

# Knowledge transmission channels: a comparative study of clusters in Brazil and in China

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## Abstract

The aim of this paper is to identify and analyze the knowledge transmission channels in two textile clusters located in two emerging economies: one in Vale do Itajaí, in Brazil, and the other in Haining, in China, highlighting the existing similarities and discrepancies. Information in the textile cluster in Brazil was collected through: studies on secondary sources and fieldwork. The characterization and identification of knowledge transmission channels most used in cluster in Chinese cluster were based on survey data collected from secondary sources, namely research published by international organizations. In both clusters, opportunities of direct learning are found with other companies operating in the same market can be restricted due to the similarity between the goods and a limited competitiveness. The results show that the relations with competitors, suppliers and customers are important knowledge transmission channels in textile clusters. This research can be used by managers to enable the understanding of the mechanisms and determinants of knowledge transmission channels and can also influence the knowledge diffusion more effectively.

**Keywords:** Knowledge transmission channels, collaborative learning, cluster, Brazil, China.

## 1 Introduction

There is a clear indication of a drop in Brazil's industrial competitiveness. A recent study by the National Confederation of Industry (Confederação Nacional da Indústria, CNI, 2010) elaborated this in comparing 14 countries having a level of development similar to that of Brazil's. In the textile industry, if exports of textiles are used as an indicator of performance, it can be concluded that although exports in Brazil showed a good performance from 1990 to 2000, a stagnation and even decline occurred in the following years, falling from US\$ 2.2 billion to less than US\$2 billion in 2008. A reflection of this situation can be found in the cluster textile of Vale do Itajaí with the share of its textile exports reducing over the past few decades. In 2001, they were at 22% and in 2010 only 8%. Imports, however, experienced opposite with a large increase: from only 6% in 2001 to 28% in 2010 (FIESC, 2010). The Chinese increased their textile exports of US\$7.2 billion in 1990 to US\$65.3 billion in 2008 (WTO, 2010). In this context, it is believed that the growth of the Chinese market and the stagnation and decline in the Brazilian textile market on a global scale emphasizes the need for studies to analyze the reasons for these occurrences.

In front of this context the aim of this paper is to identify and analyze the knowledge transmission channels in two textile clusters located in two emerging economies: one in Vale do Itajaí, in Brazil, and the other in Haining, in China, highlighting the existing similarities and discrepancies.

In the concept of industrial clusters presented by Porter (1998), Giuliani and Bell (2005) and Morosini (2004) the importance of knowledge and learning are evident. Also, researchers such as Cunha (2007), Saublens (2011), Wragg (2012), Kleindorfer and Wind (2012) agree that collaborative learning processes in clusters are crucial for the formation of the companies' competitive advantage of individually and in the group making up the cluster.

## 2 Scope Industrial Clusters: mechanisms of learning

Knowledge spillover is just one of the externalities that are argued to be the main forces behind industrial clustering. From the classical work of Marshall, Krugman and Wells (2013) derive three kinds of externality that are important for clustering: 1) economies of specialization caused by a concentration of firms being able to attract and support specialized suppliers; 2) economies of labour pooling, where the existence of a labour force with particular knowledge and skills attracts firms, which in turn attract and create more specialized labour; and 3) technological externalities or knowledge spillover (LKS), where knowledge and information flow more easily between actors located in a cluster than over long distances.

Authors such as Larsson et al. (1998), Cunha (2007), Balestrin and Verschoore (2008), Asproth (2007), Prange (1999), Lundvall (2009), Saublens (2011), Wragg (2012), among others, make it clear that clusters, in their inter-related spaces, promote an environment which encourages knowledge sharing and collaborative learning, conceptualized as the collective acquisition of knowledge by a set of organizations.

This concept refers to the understanding that this type of learning can be considered as distinct from organizational learning because of the inclusion of learning synergy in the participating companies that form the cluster. In other words, the achievement of collective competitive advantage might not occur if there was no interaction between them (Larsson et al. 1998).

Collaborative action directed towards collective learning is not just about searching for external knowledge on individual companies through relationship networking, but above all, on knowing how to develop it through partnerships. Thus, social and institutional knowledge and knowledge of network itself knowledge collectively builds and new knowledge is learnt jointly in the group (Larsson et al., 1998; Asproth, 2007). According to Håkansson et al. (1999) one important way to learn is through others. For these authors the extent to which learning takes place seems to be highly related to the existence of connections between the relationships. They show that the more each single relationship is part of a network the more the company in average seems to learn from it.

Problems related to knowledge sharing and collaborative learning are found in the scope of inter-organizational networks. In this sense, Cunha et al. (2007) point to "myopia" on the part the organizations' managers who are part of inter-organizational networks. According to the authors, the first factor of "myopia" comes from the fact that the very administration of network organizations is not used to being something inherent to the managers' ideas. According to Prahalad and Ramswamy (2004) and Mouzas et al. (2008), collaboration is not an easy or natural task for most managers, which shows the difficulty of obtaining a collaborative vision. Difficulties related to collaboration in the inter-organizational context reflect problems related to knowledge sharing and collaborative learning (Asproth, 2007).

Mouzas et al. (2008) argue that developing network insight is a managerial challenge encompassing the amalgamation of dispersed pieces of atomized network pictures through heedful, multilateral interactions. For the authors a managerial activity transcends the task-specific knowledge base of managerial cognition and leads to objectified organizational learning within a business network. Mouzas et al. (2008) also highlight that managers that develop insight in business networks are able to mobilize other actors and create a competitive advantage for their organization that is crucial for innovation and growth.

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Clustering can bring a variety of benefits or competitive advantage to participating companies, both in explicit and implicit scopes. The main explicit benefits are linked to the achievement of economic advantages. Regarding the implicit character, the advantages are the reduction of uncertainty, synergy and complementarity between companies involved and the creation of experts (Porter, 2008; Cunha, 2007; Casarotto and Pires, 2001). In this sense, Cunha et al. (2007) state the second factor of "myopia" is due to a limited perception in which managers do not easily perceive the implicit factors.

Giuliani and Bell (2005) found that knowledge related to innovation is not spread evenly between companies in industrial clusters, but instead flows in a highly selective and unequal manner between them.

For Guo and Guo (2010), there is a wide range of knowledge transmission channels in clusters. The authors cite the relationships between companies in the client-supplier cluster type, relationships with suppliers of specialized services, raw materials and equipment, the processes of imitation, the mobility of labour, relationships with universities and research institutions and business associations. In the scope of the companies, the authors emphasize internal training and research and development departments.

Knowledge transmission channels can be intentional or unintentional. From this perspective, Guo and Guo (2010) consider that literature emphasizes the analysis of intentional channels, somehow ignoring contributions of informal or unintended channels. The exceptions are the studies made by Saxenian (2006) that shows the importance of informal contacts such as knowledge transmission channels. According to Guo and Guo (2010), studies of authors such as Giuliani (2005), Lissoni (2001), Breschi and Lissoni (2001) and Morrisoni (2004) have neglected the fact of several learning mechanisms coexisting.

Thus, there is a strong sense and justification for conducting a study with the objective of identifying and analyzing the main knowledge transmission channels in the textile clusters in Vale do Itajaí, in Brazil, and in Haining, in China.

Research on the knowledge system structure in clusters show that leading companies generally behaves as gatekeepers of knowledge. For Guo and Guo (2010), these type of companies are usually the largest ones and more dependent on their research and development departments for the acquisition of technical knowledge. The authors indicate that in clusters of emerging economies, medium and small sized companies have difficulty obtaining sufficient financial and human resources to create and maintain departments of research and development, and they are obliged to acquire external technological knowledge.

### 3 Methodological Procedures

This study uses the basis of an exploratory approach. The characterization and identification of learning channels most used in the Haining cluster in China were based on survey data collected from secondary sources. Results of the research published by international organizations, research centers and scientific articles through indexed databases and international sites were analyzed.

Information in the textile cluster in Vale do Itajaí in Brazil was collected through: a) studies on secondary sources: scientific articles, theses and dissertations, books, magazines, websites and b) field work. Formal interviews were done with six key informants: three PhD researchers specialized in company networks, who study the textile cluster in Vale do Itajaí and three managers of companies with more than twenty years of experience in that cluster.

The collection of primary research came from a questionnaire based on a study by Guo and Guo (2010) in the warp-knitting cluster in Haining, in China. The study on the Chinese cluster took seven categories of classification into account, with a total of seventeen knowledge transmission channels: (1) interpersonal relationships: informal relationships with employees of innovative companies in the cluster, relationships with suppliers of raw materials, relationships with suppliers of equipment and specialized services; (2)

contracts: hiring of company employees in the cluster, hiring of company employees from outside the cluster; (3) imitation: imitation of companies in the cluster, imitation of companies from outside the cluster; (4) study and development: the research and development department, (5) training: training given by major clients, technical training offered by educational institutions; (6) collaborative development: collaborative development with universities and/or research centres, collaborative development between companies in the cluster, collaborative development with companies from outside the cluster; and (7) coded knowledge: technology licenses, patents and publications. In the view of important contributions contained in the systemic competitiveness model proposed by Meyer-Stamer (2001), two other categories were included in the questionnaire: (8) relationships with the government: public policies that stimulate studies and transfer knowledge among companies in the cluster, public policies that stimulate studies and knowledge transfer between companies in the cluster and companies outside the cluster; and (9) cultural environment: motivation for knowledge sharing among companies in the cluster and an openness to knowledge from outside the cluster.

From the pre-test of the questionnaire in the codified knowledge category, patents and technology licenses were considered together as one single knowledge transmission channel in the context of this study. In the category "relationships between companies and employees", two channels were included together: the process of selling and buying products. This category was also split for a better understanding and analysis, thus the relationship between suppliers was placed in a separate category.

For a better understanding from the respondents, the questionnaire was retyped in an affirmative and interrogative manner. As in the study of Guo and Guo (2010), the Likert scale with seven levels was used to measure the effectiveness of the knowledge transmission channels, considering level 1 as completely inefficient and level 7 as very efficient.

To analyze the results of field research, the average of the grades given by each interviewee were calculated. In turn, the five most effective knowledge transmission channels in the textile cluster of Vale do Itajaí were classified and identified.

## 4 Results

The data obtained in the two clusters as well the results of this study are presented and compared in the follow section.

### 4.1 Warp-knitting cluster in Haining, in China

The cluster of warp-knitting in Haining is located in the province of Zhejiang in China (Guo and Guo, 2010), a country that has risen to become the largest producer and exporter of textiles and clothing, and attracting foreign investment (from the Japanese and British, supported by investments from the U.S.A. and Russia, and on a lower level, from France and Italy). The industrialization process initiated by the government in 1978, attracted foreign investors and stimulated domestic entrepreneurship-private and public – by changes in the goals and standards of management of State Owned Enterprises (Cunha, 2008).

Zhejiang is a coastal province located in the south of Shanghai city, with a population of about 50 million, with 101 800 km<sup>2</sup> of span. Its capital is Hangzhou, with approximately 6.5 million in habitants (Jeannet, 2009).

This province has a long tradition in the silk and tea industries and housed the first experiments of China's free market (Jeannet, 2009). Its people have an entrepreneurial and associative tradition. About 80 percent of all entrepreneurs in the province attended school for eight years or less. Many of its projects were financed by informal loans. Much of the money is borrowed from friends, relatives and business partners at interest rates higher than those charged by banks. Many deals are closed with just a hand shake (Hays, 2009). For Jeannet (2009), the companies in Zhejiang have a high degree of collaboration, many acquire

raw materials together and develop partnerships in the sale and promotion of finished products to foreign markets.

Together with the provinces of Guangdong, Shandong and Shanghai, it has attracted most of the foreign investment projects, which account for 61% of income and almost half of the investments in private companies in the country (Cunha, 2008). In Zhejiang, companies are focused on the production of textiles, clothing, fashion accessories, socks, and equipment and machines for the textile industry (Texinfex, 2011).

In relation to technological development, Jeannet (2009) notes that improvements in production and technological processes are the main objectives of the Zhejiang clusters. This author points out that the quest for the internal development of design and investment in creating valuable brands will be the first major change for many Chinese companies.

Haining is a city with industries focused on leather and textiles production. Considered as one of the ten most powerful municipalities in the economy, the province of Zhejiang has a total GDP of US\$ 14.38 billion (RightSite.ásia, 2011).

In the early 1980's, there were two companies of warp-knitting in the city that worked in the handcrafted fashion and focused on attending to the domestic market. During the 1990s, due to government's development policies, Haining initiates a cycle of economic development, being considered as one of the most competitive clusters of warp-knitting in China, owning approximately 35% of the market share of the industry in China. (Li&Fung Research Centre, 2006; Guo and Guo, 2010).

Guo and Guo (2010) note that the construction of the first centre of national development testing, studies and innovation in the knitwear cluster shows its strategic importance. At the end of 2006, there were 325 companies in the cluster connected to the productive knitting chain, with a gross industrial output of US\$1.56 billion. Most of the companies are small or medium-sized businesses (Guo and Guo, 2010).

Guo and Guo (2010) identified five knowledge transmission channels used by most companies in the cluster of Haining. They are the following: relationships with specialized service suppliers, imitation among companies in the cluster, recruitment of the companies' employees in the cluster, relationships with raw materials suppliers and relationships with the most important clients.

## 4.2 Textile cluster in Vale do Itajaí, in Brazil

The textile cluster in Vale do Itajaí has existed for more than a century, being spontaneously formed by entrepreneurs of German origin. The settlement was made mainly in the 19th century by German immigrants who began arriving in 1828 and came in large numbers after 1850.

The cluster of Vale do Itajaí is located in the state of Santa Catarina, in southern Brazil, and it has about 1,509,273 inhabitants and 13,003.018 km<sup>2</sup> of span (IBGE, 2010). The textile industry in Santa Catarina employs 172,824 workers and is comprised of 9,264 establishments, having a share of 18.71% in Santa Catarina industry in 2009 (FIESC, 2010).

The textile cluster of Vale do Itajaí covers several municipalities that are located mainly in the middle portion of the Valley. The city of Blumenau is its flagship municipality, with a solid industrial tradition, and with easy access to the largest Brazilian market that is São Paulo, and two ports such as Itajaí and São Francisco do Sul.

The business structure is heterogeneous. Data from the "Annual Relationships of Social Information" presented by Lins (2008) report that the micro-region of Blumenau recorded the running of 2,435 establishments, and micro and small companies accounted for about 96% of all such establishments in 2002.

It consists of a complex of companies of various sizes, including companies from the stage of micro-units to nationwide leading companies. They operate in various stages of the production chain. According to Cunha (2003), it is the largest textile cluster in Brazil.

The 1990's presented great difficulties for the companies in this cluster. One of the crucial factors being that of excessive debt, in some cases, having manifested from the previous decade. Another was the lucrative exchange rate and also the emergence of new technologies, especially in the textile industry. The sum of factors that inhibit competitiveness resulted in the loss of foreign markets and the entry of foreign products into the domestic market. Thus, bankruptcies, changes of corporate control and defensive productive restructuring of traditional companies in the region were recorded. Studies on the cluster show that important technological upgrading of enterprises took place, however, it was not sufficient enough to maintain the performance in the foreign market (Cario, 2008).

Regarding collaboration, Lins (2008) highlights a limited presence of internal cooperation initiatives for vertical arrangement and productive urbanism in major companies, despite the growth of outsourcing in the 1990's, features that do not contribute to the practice of collective learning. This situation results in poor distribution, particularly between smaller companies, of concepts involving new models of organization along with other knowledge (Lins, 2008), building a cluster with low incidence of cooperative links, in which partnerships or strategic alliances aimed at production, marketing and relationships with the supplier are rare.

The field study data shows that relationships among companies are rare as are the relationships with the government and universities. The main knowledge transmission channels related to product innovation and product processes are based on practices of imitation between companies in the cluster, relationships with equipment suppliers, relationships with suppliers of raw materials, internal training, and training promoted by institutions such as SEBRAE (Serviço Nacional de Apoio às Micro e Pequenas Empresas), SENAC (Serviço Nacional de Aprendizagem Comercial), SENAI (Serviço Nacional de Aprendizagem Comercial) and SESI (Serviço Social da Indústria).

### 4.3 Comparative Analysis

In clusters in Haining and in Vale do Itajaí, the technological complexity of products is low. In Vale do Itajaí, there is an increasingly adopted process of outsourcing in the purchasing of raw materials and finished products. During this study's research work, managers of the companies observed that about 20% of the products of large companies are manufactured in Asia and arrive ready for distribution in Brazil. This shows the growth of the outsourcing process. In this context, there is a concern on design and building of valuable brands in the companies.

Considering that knowledge transmission channels can be of three types: horizontal (contracts, imitation, collaborative development); vertical (relationships with customers and suppliers); and infrastructure (links with universities, research centres, training centres, and others.) (GUO and GUO, 2010) The results show that in the case of the cluster in Haining, companies are more dependent on vertical relationships, relationships with suppliers are shown as the most effective communication channel. In the cluster of Vale do Itajaí, there is a greater heterogeneity of knowledge transmission channels. Among the most effective main knowledge transmission channels, two are horizontal, two are vertical and the other two are infrastructural (see Table 1).

Table 1: Knowledge transmission channels in Haining and in Vale do Itajaí clusters

Knowledge transmission channel	Haining	Position	Vale do Itajaí	Position
Relationships with equipment suppliers	5.5	1st.	5.8	2nd.
Imitation among companies in the cluster	4.47	2nd.	6.0	1st.
Recruiting of employees of companies in the cluster	4.3	3rd.	4.1	6th.
Relationships with raw material suppliers	4.7	4th.	5.5	3rd.
Training promoted by the most important client.	3.77	5th.	1.3	16th.

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When knowledge transmission channels of the clusters were being compared, it was clear that most of them have very similar scores. The relationships with equipment and raw material suppliers and imitation between companies are in five of the main knowledge transmission channels in the Chinese cluster as well as in the cluster in Santa Catarina, in Brazil.

It is thought that several factors can explain the patterns of similarity in respect to knowledge transmission channels in both clusters. Firstly, it can be seen in both cases that technological advances are incremental, and driven by advances in technology and client needs. Another factor is linked to the cultural environment of the companies that are part of the clusters, which looks upon imitation as a common learning mechanism. In both, opportunities of direct learning are found with other companies operating in the same market can be restricted due to the similarity between the goods and a limited competitiveness.

In Haining, the influence of important clients and the hiring of employees between companies in the cluster still stands out, causing a rotation of employees within the cluster.

In the cluster of Vale do Itajaí, channels related to imitation of companies in the cluster, the relationship with suppliers of raw materials and machinery manufacturers, followed by internal training, imitation of companies outside the cluster and training promoted by institutions such as SEBRAE, SENAC, SENAI and SESI (fifth place) emerge as the most effective knowledge transmission channels.

It was observed that while the training promoted by the most important clients in Haining is one of the main channels of transmission of knowledge in the Vale do Itajaí we can observe a very different situation. Large clients have a little influence, ranked in 16th place. We assumed that this discrepancy may be the result of fall in exports. According to data obtained from the field survey indicated that in the 1980s, when companies were meeting large North American clients needs, the latter promoted training for adequacy standards of quality and cost. With the development of Chinese textile industry many large clients opted to buy from China seeking lower costs, which contributed to the decline in exports of Brazilian cluster as we can see in Sohn et al. (2012).

The study made in the cluster of the Vale do Itajaí and in the cluster of Haining highlights that in both cases there are low scores in some knowledge transmission channels, especially those related to collaborative development (with universities, among companies in the cluster and elsewhere), in this sense, being shown the importance of studying the reasons that inhibit the use of these channels.

It can also be found that there is a predominance of the knowledge transmission channels related to the micro level of systemic competitiveness in both clusters studied.

## 5 Conclusion

In the conclusion of this study, the international expansion of the cluster in Haining and the stagnation and decline in exports in the cluster of Vale do Itajaí can be highlighted. And, by understanding that in the context of the partnership of the knowledge, this appears as an important source of competitive advantage, a greater attention to knowledge transmission channels that promote innovation within the cluster and the collective efficiency is recommended.

It can be noted that these clusters generally develop a non-systematic exchange of information and noticeable that the grades accredited to the relationships with suppliers and the recruitment of the companies' employees in the clusters were almost equal in both cases. The relationship with suppliers of raw materials and imitation between companies in the clusters recorded differences but received significantly elevated assessments in both clusters respectively. The results show that the relations with

competitors, suppliers and customers are an important source of collaborative learning in these textile clusters.

It was concluded that there is a similarity in the use of certain knowledge transmission channels in both clusters, despite the differences, such as product lines, age of the clusters (Haining is about 30 years old and Vale do Itajaí is over 130 years old), and the great cultural and historic differences.

We highlight that this research can be used by managers to enable the understanding of the mechanisms and determinants of knowledge transmission channels and can also influence the knowledge diffusion more effectively. The research reinforces the proposition that business networks can provide collaborative learning environments. It is believed that this study contributes to the empirical theoretical development in clusters and shows that there are different knowledge transmission channels which contribute for the collaborative learning in industrial clusters. We believe that it is necessary to establish a systematic structure and foster a culture that promotes active knowledge sharing once these are critical issues that should be the focus of all clusters policies.

This paper has tried to provide a comprehensive understanding about knowledge transmission channels in clusters. Since there was a lack of such research in Brazilian and Chinese clusters, this paper can provide theoretical basis for future researches as well as practical implications for managers and practitioners. The research is original in that it takes an approach of cluster knowledge transmission channels.

The research could be applied in other industrial clusters in order to compare the results. We believe that the results may not be easily generalized to other clusters, but are useful for managers' reference, especially for those whose circumstances are similar to the studied clusters. From this, the doors are open for the promotion of further studies using other types of industrial clusters. In this sense, it is suggested that an analysis of the knowledge transmission channels in Vale do Itajaí is carried out, comparing the perceptions of researchers with entrepreneurs.

Finally, it is evident that by electing other Chinese clusters as benchmarks for comparison, it is useful to establish contacts and an exchange of ideas and experiences.

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