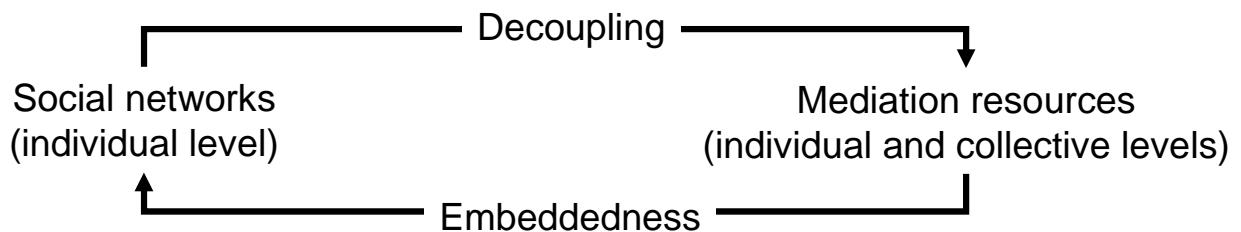
In comparison with the previous study, it is worth noting the important weight of local relations, whether initiated through the activation of a relational proximity or of a mediation proximity. The study subject (creation of innovative companies vs. science-industry relations) probably explains that result to a great extent. We also find the idea that the two forms of proximity are activated considerably and that relational proximity combines more frequently with spatial proximity.

6. Embeddedness and Decoupling

Beyond this static characterization of the entities, resources and modes of coordination, the main issue in terms of research is to wonder about the dynamics of the so-described system, more particularly about the interactions between relational proximity and mediation proximity. Hagerdoorn (2006) takes a similar approach by distinguishing various levels of embeddedness (environmental embeddedness, interorganizational embeddedness and dyadic embeddedness) and by underlining « the importance of a theoretical analysis of the role of embeddedness that focuses on the complex interaction effects of different levels of embeddedness, leading to a cross-level understanding of interfirm partnership » (p. 670). For our part, we propose to keep the distinction between the two basic levels of action (individual level vs. collective level) – it being understood that the collective level could be broken down later for applied analyses – and to base ourselves on the converse processes of embeddedness (Granovetter (1985)) and decoupling (White, 2002; Grossetti and Bès, 2001) with a view to understanding the dynamics of the system of actors.

Embeddedness corresponds to the idea that the economic relations between the actors are often based on a pre-existing network of social relations, as we saw with the example of the labour market, as well as in the studies on the science-industry relations or on the creation of innovative companies. In all cases, mediation proximity develops on the basis of a pre-existing relational proximity. In a way, decoupling corresponds to the converse process. Let us consider again the example of science-industry relations: once the first partnership contract has been established, both entities may continue collaborating together (development of new contracts which are comparable to new mediation resources), even if one of the actors, or even the two of them, leave the organization to which they belonged. The development of interorganizational relations is free from the underlying social network.

Figure 2: Embeddedness and Decoupling



To our knowledge, there is still no thorough statistical study which would permit to assess the importance of these phenomena of embeddedness and decoupling. But we have at our disposal first empirical elements which permit to identify them. Grossetti and Bès (2001), first, observe processes of embeddedness and decoupling in certain science-industry relations stories. Here is for instance the story of one of the relations presented by Grossetti (2006): “Thomas, a student seeking to write a thesis in a laboratory attached to an engineering school, used his own means to find a manufacturer willing to co-fund his thesis rather than relying on the customary laboratory relations. He mobilized his father who worked in a firm in the aeronautical sector, who put him in contact with one of his colleagues, the head of a research department. The student then put this department head in contact with his professors, and the thesis received its funding. The thesis consisted of adapting a modelling method and a specific software the laboratory had taken to using to the needs of the company. Once the thesis was under way, other students associated

with the lab were recruited by the company and pursued the work begun by Thomas, and the relation between the company and the lab was institutionalised by an agreement. The relation between the two organizations was decoupled from the individual relations in which it had been embedded at the start”.

Bouba-Olga (2006) develops a similar example relating to the development of subcontracting relations between French principals and Turkish subcontractors in the textile-garment industry. Ari Gürman, the manager of the Turkish company Bolero, spent ten years in Paris, in the Sentier quarter, where he worked in a textile company. Over that period, he built up a network of socioeconomic relations which he then activated on his return to Turkey to find his very first customer: “Thanks to my network in France, I found my first customer, a French company which ordered from me dresses, skirts and blouses that were eventually sold to mail-order organizations (La Redoute, Blanche Porte, Daxon, ...)” (interview for *Le Figaro Entreprises*, 2002). Here is therefore observed an embeddedness of this individual within a transterritorial social network, which enabled him to build up a first set of economic relations with France. But the story does not stop there: “At the end of three years, as my intermediary wanted to reduce my prices, I contacted some other companies and started working directly with them”. This second stage of the company’s story may be regarded as a decoupling process since the new economic relations no longer rely on the initial social network.

The processes of embeddedness and decoupling correspond to essential operators of the change in organizational forms: change in the level of action on the one hand (change from the individual level to the collective level, and vice versa); change in the forms of proximity on the other hand (change from a relational proximity to a mediation proximity, and vice versa). An essential issue of future research studies will consist in showing that this change in organizational forms may sometimes lead to a change in their relationship with space.

7. Conclusion

We proposed here an explanatory outline of the innovation activity agglomeration phenomena and the coexistence of local and non-local relations.

Rather than insisting on the tacit nature of knowledge, we emphasized the key role of relational proximity and mediation proximity. In some cases, these forms of proximity combine with a spatial proximity, which explains the agglomeration of innovation activity. In other cases, they distinguish themselves from spatial proximity, which explains the coexistence of local and non-local relations.

We also underlined the relevance of analysing the interactions between the various forms of proximity by basing ourselves on the notions of embeddedness and decoupling. It is then obvious that one of the main issues in terms of research is to carry out systematic statistical analyses with a view to identifying and assessing the importance of such processes.

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