Knowledge Management in the Brazilian Ceramic Tile Industry & New Challenges Of Competition in the Global Value Chain

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ABSTRACT:

This paper has the objective of investigating the role of the knowledge management of the local firms in regards of the new competitive global scenario of the Brazilian ceramic tiles industry. In a more specific way, I focuses on the dynamics of two main local production systems, located in the region of Criciúma, in the state of Santa Catarina and in Santa Gertrudes, in the state of São Paulo. The new organization of global value chain shows a strengthen of the international pattern of competition, especially as the growth of exports of China, which consolidated itself as the main world manufacturer of ceramic tiles, and Spain as well as the decreased share of the Italian industry. Despite the stronger competition in international markets, the Brazilian industry went through a period of expansion, with the simultaneous growth of the domestic market and of exports. This growth reflected itself in a high dynamism of the domestic industry, which relied both on the expansion of the offer of ceramic tiles and on significant changes in the technical-productive parameters of the companies involved. In this process, it should be underlined the importance of some factors which exerted a fundamental role in the creation and dissemination of new knowledge and in fomenting innovative activities by companies, such as the suppliers of glazing materials, the manufacturers of machinery and equipment and the local service-rendering institutions. It should be emphasized that the productive organization of the industry in local production systems had a fundamental role in this process as it facilitated the dissemination and the circulation of new knowledge among all involved. To do that, it is presented the main characteristics of the global chain of the ceramic tile industry and the Brazilian scenario. Later, it is presented some considerations with respect to the dynamics of the Brazilian ceramic tile industry and its insertion in this new competitive international scenario, with special focus on the mechanisms of creation and dissemination of knowledge among local manufacturer.

Key words: *Knowledge management; Local production systems; Brazilian industry, Ceramic tile, Global value chain*

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1. Background

In today's innovation-driven world, the knowledge management and learning have become the key success factors of competitiveness of the firms. Knowledge-acquisition is one part of knowledge management which, in turn, has been defined as

the process of critically managing knowledge to meet existing needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities (Gavigan et al, 1999).

One of the challenges to knowledge transfer or acquisition is how to codify. According to Hall (2006) codification of knowledge into information has to be seen as the predominant mechanism by which knowledge transfer in organizations can be achieved. In the knowledge management literature, Davenport and Prusak (1998) and Ruggles (1997) place particular emphasis on knowledge codification as a way of effecting the transfer of knowledge. While there has been much interesting discussion in the literature about the transferability of "tacit" knowledge through processes such as "socialization" (Nonaka and Takeuchi, 1995), in practice many of the recommended approaches and solutions to KM problems are predicated on the need to codify knowledge into information. In the case of this paper we will focus on the last stream which is related to the tacit knowledge.

Tacit knowledge is considered to be a vital component in innovation processes (Grant, 1996; Hall, 1993; Nonaka and Takeuchi, 1995). To transfer tacit knowledge is however difficult due to factors like culture, language and other circumstances in the environment where the knowledge was created (Swan et al., 2000). When knowledge is transferred it is suggested that knowledge has first to be internalized by the receiving individual before it can be used (Schonstrom, 2005).

The main knowledge management activity of organizations is to package up knowledge as information in order to move it from A to B. However, the empirical research will show that codification involves more than simply the codification of knowledge into information.

Nonaka and Takeuchi (1995) are talking about codification of previously "tacit" knowledge in their distinction of a movement between tacit and explicit forms of knowledge. Codification of knowledge in this sense may involve the use of language to articulate, describe, explain, etc. While there is considerable debate over whether Polanyi's concept of tacit knowledge effectively defies codification the codification can simply be taken as a process by which knowledge is made explicit, whether it be "tacit" knowledge or not.

The generation and diffusion of knowledge can be stimulated by the location proximity among the main sources. Much of the advantage of such collaboration is thought to come from efficiencies in collective learning (Belussi, 1999). Geographical proximity is thought to be important for innovative activity whether understood as generating economic externalities or spillovers of knowledge (Audretsch and Feldman, 1994) or facilitating inter-organizational transmission of tacit knowledge via human capital mobility.

Any exploration of geographic proximity leads directly to studies of successful knowledge sharing inside industrial clusters (Porter, 1998). Regional and local innovation systems, industrial districts, learning regions, local production systems and agglomeration economies are other labels given to the phenomenon of geographically

co-located firms in a value chain collaborating in some fashion in order to gain a measure of collective efficiency (Rabellotti and Schmitz, 1999).

The observation of local production systems is not new with most researchers referring back to Marshall's work. A rise in the number of studies of industrial districts led economic growth in the 1980s combined with the increase in interest in 'networks' and social aspects of inter-organizational interaction.

2. The Brazilian Local Systems In The Ceramic Tile Industry

2.1. The Local Systems Of Criciúma

The industry of ceramic tiles of Criciúma appears as the most traditional productive center in Brazil. Some of the local companies which still are active in the industry started operating in the 50s but the period of greatest dynamism occurred in the 70s and 80s, linked to the growth of domestic demand for ceramic tiles. This period of high dynamism ceased in the 90s, when local manufacturers faced a huge demand crisis, associated to the strengthened of competition in the domestic market, as a result of the growth in the offer of ceramic products, originated specially from the local system of Santa Gertrudes (discussed below).

This crisis brought about significant restructuring movements by local manufacturers, especially among large companies. This restructuring involved the switched off of old manufacturing lines and the opening of new ones, expansion of production, building and acquisition of industrial plants, modernization of equipment, in addition to changes in organizational and managerial structures.

Within this process of production restructuring, there was also the decentralization of several local companies. Before this period, many companies exerted internally the activities of glazing material production and enameling, which meant that the companies were forced to maintain within their structures activities linked to the chemical industry. From the 90s onwards, this strategy truly showed itself problematic, as the ceramic companies were no longer able to accompany the more accelerated pace of dissemination of innovations by the companies specialized in glazing materials.

For this reason, companies which possessed internal activities in the area of enameling were impelled to abandon these activities. For the glazing material companies born from this change, it was possible to centralize the efforts of product development, intensifying this activity and the efforts associated with it. The glazing material companies started not only to sell their products to manufacturers of ceramic tiles, but also to offer a combination of correlated products and services, among which were the design of tiles and counseling in the manufacturing process, specially with reference to the adaptation of new products and processes applied to raw material and to the other demands of the manufacturers.

This, however, has a negative side for the Brazilian industry, as pointed out by some authors such as Ferraz (2002). These strategies of glazing material companies, mainly of the foreign companies in Brazil, create difficulties and do not stimulate the internal

generation of capabilities in product design among the domestic manufacturers of ceramic tiles. Meanwhile, it is worth pointing out that far less often the ceramic industry internalizes these types of abilities since the glazing material companies have demonstrated to be extremely capable and much more rapid in generating, adopting and disseminating the innovations in the ceramic industry, what not only does not stimulate but practically impedes the tile manufacturers from carrying out these activities. The experience of the industry of ceramic tiles in the Spanish region of Castellón is particularly illustrative of this phenomenon.

Another important vector of the restructuring process of the ceramic tile industry of Criciúma was the modernization of the manufacturing plants of local firms, through strong investments on capital goods. This implied a high volume of capital goods imports, mainly from Italy, the world's main supplier of capital goods for the ceramic industry.

As a result of these productive, technological and organizational restructuring processes, the ceramic tile firms began to focus their efforts on their main activity, the production of ceramic tiles. At the same time, this stimulated the creation and the growth of new companies in related activities, as in the case of the glazing material industry, resulting in an increase in the complexity of the local system. In the middle of the 2000s, the local system was then composed by about 10 companies of ceramic tiles, 14 suppliers of raw materials (among producers and distributors, but all of them with several services which were rendered to the tile companies) and 5 manufacturers of machinery, equipment and replacement parts (data from local institutions).

In addition, this increase in complexity of the local system of Criciúma created new spaces for the action of local institutions, closely linked to a more qualified demand by local ceramic tile manufacturers.

An example of this movement was the creation of the Center of Technology in Ceramic – CTC, in 1995, through a joint action among the local association of manufacturers, the local labor training organism (called SENAI) and the closer university (Federal University of Santa Catarina).

The main objective of the creation of the Technological Center was the establishment of an organization capable of rendering technical and technological services to local manufacturers, such as analysis of materials, experiments and laboratory tests, certification of products and productive processes, technological information, in addition to the development of research and development projects in conjunction with local companies linked to the productive chain. Among the most important services, it is worthy of mention the creation of a specialized structure for carrying out tests for certification of quality of products.

The laboratory of the Technological Center was accredited by INMETRO, the Brazilian Institute of Metrology, Standardization and Industrial Quality, permitting it to certify firms with the ISO 9001 and to issuing certificates of the finished goods recognized internationally. The Technological Center has a line of experimental production known as Pilot Plant, which is able of simulating the entire ceramic

manufacturing process for the development of raw material, enamels and ceramic products in semi-industrial scale. Another institution which was created during the restructuring of the local system throughout the 90s was the Upper Course of Ceramic Technology, created in 1996, a result of a joint action between the local manufacturers' association and a local university (called UNESC).

This university joined two other institutions of technical level. First is the Maximiliano Gaidzinski technical training school, who is dedicated to the teaching at the technical level. This school became the most important institution for obtaining technical apprenticeship in the country, supplying technicians for companies throughout the country. Second is the course of technical level of the region by another local institution, called SENAI.

Finally, we bring forth the existence of the Interdisciplinary Laboratory of Materials of the Federal University of Santa Catarina (LabMat-UFSC). Despite its location in the municipality of Florianopolis, capital of the state of Santa Catarina and 200 km away from Criciúma, the laboratory has several lines of research geared toward the development of new ceramic materials, from raw materials, production processes and traditional ceramic products including vitreous and vitro ceramic materials.

We can notice, in this context, the presence of a huge institutional framework to foster and support local manufacturers, both with reference to the technical learning and training as well as with what concerns the technical and technological services and in the development of research projects linked to the activities of local manufacturers. However, several authors point out (Meyer-Stamer et al, 2004; Meyer-Stamer, 1998; Meyer-Stamer & Seibel, 2002; Ferraz 2002) that difficulties in relationships between firms and local institutions have prevented the establishment of more numerous and longer lasting joint projects among those involved. As an example, there were very few projects which have been taking place between local companies and the Technological Center, whose participation has been restricted to providing technical and technological services such as experiments and laboratory tests. The same fact occurred with the university-enterprise interactions.

Thus, although the response of the local companies to the stimulation of competition in the internal market has indicated an increase of efforts and of innovative activities, companies do not take full advantage of the institutional apparatus available. Then, the producers could not benefit themselves from all the positive external services which are generated by the industrial clustering.

2.2. The Industrial District Of Santa Gertrudes

The local production system of ceramic tiles of Santa Gertrudes, and the surrounding area, is located in the hinterland of the state of São Paulo, a state which is responsible for around 45% of the country's GDP and which concentrates the main consumer market of several products, including ceramic tiles. In the region there are about 45 ceramic tile firms which are responsible for around half of the country's physical production. The origin of the local system has strongly been linked to the availability of clay which was utilized in the production of bricks and roofing clay tiles in small

industrial businesses. From the 80s onwards, however, the companies invested in the production of ceramic tiles, utilizing the locally available raw material for the production of tiles geared towards medium and low income consumers.

These investments in manufacturing plants allowed the local firms a strong growth during the 90s, having taken great advantage of the increasing demand for ceramic tiles in Brazil. Two mains factors played a decisive role on this growth process.

The first key factor is the importance of the availability of raw material at low cost in the region and its characteristics which together allow the local firms to make use of the dry process. Although this ceramic tile production process presents slightly inferior technical characteristics in comparison to the water process, it presents substantially lower costs. These lower costs are associated with the facility in obtaining and extracting clay from nature and to the lower production costs, considering that the production process takes place in a much shorter period of time and with abundant economy of energy.

The second key factor in the fast growth of the local system of Santa Gertrudes was the huge investments of firms in the manufacturing process modernization, specially through the acquisition of up-to-dated technologically capital goods. In addition to the acquisition of modern ovens used in the process of burning, the companies acquired new systems of raw-material preparation, which permitted reaching lower grain size and provided improvements in the process of granulation and humidification. It is worth to underline the important role exerted by the suppliers, above all Italians, of capital goods for the local firms since they allowed the fast modernization of the local plants by the adaptation of machinery to the characteristics of the local production process.

In this way, the growth of the ceramic tiles firms of Santa Gertrudes brought together the creation and the reproduction of capabilities among firms in the manufacturing area, as becomes clear in the process of technological modernization of the production process. We should underline that the Italian suppliers of machinery and equipment had a key role in the development of these capabilities and for the local knowledge management.

In addition, we must point out the importance of two other factors which contributed for the growth of forms, which are the suppliers of glazing materials and the local service-rendering institutions, specially CITEC – Center of Technological Innovation.

In the case of glazing material suppliers, their role was particularly important because of the new characteristics of the competition process in the ceramic tiles industry, in which the product development product were, to a great extent, transferred to the glazing materials suppliers. Since the local ceramic tiles firms did not have in-house product development departments, they could make use of the services of their suppliers, and they could not establish their own structures for product development. In general, the local firms attend to a low and medium income consumer, in which the requirements of product are far less important. Thus, the labs of the local ceramic tiles producers were not established in-house but they relied on products which were

designed by their suppliers. This had an important effect on the fast growth of local manufacturers, since they did not need to develop capabilities in the product development area.

The other institution was the Technological Center (CITEC). Inaugurated in 2002, in Santa Gertrudes, the Technological Center was created through a joint action between the local manufacturers' association and the public administration, with the support of the Ceramic Center of Brazil (CCB), the main Brazilian institution providing services to companies in the industry. It was initially conceived to carry out experiments and tests for the certification of products in accordance with Brazilian and international rules. However, the role of the Technological Center of Santa Gertrudes began to include several other activities related to the productive process and to technical and technological assistance, in a important way in the knowledge diffusion. The Technological Center also has an "innovation department" which has physical structure, equipment and qualified human resources for the creation and execution of decorative projects, development and dissemination of methodologies of management of innovative projects, carrying out iconographic research.

In this sense, the Technological Center has an important role in fostering the development of local capabilities. Despite its performance had been initially linked to the activity of product certification, the Technological Center had a much broader role, by contributing to the process of knowledge creation and diffusion. The local firms, in order to reach the technical requirements for their products and reach the levels stipulated by the certification systems, were forced to put into practice improvements in their productive processes and were able to collaborate with the Technological Center.

3. The Brazilian Local Production Systems And The New International Competition

In face of this competitive global landscape in the ceramic tile industry, there are some factors that did impact on the dynamics of the Brazilian industry and more specifically on the knowledge creation and diffusion in local production systems of ceramic tile of Criciúma and Santa Gertrudes.

The new landscape of international market in the ceramic tile industry, as well as other industries, shows the strengthen of the pattern of competition, because of the growth China's production and exports. So, the new organization of global value chain shows the consolidation of China as the main world manufacturer of ceramic tiles. The huge growth of China put a lot of pressure to the traditional producers, such as Spain, Italy and Brazil. In the Spanish industry, which production is strongly concentrated in the local system of Castellón and region, the strong linkages between ceramic tiles producers and their glazing material suppliers' upheld important improvements in their competitiveness, and in their market share. By other side, the Italian industry, spacially concentrated at Sassuolo local system, overtook a period of crisis, because of their producers were not able to maintain their share in the international marked, which enforced a decrease in the domestic production, despite the strong presence of capital

goods producers in the region of Sassuolo (Russo, 1985; Russo, 2004; Meyer-Stamer, 2004; Scur & Garcia 2004).

Brazil has a small share of the international market, since the firms attend firstly the large domestic market. In this context, the significant growth of the Brazilian ceramic tiles industry during the 90s has been strongly associated to the expansion of the domestic sales. However, in the past few years it has been perceived a substantial increase in exports, despite it still represents a small share of total production (around 20%). This growth was particularly strong in the local systems of Santa Gertrudes, what entailed shrinkage of the performance track of other manufacturers and even in the decrease of their market share. This is one of the reasons which explain the expansion of international sales of the Brazilian industry, since the main players in this process of search for international market were not from Santa Gertrudes, but from other regions of the country, mainly from the local system of Criciúma.

This is one of the main differences of the Brazilian ceramic tiles industry and the experiences of other countries such as Italy and Spain, where it can also be seen an industrial structure based on the existence of local production systems. Take as an example, the comparison with the Italian industry. Despite the growth of Brazilian exports of ceramic tiles in the last years, the exports coefficient in Brazil reached, in 2004, slightly more than 20% of the total production. The Italian industry, in turn, had presented in that same year a coefficient of exports of around 70%, what clearly shows its strong international insertion and the importance of the external market as the destination of local production. So the new organization of the global value chain did fewer effects on Brazilian ceramic tile industry.

On the other hand, the imports of ceramic tiles in Brazil were very low. This shows that despite the vast Brazilian domestic market, the second largest in the world and of the stimulation of competition in the international market, there are no significant efforts made by foreign companies in Brazil. In addition, Brazilian firms which detain important brand names in the domestic market do not utilize international sub-contraction schemes for the supply of goods, a steadily common occurrence in industries, such as clothing and shoe manufacturing. One of the reasons for this is the physical characteristics of this product, which presents a low relation “value-weight”. In addition, in the case of the Brazilian industry, there was a significant growth in the supply and in the productive capacity, which was accompanied by improvements in the production systems and by productive gains.

In this context, China’s growth in the international market did not make major effects on the dynamics of the Brazilian ceramic tiles industry, since there was no larger increase in imports. In the international market, where it was perceived the growth of the Chinese industry as the major international supplier, with important effects on the competitive patterns of the global chain, the Brazilian industry was little affected. Despite this adverse international landscape, we can verify the growth of Brazilian exports of ceramic tiles, which nearly doubled in the 2000-2004 period.

4. Conclusions

Finally, we need to point out the origins of the knowledge outflow and the accumulation of capabilities in the Brazilian ceramic tiles industry and, more specifically, among producers located in the two most important local production systems. As pointed out, the growth of this industry in the last few years has been accompanied by important qualitative changes, with reference to the creation and accumulation of technical and productive capabilities.

The first of these factors were the suppliers of capital goods, mainly from Italy, for the ceramic tiles industry, since they constituted a great source in generating knowledge and innovation. The acquisition of modern machinery and the strong interactions with the capital goods suppliers were capable of making available to Brazilian manufacturers, both of Criciúma and of Santa Gertrudes, important improvements in their production systems, including extensive increase in productivity.

The second factor was the interaction with suppliers of chemical raw materials, specially glazing, frits and ceramic colorants used in ceramic tiles manufaturing. Once more, the interactions with the glazing material suppliers represent an important source of knowledge, since they allowed the ceramic tiles producers to add new patterns of product design and new characteristics to their goods. The interaction with the glazing material suppliers was particularly important because these firms has assumed an important role in the knowledge creation and diffusion, while they are the main players in the product development processes, by supplying it for the ceramic tiles manufacturers. In the case of the companies in the local system of Criciúma, these interactions created conditions for the manufacturers to incorporate new elements to tiles with higher value added. In the case of producers of Santa Gertrudes, the interactions with the glazing material suppliers foster a fast growth, since they did not internalize capabilities in the product development area, because these tasks are done by their suppliers. So, local firms just have to integrate the development of products to their manufacturing process. By transferring these capabilities for the ceramic tiles producers, the glazing material suppliers did an important role in the diffusion of knowledge among the firms fo the local system, since they could put into their products this kind of capability.

Third, we should point out the role of local institutions which rendered services to manufacturers. The importance of the service-oriented institutions was particularly seen in the case of the local system of Santa Gertrudes, in which the local Technological Center played an key role in the creation and dissemination of new knowledge among the local manufacturers.

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