Evolutionary Competitive Dynamics in Industrial Clusters: Competitive Stratification in a Structural Ceramic Cluster

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Abstract

This article presents an approach for analysis of the competitive dynamic in local clusters through an evolutionary perspective. From a review of the concepts and basic principles of the economic change evolutionary theory, a set of general hypotheses is considered for the treatment and analysis of the competitive environment in local competitive clusters. In local competitive clusters, the stratification process of firms can be seen as a decurrent phenomenon of the diversity of adaptation strategies of each one front to a selective environment where technological changes can modify the structure of the system. In the approach proposal, evolutionary concepts of path dependence, technological patterns and regimes are adopted. Instead of analyzing the evolution of a specific technology in global level, as the traditional concept of "technological path" suggests, for the boarding proposal, the focus of the analysis is centered in the competitive dynamics of a determined local cluster, for paralleling, evaluate the behavior of the firms and so the possible chances of technological change. The analysis of the competitive dynamics of firms in local clusters is treated from the population diversity hypothesis. In order to capture such diversity, a methodology of stratification in specific groups was adopted. Last, the general lines and the results of the approach proposal and the methodology applied in a typical case of local cluster are presented.

Keywords: Industrial Organization; Competitive Dynamic; Industrial Clusters; Evolutionary Approach; Technological Change; Competitive Stratification.

1 Introduction

The growing importance of the processes of innovation and technological advances for increased competitiveness and sustainability of businesses and countries has caused considerable increase in the number of approaches to understanding the progress and economic growth. The approaches to these developments basically follow two distinct streams, one mainstream, called neoclassical, and other alternative, called evolutionary (or neo-Schumpeterian), more prominent in recent years. In this paper it is propose a dynamic approach to competitive industrial clusters based on evolutionary principles. In the evolutionary approach of Nelson and Winter (1982), using the theoretical framework of Simon (1959), the neoclassical notion of "optimizing rational behaviour" is replaced by a more realistic concept of "temporary satisfaction" in situations of uncertainty and imperfect information. Subsequently, the fact that the process of decision making occurs within the borders of pre-existing routines was also incorporated.

According to Nelson (1995:56), the term "evolutionary" "defines a class of theories, models or arguments that have the following characteristics: 1) explain the motion of a system over time, or explain how such a system is what is a moment in time, i.e., the analysis is essentially dynamic, 2) the explanation involves both random elements which generate or renew the system variables in question and mechanisms to periodically select the ones survivors, and 3) assume that there are inertial forces that "ensure the continuity of the winners" for a period of time following.

In this sense, uncertainty and bounded rationality are important assumptions of evolutionary theory, since they imply a change in focus on the nature of the process of decision making and adjustment to the problem. A recurring criticism of the defenders of the evolutionary approach to the traditional approach focuses on the problem of economic agents are confronted with high uncertainty due to the complexity and instability of the economic environment in which they operate, while the information really useful or valuable to decision making are not freely available, as assumed by neoclassical theory (Nelson & Winter, 1982).

In a system evolutionary stability of any macroscopic shape is continuously tested by events in each local context of the system. The power of self-transformation is a natural result of the proceeding involving the ability to evolve and ability to adapt and change in response to the uncertainties of the real world. These characteristics result in internal diversity and variability of populations (Foster, 1997; Ziman, 2000). In this view, we understand that the present circumstances are not inevitable. They are part of a particular story that was created and marked by decisions, events and creative emergence of new forms, functions and organizations. Thus, the survival (or extinction) in the long run of any particular system or body is, to some degree more a function of their ability to cope with uncertainty and change, generating appropriate responses (local) than the optimization needs of their behaviour in a given period. In evolutionary economic approach, in general, we can highlight four main concepts, which are: variation, selection, retention and competition (for scarce resources and markets), which can be interpreted and summarized as follows:

<u>Variation</u>: refers to changes in routines, skills and organizational structures. This concept is not restricted to a simple Darwinian biological analogy, in which there would be no room for human intentionality and conscious activities of searching for targets. Thus, it is assumed lack of purpose in the action of agents, and one way of change is just that generated by intentional actions. When individuals act in the search for alternatives and adjustments (trial and error) to solve concrete problems, the learning process may involve political factors (characteristic of human behaviour), generating an intentional variation (Allen, 1987; Metcalfe, 1994; Saviotti, 1996). Variations may result from unintended and unpredictable random factors, such as accidents, accidents, unforeseen and even 'luck', fruit of the creative process itself or what is sometimes called serendipity. The set of alternatives generated in a competitive environment (adaptation and interaction with the environment), certain types of variation are more likely to succeed than others (innovations), setting a selection process. In this process, the ability to recombine resources accumulated and to obtain new resources is a key factor for survival.

<u>Selection:</u> refers to the capacity of the environment to favour certain variations (or types of variation) over others. In this decision process, the selection mechanisms prioritize and evaluate certain requirements, characteristics and trends through which condition the medium. According to Lambooy (1988), three main types off actors influence the selection process: the economic (capital, demand, competition pattern etc.), the institutional (laws, rules, patterns, etc.) and geographic (climate, natural resources, infrastructure structure, etc.). According to the dynamic environment, the selection mechanisms operate at different levels of demand, conditioned by the availability of resources (physical, financial, knowledge) and suitable for the environment (legal, regulatory, demand) that restrict certain types of variation. At each level, however, such mechanisms operate through a process of trial and error with several iterations, which characterize learning. Information on which, and at what level, such factors will be prioritized are fundamental in the indication of the possible directions of the process of change and adaptation.

An evolutionary process involves a third mechanism: The selective <u>retention</u> of certain variations. This mechanism provides incentives to preservation of certain kinds of variation, duplication and other forms of reproduction of certain species best adapted to the means (market). Genes (in biology) would exert a similar role. Within organizations this mechanism is represented by technical patterns and procedures adopted and retained, encoded and transferred through rules of conduct and operational behaviours, seeking general objectives of the organization as an organization, quality, productivity, profitability, among others. Moreover, this mechanism can generate a trend due to inertial stability that gives activities and administrative structures, and physical resources associated with certain technologies, buildings and machinery (Nelson & Winter, 1982, Hannan & Freeman, 1984).

Variations selected (retained) can also spread through imitation and adaptation (mimetism), due to the mobility of people, technologies and organizations. Despite advances in telecommunications and transport, spatial proximity can be a key factor for the transfer and diffusion of innovations, imitations and adaptations found uncertain activities due to social and cultural aspects involved (Baum & Singh, 1994; Zi man, 2000).

In an evolutionary system, the selection mechanisms guide and constrain the creative and adaptive behaviour, and thus determine what changes will thrive and which fail. New varieties (firms, products, technologies) that do not fit within of the local environment (market rules, cultural norms), tend to disappear.

The selection environment consists of markets (such as capital markets and products), and a set of extra-market factors, which include opportunities, institutions, values, norms, beliefs, customs and socially accepted practices (Dosi, 1982). In this system, stochastic events can influence the environment, but the "selection mechanisms" such limited randomness to a certain set of elements "that are better adapted." However, the intensity of the selection process, and the consequent pressure to search for effective change (new solutions), is proportional to the scarcity of resources.

Competition: The competition between economic actors for supplies and production inputs is larger and fiercer when they are limited or scarce. Markets with greater potential returns, or more attractive in terms of status and power also tend to be played (which is compatible with the Darwinian notion of "struggle for life"). Thus, the competitive environment is established. The set of ideas that are formed and who hold the majority of strategic corporate decisions can be seen as heuristics (principles with which to seek an "approximate solution" or a proposal for improved survival problems and increasing profitability, which is not necessarily the best answer), which have been treated under the generic name of "corporate strategy" or "competitive strategies" (see, eg, Hamel & Prahalad, 1995; Henderson, 1998; Mintzberg et. al., 1998)

In this context, firms will not adopt or implement new technologies or adapt to environmental changes as smoothly as conventionally assumed. Well, due to uncertainty, they tend to behave "routinized" by setting certain patterns of behaviour more or less predictable. Thus, rather than consciously maximize profits or utility functions, the typical attitude of producers and buyers is to form habits and conventions in the medium in which they operate. Such habits and conventions are formed within a specific context of interactions between agents, which are "embedded" in the local culture (Arthur, 1980; Best, 1990; Storper, 1997).

An innovation in an organization may consist of the establishment of new patterns of information and material flows between sub-routines previously established. According to Nelson and Winter (1982): "(...) routines reliable, well-defined scope, provide the best components for new combinations to be successful" (op. cit., p.131). In this view, the routine would be "a kind of 'gene' built and modified over the organizational history" (op. cit., p.134). In this sense, improvements and technical advances are more likely to be undertaken locally, and thus more likely to go after markets and technologies with which firms have become "family" or had any previous contact (Nelson & Winter, 1982). From the standpoint of the firm, this process can be rational in the sense that some times are discarded promising alternatives (and sometimes higher, incidentally), due to high adjustment costs, high risks and greater uncertainties involved. Thus, the local environment acts as a kind of selection mechanism that may or may not provide favourable conditions to achieve new requirements change. In other words, the boundaries of existing paths act as restrictions on the ability of economic agents react to market changes or technological changes (Vietor, 1994). These elements support the neo-Schumpeterian concept of "path dependence" (Dosi, 1988), which, in a sense, opposes the concept of Schumpeterian "creative destruction", because while the first reflects an inertial tendency to keep step by step (events) on a certain route (time irreversibility), the other represents the forces that lead to jumps in a certain trajectory (substantial improvements) or switching to alternative routes (new opportunities and technologies).

The story, in terms of heritage structures, institutions and regional cultures, often acts as a filter to access and make use of new opportunities. New developments are not always perceived as anew mode of production or organization within the context where they occur. Established groups (political, industrial, cultural, etc.) naturally tend to resist fundamental changes that are happening in the environment as a way of keeping positions obtained, since the benchmarks that held such positions, with the changes hardly remain intact (Bianchi & Miller, 1996). On the other hand, in a dynamic environment and competitive evolutionary, the "winner" is not always "selected" by the environment. For example, as noted by David (1985), there was no choice in the selection or optimization of the pattern QWERTY keyboard (PC's). He was just chosen.

A similar process has happened with the choice of the technological pattern of digital TVs, high-resolution, whose dispute involves three main patterns (European, American and Japanese, among others) in which the selection criteria involve political and strategic interests of different countries and economic blocks.

Considering the fundamentals and economic ramifications of an evolutionary approach set out above, the overall goal of this paper is to present the competitive dynamics of the evolutionary approach proposed by Souza (2011), for understanding, studying and analyzing the competitiveness and sustainability of enterprises in industrial clusters.

The choice of the Norte Fluminense’s cluster of structural ceramic for that research is paradigmatic. Due to its characteristics rudimentary, in technological terms the cluster can be seen as an "enclave of technological backwardness." In this sense, the research questions posed are: There is a process of stratification between firms of the cluster? If there is a stratification process, this follows certain competitive patterns? What are the effects on the strategies of the firms in terms by product, process and market? This paper presents an approach to try to answer some of these issues. In follow sections, are presents the general assumptions considered, a specific proposition derived from such assumptions and a summary of a methodology for analyzing the competitive dynamics with applying in a case of local cluster.

2 The evolutionary competitive dynamic of firms in industrial clusters

Understanding the formation of segmentation and competitive dynamics in industrial clusters is essential to define the business strategies and the effects of dependence on local history, preservation of socio-environmental conditions at satisfactory levels and direction of new investments. However, for methodological reasons, traditionally incentive policies and programs to support the development and industrial competitiveness are distributed generally to a sector or region, and clusters are assumed to be a homogeneous and complete. The internal diversity of these clusters, and the stratification factors between companies, are not captured, which makes such initiatives inefficient and often ineffective (Souza, 2011). The effect of such treatment, a considerable portion of business cannot qualify for government programs to support competitiveness. For others, such initiatives do not meet your needs or not they contribute to overcome their organizational and technological barriers, develop and implement improvements or innovations.

Advances in the study of local economic development and new forms of productive organization have shown that there is a need to explore a new frontier of research in this field. In this case, the traditional view of the division of economic phenomena in microeconomics and macroeconomics needs to be replaced by the sight of another dimension, which could be regarded as mesoeconomic, bound specifically to aspects of the competitive dynamics of local clusters (Souza & Arica, 2006). This dimension interacts with and is conditioned by the dimensions of the micro and macro economic environment, social and environmental, but that is not captured by traditional approaches.

In this sense, the consideration of evolutionary principles can contribute to development of specific approaches to the study and analysis of the competitive dynamics of industrial clusters. Consequently, some cases of a general set that characterizes the concept of "evolutionary" should be assumed. Souza (2003) presented a set of assumptions that characterize the competitive dynamics of the evolutionary approach:

H1 - The "path dependencies" influences the capacity to absorb new technologies;

H2 - The competition is constrained by selection mechanisms;

H3 - The domain and use of available technologies cause diversity among competitors;

H4 - The occurrence of own contributions (adaptations, changes) affect the performance (this is a feature closer to the concept of Lamarckian to Darwinian evolution);

H5 - The dynamics of adaptation and change, there is a characteristic of self-organization of the system, caused primarily by competition for survival. This hypothesis implies a degree of rationality of agents (unlike the biological environment).

Souza (2003) proposed to adopt the perspective catching-up (Abramowitz, 1986) for the study and analysis of the competitive process of firms into clusters through an evolutionary approach. Accordingly, companies in local productive cluster can be classified into three distinct groups:

- Group 1 (Forging Ahead) - comprises those companies that "jump ahead" of the competitive process of their arrangement. Dominate the production process in terms of technical, cost, quality and flexibility of products. These companies develop expertise and generate from these products, innovative technology; compete externally to the arrangement or imitate, assimilate and adapt foreign technology and develop their own solutions. Emerge in the competitive landscape sectoral / regional markets and expand have competitive advantages based on skills specific.
- Group 2 (Catching up) - characterized by companies seeking to follow the technological evolutionary process and organizational leaders (group 1), but with some lag technical and organizational. Not mastered technical knowledge, or dominate, but do not have ability to convert it into useful technology and performance operating competitive. These are aimed at adapting and developing substitute products through engineering simple imitation and reverse. During the time, restrictions on internal competence, and investments in Research and Development (R & D), production management and quality, only a small portion of these can inclusion in the leadership group of the arrangement.
- Group 3 (Falling Back) - This group is characterized Companies that fail to follow the technological advances and market demands, compete primarily on price, tend to become increasingly technologically outdated and "disappear" from the arena competitive or lose the most significant portion of its market. Following this trajectory, such companies would be bound to pay a price higher and higher by Therefore, due to the fact that they become mere clients external technological products. This group has been dedicated to niche markets with low purchasing power with processes based on technologies with declining demand or already in obsolescence.

The methodology based on the above hypotheses, and in the "catching up" classification have been adopted in a study to analyze the impact of technology insertion of natural gas in the cluster of red ceramic in the city of Campos dos Goytacazes, localized at North of Rio de Janeiro State (SOUZA &ARICA, 2003a). In that approach, it is assumed that changes in technology and opportunities offered by the local environment cause a competitive process of stratification between competing one cluster (H3.1 – The hypothesis of stratification patterns among firms, derived from H3). In this case, firms in the cluster were stratified according to levels of resources and performance through specific indicators were modelled as shown by Souza (2003; 2011).

3 Characteristics of the Structural Ceramic Cluster

The choice of the Campos dos Goytacazes's red ceramic cluster is paradigmatic. Due to its characteristics almost craft, in technological terms the cluster can be seen as an "enclave" of technological backwardness. This would as a "worst case", to observe and verify aspects evolutionary dynamics of local arrangements. With this, it is believed that even additionally, arise contributions to the conceptual approach of microsystems evolutionary "quasi-static". In general, except for some characteristics dynamic, it may be affirmed that segment is in a vicious cycle, determined primarily by competition for the price, the inability to incorporate more advanced technologies and the difficulty to explore new markets.

The availability of natural gas in the North Fluminense (Rio de Janeiro), and related technology for use as fuel in the production processes of various industrial sectors roughly represent an exogenous source of technological change. However, the feasibility of its implementation involves several endogenous factors such as organizational structure, efficiency process, the logistics, the pattern of competition, cost structure and skills. The traditional process of burning fuel is based on a process model whose production cost structure and value chain specific, although essential from the point of view of the pattern of competition site are shown saturated technological point of view and new markets. In this case, the technology prevents the diversification of products (including roofs and coatings) due to limitations inherent in the process of burning wood (eg, for temperature and uniformity). Such technical constraints affect other factors that influence the strategies and the competitive performance of companies, such as product mix, quality, differentiation, and exploring new markets, among others.

However, technological change involved in implementing burning natural gas can not be considered solely from the standpoint of costs, as this will enable the processing of all or much of the value chain and organizational configuration of the local industry. On the one hand this change increases the cost of the production process, and would now be comparatively "less profitable" in relation to the wood, on the other hand, allow another product portfolio with new profit margins and opening new markets. In this sense, the implementation of natural gas in red ceramic segment in the North Fluminense, for example, should not be seen based on the current production structure (with the input fuel), which will certainly prove to be unfeasible economically for many units. It should take into account the trend of course competitive cluster, the dynamics of consumer markets, the new products and their substitutes.

At first, by changing the production process and products, the factors to enable the implementation of the gas depend more internal elements (more control over the process, increasing efficiency, reducing wastage of raw materials, new products, new markets among others) than external (such as public policy incentives). However, from the standpoint of economic and social development location in a period of transition and adaptation, a greater concentration of efforts may be crucial to overcome historical barriers of the effects of path dependencies and the vicious cycle in which the industry is. In this case, specific incentives to certain groups (assuming stratification) may represent a key factor to encourage and promote change and enable a leap in technology and quality in the industry, considering the diversity of the medium.

4 Research methodology

The impact of technological change brought about by the implementation of natural gas, compared to burning wood, was assessed through the identification and analysis of the technical patterns of both technologies, also considering a hybrid system, a transition stage to another technology. Through the reference variable "technology", conceptually considered as "a way of doing things", was established a taxonomy of "technological level", from differences in technical patterns identified in technological regimes observed in the production system (basically: 1 - the wood burning, 2 -

burning mixed, 3 - burning natural gas). Here, technological regimes represent segments in technological trajectories considered.

Where: n ({1,2,3}; RT1 = [firewood]; RT2 =[mixed regime]; RT3 = [natural gas]. It is assumed that each system is composed of m technical and organizational patterns, which are established in the process of learning and absorbing the technology specific to each unit. In the passage of a technical pattern to another, in each regime, it is considered "stationary periods" representing time lags, certain gaps, needed to overcome barriers such as inefficiency or endogenous disability itself, and exogenous, such as imbalances in relative prices, unfavourable industrial policies, social or economic crises, etc. (see Souza, 2011). The study was conducted in a stratified sample with representative elements of each of the schemes considered (RT1, RT2 , RT3). It was assumed each of the schemes as representing a stage of technological development in time, although they coexist in practice. Each system includes certain technical patterns and organizational characteristics, which must be assimilated in the transition between two technological regimes different (Spencer, 2011). Technical and organizational patterns that characterize each of these schemes were raised in a specific investigation (see Souza et al., 2003).

4.1 Approach method

At first, we attempted to gather information and data reported on similar sectors in other regions (in theses, books, websites, newspapers and magazines), in order to define the type and information to be gathered for this specific case. Then, the same procedure was performed to the researched cluster. This information served to a general mapping of the companies of the Cluster and the type of information needed but not available on them. Thus, we defined a set of information that should be raised through direct research. The next stage was a survey of information and primary data through interviews and observation techniques on site in a stratified sample of firms of that cluster. To select the sample, was previously elaborated a questionnaire to the technological diversity of the cluster. It were consulted professionals and researchers from institutions in the region working in the area, including: the Association of Potters, the Laboratory for Advanced Materials and Civil Engineering (both from UENF), and technicians at High Technology Park North Fluminense (TECNORTE), the Federal Center of Technological Education (CEFET-Campos), the National Service of Industrial Learning (Senai) site, and the potters themselves.

In order to capture the diversity of the arrangement for the research sample, we requested that respondents indicate four companies of the arrangement for each of the three proposed groups (leading, intermediate, tardy), using as parameter the technology x product x market. It was suggested that would base their choices on criteria such as (i) modernization of the production process, (ii) products of better quality and (iii) product adding value. After the nominations, the most mentioned companies were chosen for the sample of the ceramic cluster. The total number of selected companies was fifteen, four in each group and three otherschosen at random among those cited. In the stratified sample canbe considered that the companies indicated for the first group accounted for nearly 100% of the stratum in the population and the second group, about 80%. The third group, even though the sample for that segment is low compared to its corresponding population (about 5%), verified by a previous mapping and informal visits to a dozen other random units, the lack of diversity technology justifying include more units in the sample representative of that group. Whereas the total population of the array is approximately 120 units, can be considered a stratified sample of 15 units selected as highly representative.

4.2 Procedure method

This stage of the work, the research field itself, in two phases: (i) interviews with the owner or manager of each firm, (ii) monitoring the production process. In the first phase, the owner (or manager) answered a standard questionnaire containing general information on the value chain, data related to the management, processes, products, markets, investments and strategies. The second phase took place in situ monitoring of all stages of production, the deposits from extraction, through the stages of mass preparation and manufacture, until the stock of end product, with emphasis on points differential. Besides the observations of process steps, each point representing diversity in terms of equipment, method, or routines was photographed for later analysis (Souza, 2011). Based on this information, a report was drawn up with a multicriteria analysis of each company, step by step. The field work lasted about six months.

5 Results

Among the ceramic visited (fifteen), only eight companies (A, B, D, G, H, K, L, M) actually used natural gas as fuel. These companies are among those that have the ability to burn and higher volume of parts produced. Due to the more homogeneous pattern provided by natural gas, the products manufactured by units in this group have characteristics more uniform and better quality. The patterns and characteristics of diversity observed in the arrangement were classified according to the methodology proposed in three distinct groups:

The first group (G1) consists of those companies considered the most dynamic and are ahead of the competitive process in the cluster. Dominate techniques of production that enable better product quality and diversification of parts. These companies acquire expertise through conferences and journals, using them according to their needs and constraints. Their strategies are aimed at producing higher value-added items and expansion of market niche, catering to a market share of greater purchasing power and growing demand. This group represented approximately 4% of the companies of studied cluster.

Companies in the second group (G2), the intermediate units are seeking to accompany or join the group leader, but still have internal barriers and limitations, both in the production process and management activities in the value chain that prevent a better performance. Deficient with respect to cost control process, and do not use techniques to control the production process. As a result, their profit margins are much smaller than those of group leader. Marketing strategies have blurred, trying to position it to meet the consumers without definite profile. Invest in product diversification, but without setting specific niches. This group represents about 10% of companies in the cluster.

In the latter group (G3), are characterized by those companies unable to keep up the competitive process and technological change. This group includes companies that serve a large market share, but in terms of "predatory competition" suffering as a consequence, strong pressure on prices. These, they can not even become "recipients" of foreign technology (as in the case, the deployment of burning gas), and tend to become increasingly excluded from more lucrative markets. However, still manage to sell their products to consumers undemanding in niches with low purchasing power. This group comprises the remaining companies of the cluster studied. Table 1 summarizes the characteristics representative of the units of each group.

Table 1 – Competitive Stratification for the cluster analyzed

Stratification	Unities (firms)	Main Characteristics		
		Process/Technology	**Product**	**Market**
G1	B, L	More compact plants; Increased productivity; More efficiently burns Conducting tests in clays; Treatment after extraction; Reuse the heat of the drying ovens.	Compliance testing; Average variability of patterns; Diversification directed.	Exploitation of specific niches (higher purchasing power); Demand somewhat variable.
G2	A, C, D, E, F, G, K, M	Modernization of the furnaces; Replacement (slow) of wood by natural gas; Initiatives to reduce costs.	Informal tests of compliance; Wide variability of patterns; Diversification is not targeted at specific niches.	Strategies undefined; Sales is not directed at specific market niches; Large variability in demand
G3	H, I, J, N, O	Family management; Inefficient furnaces; Rudimentary equipment; Low productivity; Lack of process losses and their costs.	No testing or inspection; Variability of patterns out of control; Parts of low quality.	Sell to niches with low purchasing power; Demand somewhat variable.

Source: Souza (2011)

6 Conclusions

The understanding and analysis of external factors, of market, which determine the behaviour of firms in certain environments has advanced greatly in the literature recent. However, it remains an open question what the relationship between the internal factors that emulate the capabilities and competencies of an organization and the effects of their strategies and behaviour in certain clusters of companies. In this case, answers to such questions depend on empirical research and, above all, robust methodologies and approaches that reflect the diversity of behaviours and their effects on the competitive performance of these systems. The approach to the stratification of groups of companies as their patterns of competitive behaviour in a “porterian way” rescues the idea of "strategic groups", but the local point of view and dynamic, whereas the learning process and selection mechanisms (technologies, technical standards and operational, etc.) influence the process of stratification in local clusters. Considering the evolutionary hypotheses proposed suggest a new perspective to address this problem. If the specifics in relation to its internal value chain, productivity, quality, routines, and other parameters of competitiveness training, follow certain patterns and form characteristic clusters, will be able to propose specific programs and differentiated solutions for businesses of every group identified according to their characteristics and needs, their level of resources and technological stage, and their difficulties, considering their skills.

The approach enabled the capture of information for understanding the mechanism of specific selection. Such information suggests that the future development paths of the array undergo a certain type of trade-off between the effects of "creative destruction" and "path dependencies". The first, caused by pressure of the competitive market and the availability of the necessary conditions for implementation of the technology of natural gas. In a way they are opposed to the effects of "path dependence" because of the historical features of underdevelopment, the slow development of technical and organizational segment, and corporate culture-specific cluster. These factors are strongly conditioned by the effectiveness and efficacy of interventions on adjustment activity, through institutional and governmental policies (programs, incentives and tax exemptions) and regulatory patterns (monitoring environmental and social), which traditionally represent only one character to the welfare sector.

Pragmatically, in principle, it may be affirmed that the cluster is in a vicious cycle, characterized primarily by competition for price, the inability to incorporate more advanced technologies, and the difficulty of exploiting new opportunities, in this case, the availability of natural gas. However, it was found that the characteristics of "path dependence" and lock in technology are addressed differently by the companies of each group.

As seen, the vast majority of companies in the cluster of ceramic structural North of Rio de Janeiro State is strongly dependent on the traditional process of burning wood (group 3), which, although still supported by the pattern of local competition, it constitutes a model saturated in terms of technology, new markets and competitive sustainability. The process of burning the wood hinders the diversification of products (including roofs and coatings) due to technical limitations inherent in the system (temperature, uniformity, etc.). Due to their technical constraints, other factors necessary for a better performance as the optimal mix of products, quality, differentiation, and exploring new markets, are limited by the technology of burning wood.

The availability of natural gas in the North of Rio de Janeiro State, and the associated technology of burning as fuel in the production processes of various industrial sectors roughly represent an exogenous source of technological change, it can be purchased and implemented (since proven its technical feasibility and cost for each case). However, to facilitate its implementation, several endogenous factors are involved, such as organizational structure, process efficiency, logistics and the pattern of competition, cost structure, skills, among others. The mechanism of change is through changes to the technology of burning gas, and consequently the search for new products and new markets (eg, tiles and building blocks). The selection mechanism is characterized by the type of furnace and new technical patterns for new products, profitable operation in the new process and market. The retention mechanism consists of the learning process from the new technology adopted and the incorporation of new technical patterns and values added to the product, process and market through different competitive strategies.

In the evolutionary view, the environment and the agents are interacting in a dynamic process with uncertain future outcomes. However, in situations of sharp technological gap, in a first stage, trajectories of development of similar systems in other regions can serve as a reference for a benchmarking process and absorption of advanced technologies, with regards to the local and regional specificities.

At first, by changing the production process and products, the factors to enable the implementation of the gas would be more in the hands of entrepreneurs, through greater control over the process, increasing efficiency, reducing wastage of raw materials, new products and new markets, rather than externally through public policy incentives. However, from the standpoint of sustainability, in a period of transition between different trajectories and adaptation to new technological regime, justified a higher concentration of efforts of stakeholders in support through training programs and specific training for each group so to disseminate technical and managerial patterns observed in the group leader to the other, enabling the transition of enterprises to the highest patterns of performance. In this case, consider the differences between companies and the existence of distinct groups with the skills, behaviours and performance is critical to implementing actions more efficient, more effective and more effective to leverage elements of the mechanism of learning and retention of the cluster.

In this sense, rather than the adoption of generic solutions for the industry, are more important to define key actions for the solution of specific problems of each group.

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