Regional Studies, Vol. 00.00, pp. 1–16, Month 2008

Gatekeepers of Knowledge Versus Platforms of Knowledge: From Potential to Realized Absorptive Capacity

NATHALIE LAZARIC*, CHRISTIAN LONGHI* and CATHERINE THOMAS†

**GREDEG – University of Nice Sophia Antipolis and CNRS, 250 rue Albert Einstein, Sophia Antipolis, F-06560 Valbonne, France. Emails: lazaric@gredeg.cnrs.fr and longhi@gredeg.cnrs.fr*

†Université Paul Verlaine – Metz; and GREDEG – University of Nice Sophia Antipolis and CNRS, 250 rue Albert Einstein, Sophia Antipolis, F-06560 Valbonne, France. Email: thomas@gredeg.cnrs.fr

(Received June 2006: in revised form September 2007)

LAZARIC N., LONGHI C. and THOMAS C. (2008) Gatekeepers of knowledge versus platforms of knowledge: from potential to realized absorptive capacity, *Regional Studies*. The development of clusters rests on geographical proximity, cognitive interactions as well as entrepreneurial initiatives. Sophia Antipolis, a multi-technology cluster in Valbonne, France, is a good illustration of the type of challenges local systems of innovation face in creating positive knowledge externalities. This paper shows that if the existence of 'gatekeepers of knowledge' can generate the potential implementation of 'absorptive capacity', its effective realization requires some additional effort regarding the transfer of knowledge into the cluster. The concept of 'platform of knowledge' defined shows how a project of knowledge codification could generate externalities by creating new opportunities for effectively combining and absorbing knowledge.

High-technology clusters Knowledge Gatekeeper Platform of knowledge Sophia Antipolis

LAZARIC N., LONGHI C. et THOMAS C. (2008) Gatekeepers of knowledge versus platforms of knowledge: from potential to realized absorptive capacity, *Regional Studies*. Le développement des clusters repose sur la proximité géographique, les interactions cognitives et les initiatives des entrepreneurs. Sophia Antipolis, un cluster fondé sur plusieurs technologies, est une bonne illustration des obstacles que les systèmes locaux d'innovation doivent franchir pour créer des externalités de connaissance positives. Cet article montre que l'existence de 'relais de connaissance' ('gatekeepers of knowledge') peut engendrer des capacités d'absorption potentielles, mais que leur réalisation effective implique des efforts supplémentaires relatifs aux transferts de connaissance dans le cluster. Le concept de 'plate forme de connaissance' proposé montre comment un projet de codification des connaissances peut générer des externalités en créant des opportunités nouvelles pour combiner et absorber des connaissances.

Cluster high tech Connaissance Gatekeeper Plate forme de connaissance Sophia Antipolis **Q1**

LAZARIC N., LONGHI C. und THOMAS C. (2008) Gatekeepers of knowledge versus platforms of knowledge: from potential to realized absorptive capacity, *Regional Studies*. Die Entwicklung der Cluster hängt von der geographische Nähe, kognitiven Interaktionen und Initiativen der Unternehmer ab. Sophia Antipolis, ein Multi -Technologie Cluster, ist eine gute Illustration der Hemmnisse, die die localen Innovationssysteme überwinden müssen,um positive Externalitäten zu schaffen. Dieser Artikel zeigt, dass die Existenz von 'Wissensrelais' ('gatekeepers of knowledge') potentielle Absorptionsfähigkeiten erzeugen können, aber ihre effektive Realisation zusätzliche Anstrengungen bezüglich der Wissenstransferts in dem Cluster erfordern. Das Konzept der vorgeschlagenen 'Wissensplattform' zeigt, wie ein Projekt zur Kodifizierung des Wissens Externalitäten hervorrufen kann, indem neue Gelegenheiten geschafft werden um Wissen zu kombinieren und zu absorbieren.

High-technology cluster Wissen Gatekeeper Wissensplattform Sophia Antipolis **Q2**

LAZARIC N., LONGHI C. y THOMAS C. (2008) Guardianes del conocimiento *frente* a plataformas del conocimiento: de la posible capacidad absorbente a una realidad, *Regional Studies*. El desarrollo de las aglomeraciones radica en la proximidad geográfica, las interacciones cognitivas y las iniciativas empresariales. Sophia Antipolis, una aglomeración multitecnológica, ilustra a la perfección el tipo de retos a los que se enfrentan los sistemas locales de la innovación a la hora de crear efectos externos positivos de conocimiento. En este artículo demostramos que si la existencia de 'guardianes del conocimiento' puede generar la posible aplicación de 'capacidad absorbente', su realización eficaz requiere un esfuerzo adicional con respecto a la transferencia de conocimiento en la

0034-3404 print/1360-0591 online/08/000001-16 © 2008 Regional Studies Association
http://www.regional-studies-assoc.ac.uk
DOI: 10.1080/00343400701827386

aglomeración. El concepto de 'plataforma del conocimiento' que se a definido muestra de qué forma podría un proyecto de codificación del conocimiento generar efectos externos al crear nuevas oportunidades para combinar y absorber eficazmente el conocimiento.

Aglomeraciones de alta tecnología Conocimiento Guardián Plataforma del conocimiento Sophia Antipolis

JEL classifications: L20, L86, O3, R11

INTRODUCTION

High-technology clusters are strategic *loci* of creation of knowledge and resources. In the context of the 'learning economy', their role has recently been emphasized in France with the creation of the 'poles of competitiveness'[1] as keystones of regional policy. These 'poles' are supposed to be interconnected and open to their environment; such integration into global innovative networks appears to be an important condition for their viability. A vast amount of literature has emphasized the crucial role of space in building localized capabilities and learning (e.g. MASKELL and MALMBERG, 1999; and KEEBLE *et al.*, 1998, among others). In this context, space is no longer considered as a container but as a set of potential interactions between different sets of actors (COFFEY and BAILLY, 1996; RYCHEN and ZIMMERMANN, 2006).

The present paper aims to illustrate such interactions inside clusters, i.e. their ability to create local knowledge and to diffuse and absorb it during innovative projects. It will be shown below that these conditions might fluctuate according to the local organizational set-ups implemented in the cluster. Indeed, MARKUSEN (1996) has shown that different forms of territories could coexist. Consequently, the same geographical area can evolve into diverse organizational forms depending on the specific small events and feedbacks in the area (ARTHUR, 1990).

It will be illustrated why the development of clusters rests on the creation of local competencies through geographical proximity, cognitive interactions as well as entrepreneurial initiatives. The distinction between potential and realized 'absorptive capacity' (ZAHRA and GEORGE, 2002) will be introduced so as to show the necessity of re-examining the notion of 'gatekeepers of knowledge' and of discussing its possible evolution into a new one: that of a 'platform of knowledge'. The Sophia Antipolis information and communication technology (ICT) cluster, which is one of the main European high-technology centres, will be investigated. This cluster was relatively recently created so that the authors could provide an overview of its history, and of the 'small events' that have contributed to intensify its local interactions.

The first part of the paper discusses issues related to knowledge at the territorial level. Local systems, as well as what will be understood as proximity, have evolved substantially over time, mainly because of the globalization of innovation processes that characterizes modern economies. This is one of the reasons why knowledge codification might provide opportunities to change the traditional roles and may create a knowledge-fostering dynamic and a capacity to reinforce local competitive advantage. The second section provides an historical overview of Sophia Antipolis, so as to illustrate some of the local conditions that have contributed to transforming the 'satellite platform' into a 'platform of knowledge'. Finally, the third section contains a description of a specific dynamic at work locally that has contributed to the development of the ICT cluster. This dynamic will be illustrated through the presentation of the 'Knowledge Management Platform' (KMP) project which has generated various externalities.

LOCALIZED LEARNING AND KNOWLEDGE DYNAMIC

The creation of localized capabilities is a delicate process generating knowledge externalities that have to be channelled both inside and outside the cluster. In traditional districts, 'gatekeepers of knowledge' assume this role. However, the evolution of traditional districts and the creation of high-technology clusters necessitate the development of new knowledge combinations so that their growth can be sustained. 'Gatekeepers of knowledge' might have some limitations in this cognitive process. Their *transferring function* might not always be effective in a network where knowledge has to be efficiently distributed. For this reason, such actors could evolve by transforming themselves into knowledge creators. This requires a shift in their approach to knowledge sharing from closure to disclosure. The effective realization of 'absorptive capacity' by a cluster's members plays a vital role in sustaining such entrepreneurial initiatives.

Knowledge platform or how to move beyond the traditional role of 'knowledge gatekeepers'

How knowledge is created and diffused at the local level is a crucial issue for academics, practitioners, and politicians. This question is not new and has for a long time been discussed in the debate concerning the geography of innovation. AUDRETSCH and FELDMAN (1996), in a seminal work on research and development (R&D) investments, underlined the propensity for

industrial activity to cluster spatially in order to benefit from knowledge externalities. However, the real question is not that of the clustering effect, which has long been observed, but the differences in localization behaviours and in the ability to capture these externalities. These differences could be explained through the concept of 'knowledge filter', a concept that translates the diversity with which the different actors convert existing opportunities into real innovations and products (Acs *et al.*, 2003). Indeed, the traditional rhetoric according to which can automatically be transformed into industrial products is not sufficient to explain knowledge spillovers. New knowledge can be exploited by the actors, but these opportunities, which have to be discovered, do not emerge spontaneously. On the contrary, before it can become an opportunity, knowledge has to be identified clearly. There is a filter between the stock of knowledge and its use, i.e. an absorptive capacity on the part of the recipient and the emitter for successful combination to occur (Acs *et al.*, 2003).

The basic attributes of knowledge concern these various externalities and its potential openness. Knowledge is distributed among various decentralized units and needs to be shared and absorbed in a local context. As Schumpeter claimed long ago, knowledge has to be combined in order to produce innovation. This alchemy is far from automatic because some opportunity must pre-exist in order for viable interactions to occur (Nahapiet and Ghoshal, 1998). This shows that motivation is essential for such exchange to be beneficial. Indeed, without the engagement of the firms and actors, knowledge will retain its 'sticky' nature and will reinforce the 'knowledge filter' mentioned above (Szulanski *et al.*, 2004).

If it is assumed that knowledge is distributed among various groups, communities or firms, knowledge is also spatially bounded. In this context, the globalization of innovation is concomitant with its localization emphasizing why both tacit and codified knowledge are necessary for sustaining knowledge creation.[2] Because of its complexity, the innovative process has to be regulated and coordinated so that the 'absorption capacity' of each organization can be increased (Cohen and Levinthal, 1990).

In the description of a Chilean cluster in Cochagua Valley, Giuliani and Bell (2005) defined 'a cluster's absorptive capacity as the capacity of a cluster to absorb, diffuse and exploit extra-cluster knowledge' (p. 49). Firms with higher absorptive capacities are more likely to build external ties so as to reinforce their innovative capacities. The absorptive capacities of the local actors vary, preventing the uniform diffusion of knowledge. For example, some firms might transfer more knowledge than they initially receive and play an active role; others may act as 'net absorbers'. This variety generates an imbalance during interactions depending on the knowledge base of the firms and their position in the cluster. Certain firms might appear as 'technological gatekeepers' and may play a central role in the network in transferring knowledge while being strongly connected to external sources of knowledge; others are 'active mutual exchangers', i.e. characterized by the right balance of absorption and diffusion of knowledge; while others still might appear to play the role of 'weak mutual exchangers' with a balanced role of absorber. External stars have strong ties with external sources of knowledge and limited connections within the cluster, while 'isolated firms' have no strong connections either within or without the cluster (Giuliani and Bell, 2005, p. 60).

This external openness, however, is related to the territory's specificity. Usually, industrial districts are characterized by an important degree of similarity between the knowledge bases of the various actors. In the Chilean Wine cluster, the main problem is that of renewing the traditional knowledge base by importing fresh ideas. In high-technology clusters, the opposite situation might exist because firms have diverse knowledge bases with external connections and, consequently, need to increase their own interactions in order to combine knowledge efficiently. In spite of this significant difference, the question of the governance of knowledge – i.e. implementing common rules in order to enhance the actors' capacity to combine knowledge – is common to all clusters. In clear, 'technological gatekeepers' – in the sense given by Giuliani and Bell (2005) – or 'knowledge gatekeepers' – according to Morrison terminology – do exist and are not just a fable. The present authors will now be more explicit on their relative attributes.

The 'gatekeepers of knowledge' can be present during coordination and learning process (Allen, 1977; Morrison, 2004; Rychen and Zimmermann, 2006). According to Morrison (2004), gatekeepers constitute:

> a small community, they are at the core of an information network, they are exposed to external sources of information, and the linkages they develop with external actors are mostly informal.
>
> (p. 7)

They are at the heart of the network and could either create 'network externalities' or restrict knowledge access intentionally or unintentionally. In effect, they have various roles:

- A knowledge searching function for capturing external sources of information.
- A transcoding function for translating the meaning of such an information.
- A transferring function for disseminating accumulated and local knowledge (Morrison, 2004, p. 8).

If this latter function is not realized, the existence of knowledge variety cannot generate new combinations and lead to a lack of local innovation.

In his seminal work on clusters, PORTER (2000) described their main attributes: their potential upgrading role, in the industrial specialization, through the presence of fruitful interactions concerning the demand side. These externalities result from the combinations of close and distant interactions, their mobilization materializing into local capabilities. The difference between traditional districts and high-technology clusters resides in the latter's ability to provide new knowledge combinations adapted to future markets and future products present in the region. This local coordination and local entrepreneurship can be promoted by leaders' firms or 'gatekeepers of knowledge' (MORRISON, 2004; ALBINO *et al.*, 1996). However, the 'knowledge filter' might obstruct the operation of a real transferring function between each local firms or institutions.

In order to avoid this problem, a 'platform of knowledge' could be built inside the cluster so as to regulate external and internal linkages. Its purpose is to overcome the traditional obstacles to cooperation, and promote the development of suitable interactions between the different sources of technological know-how, so as to reinforce the combinative capabilities, create viable rules, and finally realize the transcoding and transferring functions. The basic hypothesis, therefore, is that a cluster can benefit from latent 'network externalities' between organizations to innovate.

In high-technology clusters the main issue is not so much the creation of external links, which are already present, but the reduction of the 'cognitive distance' between firms that belong to various technological fields. A balance must be found between local and global learning within technological trajectories so as to facilitate the creation of new opportunities with existing knowledge bases. The network could be envisaged here as a means of going beyond the traditional dilemma between exploitation and exploration and of offering both specialization and variety generation:

> Networks offer the benefit of both specialization and variety generation. The superior abilities of markets to generate variety are a commonplace belief. ... The converse of this statement is that firms are superior vehicles for the accumulation of specialized learning. ... Specialization and variety are antithetical within the firm, but define complements within a network ... network capabilities ... are not specific to a firm, but represent joint gains to coordination and learning.
>
> (KOGUT, 2000, p. 406)

The 'platform of knowledge' might regulate knowledge spillovers by creating 'Marshallian externalities' related to gains of specialization and interactions between organizations that need to accumulate know-how in a specific technological field (the exploitation stage) or, on the contrary, by creating 'Jacobian externalities' that facilitate the search and exchange of complementary knowledge (the exploration stage). This trade-off is crucial for coping with existing opportunities and for promoting evolution in the face of disruptive changes imposed by technological progress and globalization (IAMMARINO and MCCANN, 2006).

However, the governance of 'network externalities' requires the development of specific capabilities to avoid the absorption of knowledge by a small group of firms. The 'platform of knowledge' might be designed via a codification of knowledge, which makes it possible to go beyond the traditional role of knowledge gatekeepers. Codification, however, is only one aspect of knowledge creation; the other is the development of shared knowledge and tacit knowledge between the members of a community (LAZARIC *et al.*, 2003).

Very recently, the debate concerning regional knowledge platforms has galvanized the attention of some authors and has led them to explore possibilities of regional development involving various actors located within a cluster (firms, knowledge centre, research centre) (HAARMAKORPI and MELKAS, 2005; HAARMAKORPI, 2006; COOKE, 2006; ASHEIM *et al.*, 2006). In the case of Lahti in Finland, a regional platform has been developed to improve the absorptive capacity of the cluster by identifying the various existing tendencies and by elaborating various scenarios around the 'related variety' that could be created, reinforced, or imagined (variety along the traditional technological trajectory or between various technological trajectories). The main objective is to look beyond this variety and 'enhance "visualization" and "potentialization" for the region' (COOKE, 2006, p. 14). This highly empirical reflection emphasizes the importance of communication for preventing the emergence of the so-called 'knowledge filter' and for benefiting from the real 'network externalities' that exist in the cluster.

The ambition of these regional development platforms is driven by the multipurpose character of technologies present at diverse stages of the innovative process (BOSCHMA, 2005). In order to exploit the generic technologies and their potential 'related variety', the platform is a stimulating organizational set-up to transcend traditional sectoral policies and to exploit possible interrelatedness present inside diverse knowledge bases (ASHEIM *et al.*, 2006; NESTA and SAVIOTTI, 2006).

Creating localized capabilities: from 'potential absorptive capacity' to 'realized absorptive capacity'

It is generally acknowledged that the development of high-technology clusters is not a deterministic process, but the result of a chaotic and dynamic process through which activities are coordinated and a common language developed (MALMBERG and MASKELL, 1999; LORENZEN and FOSS, 2003; NOOTEBOOM, 2003).

In effect a cluster:

> merges to the extent that a group of firms establish – intentionally and/or unintentionally – mechanisms of coordination that strongly reduce the various transaction costs involved in the process coordinating the process of innovation between legally independent firms, and where these coordination mechanisms a specific to the set of geographically bounded agents.
>
> (LORENZEN and FOSS, 2003)

This definition, which goes beyond the classic argument of geographical proximity, promotes the entrepreneurial willingness to coordinate the division of labour in order to reduce transaction costs, create local capabilities, and diffuse a shared vision of business growth among diverse technological trajectories (also COOKE, 2003). In this sense, clusters are 'organized markets' aiming to reduce the cognitive distance between different firms (MASKELL and LORENZEN, 2003). Cognitive distance plays a pivotal role here because it reinforces or reduces diversity within a network (NOOTEBOOM, 2003; KOGUT, 2004), which might become an obstacle.[3] Consequently, the nature and the importance of the 'cognitive distance' between firms are critical for reducing the 'knowledge filter' in a cluster.

Clusters are essential for the exploration of new opportunities and for helping firms to move beyond their traditional views of the market and technological trajectories. Firms can absorb new external knowledge by creating combinations with localized or external firms. In this sense, the cluster should not be reduced to a set-up stimulating the exchange of tacit knowledge and shared understanding, but should be sufficiently open to allow the dissemination of new ideas (be they tacit, articulated or codified). If openness is crucial for the exploration of external markets and to the understanding of a successful cluster, information accumulation, however, should not become a substitute for relevant knowledge.[4]

The creation of localized capabilities, the reduction of transaction costs, and the building of a shared vision of the market for future technological opportunities require an original form of knowledge lying between the tacit and codified types. Clusters offer such opportunities if knowledge is mobilized through local interactions and if existing potentialities are utilized. To clarify: the knowledge base is the invisible part of the process that could be expressed in various competencies (technological, organizational, and relational). Competences are knowledge in use, whereas the knowledge base is the vast amount not always materialized in the realization of products or technologies. Indeed, before having access to some elements of the knowledge base and its possible interrelatedness, firms may have the opportunity to identify some competences present at the regional level for evaluating their fitness with prior knowledge. The absorption of knowledge is far from being an automatic procedure (COHEN and LEVINTHAL, 1990; BOSCHMA, 2006). To obtain some local competitive advantage at the regional level, firms have to mobilize energy to materialize potentialities inherent to their knowledge bases, i.e. their potential absorptive capacity (PACAP) (ZAHRA and GEORGE, 2002). The realization of absorptive capacity (RACAP) through effective innovation has to be initiated in order to be created. The passage from PACAP to RACAP is not only a period going beyond a simple discovery of knowledge base, but also is a stage where some competencies are integrated. It will be argued herein that while leader firms play a crucial role in absorbing and enriching their own knowledge base, they might not have the motivation or the capacity to invest their energy in the local community.

Various reasons could explain such behaviour. First of all, accumulation and/or creation of knowledge might require some industrial prerequisites concerning the complementarity between the different knowledge bases. More generally, this argument concerns the knowledge-based industrial dynamics that make the process viable: the various stages of development in the ICT value chain, for example; the technological strategy of each firm concerning the division of labour; and the technological protocols facilitating or impeding such cooperation. Secondly, institutional barriers might hinder knowledge diffusion by preventing the disclosure of knowledge to the public or by creating a climate of suspicion against the diffusion of academics results, or simply because of the absence of any organization that would diffuse reliable information and knowledge to the local community (KRAFFT, 2004).

In a context where the diffusion and transfer of knowledge and know-how are difficult, the actors have to be motivated and committed. This dynamic can be created if the local actors benefit from working together in specific fields in order to create and develop specific innovative products and produce original combinations of know-how. A spirit of local entrepreneurship can emerge and enable the actors to convert this know-how into innovations, as long as the social mechanisms at work locally are able to support these exchanges and combinations. The transferring function can be fulfilled through the 'platform of knowledge', which might provide opportunities to conduct new knowledge combinations. It also creates some potential RACAP while generating indirect social integration mechanisms for maintaining social compromises, particularly those related to knowledge diffusion. Fig. 1 illustrates the mechanisms of absorptive capacity.

To summarize this debate, it is argued that in a cluster, interactions and social integration mechanisms are created in a dual process. The first part of this process is related to the 'cognitive distance' that exists in the cluster; the second part is political and related to an effective mobilization and engagement of the

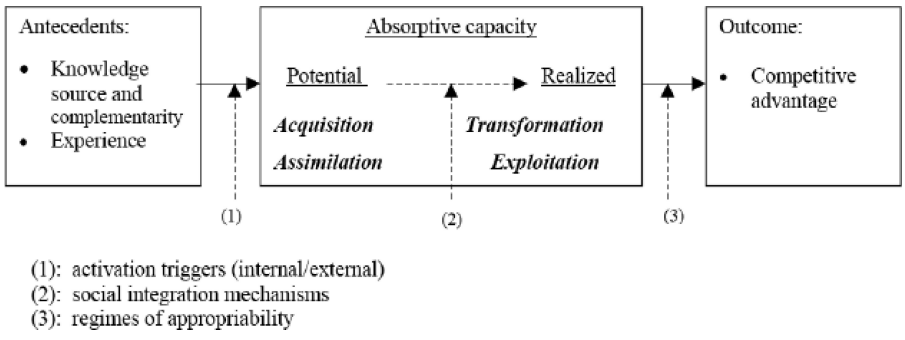

Fig. 1. *Potential absorptive capacity and realized absorptive capacity*
Source: ZAHRA and GEORGE (2002, p. 192).

local capabilities in order to overcome the existing obstacles to cooperation (industrial and institutional ones notably).

SOPHIA ANTIPOLIS: FROM SATELLITE PLATFORM TO PLATFORM OF KNOWLEDGE

The story of Sophia Antipolis illustrates how the conditions of the creation or development of a localized knowledge base, the mobilization of internal or external knowledge, can change according the organizational design or innovation regime that prevail locally. If Sophia Antipolis, born as a 'satellite platform' following Markusen's typology, has evolved to a high-technology cluster built around the telecommunication technologies, the presence of the 'knowledge filter' across the cluster significantly slows down the potential innovative process. The diversity of the knowledge bases is critical here for the creation of localized capabilities. The creation of a 'platform of knowledge' and the mobilization of various actors related to the ICT cluster might contribute to reducing such variety by reinforcing the social mechanisms. The 'Knowledge Management Platform' (KMP) project illustrates such a process of transformation of traditional 'gatekeepers of knowledge'. However, as will be shown, such a process is not an easy task and the mobilization of local actors is a by-product of various events leading to the gradual emergence of local entrepreneurship.

From satellite platform . . .

The choice of Sophia Antipolis for the development of a high-technology innovation cluster might seem strange at first sight since the region had neither an industrial nor a university base. Nevertheless, the area did have some significant assets, including an international airport, a pleasant climate, and a cosmopolitan tradition. However, apart from the existence of significant infrastructures, nothing predisposed the region to high-technology-based economic development.

Sophia Antipolis was the result of a succession of 'small events' that occurred during the 1960s (for a detailed analysis of the Sophia Antipolis experiment, see LONGHI and QUÉRÉ, 1994; LONGHI, 1999; and GARNSEY and LONGHI, 2004). A significant one, at the beginning of the process of development, was the establishment in 1960 of an IBM research centre near Nice. Texas Instruments soon followed IBM, a move that lent some credibility to the idea of a Sun Belt effect. Still, these ideas might have come to nothing were it not for the influence of one man, Pierre Lafitte.[5] He had a utopian vision of a rural 'Quartier Latin', a 'City of Science and Wisdom', and endeavoured to transform this vision into a project. Another decision proved crucial: France Telecom's decision to set up an infrastructure base in Sophia Antipolis was decisive in the creation of a national and international communication network.

Lafitte's ideas were diffused quite quickly. The project had a fast start thanks to the relocation of a number of external organizations into the area; these organizations were attracted by the quality of the infrastructures existing in the area. The French decentralization process led to the relocation of several large public companies and laboratories. This process was later followed by a campaign to promote the region, with an emphasis on its climate attractiveness and its industrial facilities. Large multinational companies (mostly American) chose Sophia Antipolis either as their European administrative base or as an R&D centre in charge of adapting their products to the European markets. Global firms invested heavily in the area, establishing self-contained units capable of operating without any local links.

The newly relocated companies had their own resources and their development could have been pursued with no interactions between them. All decision-making and industrial strategies were planned outside Sophia Antipolis. Therefore, despite the territorial proximity, the 'cognitive distance' between the various organizations (public and private) was significant in the early stages of development and the interactions between them were sparse. These small

events created a 'satellite platform' for using MARKUSEN's (1996) taxonomy, i.e. a system directed from outside, rich in external connections, but deprived of internal linkages. Despite this, a process that reinforced the early expansion soon set in. The agglomeration resulted in the emergence of two main clusters of technological activity. The first cluster comprised organizations specialized in the fields of computer science, telecommunications, and electronics. It was this first cluster that provided the impetus for the growth of the project and structured the development of its industrial environment.[6] The second cluster was home to life and health sciences. Thus, Sophia Antipolis was composed of independent co-located firms whose strategic choices were largely constrained by external decisions taken by the parent companies. Nevertheless, these initial conditions played an important role in developing future local and original resources (LONGHI and QUÉRÉ, 1994).

. . . to crisis . . .

The limits to the growth of Sophia Antipolis were strongly related to the conditions under which it was created, i.e. a lack of a local labour market, the weakness of endogenous resources, and the scarcity of small and medium-sized enterprises (SMEs) and specialized services. Over time, however, the accumulation of economic activities on the site triggered a number of positive processes that mitigated these limitations until a crisis occurred in the early 1990s.

A first process was related to the human capital present locally. The arrival of public education and research institutes in Sophia Antipolis – as a result of the decentralization policy – the Ecole des Mines, the Centre National de Recherches Scientifiques (CNRS, i.e. National Centre of Scientific Research), and Institut National de Recherche en Informatique Appliquée (INRIA, i.e. National Research Institute on Informatics and Automation) – play an important role in sustaining endogenous growth. INRIA, in particular, played a fundamental role in structuring local technological development, thus favouring the emergence of an endogenous innovative capacity and local start-ups. However, this potential proved to be rather insufficient to train the graduates required for the development of a local labour market. A significant event in this regard was the decision to move some of Nice University's research institutes and PhD programmes to Sophia Antipolis. The shift, which began in 1986, soon reached a critical mass.

A second element was the creation of service activities. Despite its heterogeneity, this activity has grown significantly since 1982. Today, it represents 28% of all jobs and more than 50% of all firms. Its growth can be partly explained by a catch-up effect, due to the original absence of services in a 'greenfield' site such as Sophia Antipolis. These various elements have contributed to the reversal of the site's established trends of exogenous-oriented development and to the creation of some localized capabilities able to sustain local innovative processes. However, in the 1990s doubts were raised concerning these developments.

The crisis that characterized the early 1990s had a considerable impact on Sophia Antipolis. First, the crisis struck at the heart of the project's growth engine – i.e. the computer science activities – which forced many large firms to downsize. Second, it gave rise to serious doubts about the validity of the project's development strategy, which was essentially a marketing strategy attracting investments from large firms. Whereas the 1980s had been characterized by multinational developments driven by market processes, the 1990s brought on new forms of globalization.

The nature of the globalization process in high-technology activities changed dramatically in the 1990s (VELTZ, 1993; LONGHI, 2003; MASKELL and MALMBERG, 1999) and the creation of localized innovative activities proved to be crucial. As the development of specific capabilities and knowledge is critical, location does matter. This explains why a new development strategy, based on local resources and competencies, had to be generated. In this context, knowledge creation and absorption became critical for the viability of the cluster, generating a suitable balance between local and global interactions (RYCHEN and ZIMMERMANN, 2006). Historically, only external relations seem to have been extensively developed, whereas relations of proximity were underdeveloped, which prevented the development of social integration mechanisms.

. . . and to the emergence of the future platform of knowledge

Following a period of instability in the early 1990s, new dynamics emerged in the area. The growth regime shifted from exogenous to endogenous dynamics, and new interactions between local firms and/or research institutes were generated (GARNSEY and LONGHI, 2004). The constraints were no longer related to a simple question of attractiveness, but to innovation and knowledge, and its specific coordination. An important part in this change was played by the park's professional associations, which initiated the development of local interactions.

The roles of the various business associations and clubs shifted from the traditional lobbying to more collective and coordinated initiatives. The Telecom Valley Association was one of the first initiatives in this regard. Originally created by the seven local telecommunication majors, it now includes all the local actors in the field, be they public or private, large or small organizations. Faced with a rapidly deteriorating economic position and the risk of having to relocate away from the park, this network attempted to make visible the local competencies that the actors had accumulated

over time in the field of telecommunications. This generated important externalities between the members of the network and enabled them to share technological visions and resources and combine complementary know-how. Today the area is a strategic centre for telecommunication activities in Europe, with a specific advantage in wireless technologies. The main European institutions defining the standards for telecommunications (ETSI) and Internet (WWW) are located in Sophia Antipolis; this places the technopole at the heart of the innovation process and makes it a strategic area for gathering information on future technologies. Telecom Valley is not the only organization of its type. A number of associations and clubs connecting SMEs (Imet, MITSA), research institutes (Persan), or specific technologies (Club Hi-Tech), with the explicit aim of promoting networking and local collective learning processes, are present and play a fundamental role in coordinating the innovative activities of firms, in providing information about both technologies and markets, and in developing local ties.

Another important evolution is related to the creation of new SMEs. Historically, spin-offs were restricted to research institutions, but the crisis shifted this process towards large firms. Paradoxically, this creation of new SMEs occurred in the early 1990s, a period during which employment growth slumped and large firms began downsizing and outsourcing. A wave of 'forced' spin-offs gave rise to the creation, by engineers formerly employed by the large firms,[7] of local start-ups in software, multimedia, telecommunication, and Internet technologies. Though several of these then subsequently disappeared with the end of the bubble and euphoria concerning the 'new economy', the dynamic of the creation of new resources was maintained and was no longer restricted to large firms.

The shift towards an endogenous growth regime could not have occurred if the area's training and research capabilities had not been developed or in the absence of industrial interdependence. The existence of a local labour market, allowing for skilled labour mobility, contributed to local development by facilitating the diffusion of tacit and technological know-how (KEEBLE *et al.*, 1998). In addition to the qualified human resources supplied by the higher education institutions, the process of downsizing and externalization initiated by the large firms led to the emergence of newly qualified human resources in the local labour market.[8]

Overall, it has been observed that in the cyclical downturn the information technology sector experienced in the mid-2000s, it did not actually affect the cluster. A number of information technology firms in Sophia Antipolis continued to grow with only a slow decline in their activities, which could be interpreted as a sign of the good functioning of localized innovation activities (KRAFFT, 2004). The recent move of several multinational firms to Sophia Antipolis is the ultimate confirmation of the park's technological and innovative potential and its position as a 'pole of excellence' paves the way for the acknowledgement of local capabilities. Indeed, the arrival of new firms involves neither large investments nor the simple adaptation of existing products or services; they tend to settle in the park as tenants with small units and grow locally drawing on local capabilities.

Growth, almost exclusively endogenous, is now the result of local processes inside the cluster (GARNSEY and LONGHI, 2004). Moreover, expansion and high skills are concentrated in the information technology sector.[9] The emergence of this new regime and of new institutional arrangements following the crisis shows that the resources accumulated in the 1980s were sufficient to reconfigure the 'satellite platform'. Whereas public intervention had prevailed at the beginning of the project, the process is now somewhat self-organized and driven by private firms. In order to reinforce regional localized capabilities, Sophia Antipolis has to build networks that will make it possible to sustain innovative activities with local partners.

The Telecom Valley especially, and other associations, have played a key role in changing the coordination processes that prevail in the system with the elaboration of a 'platform of knowledge'. Some pivotal firms have developed decisive innovations, related especially to mobile technologies, or introduced new forms of knowledge in the area. 'Gatekeepers of knowledge' have emerged and present many similarities with the organizational set-up defined by MORRISON (2004) due to vertical cooperation. Furthermore, the new ICT cluster is based on different interconnected, but 'cognitively distant', technologies ranging from microelectronics to telecommunications and software. The evolution from geographical proximity to organized proximity is not a sufficient condition for the emergence of knowledge and innovation from the interaction of local firms or actors: face-to-face interaction between two actors cannot alone generate synergies; the latter can only develop between two individuals who share common representations (TORRE and RALLET, 2005). These different sectors have had to coordinate their R&D activities in mobile and Internet-related technologies for exploiting the 'related variety' present in the cluster. This technological necessity has forced the associations and actors of Telecom Valley to get involved at the local level. However, some horizontal processes were still lacking for facilitating the absorption of different knowledge bases across the different sectors.

Indeed, most of the endogenous growth has taken place through vertical productive relationships in a number of specific technological trajectories. The potentialities provided by the presence in Sophia Antipolis of the main actors in ICT were not fully utilized. That is why it was necessary to find a way of sharing

different knowledge bases and of reducing the cognitive distance. In this regard, the 'platform of knowledge' implemented by Telecom Valley has devoted itself to reinforcing the linkages between the different actors present in the area and to promoting and maintaining future collaborations through the implementation of ICT tools. Knowledge needs to be shared before it can be applied and commercialized inside the cluster. The following section will describe this process. The issue at stake is fundamental for Sophia Antipolis; the 'knowledge filter' is far from negligible, neither are the divergences regarding new ideas, opportunities, and gains offered to the innovators (Acs *et al.*, 2003).

THE 'KNOWLEDGE MANAGEMENT PLATFORM' (KMP) PROJECT

The Telecom Valley association has grown rapidly as a main force in the collective dynamics of Sophia Antipolis. It has promoted the development of socio-economic linkages between the different actors (public and private, large and small organizations) of the telecom cluster and is akin to a self-organized project born from the constraints that emerged during the crisis. The KMP project is an intentional attempt to implement social integration mechanisms that will enable the firms to enhance their capacity to combine knowledge absorptive capacity.

The KMP project as a 'boundary object' that reinforces social integration mechanisms

At the beginning of the new millennium, Telecom Valley's objective was to increase innovation and technical knowledge by establishing collaborative agreements between academic and industrial players. This objective emerged because of the perception that a network could facilitate the development of informal interactions and, therefore, promote mutual understanding within and between the various technological trajectories present in the area – which by nature represent a multi-technological field. Unlike industrial districts, the firms in Telecom Valley belong to different professional groups and so share neither a similar vision concerning the implementation of innovative projects, nor any communication codes. For this reason, measures must be taken to facilitate knowledge transfer among the various technological poles so that new knowledge combinations and innovation can be generated. In other words, this includes the transformation of PACAP into RACAP. This requires an increasing commitment of and an immaterial investment by all the local actors in order to overcome the 'knowledge filter'.

Goal of the KMP project. The KMP project, which was launched in 2002 and ended in 2005, is a good illustration of this new initiative.[10] Indeed, its objective was to elaborate an innovative Knowledge Management Solution, including a map of the competencies present in Telecom Valley that would help identify the actors and projects, while facilitating cooperation. The KMP project is in fact an experimental ICT infrastructure: a semantic web service of competencies enabling networks of firms with different objectives to collaborate by guaranteeing information consistency without requiring the diffusion of strategic information. The project had several objectives, in particular:

- A description of firms' competencies (technical, organizational, and relational) in order to increase mutual understanding.
- The development of a common language to facilitate exchange and the combination of competencies.
- The elaboration of a shared business vision, including an common understanding of market characteristics and customer needs, in order to identify innovation opportunities accurately.

In order to promote the combination of competencies within the cluster, the project aimed to develop cooperation between not only the firms, but also the industrial and academic actors. The users were part of the advisory board and in permanent interaction with the project team, which was composed of representatives of different academic disciplines – economy and management: CNRS (Groupe de Recherche en Droit Economie et Gestion, or GREDEG) and Telecom Paris (Groupe des Ecoles de Télécommunications, or GET); computer science and ergonomics: INRIA; and telecommunication sciences: Ecole Nationale de Sciences et de Télécommunications (ENST) Bretagne (GET)). The main role of the advisory board was to reach a common validation at each stage of the prototype's development.[11]

Methodology: history of the project and position of researchers. The project was initiated by a few firms and was driven by academic partners. Two of the present authors have been involved in the project: one was the KMP project coordinator and played the role of intermediary between academic and industrial partners (public or privates ones); the other had a more discrete role of observer. They both followed the various stages of the project and reported on the different opportunities provided and limitation associated with knowledge codification. This direct involvement enabled the authors to collect a vast amount of data drawn from interviews conducted at different stages of the project: at the beginning, during the development of the ICT tool and after its launching in the cluster.

Indeed, inside the KMP project a methodology to implement a design research in the specific case of the building of an artefact has been developed.[12] The design process (designers' world) is composed of iterative loops (Akrich *et al.*, 2002).[13] The users' world represents the socio-technical network that supports

the process of innovation. Users-pilots (or lead users) are not the only components of this socio-technical network. In this perspective, the success of a design project depends on the '*art of interessement*', i.e. to enlarge the socio-technical network. To sum up, six main steps composing the design methodology were implemented:

- The feeling of discomfort – to analyse the specific managerial problem to solve.
- Building a theoretical support – as underlined by ROMME and ENDENBURG (2006); this step consists in building construction principles and design rules.
- Uses scenarios – they focus on the interaction between a system and its environment.
- Building archetypes – in the specific case of an ICT tool design, these archetypes consist of the successive prototypes (including user interfaces) resulting from the co-evolution of both the designers' and the users' world.
- Experimentation – two complementary but non-sequential phases compose this step: on the one hand, and interestingly, a growing number of heterogeneous actors (users, professionals, bureaucrats, granters, etc.); on the other hand, evaluating the successive prototype.
- The change process – the adoption–adaptation process progressively spreads and transforms the organizational context. These transformations lead to an evolution of the managerial problem, which results in a new design loop.

Four loops have composed the KMP project: the first (2001/02) concerns the elaboration of the project; the last (2005/06), the transition phase, has formed the prototype to its industrialization. Loops 3 (2003) and 4 (2004) were the core years of the design process. During these two loops three uses scenarios were built.[14]

A large number of interviews were conducted formally in order to identify the needs of Telecom Valley and the objectives of the tools (see the details and number of these interviews in Appendix 1). The objectives evolved with time. For example, the initial aim of the project was limited to the construction of a simple 'boundary object' (CACCIATORI, 2003). This objective was surpassed and expanded to the more ambitious development of a platform of knowledge. In short, the KMP project initially assumed the searching and transcoding function, but, as a result of its success, the project shifted progressively to a transferring function. To clarify: the goals of the project evolved according to the different, cognitive or political, constraints. Indeed, the ideas and potentialities of such a 'platform of knowledge' were unknown at the beginning and were discovered over time during the co-development of the prototype. For example, in 2002, the Telecom Valley association suggested that the KMP project capture competencies in order to facilitate the identification of project partners. Progressively, however, the project shifted toward the analysis of the cluster dynamic through the identification of new value chains among the various technological poles (microelectronic, computer science and telecom).[15]

Building a common space: generating and maintaining knowledge exchange and combination

An important characteristic of clusters is their ability to create a space for collective learning and to promote knowledge sharing. DYER and NOBEOKA (2000, p. 353) underline that knowledge sharing is facilitated if the actors can reach a shared representation of space. The 'platform of knowledge' generated many opportunities for the cluster, particularly through emergence of a common representation of an open space with evolving boundaries. This shared representation was developed in two stages: first, the representation of the telecom value chain, drawn up in collaboration with local actors;[16] and second, the representation of the Telecom cluster, including all the cluster's stakeholders:

- Local development institutes (LDIs) in charge of promoting the cluster abroad and attracting foreign investment and companies. Clubs and associations in charge of reinforcing exchange in the cluster. These are considered to be the 'facilitators' of the relationships established between academia, industry, and consumers.
- Research institutes and telecom standards institutes, considered to be stakeholders; indeed, the research institutes can benefit from partnerships with industrial actors and telecom standards institutes in their elaboration of new technological standards.
- Consultants in the domains of law, finance, and management; they have a supporting role and help ensure an efficient management of the economic and non-economic linkages in the telecom value chain.

The characteristics of the Telecom cluster are summarized in Fig. 2. The collective representation was the result of many interactions between the Telecom Valley association and KMP project's advisory board. Fig. 2, which is a preliminary result of the project, shows the configuration of exchanges that occur in this sector. Indeed, starting with the end-user consumer: (1) the value chain leads to seven nodes, which are the main sources of value creation: (2) internet access and service providers; (3) the value-added resellers; (4) the distributors that play an active role between the end-user consumer and the terminal device (especially in guaranteeing information exchange); (5) the content providers; (6) the network operators and telecom service providers; (7) the terminal device manufacturers; (8) the network infrastructure providers; and (9) the application developers. Most of the actors located in Sophia Antipolis belong

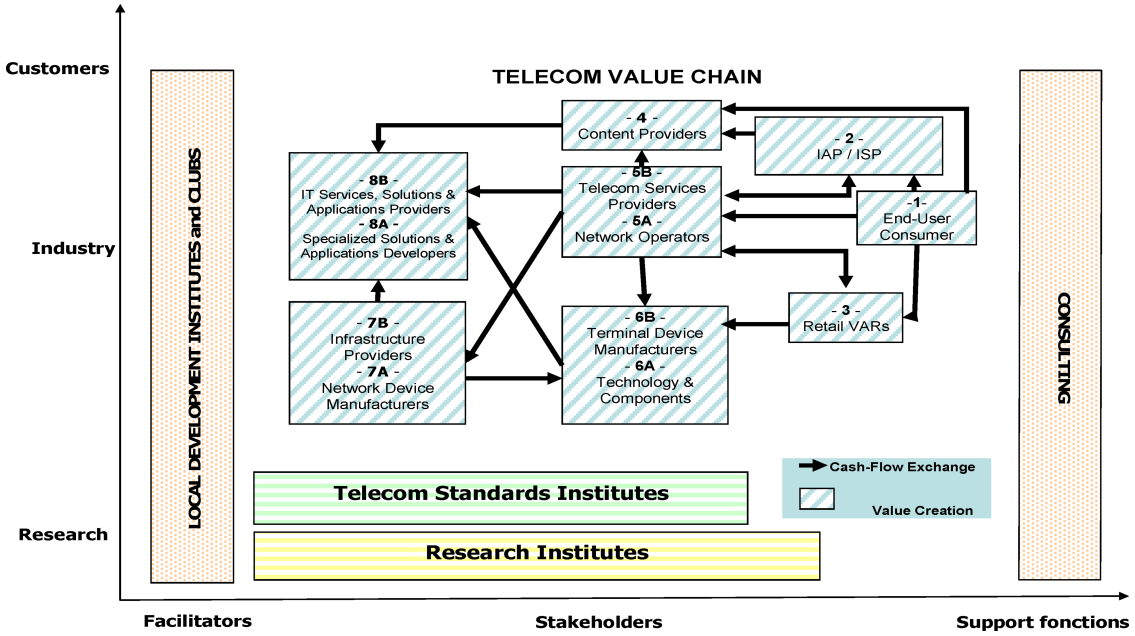

Fig. 2. Information and communication technology (ICT) cluster in Sophia Antipolis, France
Source: Authors' research.

essentially to nodes 5–8, though some start-ups have begun developing node 4, i.e. software applications. Of course, this local representation of actors might not fully correspond to the overall situation in which the firms find themselves at the level of their group.[17]

In 2004, all the firms of Telecom Valley – as well as the eleven KMP project's pilot firms – were asked to position themselves on this value chain. As a result, the members of Telecom Valley adopted this value chain as their own. This shared representation of collective space reinforced the collective identity and influenced the strategies of cooperation. For example, the subsidiary of an American multinational group, which had been hesitant at the beginning of the project, became eager to be a 'lead user' when it eventually managed to position itself in the collective space.

Similarly, the shared representation of the telecom cluster has made it possible to determine the boundaries of the community of Telecom Valley. The ability to share this representation has even become a *sine qua non* for becoming a member of Telecom Valley. These shared representations motivate the firms to engage locally as they enable them, be they industrial or academic organizations, to position themselves in the regional cluster.

Local actors might be aware of the effects of critical mass and of possible deficiencies in certain technological fields, which in turn enable them to envisage new combinations with other territories that might possess complementary competencies. In Sophia Antipolis most firms operate on segments 5–8. It is at the level of information providers (segment 4) of internet access and service providers (segment 2) of firms that commercialize and/or assemble office and computer equipment (segment 3) that these complementary competencies are needed. Telecom Valley, which initially struggled to define itself, was reluctant to accept new members. Today, however, thanks to the modelling of the common space, Telecom Valley has opened its doors to new members, and particularly to multimedia firms (segment 4). In this regard, the shared image of the value chain facilitates the identification of value-adding knowledge combinations and results in a shared visualization of these opportunities, which reduces the knowledge filter and enhances the cluster's absorptive capacity (ZAHRA and GEORGE, 2002).

Codification of knowledge and the emergence of new forms of governance

Once the perimeter of the selected space has been determined, a portfolio of potential competencies can be defined in order to foster interactions through which collaborations can emerge (NAHAPIET and GHOSHAL, 1998). This representation is not only cognitive, but also political, because it helps to identify the potential knowledge combinations among various and complementary resources used in different projects. For example, some interactions have been fostered in order to solve various problems such as follows:

- Finding a suitable way of adding value to individual corporate competencies.
- Finding a partner for solving problems in areas where internal competencies are insufficient.

- Gaining a better understanding of partners' needs in order to improve the description of internal competencies.
- Sharing resources in order to exploit network competencies better.
- Creating a shared vision of the market in order to develop present and future projects.

A partial and limited disclosure of knowledge with an abstract representation of competencies. This codification had various objectives. Indeed, the KMP project was a regional 'platform of knowledge' used by local actors in order to enhance their absorptive capacity at a local and a corporate level. The collective representation was aimed not to codify know-how, but rather to identify competencies in order to combine them more accurately. This delicate process was achieved through a partial disclosure of information and a strategic approach to knowledge diffusion: competencies should not be described in depth and exhaustively; however, their description must be precise enough to make these competencies visible. This kind of approach also opened opportunities for communication between firms, which can thus join the cooperation process and find a suitable way of representing their activity.

Knowledge and competency are difficult to disentangle from specific contexts as knowledge travels on the rails laid down by practice. They are difficult to separate from their original context and consequently difficult to articulate and codify. Nevertheless, an abstract representation – or ontology – even if incomplete or partial, is necessary in order to identify them. Therefore, articulation and codification can be useful even though they are intrinsically complementary to the production of tacit knowledge (LAZARIC *et al.*, 2003).

For this reason, an abstract representation of competencies based on four points: (1) action, (2) key resources (technological, organizational or scientifically resources), (3) deliverable, and (4) business activity, was put forward (ROUBY and THOMAS, 2004). These levels of abstraction have made it possible to identify the competencies and to compare them, taking into account the interests of the different actors looking for them. Once competencies were identified and located, a precise description was suggested including details on resources, patents, publications, R&D collaboration, and industrial partnerships. This additional information was essential to a proper understanding of a partner's competencies and was effectively based on 'know-what' (on this point, see LUNDVALL and JOHNSON, 1994). Therefore, the codification used did not disclose the strategic aspects of a firm (its 'know-how' and 'know-who'), but communicated a part of the relevant knowledge, a kind of 'show-how' put in place to help actors in the cluster identify which organizations have certain competencies and where they can be found (ROBERTS, 2000).

Local actors' involvement in the codification process. An important outcome of the KMP project was also that it revealed the nature of the various existing competencies, in other words, their similarity and complementarity, in RICHARDSON's (1972) sense of the terms. The similarity had to do with the competencies that shared the same resources and actions, whereas the complementarity had to do with the competencies found in the ICT sector that could be shared among different organizations. The KMP project also publicized the existence of a need, within the Telecom Valley association, for an understanding not only of the nature of competencies inside each firm, but also of the possible critical masses and complementarities. This leads local actors to increase their awareness of some of the cluster's strengths and weaknesses.[18]

Moreover, by making those competencies more visible and by creating new forms of governance within the Sophiapolitan cluster, the concepts of similarity and complementarity have also had some structural effects within the cluster. For example, Sophia Antipolis Micro Electronics (SAME) is an association set up recently in order to reinforce R&D policy within the microelectronic sector. This initiative was perceived by Telecom Valley as representing a potential obstacle to visibility within the cluster. Telecom Valley argued that different associations might hinder interactions (by introducing an overly fragmented new division of labour within the cluster). This dispute was finally solved by clearly establishing the different roles of the various associations in the cluster. Associations such as SAME play a crucial role by promoting technological innovations, others like Hi' tech or Telecom Valley have of a more horizontal role, orienting markets and defining the future uses of some products' innovations. Therefore, the KMP project has given rise to a process of knowledge articulation and codification among its members; it has structured the Sophiapolitan cluster and transformed the role of the different associations by defining their specific role in supporting knowledge combination or in orienting the long-term strategy of firms more clearly.

More generally, the creation of a common language and the introduction of the concepts of similarity and complementarity have enabled the various actors to improve their ability to anticipate the value created by partnerships, by increasing their capacity to detect the best opportunities and prospects. In 2005, for example, firms and organizations operating in the Provence Alpes Côte d'Azur (PACA) region adopted and started using these concepts so as to be able to participate in the national project of 'poles of competitiveness', and particularly those of the Solutions Communicantes Sécurisées (SCS) pole. These concepts enabled them to structure the presentation of the cooperation projects within the SCS pole. Two types of projects were identified: the user-oriented projects (i.e. combining complementary competencies); and the technology-oriented

projects (i.e. combining similar competencies and aiming for technological innovation).

Finally, through the establishment of a multi-sectoral ontology, which became the common language of the actors involved, the KMP project directly facilitated the identification and possible combination of technological competencies, and thus reduced the cognitive distance. Through this process of articulation, which was implemented before the codification, new tacit knowledge emerged and thus reinforced the local entrepreneurial dynamic.[19] The tacit knowledge, produced through the processes of social integration, enabled the local actors to create an effective 'platform of knowledge'.

CONCLUSION

The history of Sophia Antipolis illustrates the evolving constraints a high-technology cluster must face in order to generate innovation and growth. The gradual transformation of a 'satellite platform' into a high-technology cluster with the emergence of localized capabilities embedded into global innovative networks was described above. The KMP project provides a good example of such regional mobilization. Indeed, 'gatekeepers of knowledge' have transformed some of their specific attributes by disclosing more knowledge. Their behaviours were not entirely motivated by philanthropy, but rather resulted from an acknowledgement of the spatial dimension of innovation and from the understanding that new rules of the games have to be implemented in this 'organized market'.

The 'knowledge platform', which has facilitated the implementation of a regulation of external and internal links, facilitating the combinative capability and fulfilling the transcoding function, is illustrative of this new form of governance. Though the transferring function might be more difficult to evaluate at the moment with only a qualitative case study, the emergence of a new collective interactive dynamic inside the cluster is not at all neutral. Indeed, the KMP project has contributed to the emergence of this new dynamic at two levels: cognitive and political.

Firstly, the different representations of the collective space have had an effect on the emergence of a collective identity by making sense of the logics of action and by reinforcing the actor's commitment to the community.

Secondly, the development of a common language (ontology of competencies, concepts of similarity and complementarity) reduces the cognitive distance between the various entities and the 'knowledge filter' by creating a shared representation of the technological, scientific, and managerial resources available in the cluster and of the knowledge combinations that can potentially create value. The creation of a common language has offered the local actors the possibility of benefiting from both 'Marshallian externalities' (exploitation of the same technological trajectory) and 'Jacobian externalities' (exploration of new combinations).

The present case study leads to the conclusion that, in a network, the distinction between the ability to absorb new knowledge and to combine it effectively is essential. These two processes require different organizational mechanisms. The absorption of new knowledge (PACAP) could be driven by parent firms playing the role of partial gatekeepers of knowledge. The combination of new knowledge with prior knowledge (RACAP) requires a specific organizational mechanism. It has been suggested that the concept of 'platform of knowledge', based on a codification process, is useful for converting PACAP into RACAP. Moreover, the indirect result of the project has been the development of the social integration mechanisms because the co-evolution of tacit and codified knowledge is a key element in knowledge-related dynamics and in the establishment of a long-term competitive advantage.

APPENDIX

The co-development approach adopted for the 'Knowledge Management Platform' (KMP) project requires a mechanism of high interaction locally. The interaction mechanism was organized around five main modalities:

- Exploratory interviews of potential users (firms, organizations of regional development, and research organizations). This first, familiarization stage enables the actors to gain an understanding of the purposes of the tool, of the reasons why the client wishes to develop it, and to identify the key actors for the project.
- Semi-directive interviews of pilot users. Two types of interviews were conducted: the first type aimed to identify and map the different actors' competencies; while the second type aimed to detect the practices and logics of action that recur during the construction of partnerships or projects of local development (user scenario).
- Ad-hoc committees with the pilot users. These committees had a supporting function in specific codification processes and in determining the common space and establishing the ontologies of competencies.
- Pilot committees. The latter made it possible to evaluate and present (every three months) the intermediary results of the research team to the pilot users. This stage is essential to ensure the involvement of the users, to validate the legitimacy of the research team, and to promote trust between the different stakeholders.
- Interviews, the purpose of which was to evaluate the solution, so as to be able to test, towards the end of the project, the elements proposed.

Table A1 is a synthesis of these different interactions between the researchers and local actors.

Q12 *Table* A1.

	2001–02	2003	2004	2005–06
Exploratory interviews	26			
Semi-directive interviews: mapping		31	33	
Semi-directive interviews: user scenario		24	28	
Ad-hoc committees	22	30	24	19
Pilot committees	1	5	3	1
Evaluation of the device			12	9

NOTES

1. In French, '*Pôles de Compétitivité*'.
2. In contemporaneous economies, this problem can be solved through the existence of 'local buzz' or 'global pipelines' (BATHELT *et al.*, 2002). The notion of 'local buzz' refers here to the 'Marshallian atmosphere', particularly the fact that a milieu could emit a lot of noise. More precisely, 'buzz' refers to the information and communication ecology created by face-to-face contacts, co-presence, co-location of people and firms within the same industry, and place or region (BATHELT *et al.*, 2002, p. 11). The term 'global pipelines' refers to the channel used in distant interactions to open the cluster and establishing systemic linkages with external sources of information.
3. Notably, if the distance is too wide, it might become an obstacle to the efficient combination of knowledge within a group of closely located firms.
4. Indeed: 'a cluster which is more or less empty because its important actors are constantly travelling the world in order to build and maintain an extensive pipeline system will of course run an obvious risk of becoming less vibrant' (BATHELT *et al.*, 2002, p. 24; see also BRESNAHAN *et al.* (2001) in the same vein.
5. Pierre Lafitte was then Director of the renowned Ecole Nationale des Mines de Paris, one of France's 'Grandes Ecoles'.
6. These activities now represent around 75% of technology jobs in the technopole, involving both large French and international companies (R&D centres) and units of large research institutions.
7. Many still have sub-contracting relationships with their parent firms and have maintained a high level of informal interactions to solve problems.
8. Indeed, this qualified labour force is related to the ICT sector – characterized by a high turnover rate – which has given rise, in Sophia Antipolis, to new behaviours in terms of the labour market.
9. More than half the Sophiapolitan jobs are high-qualification jobs (executives and engineers), and in the information technology sector the proportion rises to over 70%.
10. The KMP project has been subsidized by the Minister of Telecommunication Réseau National de recherches en télécommunications (RNRT) network (see http://www.telecom.gouv.fr/rnrt/projets/res_02-88.htm).
11. This 'step-by-step' approach enabled the actors progressively to get involved in the process of adoption/adaptation of the prototype (LATOUR, 1989) and fostered trust relations among all the partners of the project (LAZARIC and LORENZ, 1998). The validation rule was crucial in sustaining cooperation between the different networks of practice and members (the project team and the advisory team) without which it would have been impossible to give a sense to this dynamic (LAZARIC, 2003).
12. Design methodologies are specific modes of engaging in research. They are especially characterized by an active intervention process in the system in which the researchers act. In this perspective, a new figure of 'engaged scholarship', in which researchers and practitioners co-produce knowledge, has emerged in the 1990s (DAVID, 2000; HATCHUEL, 2005; VAN HAKEN, Q14 2005; VAN DE VEN and JOHSON, 2006). This new figure, called 'mode 2 knowledge production', is multidisciplinary and aims to solve complex and relevant field problems.
13. According to the structurational approach (ORLIKOWSKI, 2000), a separation between the designers' world from the Q15 users' world has been introduced.
14. The scenarios used were as follows: (1) description of competencies and storage by television members; (2) television cluster exploration; and (3) queries when actors look for a partner.
15. This permanent involvement of the Telecom Valley association with the advisory team generated a dialogue concerning the limits and possibilities of codification, and in the process gave rise to a dynamic that went far beyond the initial objective a simple technical project. Progressively, the members of the network adopted these ideas as their own and the Telecom Valley association imagined other scenarios for the development of the local ICT sector, which had not been part of the initial plans.
16. The construction of the Telecom Value Chain was based on the MIT 'Telecom Value Chain Project' (HTTP://MITSLOAN.MIT.EDU/RESEARCH/CLOCKSPEED/MAIN.HTML) and was developed by a think tank including both Telecom Valley members involved in the KMP project and researchers.
17. For instance, the local subsidiary of Hewlett-Packard (formerly Compaq) designs and commercializes Telecom Network Infrastructure solutions, while the parent company is generally known to design and manufacture computer devices and solutions.
18. Firms and local development institutes have largely adopted this representation of potential combinations inside the cluster in order to create opportunities of promoting the cluster abroad.
19. Thus, the organizations located in the area clearly had to position themselves, which has led them to define their logic of action clearly and avoids 'congestion effects' and problems of visibility between these various associations. The Vice-President of Telecom Valley claimed in 2005 that KMP had contributed to a clear identification of the clubs, allowing one to achieve an efficient exploitation of competencies in Sophia Antipolis, the position and interests of all concerned being clear and known to all. The chairperson of the 'club Energie' emphasized that such clearly defined logics of action contribute to the emergence of a collective identity, a collective identity that 'will enable Sophia Antipolis to develop in a sustainable manner'.

REFERENCES

ACS Z., AUDRETSCH D., BRAUNERHJELM P. and CARLSSON B. (2003) The missing link: the knowledge filter and endogenous growth. Working paper presented at the Druid Summer Conference on 'Creating, Sharing and Transferring Knowledge. The Role of Geography, Institutions and Organization'.

AKRICH M., CALLON M. and LATOUR B. (2002) The key success in innovation. Part I: The art of interessement, *International Journal of Innovation Management* **6**, 197–206.

ALBINO V. and GARAVELLI A. C. (1999) Knowledge transfer and inter firm relationships in industrial Districts: the role of the leader firm, *Technovation* **19**, 53–64.

ALLEN T. J. (1977) *Managing the Flow of Technology: Technology Transfer and the Dissemination of Technological Information Within the R & D Organization*. MIT Press, Cambridge, MA.

ARTHUR B. (1990) Silicon Valley locational clusters: when do increasing returns imply monopoly, *Mathematical Social Science* **19**, 116–131.

ASHEIM B. *et al*. (2006) *Constructing Regional Advantage. Principles, Perspectives, Policies*. Report for the Directorate-General for Research. European Commission, Brussels.

ASHEIM B., COENEN L. and VANG J. (2005) *Face-to-Face, Buzz and Knowledge Bases: Socio-spatial Implications for Learning and Innovation Policy.* Working Paper No, 2005. CIRCLE.

AUDRETSCH D. B. and FELDMAN M. (1996) R&D spillovers and the geography of innovation and production, *American Economic Review* **86**, 630–640.

BATHELT H., MALMBERG A. and MASKELL P. (2002) *Clusters and Knowledge Local Buzz Global Pipelines and the Process of Knowledge Creation*. Working Paper. DRUID (available at: http://www.Druid.dk).

BOSCHMA R. A. (2005) Proximity and innovation: a critical assessment, *Regional Studies* **39**, 61–74,

BRESNAHAN T., GAMBARDELLA A. and SAXENIAN A. (2001) Old economy inputs for new economy outcomes: cluster formation in the New Silicon Valleys, *Industrial and Corporate Change* **10**, 835–860.

CACCIATORI E. (2003) Organisational memory in innovative project based firms: a boundary object perspective. Paper presented at the DRUID Conference, June 12–14 (available at: http://www.druid.dk).

COFFEY W. and BAILLY A. (1996) Regional Science: back to the future?, *Annals of Regional Science* **30**, 153–163.

COHEN W. and LEVINTHAL D. (1990) Absorptive capacity: a new perspective on learning and innovation, *Administrative Science Quarterly* **35**, 128–152.

COOKE P. (2003) *The Role of Research in Regional Innovation Systems: New Models Meeting Knowledge Economy Demands*. Regional Industrial Reports, Cardiff University, Cardiff.

COOKE P. (2006) *Between Implicit and Explicit Knowledge: Translational Proximities and Innovation*. Working Paper DIME COPs: A Driver for Innovation and Competitive Advantage, 27–28 October.

DYER J. H. and NOBEOKA K. (2000) Creating and managing a high-performance knowledge-sharing network: the Toyota case, *Strategic Management Journal* **21**, 345–367.

GARNSEY E. and LONGHI C. (2004) High technology locations and globalization: converse paths, common processes, *International Journal of Technology Management* **28**, 336–355.

GIULIANI E. and BELL M. (2005) The micro-determinants of the meso-level learning and innovation: evidence from a Chilean wine cluster, *Research Policy* **35**, 47–68.

HAARMAKORPI V. (2006) Regional development platform method (RDPM) as a tool for regional innovation policy, *European Planning Studies* **14**, 1085–1105.

HAARMARKORPI V. and MELKAS H. (2005) Knowledge management in regional networks: the case of Lahti, *European Planning Studies* **15**, 641–660.

HATCHUEL A. (2005) Towards an epistemology of collective action: management research as a responsive and actionable discipline, *European Management Review* **2**, 36–47.

IAMMARINO S. and MCCANN P. (2006) The structure and evolution of industrial cluster: transactions, technology and knowledge spillovers, *Research Policy* **35**, 1018–1036.

JOHNSON B., LORENZ E. and LUNDVALL B.-Å. (2002) Why all this fuss about codified and tacit knowledge?, *Industrial and Corporate Change* **11**, 245–262.

KEEBLE D. *et al*. (1998) *Collective Learning Processes and Inter-firm Networking in Innovative High-technology Regions*. Working Paper No. 86, March. ESRC Centre for Business Research.

KOGUT B. (2000) The network as knowledge: generative rules and the emergence of structure, *Strategic Management Journal* **21**, 405–425.

KRAFFT J. (2004) Entry, exit and knowledge: evidence from a cluster in the info-communication industry, *Research Policy* **33**, 1687–1706.

LATOUR B. (1989) *La science en action*. Gallimard, Paris.

LAZARIC N. (2003) Trust building inside the epistemic community: some investigation with an empirical case study, forthcoming, in SIX F. and NOOTEBOOM B. (Eds) *The Process of Trust in Organizations*. Edward Elgar, London.

LAZARIC N. and LORENZ E. (1998) The learning dynamics of trust reputation and confidence, in LAZARIC N. and LORENZ E. (Eds) *Trust and Economic Learning*, pp. 1–20. Edward Elgar, London.

LAZARIC N., MANGOLTE P. A. and MASSUÉ M. L. (2003) Articulation and codification of collective Know how in the steel industry: some evidence in the French blast furnace, *Research Policy* **32**, 1829–1847.

LONGHI C. (1999) Networks, collective learning and technology development in innovative high-technology regions: the case of Sophia Antipolis, *Regional Studies* **33**, 333–324.
LONGHI C. (2003) Local systems and networks in the globalisation process. Paper presented at 'Distretti, pilastri, reti. Italia ed Europa', Accademia Nazionale dei Lincei and Fondazione Edison, Rome, 8–9 April. **Q13**
LONGHI C. and QUÉRÉ M. (1994) *Sophia-Antipolis: Vers une redéfinition du projet*. Research Report. CNRS-LATAPSES. **Q13**
LORENZEN M. and FOSS N. (2003) Cognitive coordination, institutions and clusters: an exploratory discussion, in BRENNER T. (Ed.) *The Influence of Co Operations, Networks and Innovations on Regional Innovation Systems*. Edward Elgar, Cheltenham.
LUNDVALL B. Å. and JOHNSON B. (1994) The learning economy, *Journal of Industries Studies* **1**, 23–42.
MARKUSEN A. (1996) Sticky places in slippery spaces: a typology of industrial districts, *Economic Geography* **72**, 293–313.
MASKELL P. and MALMBERG A. (1999) Localised learning and industrial competitiveness, *Cambridge Journal of Economics* **23**, 167–185.
MORRISON A. (2004) Do leading firms feed industrial districts? Evidence from an Italian furniture districts. Working paper presented at a DRUID Conference, January 2004.
NAHAPIET J. and GHOSHAL S. (1998) Social capital, intellectual capital, and the organizational advantage, *Academy of Management Review* **23**, 242–266.
NESTA L. and SAVIOTTI P. (2006) Firm knowledge and market value in biotechnology, *Industrial and Corporate Change* **15**, 625–652.
NOOTEBOOM B. (2003) Problems and solutions in knowledge transfer, in BRENNER T. (Ed.) *The Influence of Co Operations, Networks and Innovations on Regional Innovation Systems*. Edward Elgar, Cheltenham.
ORLIKOWSKI W. (2000) Using technology and constituting structures: a practice lens for studying technology in organizations, *Organization Science* **11**, 404–428.
PORTER M. (2000) Location, competition and economic development: local clusters in a global economy, *Economic Development Quarterly* **14**, 15–34.
RICHARDSON G. B. (1972) The organization of industry, *Economic Journal* **82**, 883–896.
ROBERTS J. (2000) From know-how to show how; questioning the role of information and communication technologies in knowledge transfer, *Technology Analysis and Strategic Management* **12**, 429–443.
ROMME A. G. L. and ENDENBURG G. (2006) Construction principles and design rules in the case of circular design organization, *Organization Science* **17**, 287–297.
ROUBY E. and THOMAS C. (2004) La codification des compétences organisationnelles: l'épreuve des faits, *Revue Française de Gestion* **March/April**, 51–68.
RYCHEN F. and ZIMMERMANN (2006) *Clusters in the Global Knowledge Based Economy: Knowledge Gatekeepers and Temporary Proximity*. Working Paper. GRECAM, Marseilles. **Q13**
SZULANSKI G., CAPPETTA R. and JENSEN J. R. (2004) When and how trustworthiness matters: knowledge transfer and the moderating effect of causal ambiguity, *Organization Science* **15**, 600–613.
TORRE A. and RALLET A. (2005) Proximity and localization, *Regional Studies* **39**, 47–59.
VAN DE VEN A. H. and JOHSON P. E. (2006) Knowledge for theory and practice, *Academy of Management Review* **31**, 802–821.
VAN HAKEN J. E. (2005) Management research as a design science: articulating the research products of mode 2 knowledge production in management, *British Journal of Management* **16**, 19–36.
VELTZ P. (1993) D'une géographie des coûts à une géographie de l'organisation. Quelques thèses sur l'évolution des rapports entreprises/territoires, *Revue Economique* **no. 4**.
ZAHRA S. A. and GEORGE G. (2002) Absorptive capacity: a review, reconceptualization, and extension, *Academy of Management Review* **27**, 185–203.