

Knowledge dynamics, coherence and communities within networks: the “Telecom Valley[®]” case.

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Knowledge creation is nowadays a major issue for firms that want to be competitive. We are in a new era, where knowledge plays a dynamic role in innovation processes and corporate performance. The nature of the firm is changing: Kogut & Zander (1996) define firms as social communities specialized in knowledge transfer and creation. What makes firms superior to markets is not their capacity for reducing costs, but their capacity for creating and transferring knowledge. Organizations are not only considered as knowledge-processing systems but above all as knowledge-creating systems (Nonaka & Takeuchi, 1995).

According to March (1991) strategies linked to organizational knowledge creation aim to explore new opportunities or exploit existing capacities. This exploration / exploitation dilemma assumes a strategic choice between knowledge bases' heterogeneity and specialization of activities, in accordance with environment turbulences. The specialization focus on the problem of novelty emergence that assumes the existence of diversity, and it can become a source of inertia if organizations do not regenerate their knowledge bases in order to renew their competencies (Baden-Fuller & Volberda, 2001). It reveals therefore the need to rely more and more on the exchange and the combination of external resources with partnerships and alliances, and conduct firms to open themselves to the outside. Following Kogut (2000), an organizational form able to offer the benefit of both specialization and variety generation exists: the network. Specialization and variety are antithetical within the firm, but complementary within a network. The network appears as an organizational configuration able to push away the limits of March's dilemma.

However, network structures can have different forms. Networks with centralized structures have both structures and exploration pre-determined by the influence of central actors. These networks tend to be specialized and impoverish therefore exploration. We suggest then that decentralized network structures like Silicon Valley (Saxenian, 1994) enhances exploration dynamics, i.e. radical innovation, thanks to its social ties. Decentralized networks that present a configuration of companies gathered in a close area, where proximities are both geographical and technological, could be defined as clusters (Porter, 1990). A cluster is structured around economical and social inter-organizational relations. These relations are formal and / or informal and they emphasize the socio-cultural dimension of inter-firms relationships, in order to create knowledge. The precursor works of Lave & Wenger (1991) and Brown & Duguid (1991) show the importance of knowledge creation social entities, such as communities, in organizational learning. More recent works (Lesser and *al.*, 2000) have identified a plurality of community forms (of practice, of interest, epistemic...), due to the ICT development. Whatever are their forms, they have as common

purpose to facilitate knowledge sharing and creation. We study the role of these communities on the network knowledge-creation processes from the study of a cluster that presents these distinctive features: (i) It combines local logics and modular logics; indeed some firms of the cluster produce products and / or services integrated in a worldwide scale solution; (ii) At the local level, the cluster dynamics rely on social interactions through several communities of interest, of practice or epistemic.

Our paper is structured in three parts:

We identify and analyse the impact of networks on the resolving of the exploration / exploitation dilemma (Kogut, 2000), by emphasizing the capability of a network to constitute a truly negotiated environment facilitating exchange and absorption (Barlatier, 2003). This capability is based on management of a duality between exploration of new opportunities and exploitation of the existing capacities, in relation to the network's specific environment (March, 1991).

Then, relying particularly on the works by Foss and Christensen (1996, 1997) concerning corporate coherence and by Kogut (2000) concerning knowledge creation within networks, we argue that coherence exists at the network level (Barlatier, 2002, 2003). The concept of coherence is used in a general way for studying the capacity of an organisation to generate and explore "synergies" of various kinds. Briefly, the notion of network coherence developed in our research represents a cognitive category which implies a "dynamic" dimension through learning, path-dependence and the accumulation of heterogeneous knowledge-based assets. The network capacity to manage the duality between exploration and exploitation is thus dependant of the social interactions existing within this network. This implies that network coherence requires a mutual adjustment of actions and behaviors of its elements through more or less intense interactions. We present also the social and collective phenomenon through the notion of community approach and we study the impact of these communities on knowledge creation mechanisms. Hence, we consider the community approach as a privileged mode of network management, which answers the need to take care of the social links in the knowledge creation and transfer mechanisms. We analyse therefore the specific role of epistemic communities and communities of practice on knowledge combination and exchange mechanisms.

Finally, we illustrate the complementary roles played by epistemic communities and communities of practice in knowledge dynamics from the study of a cluster localized in the scientific park of Sophia Antipolis (Alpes-Maritimes, France). Case-study research seems to be the most appropriate methodology for this research in industrial networks as it takes into account the embedded character of network relationships and allows for the identification of the causal forces influencing actor behavior and the evolution of the network (Mønsted, 1995). Our empirical study focus on the telecommunications-computer-electronic pole that represents nearly 25% of the companies and 50% of the jobs of the area. This pole and its near environment gather international well-known companies like Amadeus, Atos Origin, AT & T GNS, Hewlett-Packard, France Télécom, IBM, Philips semiconductors, Texas Instruments, Thales-IS ; research and training organisms like the University of Nice-Sophia Antipolis, the CNRS, the INRIA... and at last two European telecommunications standard institutes : the ETSI and W3C.

1) Knowledge creation and Networking

Knowledge is a key concept and a main source of innovation, subject of many studies in social sciences. We can find in the literature different knowledge epistemologies (von Krogh & Roos, 1995; Venzin, von Krogh & Roos, 1998), that consequently provide different explanations and applications to the concept of knowledge.

Following Kogut & Zander (1992, 1996), Nahapiet & Ghoshal (1998) and Shawney & Prandelli (2000), we support in this paper the fact that organizational knowledge creation is above all a social process. In this perspective, Shawney & Prandelli (2000: 27) have studied several theoretical contributions in sociology of knowledge, organizational behavior, learning, international comparative analysis and social systems. According to their synthesis of these works, we can define knowledge as:

- Socially spread and influenced by social settings;
- A social construction, embedded in a system of individual, lasting relationships;
- Based on the interaction of several meanings;
- Shared by agents who process data “through cultural processes”;
- Shared among organizational members, both demanding and allowing for languages;
- Material, but also mental and social;
- Developed through participation in “communities of practice”;
- Catalysed by the development of network organizational structures; and
- Continuously changing: from individual to social, from tacit to explicit.

In this sociological approach, knowledge creation is “*an emerging, dynamic and diffuse process*” and “*new knowledge is the output of a synergistic interplay between individual contributions and social interaction*” (Shawney & Prandelli, 2000: 28).

It follows that the works of Schumpeter, Moran & Ghoshal (1996) and Nahapiet & Ghoshal (1998) maintain that knowledge creation is based on two key mechanisms: **exchange** and **combination** (even if they admit that other processes may exist, especially at the individual level...).

Combination

Knowledge creation is the result of changes and developments of existing knowledge, know-how and experience (Schumpeter, 1934; Kogut & Zander, 1992). Creating new knowledge requires therefore combining elements previously unconnected or developing novel ways of combining elements previously associated (Nahapiet & Ghoshal, 1998). In this perspective, Kogut & Zander define a firm’s combination capabilities as its ability to exploit its knowledge base and its unexplored potential, which means anticipate and detect opportunities, particularly in stimulating interactions between organizational agents. In order to make efficient combination situations, these interactions require common languages or codes (March, 1991) and the construction of “architectural competencies” (Henderson & Cockburn, 1994) allowing integration and layout of tacit individual knowledge. This “organizational architecture” (Nelson, 1991) could be a source of competitive advantage, especially if the firm develops its “*ability to access new knowledge from outside the*

boundaries of the organization” (Nelson, 1991: 66), which means developing its exchange processes.

Exchange

When resources are held by various agents, exchange is a prerequisite for resource combination. Indeed, as intellectual capital creation is generally the fruit of a knowledge and experience combination process of various parties, it is consequently dependant from the quality of exchanges between these parties (Nahapiet & Ghoshal, 1998). We can make a distinction between two types of knowledge exchange: On the one hand, it is explicit knowledge exchange, possessed initially by individuals or groups, such as information exchange in a scientific community. On the other hand, there is tacit knowledge exchange which is possible thanks to social interaction.

Combination and exchange are therefore complex social processes that reflect the interlocking of knowledge forms in an organization able to create and share knowledge, to coordinate, structure, and communicate. These dynamics justify the organization as a source of value different from the simple aggregation of individual knowledge. Exchange emphasizes teamwork, receptivity and connectivity of the agents, with the aim of creating knowledge by combining heterogeneous knowledge. Knowledge combination capabilities emphasize architectural competence, common language and proximity phenomenon with the aim of creating knowledge thanks to the efficiency of socialization processes (especially mental models) that insure the strategic intention, and the channelling of learning.

The study of these knowledge creation mechanisms underlines the necessity for organisations to open themselves to the outside in order to be competitive by creating new knowledge. The setting up of a network of firms thanks to spatial and / or technological proximities creates exchange opportunities. A network’s efficiency is measured notably with its capacity to transfer information quickly (role of information provider and distributor), but above all in its capacity to lay out various competencies and professions. Beyond information traffic it poses a problem of comprehension (receptivity, adaptability) that can not be solved by a purely technological approach and requires the establishment of a common language. Indeed, if new information and communication technologies provide a full and fast connection of organization members, they can not provide comprehension and the ability for team working, which would then allow for a situation of combination, that is, of knowledge creation.

This organizational knowledge creation analysis strengthens Kogut & Zander’s idea that organizations are more efficient than markets in the creation and exploitation of intellectual capital. But beyond this aspect, as March (1991) points out, strategic knowledge management within a firm implies **managing the balance between knowledge base heterogeneity and specialization of activities**. Managing this balance is a complex task, because it is a function of expected returns, while also depending on the process of resource allocation, that is a choice between heterogeneity and specialization, including at the same time temporal, institutional and individual variables and risk-taking (March, 1991).

March’s dilemma

According to March (1991), development and use of knowledge in organizations aims **to explore** new possibilities (searching new development opportunities) or **to exploit** certainties (for instance improvement of an existing technology). These two strategies are essential for an organization, but the fact they use the same scarce resources implies an

implicit (for the organizational form) or explicit (for decision-making) choice between these two objectives.

However, March points out that organizations which devote themselves to exploration will bear experimentation costs without necessarily gaining many of the benefits of exploration, and organizations which devote themselves only to exploitation will risk lapsing into inertia (Baden-Fuller & Volberda, 2001). Investment returns of the exploration of new knowledge are uncertain, rather long-term in nature, while for organizations evolving in turbulent environments and / or looking to maximize their short-term value, the perspective of an immediate income is sometimes more attractive: *“The search for new ideas, markets, or relations has less certain outcomes, longer time horizons, and more diffuse effects than does further development of existing ones”* (March, 1991: 73).

As a result, March deduces that *“maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity”* (March, 1991: 71). He maintains furthermore that this balance underlines specific characteristics of organizations’ social context, **some characteristics peculiar to firms** (individuals and organizational learning) and **some environmental characteristics** (competitive context):

- Organizations capitalize their knowledge particularly through their rules, procedures, norms and forms (basic notions of knowledge bases and intellectual capital). They learn from their members and thus accumulate knowledge. At the same time, individuals composing the organization are “internalized” by the organization through organizational beliefs and principles. It is then necessary that individual and organizational beliefs, via the organizational code, converge with the aim of creating a common meaning in exchange diversity. He emphasizes here that the exploration / exploitation balance in organizational learning implies conflicts between long-term and short-term conceptions and individual and collective knowledge gains.
- For organizations evolving in turbulent environments, which means they must adapt themselves to change, the results of March’s studies show that firms implementing a turnover policy for their agents succeed better than others, at middle and long-term. The efficiency of staff turnover as a source of exploration is recognized in a high-velocity environment.

This implies then that for stimulating the innovative nature of exploration, it is better to multiply mutual learning situations within the organization (i.e., exchange and combination of various knowledge situations). On the other hand, in order to increase efficiency of a production process, it is more suitable to establish a learning system focused on the research of short-term organizational advantage, which signifies exploiting to its maximum the firm’s knowledge base with a specialization of its activities.

Nevertheless, March (1991: 73) points out: *“The trade-off between exploration and exploitation exhibits some special features in the social context of organizations”*. He considered the issue of mutual learning in organizations and the importance of the design of the organizational code¹ in order to build up a source of diversity, or a heterogeneous knowledge base (March, 1991). However, as March (1991) emphasized, the code must be homogeneous enough in order to make exchange and combination possible, but a code which is too specialized would be harmful to exchange diversity, and then impoverish combination.

¹ According to March (1991: 74), the organizational code is composed by languages, beliefs, and practises useful for “socializing” organizational members, especially newcomers. This code also diffuses organizational knowledge and means to create organizational knowledge.

In this context, the ideal firm's perspective would be to have the capacity of handling exploration and exploitation complementarities between stocks of dispersed knowledge and localized learning processes. Foss & Christensen (1996, 1997) have adopted March's works, and have concluded that the exploration / exploitation dilemma is in fact a question of firms' coherence: "...coherence is a general property of human systems, including firms, and refers to the balance between the exploitation of existing knowledge and the production of new knowledge..." (Foss & Christensen, 1996: 21) and maintain that long-term efficient firms are the ones that balance this trade-off. The concept of coherence is used in a general way for studying the capacity of an organisation to generate and explore "synergies" of various kinds.

This capacity is often measured in the literature by the related concept of "similarity" in terms of products and/or resources and underlying capacities (see Teece and al., 1994), that is acknowledged by Foss and Christensen by economies of scope². According to them, the interpretation of synergy as economies of scope is too restrictive. The concept of coherence is a concept that should be comprehended in a more dynamic way, adding for instance "*the ability to discover new – potentially profitable – combinations of various types of assets where the relevant combination is based on some complementarity*"³ (Foss and Christensen, 1996: 5). Hence, Christensen and Foss (1997) put forward a dynamic understanding of corporate coherence, emphasizing the "resource and competence" side of firms rather than the product-market side, and focusing on "synergistic dynamics"⁴ (e.g., dynamic complementarities between activities) rather than focusing on economies of scope.

Empirically, the works of Nesta (2001) show that in stable environments, firms tend to exploit their knowledge bases; the new created knowledge combines more and more complementary existing technologies and this in an easily predictable way. During a turbulent period, on the other hand, where knowledge creation is particularly important, companies with diversified knowledge bases are more armed than the others. They can easily access and absorb new knowledge, because they master a broader know-how of the technological universe. In order to prevent themselves from inertia, they give priority to a diversification of their technological portfolio, thus building a cognitive stockpile. Nevertheless, the author emphasizes that this diversification conducts firms to a loss of efficiency. The firms then direct themselves to a homogeneous technological space, searching explicitly technological complementarities.

Fitting into March's scheme, the paradox of Nesta between knowledge base diversification and the technological space specialization actually determines the question of the coherence of the firm (Foss and Christensen, 1996), defined by its ability to create and use its knowledge base according to turbulences in its environment. Clarifying this vision of coherence implies firstly to have an **organizational reading of this concept**.

Organizational characteristics of coherence

The "organizational" study of this concept of coherence shows two main characteristics: a tendency to specialize and the importance of absorptive capacity.

² Economies of input sharing.

³ Foss and Christensen underline that the relevant complementarity need not to be specifically technical. According to Richardson, there is complementarity between two assets when the returns from accumulation of one of the assets is a positive function of the level of the other asset and *vice versa*. Usually, technical and economical complementarities coincide.

⁴ Foss and Christensen (1997) use the term "synergistic dynamics" to refer to this approach and use the concept of economies of diversity.

Towards specialization

According to Kogut (2000: 408): “*Firms are social communities that permit the specialization in the creation and replication of partly tacit, partly explicit organizing principles of work*”. Indeed, as showed in the works of Nesta (2001) in the biotechnology sector and Dyer & Nobeoka (2000) in the motor industry, firms tend nowadays to give priority to the exploitation of their knowledge bases. These studies show a great tendency toward specialization of firms, while the proximities phenomena (geographical and / or technological) affect their strategic behavior. And, these firms are in the habit of exchanging with other firms that have adopted a similar language, hence technologically close. Nesta highlights that the average strategic behavior of firms is “*obviously more oriented to exploitation of accumulated technological knowledge*”⁵ deducing that “*as the possible states of the world tend to become more and more common knowledge, technological learning turns to the exploitation of the more profitable productive combinations*”⁶ (Nesta, 2001: 205). Indeed, exploitation strategies are elaborated around particular technological combinations, and are united with the own construction of technological combinations of the firm. “*The specialization of the knowledge bases of the firms is made according to their own sector on one hand, and according to local contingencies on the other hand. In this sense, an organizational choice remains, and it comes under the perceptions of the firm’s managers*”⁷ (Nesta, 2001: 276).

Nevertheless, this specialization phenomenon poses a problem for the emergence of novelty. Indeed, a firm that is used to specializing its activities will encounter inertia in the long term, because the firm’s knowledge bases will not be able to provide the required diversity in order to innovate. In this sense, **absorptive capacity** (Cohen & Levinthal, 1990), guarantees the firm’s exploration perspectives, and represents this capacity to recognize, and then to combine new knowledge. The absorptive capacity represents consequently a critical component of a firm’s innovation process.

The role of the absorptive capacity

Indeed, what Cohen & Levinthal (1990) call absorptive capacity is: “*...The ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends... We label this capability a firm’s absorptive capacity...*” (Cohen & Levinthal, 1990: 128).

But this capacity is widely dependent on the level of the firm’s knowledge base, which signifies that from the simple know-how of a technician to the mastering of the last scientific or technological discoveries, this mastered knowledge will constitute therefore the efficiency of a firm’s absorptive capacity.

According to Cohen & Levinthal (1990), the absorptive capacity of an organization depends naturally on the absorptive capacity of its members, but it does not represent the aggregation of the absorptive capacity of its members only. Indeed, it lies not only in the acquisition or assimilation of information by the organization but also in organizational processes efficient enough to exploit this information. That means that the absorptive capacity

⁵ « *manifestement plus orienté vers l’exploitation des connaissances technologiques accumulées* » (Nesta, 2001: 205)

⁶ « *comme les états possibles du monde deviennent de plus en plus connaissance commune, les apprentissages technologiques se tournent vers l’exploitation des combinaisons productives les plus profitables* » (Nesta, 2001: 205).

⁷ « *La spécialisation des bases de connaissance des firmes s’effectue en fonction du secteur dans lequel elles se trouvent d’une part, en fonction des contingences locales d’autre part. En ce sens, un choix organisationnel demeure, et il relève des perceptions de la direction de l’entreprise* » (Nesta, 2001: 276).

of an organization depends not only on **its interaction interface with its direct environment** but also on **its capacity to diffuse knowledge through its elements**:

- Interaction with direct environments leads to reconsidering the importance of social context in the efficiency of the knowledge creation process of the firm, insofar as external partners of the firm represent as many privileged accesses to resources, information and opportunities. Hence, interactions between firms are able to increase the quality and the efficiency of mutual exchanges of knowledge and sources of heterogeneity of their respective knowledge bases (Lane & Lubatkin, 1998; Yli-Renko, Autio & Sapienza, 2001).
- The capacity of a firm to diffuse knowledge to innovate is directly dependent on its organizational form (Cohen & Levinthal, 1990; Lewin & Volberda, 1999; Kogut, 2000). For Lewin & Volberda, the current diversity of organizational forms should be interpreted as a long story of variations and selections. The apparition of new organizational forms answers to be a mutation caused by “high-order organizing principles”, with the aim of making current organizational forms evolve, making them flexible and adaptable according to environment turbulences, and therefore allowing the absorption of external knowledge. These forms are described as “hyperadapative” (Lewin & Volberda, 1999).

Hence, absorptive capacity should not be mainly linked to existing knowledge, but to the firm’s ability to create specific situations of creation and acquisition of new knowledge (Guilhon, 2001), and as the environment represents a huge source of diversity, it is then logical that firms seek to open themselves to the outside.

This study of absorptive capacity opens new perspectives so as firms can absorb knowledge efficiently without becoming harmful in terms of coherence, thanks to two important characteristics: **the organizational structure**, which in being “hyperadapative” could make absorption of exogenous knowledge easier and faster, and could allow the firms in a way to enhance quickly their knowledge bases; and **the access to a source of diversity** that represents the possibility to assimilate various knowledge, increasing thus absorptive capacity and exploration perspectives.

It is in this purpose that we study a particular type of inter-firm cooperation strategy, an organizational form that provides diversity: **the network**. The next section emphasizes the essential role of networks of organizations in exchange and acquisition mechanisms in order to stimulate knowledge creation dynamics.

2) Organizational Advantage of Knowledge-creating Networks

The reflection engendered by the exploration / exploitation dilemma leads firms to find a source of heterogeneity in their knowledge bases, and considering the network contributions in this regard is the aim of this section. Networks in social sciences are a concept applied to a variety of phenomena and are the subject of various definitions. According to Godfroij (1993: 71), we can notice two main interests of networks studies in social sciences. The first consists to “*describe and explain the patterns of behavior, decision making or cooperation in networks, which are based on more or less objective relationships of interdependence, but may also be related to the definition of the situation by the actors*”. These studies focus on the strategies of the actors and the resulting interaction processes, and explain, for instance, the difference between the espoused goals of coordination and cooperation and the often unexpected results. In this case the network is considered as “*an action system or an arena in which actors try to make the best of their interdependence*” Godfroij (1993: 71). The second perspective focus on the “systemness” and the structure of

networks. Here, networks are seen as “organizations of organizations” oriented to the realization of common goals, a structure or an instrument designed to coordinate policy and action. They exist somewhere between market and hierarchy, and can be used as devices to coordinate action between autonomous actors or organizations. The network form of organization appears as an answer to the need for finding reliable external relations, and consequently is perceived as a vital tool for strategic management (Godfroij, 1993).

Our attention is drawn here to a special form of network, the clusters. A cluster is a configuration of organizations gathered in a close area, where proximities are both geographical and technological (Porter, 1990). This concept is rooted in the industrial districts analysis (Marshall, 1919), and later, other concepts like technopoles, science parks, etc. convey a certain theoretical malleability that leads to the question of the role of networking in the dynamics of knowledge creation. Although the final word has not been said on the distinction between industrial districts, clusters, technopoles, etc. they share features of connectedness, shared purpose, variety of activity, limited hierarchy and centrality, local embeddedness as well as the emergence of a “*milieu innovateur*” thanks to the institutions and research institutes. We include these concepts through studies concerning the broader notion of cluster. The studies of clusters networks show that clusters yields added value by synergy effects of complementary competencies or assets, for improved products, efficiency or market access, but above all influence the extent to which knowledge is created, accumulated and transferred. Our analysis in the next section develops the network effects on knowledge creation strategies and their implications on its coherence.

Emergence of a coherence at the network level

The search for diversity of a firm is done at the level of its environment. The emergence of a network offers an interesting heterogeneity of available knowledge for the firm. Indeed, according to Kogut (2000: 407): *“Networks offer the benefit of both specialization and variety generation. The superior abilities of markets to generate variety is 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”*.

As Kogut (2000) points out, it is quite reasonable to think that costs of variety searching increase in function of the quantity of sought diversity. When diversity is weak, a firm produces at less cost than the market, explaining therefore the specialization phenomenon. But a point is eventually reached where the internal management of increased diversity will become more costly than the external acquisition of diversity. The negotiated environment that the network represents is a privileged source of knowledge acquisition, because a network is less costly than a lesser negotiated environment (i.e., the market).

The network is thus an efficient means for firms for acquiring external resources like knowledge (Håkansson, Havila & Pedersen, 1999), because the establishment of lasting relations between organizations that compose a network stimulated by proximity dynamics (geographical and / or technological) lead to the creation of technological complementarities, non-market interdependencies and information flows, which represent many positive externalities. A network structure provides the stability that can be used for collective learning purposes that can be combined with a certain variety in terms of involved organizations (Håkansson, 1993).

These capacities to create, accumulate and transfer collective knowledge are named “**network capabilities**” (Foss, 1999 and Kogut, 2000), and represent the effects of the network form of organization on knowledge creation strategies. However, network

capabilities are an emergent and exploratory concept. Indeed, theorists define network capabilities as “*what collectivities of firms – networks – know about the production of goods and services, the organization of this production (network capabilities), and how they learn about it (collective learning).*” (Foss, 1999: 3), or “*...network capabilities... are not specific to a firm, but represent joint gains to coordination and learning*” (Kogut, 2000: 406). These capabilities can also emerge from interactions of organizations within networks, but can not be fully reducible to the capabilities of individual organizations (Foss, 1999) and are quasi-public goods to members (Kogut, 2000).

Then we can distinguish two preponderant roles played by network capabilities:

- (i) To develop knowledge creation mechanisms within networks;
- (ii) To provide an internal diversity, or an access to diversity efficient enough for organisations constituting the network to be able to continue to be innovative and thus avoid inertia situations.

According to the current rich literature on knowledge creating networks, and also supporting the view that knowledge creation is a fundamentally embedded social complex process with particular situations of co-evolution and relationships (see notably Nahapiet & Ghoshal, 1998), we argue that network capabilities rely on four characteristic dimensions:

- A *structural dimension*, which influences mainly the development of new knowledge (but, not exclusively) according to the way its different facets alter actors’ access to exchange situations and their participation in the knowledge creation process;
- A *cognitive dimension*, which reflects knowledge as a deeply social construct, and that knowledge and its signification are always embedded, or dependant of a social context, at the same time created and maintained through social exchanges and combination situations;
- A *relational dimension*, which points out the social origin of knowledge creation, guarantees a privileged access to information and new opportunities;
- An *economical dimension*, which rather set limits and constraints on knowledge creation due to the fact of return imperatives, but can also stimulate the process by “forcing” actors to cooperate in order to survive.

These dimensions are interdependent but not necessarily self-reinforcing. For instance, an efficient network in terms of structure will not necessarily be the best asset to develop cognitive links strong enough to enhance combination capabilities.

Relying particularly on the works by Foss and Christensen (1996, 1997) concerning corporate coherence and by Kogut (2000) and Foss (1999) concerning knowledge creation within networks (i.e., network capabilities), we argue that coherence exists at the network level (Barlatier, 2002, 2003). We can then notice that this network mode provides notably the possibility to balance the trade-off heterogeneity / specialization of firms with creating a meso-environment likely to generate externalities and cumulative phenomenon, in particular at the level of knowledge and competencies. The network manages its own dialectic specialization / heterogeneity in order to insure its identity and its coherence according to its environment. Network coherence has two distinct aspects:

- (i) The idea of coherence as “*related diversification*” that shows the difficulty of the study of “*synergistic relations*” between assets. Indeed, as Foss & Christensen (1996) point out, most of the empirical works on diversification

and relation between assets are conducted at the market or industry level, not on the level of capacities and other assets. This represents a real problem, given the cognitive nature of concepts such as coherence, and what can be qualified as coherent for an organisation or a network may not be for another organisation or network. Thus, a study of network coherence is necessarily subjective, and should take into account the context of the network studied and its environment, since it is the network coherence which will condition the absorption of exogenous knowledge, i.e., its technological paradigm⁸;

- (ii) The idea of coherence as “*interconnection between assets*”, which underlines interconnection relations, particularly relations between co-specialization of elements representing network assets. A coherent network is characterized by a high-level of co-specialization of the assets constituting it. In addition, this notion of interconnection allows, according to Dierickx and Cool (1989), the comprehension of the durability of the competitive advantage and according to Langlois and Robertson (1995), the construction of a dynamic theory of network boundaries. This approach shows the importance of the quality of the architecture of resources and capabilities and their layouts within the network, in intra and inter-organizational relations. Hence, network coherence directly affects network capabilities and the knowledge creation process of the network.

In short, there is a co-evolutionarist phenomenon between network capabilities and its coherence, because as we have noticed it, the coherence of a network relies on its capabilities, and the capabilities of a network are strongly dependant on the shaping of its coherence. Following Foss and Christensen, the notion of network coherence developed here represents a cognitive category implying a “*dynamic*” dimension through learning, path-dependancy and the accumulation of heterogeneous knowledge-based assets and capabilities which are not detected by the “*classic*” conception of coherence, too static, unable to efficiently detect synergies.

We share the opinion of Dyer & Nobeoka (2000) who argue that “*knowledge is most effectively generated, combined, and transferred by individuals who ‘identify’ with a larger collective*” (Dyer & Nobeoka, 2000: 352). This identity could be defined by the organizational boundaries which dictate the members of the network, by shared goals and values and by patterns of interactions among organizations that give rise to a common language and common frameworks for action⁹. Thus, the identity of a network constitutes a system of preferences that regulates a firm’s engagement in the network and the behavior of the different members of this network. Indeed, the strategic choices of firms co-evolve with strategic choices emerging in a network. A system of preferences emerges consequently from these interactions, and it constitutes therefore a key element of the network coherence and facilitates the combination of knowledge within the network. As Dyer & Nobeoka (2000: 352) wrote, “*If the network can get its members to ‘cooperate in a social community’ it will create learning opportunities far superior for firms that do not reside within such a network*”.

However, as Kogut (2000) points out, there is an important distinction between emergence and intentionality in network structures: “*Networks are rarely formed by design, but rather they emerge initially in response to the institutional and technological opportunities of an industry or field*” (Kogut, 2000: 413). It implies that the coherence of a

⁸ Also the path-dependancy phenomenon.

⁹ The notion of identity developed in this paper refers to the development of community links within the network.

network emerges from interactions between the different partners involved. The network coherence co-evolves with the individual strategies of different members of the network and with its environment.

Current studies of several networks show that there is also a co-evolutionist phenomenon between the structure of a network and its coherence. The coherence of a network corresponds to a collective capacity to modify strategic paradigms in terms of complementarity and homogeneity of knowledge available in the network, in relation to the degree of turbulence in its environment. In a similar way the structure of a network is not only determined by exogenous factors, but is an expression of competing and evolving rules that guide the behaviors of interacting entities (Kogut, 2000).

These studies show that centralized structures with a strong network identity (such as the Toyota production network, see Dyer & Nobeoka, 2000) appear to be efficient for unfolding exploitation strategies; and decentralized networks of heterogeneous actors with a strong network identity (such as Silicon Valley, see Saxenian, 1994) appear to be efficient for unfolding exploration strategies. In the case of a weak network identity (i.e., a weak network coherence), the lack of cohesion and strong ties is harmful for knowledge creation strategies. In these networks, the level of focus on exploration or exploitation cannot reach the level of other structures with a strong coherence. In every case, a strong network identity is a powerful base for knowledge creation. As the next section will show, **communities and associations forge the network identity, and a strong network identity shapes its coherence.**

The capacity of a network to manage the duality between exploration and exploitation is thus dependant on the social interactions existing within it. It implies that the coherence of a network requires that organizations mutually adjust their actions and behaviors through more or less intense interactions. The next section presents this collective, social phenomenon through the notion of “community approach” and studies the impact of communities on knowledge creation mechanisms within a network.

The community approach: A privileged mode of knowledge-creating networks management?

The concept of “community” has been used for a long time in sociology, anthropology and economics. Its introduction in management studies is a relatively new phenomenon and very fruitful in view of the mass of theories it has inspired. It defines a group of individuals linked by a tangle of social links based on the sharing of norms, traditions, identity and brotherhood (von Krogh, 2002). This whole constitutes thus a “shared values system” that contrasts with individualism, opportunism and the pursuit of own interests. This “community approach” represents a social approach that adopts a vision of knowledge as built by a game of social interactions within a community. This approach conveys the need to take care of social links in knowledge creation and sharing mechanisms. Beyond individual efforts, agents are forming work communities based on social processes, and these “micro-communities” represent for von Krogh and *al.* (2000) the relevant conceptual background for analysing knowledge creation mechanisms.

The emergence of a new economy based on knowledge contributes to highlight the role of two specific communities: communities of practice and epistemic communities (Cohendet and *al.*, 2001). Some precursory works (Lave & Wenger, 1991; Brown & Duguid, 1991) have placed communities of practice at the heart of organizational learning issues. Some recent works (Lesser and *al.*, 2000) have identified a plurality of community forms (of practice, of interest, epistemic, etc.) that have emerged thanks to ICT development. These studies show that whatever their form, these communities have a common purpose, to a more or less

important extent, of making knowledge creation and sharing easier. This diversity of communities emphasizes at the same time the scientific potential of this concept and the emergent character of associated management modes.

Because they privilege social and cognitive interactions, communities appear as an organizational knowledge creation vector, by facilitating exchange and combination of knowledge. Hence, the next sections analyse the specific role of communities on knowledge creation dynamics.

Communities of practice and combination capabilities

Lave & Wenger have introduced the concept of “communities of practice” by identifying groups of individuals involved in the same activities and who communicate regularly amongst themselves concerning their practice. It is thanks to this game of social interactions among community members that community practices exist and evolve (Lesser & Prusak, 1999). Communities of practice are characterized by three dimensions:

- (i) a mutual engagement;
- (ii) a common enterprise and
- (iii) a shared repertoire (Wenger, 1998).

Mutual engagement conveys the multiplicity of links gathering individuals involved in a collective action; the common enterprise expresses the need felt by individuals to join forces to face issues in a shared organizational context; lastly, the shared repertoire supposes the existence of shared representations of the practice. Brown & Duguid (2000) insist on the role of narration in emergence and construction of these communities: stories relating work procedures, problem-solving methods, etc. constitute for these authors a true collective memory, more flexible than a procedures book, and made up with expertise and wisdom accumulated by experience.

Communities of practice gather two notions: “community” and “practice”, which are today at the heart of the reflections in economics and management (Cohendet and *al.*, 2001). A relation exists between these two terms: the practice is at the origin of the emergence of the community, but the community, once formed, could influence learning and finally the practice. This duality can be perceived in a recursive way. In this perspective, the “auto-organized” status is an essential characteristic of communities of practice (Cohendet and *al.*, 2001). This status confers to the community its capacity to organize itself particularly by its process of “negotiation of senses”, which generates production of conventions, forms, attention points (Wenger, 1998). This creation of meanings, significations close to Weick’s notion of “enactment” (Weick, 1995), even if it is more embodied in a practice, refers to the autopoietic epistemology in the way it constitutes the “self-referencing” system of the community. This process of “reification” of significations, that compose the common repertoire, forms resources involved in the production and reproduction of practices.

It is thanks to the diversity and the richness of the interactions, mixing similar and complementary knowledge, tacit and explicit, that organizational learning processes are allowed within communities. This learning refers to the “doing”, to the action, and this doing is historically and socially situated (Wenger, 1998). This learning is strongly dependent on the characteristics of the community (Wenger, 1998). The negotiation of senses and the constitution of a shared repertoire ensure a certain continuity of significations, therefore insuring learning. The mutual engagement based on complementarities and the capacity of individuals to efficiently connect their knowledge to the knowledge of other individuals supposes mutual aid relations between members necessary to knowledge sharing

and combination. Finally, the common enterprise supposes a collective action that creates relations of mutual responsibilities between involved individuals, the foundation of mutual engagement and cooperation. Thus, the shared repertoire and mutual engagement are founding the combination capabilities of the communities of practice.

The self-organisation process produces an organizational closure, which is a guarantee of the community's identity and organizational learning. The aim of communities of practice is firstly and mainly directed to its members; they develop and increase their competencies in the current practice (Cohendet and *al.*, 2001). At the same time, this closure constitutes a boundary that can be revealed as a brake for exchange among communities and hence eventually to organizational learning processes that require for their self development the combination of heterogeneous knowledge. The necessary management of the boundaries and the importance of connecting different communities are then pointed out by many authors. Brown & Duguid (2000) notice the importance for an organization defined as a "community of communities" to preserve and reinforce the autonomy of each community, and also to stimulate connections among these communities in order to insure the diffusion of results and experiences of every community in the organization. Wenger and *al.* (2002: 250) argue that: "*Communities of practice do not exist in isolation*"; they consider the "hyperspecialization" inherent to the community as long term source of inertia to be a fossilization of knowledge. Wenger (2000) suggests then to work on the communities' boundaries beyond the organization in order to interconnect them to broader learning systems, existing for instance at the industry level, regional level or consortium level. Thus, it seems to be essential to understand the interaction mechanisms between various communities and to identify the links we can draw up between these communities.

Epistemic communities and exchange

The concept of epistemic communities comes from the works of Haas (1992) in the field of international relations. In his research framework, epistemic communities aim to satisfy the need for information of institutions so as to reduce their inertia linked to uncertainty. They are composed of members coming from various disciplines (belonging to different communities of practice), well-known for their expertise and competence in their respective domains (and having also diverse experiences). According to Haas (1992: 4): "*Epistemic communities are one possible provider of this sort of information and advice. As demand of such information arise, networks or communities of specialists capable of producing and providing the information emerge and proliferate. The members of a prevailing community become strong actors at the national and transnational level as decision-maker solicits their information and delegates responsibility to them*". Hence, institutional decision-makers confronted with complex issues use epistemic communities in order to assist themselves to interpret and express the necessary pieces for decision-making. If a continuous need for information exists, for advice and interpretation, then the epistemic community will be highly solicited and will consequently tend to be "institutionalised".

Following Haas, the main motivation of the members of an epistemic community is to influence institutional decision-makers, and this influence will provide them acknowledgment by peers. The epistemic community members will then enter in a reputation and influence game among actors and will try to affirm their importance, and prestige in relation with their counterparts. The epistemic community claims thus to be an "authority" in organization and evolution of knowledge in the concerned domain. What is at stake here is clearly a matter of reputation and power. We can consider in a way that scientific communities are epistemic communities, where the actors draw their motivation from this game of reputation and influence.

Haas (1992) identifies four key elements that constitutes an epistemic community:

- (i) a shared set of normative beliefs, of principles, which provides a *raison d'être* for the social action of the community members;
- (ii) a common reference framework coming from professional activity and experience, from training and practice that serves as reference base during the resolving of issues linked to their activity;
- (iii) some shared notions of validity, which provide estimation and validation criteria of created knowledge; and
- (iv) a common policy enterprise, which means that community members are going to pool their experiences and their issues and make good use of their respective competencies, without necessarily being convinced that the result will have the effect of improving the collective welfare.

In addition, some recent works on epistemic communities like those of Cohendet and *al.* (2001) and Cohendet and Llerena (2001) are more focused on the activity of these communities, that is to say knowledge creation and codification issues. According to Cohendet and Llerena (2001), epistemic communities are defined as a group of agents sharing a common goal of knowledge creation, and a common reference framework. This goal is at the same time internal and external to the community because the community is involved in the process of diffusion of the created knowledge and also in the rules of knowledge creation. One of the essential characteristics of epistemic communities lies then in the existence of a procedural authority, which can be explicit or not, emergent or eventually imposed from the outside by the games of reputation and influence. This procedural authority leads the interactions among community members and channels learning processes so as to aid the whole community in achieving its cognitive goal. This authority contributes too to setting the rules of belonging for the community. Epistemic communities are structured with a common goal of knowledge creation and with a procedural authority that makes the reach of this objective easier. The commitment and the capacity to contribute to the creation of knowledge constitute the intra-community social link, and the epistemic community represents a closed social group with delimited boundaries.

However, autonomy and identity of an epistemic community are weaker than the community of practice communities; which develop the creativity potential of the community: the community increases then its *savoir-voir*, its ability to detect opportunities to come (Cohendet and Llerena, 2001). In this perspective, this organizational configuration favours knowledge creation in creating a synergy between the heterogeneous members. Indeed, the heterogeneity of the community members allows various exchanges and promises, and afterwards, a rich combination that develops knowledge creation dynamics which is a main goal of the community. The first task consists therefore of creating a common code so as to allow the heterogeneous community members to communicate with each other. This first step will end with knowledge creation, articulated but not totally codified because the code created remains shared only by the community members. The second task aims then to codify this articulated knowledge so as to make it visible from the outside, fulfilling the goals of reputation and influence, whether internal or external to the community.

In this sense, the epistemic community enhances the exchange mechanism and can constitute a reply to the issue of the communities of practice boundaries. The next table presents a synthesis of the characteristics of these types of communities:

	Objectives	Members	Cognitive activity	Selection rules	Nature of the objective	Nature of the social link	Role in knowledge creation
Community of practice	Increase individual skills in a given practice	Homogeneous	- Accumulate knowledge about a given practice - Combine "best practices"	Self-selection by members	Unintentional	Common passion for a practice	Enhance combination capabilities
Epistemic community	Produce collective knowledge	Heterogeneous	- Construction of knowledge and / or languages - Circulation of codified knowledge	Selection by peers	Intentional	Respect of a procedural authority	Facilitate exchange

Table 1: Characteristics of communities of practice and epistemic communities (inspired from Cohendet et al., 2001).

The community of practice and the epistemic community constitute two “ideal types” particularly useful for analysing the knowledge dynamics of inter-organizational networks. We can notice however that a community can evolve from one form to another (Cohendet and al., 2001). Indeed, the emerging character of the procedural authority within an epistemic community suggests that a community of practice can become an epistemic community if it progressively sets an explicit goal of knowledge creation and codification, opens itself to its environment, and takes part to a game of reputation and influence in order to achieve acknowledgement for the knowledge created.

The next section proposes an **illustration of the complementary roles played by these two kinds of communities within a cluster** and therefore **their impact in terms of network coherence**.

3) Interwoven, chain-like communities and knowledge dynamics: an illustration in the Telecommunications domain

After a brief presentation of the studied cluster, we propose to analyse **the diversity of communities configurations** and their **impact on knowledge creation dynamics**.

Sophia Antipolis: a cluster in the Telecommunications Industry

The illustration of this work in progress is located in the scientific park of Sophia Antipolis¹⁰ (Alpes-Maritimes, France). This site can be defined as a technopole in Callon’s terms because it is composed “*of a group of heterogeneous actors: public laboratories, centres for technical research, companies, financial organisms, users and state-owned organizations that collectively contribute to the conception, the construction, the production and to the distribution-diffusion of goods and services production companies*”¹¹ (Callon,

¹⁰ The scientific park of Sophia Antipolis has grown continuously for more than thirty years. Today it has more than 1227 companies and 35 000 to 40 000 employees. For further information consult the following web site: <http://www.sophia-antipolis.org>

¹¹ “*d’un ensemble d’acteurs hétérogènes : laboratoires publics, centres de recherche technique, entreprises, organismes financiers, usagers et pouvoirs publics qui participent collectivement à la conception, à l’élaboration, à la production et à la distribution-diffusion de sociétés de productions de biens et de services*” (Callon 1991 : 196).

1991: 196). Our empirical study¹² focuses on the telecommunications-computer-electronic pole that represents nearly 25% of the companies and 50% of the jobs in the area. This pole and its environment gather well-known international companies such as Amadeus, Atos Origin, AT & T GNS, H-P, France Télécom, IBM, Philips semiconductors, Texas Instruments, Thales-IS ; research and training organizations such as the University of Nice-Sophia Antipolis, CNRS, INRIA, etc.; and lastly, two European telecommunications standard institutes : ETSI and W3C.

This pole can be understood as a cluster thanks to its technological and geographical proximities (Porter, 1990). Some recent works on territory dynamics point out the essential characteristics of these networks:

- (i) Local coordination among actors are strongly based on social interactions, and not only economical interactions (Saxenian, 1994);
- (ii) Economical relations, in order to be perpetuated, must articulate the placement of actors in local logics and the opening up that can constitute the relations of these same actors with external partners;
- (iii) An efficient cluster is a cluster that innovates. Cognitive complementarities among sectors are more successful within the framework of geographical proximity relations than distant relations.

Clusters are characterized at the same time by complexity of their interaction modes and a capacity to combine knowledge efficiently. They consequently constitute a field of study particularly suited to the analysis of the role of communities in the knowledge creation process.

The Telecom cluster of Sophia Antipolis is quite decentralized, with few central actors, and without bureaucratic or ethnic ties, we can associate it with a network structure close to the Silicon Valley one. Nevertheless, we can distinguish three great differences between these clusters:

- First, if we think about a life cycle of cluster, Silicon Valley is a more mature cluster than Sophia Antipolis. Indeed, Silicon Valley is already a worldwide famous innovative reference in its domain while Sophia Antipolis' Telecom cluster intends to;
- Second, the firms that compose the Silicon Valley cluster are mainly decision-makers. Indeed, the strategic important decisions are, in this case, made within the Silicon Valley cluster, because most of these firms are parent companies. On the other hand, firms that compose the Sophia Antipolis' Telecom cluster are start-ups and young companies born within the cluster or international antennas functioning as excellence centres for international companies, and consequently they don't have often strong economic ties with other companies of Sophia Antipolis;
- Last, as a direct consequence of the second difference, the development of Sophia Antipolis is not supported by an industrial dynamic context such as Silicon Valley,

¹² Our empirical study will be conducted as a part of a research contract, the Knowledge Management Platform (KMP) project gathering the Telecom Valley® (with particularly firms like Amadeus, Atos Origin, France Télécom, Hewlett-Packard, Philips, Thalès-IS,...), CNRS, INRIA, GET and RODIGE. The aim of this contract is to build a web service of competencies in order to enhance exchange and combination dynamics of knowledge within the Telecom cluster. For further details, consult the web sites <http://www.telecom-valley.fr> and http://www.telecom.gouv.fr/rnrt/projets/res_02_88.html

while the parent company is generally known to conceive and manufacture computer devices and solutions.

The management modes of this value chain are characteristic of clusters, because they:

- (i) combine local logics and modular logics, indeed some firms of the cluster produce products and / or services integrated in a wider scale solution;
- (ii) at the local level, the cluster dynamics rely on social interactions through several communities of interest, either practice or epistemic.

The complexity of local forms of coordination: interwoven, chain-like communities

The specific particularities of clusters and geographical and technological proximity effects contribute to the emergence of various kinds of communities: either practice, interest or epistemic.

(i) Some “institutionalised” communities of practice

Communities of practice gather actors with similar competencies, take for example the different clubs and professional associations such as PMI France Sud (gathering project-managers), the Club of Executives (gathering top-managers) or the DFCG (gathering financial managers and management controllers). These associations and clubs have the special feature of gathering individuals that share the same practice, to combine their knowledge and experience. The boundaries of these communities widely expand the framework of the members’ respective organisations, some being national or international. The impact of these communities on knowledge dynamics within the cluster remains however limited because the nature of the knowledge shared in these communities is essentially managerial and transversal. Indeed, this knowledge does not constitute the essence, the core business knowledge of the cluster, which is essentially technological.

It is nevertheless interesting to note that some of these communities begin developing characteristics of epistemic communities, for instance PMI France Sud legitimises and promotes a certain number of project management practices in editing manuals and delivering diplomas.

(ii) Some invisible but essential communities of practice

Some communities of practice, gathering actors with complementary competencies, have progressed toward recurrent partnership relations among firms or among firms and research institutes. From the empirical study in progress, two significant examples have been identified.

The first example concerning an Information Technology Service Provider and research institutes involved in research consortiums in order to apply for project calls from the European Community or the French government. The research manager of this IT Service Provider company, often project leader, notices that these partnerships were “*created by acquaintance, thanks to informal networks linked with some teams belonging to these research institutes*”¹⁴. A recurrent partnership relation therefore exists among the same teams: “*The ‘F’ project constitutes hence a continuity of other projects with the same consortium. It*

¹⁴ “*Ces partenariats se sont créés par connaissance, grâce à des réseaux informels liés avec quelques équipes appartenant à ces Instituts de Recherche*”

is very 'Telecom' and our group has a strong expertise, they are acknowledged on a worldwide scale...¹⁵".

The second example gathers a contracting firm and some of its subcontractors (IT service providers, start-ups, etc.) with whom the firm maintains long-term partnership relations. The recurrent partnership practice in this case settled privileged relations among these actors: these subcontractors are even involved in the final product conception, as shown in this interview extract with an executive of the contracting company: "*what I want to say is that they are partners to the point that at the moment, the majority of our replies to call for tender includes their products, that is to say they became such close partners that they have developed products which are integrated in our T. Platform and these products are so important they find themselves at the heart of our offer now*¹⁶".

These two examples demonstrate the existence of "communities of practice" among different actors sharing a mutual engagement on common projects around a practice. The repetition of common projects allowed the development of a shared repertoire, architectural competencies and trust relations that make combination of expertises easier. This kind of community enhances therefore knowledge creation dynamics by developing combination capabilities. However, the closed nature of developed links considerably reduces exchange opportunities exogenous to these micro-communities. As denounced by a contracting company, their partnership research process is "frozen" not to say "tensed", indeed in some calls for tender "*some companies were not consulted, and afterwards, by chance, we met a person of such and such company and then we discovered that this company had the search competencies*¹⁷".

(iii) Some communities of interest that aim to make the technopole more dynamic, and more attractive from the outside to stimulate local synergies

Many clubs and associations were created in order to facilitate exchange and prospective reflections within the technopole: The Club Hi-Tech - In Tech'Sophia - Fondation Sophia Antipolis - PERSAN - Club Sophia Start-Up - Telecom Valley – etc.

For instance, the Sophia Antipolis Foundation (FSA) aims to develop the scientific and cultural animation of the technopole, and to facilitate the establishment of partnerships and technology transfer. The FSA, founded in 1984, is at the origin (or supports) the creation of various clubs or associations that regulate the cultural, social or economical life of the technopole, such as the Artsophia association (for cultural life), the Residents of the Sophia Antipolis Park association (for social life) or else the Club Sophia Start-Up (for economical life). These associations gather their members around common interests but aim also to stimulate exchanges among communities within the technopole. The FSA, for instance, organizes forums and thematic breakfasts, edits a newsletter, receives foreign delegations or else organizes a great annual day of associations and local clubs. The Club Sophia Start-Up pursues similarly objectives as indicates its delegate: "*The Club Sophia Start-Up aims to federate, to gather companies and organize regular events. Every second Monday of the month, we gather start-up managers, company managers, investor; it lasts four hours. In fact,*

¹⁵ "*Le projet "F" constitue donc une continuité des autres projets avec le même consortium. C'est très télécom et notre groupe de personnes dispose d'une expertise très forte, ils sont reconnus au niveau mondial...*"

¹⁶ "*ce que je veux dire c'est qu'ils sont partenaires au point qu'à l'heure actuelle, la majorité de nos réponses à l'appel d'offres incluent leurs produits c'est-à-dire qu'ils sont devenus des partenaires tellement proches de nous qu'ils ont développé des produits qui viennent s'intégrer sur la plate-forme T. et ces produits sont tellement importants qu'ils se retrouvent au cœur de notre offre maintenant.*"

¹⁷ "*certaines entreprises n'ont pas été consultées, et puis après, par hasard, on rencontre une personne de telle société et on découvre qu'elle avait les compétences recherchées...*"

the Club Sophia Start-Up objective is to introduce, and get to know companies coming not only from the park but also from the whole country, even international companies or European, and to connect them with investors, lawyers, persons that they might meet themselves and meet them during our receptions¹⁸”.

Hence, these communities facilitate the inter-community exchange which is dynamic, endogenous and / or exogenous to the technopole, by answering to a demand of “opening” of the different communities’ boundaries: this is the principle of cross-fertilization itself.

Beyond providing information on a topic or a shared interest, these communities also pursue an objective to open by creating an environment favourable to exchanges. This second mission brings them closer to epistemic communities. However, the diffusion of knowledge among communities supposes, as we have seen before, the creation of a shared language and common framework and also a clearly declared objective of knowledge creation, which is acknowledged and validated beyond the borders of the originating community. These elements are characteristic of an epistemic community. It is then interesting to note that by pursuing their objective of exchange, some interest communities tend to become authentic epistemic communities.

(iv) Telecom Valley: the emergence of an epistemic community

Telecom Valley^{®19} (T.V.) is a non-profit association, an important actor of the economic environment, recognized on a worldwide scale, that gathers nearly 80 members which represent locally more than 8 000 employees and 3 Billion Euros of turnover per year. It is a group of firms belonging to the telecommunications domain (in a broad sense) and of local institutions, which maintain cooperation and synergies, and share a common ambition: *“to become one of the first communities that anticipate, develop and promote uses, services and technologies that will make the future of the ‘Information Society’”*. In this sense T.V. aspires to be the European or world leader in some expert domains such as: smart networks, wireless communication, software development of data transmission, etc.

In order to achieve its goals, T.V. organizes itself into four commissions: Training, Research and Development, Communication, and Partnerships, all managed by a board of executives. The actions of these commissions pursue a double aim:

- (i) to acquire a worldwide reputation in these domains;
- (ii) to structure interactions among members so as to facilitate exchanges and cross-fertilization.

In the first case, the various implemented actions are:

- to attract new companies;
- to advise institutional decision-makers and training organizations;
- to suggest demonstrations of innovative technologies

The second objective supposes the construction of a genuine procedural authority so as to bring the whole community closer to its goal of knowledge creation. Hence, some “rules of

¹⁸ *“Le club Sophia Start-Up a pour objectif de fédérer, de rassembler les entreprises et d'organiser des événements réguliers. Tous les deuxième lundi du mois, on rassemble des patrons de start-ups, des patrons d'entreprise, des investisseurs, ça dure quatre heures. En fait, l'objectif du club Sophia Start-Up est de présenter, de faire connaître les entreprises non seulement du parc mais de toute la France, même des entreprises internationales, européennes et de les mettre en relation avec des investisseurs, des juristes, des personnes qui doivent se rencontrer et qui donc se rencontrent lors de ces réunions”*.

¹⁹ further information is available in the following web site: <http://www.telecom-valley.fr>

good behavior” within the community have progressively emerged, thanks to several prizes, such as the CLIPSAT (*CLient Partenaire SATisfait*) Trophy (rewards the best evaluated subcontractor by its customers) or else the “Prize of Innovation” (rewards an original project in the telecommunications domain). In addition, T.V. implements, in a more or less formal way, some “rules for belonging”, thus some IT service providers were excluded because of competitive practices considered unfair by the T.V. partnership commission.

So as to reinforce its action in these two domains, T.V. is involved in an innovative knowledge management project: “Knowledge Management Platform” (KMP). This project consists of the implementation of a web service that provides competencies mapping of the different actors of the telecommunications-computer-electronics pole of Sophia Antipolis. This project, labelled by the National Research Network in Telecommunications (RNRT), provides T.V. with internal and external visibility as a “community”. The content of the project itself clearly affirms its cognitive objective of knowledge creation by stimulating exchanges and synergies among T.V. members. The conception of this tool implies detection and codification of knowledge and competencies of the actors, a basis for common language and framework. Finally, the implementation of the web service may structure interactions among members. This project contributes then to endow T.V. with the characteristics of an epistemic community.

Moreover, by facilitating inter-firm partnerships or partnerships between firms and research institutes, this project might allow the development of exchanges beyond invisible communities of practice described in **(ii)**.

Conclusion

Our study shows that the community approach can significantly contribute to an analysis of the knowledge creation process within a decentralized cluster, by recognizing the multiplicity of the social and cognitive links that feed this process. This approach defines knowledge creation as a complex social process which is endogenous to the community, emphasizing the self-organized character of communities and the production of their own signification system (or self-referential), more or less formal in nature according to the type of community.

Thanks to a cross-study of work on communities of practice and epistemic communities, with regard to the two key mechanisms of knowledge creation, exchange and combination, it has been possible to identify the first elements constituting the study of the role of communities in network coherence of decentralized clusters.

Communities of practice, by enhancing the emergence of a shared repertoire and mutual engagement, allow knowledge combination, but produce an organizational closure that eventually constitutes a curb on organizational learning by limiting access to diversity. Epistemic communities, on the contrary, focus on exchange processes and can thus be considered as an answer to the delicate problem of boundaries linked to communities of practice. The illustration reinforces this feeling by pointing out the key role played by the T.V. community within the Telecom cluster of Sophia Antipolis. By its activity of codification, T.V. allows the construction of a common language and framework. By the progressive settlement of a procedural authority, T.V. guides interactions among members and channels learning; thus many elements make exchanges among firms and various communities of practice more easily achievable within the network.

Finally, we will emphasize the central role played by the procedural authority in the establishment of real “*capacities to coordinate firm’s behavior*” or “*network capabilities*” in Kogut’s sense (2000), especially in the case of highly decentralized networks.

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