Strategies and Knowledge within an Industrial Cluster of Medium-Low Technological Innovation in an Emerging Country

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Résumé

Cette recherche décrit comment les stratégies et les connaissances peuvent être utilisées au sein des pôles industriels de moyen-faible innovation technologique à obtenir des avantages concurrentiels. Nous avons utilisé deux étapes : d'abord, une étude méta-bibliographique de la littérature pour trouver des lacunes, d'autre part, une étude de cas. Toutes les données ont été recueillies à partir d'entrevues, de la documentation et plusieurs observation non-participant. Les données ont été analysées par la technique de catégorisation, après réduction, hiérarchisée et synthétisée. Pôles à l'aide de stratégies d'adaptation, selon la typologie de Chaffee et la différenciation de Porter peut externaliser la R&D de chaque entreprise aux centres de recherche spécialisés. Ce pôle est caractérisé par des grappes de forts tendances de coopétition, les relations de confiance, la planification des activités conjointes qui fournissent apprentissage, la combinaison efficace des ressources dans les communautés stratégiques des démarreurs, l'efficacité économique comme des pôles potentielles. La connaissance stratégique principal a tendance à être le marché consommateur plutôt que des secrets ou des brevets. Nous proposons de nouvelles recherches pour comparer les dynamiques existantes dans les pôles industriels de moyen-faible innovation technologique. Un pôle industriel de moyen-faible innovation technologique peut utiliser les stratégies des entreprises collectivement au sein de ce groupe. Les connaissances liées au marché et les connaissances spécifiques d'experts sont les principaux actifs stratégiques qui confèrent des avantages concurrentiels au pôle. Cette recherche constitue une première tentative pour comprendre les dynamiques industrielles en matière de stratégie et de connaissances dans un contexte d'un pôle de moyen-faible innovation technologique. Cette approche peut aider les gouvernances du pôle pour améliorer les compétences de gestion et de surmonter les limites de cette forme d'agglomération. La nouveauté de cette recherche est l'approche de l'utilisation de la stratégie et de la connaissance dans une étude de cas de basses dynamiques.

Mots-clés : Stratégie. Gestion des connaissances. Pôles industriels. Innovation. Moyen-faibles innovations technologiques.

Resumo

Esta pesquisa descreve como estratégias e conhecimentos podem ser usados em *clusters* industriais de médio-baixa inovação tecnológica para alcançar vantagens competitivas. Foram utilizados dois estágios: primeiro, um meta-estudo bibliográfico da literatura para encontrar lacunas; segundo, estudo de caso. Todos os dados foram coletados a partir de entrevistas, documentação e várias observações não participantes. Os dados foram analisados através da categorização, depois de reduzidos, priorizados e sintetizados. *Clusters* que usam estratégias adaptativas, de acordo com a tipologia de Chaffee e diferenciação de Porter podem terceirizar P&D de cada empresa para centros de pesquisa especializados. Este *cluster* é caracterizado por fortes tendências de coopetição, relações de confiança, planejamento de atividades conjuntas que proporcionam aprendizado, combinação eficaz de recursos em comunidades estratégicas de *starters*, eficiência econômica de *clusters* potenciais. O conhecimento estratégico principal tende a ser o mercado consumidor ao invés de segredos ou patentes. Sugerimos novas pesquisas para comparar as dinâmicas existentes em *clusters* industriais de médio-baixa inovação tecnológica. Um cluster industrial de médio-baixa inovação tecnológica pode usar coletivamente as estratégias das empresas do cluster. O conhecimento relacionado ao mercado e conhecimentos específicos dos especialistas são os principais ativos estratégicos que conferem vantagens competitivas para o cluster. Esta pesquisa representa uma primeira tentativa de compreender a dinâmica industrial sobre estratégia e conhecimento em um contexto de *cluster* de médio-baixa inovação tecnológica. Essa abordagem pode ajudar governanças dos *clusters* para melhorar habilidades gerenciais e superar limitações desta forma aglomerativa. A novidade desta pesquisa é a abordagem em usar estratégia e conhecimento em estudo de caso de médio-baixas dinâmicas.

Palavras-chave: Estratégia. Gestão do conhecimento. *Clusters* industriais. Inovação. Médio-baixas inovações tecnológicas.

Abstract
This research describes how strategies and knowledge can be used within industrial clusters of medium-low technological innovation to achieve competitive advantages. We used two stages: first, a meta-bibliographical survey of literature to find gaps; second, and a case study. All data were collected from interviews, several documentation and non-participating observation. Data were analyzed through categorization technique, after reduced, prioritized and synthetized. Clusters using adaptive strategies, according to Chaffee´s typology and Porter´s differentiation can outsource R&D of each firm to specialized research centers. This cluster is characterized with strong tendencies of coopetition, trust relationships, planning of joint activities that provide learning, effective combination of resources in strategic communities starters, economic efficiency as potential clusters. The main strategic knowledge tends to be consumer market rather than secrets or patents. We suggest new researches to compare existing dynamics in industrial clusters of medium-low technological innovation. An industrial cluster of medium-low technological innovation can use firms´ strategies collectively within this cluster. The knowledge related to market and specific expertise of experts is key strategic assets that confer competitive advantages to cluster. This research represents a first attempt to understand industrial dynamics regarding strategy and knowledge in a context of a cluster of medium-low technological innovations. This approach can help cluster governances to improve managerial skills and overcome limitations of this agglomeration form. The novelty of this research is the approach of using strategy and knowledge in a field study of medium-low dynamics.
Keywords: Strategy. Knowledge management. Industrial clusters. Innovation. Medium-low technological innovations.

Champ thématique : 03 – Réseaux.

1 Introduction

In clusters of technological frontier, knowledge and strategies used are highlighted because the protection of core knowledge of the firm and also by the use of sophisticated strategies for survival and sustainable growth of the firm through competitive advantages. However, what are the possible benefits in terms of knowledge and strategies related to clusters of medium-low technological innovation in an emerging country?

Results found by Decarolis and Deeds (1999) already indicated that the creation, accumulation and application of knowledge are a source of superior performance. Bierly and Chakrabarti (1996) argue that strategic choices made by decision makers determine the knowledge base of the firm. Thus, the search for competitive advantages related to knowledge may be available in the productive clusters, as in the case of an industrial cluster.

Industrial clusters are considered in this research an interdependent agglomeration of firms in a geographic area that are supported by an institutional infrastructure and represent one of the possibilities for productive agglomerations. The companies entered into clusters tend to benefit from proximity interactions among members (competitors, suppliers, spillovers, universities, research centers, among others) and the assets available there, to create new knowledge in a more efficient or effective way (Porter, 1989; Bathelt, 2005; Iammarino and McCann, 2006; Menzel and Fornahl, 2007).

Regarding spillovers, it is the "leakage" of knowledge, i.e., from a company to the others. Normally, this overflow is generated by firms engaged in innovation activities where new knowledge is available and transferred to others (Gilbert et al., 2007).

The economic theorists argue that the productive concentration-shaped cluster provides cost reductions, however strategic theorists claim that clusters provide competitive advantages. From these assumptions, this research examines how strategies and knowledge are related and used within a cluster of medium-low technological innovation to obtain competitive advantages.

Some studies have been directed to clusters of high technology frontier and innovation, as developed by Ferasso (2008), Beaucage and Beaudry (2005), Boufaden and Plunket (2005), Cooke (2002), Eng (2004), Hsu et al. (2005), Kodama (2007), Kraft (2004), Lissoni (2001). A limited number of studies on clusters of low or medium-low technological innovations on emerging countries are available, also due researchers would focus more intense technological sectors. This paper focused a medium-low technological innovation cluster according to the technology intensity classification of OECD (2011) because of a great number of industrial clusters in Brazil are classified as medium-low or low technological intensive according to the Ministry of Development, Industry and Trade (Brazilian Federal Government) (MDIC, 2013). So, we decided to explore strategy and knowledge dynamics in this context, choosing as a unit of analysis a cluster of rubber/plastic products located in Rio Grande do Sul (Brazil).

This research, therefore, aim to identify strategies and knowledge pertaining to clusters of medium-low technological innovation available in the literature and by checking into a case study.

2 Theoretical base
2.1 Strategy

The strategy involves different concepts and contributions. Henderson (1989) states that from the Gause principle of competitive exclusion, two species cannot co-exist in a given space and in the same conditions. Strategists can use their imagination and abilities to think logically and accelerate the effects of competition and change. Thus, imagination and logic make the strategy possible.

The basic elements of strategic competition to Henderson (1989) are:

a) Ability to understand the competitive behavior as a system in which competitors, consumers, money, people and resources interact constantly.

b) Ability to use this understanding to predict how a given strategy can affect the competitive balance.

c) Ability to recognize resources that may be related to new uses.

d) Ability to predict the risk and return accurate and reliable enough to justify such a commitment.

e) Willingness to act.

Ghemawat (2002) states that the strategy scope, as a way to control market forces and shape the competitive environment, began to take shape in the second half of the nineteenth century. The problem of allocating scarce resources has made several innovations arise in the field of administrative sciences.

While a portion of strategy theorists relate to the traditional view warmongering, Mintzberg (1978) argues that strategy can be defined as a plan, a pattern, a position and perspective. Thus, Quinn, Mintzberg and James (1988) present strategy as a pattern or plan that integrates goals, policies and actions sequential cohesively. The authors also emphasize that the essence of strategy is to build a stand so that the organization can achieve its goals, despite the unpredictability of external forces.

Chaffee (1985) presents three models: linear strategy, adaptive strategy and interpretive strategy, conceptualized as follows.

a) Linear Strategy: this strategy is the most widely adopted and focuses on planning, where the actions (methods, the way planning is managed) assume a sequenced manner. The strategy consists of linear integrated decisions, i.e., plans that will enable organizational objectives. The organizations vary their contacts with the environment through changes in its products or markets or performing other entrepreneurial activities.

b) Adaptive Strategy: organization constantly evaluates the internal and external conditions. Therefore, adjustments in organization or environment may create satisfactory conditions relevant to exploit an opportunity. This strategy involves more variables and is more prone to change than the linear strategy. The environment is more dynamic and less susceptible to forecasts, and involves competitors, trends and stakeholders. In adaptive strategy, the organization must change with the environment.

c) Interpretative Strategy: This model is based on the social contract, where organization is seen as an umbrella of cooperative agreements. The reality is defined as a process of social interchange in which perceptions are affirmed, modified or replaced according to the congruence and perceptions of others.

The concept of Porter (1996) on competitive strategy is differentiation. This means that the organization must choose a different set of activities to deliver a unique mix of value.

Mintzberg (1978) found three theorists groups about strategy:

a) The planning group: involves a highly ordered, tightly integrated with strategies outlined and recorded by the organization.

b) The adaptive strategy group: multiple decision makers with conflicting objectives bargain with each other to produce a stream of decisions.

c) The entrepreneurial strategy group: the leader, who has the power, assumes the risk of decisions taken in the past.

The strategy of coopetition is an alternative when an organization cannot, alone and isolated, achieve its goals. An organization in a coopetitive strategy, not necessarily aligned to the interests of other partners. This partial interest requires consideration of the issue of fairness that is involved in this type of strategy (Grandori and Neri, 1999).

The coopetition received criticism from theoretical and empirical studies regarding trust and opportunism of Williamson (1979), seen as incompatible behaviors by organizations. However, opportunism and trust are behavioral variables that co-exist in the same context and in different degrees (Dagnino and Padula, 2002).

The authors cited above show the occurrence of coopetition on three different levels:

a) Macro Level: actors that coopete are located on this level, which refers to the interconnections between clusters and between firms and industries.

b) Meso level: related to relationships between companies (actors) that are interconnected vertically or horizontally.

c) Micro level: the actors are the divisions and departments within organizations or employees in a given firm.

Clusters are located in the meso level, according to the same authors.

Industrial clusters usually coopete by government resources allocated to R&D, access to capital markets and investment of stakeholders, beyond the differentiation of these activities when the cluster companies enter new markets (Dagnino and Padula, 2002).

Industrial clusters have characteristics of cooperation and competition, which characterizes the coopetition. It is this strategy that many productive clusters owe their success and maintenance (Pedrozo and Hansen, 2001).

Inter-organizational relationships provide several advantages to participating organizations. Learning is commonly cited as one of the biggest advantages for companies that participate in interorganizational networks. This structure allows the creation of interorganizational knowledge and encourages the formation of communities that have an important role in knowledge production and also innovations. The exchange of information and knowledge with a large number of such organizations enhances knowledge sharing, since organizations face complex problems and the skills needed to overcome such limitations are largely derived from the tacit dimension (Forgues et al. 2006).

For Zack (2002), knowledge is a way to access competitive advantage. Organizations that have superior knowledge will be better able to coordinate and combine their traditional resources and capabilities in new and different ways, providing more value to consumers than competitors (Nonaka and Takeuchi, 1997; Liebeskind, 1996).

Enterprises that obtain superior brainpower can understand how to exploit and develop their resources better than competitors, even with regard to resources that are not unique and rare.

Knowledge can be considered as the most strategic resources, and the ability to acquire, integrate, store, share and apply such knowledge is considered a capability to build and maintain a competitive advantage (Zack, 2002).

In this research, knowledge is seen as an asset that can be found both within organizations that form an industrial cluster (such as companies, research centers, universities, unions, among others) and can be found in the cluster itself e.g. outside the enterprise (other companies that are part of the cluster, among others).

Rosenfeld (1997) presents a framework and extends the conventional use and based on market criteria to determine what a cluster is effectively. Its framework includes dynamic characteristics and intangible flows that represent patterns of information, knowledge and innovations. A cluster is represented by a local productive system that is embedded in a social site.

The author suggests an identification typology from dynamic found there:

a) Working: stage at which the cluster already has consistency and is able to realize its full potential and produces more than the sum of its parts.

b) Latent: stage at which the cluster identifies opportunities but not the exploiting and synergies are not yet fully realized.

c) Potential: stage at requisites are located in some place but there are missed opportunities.

Rosenfeld (1997) presents key factors that are crucial to the cluster economic efficiency: the ability of R&D, human resource development, proximity to suppliers, availability of capital, access to specialized services, manufacturers of machines and tools, current network contacts, social infrastructure, entrepreneurial energy, innovation, shared vision and leadership, skills and knowledge.

However, in the opinion of Krogh et al., (2001), not all knowledge has strategic value. The knowledge that ensure profitability for a company above the industry average, are considered strategic expertise. The authors suggest that knowledge can be classified into unique, possessed only by the enterprise, and public knowledge, which is accessible by competitors.

The competitive advantage of the unique knowledge can only be achieved if it is valuable, difficult to imitate by competitors and difficult to replace, as Krogh et al., (2001). The author emphasizes that the company ends up doing with the knowledge, applying it to value-creating activities, matters more than the public availability of the content.

Still based on the authors above, the strategies of survival and advancement generate specific processes, namely:

a) Survival Strategy: occurs through knowledge transfer.

b) Advancement Strategy: occurs by creating new knowledge.

From the contributions presented in the literature, it is clear that knowledge is a strategic asset and can be generated, shared, used and internalized as the different objectives of the organization.

2.2 Industrial clusters

Some of commonly-found definitions about clusters are derived from economic theories. There is no consensus on a definition of cluster, however, we can synthesize these concepts upon commonly cited authors, who have devoted to the study of clusters, such as Marshall (1920), Porter (1989), Cooke (1999); the latter focusing specifically biotechnology clusters (a sector of high technological innovation level). We can find researches made on wine sector, considering industrial cluster approach (Giuliani et al, 2010; Giuliani, 2011; Giuliani and Rabellotti, 2012; Giuliani, 2012).

Bathelt (2005) treats the cluster under a regional approach, where clusters are seen as regional concentrations of firms in a value chain or as parts of it. Clusters must be analyzed in multiple dimensions (vertical, horizontal, institutional, and external dimensions of power). In this perspective, the clusters cannot exist without systematic external links with suppliers, markets and technologies.

Thus, we understood that the approach of this author deals with general questions regarding policies about clusters and cluster itself, arguing that they not function as closed systems, but as local units that interact with other external members that agglomeration.

One of the key issues in policy of a cluster formation is to develop a regional industrial structure that is sufficiently specialized to benefit interdependencies (Bathelt, 2005).

According to Malmberg and Power (2005), clusters are sites of informal social interaction and are considered skilled labor markets, and is characterized as localized systems of interrelated enterprises. The dynamics of the local labor market and social interactions play an important role in the process of knowledge creation within clusters.

Although cluster members can collaborate, they also have competitive behaviors. The competition of an enterprise can be set up according to five competitive forces: a) the threat of new businesses, b) the threat of new products or services, c) the bargaining power of suppliers, d) the bargaining power of buyers and e) the rivalry among existing competitors. The dynamics of these five forces varies from enterprise to another and affect the profitability of these companies in the long-term, as they determine: product prices, the costs to be incurred and the investment needed to compete. Power is a function of the enterprise structure, its economic characteristics and techniques which underlie it (Porter, 1989).

Iammarino and McCann (2006) offer a cluster taxonomy, where clusters are ranked from the nature of the enterprises that compose them and the nature of relationships and transactions that occur outside the cluster level.

In the model of pure agglomeration, inter-enterprise relationships are transitory, firms have no market power and continuously change their relationships with other firms and consumers in response to market opportunities as well as intense local competition (Iammarino and McCann, 2006).

At the industrial complex, the primary characteristic is the long-term stability and predictable relationships among firms in the cluster, involving frequent transactions. This type of cluster is most commonly observed in chemical industries. This inter-organizational agglomeration is also based on production and localization model and there are input and output barriers of this industrial complex (Iammarino and McCann, 2006).

The third type of industrial cluster is the social network model where there are relationships based on trust among key players. Such trusts result in reduced transaction costs among firms because they face no transaction costs originating from problems with opportunism (Iammarino and McCann, 2006).

Trust and collaboration were also research foci of Teerajetgul and Charoenngam (2006). The authors identified the existence of factors that influence the knowledge creation process in the firm, including trust and collaboration were among the factors that influence the knowledge creation process of the same.

Fornahl and Menzel (2007) argue that the diversity and variety of existing and applied knowledge in the cluster is a factor that affects its development. The cluster life cycle is linked to quantitative and qualitative elements. The heterogeneity of skills available in a cluster is crucial for their development. The life cycle of a cluster may decline when this heterogeneity is not sustained.

The transition between the stages of the life cycle of the cluster (birth, growth, maturity and decline) is due to the heterogeneity of skills, which form the qualitative dimension. In the quantitative dimension, the transition among the stages of the life cycle is by using this heterogeneity. The absorptive capacity among firms in the cluster and the subsequent adjustment processes have the following effects on the life cycle of the cluster: the cluster during birth, a greater absorptive capacity among firms in the cluster can explore distances technology sooner and use more synergies than firms that are not located in a cluster (Menzel and Fornahl, 2007).

During the growth stage, firms fit to each other and generate sub-optimal distances technology. A sub-optimal distance can reach a small technology gap can be found in the decline stage. The optimal technological gap can be found only if the cluster become sustainable. This sustainability of the cluster is given by the implementation of external knowledge to cluster formations that firms always have strayed from existing knowledge. If firms in the cluster cannot find that balance, they show a worse development than firms that are not part of a cluster, so the cluster enters the decline phase. This balancing effect by external knowledge is not necessary for businesses that are external to the cluster level because they always had knowledge outside the cluster (Menzel and Fornahl, 2007).

The life cycle of the cluster is related to the balance of knowledge that are absorbed from the external side of the cluster and are implemented within the cluster. This balance is related to the absorptive capacity of the members of the cluster.

In this research, cluster is called as industrial agglomeration of firms in a particular sector, geographically close, they have the support of institutional associations, research centers, universities, and others, who provide expertise available to the participants in this cluster. Firms operating in clusters interact with other members (competitors, suppliers, spillovers, universities, research centers, etc.) in the pursuit of competitive advantages, under the logic of coopetition and to obtain innovations.

2.3 Knowledge within Industrial Clusters

Lissoni (2001) re-examines the tacit knowledge and coding approach, focusing on industrial districts and knowledge spillovers. The survey revealed that knowledge within a cluster can be highly codified, as evidenced in the case of mechanical sector enterprises located in Brescia (Italy). This research reveals that the codification of knowledge within a cluster occurs at a high level. The author reveals that knowledge circulates in small epistemic communities located within the cluster. The research focus was directed to the tacit and explicit knowledge and is recommended future research to identify the existence of epistemic communities in other sectors of economic activities, inter-enterprise distribution and geographical structure.

Bathelt, Malmberg and Maskell (2004) show the relationships between the clusters of economic activities and the spatiality of knowledge creation in interactive learning processes. The study highlights that both tacit and encoded knowledge can be exchanged at local and global levels and also local rumors (informal communications among members of clusters) can foster the dynamism of the cluster.

The knowledge sources external to the cluster can benefit enterprises in relationships with members outside the cluster. The members who serve as a communication bridge between the cluster and its exterior (gatekeepers) disseminate information to other firms through local rumors (Bathelt, Malmberg and Maskell, 2004).

The authors argue that ambitions and policy initiatives in order to build, support and develop clusters of similar economic activities have grown regarding the development of mechanisms that promote the potential for interactive learning and knowledge creation among enterprises and other organizations located in a cluster.

New technologies can facilitate the creation and transmission of knowledge. In this sense, Eng (2004) researched how the telecommunication-based internet can aid this process. While studies have reported the importance of localized expertise for the knowledge creation and dissemination, the internet has introduced a new competitive scenario has led businesses to virtual networks. Little research has been done on the internet's influence on the development of regional clusters and the role of the internet in the knowledge creation and dissemination. Supported by case studies of British firms

in high technology sector, the data revealed that there are four possible ways related to internet use: open systems, virtual channels, multi-user engagement and extended customization. The internet facilitates communication, extends capabilities and customization features new virtual channels that can strengthen the interactions of spatial locations of enterprises for production and innovation.

It is understood, therefore, that information technology is an important channel of communication because it has facilitated the knowledge transfer in internal and external cluster levels and therefore also facilitates the transfer of businesses located within this cluster.

Dahl and Pedersen (2004) focused on the development of informal networks in regional clusters, informal contacts among employees and firms. In an empirical study, the authors investigated engineers who acquire knowledge in these informal networks. The research revealed that informal contacts represent an important channel for knowledge dissemination in a cluster. Knowledge flows in a cluster tend to be more or less depending on the degree of informal specialty of this knowledge. In clusters with the highest level of expertise, knowledge is diffused by formal channels of knowledge, such as patents. The authors recommend further research relating the informal inter-enterprise contacts with the company's performance and the influence exerted by the relationships of their employees.

The protection of knowledge, by the firm, serves to induce investment in strategic innovation. If firms manage to protect the value of their knowledge more effectively than other firms, they will have stronger incentives to innovate (Liebeskind, 1996).

New knowledge is produced by investments in innovation and testing evidence. Because innovation and such tests have a high cost, and the fact that the production of new knowledge is an activity inherently an uncertain process, the knowledge value is not distributed. Firms should only protect the unique knowledge, value which would enable a return on investment of the costs of protection (Liebeskind, 1996).

The study focus of Krafft (2004) is in industrial dynamics and knowledge. The creation, accumulation and eventual destruction of knowledge shape profile and evolution of industries. The argument refers to dynamic knowledge-based industry, with an approach that can explain how a cluster can lower the knowledge barriers of the firms located in this and to create dynamics and specific knowledge that can shape the industrial dynamics.

Such knowledge-based dynamics are those where a) the knowledge is localized, specialized and dispersed locally, and b) the process of knowledge generation, diffusion and their coordination is implemented step by step, through the contribution of the various members of the cluster, with irreversible effects in the subsequent period (Krafft, 2004).

The author argues that firms located in clusters can benefit:

1) The accumulation of specific knowledge of different industries, which joined, can serve as positive for new entrants as the viability of businesses located in the cluster. Thus, to the extent that the complementarities of knowledge are organized within the cluster, the interfaces are favored and organizational barriers to knowledge decreases.

2) The interaction between the innovative behavior of firms, infrastructure and academic resources on local public policies and incentives become key factors in the performance of the cluster. The presence of institutions in the cluster is an important factor for the development of dynamic local knowledge.

3) The knowledge dynamics resulting from the re-combination of cumulative knowledge that is dispersed, complementary, internal and external, tacit and codified. Once technological knowledge is created based on the interactions among firms and other institutions (knowledge sources), the transformation of this knowledge into a market opportunity or innovation yet to be finalized.

The knowledge proximity is approached by Breschi et al., (1998). According to the authors, such proximity allows the generation of new knowledge from existing in a given space, providing new opportunities and innovations. The knowledge proximity is the result of a process of gradual changes in terms of knowledge creation and accumulation, interdependencies (among those involved in the process) and spillovers. The authors conclude that in most clusters involving technologies in terms of knowledge, such as bio-pharmaceutical clusters, these technologies have close ties and interdependencies as well. The knowledge proximity is an important factor in the process of technological diversification, and when installed on the cluster introduces innovative technologies not as innovative firms that, e.g., may be close and with whom it maintains innovative interactions.

As for Moodysson and Jonsson (2007), it is needed go beyond the geographical distance, i.e., one must consider the intangible dimension of distance. The authors mention the contributions of Boschma in relation to functional categories and relational proximity. The functional proximity refers to the physical distance affected by mobility, which may be associated with accessibility. This category is similar to the geographical distance. The relational category refers to the intangible dimension based on affinity and similarity. This category is not easily identified by means of measurable indicators (such as time or costs) but can be considered as a set of dimensions intangible cognitive organizational, social and institutional.

The strictly economic theories origin focus reveals that the knowledge dissemination depends on the type of cluster (Iammarino and McCann, 2006) and stage of their life cycle (Menzel and Fornahl, 2007).

Håkanson (2005) argues that commonly clusters privilege access to the tacit knowledge that is not available, or available at high costs in firms located elsewhere, and that such access provides competitive advantages that make them grow and develop both firms and the these regions where clusters are located. The author proposes a model of cluster dynamics that emphasizes two interdependent processes: 1) the concentration of specialized and complementary epistemic communities, and 2) the high rates of entrepreneurship and new enterprises formation.

It is understood from this author, that tacit knowledge not available to the cluster becomes a barrier to building knowledge-based competitive advantages. The key advantage of clusters is the

simple fact that individuals seeking employment and entrepreneurs have access to attractive opportunities without occur in costs incurred by long distances (such as travel or changing from one city to another).

The relationship between industrial clusters and innovation is the study focus of Giuliani (2005). The learning process of the cluster is approached from two perspectives: 1) the structure of the knowledge network in a cluster is related to the heterogeneous distribution of the knowledge bases of the firm, and 2) the interaction of business and knowledge flows are phenomena not co-occur in large scale. Furthermore, the research highlights how the heterogeneity of the knowledge bases of enterprises can generate unequal distribution of knowledge and learning selective inter-company.

In this paper we used the Schumpeter (1985) innovation concept, who claims that innovation can occur through introduction of a new product, new production methods, opening of a new market, the acquisition of new source of raw materials or half-manufactured the goods or reorganize an industry.

Companies located within clusters have different knowledge and experiences. Knowledge is considered a public good in a particular location (in this case, in a cluster). The survey revealed, unlike other positions, similar characteristics as proximity does not necessarily contribute to knowledge sharing (Giuliani, 2005).

Thus, considering that companies integrate these industrial clusters and are responsible for the creation of economic value, by the sale of its products, innovation cluster will be considered in the light of Schumpeter (1985).

Clusters of low industrial innovation are considered in this research, as clusters whose division represents low degrees of Schumpeterian innovation.

3 Research design

This research has the objectivist epistemological positioning (Burrel and Morgan, 1979), we begun from theoretical background for the subsequent field research. Therefore, this study was conducted in two stages.

At first, we used the meta-bibliographical study, a survey of the literature, where it was possible to identify the state of evidence of the study area and allowed the construction of a theoretical basis. We found publications indexed in international databases of scientific journals, from 1998 to 2008. The information was obtained through the pursuit of the following keywords: Cluster & knowledge management, knowledge & cluster, knowledge & structure, and enabled the formulation of proposals for the structure of this research. Other terms (such as knowledge & process) were investigated but did not return significant results to the research.

Besides the journals, were found forty-three papers published in DRUID Conference proceedings between 1998 and 2008, available on the website of this institution.

The results pointed to a total two hundred and eighty-two papers involving issues knowledge and clusters. Of these papers, one hundred seventy-seven were relevant to the proposed research. The literature provided the structuring research and problematic identification.

From the survey of concepts that are related to knowledge and strategy, from a semantic categorization literature (Usunier et al., 1993), identified the main approaches and contributions on the subject. The study also was based on a methodological triangulation of theories derived from economics to explain a phenomenon in the area of Knowledge Management, as postulates Collis and Hussey (2005).

In the second phase, for the field research, we used the case study methodology to collect and analyze data (Yin, 2005). In that case, we studied the knowledge and strategies of a cluster. The cluster was selected due to its importance in the rubber/plastic sector in Rio Grande do Sul, representing the greater cluster of this sector in that state, and is the unique elastomer's cluster in Latin America.

The data was collected through two semi-directive interviews (Yin, 2005; Usunier *et al.*, 1993) that were recorded and transcribed. Interviews were done with aid of an interview guide constructed from the literature used in this paper, whose main subjects were used on the structuration of Table 01. Usunier *et al.*, (1993) affirm that top-managers give access to critical information. Data was complemented with several documentation (such as reports) collected on cluster governance (Yin, 2005; Pimentel, 2001) and non-participating observation through visits to the cluster was located. Data ware analyzed through categorization technique (Bardin, 2004) was done according to the thematic content analysis (Bardin, 2004; Miles and Huberman 1991).

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), was used the analysis of thematic content technique (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.

4 Data presentation and analysis

4.1 Cluster characterization

To verify all concepts and approaches from literature, 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 ninety-two enterprises, two universities, one enterprises` syndicate, one research center and many suppliers in the value chain. The products are largely components for other industries (footwear industry, agriculture products and equipment 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, supporting and encouraging the emergence of new industries (Ucha, 2003).

The enterprises` syndicate has as role to improve the competences of its members (enterprises) through educational programs, market prospection, amongst other managerial services. In this syndicate, the enterprises can find 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).

4.2 Data analysis

After collecting, analyzing and synthesizing data, we elaborated the following categorization of strategies and knowledge checked in this cluster of low technological innovation.

Bibliographic research	Field research	
Theoretical contributions	Cluster positioning in relation to knowledge	Cluster positioning in relation to strategies
Action plan that provides a competitive advantage (Henderson, 1989; Quinn, Mintzberg and James, 1988).	- The cluster must have near actors (universities, technology center, suppliers and consumers). - A research center promotes the generation of specific knowledge.	- The geographical proximity of cluster members can be considered a major factor in technological terms. - A research center can be established for the creation of new knowledge for the benefit of members of the cluster. - The resources and incentives to cluster can be obtained through the submission of projects with the governmental spheres.
Linear, adaptive and interpretive strategies (Chaffee, 1985).	- The companies of the cluster can assume a linear strategy in terms of knowledge.	- The cluster as a whole can assume the adaptive strategy.
Differentiation strategy (Porter, 1996).	- The cluster firms can outsource R&D department for the research center. This would favor the exchange and access to a diversity of knowledge greater than if each company individually to develop its	- The diversity of knowledge available to all members of the cluster can provide advantages to the creation of new products and knowledge, with most competitive costs.

	products in its R&D department.	
Coopetition strategy (Grandori and Neri, 1999).	- The fewer secrets cluster has, the greater the collaboration for the creation of specific products collaboratively.	- Firms can collaborate to achieve and exploit consumer market, but they can compete individually for access to resources coming from different sources. For this, each firm should specialize in manufacturing a range of products to meet specific market needs jointly.
Opportunism and trust (Dagnino and Padula, 2002; Pedrozo and Hansen, 2001).	- The knowledge generated by the firms participating in the cluster must be complementary. There must be a strongly trust established.	- The products of each company should be different and complementary. Firms trust on each other. Firms explore the consumer market together. - Contracts can be used as tools to reduce opportunism among organizations in the cluster.
Advantages offered by learning (Forgues et al., 2006).	- The accumulation of specific knowledge, in more differentiated forms, can provide cluster members the various process improvements and the introduction of a culture focused on planning activities in the sector.	- The cluster members can develop long-term projects based on plans drawn up jointly.
Effective combination of resources through knowledge (Zack, 2002). Strategic communities (Kodama, 2005).	- The cluster can be organized around starters: in governance that can centralize knowledge concerning the management, strategy and policy; and research center that can centralize technical and specific knowledge. - The knowledge of specialists can be shared in the research center, and it increases access to knowledge in the production of new products. - Entrepreneurs can find complementary knowledge management in cluster governance (community specific issues - strategic communities).	- Companies can get both at the research center and in governance as the expertise and knowledge to leverage the competitiveness of enterprises, in terms of new technologies, both in terms of new consumer markets and new resources of funds. - The combination of knowledge of many experts who are present at the research center can increase the competitiveness of products manufactured by the firms in the cluster. - The combination of complementary knowledge can provide greater competitiveness on the performance of individual companies. - The strategic communities can compose a cluster of firms' strategy to increase the knowledge base of enterprises, individually. - Companies can collectively decide on the strategies of the cluster.
Key factors of economic efficiency of the cluster (Rosenfeld, 1997): the ability of R&D, human resource development, proximity to suppliers, availability of capital, access to specialized services, manufacturers of machines and tools, intensity of networking, social infrastructure, entrepreneurial energy, innovation, shared vision and leadership, skills and knowledge.	- The proximity of specific technical knowledge can streamline processes in terms of management and facilitate the development of products with competitive costs. - Technical knowledge is produced in a research center outsourced. - Existence of skilled labor. - The cluster has professionals that have specialized knowledge. - Social interactions occur constantly between members of the cluster.	- The competitive cost and advanced technology of processes allows cluster members to achieve levels of competitiveness. - An outsourced research center can perform R&D for the entire cluster. - The mobility of skilled labor reduces the cost of training of skilled manpower coming from outside the cluster level. - Access to financial resources is given upon submission of projects for governmental spheres. - Knowledge is shared in strategic communities.
Cluster dynamics (Rosenfeld, 1997): working cluster, latent cluster or potential cluster.	- In terms of knowledge, the cluster is structured as a potential cluster. Market opportunities may be missed by low technology used in product development by firms.	- In terms of strategy, the cluster is structured as a potential cluster.
Strategic knowledge (Krogh et al., 2001).	- The main strategic knowledge of the cluster is referred to the consumer market.	- The main strategic knowledge of the cluster is referred to the consumer market.

Table 01 – Main results of bibliographical and field researches in relation to strategies and knowledge of a cluster of low technological innovation

4.3 Discussion

The literature and field researches highlighted the various aspects related to strategies and knowledge within this cluster of low technological innovation. From the main results presented in the table above, we describe below the main theoretical and practical evidence of this research.

The knowledge creation that can be taken internally in the cluster can occur by sharing the expertise of specialists that circulate in the three levels of analysis (internal to the enterprises, internal and external to the cluster) and also between corporate managers who maintains contacts with cluster governance formally, and among firms informally.

Specific knowledge can be created at the research center where experts interact in the creation of new knowledge, thus geographical proximity (to reduce costs) and the proximity of knowledge (access to new and diverse knowledge) are important to occur this process.

Enterprises that make up the cluster get more advantages in terms of knowledge, creating new knowledge through information sharing among experts from other companies.

The research center can hold and centralize specific technical knowledge on R&D. The research center disseminates technical knowledge among cluster members and it is in this center that enterprises found an infrastructure for their expertise.

The research center, in addition to providing machinery and latest equipment, may be the site where experts from companies socialize and internalize technical knowledge available, which are needed for production processes in internal level of cluster´s firms.

Gains to the cluster can be translated into the quality and quantity of knowledge generated and available (knowledge approach), as well as reducing costs for the generation of such knowledge (strategy approach).

In addition to the specific knowledge used by experts and invested in firms (as in the development of products and their manufacturing process, properly), it can be created within the cluster communities of specific issues in terms of management, policy and strategy (e.g., exploration of new markets, bargaining with at governmental levels) and the cluster governance must act as a gatekeeper to the external level of the cluster with respect to contacts, and also act as spillover disseminating information and knowledge found among cluster members. These communities of specific issues gather together in cluster governance syndicate, must be composed of groups that decide on the collective strategies of the cluster.

Personal contacts and affinities allow the socialization of diverse knowledge available in the cluster, specifically among governance and its members and also among research center and its members. Firms tend to interact with each other in an informal manner due to geographical proximity provided by the cluster. The trust relationships between organizations give rise to opportunism and this trust is essential for information sharing.

Enterprises can use specific knowledge generated in the research center, in the manufacture of its product lines in specific industrial scale, meaning the new and specific technical knowledge created at the research center can be replicated internally in the firm and sold in the market at lower costs.

The way that firms can organize among themselves, to each of these focus on a specific product line promotes competition in the internal cluster rather low, which may facilitate the opening of enterprises with respect the exchange of diverse knowledge. Firms can share knowledge (e.g., about market, production processes) to meet, jointly, the market needs (principle of coopetition of Neri and Grandori, 1999).

Cluster governance must represent the interests of the cluster with respect to political relationships that can happen through submission of projects to attract incentives and resources to the interests of the cluster.

Entrepreneurs who do not have specific knowledge of management, may seek such knowledge on cluster governance (syndicate). One of these skills can be the knowledge of the consumer market, which can also be considered a secret at internal level of the cluster.

5 Final Considerations

We found that in this industrial cluster of medium-low technological innovations (according to OECD classification), strategies can be used to obtain competitive advantages in a planned manner, such as the decisions made in relation to technical knowledge, with the creation of a Research Centre for the production of new knowledge, with the creation of a governance which assumes a role of centralizing the management expertise necessary for firms who are not familiar with such matters.

According to the classification of Chaffee (1985), a cluster with such characteristics can be characterized as adaptive strategies, while firms can take that composes the linear strategies, which is observed in the studied case.

The differentiation concept of Porter (1996) is linked in outsourcing departments of R&D of each firm of this cluster that transfer to the cluster's Research Centre that gives the appearance of strategic communities with specific matters: experts from firms who possess specific knowledge and tend to share and internalize this new knowledge on this Research Centre. These new insights are typically applied in internal level of firms, which turn them into products. The existence of an environment like this enables competitive advantages in reducing the production costs of this new knowledge in a jointly and shared way.

The coopetition (Grandori and Neri, 1999) is also present in this cluster of medium-low technological innovations and collaborations are manifested in the production of specific products and the exploration of consumer markets, while the inter-firms competitions can happen when these competing for resources and incentives arising mainly from the external level of the cluster.

Due to this clusters' firms manufacture different products at the most complementary, they are not characterized as competitors. Thus, trust relationships are more strongly present than opportunistic (Dagnino and Padula, 2002; Pedrozo and Hansen, 2001).

The planning of joint activities and presentation of projects to raise funds provide learning (Forgues et al., 2006) to the cluster members and the accumulation of knowledge resulted from this process will provide advances that can also be considered as sources of competitive advantage.

The effective combination of resources (Zack, 2002), may be present as the starters (e.g., governance, research centers, universities) produce initiatives that are adopted by other cluster firms. The combination of technical expertise and combination of knowledge management, on cluster governance, are considered key factors of competitiveness of cluster enterprises and these combinations occur in strategic communities.

In the case of strategies classification of Krogh et al., (2001), the investigated cluster is characterized by the use of advancement strategy as it creates new knowledge in strategic communities present in the cluster.

Regarding the key factors of economic efficiency of the cluster (Rosenfeld, 1997), this shows factors that permit to classify as a working cluster, i.e., a structured cluster where the result is greater than the sum of its parts, as seen in the studied case.

The main strategic knowledge (Krogh et al., 2001) of the cluster in this study is on the consumer market. Chemical formulas are no longer strategic knowledge, as it was at the beginning of the activities of this cluster.

We conclude, therefore, that an industrial cluster of medium-low technological innovation, like the studied case, can be used broadly defined strategies by firms collectively within this cluster. The knowledge related to market are key strategic assets that confer competitive advantages to cluster in the same way that the specific expertise of chemical engineers, shared in communities of practice at the research center.

As limitations, this case study represents a first attempt to understand the phenomenon and we suggest new researches to compare and confirm the existing dynamics in industrial clusters of medium-low technological innovation, as the case studied here.

References

Bardin, L. (2004). *Análise de conteúdo,* Edições 70, Lisboa.
Bathelt, H. (2005). "Geographies of production: growth regimes in spatial perspective (II) – knowledge creation and growth in clusters." *Progress in human geography,* Vol. 29.
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.
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 DRUID Summer conference,* Copenhagem.
Bierly, P. and Chakrabarti, A. (1996), "Generic Knowledge Strategies in the U.S. Pharmaceutical Industry." *Strategic Management Journal,* Vol. 17(Winter Special Issue).

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

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

Burrell, G. and Morgan, G. (1979), *Sociological paradigms and organisational analysis: elements of the sociology of corporate life,* Heinemann, London.

Chaffee, E.E. (1985). "Three models of strategy." *Academy of management review,* jan. 1985.

Collis, J. and Hussey, R. (2005). *Pesquisa em administração: um guia prática para alunos de graduação e pós-graduação,* 2. ed., Bookman, Porto Alegre.

Cooke, P. (2002). "Regional innovation systems: general findings and some new evidence from biotechnology clusters." *Journal of technology transfer,* Vol. 27, No. 1.

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

Dagnino, G.B. and Padula, G. "Coopetition strategy – a new kind of interfirm dynamics for value creation." *EURAM conference proceedings*.

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

Decarolis, D.M. and Deeds, D.L. (1999). "The impact of stocks and flows of organizational knowledge on firm performance: an empirical investigation of the biotechnology industry. *Strategic management journal,* Vol. 20, No. 10.

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.

Evrard, Y.; Pras, B. and Roux, E. (1997). *Market – Études et recherches en marketing – fondements, methods,* 2. ed., Nathan, Paris.

Ferasso, M. (2008). *O processo de criação de conhecimento em empresas localizadas em clusters industriais: um estudo multi-caso no setor de biotecnologia na França e no Brasil,* Thesis (Master). PPGA/EA-UFRGS.

Forgues, B.; Fréchet, M. and Josserand, E. (2006). "Relations interorganisationnelles – conceptualisation, résultats et voies de recherche." *Revue française de gestion,* No. 164.

Ghemawat, P. (2002). "Competition and business strategy in historical perspective." *Business history review,* Vol. 76, No. 1.

Gilbert, B.A.; McDougali, 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. (2011). The Role of Technological Gatekeepers in the Growth of Industrial Clusters: Evidence from Chile, *Regional Studies*, Vol. 45, No. 10, p. 1329-1348.

Giuliani E. (2012). Clusters, networks and firms' product success. An empirical study, *Management Decision*, (in press).

Giuliani E. et al. (2010). Who are the researchers that are collaborating with industry? An analysis of the wine sectors in Chile, South Africa and Italy, *Research Policy*, Vol. 39, No. 6, p. 748-761.

Giuliani E., and Rabellotti R. (2012). Universities in emerging economies: Bridging local industry with international science. Evidence from Chile and South Africa, *Cambridge Journal of Economics*, Vol. 36, p. 679-702.

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.

Grandori, A. and Neri, M. "The fairness properties of interfirm networks." In: Grandori, A. (org.). (1999). *Inter-firm networks,* Routledge, London.

Håkanson, L. (2005). "Epistemic communities and cluster dynamics: on the role of knowledge in industrial districts." *Industry and innovation,* Vol. 12, No. 4.

Henderson, B.D. (1989). "The origin of strategy." *Harvard business review,* Nov./Dec./1989.

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.

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

Kodama, M. (2007). "Innovation and knowledge creation through leadership-based strategic

community: case study on high-tech company in Japan." *Technovation,* Vol. 27.

Kodama, M. (2005). "New knowledge creation through leadership-based strategic community – a case of new product development in IT and multimedia business fields." *Technovation,* Vol. 25.

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

Krogh, G.; Ichijo, K. and Nonaka, I. (2001). *Facilitando a criação de conhecimento – reinventando a empresa com o poder da inovação contínua,* Campus, Rio de Janeiro.

Liebeskind, J.P. (1996). "Knowledge, strategy and the theory of the firm." *Strategic management journal,* Vol. 17 (winter special issue).

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

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

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

MDIC (2013). Levantamento de arranjos produtivos locais no Brasil/Planos de desenvolvimento preliminares. Available at <http://www.desenvolvimento.gov.br/sitio/interna/interna.php?area= 2&menu=3101#Levantamento%20APLs>. Access on 19/Feb./2013.

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

Mintzberg, H. (1978). "Patterns in strategy formation." *Management science,* Vol. 24, No. 9.

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.

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

OECD (2011). ISIC Rev. 3 technology intensity definition. Available at: <http://www.oecd.org/sti/industryandglobalisation/48350231.pdf>. Access on 19/Feb./2013.

Pedrozo, E.A. and Hansen, P.B. (2001). "Clusters, filière, supply chain, redes flexíveis: uma análise comparativa." *Proceedings of Colóquio de Clusters (Brasil e França): As relações econômicas franco-brasileiras,* Grenoble.

Pimentel, A. (2001), "O método da análise documental: seu uso numa pesquisa historiográfica", *Cadernos de pesquisa,* No. 114.

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

Porter, M. (1996). "What is strategy?" *Harvard business review,* Nov./Dec./1996.

Quinn, J.B.; Mintzberg, H. and James, R.M. (1988). "The strategy concept." In: Quinn, J.B.; Mintzberg, H. and James, R.M. (1988). *The strategy process: concepts, contexts and cases.* Prentice Hall, New Jersey.

Rosenfeld, S.A. (1997). "Bringing business clusters into the mainstream of economic development." *European planning studies,* Vol. 5, No. 1.

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

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.

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.

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.

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

Williamson, O.E. (1979). "Transaction-cost economics: the governance of contractual relations."

Journal of law and economics, Vol. 22.

Yin, R. (2005). *Estudo de caso: planejamento e métodos,* 3. ed., Bookman, Porto Alegre.

Zack, M.H. (2002). "Developing a knowledge strategy." In: Choo, C.W. and Bontis, N. (2002). *The strategic management of intellectual capital and organization knowledge,* Oxford Press University, Oxford.