Rallet A., Torre A., 1998, On Geography and Technology: Proximity Relations in Localised Innovations Networks, in Steiner M. (ed.), *Clusters and Regional Specialisation*, Pion Publication, London.

On Geography and Technology.

The Case of Proximity Relations in Localized Innovation Networks[♣]

Alain RALLET*/André TORRE**

* University of Bourgogne & IRIS (University of Paris-Dauphine)

** Institut National de la Recherche Agronomique, Paris

E.Mail: *Alain.Rallet@dauphine.fr/**Andre.Torre@wanadoo.fr

Abstract

This paper intends to start the discussion about the role played by the geographical proximity in the process of technological transfer, a conventional argument often regarded as the explanation of the high degree of concentration of innovative activities. The theoretical assumption that geographical proximity is as a necessary condition for an efficient share of knowledge, especially in the case of tacit knowledge intensive activities such as innovation has to be put under closer examination. The paper explores this discussion into two main directions. In the first section, it is asked if advances in information and communication technologies change the need for geographical proximity between knowledge users. We show that another kind of proximity - organizational proximity - combined with the mobility of human resource is an alternative basis for knowledge exchange that no longer requires permanent co-location. The second section enhances this thesis by examining the role of geographical proximity in the networks of innovation. Lessons drawn from case studies on localized networks of innovation supported by public institutions in three French regions reveal that organizational proximity appears as a stronger support of technology transfer and innovation diffusion than geographical proximity. As a conclusion, new directions for local development policies are suggested.

Introduction

The concern for the relation between geography and technology is nowadays one of the major focus points in spatial economics and gives rise to a number of valuable researches. During the 80's and the 90's, many studies have been devoted to such topics as innovative milieux (Ratti and al., 1997), technological districts, technopoles and science parks and, more generally, to localized systems of production and innovation. More recently, certain works in the field of economic geography put the stress on the spatial consequences of technological spill-overs and proposed new measures concerning the relation between academic research and location of R&D expenditures at the level of the firm (Audretsch and Feldman, 1996).

♣ This research has been partly supported by the Commissariat Général du Plan (grant n°17-95) as part of the programme « l'entreprise et l'économie de l'immatériel ». The help and support are greatly acknowledged.

The works performed in the so-called domain of geography of innovation put the stress on the role played by geographical proximity[1] in the process of technological transfer, be there between private firms or public bodies. They are based on the idea that geography provides organization for the diverse types of knowledge needed for production and commercialization, but also on the assumption that "knowledge transverses corridors and streets more easily than continents and oceans" (Feldman, 1994). Whereas information may be transmitted across distances, to transfer knowledge needs communication and repeated interactions. It is assumed that this process of trial and feedback is facilitated by face-to-face interaction, which permits reciprocal exchanges, negotiations and deep communication during the complex process of innovation. In most of these papers innovation is regarded as a cognitive process, which implies, in particular during first stages, a strong uncertainty requiring the building of common codes. Spatial dimension takes place here, for it is assumed that this process is enhanced by face-to-face interactions and thus by geographical proximity.

This assumption is supported by theoretical arguments borrowed from "the economics of information and knowledge" (Foray and Lundvall, 1996). As a result, proximity and location matter because of the specific nature of exchanges between agents involved in R&D or innovative activities. Indeed, if information and knowledge are mainly what is exchanged between these agents they are not public goods freely diffused in the economy as suggested by Arrows (1962). More precisely a crucial distinction has to be made between two kinds of knowledge, namely tacit and codified knowledge (Polanyi, 1966). Usually, « tacit knowledge refers to knowledge which cannot be easily transferred because it has not been stated in an explicit form » (Foray and Lundvall, 1996) while codified knowledge – or « information »- is reduced to messages which can be easily transferred between economic agents through non human supports. It is assumed then that codified knowledge can be exchanged regardless of distance by using technologies of communication, be there old (postal mail) or new (electronic mail, computer conferencing...). At the opposite, to transfer tacit knowledge requires to share a common work experience through face to face relations. As a consequence, geographical proximity appears as a necessary condition for an efficient share of knowledge, especially in the case of tacit knowledge intensive activities such as innovation creation and diffusion.

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[1] The term "geographical proximity" can be matter of confusion as distance is a relative notion and can be measured by different ways. In this paper, a conventional definition of "geographical proximity" is adopted : economic agents or individuals are considered geographically closed when they can have daily face to face relations.

This paper intends to start the discussion of this argument, which can be regarded as the conventional explanation of the high degree of concentration of innovative activities. This major theoretical assumption - because of the need to transfer tacit knowledge - has to be put under closer examination. The paper explores this discussion by two main directions.

In the first section, it is asked if advances in information and communication technologies (ICTs) change the need for geographical proximity between knowledge users. It is claimed that recent advances in ICTs alleviate to some extent this constraint even if it remains rather strong. More important is the argument that there are other supports of tacit knowledge exchanges than permanent location at the same place. Another kind of proximity - what we called organizational proximity - combined with the mobility of human resource is an alternative basis for knowledge exchange that no longer requires permanent co-location.

The second section enhances this thesis by examining the role of geographical proximity in the networks of innovation. Localized networks of innovation are usually regarded as an efficient framework of transfer and innovation diffusion. It is the reason why local development policies are often focused on the networking of local producers and users of technology (firms, universities, public research laboratories...). In this section, lessons are drawn from case studies on localized networks of innovation supported by public institutions in three French regions (Corsica, Aquitaine, Rhone-Alps). The conclusion is the same as the one of the first section : organizational proximity appears as a stronger support of technology transfer and innovation diffusion than geographical proximity. As a conclusion, new directions for local development policies are suggested.

1- Coordination mechanisms in innovative and research activities, information and communication technologies and the geographical proximity constraint

This section analyzes the need which economic agents have to be closely located to jointly develop activities of innovation considering the very fast development of technologies allowing remote coordination. To begin, the traditional thesis will be put under examination. According to it, the development of information and communication technologies (ICT) basically does not modify the constraint of geographical proximity which characterizes the activities of innovation (1-1) Then, this thesis will be criticized by showing that the advantages of physical proximity to coordinate economic agents can also be provided to a certain extent by other means of coordination (organizational proximity) and that ICT

increase to a significant extent the possibilities of remote coordination (1-2) Finally, some lessons will be drawn from case studies (1-3).

1-1 The traditional thesis: ICT do not call into question the need to be closely located

Remind us of the arguments which justify the role played by geographical proximity to jointly develop innovative and research activities :

- these activities are characterized by the important weight of tacit knowledge
- the more tacit knowledge is, the more face to face relations are necessary
- the higher the frequency of face to face relations is, the more the need for permanent physical proximity is important.

The two criteria (the weight of tacit knowledge and the frequency degree of face to face relations) vary according to the nature of the activities and the stage of their development. Most of studies show that the need for being closely located is stronger in the first stages of the development process of research activities because of the importance of tacit knowledge during these stages.

The question is to know if ICT change this situation. It is usually suggested that ICT do not basically modify the need for geographical proximity. According to this point of view, ICT are only increasing long distance exchanges of codified knowledge. From a remote location, it is rather easy now to be connected to databases, to read technical instructions or working papers, send texts, data or pictures... Consequently, it is expected that ICT increase the scope of remote coordination in so far as it is mainly based on exchange of codified knowledge. But as the research activities imply also intensely exchanges of tacit knowledge, the geographical proximity constraint remains very strong.

However, it could be argued that ICT increase the possibilities of remote coordination in so far as they are a powerful mean to turn tacit knowledge into codified knowledge (for instance conversion of tacit knowledge into expert systems and know-how databases, storage of organizational knowledge on CD ROM, automation of routines by the mean of *workflow* software....). If such were the case, the geographical proximity constraint would become less and less strong.

It should for that be supposed that ICT can reduce gradually tacit knowledge considered as a given stock. However that is impossible for four reasons:

- The process of coding knowledge implies a cost which is a growing function of the tacit degree of knowledge. It is often more efficient and less expensive to rely on tacit knowledge exchanges than to codify it in order to transfer it easily (see the limits of expert systems, cf. Hatchuel and Weil, 1995)

- Advances in science and technology constantly rebuild new tacit knowledge. As a matter of fact, the development of science and technology takes the form of emergent knowledge which cannot be immediately codified. The domination of tacit knowledge in the first stages of its development explains why knowledge cannot be easily transferred from an individual to another individual or from a team to another team. That is the reason why invention and innovation are so much concentrated in some places.

-Tacit and codified knowledge are complementary. As Nonaka (1994) underlines it, the transmission of codified knowledge supposes to use and to share common tacit knowledge. Conversely, the transfer of tacit knowledge is based on the use of codified knowledge.

- Lastly, the use of ICT tools requires to share common codes and practices of communication which are tacit. This is why the tools of remote communication are especially used by individuals who frequently meet.

For all these reasons, tacit knowledge will be always used in the research and innovative activities. Consequently, face to face relations prove to be necessary to this kind of activities. The geographical proximity constraint thus remains strong.

Conclusion : one has to expect an extension of the geographical scale of the coordination process in the research and innovative activities thanks to the possibility of remotely sharing codified knowledge. But the development of ICT does not basically modify the need for face to face relations owing to the important weight of tacit knowledge in these activities. Geographical proximity remains an necessary and important tool of coordination.

1-2 Geographical proximity as a relative and less and less strong constraint

Two arguments come to moderate the above thesis. The first one underlines the possibility of satisfying the need for physical proximity by the temporary mobility of individuals, i.e. by travels, and not by permanent co-localization. The second one puts the stress on another kind of proximity (organizational proximity) which allows the sharing of tacit knowledge between remote locations.

- The need for a face to face relation to exchange tacit knowledge does not imply that individuals are closely located. It implies only that individuals often meet. In certain circumstances, the problem can be solved by the mobility of individuals. It is the case when the frequency of tacit knowledge exchange is not very high. Then individuals can move at the time when this exchange must be carried out. Their locations continue to be determined by other factors: proximity of production centers, market places, specific scientific or technological resources or historical and institutional factors... This case is frequent : to design and to develop a product, firms constitute project-oriented task forces based on teams gathered temporarily and belonging to different plants. Individuals of the task force meet at the beginning of the process then only at defined moments (to make a synthesis, to pass to a new stage, to redefine the project...).

Alternation between moments of proximity coordination and moments of remote coordination is supported by the decrease of transport costs and the development of high speed means of transport. Temporary mobility appears thus as an effective solution to coordinate individuals having to share tacit knowledge.

- Geographical proximity is not the only kind of proximity which makes it possible to share and to exchange tacit knowledge. There is also a kind of proximity created by the membership of a same organization or a same professional community, which we call *organizational proximity*. Organizations are characterized by collective value systems and representations of the world ("corporate culture") which tend to homogenize individual behaviors in given situations. They develop in the same way a homogeneous technical culture, i.e. common ways to think and solve productive problems. This collective and technical culture guarantees that employees will spontaneously give the same interpretation to exchanged data or text, even if they are located at different places.

One can even suggest that organizational proximity is a much more effective support of tacit knowledge exchange than geographical proximity. Indeed, it is well known that individuals can be closely located and nevertheless behave like foreigners. Geographical proximity is effective only if it coincides with the existence of organizational relationships. Whereas at the opposite, one can imagine individuals sharing common tacit knowledge without being physically close.

Geographical proximity is not the only support of coordination, especially for research and innovative activities. This argument is strengthened by the use of ICT to coordinate individuals and teams.

As we saw, the traditional thesis claims that ICT support codified knowledge exchange. For this reason, they widen considerably the potential scope of remote cooperative work or activities (search for new partners, large access to knowledge databases, teleconferencing, codification of cooperative work procedures...). But on the other hand they are supposed to have a weak impact upon the exchange of tacit knowledge (except if it can be codified by ICT). The need for tacit knowledge exchange continues to lock the door of extensive remote cooperation.

But this argumentation does not take into account one of the most important changes brought by ICT during these last years, i.e. their ability to support exchanges of tacit knowledge. However we have to be careful with this assertion. We must keep in mind that ICT are not a simple substitute for in-person contact. ICT and especially computer-mediated communication are characterized by limited social presence. Indeed, social presence cannot be easily recreated by ICT tools. Many studies showed it by comparing face to face relationships with mediated situation of communications in laboratory simulations (psycho-behaviorist approach) or by analyzing in context these two situations within the framework of an ethnological approach (on this subject, see the surveys of Garton, Wellman, 1996, Wellman and alii, 1996, Cardon, Licoppe, 1997). Face to face meetings and computer-mediated situations of communication are never equivalent. As a result, the need for geographical proximity cannot be totally eliminated by the use of ICT tools.

Nevertheless ICT can be used to support the exchange of tacit knowledge and informal relationships. For instance, the practice of computer conferencing or e-mail does not replace face to face meetings but creates new kinds of social contacts and even interpersonal relationships between persons who are physically distant. ICT increase access to new people, provide individuals with new opportunities of contact and facilitate social networking by weakening social, spatial and temporal barriers (see the use of e-mail, newsgroups, forums, discussion lists... on Internet). It is no longer possible to identify ICT and formalized communication as it was usual to do it before the development of Internet. Other examples of ICT supporting the exchange of tacit knowledge can be quoted. For instance, ICT generates redundant information which is generally presented as one of the main advantages of geographical proximity because it provides the capacity to build up social ties like bridges between informal sources of information. Lastly, some ICT tools such as hypertext are based on cognitive processes similar to those which characterize tacit knowledge, for instance the use of metaphors (on the characterization of tacit knowledge by metaphors, cf. Nonaka, 1994) or the analogical way of reasoning.

Consequently ICT are not used only to support strong ties by codified relationships but also to support weak ties by informal interactions. Thus we know the important role of weak ties to set up, to regulate and to widen social networks and professional communities in the field of research and innovation. So ICT raise the capacity to develop new ways of tacit knowledge exchange between physically distant individuals or teams. The possibilities of coordination through space are improved thanks to this capacity. This could be one of the major impacts of ICT on location patterns.

However it must be repeated that ICT do not eliminate the need for face to face meetings. They generate a dynamic complementarity between face to face meetings and distant coordination. It is well known that the development of distant coordination by the means of ICT increases the incentives for people to travel in order to have face to face meetings. This rule is particularly true in the field of research and innovation : in many cases of telecooperation, airplane tickets are the main item of the teams budget. ICT thus reinforce the probability for coordination to be supported in an alternate way by mobility and distant coordination. In this perspective, the crucial location factor for individuals or firms engaged in cooperation is not to be physically closed to partners but to be located close to high speed transport infrastructures which allow them to meet when it is needed. It is what our case studies show us.

1-3 A few lessons drawn from case studies

Two case studies are related to development and research projects. The first one is focused on the case of a graphic data processing company (Silicon Graphics) whose centers of R&D are distributed on 5 world sites. The purpose of their cooperation is to conceive and to develop graphic animation software. The second one is related to the design and the development of a videoconference system by CNET (National Center of Studies for Telecommunications, France). This project needs the cooperation of four research centers located at different sites.

The third case study is on the constitution by a Corsican Studies Center (CIRVAL) of an expert database on specific agricultural products. The database is fed and consulted by research and studies centers located around the Mediterranean basin.

Finally a questionnaire was addressed to academic researchers and teachers of two French universities, the university of Bordeaux I (physics and chemistry) and the university of Bordeaux II (biology and medicine). The questionnaire was focused on the communication practices of academic people in the framework of their research projects.

Some conclusions can be drawn from these four case studies:

1) *the geographical constraint of proximity is especially strong for research projects carried out within the university community.*

The need for frequent interactions is important throughout the whole process, not only for specific stages such as the browsing of the subject, the definition of a common framework or the conclusion of the process but also for the implementation stage for which the solution of a short, medium or long term stay at the same workplace is often used. This is due to the importance of tacit knowledge used through the frequent mutual adjustments between researchers at all the stages of research projects. The high weight of tacit knowledge can be of course explained by the importance of basic research in these projects but also by the organizational characteristics of academic communities. The weak division of labour which characterizes them leads to many overlapped tasks and as a result to the need for partners to carry out frequent mutual adjustments all over the project. This need is reinforced by the absence of an strong authority able to solve the problems of coordination. Whatever they be important or not, these problems must be regulated by a direct and consensual dialogue between researchers.

ICT do not change this situation basically. The need for frequent mutual adjustments explains why communication is mainly supported by the use of "rich media" such as face to face meetings, telephone, fax, electronic mail and electronic forums. "Poor media" , i.e. those which imply formalized and codified relationships, are practically not used. It is the case of groupware tools and other techniques of communication based on the respect of heavy organization constraints.

2) *The more informal the organization of the project is, the more difficult the remote coordination is*

The CIRVAL example shows the difficulty in cooperating remotely through the sharing of knowledge databases within rather informal communities. The reciprocal and decentralized basis of Internet - I put on the network information in exchange of other information I can catch there (network externalities) - is adapted to information and knowledge which is already made up and available. Difficulties appear when the network is used as a decentralized means of knowledge production. Such an attempt immediately highlights organizational problems : who are the actors who will make the effort to produce knowledge for the network ? which are the incentives to do it ? does exist sufficiently strong common interests to prevent free rider behaviors ? These problems are not technical but

organizational. They are hard to be solved when the community concerned by the network is not well organized. This is the case of the CIRVAL project.

3) *In the case of R&D projects within firms, the need for geographical proximity is relative and can be mainly satisfied by periodic meetings.*

When research projects are developed within organizations characterized by well defined objectives and strong central authority, geographical proximity is necessary only for specific and limited stages (both cases of Silicon Graphic and CNET). It is especially needed for the launching of the projects. In the upstream stage of a project, teams are engaged in brainstorming. During this stage, they are occupied to confront arguments, to convince and finally to converge towards the same position. At this stage, face to face meetings are required because the consensus is obtained much more quickly than through remote coordination even supported by ICT. Remote coordination by phone can be used during this stage but especially to discuss points of view related to a precise point within the framework of a bilateral relationship and not for long and multilateral discussions. Videoconference is more appropriate for technical meetings inso far as it cannot replace face to face meetings for complex discussions.

The face to face constraint is much less strong during the technical development stages. During these periods, tasks are defined and distributed prior to their carrying out, so that remote coordination becomes easier to manage. Adjustments between individuals or teams can be performed through remote coordination by using in a complementary way the whole range of ICT tools, from phone to specific cooperative software (groupware) and by moving when an important difficulty must be solved.

In conclusion, case studies show that :

- the need for being closely located remains strong for specific stages of innovation and research activities. That is due to some characteristics of these activities, namely the importance of tacit knowledge whose exchange implies frequent face to face contacts between partners but the weight of this constraint also depends on organizational characteristics. When work is divided into precise tasks, when the coordination of these tasks are under the control of a central authority and when partners share the same cognitive maps, the possibility of remote coordination increases

- the need for face to face contacts is not permanent and can be satisfied by periodic travels and short stays combined with the use of ICT to transmit codified knowledge and to develop new kinds of social networking.

Geographical proximity always plays a role but some of the needs for physical proximity can be satisfied more and more by the mobility of people and the use of ICT. One of the result is that functional needs for coordination are no longer a sufficient explanation of the high degree of geographical concentration of innovation and research activities.

2- The place of local networks in the process of technological development

We have seen that localized actors do not always need to be closely located to take part in a process of innovation and that the organizational proximity is as important as the geographical one. This result was obtained starting from the analysis of the role of information and communication technologies. One obtains an identical conclusion on the basis of the analysis of another geographical dimension of the innovation process, namely the role of local networks in the diffusion of knowledge and technologies.

In this section, we will try an assessment of local technological policies which plan to support the diffusion of knowledge and technologies by easing contacts between geographically closed actors. The weight of the geographical proximity will be relativized there too.

2.1. From the importance of local networks of innovation to the institutional support for these networks

It is nowadays widely assumed that local networks play a major role in the economic and technological development of regions. This idea gives birth in the economic literature to an increasing use of concepts such as local networks, localized systems of production, local systems of innovation, etc. All these concepts rest on the importance of geographical proximity relations in the setting in network of the actors of the innovation.

Because they are convinced of the importance of these local networks, the public actors developed regional technological policies directed towards the support or the installation of collective processes of research and innovation. The policies having for objective to share knowledge or competencies within a local framework supplement from now on the traditional policies dealing with material infrastructures. The development of collective networks of actors is thus supported by the local or regional institutions. One must however wonder about the relevance and the limits of these local technological policies. Their implementation reveals indeed several obstacles that we will examine. The major one relates

to the connection between spontaneously created local networks and local networks developed by the institutions.

The spontaneous local networks are a regrouping of local actors around one or several joint economic projects, according to a non market form of organization. The links are generally not based on contracts or completely explicit agreements, but rather on the support of processes of co-operation or collective learning. The main purpose is a common interest for the production of a good, for the sharing of a technique, or for the search of information necessary to all the members. The exchanges mainly relate to the transfer or the sharing of knowledge and are made through trust relations.

The institutional local networks correspond to structures settled by public bodies in order to bring support to the firms. They concern flexible organization forms, founded on common acceptance of rules which engage the participants, among which one can make a distinction between the producers and the users of information and technological knowledge. The link between the participants in the network is materialized by an adhesion as well as an utilization of the services offered by an organizing cell which also plays an animation part of the whole network. One can find general or specialized networks.

There is a difference between technological policies according to whether spontaneous local networks already exist or not. When they do not exist or are poorly developed, the policy aims to impulse them, to even create them, by the means of incentives or voluntarist policies. When they already exist, the objective is to support their development by in particular supporting transverse cooperations between partners belonging to different worlds (industry, research, higher formation, technical centers...). In both cases, the objective is to connect a spontaneous network of economic actors and an institutional network impelled by the local authorities.

The relations between these two categories of networks, namely spontaneous and institutional networks, are illustrated for the following examples, based on the French experience.

2.2. Two examples of regional technological policies based on institutional networks

The first example is that of a Region, Corsica, *where the spontaneous local networks are poorly structured*. The case of the Aquitaine and the Rhone-Alps Regions where the spontaneous networks are already developed will be examined after.

In Corsica, the public authorities objective was to set up an institutional network in order to support the diffusion of knowledge and technologies. There exists for that in twenty French Regions the so-called Networks of Technological Diffusion (NTD) whose mission is to diffuse innovations and to support technology transfers. Their main objective is to help the SMEs to solve their innovation problems, be there related to the internal organization of the firms or to their relations with external partners (laboratories, Universities, other firms, public bodies...).

The network of innovation of the Corsican Region is most of all characterized by cooperations between local and " continental " firms. The connections between the local firms miss coherence because of the very narrow local market and the weak development of the science-industry relations. This weakness of local interactions shows that the search for competencies is the most important factor of interfirm co-operations. In this case such a search is done outside the Region when competencies do not exist or are very weak at the local level. The geographical proximity is not a sufficient condition to the existence of a system of innovating enterprises insofar as the local firms are obliged to seek competencies outside the Region. In this context, the support brought by the public institutions for the local firms is a major one and can take the form of government aid to the development of innovative firms. But the institutional support can be further trying to support the formation of a local network of innovators. It is the objective of the NTD.

Created in September 1995, the Corsican NTD rests on the following statement : not enough local firms have access to available technological competencies and use the device of innovation support. Its creation follows upon a dialogue impelled by the Local Authority of Corsica (Collectivité Territoriale de Corse) with the purpose of pushing NTD one of the major pieces of a strategy of technological development. The Corsican NTD was created to make it possible to SMEs to reach external innovation and technology competencies, to mobilize and to regroup local actors, but also to match their actions and to promote the activity of consulting. It aims to improve the efficiency of the regional devices of development aid and support, by easing collaborations and exchanges between the various operators in order to obtain synergetic effects. To fulfill its mission, it is thus based on « the network effect » as well as on the formation of human resource and the Technological Network Service, grant intended to encourage the firms to launch out in technological innovation.

The case of the Aquitaine and Rhone-Alps Regions is different because there exists already strongly structured spontaneous networks. Consequently, the role of the institutions is less generic and answers the need for supporting specific projects or poles, in this case Biological and Medical Poles (BMP).

The Aquitaine Region is characterized by an old system of high and average technology industries like pharmaceutical industry and medical equipment goods (surgery, medical imagery). Concurrently to this industrial pole, there are solids scientific and technological competencies in the field of health and life sciences. But these competencies are insufficiently developed and not articulated enough with the industry. In addition to the development of the infrastructures and human resources of scientific research, the industrial and academic actors thus sought to develop cooperations facilitating technology transfer. However, the setting of these networks appeared insufficient and was often poorly connected with local industrial competencies.

The innovation network of the Rhone-Alps Region occupies a foreground position in the activities related to the sectors of health. At the end of the Seventies, the Region was characterized by a strong presence of large pharmaceutical companies but also of firms specialized in medical goods or medical engineering activities. As regards hospital and R&D, the Region had an international reputation but the co-operation between the local actors was considered to be insufficient. The relations between firms, hospital and researchers were limited to traditional fields such as the drug industry. Construction of interrelations appeared essential in emergent sectors like the activities related to biomedical technologies. But the formation of these relations was complex because of the heterogeneity of the sector, thus the networks could not be led by the only industrial actors.

BMP poles of the two Regions (created in 1979 in the Rhone-Alps and 1987 in Aquitaine) are specialized networks, organized around techniques and specific products. Constituted, directed and coordinated by a local institution, they are intended to support the creation of a local technological milieu. Their actions consist in encouraging the relations between research, industry and public authorities in order to support innovation and encouraging the creation of internationally dynamic markets oriented firms.

These poles were at the beginning to intervene upstream of the chain of innovation, i.e. to support the relations between the public scientific laboratories and the firms. But they quickly changed and rather became providers of services in response to the needs expressed by local industries. Their intervention is now downstream. In 1993, the Rhone-Alps pole has been considered to be insufficiently efficient : the projects mainly associated public

laboratories and not industries. The Region then creates an Agency for biomedical technologies, the ARTEB, which gives the priority to industrial firms. The BMP Aquitaine followed the same evolution as revealed by the forming of an Health Strategic Action filiere whose objective is to shorten the delays between the R&D process and the industrial applications. This reorientation testifies to the desire to carefully listen to the needs of the industrial leaders.

2-3 From the initial objectives of the policies to the actual local networks

It is worth to put the emphasis on the fact that, in the preceding experiments, the policies do not always achieve the announced goals. In particular, one can up to what point wonder if institutional networks, which promote geographical proximity while considering that it supports the process of technological development, are able to encourage synergetic effects at the local level. From this point of view, the gap between the initial objectives and the actual networks exhibits limits of the power of the geographical proximity.

The investigations carried out in the three Regions show indeed that exist only partial re-covering between spontaneous and institutional networks and that, very often, the objectives originally defined by the public authorities have not been reached or have changed on the way.

The Corsican NTD gathers primarily the regional public actors who intervene in the field of technology. After 2 years of existence, it especially succeeded with better coordinating the practices and the research operations between these partners. Their image, their competencies and their fields of intervention became more readable for local economic actors too. Several firms however remain outside of this institutional network even if this is not linked with a lack of information. In fact, the institutional network is poorly articulated with the private actors networks because there are mainly non local ones.

Theses evidences reveal that in absence of strongly organized spontaneous local networks, the intervention of the public authorities to support local cooperations takes two main steps. The first one is to set up institutional networks in order to cope with the absence of dynamic economic environment and to organize assistance procedures for the local firms. These networks tend then to privilege an institutional functioning, i.e. to develop co-ordination between the public organisms specialized in the support for innovation without really articulating themselves with the local actors. As shown by the case of Corsica, the logic of partnership then remains largely centrifugal.

The analysis of the cases of the Aquitaine and Rhone-Alps Regions exhibits different relations between spontaneous and institutional networks. The problem is rather to put in synergy various actors of the process of innovation and production of knowledge.

In Aquitaine, the institutional networks suffer from an asymmetry between actual academic competencies and insufficient industrial activities. The BMP appears at the same time in shift compared to the spontaneous networks when they exist and in permanent search for a more solid anchoring. That condemns it to widen the field of its missions to the whole medical activities and to play on the connection with foreground institutional actors. In the Rhone-Alps, the existence of a strongly developed industrial system confers to the firms a prior role. The institutional networks have then two problems to define their place and their role. On the one hand, the firms relations largely exceed the regional area. On the other hand the industrial environment is heterogeneous with regard to the types of activities and the sizes of firms. Questioned on their relationships to the proximity networks set up to facilitate technology transfers, the firms, especially the smallest ones, consider them interesting but deplore a disconnection between too general collective interventions and their very specialised needs in terms of activities and markets knowledge.

We moreover stressed that the attempts to establish relations between various actors situated upstream of the chain of innovation failed and that the institutional networks especially attempted to offer services to the downstream firms (case of the BMP).

All that shows that it is difficult to connect, in a voluntarist way, the local actors belonging to different worlds. For example, the fact that doctors and entrepreneurs are located at a short distance is not sufficient to make them work together and constitute themselves in network, in spite of the efforts of the institutional actors. It is even observed that these efforts often lead to the opposite result. They end indeed up supporting homogeneous but distinct networks (the doctors, industrialists, chemists…) and thus give up their initial objective in spite of partial successes (a certain number of concluded contracts). The weakness of the relations between local actors is then likely to be reinforced and to lead to the maintenance of centrifugal logic's of cooperation. Once more, the geographical proximity is put in failure as a form of proximity organized for the activities of innovation.

2-4 Cognitive logic and importance of the organizational proximity

The case studies reveal the uneasy installation of local networks of innovation supported by public policies and show at which point it is difficult to impulse in a voluntarist way localized synergies in terms of innovation and of technology.

The fact that these policies had to deviate their initial objectives and to return to less ambitious goals shows that the often made analogy between geographical proximity and easy diffusion of the techniques or the knowledge must be seriously questioned, in particular if one connects it to the tacit or codified character of knowledge. It is clear that one of the aim of the regional policies is to impulse a technological development on the basis of voluntarist networks of local actors. It is not so simple, however, to break with organizational or cognitive logic's which function since several years.

Our results reveal two main obstacles for the installation of local networks of innovation supported by public policies (these obstacles make clear why these policies had to deviate from their initial objectives) :

- cognitive logic differences, or the importance of the organizational proximity :

One of the obstacles faced by local technological policies is to set up transverse co-operations between local actors of various nature (entrepreneurs, researchers, trainers...), as revealed by the experience of the BMP poles. The practices of work and cognitive logic's are very different from one world to another. Moreover tacit knowledge is more easily transmissible within a professional world (even at distance) than between different worlds (even in the proximity). Although it is supported by the voluntarist development of institutional networks, the sole geographical proximity is not sufficient to break these barriers. Consequently, the diffusion of knowledge and technologies assumes that exists an organizational proximity between the actors, i.e. former relations founded on professional links, these links having or not a local content.

Disjunction between researchers and firms whose cognitive logic's are strongly differentiated is striking in the Aquitaine and the Rhone-Alps Regions. It blockades the process of transmission of knowledge. The visions and expectations remain rather unmatched, the knowledge and the fields of application are heterogeneous. As a consequence, each group of actors only trusts partners with whom it is accustomed to work, even if they are located outside the Region and even if there are sometimes more skilled actors within the Region. The actors privilege the organizational proximity which is based on a long common experience of interactions and reciprocal learning and enables them to overcome the differences in cognitive

differences in cognitive logic's. Moreover, it is frequent that the required partner only exists in another Region, or even in another country, which limits the interest of the search for local relations, with or without BMP pole. Between the " territory " of spontaneous networks (which goes from the Region to the contacts on a world-wide scale) and the regional level of the institutional network, the interrelationships slowly build themselves.

- *the weight of the past :*

Thus, the organizational proximity does not necessarily have local foundations. For reasons linked with the way in which the local systems were constituted, the actors are often engaged in cooperations with partners external to the Region. They are accustomed to cooperate, a practice which results in the mutual knowledge of the men and the organizations, as well as by common procedures of work which proved reliable. Putting in contact actors who are geographically closed from each others is not sufficient enough if they did not keep organizational relations before.

The history of local relations counts (« proximity matters ») but also the history of the non local relations (« distance matters »). By forgetting that, the voluntarist technological policies often end up reproducing the situations to which they previously proposed to bring solutions. The example of the Corsican TDN reveals that it is unrealistic to seek to impose a fast technological development on an interventionist basis, and even more to support in a voluntarist way local interactions with the detriment of external contacts. This is why the current stage is that of an appropriation of new knowledge by the members of the institutional network. This stage is essential to build shared skills between them and because the development of projects and their realization start a second phase, of recombining of the former relations on the basis of now well defined coordination. Once again, the permanence of the organizational and professional trajectories are very impressive. The previous relations appear strongest and it is only if they imply at the same time a geographical proximity and an organizational proximity that it is possible to promote or to support them within the framework of a regional technological policy.

Conclusion :

The aim of this paper was to engage a discussion about the role played by the geographical proximity in the process of technological transfer, a conventional argument often regarded as the explanation of the high degree of geographical concentration of innovative activities.

Our starting point was to put under closer examination the theoretical assumption that geographical proximity is a necessary condition for an efficient share of knowledge, especially in the case of tacit knowledge intensive activities such as innovation has to be. We explored this discussion into two main directions.

In the first section, it was asked if advances in information and communication technologies change the need for geographical proximity between knowledge users. We showed that another kind of proximity - organizational proximity - combined with the mobility of human resource and the use of ICT is an alternative basis for knowledge exchange that no longer requires permanent co-location.

The second section enhances this thesis by examining the role of geographical proximity in the networks of innovation. Lessons drawn from case studies on localized networks of innovation supported by public institutions in three French regions reveal that organizational proximity appears as a stronger support of technology transfer and innovation diffusion than geographical proximity.

It appears that the role played by geographical proximity to set up and to develop networks of innovation has been overestimated in the economic literature. Consequences should be drawn for local development policies. It would be appropriate for them to diversify their orientation and to gradually move from the exclusive search for local synergies to more open strategies of development.

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