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Enterprises' Knowledge Creation within a Brazilian's Industrial Cluster

Marcos Ferasso, Lilia Maria Vargas and Corinne Grenier

ABSTRACT

This research deals with knowledge creation at the level of enterprises located within a cluster. This paper is based on a case study, which is the industrial cluster dedicated to elastomers technologies, located in the Sinos Valley, Rio Grande do Sul. The data were collected from interviews with the strategically level of the cluster coordination, completed with secondary data. The results show that the research centre centralizes the technical knowledge on companies' products development and the companies send their technicians to exchange knowledge with this research centre. The knowledge developed in this center is replicated into companies when they develop new products. The managerial knowledge is centralized on the syndicate which helps enterprises to improve their competitiveness and managerial skills. Individual actors meet together in communities of practices to exchange information and perspectives on strategy, policy and technological matters. We suggest that the cluster should encourage and support an additional level of interactions to maintain knowledge creation and interest of the cluster: this level is concerned with inter-enterprises interactions (i.e., alliances). We also point the critical role of the cluster governance for supporting three main dimensions of knowledge: technology based managerial based and commercial based knowledge. This research considers the process of knowledge creation that occurs within the cluster's actors, through four dimensions (actors, economic and strategy, social and political, management) that makes the process occurring on two levels (intra-company and the cluster) dynamic.

KEYWORDS: Knowledge creation, industrial cluster, clustered enterprises, elastomers sector.

JEL CLASSIFICATION: M1, M15, D8, D83

BIOGRAPHICAL NOTE : Marcos Ferasso is Professor at SENAC Faculty of Technology, Santa Catarina, Brazil. His Research interests include knowledge management, clusters, small enterprises, Strategy and local/regional development. He can be reached at admmarcos@admmarcos.adm.br
Lilia Maria Vargas is Professor at the Graduate Program in Management, at the Federal University of Rio Grande do Sul, Brazil. Her Research interests include enterprises•™ networks, cooperation and coordination, knowledge management and biotechnology. Corinne Grenier is Professor at Euromed-Management, Marseilles, France.

INTRODUCTION

Knowledge is considered as one of the major assets of firm. Knowledge allows company to add value to its products, to solve problems during the productive process, and to produce knowledge from the already existing one in a continuous process of innovation, according to Schumpeter's concepts of innovation (1985).

Knowledge creation (KC) is considered as a permanent process of collaborative transformation from individuals' knowledge and company's knowledge to the attainment of results as competitive advantages and innovation. This

process is basic for the functioning of company and therefore mobilizes its tangible assets (financial machines and equipments, people, resources, manufactured products, amongst others) and intangible assets (experiences, know-how, intra-organizational contributions, personal and organizational abilities, amongst others), in the reach of intended results. The companies search to overcome limitations, such as the resources access, the specialized knowledge available, distribution net, amongst others, and these companies can find ideal strategical formation that facilitates to the access to such assets, reducing costs and increasing the competitiveness in the productive agglomerations. Another way to overcome limitations of KC is for companies to be located within cluster and to benefit from the services offered by this institution and from externalities to support knowledge creation.

Industrial clusters (IC) are considered agglomerations of interdependent companies in a geographical area that receive support from an institutional infrastructure. Companies within clusters tend to benefit from proximity that enables them to interact together (other competitors, suppliers, *spillovers* (This is the "leakage" of knowledge, for example, of a company to another. Normally, this overflow is generated by companies engaged in activities of innovation where new knowledge is available and transferred, according to Gilbert *et al.*, 2007), universities, research centers, among others), to have access to assets available in the cluster, to create knowledge and to catch opportunities required for innovation.

However, although the literature is rich in asserting to what extent companies located in cluster may have better and easier access to knowledge, it remains that the structure of the KC process (at the level of enterprise and the cluster as a whole) remains to be deeply analyzed. We intend to study KC at both related levels: the micro level, concerned with the enterprises located in the cluster, and at the macro level, concerned with the cluster as a whole (considered as an institution, having its own strategy and policy, partially different from the addition of individuals' strategy).

The main research questions of our research are as follows:

- How to structure the KC process within IC at the micro and macro level?
- How to maintain and enrich KC at the both levels?

One main theoretical contribution is related with one critical level, the meso level, concerned as an additional level of relationship among the enterprises, which maintain and enrich the KC at the individual and the cluster levels. We then propose some managerial recommendations for the management of the cluster and for the enterprises within the cluster.

LITERATURE REVIEW

The theoretical bases of this paper are based on the notions knowledge, KC process and IC functioning.

Notion of industrial clusters

Generally speaking, cluster represents a locus dedicated to some specialized technologies (or knowledge) and is composed of a variety of actors (enterprises and other organizations, institutions, public or private laboratories, educational institutions, amongst others). We would now propose some perspectives to explain clusters.

The main one is the economic perspective, based on the work of Marshall (1920), Porter (1989), Cooke (1999). To these authors, cluster is a concentration of companies, a geographically-based group, with interconnections and complementarities among themselves.

A geographical focus explains how to coordinate activities easily among organizations located in the same area (Bathelt, 2005); indeed, a cluster is seen as a regional concentration of companies in a value chain. In this perspective, clusters cannot exist without systematic links with suppliers, donors, markets (consumers) and technologies.

In a social perspective, Malmberg and Power (2005), state that clusters are places of informal interactions and the cluster is like a market of specialized workforce. A cluster also is characterized as a located system of interconnected companies.

With a strategic perspective, cluster can be seen as facilitating collaboration and competition among organizations. Kastelli (2006) argues that cooperation can play an important role in the acquisition or development of an organization, and especially of new knowledge, leading to stronger competitive position. Maintaining both cooperation and competition within cluster remains important.

Clusters are then characterized by the nature of the bonds between actors, developing both cooperation and competition relationships and pursuing both individual and collective interests.

In this research, we define industrial cluster as an agglomeration of organizations of a specific sector (technology-based focus), which are geographically closed, and diversified (enterprises, other companies, educational and political institutional, private and public laboratories, amongst others), and which benefit from coopetition between them and from the supports of the cluster management to maintain (balance) coopetition. Figure 1 shows the location and interactions among organizations within cluster, considered in this research.

Iammarino and McCann (2006) offer taxonomy of clusters, where it is possible to find that clusters are classified according to the nature of the companies that compose the cluster and of the nature of the relationships and transactions that occur at the intra-cluster level. The authors classified the clusters as pure agglomeration, industrial complex and social network model.

Cluster's activities may be analyzed at different levels, depending the way we define a cluster. The first level of analysis is enterprises (the micro level) since cluster is created to support the development of enterprises and

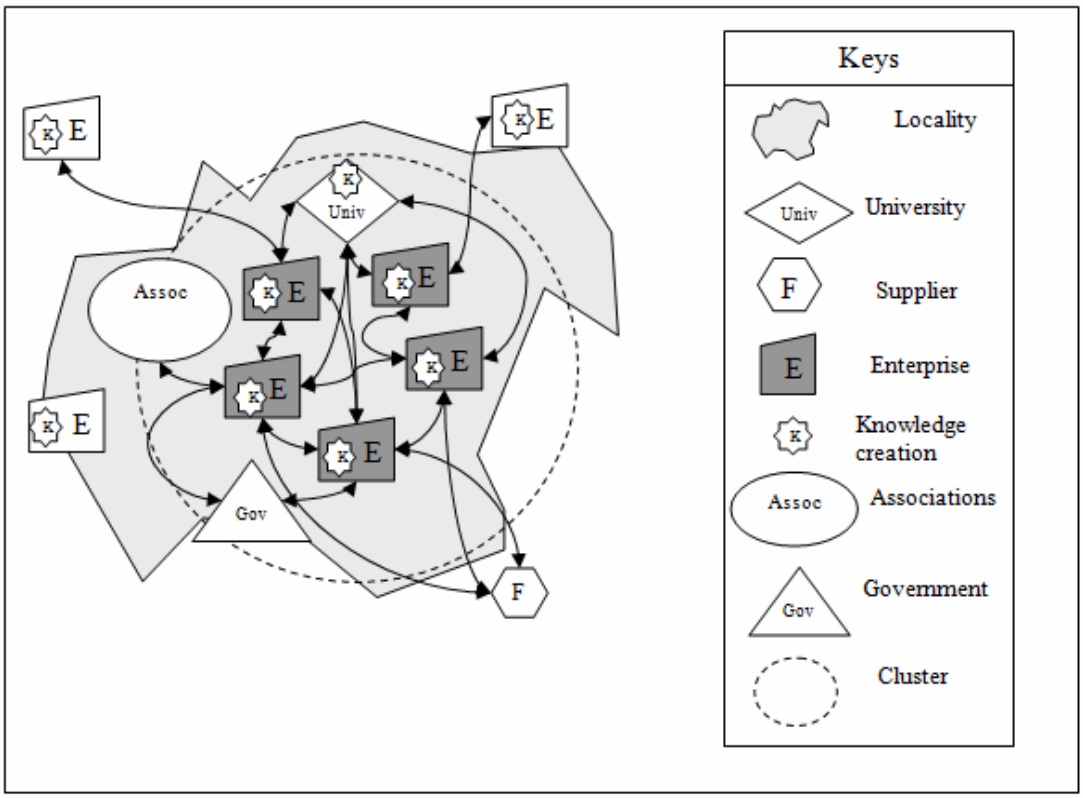

Figure 1. Location and interactions among organizations within cluster

other organizations within cluster. The question is then: to what extent could enterprise located within cluster easily create knowledge? The second level of analysis is the cluster considered as a whole (the macro level) since cluster is not just the addition of individual strategies and processes but has to elaborate and to manage its own strategy and, especially, its own KC process. In this paper, we simplify the work of Giuliani (2005), who has identified three levels of analysis: intra-company (what we call the micro level), the intra-cluster (what we call the macro level) and the extra-cluster level (external relationships of the cluster).

Before examining KC process within cluster, we then present the notions of Knowledge and of Knowledge creation.

Knowledge and knowledge creation

We define Knowledge as *Savoir*, Know-How and practices, embedded at individual, collective and / or organization levels. Knowledge may be formal or tacit (Hoegl and Schulze, 2005; Nonaka and Takeuchi, 1997; Nonaka, 1994; Polanyi, 1983).

Knowledge is a critical asset for organization, from a competitive advantage point of view (Choi and Lee, 2002; Nonaka *et al.*, 2000; Matusik and Hill, 1998) and from an innovation point of view (Kodama, 2007; Popadiuk and Choo, 2006; Lewin and Massini, 2003).

We mobilise the socio-cognitive perspective – speaking of Knowing – to explain creation, circulation and capitalisation of Knowledge (Orlikowksi, 2002). According to this perspective, knowledge creation is embedded in relationships, interaction between actors or organisations (Van Geenhuizen and Reys-Gonzalez, 2007; Drejer and Jørgensen, 2005), collaboration (Singh, 2007; Samaddar and Kadiyala, 2006; Beaucage and Beaudry, 2005; Malmberg and Power, 2005; Avadikyan *et al.*, 2001; Kastelli, 2006; Adenfelt and Lagerström, 2006; Jensen, 2003).

Various authors have proposed different models of KC process. One of the most famous is Nonaka and Takeuchi's model (1997). For them, knowledge is created through a spiral process of four stages (socialization, externalization, internationalization and combination), at individual and collective levels, and concerned with either explicit or tacit knowledge. In that line, social and organizational arrangements such as workshops and communities of practice (Hoegl and Schulze, 2005; Wenger, 2000; Martín-de-Castro *et al.*, 2007), strategic communities based on the concept of *Ba* (Nonaka *et al.*, 2000), are critical in supporting KC process. Another model is proposed by Popadiuk and Choo (2006) as a continuous mental and emotive process through three stages: new ideas, change and innovation.

However, in any case, the ability to create knowledge, which is mainly a social and collaborative process, rests on the absorptive capacity of the firm (Cohen and Levinthal, 1990). Absorptive capacity is the ability of a company to recognize the value of knowledge, assimilate it and capitalize it for commercial purposes.

We could then propose a grid of analysis of KC process based on the cluster characteristics and on our relational perspective of KC.

A grid of analysis of the KC process within the cluster

We consider the KC process at the micro and macro levels of clusters depending on four dimensions which are: Actors, Economic and Strategic, Social and Political and Management. Figure 2 presents this approach.

1) **Actors Dimension** - The competences and the know-how of actors and the various roles of the actors within the cluster haven been considered.

Confidence and collaboration are central in the work of Teerajetgul and Charoenngam (2006) for explaining knowledge creation. Various researches point the importance of either formal (Lissoni, 2001) or informal (Dahl and Pedersen, 2004) modes of knowledge diffusion within cluster. In the first case, diffusion rests on codification of knowledge; in the second case, it rests on face-to-face interactions and imitation (Nonaka and Takeuchi, 1997), often among communities of practices, or on the role of knowledge spillovers or gatekeepers (Bathelt, Malmberg and Maskell, 2004).

Levels of Analysis **Focus of Analysis** **Pre-definied Variables**	**N1 - Intra-company** (internal analysis level)	**N2 – Cluster level** (cluster analysis level)	**Authors**
F1 – ACTORS DIMENSION			
This dimension covers two variables: - the competences and know - how of the actors; - The various roles of the actors within the cluster.	- Role dedicated to communication (gatekeeper, coordinator, amongst others). - Abilities, competence and experiences. - Trust.	- Role dedicated to communication (gatekeeper, coordinator, amongst others). - Technology-based scope the cluster. - Mobility of the specialized workforce. - Trust.	Dahl and Pedersen (2004). Malmberg and Power (2005). Giuliani and Bell (2005). Gilbert *et al.*, (2007). Cross *et al.*, (2001). Beaucage and Beaudry (2005). Nonaka and Takeuchi (1997). Fontes (2003). Henderson (2007) Bathelt, Malmberg and Maskell (2004). Teerajetgul and Charoenngam (2006). Lissoni (2001). Eng (2004). Dahl and Pedersen (2004), Krafft (2004).
F2-ECONOMIC AND STRATEGIC DIMENSION:			
Dimension related to market, competition and innovation.	- Costs reduction. - Enterprise initiatives. - Search of external support. - Collaboration and partnerships. - Innovation. - Life Cycles. - Geographic Proximity with other companies and institutions based in the cluster. - Absorptive Capacity (valuable external information, to assimilate them and to explore	- Costs reduction. - Cluster initiatives. - Innovation. - Competition and cooperation among enterprises. - Life cycle of the cluster. - Geographic expanse of the cluster - Absorptive Capacity - Spillovers of knowledge.	(Stoerring, 2007). Gustavsson (2007). Popadiuk and Choo (2006). Menzel and Fornahl (2007). Porter (1989). Luo (2007). Nonaka *et al.*, (2000). Pinch *et al.*, (2003). Cohen and Levinthal (1990). Bathelt, Malmberg and Maskell (2004). Boufaden and Plunket (2005).

	them with commercial ends)		Iammarino and McCann (2006). Matusik and Hill (1998). Lissoni (2001). Breschi *et al.*, (1998). Moodysson and Jonsson (2007).
F3- SOCIAL AND POLITICAL DIMENSION:			
Dimension related to social network and social capital of the actors at the two levels of analysis .	- Social capital and social network of the company. - Types and nature of bonds. - Interactions with other companies and institutions. - Bargaining power.	- Social capital and social - Kinks and nature of network of the cluster. bonds of the cluster network. - Bargaining power.	Vonortas (2002). Soulier and Grenier (2002). Van Geenhuizen and Reys-Gonzalez (2007). Hsu *et al.*, (2005). Bathelt (2005). Stoerring (2007). Teerajetgul and Charoenngam (2006). Malmberg and Power (2005).
F4 – MANAGEMENT DIMENSION:			
Dimension related to decision, management process and tools or disposals mobilized in the management of the KC process.	- Partnerships management. - ICT and other managerial tools or disposals. - Managerial Processes. - Decision of location. - Patents and other modes for protecting knowledge. - Organizational learning.	- Partnerships management - ICT and other managerial tools or disposals. - Managerial Processes. - Patents and other modes for protecting knowledge. - Cluster learning.	Malipiero *et al.*, (2005). Giuliani (2005). Giuliani and Bell (2005). Gilbert *et al.*, (2007) Boughzala, Grenier and Zackland (2000). Soulier and Grenier (2002) Madhavan and Grover (1998) Saives *et al.*, (2005). Malmberg and Power (2005). Morris *et al.*, (2007).

Figure 2 The grid of analysis of the KC process in cluster

2) **Economic and Strategic Dimension** – Elements related to the market, competition and innovation have been considered.

In an economic perspective, diffusion of knowledge depends on the type of the cluster (Iammarino and McCann, 2006): a pure agglomeration (where inter-firm relations are inherently transient), an industrial complex (long-term stable and predictable relations between firms within the cluster with frequent transactions) or a social network (mutual trust relations between key decision-making agents in different organizations). Diffusion also depends of the life cycle of the cluster (Menzel and Fornahl, 2007), classified according to the cluster maturity, in the following phases: emergence, growth, sustaining and decline. Menzel and Fornahl (2007) state that the diversity and variety of knowledge in a cluster are factors that affect the development of a cluster. The cluster life cycle is linked to quantitative and qualitative elements. The heterogeneity of the available competences in a cluster is basic for its development. The cluster life cycle can decline when this heterogeneity is not supported.

In a more strategic perspective, the cluster policy is aiming at developing a regional industrial and social structure that is sufficiently specialized to favor innovation and value creation (Bathelt, 2005). Cluster may be seen as a part of a specialized value chain. Consequently, cluster is related to proximity management. One dimension of proximity is geographical proximity. This favors innovation but tends to diminish diversity of knowledge. Indeed, the more enterprises interact and work collectively, the more knowledge tends to be similar (Breschi *et al.*, 1998). One limit may be the decreasing innovative ability of enterprises located within cluster. Another dimension of proximity deals with affinity and similarity (cognitive and social dimensions). The greater the proximity between enterprises, the more collective work occurs between enterprises, which leads to a greater strategic development of the cluster.

3) **Social and Political Dimension** – Elements related to social network and social capital of the actors at the two levels of analysis have been considered.

Cluster development rests on the diversity of actors. Nevertheless, the cluster policy may be considered in two ways: either as the addition of the enterprises policies or as the policy of the cluster as an institution. In this paper, we have adopted the second approach. It is then critical to maintain diversity of organizations, in terms of "institutions" (firms and enterprises, local authorities, public and private laboratories or research centers, universities or other educational institutions, amongst others) and in terms of knowledge. We may sometimes observe the existing of specialized organization in the management of the cluster (the syndicate) or "core actors" largely involved in the cluster management; and such organizations are important factors for the dynamic development of local knowledge.

4) **Management Dimension** –Elements related to decision, management processes and tools or disposals mobilized in the management of the KC process have been considered.

Consequently, managerial policy, tools and other managerial disposals for favoring interactions and exchanges are critical for the development of the cluster and KC. However, two kinds of managerial devices are to be encouraged: the one supporting creation and diffusion of formal knowledge (guide and procedures, amongst others) and the other supporting creation and diffusion of tacit knowledge (like communities of practices). Other disposals such as job application, educational policy, entrepreneurship facilities, may contribute to facilitate knowledge creation.

RESEARCH METHODOLOGY

Research design

We used the case study methodology to collect and analyze data (Yin 2005). In that case, we studied the KC process of a cluster.

The data were collected through semi-directive interviews (Yin, 2005; Usunier *et al.*, 1993) and the data analysis (completed with secondary data), and were analyzed through categorization technique (Bardin, 2004) according to the thematic content analysis (Bardin, 2004; Miles and Huberman 1991). We interviewed the

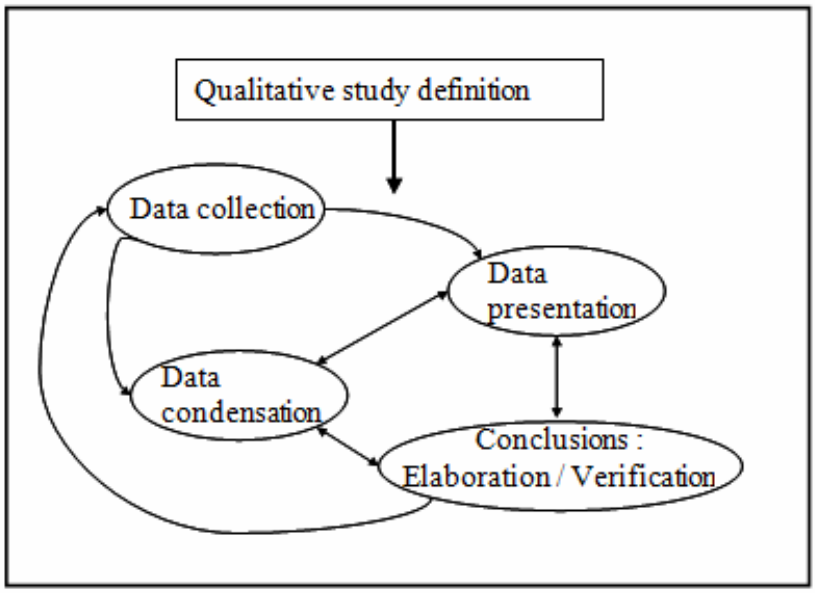

Figure 3 The data collection process, by Miles and Huberman (1991)

strategical level of the cluster coordination. Usunier *et al.*, (1993) affirms that top-managers give access to critical information.

Data have been analyzed in two forms and in two phases. In the first one, after the data reduction (where they had been separate, categorized, prioritized and interrelated, as Collis and Hussey, 2005), the analysis of thematic content technique was used (Bardin, 2004; Evrard *et al.*, 1997), in the identification and prioritization of the contents found on the secondary sources that are related to the interests of this research. In the second stage, the adequacy to the standard technique was used (Yin, 2005), where the results gotten from the accomplishment of the empirical research had been compared with the general standard deriving from the literature. Thus, the results can or cannot reach the standard previously established, where if it can infer a solid conclusion on the effect or questioning the proper proposals, respectively.

The Elastomers of Sinos Valley

We have studied the Elastomer cluster of Sinos Valley as a recent cluster. It is located in the south of Brazil, around Sao Leopoldo, Rio Grande do Sul. This cluster is located on the second major industrial area dedicated to the production of elastomers and is the unique elastomer's cluster in Latin America. This cluster is composed of 92 enterprises, 2 universities, 1 enterprises' syndicate, 1 research center and many suppliers in the value chain. The products are largely components for other industries (footwear industry, agriculture products and equipments industry, automotive industry and electro-electronics industry) (UCHA, 2003; SINBORSUL, 2007[a]).

The history of the cluster begins in 1924, when the Mercur enterprise was founded. It was a pioneer in the rubber industrialization in the State. In 1937, it was created the Borbonite Co., which highlighted the products and was responsible for the training of hundreds of rubber technicians and had become mother of dozens of other companies, which were born from (spin offs). In 1952, the enterprises' syndicate was founded and in 1992 the Polymers Technology Center was also founded. It is a technical and scientific institution that plays the role of the ancient Borbonite on training professionals to the rubber industry,

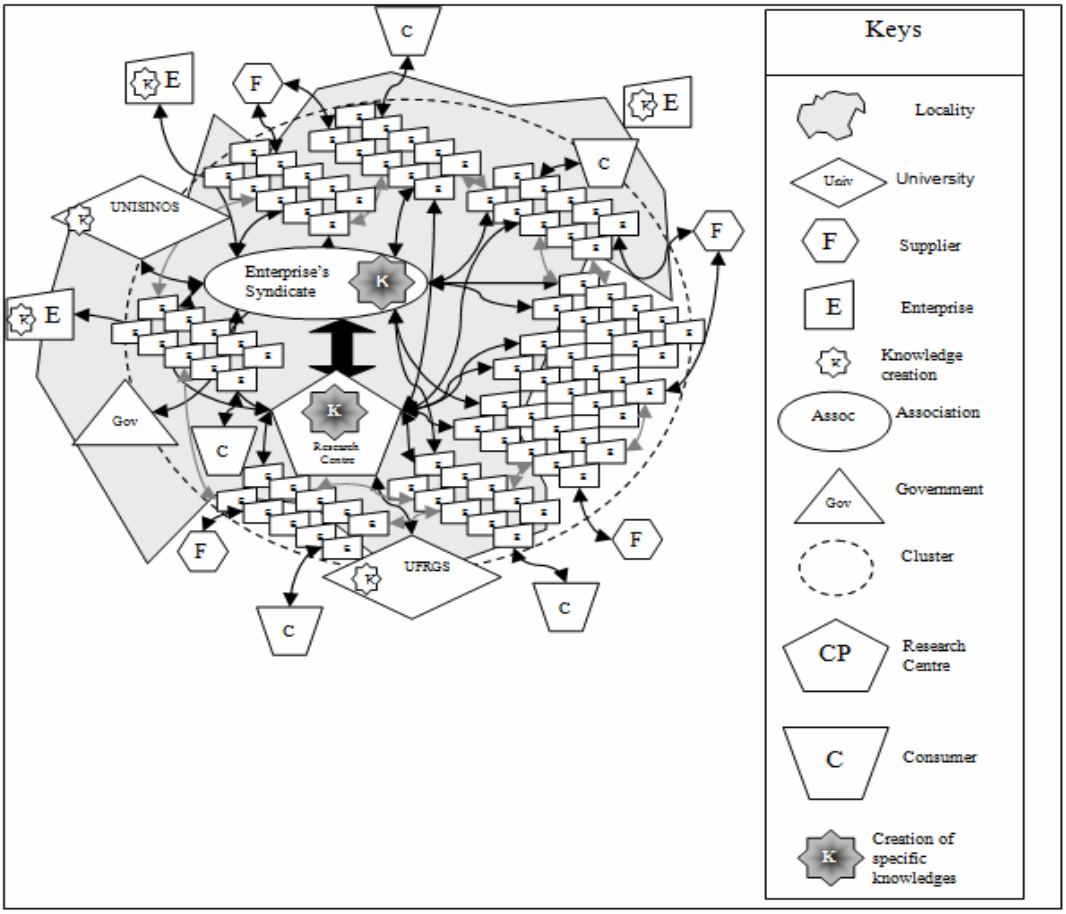

Figure 4 Enriched representation of the knowledge creation of enterprises within the elastomers cluster

supporting and encouraging the emergence of new industries (UCHA, 2003).

The enterprises' syndicate has a role to improve the competences of its members (enterprises) through educational programs, market prospection, amongst other managerial services. In this syndicate, the enterprises can get advice to explore business opportunities and new consumption markets (SINBORSUL, 2007[b]). Enterprises have created this syndicate to bargain some resources and assets in a more collective manner, and to explore opportunities in a cheaper way. The syndicate does not represent the interests of the bodies which are not members (other enterprises, universities, suppliers).

EMPIRICAL RESULTS

Data analysis

Our main observations are as follows:

1) About the Actor Dimension

Among the 92 companies located within the cluster, few are very large and competitive ones and act as leading actor to help the development of the others;

The other small enterprises are spin-offs from these ones; however what have been externalized were the technological knowledge and not the managerial knowledge; we may consider that the small companies lake managerial knowledge;

However this leadership explains the reputation of the cluster, but does not act as encouraging donor-suppliers relationships or even suppliers-suppliers relationships (Grenier, 2002);

Main part of technological knowledge is created by people working in the research center, involving that this knowledge is largely capitalized at this level of the cluster.

2) About the Economic and Strategic Dimension

We may observe that this technological knowledge – created in the research center – is largely shared by all the enterprises; consequently, the distinctive competence is the one related to marketing and commercial knowledge for entering markets; this competence may explain differentiated competitive advantages between enterprises;

The cluster permits enterprises diminish their cost production, because of proximity and confidence between enterprises and the research center (for technological knowledge) and between enterprises and the cluster syndicate (for managerial and commercial knowledge).

3) About the Social and Political dimension

The syndicate plays a great role in representing the activities and the enterprises of the cluster ahead of the governmental bodies; this lobbying role permits obtaining financial support, benefiting from taxes reduction, amongst other advantages.

The syndicate acts as gatekeeper to transfer products demands from external enterprises to internal ones which may product them;

However, this is no formal policy chart or other strategic plan elaborated by the cluster.

4) About the Managerial Dimension

The cluster tries helping the smaller enterprises acquiring managerial knowledge, through communities of practices, within the syndicate.

Representation of the KC process on the Elastomer Cluster of the SinosValley

We may improvise the Figure 1 from the above data analysis, offering a representation of the knowledge creation process of enterprises within the cluster (see Figure 3):

Two bodies play a critical role in the knowledge creation process; the research center and the syndicate;

Formal interactions like conjoint projects that may support KC only occurs between the enterprises and the research center, and between enterprises and the syndicate; enterprises interact together only on an informal basis, and generally at the level of their CEO (informal discussion, social network, amongst others);

We have not observed dense social interactions between enterprises at the level of the middle or low management;

Two universities interact with the research centre and enterprises‘ syndicate: UFRGS interacts with research centre (around technological and chemical knowledge), and UNISINOS interacts with enterprises‘ syndicate (around managerial knowledge);

There is a strong relationship between enterprises‘ syndicate and research centre in a way that these two bodies are responsible for the dynamics of the cluster as a whole;

The enterprises‘ syndicate plays a role of a broker (or gatekeeper), bringing knowledge and assets into the cluster, obtained beyond the clusters boundaries.

We suggest some limits in the way knowledge is created by enterprises within the cluster:

- No interaction based on conjoint projects between enterprises;

- No formal strategic plan and policy elaborated by the cluster;
- The enterprises are more engaged in a cost-reduction based strategy than in an innovation based strategy, explaining why enterprises are more interesting in searching new markets (logic of cost production economy principle, and scale production principle);
- A risk of imitation and impoverishment of the competences of the enterprises of the cluster because of no technological-based innovation and knowledge creation.

CONCLUSION

From these evidences, we suggest two directions to improve knowledge creation of enterprise in that kind of cluster.The first one relates to encourage conjoint projects and interactions at the meso level of the cluster, to create new knowledge (see grey arrows on the Figure 3). The second one relates to designing the governance of the cluster, in charge of the strategy of this area, and of supporting interactions at the three levels of the cluster (micro, meso and macro) and on the three main dimensions of knowledge: technology-based, managerial-based and commercial-based knowledge.How to support interactions and collaborative networks at the meso level? What should be the adequate cluster governance so as to support the interactions at the meso level and to encourage innovations? How is structured the KC process within enterprises located on ICs? What are the contributions of the cluster to this KC process of those enterprises?

The case study has raised these questions and suggested future developments for the research on the process of knowledge creation within industrial clusters.

REFERENCES

Ahlenfelt, M. and Lagerström, K. (2006), "Enabling knowledge creation and sharing in transnational projects", *International journal of project management,* Vol. 24, pp. 191-198.

Avadikyan, A. *et al.* (2001), "Organisational rules, codification and knowledge creation in inter-organisation cooperative agreements", *Research policy,* Vol. 30, pp. 1443-1458.

Bathelt, H. (2005), "Geographies of production: growth regimes in spatial perspective (II) – knowledge creation and growth in clusters", *Progress in human geography,* Vol. 29, pp. 763-778.

Bathelt, H., Malmberg, A., and Maskell, P. (2004), "Cluster and knowledge: local buzz, global pipelines and the process of knowledge creation", *Progress in human geography,* Vol. 28 No. 1, pp. 31-56.

Bardin, L. (2004), *Análise de conteúdo,* Edições 70, Lisboa.

Beaucage, J.-S. and Beaudry, C. (2005), "Collaboration networks: one of the key factor in the success of knowledge generation in Canadian biotechnology clusters", *Proceedings of the DRUID Summer conference,* Copenhagem.

Boufaden, N. and Plunket, A. (2005), "Investigating technological and geographic proximity on forms` innovation in an immature cluster: the Paris area biotech cluster", *Proceedings ot the DRUID Tenth Anniversary summer conference,* Copenhagen.

Boughzala, I., Grenier, C., and Zacklad, M. (2000), "How an extended enterprise memory can be an argumentation support for a collective decision", *Proceedings of the COOP'2000 conference*.

Breschi, S., Lissoni, F. and Malerba, F. (1998), "Knowledge proximity and technological diversification", *Proceedings of the DRUID Summer conference,* Copenhagem.

Choi, B. and Lee, H. (2002), "Knowledge management strategy and its link to knowledge creation process", *Expert systems with applications,* Vol. 23, pp. 173-187.

Cohen, W. M. and Levinthal, D. A. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative science quarterly,* Vol. 35, pp. 128-152.

Collis, J. and Hussey, R. (2005), *Pesquisa em administração: um guia prática para alunos de graduação e pós-graduação,* Bookman, Porto Alegre, RS.

Cooke, P. (1999), "The co-operative advantage of regions", in Cooke, P. (Ed.), *The new industrial geography: regions, regulation and institutions,* Routledge, London, pp. 54-73.

Cross, R. *et al.* (2001), "Knowing what we know: supporting knowledge creation and sharing in social networks", *Organizational dynamics,* Vol. 30 No. 2, pp. 100-120.

Dahl, M. S. and Pedersen, C. Ø. R. (2004), "Knowledge flows through informal contacts in industrial clusters: myth or reality?", *Research policy,* Vol. 33, pp. 1673-1686.

Drejer, I. and Jørgensen, B. H. (2005), "The dynamic creation of knowledge: analysing public-private collaborations", *Technovation,* Vol. 25, pp. 83-94.

Eng, T. Y. (2004), "Implications of the internet for knowledge creation and dissemination in clusters of hi-tech firms", *European management journal,* Vol. 22 No. 1, pp. 87-98.

Evrard, Y., Pras, B. and Roux, E. (1997), *Market – Études et recherches en marketing – fondements, méthodes,* Nathan, Paris.

Fontes, M. (2003), "Distant networking: the knowledge acquisition strategies of 'out-cluster' biotechnology firms", *Proceedings of the DRUID Summer conference,* Copenhagem.

Gilbert, B. A., McDougall, P. P. and Audretsch, D. B. (2007), "Clusters, knowledge spillovers and new venture performance: an empirical examination", *Journal of business venturing,* (in press).

Giuliani, E. (2005), "Cluster absorptive capacity: Why do some clusters forge ahead and others lag behind?", *European urban and regional studies,* Vol. 12 No. 3, pp. 269-288.

Giuliani, E. and Bell, M. (2005), "The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster", *Research policy,* Vol. 34, pp. 47-68.

Gustavsson, L. (2007), "Global knowledge creation – exploring dimensions of proximity", *Proceedings of the DRUID PhD Winter conference,* Ålborg.

Grenier, C. (2002), "Comment gérer l'articulation paradoxale individuel/collectif pour favoriser des pratiques coopératives?", *Economie ET Sociétés – série Economie de l'entreprise*, Vol. 5, pp. 793-817.

Henderson, J. V. (2007), "Understanding knowledge spillovers", *Regional science & urban economics,* Vol. 37, pp. 497-508.

Hoegl, M. and Schulze, A. (2005), "How to support knowledge creation in new product development: an investigation of knowledge management methods", *European management journal,* Vol. 23 No. 3, pp. 263-273.

Hsu, Y.-G., Shyu, J. Z. and Tzeng, G.-H. (2005), "Policy tools on the formation of new biotechnology firms in Taiwan", *Technovation,* Vol. 25, pp. 281-292.

Iammarino, S. and McCann, P. (2006), "The structure and evolution of industrial clusters: transactions, technology and knowledge spillovers", *Research policy,* Vol. 35, pp. 1018-1036.

Jensen, S. (2003), "Knowledge creation and transfer in the tourism industry. Results from a study in the county of Storstrøm, Denmark", *Proceedings of the DRUID Summer conference,* Copenhagem.

Kastelli, I. (2006), "The determinants of organisational knowledge creation in the context of R&D cooperation: the role of absortive capacity", *Proceedings of the DRUID Summer conference,* Copenhagem.

Kodama, M. (2007), "Innovation and knowledge creation through leadership-based strategic community: case study on high-tech company in Japan", *Technovation,* Vol. 27, pp. 115-132.

Krafft, J. (2004), "Entry, exit and knowledge: evidence from a cluster in the info-communications industry", *Research policy,* Vol. 33, pp. 1687-1706.

Lewin, A. and Massini, S. (2003), "Knowledge creation and organizational capabilities of innovating and imitating firms", *Proceedings of the DRUID Summer conference,* Copenhagen.

Lissoni, F. (2001), "Knowledge codification and the geography of innovation: the case of Brescia mechanical cluster", *Research policy,* Vol. 30, pp. 1479-1500.

Luo, Y. (2007), "A coopetition perspective of global competition", *Journal of world business,* Vol. 42, pp. 129-144.

Madhavan, R. and Grover, R. (1998), "From embedded knowledge to embodied knowledge: new product development as knowledge management", *Journal of marketing,* Vol. 62 No. 4, pp. 1-29.

Malipiero, A., Munari, F. and Sobrero, M. (2005), "Focal firms as technological gatekeepers within industrial districts: knowledge creation and dissemination in the Italian packaging machinery industry", *Proceedings of the DRUID Winter conference,* Copenhagen.

Malmberg, A. and Power, D. (2005), "(How) Do (Firms in) Clusters create knowledge?", *Industry and innovation,* Vol. 12 No. 4, pp. 409-431.

Marshall, A. (1920), *Industry and trade,* Macmillan, London.

Martín-de-Castro, G., López-Sáez, P. and Navas-López, J. E. (2007), "Processes of knowledge creation in knowledge-intensive firms: empirical evidence from Boston's Route 128 and Spain", *Technovation,* (In press).

Matusik, S. F. and Hill, C. W. L. (1998), "The utilization of contingent work, knowledge creation and competitive advantage", *The academy of management review,* Vol. 23 No. 4, pp. 680-698.

Menzel, M.-P. and Fornahl, D. (2007), "Cluster life cycles – dimensions and rationales of cluster development", *Proceedings of the DRUID Summer conference,* Copenhagen.

Miles M. and Hubberman, A. (1991), *Analyse des données qualitatives – recueil de nouvelles méthodes.* De Boeck Université.

Moodysson, J. and Jonsson, O. (2007), "Knowledge collaboration and proximity: the spatial organization of biotech innovation projects", *European urban and regional studies,* Vol. 14 No. 115, pp. 115-131.

Morris, M. H., Koçak, A. and Özer, A. (2007), "Coopetition as a small business strategy: implications for performance", *Journal of small business strategy,* Vol. 18 No. 1.

Nonaka, I. and Takeuchi, H. (1997), *Criação de conhecimento na empresa,* Campus, Rio de Janeiro, RJ.

Nonaka, I. *et al.* (2000), "SECI, Ba and leadership: a unified model of dynamic knowledge creation", *Long range planning,* Vol. 33, pp. 5-34.

Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization science,* Vol. 5 No. 1, pp. 14-37.

Orlikowski W. (1992), "Knowing in practice: enacting a collective capability in distributed organizing", *Organization Science*, Vol. 13 No. 3, pp. 249-273.

Pinch, S. *et al.* (2003), "From 'industrial districts' to 'knowledge clusters': a model of knowledge dissemination and competitive advantage in industrial agglomerations", *Journal of economic geography,* Vol. 3 No. 4, pp. 373-388.

Polanyi, M. (1983), *The tacit dimension.* Peter Smith, Gloucester, Mass.

Popadiuk, S. and Choo, C. W. (2006), "Innovation and knowledge creation: how are these concepts related?" *International journal of information management,* Vol. 26, pp. 301-311.

Porter, M. (1989), *A vantagem competitiva das nações,* Campus, Rio de Janeiro, RJ.

Saives, A.-L., Ebrahimi, M., Desmarteau, R. H. and Garnier, C. (2005), "Les logiques d´évolution des entreprises de biotechnologie", *Revue française de gestion,* Vol. 31.

Samaddar, S. and Kadiyala, S. S. (2006), "An analysis of interoranizational resource sharing decisions in collaborative knowledge creation", *European journal of operational research,* Vol. 170.

Schumpeter, J. A. (1985), *A teoria do desenvolvimento econômico,* Abril, São Paulo, SP.

Sinborsul. (2007[a]), Sindicato da Indústria de Artefatos de Borracha no Rio Grande do Sul. *Balanço 2006 e perspectivas para 2007,* Available at: <http://www.sinborsul.com.br /download/Balanco_2006_Perspectivas_2007.pdf>. Access on 21/Nov./2007.

Sinborsul. (2007[b]), Sindicato da Indústria de Artefatos de Borracha no Rio Grande do Sul. *SINBORSUL: quem somos,* Available at: <http://www.sinborsul.com.br/default.asp?ch= quemsomos &go=quemsomos>. Access in: 21/Nov./2007.

Singh, J. (2007), "External collaboration, social networks and knowledge creation: evidence from scientific publications", *Proceedings of the DRUID Summer conference,* Copenhagen.

Soulier, E. and Grenier, C. (2002), "A political model for the co-operative production of knowledge in the design process: the shared medical file (SMF)", *Proceedings of the ECAI 2002,* Lyon.

Stoerring, D. (2007), "The emerging biomedico industrial cluster in North Jutland: wishful thinking or reality?", *Proceedings of the DRUID Winter conference,* Åalborg.

Teerajetgul, W. and Charoenngam, C. (2006), "Factors inducing knowledge creation: empirical evidence from Thai construction projects", *Engineering, construction and architectural management,* Vol. 13 No. 6, pp. 584-599.

Ucha, D. (2003), *50 anos do Sinborsul (1952-2002): a história da indústria de artefatos de borracha no Rio Grande do Sul,* Palomas, Porto Alegre, RS.

Usunier, J.-C., Easterby-Smith, M. and Thorpe, R. (1993), *Introduction à la recherche en gestion,* Economica, Paris.

Van Geenhuizen, M. and Reys-Gonzalez, L. (2007), "Does a clustered location matter for high-technology companies' performance? The case of biotechnology in the Netherlands", *Technological forecasting and social change,* (in press).

Vonortas, N. S. (2002), "Building competitive firms: technology policy initiatives in Latin America", *Technology in society,* Vol. 24, pp. 433-459.

Wenger, E. (2000), "Communities of practice and social learning systems", *Organization,* Vol. 7 No. 2, pp. 225-246.

Yin, R. (2005), *Estudo de caso: planejamento e métodos,* Bookman, Porto Alegre, RS.