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The firm/territory relationships in the globalisation: towards a new rationale

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Abstract. – The aim of this paper is the presentation of an approach of firms-territories relationships in terms of firms' nomadism and territorial anchorage of technological and industrial activities. Such an approach is founded on the necessity to overcome the "volatile" firm's level of analysis, in which firm's mobility is investigated from the sole point of view of the leaven location. On the contrary, it should be relevant to focus on the firm's dynamics through its connections with the whole set of territories and to conceive the firm-territory relation as a result of the dialectic confrontation of the respectively concerned firm and territory both dynamics, both trajectories. Hence we are led to characterise the localised industrial unit as placed at the crossroad of a triple link: with a firm (or a group), with an industry and with a territory. Such a threefold coupling relies on proximity's effects, alternately from organisational and geographical nature, whose conjunction generates territorial anchoring and leads to the notion of productive encounter, in the sense of a capacity to formulate and give solutions to productive issues, within the context of firm-territory relationship. In terms of formal models, research works are at the very first step. Nevertheless, an approach in terms of "small worlds" seems to present very fruitful perspectives. We develop the foundations of such an approach and expose how it can provide a good framework to explain territorial anchorage and, more widely, the strength of clusters. A concrete illustration is extensively developed about SGS-Thomson Microelectronics group with regard to its productive site in Rousset, in the French Bouches-du-Rhône district.

Classification Codes: L23, L63, O18, R3, R58.

1. Introduction

The "globalisation" is a paradoxical phenomenon. At the same time national economies are led to open themselves to international economic circuits, territories, at a regional or local level, tend to acquire a renewed importance. In the field of industry and technology, the national reference progressively looses its relevance as the pertinent level, activities

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can be positioned regarding each other, to take hand in a common coherent system. Industrial organisation overcrosses the national borders and international investment flows are less and less aiming national markets. In such conditions, firms do not spread out their organisation in a homogenous world space, but decide of units mission and location according to the capture of local resources or cost advantages.

Consequently from the territorial point of view, the question is the durability of the firms' local activities. Over and above the questions of "territorial competition" to attract industrial investors, the key question is that of the capacity of territories to start up some endogenous processes of industrial and technological accumulation and to realise an effective "galvanisation" of the effects of a company's implantation on the industrial and technological development of the local structure.

It is clear that the immense progress in transport communication technology is a singular challenge to the locality of synergies and the geographical proximity of the actors. It is equally clear today that the relation to the territory itself seems to be subject to the implications of localisation/relocalisation processes in which some firms are engaged, following the cycles of products and technology. A famous example is that of the successive generations of micro-electronic circuits, but the question is the same for some industries with heavier products like the automobile industry (Lung, 1991). It is essential to analyse in what way the industrial and technological activities do, or do not tend to develop nomadism or anchoring with regard to the territories.

In the second section of this paper we will show how an analysis of the firm/territory relationship in terms of nomadism and territorial anchoring requires the implementation of a real dialectical approach, in which the different dimensions of proximity, depending on whether or not they manage to conjugate, appear to be the key to anchoring, or on the contrary to nomadism

The third section will aim to show the analytical foundations of the approach, considering the localised unit of the firm as "situated" at the crossroads of three forms of insertion, in a firm (or a group), in an industry and in a territory. We will arrive at the notion of "productive encounter" that generates the putting into practice of industrial (organisational proximity) and territorial (geographical proximity) dimensions of co-operation and reveals the territory as a pertinent space of industrial and technological activity.

The fourth section will propose to illustrate this problematic with the example of the firm ST- Microelectronics at Rousset (Bouches-du-Rhône).

Lastly in the fifth section, we will discuss about recent works, that could provide a framework for more formal models of those questions. These are parts of the economics of interactions field and are based on the social networks approach as well as of "small worlds" features.

2. Nomadism and territorial anchoring: the firm/territory dialectic

When it is effective, the territorial anchorage of a firm makes history and this founds a community of destinies. It is, as we know, the case in old industrial regions, with dominant industries like: steel in Lorraine and in the Northeast of England, automobile in

Franche-Comté, Piémont or Detroit. It is a community of destinies which binds the future developments to such a point that a company crisis becomes a territorial crisis. Industrial decline transforms itself ineluctably into a social drama. This same community binds the identity of a subsidiary or of an establishment to a territory, to the point where the latter is able to implicate itself beside other units of firms or groups in order to promote or defend a territorialised structure [1].

Today many big companies appear to be essentially nomad:

- Because they place themselves within perspectives of globalisation in which the territorial level should not in any way constitute a horizon. They put global strategies about "organisational architecture" in place, in opposition to a spatial division of labour based on individualised processes of successive localisation (Veltz, 1993).
- Because the context of uncertainty in which they develop their strategy requires an organisational flexibility that must break free of narrow territorial constraints (networks, localisation-delocalisation...).
- Because neither can they, nor do they want to assume the social consequences of their acts on a local basis, bearing in mind the requirements of current competitiveness. On the contrary they develop a behaviour of aversion to risk.

More generally some effects of irreversibility appear in territorialisation. The costs of leaving a territory are not negligible. The firms try to keep a certain flexibility and to avoid a geographical "lock-in". To do this, they try to preserve their freedom on a spatial level, a "nomadism" that becomes a component part in the firm/territory relationship.

At this point in our analysis, the concept of proximity, in its polysemic character, appears to carry a potential of analysis liable to pass the strict level of problematic devoted to the localisation of firms and attractiveness of territories.

All industrial activities proceed both from the exercise of a production activity, whose efficiency depends on the conditions of access to resources (relative prices of factors and accessibility) and to markets, and from a resource creation activity (productivity gains, technology, innovation,...) that aims to guarantee the durability of the former, whilst modifying the conditions of efficiency. Both these dimensions of industrial activity, which do not require a unity of localisation, suppose for a given company, the application not only of its own resources, but also the existence of relations of market (transaction costs) or off-market (co-operation), that create an organisational proximity (or even institutional) [2] in relation to which the company has to situate itself.

On the other hand, the efficacy of these market as well as off market relationships can see itself conditioned, or not, by the physical and geographical proximity of the actors concerned . This refers obviously to the transport costs (of goods and men) between sites but also determines the very conditions of the exercise of co-operation. Thus Rallet (1993) brings his attention to the role played by the "proximity constraints" in the innovation process. This takes us back to the spatial and territorial dimension of industrial

[1] This is the case in Scotland today in the domain of the electronic industry, see for example Buxton (1994).
[2] By "organization" we mean here the description of a techno-economical architecture, whilst by "institution" we refer to a system of production of rules and norms that underlie this organization but which do not necessarily implicate it.

activity. This dynamic of interactions, based on geographical proximity becomes then, an endogenous source for a local dynamic of growth (Torre, 1993).

The territorial anchorage of industrial and technological activities results from the conjunction between the aspects of organisational proximity, revealing of the industrial dimension, intra as well as inter firm, and the aspects of geographical proximity on which the territorial dimension is based. In this way, the problem of nomadism and territorial anchorage does not come under an exercise in examining the characteristic parameters specific to a firm, or an industry, in relation to those of a territory, with a view to knowing if coupling does or does not take place. It relies to a firm/territory dialectic in which an interaction is built, a reciprocal endogenesis, that will or will not found a dynamic common to the firm and the territory.

Going a bit further, we discover the richness of the contributions of a problematic, based on the concept of proximity. It is necessary to surpass the sole concern of the analysis of the agglomeration of the firms (which is fundamentally the one of the Economic Geography) to account for the interdependent character of the firms' global organisational strategies. In this way the supplier will not only seek to be localised near his client, but will determine his spatial functional deployment with regard to that of his main customers.

A significant example is the supply of masks in the micro-electronic industry (*cf.* Fig. 1). A firm such as DuPont Photomask is organised from the start on a global basis, on which it tries to establish its competitiveness. This organisation intends to take full advantage of the effects of proximity in each of its sites and articulates these within a global organisation. Circuit makers generally have at their disposal a specific service called "mask service" that intervenes in interface with the mask producers and whose essential skill is to "translate" the design specifications in the mask producer specifications. Within the mask producer's organisation, the customer service is in charge of this interface, as much to help the customer with his order and to check the content, as to help relations with the mask producer.

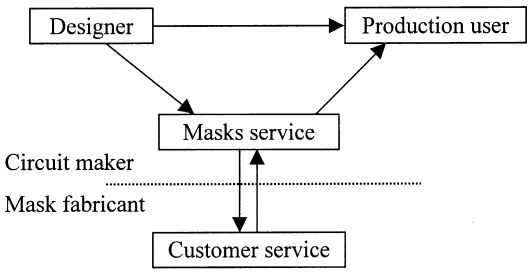

Fig. 1. *The supply of masks in the micro-electronic industry.*

Consequently, to benefit on the one hand from the proximity to the design centre, and on the other hand to the production site can be a real advantage to ensure both the quality and the time limits. But these two proximities can work in sites far away from each other,

the diagram below illustrates an ideal situation in the DuPont Photomask/ST-Microelectronics relationship (*cf.* Fig. 2).

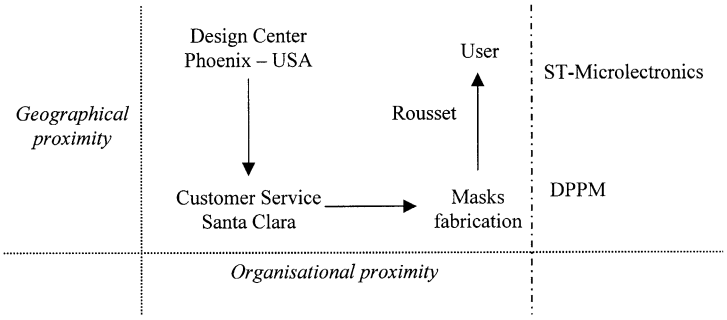

Fig. 2. *DuPont Photomask/ST-Microelectronics relationship.*

On the other hand, the presence of a major competitor in Scotland, of another in England and of a third one in Wales has pushed DPPM to build its own factory in Scotland. Here more than the cost of transportation, the competitive factor is that of the effect of the client/supplier interaction and the impact of transport time on the cycle time for the supply of masks in relation with the cycle time for circuit producers (12 hours to deliver from Rousset to Scotland on a cycle time of 8 to 24 hours for the production of masks and a cycle time of 10 to 12 days for a producer of specific circuits-ASICs).

Sooner or later these effects of interdependency determine the worldwide deployment and organisational modes of a given industry. That is a fundamental aspect of globalisation, too often erased in favour of a more generalised analysis of the internationalisation of productive and technological activities.

In the theory of localisation, the relation between firm and territory comes under an eminently static phenomenon which corresponds to the configuration of the firm and its technological and competitive environment at a given time in its history. On the contrary, the dynamic in the firm's trajectory is to be looked for in its relations to territories, that is to say precisely in its ability to play, as time goes by, with the differences and territorial specificities in order to found its own durability [3]. In other words with this approach the durability of the firm, or even its competitiveness depends precisely on its ability to keep its nomadic character (therefore the reversibility of its territorial commitments) and to use this. By its nomadic character, it dissociates its destiny from that of a given territory. Then it is the *nomadism* of companies that requires a problematic of territorial anchorage. The challenge, from territorial point of view is to surpass the idea that territorial anchorage clashes with flexibility, an idea that is precisely the main argument that pushes many companies to avoid anchorage, even at great cost.

[3] As far as the multi-establishment or multi-subsidiary firm (multinational group or firm) is concerned, the relation to territories also sets to work a use of territorial differences and specifications, but on a synchronic mode, that is to say in a set of complimentary factors.

So clearly we cannot limit our analysis to the viability of a firm/territory articulation taken as an implantation out of time, all things being equal elsewhere. The question raised here rejoins, in industrial economy, the one of the passage of a model of flexible specialisation to that of a dynamic flexibility (Coriat, 1990) and simultaneously refers back to the dynamic of innovation and to a double organisational dynamic of the firm and the territory.

In this way, our main hypothesis is that in the present conditions of industrial relations [4], the idea of a common construction, the idea of *collective learning* based on the *co-production of resources* is the one that can found a community of destinies between a firm and a territory.

If the dynamic of innovation and of technical changes constitutes the principle ferment of an eventual departure of the firm [5], a territorial anchorage can be conceived from the same dynamic. This will result from a shared investment on a common construction, from a process of innovation built up by giving importance to the effects of geographical proximity. Failing this, the innovation process which finds no territorial inscription will stay a dynamic peculiar to the company (and the industry) or will find its place elsewhere, in another territory. In any case, the innovation process "escapes" the territory under consideration.

Our aim is there *to reconcile the idea of anchorage with that of flexibility* (which is not a really new idea as shown in the example of industrial districts). We must counter the idea that the emergence of indivisibilities of a firm with respect to a territory could necessarily be a source of inflexibility and to show that the logic of anchorage is not one of fixation as that brought up in the paying off of investments was. This does not exclude the idea that at any time the firm is able to break this continuity, this common destiny, as the result of a trade-off in terms of opportunity costs and, this time, the terms are relatively different.

3. The triple insertion of the territorialized unit

The approach of firm/territory couples refers to the triple insertion (Fig. 3) and at various degrees of the unit (CGP, 1995):

- to a firm (a group): functional standing, technological and productive complementary relationships, autonomy *vs.* integration of the unit in the group...;
- to an industry: implications or not in an industrial organisation or in a market at a supra-local level: regional, national, European, international...;
- to a territory: from the simple logic of localisation/nomadism to that of anchorage.

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[4] One could certainly consider the factors such as a company director's attachment to a given territory. But we also know that when economical imperatives and rationality require it, the director's subjectivity even if he is the company's founder can be contradicted and at worst a firm can always get rid of its head or founder as numerous examples have shown especially after an entry in the stock-exchange.

[5] Which in no way means that it is the only type of reason that could push a firm to leave a territory (bad social climate, cost and quality constraints (manpower, raw materials...), loss of competitiveness, organizational changes within the group, new competition conditions...).

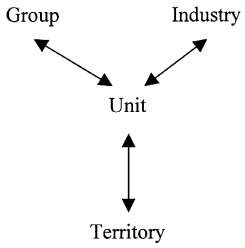

Fig. 3. *The triple insertion of the localised unit.*

Here we come across the basic diagram proposed in the studies of the LEREP "*a group's pattern of taking roots* (...) constitutes fundamentally, a *dynamic process which stems from the organisational tension between three organisational modes* (the group, the territory, the industry) where the finalities explicit and/or implicit are, *a priori*, different [6]."

The articulation from local to global(at the bottom and top of the triptych), appears to be mediated, from this point of view, by the localised industrial unit (subsidiary or establishment). Therefore it is situated at the crossroads of forms of organisation on an industrial level on the one hand, and on forms of organisation of a territorial nature on the other. From their confrontation, by complementarity and substitution games, results the specificity of a relationship to a territory and consequently the nature of the anchorage.

But each of these insertions is obviously not simply exclusive or substitutive of others. Instead they enter into interaction play, oppositions, discrepancies or contradictions that create the firm/territory dialectic, and they are sources of dynamics.

First of all, the analytical disjunction is above all a commodity because the interdependencies can be so strong between levels of insertion. In particular as far as group/industry relationships are concerned, it is possible to find polar cases corresponding to a direct and autonomous insertion of the unit in the industry (G↔U↔I), as opposed to an exclusive relationship with the head-office that consequently mediates the previous relationship (U↔G↔I). However this specification is not purely the outcome of institutional considerations and constraints (what autonomy is granted to the unit?). On the contrary, it can result from an evolution of the organic technical content of the unit's activity within the organisational architecture of the group, either because the group wants to reconsider the position of the unit, or because of the consequences (positive or negative [7]) of the effects of geographical proximity on the conditions in which the localised unit practises its activity. ST-Microelectronics at Rousset is a good example: the manufacturing unit has slowly integrated design activities, in the field of micro-controllers and above all in that of the smart card, because of the proximity of an important downstream user (Gemplus Card). This type of evolution is therefore the source of a reconsideration

[6] Dupuy ang Gilly (1995).

[7] For example due to the degradation of the social climate or on weaknesses in the environment of services to companies.

of the position within the group (and the industry [8]) and consequently leads to a transformation of the firm/territory relationship (creating more anchorage or, on the contrary leading to a certain disengagement).

In other words we must recognise and consider the idea that two firms established on the same territory will not have the same relationships with it, no more than the same firm established on two distinct territories. This concern is to put the question at the heart of the firm/territory dialectic in which the historical dimension will play an important part.

The territory must be taken into consideration in order to be able to understand the actors' practises on site. There are some legal and conventional frames external to the group and specified modes of use of these frames by the actors. If we contain our view within a strictly organisational frame (of the big firm) we will miss the practices of the actors. It seems important, on the contrary, to draw our attention to local practices, and to examine how these practises are in coherence with or in opposition to the ones which dominate in the group. Regarding ST-Rousset, it is clear that the perception of some aspects of the relation to the territory is fundamentally different depending on whether we are at the head – office or on site. A notable example is that of the trade union question which is considered as a "brake" and disruption of the group's organisation, from the head-office point of view, while locally it is sometimes considered as a vital force in a local dynamic contributing towards the site's durability (at Rousset people deplore the lack of this force for which the head-office is overjoyed).

At last, the role of men appears here to be fundamental in the articulation of two logics, of the firm and of the territory. In some cases there are some real group strategies as regards territorial construction and the unit's territorial strategies can then be the sending out of men more or less under head-office control. Therefore it is important to know if territorial anchorage when it exists is the result of a deliberate strategy from the group or is contingent to certain personalities.

In this way, the territorial organisation, if in relation *a priori* to a geographical proximity, can also generate some organisational and/or institutional proximity (of an industrial and technological nature) that arouses interactions and co-operation between units[9] situated within the same geographical proximity[10]. From then on, this conjunction of proximities, in that it opens the way to anchorage, founds the territory as a pertinent space of the industrial and technological activity in question. That is where the fundamental notion of *productive encounters* [11] (between firm and territory) lies, seen as the emerging capacity of the firm/territory couple to bring solutions to productive problems, or even to formulate and resolve some new ones. In this respect, the productive encounter brings about indivisibilities – temporary or not – in firm/territory relationships

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[8] The unit may, for example be led to develop a more direct relationship with the market or with its suppliers of goods and equipment, on the basis of new proximities whether geographical or not.

[9] In the wide sense of the term, that is to say including research laboratories, training organizations...

[10] Thus the concept of proximity takes its relevance out of its capacity to offer the permissive conditions of an interaction between agents (that doesn't necessarily lead to coordination).

[11] Colletis-Pecqueur (1993a and 1993b).

while contributing into the process of resources creation, of the firm and of the territory respectively. Consequently it is the essential factor of anchorage in the industrial and innovation dynamic.

4. SGS-Thomson Microelectronics at Rousset

The origin of the SGS Thomson implantation at Rousset (Bouches-du-Rhone, France), in the Marseilles Metropolitan Area, goes back to 1979 with the creation of the Eurotechnique society, within the context of the French national "Plan Composant" as a joint venture of the French company Saint-Gobain and an American partner, National-Semiconductors, for its technological contribution. In 1983, a reorganisation of the electronic "filière", under public supervision, led at first towards the absorption of Eurotechnique in the components branch of the Thomson group. In 1987 the fusion of Thomson's microelectronic activity with the Italian group SGS-ATES gave birth at last to SGS-Thomson Microelectronics, recently renamed as "ST-Microelectronics", since 1996 one of the ten biggest world-wide firms of the electronic components industry. Rousset's site, an establishment of the French subsidiary of the group, after a serious crisis at the end of the 80s, is nowadays one of the biggest production units of the group with approximately 10% of its total capacity. The activity, there, is principally directed towards three main product lines, micro-controllers, memory cards and EEPROM, in which Rousset represents respectively 90%, 90% and 50% approximately of S.T.'s total production in these sectors.

The implantation in the industrial area of Rousset has constituted a decision for localisation on a site with no previous relation whatsoever with electronic technologies. Rousset's industrial area had until then neither vocation nor ambition in high technology fields. It is a totally exogenous implantation, resulting from a government decision in the context of a national industrial policy and based on the entry of a firm with no experience in the field of semi-conductors with the help of foreign technology (American) being fully transferred.

If the quality of life on the site and around is undeniably a positive factor allowing the attraction of human resources, essential to the company set-up, it is clear that a more determining motive of localisation has been the situation of Rousset on the borders of the coalfield in reconversion of Gardanne, in an area still rural enough and little affected by the industrial deterioration. Consequently the site can benefit from aids due to its status as "industrial reconversion basin" (today "Objective 2B" of the European Community): subsidies, bonuses, tax exemptions...

Micro-electronics must be considered as a fundamentally nomadic industry. Cycles of products and of technologies are extremely short (approximately 5 years or less) and the technological ruptures are such that the passage to a new generation generally involves the set-up of a new factory which implantation will often as a consequence be reconsidered in the frame of the strategy of the group's global deployment. Confronted with the necessary passage of S.T. to the "6 inches" technologies and to the repercussions of a conjectural global crisis that affected the entire micro-electronic market, this nomadic character caused the Rousset site to experience a very serious threat of closure at the end of the 80's and the start of the 90's.

Despite its own weak territorial anchorage, Rousset's unit has been at the root of certain spin-off effects which have led to numerous cases of employees leaving the firm to set up their own companies. Although of a different nature than anchorage[12], this spreading has progressively contributed in a decisive manner to the emergence of a local micro-electronic structure. And it is precisely this structure that will subsequently contribute to progressively reorientate the position of the Rousset ST factory within the group, and consequently, the relationships of the firm to the territory.

Finally the threat of the firm's departure led to a collective awareness of the lack of territorial anchorage of micro-electronics in the Bouches-du-Rhone, especially from its principal actor SGS-Thomson Microelectronics. This realisation gave rise to the creation, with the help of local government (borough councils, county councils, then regional council) of a structure of co-operation aiming to establish some links which were not until then at the heart of the local industrial scientific and training potential, to bring together their existing forces, effective or potential, around silicon so as to create a mass-effect.

The CREMSI – Regional Centre for Microelectronic Studies in Silicon – came into being in 1993, on the director of economic development at Rousset's initiative, with technological research as a vocation and the fixed target of creating some networks within the population of the industrials and scientists involved. If the indirect aids brought by the local governments to this initiative (financing costly equipment for work on sub-microtechnological developments) have mostly constituted the initial motivation for joining the CREMSI, this operation has however led to a wide realisation of the interest in having co-operation projects on a local basis. It centres around the development of the effects of the structure, the effect of the proximity, through co-operation, combination of technological competencies, in a perspective of innovation that contributes to the middle-long term competitiveness of the firms, but also reinforces their links to the territory, their territorial anchoring. In this way, a network like CREMSI should be able to play a significant role of intermediation between industrial and technological actors, and to become a place (and a process) of emergence for these "productive encounters" which we discussed in Section 3.

The reopening of optimistic perspectives for the Rousset site came from a remarkable recovery in the market of semiconductors, more than from a CREMSI effect. The passage to "6 inches" was decided with a doubling of the production capacity and in parallel with the passage to the submicronic (0.8 to 1.2 μm as opposed to 1.5 μm previously). The conversion was made in 1995/1996 without stopping manufacture; engraving should still progress in the next years (0.6 to 1.0 μm); the line of manufacture could continue to

[12] These new companies were started up by executives who had been or were to be made redundant during difficult phases in the economic climate. Despite having sometimes benefited from the blessing and formal support (compensation payments, profit-sharing) or informal support of their company of origin, most of the new entrepreneurs are not in the privileged position of being a partner or supplier of that company. But as shown by Garnier (1991), this common origin gave birth to a real environment that, more than by its formal relationship of cooperation, manifests itself by a sort of solidarity between the actors, notably on a technological level (adjustment and adaptation of machines and specific equipment).

be active until 2003–2005. But the new stake which has mobilised energies, has been that of the localisation of the new "8 inches" unit of SGS Thomson. This 4–5 billion Franc investment, due to generate 800 new jobs in the long term, was finally localised at the end of 1995 on the Rousset site, after having received the assurance of a participation of 900 MF of public aid and an intense insistence by the French government for this localisation.

In the Marseilles Metropolitan Area, everybody is well aware that the factors of anchoring and of territorialisation are too weak to have been able to play decisively in this arbitration. The absence of a real structure of research strongly centred on micro electronics, like Leti and the CNET at Grenoble constitutes undeniably one of the weaknesses of the context. And the capacity to offset this inadequacy by a network organisation of the resources (CREMSI) was not yet acquired. But in the same period an other circuit maker, the American company Atmel committed in 1995 to a recovery of capital from the local enterprise ES2, a refinancing to the level of 250 MF as well as an industrial investment in the existing production line and the building of a new factory. Atmel was in position to benefit from public subsidies of nearly 300 MF.

The presence of two competitors on the same site modifies the manner in which the anchorage problems of ST should be analysed. On the one hand, this presence reinforces the existing microelectronics infrastructure, on the other hand, it modifies the strategy of ST on the territory in favouring the greatest care in the allocation of local resources. In effect, a disengagement of the Rousset site would have the effect of favouring departures for Atmel and would have reduced the mobility of staff towards an other site advocated by ST. On the leader's side of things, the interest in contributing to the development and the reinforcement of the microelectronic structure in the Bouches-Du-Rhone seems to be well received, since, beyond the new 8 inches unit, S.T. decided in 1997 to relocalise near Rousset its own training structure (S.T. University, 4 500 students and 200 000 hours of teaching by a year) and to open it to the needs of other companies of the area. ST-Rousset strength is planned to reach 2 000 to 2 500 people at the end of the year 2000, those of Atmel would go up to 1 500 at the end of year 2000 and 2 000 at the end of year 2001. The capacity of the Provencal microelectronics industry nowadays counts for 25 to 30% of the French silicon production.

During the last years (November 1997), a new co-operative structure known as PROMES (Provence Micro-Electronic System) was created at the initiative of Gemplus, with the objective of creating a technological showcase, as much internal as external, to promote microelectronics in the Bouches-du-Rhône. PROMES which, in a few months, received the memberships of nearly fifty firms and institutions, including JEMI[13] and the CREMSI, intends to distinguish itself from the latter by a concept broader than only silicon technology, an industrial and commercial vocation[14] and a strong interest in the vast distribution of microelectronics applications. PROMES received the support of public institutions: General Council, Regional Council, DRIRE, the City of Aix… and the

[13] Joint Equipment Manufacturers Initiative, French association of suppliers of microelectronics equipment, and of micro-technologies, largely represented in the Provencal microelectronics pole.

[14] The CREMSI is statutorily devoted to a technologic development mission.

President of the Chamber of Commerce and Industry of Marseilles has agreed to be the vice-president. One of the most significant ventures is the current constitution of the first *cartography and database of technological skills and resources* of the cluster and of its internal and external complementarities. Organisations such as PROMES, CREMSI or CETP [15], conduct in a more or less formal manner, the networking of industrial and technological actors and the possible identification, by each of them, of accessible and adaptable local resources by potential industrial partners.

A second aspect which needs developing is that of the articulation with downstream. Fundamentally the circuit makers' activity is becoming more and more nomadic and, considering the only production factors and financial externalities, the localisation of a new generation of factory will not have any reasons to favour a previous production site. The competition between territories finds here a strong illustration, many potential sites being systematically in competition, within the limits of the strategic/diplomatic balance of the firm[16]. As regards the site of the new 8 inches unit, Rousset was in competition with Rennes and Grenobles, in France, and also with Ireland and Singapore. The only argument that seems able to rival with this nomadism inherent in the activity is a dynamic of innovation, based not only on research and development, but also on the capacity to resolve some effective problems linked to the specifications of the applications[17]. There are many examples which show that proximity with the downstream users constitutes a source of efficiency that is often strategic[18]. The organisation and the development of such proximity effects, which bring about productive encounters, have to be considered in relation with the group's strategy and global organisation, in the perspective of a triple insertion of the localised unit as described in the third section.

This proximity with the downstream users is effective with the smart card pole which was constituted around and from Gemplus[19] while giving birth to the beginning of a real *innovative milieu*. S.T. Rousset is of course a major supplier of this pole, on a segment of

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[15] Club des Entreprises Techno-Perfomantes.

[16] In the case of SGS-Thomson, it is advisable to reserve a certain part of the implantations to both countries of origin of the group, in equal parts between France and Italy, and to take political pressures into account. In France, the state shareholder was present through the 17% of the capital in the hands of the Thomson group.

[17] In very "Lancasterian" terms of technological branches, we speak of a capacity to climb up from a problem in terms of characteristics of use to its translation in terms of (technical) performance of the product (Zimmermann, 1995).

[18] Thus at Crolles, the 0.5 µm technologies were "drawn" from the development of dedicated products (Bull in particular). But this technological experience found its limits as soon as it had to turn to manufacturing standard components (the X486, clone of Intel) for which the production rate is very high. To cross over the 33 Mhz bar, Grenobles had the help of the American team of Carolton that found solutions by modifying the specifications of the chip, while keeping the same lithographic process. At the beginning of the approach: their colleagues who had the same the problems, the innovative customers, "sophisticated" clients (like Compaq) who by specifying certain performances, opened a very precise dialogue with clients.

[19] Established in 1988 by ex-employees from S.T., Gemplus has become world leader of the memory card and employs 6 000 people worldwide (2200 of them in the Marseilles Metropolitan Area's sites: Gemenos and La Ciotat), for a turnover of 5 billion Francs in 1999.

market which today has significant growth rates and a huge potential of applications and market[20]. From 1993 to 1996, the portion of the site activity devoted to these products went from less than 10% to more than 35% of the turnover. Only on this line of products, has Rousset acquired a direct capacity for commercialisation for 40 to 50% of the production, with its main customers: Gemplus, Schlumberger and Solaic. S.T. Rousset is reinforcing its skills and its design capacities in contact with this pole. The work on smart-cards was therefore the occasion to develop a skill for non-volatile memories . This competence has spread over the development of an EPROM[21] activity and today EEPROM[22] in which S.T. has become number 3 at the world level.

S.T. Rousset is opening itself to competencies in promising future markets such as that of "tags" [23], through technological co-operation between Gemplus and Micropolish (problem of the thinning of the circuit). In the same way, S.T. Rousset benefits from its proximities with an upstream of equipment suppliers (Cybernetics), essentially in the assembly equipment of smart card products in "micromodules" [24] and in the equipment for production and packaging in a mini-environment, required by the technological choices of the new 8 inches factory and unavailable in standard on the market.

More generally, by taking advantage of these proximities and *productive encounters*, Rousset management has been looking, from many years to develop the technological aspect because the manufacturing activity is tending more and more towards a delocalisation to Asia. To each product is associated an investment in costly infrastructures which almost requires the construction of a new factory. These opportunities are put to profit by the group in considering new localisations and recentring the activities of the units. In this context, Rousset is trying to move towards some activities that are less dependent on the hazards of the life-cycle of the products, in order to keep its bearings and to face difficult future periods better than it did before. The valorisation of the proximity effects within a local structure in the process of consolidation is obviously the best guarantee for such a strategy.

5. Social networks and small-worlds models: fruitful perspectives

The approach, we have presented in this paper, being quite recent, no fitted formal models have been yet developed. Nevertheless, fruitful perspectives are emerging mainly from the field of interactions economics.

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[20] With emerging American and Asian markets.

[21] Erasable Permanent Read Only Memory (the erasing of memory is obtainable by exposure to ultra-violet rays.)

[22] Electrically Erasable Permanent Read Only Memory (the erasing of memory is obtained by the application of certain levels of difference in electric potential).

[23] The tag concept, direct descendent of the smart card concept, corresponds to an electronic and communicative label that should eventually supplant barcodes.

[24] Taking into account their future "in-carding", the smart cards' products do not go through the usual boxing, "back-end" operations, but are put into a metal/plastic support in a continuous band that allows card makers to incorporate them in their manufacturing process.

As far as co-ordination is concerned, economic standard theory refers to the concept of Walrasian market, designed as a perfect market where agents are rational and perfectly informed through the signals they are able to capture in terms of prices. Such an approach corresponds to a methodological individualism based on the character of representative agent endowed with an optimising behaviour, in a context of equilibrium prices. Passing beyond this theoretical framework by referring to interacting agents is a good way to think both the individuals' singularities and the structural characteristics of the social body. It gives rise to a fundamentally distinct approach, not any more based on average and homogeneity, but on taking into consideration of singularity and complexity. It appears as a well fitted framework to the new aspects of the firm-territory relationships, such as collective learning or productive encounters.

Two main classes of models particularly suitable for those questions are related to social networks and small-worlds approaches. They could give rise to a fruitful combination, in a next future, for the building of nomadism and territorial anchorage models.

In the field of social networks, we have studied (Steyer and Zimmermann, 1996 and 1998) the role of relational proximity structures in socio-economical dynamics, in particular for innovation diffusion but of wider implications.

- Given I a population of agents, the state of each of them, also called "activation level", is described by a normalised feature level noted f_i, $\forall i \in I$, taking its value in [–1, +1].
- We draw the way agents are interconnected by describing a matrix $\mathbf{W} = (w_{ij})_{(i,j) \in I^2}$ whose general term w_{ij} measures the strength of the connection from j to i. w_{ij} is a valuation of the way i catches the weight of j in its decision taking, and corresponds to the idea that i makes for itself from j, according to its own system of values. Furthermore, we impose a normalisation condition that express the limited and equal for all capacity of an agent to perceive influences from the other agents (receptivity), that can be written as the general rule:

$$\sqrt[\rho]{\sum_{j \in I} |w_{ij}|^{\rho}} = 1 \quad \text{with } \rho \geq 1.$$

- Within a social network, a given agent receives a cumulated influence from the other agents he is related with, that can be valuated as a balanced sum of those agents "activities" by the intensity of the links carrying the influence

$$\sum_{j \in I} w_{ij} f_j.$$

- On the base of that total received influence, that given agent will revise its proper state, its proper "activity", through what is generally called an "activation function" or a "transfer function" in neural networks into which category our model can be ranged. Then at each period of time, the network transition can be described trough the Markovian system:

$$f_i^{t+1} = F\left(\sum_{j \in I} w_{ij} f_j^t \right).$$

We have shown that the network anisotropy, if it generally tends to slow down the diffusion pace, brings in return a better long term efficiency, that can be identified, for

example, by the lower level of initial adoption required for the successful introduction of an innovation on the market. We emphasise the existence of a transition frontier, of non-zero thickness, when the network is non uniform, that determines failure, incertitude and success zones for innovation diffusion. Such a frontier offers a way to understand the different types of structural effects related to proximity relationships the agents are involved in. In terms of initial adoption rate, let's say τ^0, a double threshold effect can be identified: under a lower threshold noted τ^-, it is not possible to obtain a convergence process (in the meaning of the final adoption by a limit structure). Beyond an upper threshold noted $\tau^+ > \tau^-$, the convergence is always successful. Between those two values the convergence is uncertain and depends from the distribution of the initial adopters among the network structure. This result constitutes a generalisation of the properties of percolation models for a finite population, in a wider context than a spatial proximity.

This can be interpreted as stating a double structural effect. The first effect, related to the structure of the network itself is at the origin of the level and thickness of that transition frontier, while the second effect, resulting from the distribution of innovators (or initial adopters) among the network, is the source of the success or failure of the diffusion process on the frontier, *i.e.* when $\tau_0 \in]\ \tau^-, \tau^+[$. We found that the level and thickness of that frontier depend both of links strength and network anisotropy (Steyer and Zimmermann, 1998).

In an other paper (Plouraboué *et al.*, 1998) we have introduced a social learning process, in which agents that share the same opinion tend to reinforce their links. This learning is capable to lead the network to a critical state, where a small number of agents are able to influence a sufficient set of other individuals and give rise to avalanches likely to diffuse onto the whole network. In other terms a micro-impulse induced on any of those leaders will produce a macro-observable effect at the level of the global population. Such a phenomenon is very similar to what is described in physics by the notion of "scale invariance", meaning that there is a positive probability to observe a result of any size, in the limits of the population size itself. It is called *Self-Organised Criticality* (SOC) (Bak *et al.*, 1987).

Those properties emphasise the importance of asymmetry (leaders, key-actors,...) and history in a social network where co-operative process can take place. Such aspects are at the centre of our approach in terms of nomadism and territorial anchoring, throughout the role of key-actors in the revelation of productive problems and the importance of former successful co-ordinations that can ground a collective learning process, hence territorial construction.

A the second class of models is based on the notion of "small-world" that has been introduced in the late sixties from psycho-sociologists studies (Milgram, 1967). In the recent years it has been the purpose of a renewed attention, as well in the field of physics (for example Barrat and Weigt, 2000) as in the one of sociology (Watts, 1999) or more recently of economy (Cowan and Jonard, 1999).

Small worlds can be represented as intermediate network structures, between the "regular" graph based on the connection of each individual with its closest neighbours and the random graph that ignore any spatial support for the building of inter-individual

relationships. In such a position, small-world networks appear as a peculiar configuration endowed with remarkable properties.

In our present preoccupations, the optimal game of complementarity between local relations, eminently of spatial nature (nearest neighbours on a structure endowed with a metric), and global relations, of non-spatial nature, gives us an interesting mean to represent, on a full of promise manner, the combinatorial effects between a spatial (geographical) proximity and a non-spatial (organisational and/or institutional) proximity. It offers a well-fitted framework to study agents' behaviour in a perspective of a "situated rationality" (Rallet, 1999). The basic structure proposed by Watts and Strogatz (1998), for investigating small-worlds dynamics, appears as a best-fitted model to render this double nature of proximity. Agents are located on a lattice and connections around any given agent can be totally local with their *n* nearest neighbours, partially allocated to non-local relations or totally randomly chosen among the whole population without any spatial consideration.

The setting up of short-cuts within the graph, if it immediately improves the general accessibility (average optimal path linking any two individuals in the graph) leads also to the consequence of reducing the transitivity (*cliquishness* measured as the probability that two individuals connected with a third one would be also connected together – *i.e.* friends of my friends are also mine). Then to the regular graph corresponds a high level of transitivity and a bad level of accessibility, while the random graph corresponds to a good level of accessibility and a low level of transitivity. A "small-world" configuration, obtained when the probability p is around 10% a connection could be established outside the agent's *n*-neighbourhood[25], has the remarkable ability to conciliate a short accessibility with a strong transitivity. From that quality stems a lot of induced properties on which the literature on the topic has recently leaned.

In that manner Cowan and Jonard (1999) have studied the performance of such networks, varying *p* from 0 to 1, from the point of view of a knowledge diffusion dynamics. The investigation is based on the principles of a knowledge barter that occur when interrelated agents have the opportunity to set up an exchange, balanced on the different dimensions of their knowledge potential where they are respectively "better" than the other. They find that the performance of the system exhibits clear "small-worlds" properties, in that the steady state level of average knowledge is maximal when the lattice structure is that of a small-world (that is, when most connections are local, but roughly between 1 and 10 percent of the connections are long distance). A surprising result is that the variance of knowledge level among agents is also maximal in that small world zone.

This constitutes a very interesting result that can be interpreted in territorial terms. Clearly small-world networks, by construction, are formed by local systems where agents are mostly connected with agents situated in their spatial proximity, while those local networks, as open systems, benefit from the long distance connections or short-cuts some of their members are able to activate. For that reason the cliquishness remains high due to those local circularities and average path is set down to a very low level due to the mastering of those shortcuts. Agents that hold the access to those shortcuts can represent

[25] When $p = 0$, we are in the case of a "regular" graph, when $p = 1$, we obtain a random one.

large firms affiliates or establishments, or enterprises well introduced in global networks. They fill a key position in the network by controlling structural hole (Burt, 1992) effects in their region.

This provides a good explanation of certain aspects of local clusters performance. The recent literature on this topic emphasise the way how clusters are well fitted production structures in a globalised world (Porter, 1998) and are particularly adapted to the innovation challenges of the knowledge based economy (OCDE, 1999). The question remaining then is related to the way clusters are able to emerge and to constitutes structures into which global agents can have a real interest to participate. In this model, local interaction is not efficient in itself (a local link is *per se* not more not less valuable than a distant one) but by the fact that it is involved in the emergence of a collective level (connexity, circularity...) that can be measured in terms of "cliquishness". If communication links are considered as related to organisational proximity and adjacent positions as related to spatial (geographical) proximity, from the conjunction of both proximities stems the territory. And the remarkable result is that the efficiency of a cluster is related to its opening to outside interactions, that is on a non spatial proximity (*i.e.* local/global levels complementarity).

6. Conclusion

In this way, territorial anchorage of industrial and technological activities appears to be the result of a firm/territory dialectic. It is a result and not a gift, constructed and not constrained, periodically challenged and not definitively gained; it stems from the encounter of two stories, at the same time that it feeds and reorientates these stories. More than this, the firm, whilst sharing its destiny with the territory, transforms the very conditions of its industrial activity, of its own internal organisation, and consequently of its relationship to the territory[26].

It would seem that to the model of the "volatile" firm, to which corresponds a problematic of localisation (therefore eminently static), a new model must be opposed, based on the concept of nomadism and anchoring, to which would correspond a problematic of territorialisation (that can only be conceived in dynamics). Here anchoring and nomadism are not necessarily mutually exclusive but can correspond to different moments in history, through some setting-up periods and some moments in which the company gets back to a situation where there is a choice between leaving or staying and strengthening its implantation. And therefore, it seems essential to distinguish factors of localisation and factors of territorialisation.

With the evolution of the conditions of competition, the analytical concept of "volatile" firms would seem to be losing its pertinence, in opposition to the standard approach, while the off-cost dimensions of competitiveness are progressively taking a determining importance opposite the cost factors. The durability of the firm supposes a strategy that in the long term, cannot be limited to objectives of costs' minimisation in

[26] See Perrat (1995) in particular.

the context of a stable production function. The dynamic of innovation is overtaking the research of the economies of scale [27], the models of dynamic flexibility, based on the combination of technologies in a context of geographical proximity, substitute themselves for those of fixed productive combinations, stable over time.

So, as we can see, the "productive encounter" emerging or not from the firm/territory dialectic, is not only the search for a solution to a pre-existent productive problem, it is also the possible emergence of new problems that favour encounter or on the contrary separation, depending on whether available or mobilisable resources on the territorial scale are up to the task of providing satisfactory solutions to the problem in question. It is this non determinist perspective that we think essential to adopt from the moment that we break with the static localisation-attractivity approach and that we choose to place ourselves in a long term perspective.

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[27] This does not mean that they disappear.

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