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Technology and Development in Mediterranean Lagging Regions. The Conceptual Context and the Nicean Model

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Introduction:

One of the major challenges faced by contemporary economies is the generation and the attraction of new techniques and scientific discoveries. A large part of the Japanese, U.S. and European industrial programs is now strongly devoted to the development of inter firms or inter industries partnerships in such sectors as semi conductors, NTICs or biotechnologies. The stake is then to try to build up indigenous innovation networks in order to resist to the intrusion of foreign productions and services by increasing the number and frequency of interactions between domestic actors. In this respect, such concepts as national technological infrastructure (see Tassey, 1992) or national systems of innovations (Lundvall, 1992) provide further developments to the notion of competitive advantage previously developed by Porter (1990).

At the same moment, the competition between territories is wide opened (see Jayet, 1993), be there at the national or regional levels. The often cited example of the new industrialised countries is at the core of this new process of production but is now surrounded, within the developped areas, by the competition between different regions. By the way, the examples of delocation of several plants from France and Germany to Wales, Scotland or Portugal reveal the attraction effort of several less developped E.E.C. regions, mainly supported by the existence of low wages or by peculiar trade union conditions. This strategy provides a first answer to the case of non specialised manufacturing process, in augmenting the chances of development of sparse regions in the process of "glocalisation".

The case of underindustrialised regions with a high level of income is highly more complex, both because of their peculiar position and of the very nature of their technological effort, sometimes quite different from high tech operations. It is of interest in this paper, which mainly focuses on the case of mediterranean lagging regions, facing the challenge of improving their technological intensity. As it has been shown by numerous scholars (see Krugman, 1991, or a large part of the modern theory of endogeneous growth), the attractivity of such places is strongly linked with the presence of a local labor market, involving skills and competent human resources. The case of the manufacturing

belt in the U.S. highlights the influence of industrialised synergies based on path dependency and of hysteresis effects. The success of this area, now associated with a lack of natural ressources, is driven by the synergetic relations and increasing geographical returns between local firms, both large ones and S.M.E.s.

Is it possible to go beyond the mediterranean determinism and to break the vicious circle of under industrialisation? Is it feasible to attract foreign technologies and to promote a scientific development in peripherical regions which combine a low technological intensity and a high level of wages sometimes due to other activities such as the extraction of an administrative rent or the tourism activity? In our opinion, two polar cases may be under examination when considering Mediterranean Production Systems with the presence of high wages : the one of regions with a high level of administrative rent and transportation costs and a low potential of scale economies (the case of these regions and more particularly of the mediterranean islands is developped in Filippi and Torre, 1995) and the one of regions with a medium level of industrialization and no experience in administrative rent.

The technopolis model, experienced in several places all around the world, seems an opportunity to promote new areas of industrial (and more precisely technological) growth in the second type of lagging regions. In this respect, the case of Sophia Antipolis, on the French Riviera, is well known and now sometimes cited as an example in Europe as a successful story in increasing the technological intensity of a less developped mediterranean region. In the 60's the region of Nice was most famous by the standard of living and retirement than for its economic activity; now, the Côte d'Azur (the French Riviera) is the most attractive of the (non Paris'areas) French regions in terms of firms location, and more precisely in terms of science based activities. We will discuss about this (semi) success in the paper and try to draw some conclusions from this example and others. The first part of the paper is devoted to a theoretical introduction to the question of technological location and lock in processes. Then we discuss about localised technological diffusion and technopoles. The last part of the paper concentrates on the nicean model and tries to evaluate its performances in terms of attraction and location of technologies.

I. Technological Location and Lock In Process

IA. Several Theoretical Insights

When thinking about technological location in mediterranean regions, one must ask first the question of the analytical device. Sometimes far from the mediterranean diversity, **the economic theory has provided with general answers to the question of the attraction of new firms in spatially well defined areas.** The determinants of Foreign

Direct Investment are either based upon the assumption of competitive markets where the atomicity of relevant firms is a basic condition, or on a market structure of imperfect competition with peculiar role played by several firms (J.P. AGARWAL, 1980).

The theories of Foreign Direct Investment based on a competitive market hypothesis are often directly concerned with the role played by the returns on investment. In this respect, the firms seeking for profit maximisation will localise their production activities in areas which offer the highest rate of profitability, even if this approach does not provides with an explanation of the reason why not all the firms delocate their production in the same area. The portfolio approach takes into account the risk as a major dimension in the investment decision and makes reference to the propensity of firms to diversify their locations, which elucidates the persistence of cross investments from related countries. The access to the market approaches bear on the idea that firms invest more when domestic demand and G.N.P. per capita tend to increase, without giving any role to the firms behaviors.

The theories of Foreign Direct Investment based on imperfect competition appear to be more realistic in their acceptance of the interdependencies between firms' behaviors. The works of Hymer (1976) or Kindleberger (1983) develop the idea that several firms beneficiate from advantages such as product differenciation or peculiar techniques, patented inventions or financial discriminations, external or internal economies of scale, and governmental limitations. If this dominant position is at the origin of higher profit rates than those of the domestic firms it does not provide with a clear explanation of the determinants of the location of one firm in several countries. In a way, the product life cycle (Vernon, 1966) may be considered as a kind of deterministic approach, which directly links spatial location with products' characteristics, without any consideration for local characters or territories specifications. The oligopoly approach (Knickerbocker, 1973) introduces strategic interdependencies between actors into the determinants of location: a firm finds an incentive to foreign investment when its competitors have already obtained several advantages from their setting up in another area. However, the most interesting outcomes have been provided by the so called eclectic approach of Dunning (1988). It is greatly to the credit of the OLI paradigm to associate both the ownership advantages (specific to the firm) and the locational advantages (specific to the location country) without excluding market failures or imperfections (internalisation advantages). The juxtaposition of these advantages is then the gist of the determinants of international or inter-regional production location.

These nowadays traditional approaches of the international factors of firms' location however exhibit two main limits:

- they do not cope with technology transfers (see however Casson, 1991, or the researches performed at the University of Readings on this topic). This new form of direct

investment which underwent a constant increase during the eighties and the early nineties is becoming one of the major sources of local development;

- they focuse on the manner to attract foreign firms, but never consider the way to maintain them in an area. One of the most recent dramatic changes concerns the rise of a great tendency to rapidly delocate the firms with regards to the emergence of new forms of international advantages.

Several answers to these questions have been provided by spatial analysis such as the technological districts and milieux approaches or the geography of innovations. The notion of technological district (Antonelli, 1986) may be viewed as a development of the marshallian concept of industrial district, which focuses on the role played by large firms and cities in the technological growth of a region. T**he so called milieux approach developped by the GREMI** (see for example Maillat and alii, 1993) **gave birth to a theoretical apparatus mainly devoted to the study of highly technologically concentrated areas.** This approach is based on the observation that the technological development of the (most and semi) industrialised countries strongly depends on the creation and the growth of localised systems of production, namely the agglomeration of firms, sometimes specialised and located on well bounded geographical areas. The concept of "milieux innovateurs", as well as those of local networks of innovators or local systems of innovation, is dealing with the opportunity to promote and to develop the technological intensity of a territory. The challenge is to organise the creation and the transfer of innovations and their diffusion towards the local productive systems. The GREMI approach is founded on the idea that local milieux may be considered as the incubators of innovation and that the interdependencies and the cooperations play a major role in the setting of technological processes. The firms have a major tendency to promote organisational strategies based on alliances, (complete or incomplete) contracts, partnership or collective learning, and to develop a local process of creation of innovation. This analysis, which mainly focuses on the organisational and innovative factors, is probably an important step towards an explanation of the motives of a localised technological development, partly based on localised organisational learning due to the collective character of innovation processes.

The researches performed on the **geography of innovation** shed in light

IB. Technology and Innovation within Localised Production Systems

In order to provide a general answer on the manner to attract and to maintain foreign technologies in mediterranean regions, let us go one step further and take into account the spatial dynamics of innovation and production within localised production

systems. First of all let us define the circulation of goods and informations within the network of local industries. It may take two different forms:

- a combination of small and large (or medium) size firms characterised by the existence of hierarchy (leaders) or dependence relations. Small firms, sub-contractors of larger plants or (semi) independent ones, are then linked with market relations to other entreprises and their activity is often related to services or high tech productions. For example, a lot of technopolitan small firms are specialised in science knowledge or provide some advices to larger partners. Local large (or medium) firms may also be of two different types: independent ones, with a medium size and a local structure of ownership or, in most of the case, linked to large groups or conglomerates. They may have only financial links with their owners or be included into a more general production process, for example within a vertically integrated organisation. Large firms also use to delocate their research laboratories in science parks or high tech areas, in the search of closed links between academic and industrial researches.

- the local industry network can also be only composed of small firms, fully independent, linked with quasi integration relations (the case of industrial districts) or depending on larger firms located in other areas or regions. We shall state that this structure is characterised by the absence of local leaders, or a halo of small or medium size firms, and the existence of reciprocal relations, without dependence.

Another point of relevance is the type of relations between the actors within the structure of localised production systems:

- vertical links of purchases and sales, including sub contracting, are the most frequent form of inter-firms connection. The relations between producers and users are founded upon the exchange of goods and services, but they are also related to the diffusion of technological knowledge by dint of patents and licenses. Vertical collaboration between producers and users (Von Hippel (1978), Lundvall (1988)) imply that the partners may be involved together in organisational learning processes such as the joint elaboration and production of goods.

- lateral or horizontal relations involve lateral collaborations or cooperation. Lateral collaboration between partners from different market areas entails informal cooperation between firms owing to different industries. Ownership may play an important role in these types of relations but the two parties can also cooperate on equity bases. Lateral collaboration between rivals may be applicable to any situation in wich individuals or organizations are involved in a competition where possession of proprietary know-how represents a form of competitive advantage (Von Hippel, 1989). More precisely, when engineers cannot find required know-how within the firm or in publications, they ask for this information to other specialists.

According to these features let us define, in table 1, a taxonomy of localised production systems, classified with regard to their major type of internal organisation features (see Torre, 1992). A recent study (Gaffard and alii, 1993) puts the stress on the diversity of territories in Europe at the applied level: priority of internal cooperative or collusive relationships and external market links, dominance of internal relations of exchange and external cooperations, or major role played by external relations.

Table 1: Localised Production Systems: a Taxonomy

Leader(s)	Halo
Lateral links	Lateral hierarchy	Lateral reciprocity
Vertical links	Vertical hierarchy	Vertical reciprocity

The dynamics of development and lock-in of technologies depends on this taxonomy. The static circulation of goods, services and informations is dynamised by the transmission of positive external economies and may give rise to local processes of technological agglomeration such as the often described manufacturing belt in the United States.

The main point is related to the existence of increasing returns in the process of economic and technological development (Krugman, 1991a and b). The process of mutual reinforcements which may lead to the lock in of technologies lies on the existence of technological or pecuniary externalities à la Scitovsky. Pecuniary externalities, external to the firm and to the industry, spread by dint of market exchanges and partly make reference to the so called concepts of backward and forward linkages initiated by Hirschman. External to the firm but internal to the market the technological external economies correspond to the notion developped in Public Economies or in the theories of endogenous growth and their transmission does not follow the market channel. They both contribute to the modification of the production function without implying any change in the input combination. When the local actors are involved in positive lock in effects they do not have any incentive to delocate (on this topic see Torre, 1993).

History plays a basic role in the process of a long term location of technologies. Two cases must be under examination:

- market interactions both refer to intra and inter industry relations. The intra industry relations are regarding the inter firms cooperation based on voluntary contracting

and the exchanges of technical or commercial informations. The inter industry linkages are strongly linked with the circulation of pecuniary externalities thanks to the presence of increasing returns internal to the firms (imperfect competition structure) and of a skilled human capital. When a firm obtains super profits it diffuses its growth dynamics by the intermediary of backward linkages to other firms which may be capable to carry on the diffusion process if their prices are higher than the marginal costs. This effect may be helped in a localised production system by the human capital behavior which contributes to the development of forward linkages. The skilled workers try to locate near the concentration of high tech firms which offer them a high level of wages and the firms are also encouraged to locate near the concentration of skilled workers (see Blanchard and Katz, 1991);

- untraded interdependencies also refer to intra and inter industry relations. The inter industry relations are related to informal cooperations between local actors or interactions between science and industry (see below). The intra industry dynamics is founded on the diffusion of technological externalities, and most of all of tacit knowledge between skilled workers. This knowledge may diffuse throughout the system and give birth to an increase of productivity of local firms (see Romer, 1990). Such a process may lead to spatial lock in effects, due to the specialisation on a technological trajectory and not to the intrinsic superiority of the technical combination (see Arthur, 1990 or David, 1973).

These effects indicate the way to maintain technologies in a given territory. When the firms are locked in spatial dynamics one can expect that they will find the local advantages gained from the existence of increasing returns more attractive than external location supplies in terms of lower prices of land or public incentives. However, one may ask

IC. On Technological Transfer

In order to assess the technological diffusion within localised systems of production and innovation let us now examine the diffusion process of innovation and technological knowledge. The partly appropriable character of technology induces a diffusion by means of the different channels reported before .

- market interactions, linked with input-output exchanges between firms selling intermediary or capital goods but also exchanging patents and licenses. The case of market diffusion via intermediary or capital goods rests on the assumption that technology is incorporated within the goods sold by an innovative firm. We shall speak of an unvolontary diffusion process, in contrast with the voluntary process of selling patents and innovations. An explanation of this transmission mechanism, obviously bounded to the case of product innovations, is given by Griliches and Lichtenberg (1984) in terms of "shadow prices". It can be related to the results obtained by Levin, Klevorick, Nelson and Winter (1987) concerning appropriation procedures, who show that several industries, such

as Chemicals, develop important protection mechanisms because their innovation effort is mainly devoted to the introduction of new processes. Other sectors (Food, Steel...), concerned with the production of new types of goods, do not develop any kind of protection mechanism and give birth to technological diffusion.

- untraded interdependencies refer to complementarity relations between partners, interactions between producers and users, and complementary innovations. Technological intra or inter industry spillovers refer to the inspiration that a R&D performance, a technical invention or an innovation can provoke in another firm or sector, without necessary connection between the two parties (unvoluntary diffusion). The collaboration between producers, often rivals, is an exchange of informations and experiences about production knowledge or savoir faire (voluntary diffusion). The cooperation may be formal, including cooperative agreements, joint-ventures or joint plants. Some studies also make reference to informal technology transfers, especially between technical managers (Schrader, 1991) of different firms. Interactions between producers and users are also of interest: competent users help in developping new innovations thanks to their peculiar demands, or even develop their own intermediary goods and ask their suppliers to produce them. All these points are summarised in table 2.

Table 2: Types of technological diffusion

	voluntary diffusion	unvolontary diffusion
Lateral links	Exchange of informations	Technology spillovers
Vertical links	Patents, innovations	Goods and services

Though difficult to quantify and to measure, **the diffusion of technological knowledge between Science and Industry** is probably one of the most interesting fields of investigation related to the links between technology spread and local development. The exchange between science and industry always takes a vertical direction but it may be both voluntary or unvoluntary. Research institutions (Universities or Institutes) are considered as knowledge producers, their output being a basic component of the public part of technology. According to recent researches in this field it is likely that about 10% of the new products introduced in manufacturing industries could not have been developped (without substantial delay) in the absence of academic research (Mansfield, 1991). Some

evidences also suggest that these links are often based upon proximity relations, the diffusion process being bounded to geographical areas such as science parks or university campuses (Jaffe, 1989; Acs, Audretsch and Feldman, 1992)). Technology spillovers are facilitated by the geographic coincidence of universities and research laboratories and the impact of universities researches is both great on innovations and on patented inventions. Cooperations are often informal, bounded to the relations between (private or public) researchers or technical managers. Numerous institutional arrangements are however promoted in such areas as technopoles or science parks, based on bilateral relations between scientists and firms.

II. A Technological Experiment on the Mediterranean Sea: the Technopoles

IIA. The "Revenge of the South": the French Case

Unlike countries like Italy or Greece, it is obvious that France is not only occupied with the mediterranean sea and that the country is also widely opened to northern influences. In another respect, the attraction power of the french central state gave birth to such a concept as "Paris et le désert français", which gives a nice picture of the role played by domestic public bodies and the government in the national economic life. One must notice however that, despite the persistent domination of the Region Isle de France several major changes recently occured in the french spatial economic organization, the most important beeing the shift of the population towards the southern regions. All the recent economic and statistical studies reveal indeed that an increasing part of the qualified jobs are located on mediterranean areas, that the demographic dynamics run in favor of the southern regions and also that the relative economic weight of these regions is increasing at the expense of the other french zones. It is also of interest to notice that a major part of the french technological development (except from the Parisian region) is nowadays due to the southern regions and more particularly to several areas such as Toulouse-Le Mirail, Grenoble-Zirst de Meylan or Nice-Sophia Antipolis : the so-called french technopoles.

Due to these facts some authors now speak of a "revenge of the south" (Berger and alii, 1988), marked by a brilliant future for these regions. One may have some doubts about this prospect, with regards to the true functioning of these technological areas. **In order to bring some light on this technological process, let us turn to a case study, e.g. the so called "technopole of Sophia Antipolis".** One of the best symbols of the french technological spirit of the eighties, **the technopolis of Sophia Antipolis** employs now about twelve thousand people in a well defined place, located near Nice and Antibes on the Côte d'Azur (the French Riviera). This localised system of production and innovation is of a high interest for our research because it remains a nice case study and that it could provide several stylised facts about the manner to attract (and to lock in?) foreign technologies in a Region which was not previously involved in high tech productions. Even if France Technopole (the french national agency which organises and promotes the development of the french technopoles) recently made an inventory of fourty two parks, one must notice that Sophia Antipolis occupies a peculiar situation in this national

organisation, both regarding the fact that it was build on a place and in a Region traditionnaly devoted to sunny holidays or retirement and with respect to its economic efficiency in terms of technological attractiveness. The image of **Sophia Antipolis** is that of a département (les Alpes Maritimes) whose local authorities claim that technological incomes are now more important than those yield by tourism activity. It also **gives a nice picture of the success attached to technological development, and most of all to the power of synergetic feedbacks or "cross pollinisation" effects.** Last but not least it is the best picture of a winning new South, along the costs of the mediterranean sea.

The Science Park of Sophia Antipolis has been created in the seventies as conceived by the personal initiative of the director of the "Ecole des Mines" (one of the most famous french high schools, the focal point of french public bureaucracy and large firms' management), Pierre Laffitte, who had the vision of a city of "Science, Culture and Wisdom" (on the creation and development of Sophia, see Quere, 1990). The slow start of the seventies has been followed in the eigties by a period of great success, which is conducing now to a large concentration of both private and public institutions, mainly specialised in high technologies. Several laboratories of french or US firms are located on the park (Thomson, Télésystèmes, Dow Chemicals, Dow Corning, D.E.C.,...), together with public bodies like C.N.R.S., the University of Nice-Sophia Antipolis, the Ecole des Mines or the Institut National pour la Recherche en Informatique et Automatique (INRIA). A small network of small firms is to rise up in the nineties, mainly devoted to producers services. A major feature of the park is that it does not involved any kind of production activities; only fundamental research or R&D laboratories.

IIB. Technopoles and Science Parks

As revealed by the french example Technopoles are partly an answer to the question of localised technological development and most of all to the debate on creation and location of technology. Sometimes called science parks, these local areas combine location of hi tech production, exchange relations between such actors as firms and/or both private and public laboratories, and cooperation networks. They give a nice picture of the technological spirit of the winning regions of the eighties and seem to pave the way for future technological successes. **Beyond this positive image one can wonder if all the technopoles are capable to attract foreign technologies and to lock them on a well defined area and if they bring new technological opportunities of economic development to the mediterranenan regions?**

Let us remind first that, according to several scholars in the field there exists various types of technopoles or science parks, with peculiar characters. For example, the approach in terms of "regional innovation complexes" (Stohr, 1986) implies determinants such as the education and professional training institutions, technology

management and venture financing, in order to explain localised synergies. But it is widely accepted that the main characteristic of a technopole is the integration of two functions : technological innovation and territorial construction (Perrin, 1990). Yet, **recent empirical researches showed the existence of two types of technopoles** (Charbit and alii, 1991):

- the first model - which also seems to be the most common - **concerns the technopoles conceived as agglomerations of R&D subsidiaries, created in order to promote a localised development of high technology activities.** They can be divided into two distinct types : the firms nurseries or incubators, and the science parks. The firms nurseries or incubators are devoted to the support of high tech firms at their very beginnings, the initiators of these parks may be of a public or private nature. The science parks are constituted as a regrouping of R&D activities : production activities remain quite rare.

- the second model is based on technopoles integrated to localised innovation or production systems. These forms focus on cooperations existing in a given site, between the different members of the production process of goods, amongst which appear collaboration networks based on spatial proximity. The "technopolitan" nature of such systems does not rest on the type of resource they offer, but on the density and persistence of industrial cooperations maintained by firms which belong to the same network, and also on the articulation between the different networks, which gradually structures the territory, and even the region, into innovative "milieux" (Camagni, 1994) or "localised systems of innovations".

Yet, it must be kept in mind that the technopole is first of all an "image" and a particular supply of site, or in other words a property transaction (Rallet, 1991). In any case, the image sustained is very important and often surpasses the possible local synergies, to the point that the function of loss leader of the technopole, and its window dressing effect becomes locally paramount. Then, the driving effects or the diffusion of innovations technologies should be assessed at the regional level in more general terms.

This diversity of the technopoles is probably one of the main grounds of the diversity of location motives of the firms in a science park. However, according to the studies of Monck et alii (1988) or Galbraith and De Noble (1988) concerning a few Britain and US case studies, High Technology firms mainly refer to the same themes in their answer about the location question. The technological attractiveness of the technopole comes far away from other motives such as the image of the site, the cost of land, the sense of safety or the proximity to the highway or the airport. Several firms even adopt free riders behaviors when they just put their official adress in a technopolis in order to beneficiate from the image, without any activity on the site. Let us notice however that the presence of a University or of a school of engineers is generally considered as a highly

positive factor of location, together with the credit linked with the location within a high tech area.

IIC. The Nicean Model: better shred than dead

Given these theoretical underpinnings, one needs to go beyond the picture of Sophia-Antipolis and the other southern french technopoles and to focuse on two main topics:

- what are the genuine effects of this technological growth on the development of the French southern regions? (in other terms, is this attraction of foreign technologies correspond to or induce a parallel development of the whole Region?)
- what is the true functioning of the technopolis of Sophia Antipolis? (in other terms, does the synergetic effects really exist and are they at the core of the attraction and generation of technologies?)

As pointed out by Centi (1993), the real meaning of the so called "revenge of the south" deserves little attention in the economic literature, and it is widely accepted that the development of the mediterranean regions is paving the way for the future of France (see for example Berger and alii, 1988). Deeper explorations in the relations between North and South exhibit however a major disequilibrium between Paris and the other french regions. For example, about 40% of the graduates students leave the Côte d'Azur to Paris, because they do not find a job on the south (given the fact that a lot of mediterranean students are obliged to perform their studies in Paris due to the lack of local specialisations and never come back to the southern regions).

Moreover, the existence of such places as Sophia Antipolis, with a high rate of attraction, devoted to scientific researches, brains and quality without pollution is supposed to give birth to a new model of development, and even to a new model of management of innovations. One may ask the question of the existence of such a model and most of all of the inducement power of this technopolitan development. Even if an accurate answer is far from being easy, we can provide with some preliminary insights. For example it is obvious that the rate of unemployment has experienced a constant growth in the eighties and is now one of the highest in France on the French Riviera. The opposite is true for the employment/population ratio, one of the lowest in France and still stationary until the sixties. **It is clear that the success of several science parks does not involve a general dragging effect on the southern regions and that these areas still suffer from a lack of development.**

The explanation of this somehow paradoxal situation is twofold. Firstly the major role played by Public Bodies is an obstacle to the process of regional

development, secondly the non production status of the technopolis of Sophia Antipolis makes it sensible to the delocation processes. The role played by Public authorities, and especially by the D.A.T.A.R. (Délégation à l'Aménagement du Territoire et à l'Action Régionale) in the development of Sophia Antipolis is at the core of this question. The choice to promote the development of several southern regions and especially in our case of Sophia Antipolis has led to the repeated location of public research laboratories, which represent nowadays about 50% of the research employees in the Provence Alpes Côte d'Azur (PACA) Region. Centi suggests that this distribution is just an outcome of the french willingness to delocate some of the activities of the Parisian belt, without giving any incentive for a southern regional development. The comparison with the so called "third italy" is at stake: the industrial districts of Prato or Sassuolo... are the result of ancient processes of local production and collaboration between private actors, even if public authorities provide them with some incentives (an integrated communication network for example). The French case is entirely opposed: the delocation of (a small part of) public research corresponds to a choice in national distribution. These laboratories only have small links with the regional production system and often give priority to their relations with Paris (as an illustration, there are everyday fifteen direct flights from Paris to Nice). According to Centi one may suggest that the nicean model is partly an appendix of the Parisian system, which collects economic activities due to the attractive character of the ecologic environment.

The fact that most of the activities of the science park are devoted to fundamental or applied research, with no productive outputs, is more intriguing and asks the question of the peculiar character of synergetic effects within the technopolis. In a more general manner it may be hazardous for the durability of Sophia Antipolis because **these activities:**

- are not linked with a local economic tradition in this domain and then may be isolated, without network connections and intermediary organisms (this point may however be subject to slightly changes in the near future given the increasing number of interactions between the University or High Schools and the larger firms concerning the creation of a skilled human capital);

- present a high probability of delocation, due to the lack of relations with a local production complex.

Despite these limits, the technopolis of Sophia Antipolis remains a successful example of the opportunity to attract foreign technologies in a previously non developped area. Let us have a more precise investigation into its internal functioning and try to explain its attractiveness with reference **to several studies performed on this topic by local institutions or researchers** (Maynard, 1992, Quere and alii, 1987). **All these studies**

indicate both a high technological intensity and a lack of internal relations within the park.

As indicated by Maynard the studies of the local Chamber of Commerce reveal that nicean firms limit their local relations to the purchase of common services and favour national or international competences for their consumption of peculiar products and services. The same result is obtained in a joint study performed by several laboratories of the C.N.R.S. (Quere and alii, 1987), introducing a distinction between indigenous and allogenous firms. The first ones are locally created enterprises, mainly of a small size and linked with sub-contracting relations to larger firms, when the allogenous firms are affiliates of large, usually multi plant, entreprises and have been delocated in Sophia during the seventies and the eighties. To the authors, who restate their results in another study (Charbit and alii, 1991), the technopolis of Sophia Antipolis is characterized by the weakness of the internal relations between local actors. Mainly organised around three poles (NTIC; Chemicals, pharmaceuticals and biology; Energy), the park is suffering from a lack of linkages between the large firms, be there partnerships, exchange of informations or purchase of services. They conclude to the lack of a local labor market, capable to perform a regulatory function. **The technopolis is exposed to a great peril: the allogenous firms (the most significant local actors) may be prompt to delocate if they receive better proposals from other science parks or technopoles.**

If we compare the position of Sophia Antipolis with the taxonomy sets in tables 1 and 2, the main features of the area are clearly revealed. Concerning the table 1, one can notice that technopoles are mainly concerned with vertical links (due to the lack of vertical cooperations) and may be both linked with the existence of a local leadership from large firms or a halo of small firms, but the case of Sophia Antipolis must be restrained to the intersection between "leaders" and "vertical links". For the table 2 on technological diffusion, one must admit that the local process of technological transmission is bounded to the embodied unvoluntary diffusion by dint of services and the limited local exchanges of patents and innovations. The only exception is due to the exchange of skilled human capital between Universities and High Schools and local firms.

It is clear that the the area is highly unable to create a spatial lock in process. **The (semi) success of the technopolis of Sophia Antipolis (high coefficient of attraction, poor stickiness) is mainly based on four factors :**

- the accumulation of R&D knowledge;

- the speculation on lands;

- an effort in promoting the image of the technopole, or in terms of window dressing;

- a recent but increasing relation between scientific bodies and local firms.

These factors explain both the location of foreign laboratories and public bodies and the constant risk to a rapid delocation. The accumulation of R&D knowledge and laboratories is a key success for the park. It has allowed the delocation of thousands of jobs and still continue to supply the firms with young researchers issued from the University or the Schools of engineers. The speculation on land gave rise to an attraction process: the science park is located now in a place where the prices raise a very high level, regarding to the lack of ground for promoters. The firms which had anticipated this process are today the owners of sites of an extremely high value. But this positive point may turn to a risky adventure in the cases where the firms decide to leave the technopole and to realise their profits (two years ago, several large firms threatened to leave the park if the Chamber of Commerce does not make any improvement in the development of international connecting flights). The window dressing effect, which is organised by the Fondation de Sophia Antipolis, is of a very high interest. The foundation uses to promote the image of the park in terms of synergetic effects, cross pollinisation and sunny environment. Its promotors are aware of the very nature of the park but they think preferable to diffuse an image wich can contribute to the attraction of foreign technologies. In a word, the technopolitan system runs well but is a fragile one.

Conclusion

A policy devoted to the attraction and the durability of the location of technologies in a technological area has to deal with the peculiar character of the different localised systems of production and innovation. As suggested by the example of the technopolis of Sophia Antipolis, the minimal conditions (sometimes disappointing in their simplicity) to attract foreign technologies are to organise an important effort in promoting the image of the technopolis or in terms of window dressing, to encourage the accumulation of R&D knowledge and to organise the speculation on lands.

It is however even less easy to lock in technologies or to guarantee the durability of a technological area. First of all, local actors (private and public bodies, intermediary organisms and consumers) must share joint expectations (see Matsuyama, 1991). Then, after consideration of the type of technological diffusion within the peculiar system, the policy may consist to promote the local spread of information and to organise a network of local actors and skilled workers in order to increase the cost of delocation and to lock in local technological knowledge.

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