CONTRIBUTION OF GLOBAL FIRMS TO TECHNOLOGICAL CAPABILITY IN DEVELOPING COUNTRIES[1]

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RESUMO

Na busca por competitividade as firmas contemporâneas combinam novas estratégias com inovações tecnológicas e organizacionais na construção de suas trajetórias, valorizando o processo de aprendizado a partir de suas histórias.

Os desafios da competitividade vão além das fronteiras da firma e dependem de integrações sistêmicas entre diferentes agentes. Nesse contexto, as empresas e seus centros de P&D incorporam a concepção dinâmica de pesquisa e introduzem novos arranjos para manterem-se na fronteira tecnológica, focando em suas competências básicas e reduzindo os custos de transação.

Nesse processo, a integração com os países em desenvolvimento favorecer a capacitação interna. Isso dependerá entretanto, não apenas das estratégias das firmas, mas da natureza da tecnologia, da trajetória tecnológica do setor e das perspectivas de mercado.

Esse artigo discute a experiência de uma firma global francesa no estado de Minas Gerais e sinaliza para a o papel que essas empresas podem exercer no adensamento do sistema regional de inovação e da competitividade do país.

ABSTRACT

The contemporary company has a dynamic role and it incorporates technological changes at a pace unprecedented in history. In the search for competitiveness, it combines new strategies with technological and organizational innovations, building its own path when including learning starting from its history.

The challenges of competitiveness surpass the boundaries of the company and they depend on systemic integration among the several agents. In this challenge context, firms and their R&D centers have incorporated dynamic conception of research and introduced new arrangements to achieve and maintain themselves on the technological frontier, strengthen their key competencies and reduce transition cost.

In this dynamic process the integration with developing countries, could, in same cases, permit and encourage the construction of local capability, which contributes to the local innovation systems strength that is basic to the country's competitiveness. This possibility, otherwise, depends on the global strategy of the Group, the nature of technology, the technology trajectory of the sector and the market perspectives.

PALAVRAS-CHAVE

Estratégia globais, competitividade, novos arranjos de P&D, conhecimento tácito, capacitação em países em desenvolvimento.

KEY WORDS

Global firms strategy; competitiveness; new R&D arrangements of R&D; tacit knowledge; developing countries capability.

INTRODUCTION

The dynamic role that the company assumes these days will demand from the entrepreneur the combination of new strategies with technological and organizational innovations. More than a production planner, he needs to have a strategic vision which means permanent evaluation of the opportunities, competitive advantages and disadvantages associated to the development of local competencies, which will start from a process of selection, learning and definition of new operational routines. That implies the domain of basic competencies (core-competence) to evaluate and define more effective organizational arrangements (PRAHALAD AND HAMEL, 1998).

In this constant challenge the company is forced to interpret and decide on technological changes and implement internal changes that allow it to maintain itself in a position of competitiveness.

This study is in the context of a line of investigation that searches to rescue the contributions of J. Schumpeter in the sense of incorporating technical progress as a key variable of the evolutionary process of the company and the market. In that perspective, the company is considered as production space, place of wealth and innovation creation (competence).

The learning process is cumulative and "path-dependent"; in other words, the evolution of a company is determined by the accumulated competencies and by the nature of its specific assets. The competencies change in function of the technological opportunities. The diversity of selection environments will explain the different paths and varieties of market structures.

In this dynamic process the integration with developing countries, could, in some cases, permit and encourage the construction of local capability, which contributes to the local innovation systems' strength, basic to the country's competitiveness. This possibility, otherwise, depends on the global strategy of the Group, the nature of technology, the technology trajectory of the sector and the market perspectives (RIBEIRO et al, 2001).

"When a company grows by vertical integration, it is not a question of just more of the same, but more of something approximately related, something on which the company has

some degree of important knowledge. The evolutionist view suggests that this 'degree' is probably an important point from where the integration happens or not" (WINTER, 1993). Much of a company's knowledge is tacit, social and distributed or fragmented among several participating agents of the economic process, especially in the production sphere.

This article proposes to draw a parallel between the construction process of the strategy of the French group, Vallourec, and the main tendencies highlighted by theoreticians of innovation strategy and economy. The objective is to notice the potential of local development in the subsidiaries and their insertion in the global market.

Thus after this brief introduction the next item will present the conceptual bases that support this analysis, highlighting the relationship between the corporative strategy and technological strategy. In this same item the general tendencies in research in the world will be discussed in the face of the growing competitiveness and the research dynamic. The following item presents the action model of the Vallourec Group and its technological management; the third item discusses the potentials and challenges of development and subsidiary capacitation bearing in mind the management model of the Vallourec Group, the local competencies and the market perspectives. And finally in the conclusions, a reflection on the potentialities and limits of the contribution from global corporations to local development.

THE INTERFACE BETWEEN TECHNOLOGY AND CORPORATE STRATEGY

The re-structural process of the worldwide economy, historically dated from the late 1970's, was marked by profound changes, whether at the national state level or at the level of reorganization of the greatest multinational groups, seeking higher competitivity. Competition and consequent access to new technology became crucial issues for the organizations. The innovation process is mainly characterized by strategic integration, in the form of networks among agents, which are concerned about diminishing the increasing costs implicit in research and increasing the chances of expansion through cooperative contracts and strategic alliances (CHESNAIS, 1991;ROTHWELL, 1992; PORTER, 1990; POSSAS, 1996).

Strategic formation is a dynamic process through which the company explores its technological and marketing environments as a base from which to obtain competitive advantage. Understanding of the technological strategy can be refined with the recent developments in the evolutionist epistemology, which provide information about the reasons for the differences among the companies. Technological strategy involves the alignment of the objectives and actions that influence and respond to future changes. Although technology is not the only source of competitive advantage for a firm, it is vital in a context in which the firm can drastically change its essential activities (METCALFE AND BODEN, 1992).

Since the construction of technological capabilities is a consequence of historical factors that condition the accumulation of knowledge, a wider understanding of the effective technological paradigms and technological paths of the companies is required. Dosi (1982) was the idealizer of the concept of technological paradigm, developed by him in analogy with the scientific paradigms. A technological paradigm is a standard model of problem solving, based on selected principles and on selected material technologies. The emergent technological paradigms have great power to totally exclude the old paradigms.

However, in transition situations the coexistence of several paradigms is possible, especially when the costs for elimination of the old paradigms and the investments and uncertainty associated with the new paradigms are high (POSSAS, 1996). The technological paths, on the other hand, refer to incremental innovations within a same paradigm.

However, as pointed out by Metcalfe and Boden (1992), for the study of the strategies, Dosi's concepts should be used in a more restricted focus. Therefore, the authors propose the consideration of technological regimes, which consist of essential scientific and engineering principles that are used by any company operating in that regime. The analysis focus can be further restricted, by using the configurations of technological design, or specific principles related to the nature of the product and the way it is produced, developed through an innovation time sequence established by means of the developed patterns. An example of different technological designs in a same regime is diesel and gasoline within the same technological regime of internal combustion engines. A good strategy is the one that explores the maximum potential of a given configuration at least as quickly as the rivals.

Therefore, coherence at the level of a business line refers to the diversification for products that possess technological or market similarities with existing products. In the case of the corporations, the coherence is less visible and it needs more considerations in regard to capacity of administration of several lines of independent businesses that concentrate the differentiated competences and present internal coherence (DOSI et al., 1992).

The main implication of these studies in the understanding of strategies falls on the fact that strategic variety is limited by the technological regime, or rules and structures that define the translation of "skills" into competences. Coherence also helps to define excluding options highlighted by Porter (1996), which result from the coordination and internal control limitations. The excluding options are implicit in the positioning and they imply the restriction of the company's offers. The key word used by Porter is "compatibility" among the company's activities, which implies a fine coordination of activities directed to the objectives of the strategy. Compatibility creates and sustains the competitive advantage through the coherence of activities provided by collective learning and ability to integrate technological and marketing currents.

The diversification of purchasing strategies and the connections among companies depend on their capacity to promote strategic alliances with the market and sources of scientific knowledge to have access to a larger technological capacity (CHESNAIS, 1991). The competences are dynamic and conditioned by learning. Thus, the structures and arrangements need to be dynamic. The response of successful firms is increasingly likely to involve some measure of networking and collaboration (TIDD, BESSANT AND PAVITT, 2001).

THE NEW DYNAMIC OF THE INNOVATION PROCESS AND THE CHALLENGES OF TECHNOLOGY MANAGEMENT

Since the early 1980s, in the search for greater competitiveness, the large economic groups have shown a tendency to increase resources for basic research attending to the complementary and interdisciplinary aspects of the new branches of knowledge. On the other hand, the public research institutes are re-orienting their research towards the market, or the needs of the productive sector (WARRANT, 1991; HOWELLS AND WOOD, 1993). These movements create areas of convergent interests among the sectors (FAUCHER AND RIBEIRO,

1994 and 1996) and allow transaction cost reductions (JOLY AND MAGEMATIN, 1996).

State support for basic research is particularly important because of the high level of uncertainty and risk inherent in this type of research and because companies do not easily capture its benefits individually. Basic research creates general knowledge based on a restricted number of variables and the results are generally published in reproducible publications and experiments. On the other hand, applied research, and especially the development, tests and production engineering, are knowledge and experience accumulated in several variables, whose result is not only specific knowledge, but also tactical knowledge, which is generally difficult and expensive to reproduce (PAVITT, 1992, 1994 JOHNSON AND LUNDUVALL, 2000)[2]. It is the technical and scientific knowledge that authorizes a company to adopt a new technology, as well as to assess the alternative technologies. Thus there is an extremely complex relationship between science and technology, which varies according to sector and technology type.

The success of a company is intrinsically related to its capacity to innovate in the widest sense, from technology to new methods of management. Innovation is, therefore, as Porter states (1990) the only way to ensure competitive advantage. Although the company continues to be the innovation site (CHANDLER, 1992), the need is growing for partners and external articulations, which ensure the interdisciplinary and complementary aspects inherent to the innovative process. In this perspective, institution restructuring implies an organizational re-design and action strategy change that gives priority to partnership and cooperation contracts and agreements. It valorizes the collective innovation without loosing sight of the 'core competence'.

The new designs valorize the learning process that leads to more stable relationships between clients and suppliers and consequently to an increase in the specialization level of the services. The learning concept can be understood as a possibility of understanding before, and better, the signs and symbols of the environment. In this sense, this concept incorporates the principle of flexibility, which is the ability to adapt and respond to the market dynamic.

Research carried out by Rush, Hobday and Bessant (1994) involving technological centers (benchmarking) in several European countries, showed that there are no pre-established rules that guarantee best results to technological centers, especially when the diversity of factors that impact their action are considered. Each center has its strengths, weaknesses and potentials. Aiming to understand the dimension of these forces for planning a strategy that consolidates the action of each one in the region where it acts seems, therefore, an essential condition for survival.

The study by Joly and Mangematin (1996) on the comprehension of the relationship between technology production, development and transference showed two important conclusions: i) that research does not only produce information, but also knowledge, which can be coded or tacit; ii) where the knowledge is tacit, the learning process is local and cumulative. Similarly, Cohen and Levinthal (1990) pointed out that the degree of 'spill-over' of research depends on the ability of the company and the nature of the technology. In this sense, the research activity has two complementary faces/sides: it not only contributes to the creation of information and knowledge, but through the learning process it contributes to the improvement of the ability to absorb knowledge.

This reinforces the argument that external research does not substitute internal research in the company. Rosenberg (1990) used a similar argument to explain why large companies do basic research. The code must be known to appropriate the results of the academic research, even when it is coded. In this sense, the objective is more to construct an interface than produce new knowledge.

According to Freeman (cited by TIDD et al, 2001) the twentieth century was essentially the era of organized R&D and the rise of the firm as the unit of innovation. The firm essentially defines the stage at which they act. But as we move into the twenty-first century the locus has shifted again and innovation is increasingly the product of networked activity. The importance of such networking is not only firm-to-firm, but also about building rich linkage within the national system of innovation. Although the underlying question remains the same to the innovation management: "how to identify triggers and develop coherent strategic responses", the unit to be managed is a cooperative federation player"(TIDD et al, 2001, pag. 30).

THE VALLOUREC GROUP: A HISTORY THAT BEGAN IN THE 19TH CENTURY AND SHOWS WHY LEARNING AND HISTORY MATTER.

Most of the companies of the Vallourec Group were founded during the last decade of the 19th century. It took the name Vallourec in 1957 when first quoted on the Paris stock Exchange.

At the end of the 1970s, after the acquisition of France's major tube manufacturer, Vallourec became the only French manufactures of seamless steel tubes and large diameter welded tubes, and the largest producer of small diameter welded tubes and cold drawn tubes. *After that Vallourec in the 1980s concentrated his production on seamless steel tubes and in 1997, Vallourec* merged its seamless tube plants with those of *Mannesmannrhören-Werke. With* this joint venture, VALLOUREC & MANNESMANN TUBES (Vallourec holds a 55% share), the group achieved the position of world leader on the market for seamless steel tubes (VALLOUREC, 2001).

The Vallourec Group contains over 50 industrial and commercial companies grouped industrial sectors, more than 50 plants, 20 being outside France. Around 75% of the sales are made outside France. Vallourec is pursuing its development in industrial activities, which provide a synergy with its core business in: the automobile industry, oil and gas industry, mechanical engineering, power generation, chemicals & petrochemicals and construction (Vallourec In formations, 2001).

Over these years the Vallourec Group has been constantly concerned with the perfecting of products and technological processes and with the incorporation of new management practices and organization arrangements keeping up to date with world market tendencies. Following its technological trajectory Vallourec remains on the cutting edge of knowledge of products and processes linked to its core business.

The Group is organized in companies specializing in specific areas. These companies are kept as small as possible and enjoy a large degree of autonomy. They are grouped together under industrial Divisions. This kind of arrangement avoids transaction costs while offering the advantages of a large industrial Group. The approach based on production lines simplifies management structures and encourages the integration of senior staff in the plants.

There is an incentive to the local learning process and to incorporation of the tacit competencies so that these corporations act as global players.

"To capture some of the externalities generated by technologically advanced multinational corporations, they must have domestic firms with the ability to learn from them" (LALL, 2000. p 10). Capability building involves effort at all levels – shop floor, process and product engineering quality management, maintenance, procurement, inventory control, outbound logistics, and relations with other firms and institutions. It is important to point out that a formal R&D does became increasingly important in more complex technologies, where even efficient absorption requires distinct research and experimentation (LALL, 2000). This has been the policy of the Vallourec Group.

THE MANAGEMENT OF TECHNOLOGY IN THE GROUP

The Vallourec Research Center – CEV has global activity supporting the Research and Development strategy of the Group. Designing, improving and promoting products, equipment and processes to support the expansion of the Group is its main role.

The various skills of the Research Center, specialized in such fields as metallurgy, corrosion, non-destructive testing or calculation, are some of the basic foundations of Vallourec's know-how. This expertise in steel and steel tubes may be divided into 3 main themes:

- Development support to new products and processes;
- Technical consulting for the plants which include temporary personnel support to the plant or coordination of project teams;
- Basic research with medium to long-term perspective.

The CEV is responsible to the communication internal to Vallourec. It is also in charge of the technical communication of this entire project with the various Vallourec companies and with external business partners.

This communication is made in three directions, searching for a strong integration of the center with all actors involved in the Vallourec business:

- Documentation and standardization; contribution to international standards in order to stay at the cutting edge of technical developments;
- Cooperative Research with steel industry laboratories, universities, engineering schools, national and European centers, etc.
- Publications and patents, providing a scientific showcase for the Vallourec Group via conferences and scientific publications of international renown and the filing of patents.

It is also important to point out the activities that aim to transfer the skills continuously adapting to the development and offering:

- Standardized training courses which can be directly implemented in the plant;
- "Customized" courses to meet specific needs; and,
- The organization of Skills Clubs, a space for meetings and exchanges between experts from various plants to determine the best class practices in each area and implement their sharing across the Group.(Research Center CEV, 2001).

The CEV is an independent unit, with its own budget negotiated annually with the business units that gives the center flexibility of action while maintaining a policy in tune with the Vallourec Group Strategy. There is direct integration between corporative strategy and technological strategy.

The management approach is in tune with the main research tendencies mentioned previously. There is a concern and valorization of the tacit knowledge in the learning process. Although the center is located in France there is interaction with all the companies and the technicians are trained in the CEV to absorb

new technologies. It is within this perspective that it is believed that this form of management opens space for local competency development that can be expanded to the rest of the economy, from the interaction with the other actors involved in the production/ distribution process.

> *The successful transfer of technology can be a prolonged process, involving local learning to complete the transaction. The embodied elements can be used at best practice levels only if they are complemented by a number of tacit elements that have to be developed locally (NELSON, 1990).*

The CEV has developed new research approaches that permit greater visibility of the future that mean widening the research areas that include the interdisciplinary nature of knowledge and its dimension that favors the creative process. Learning how to learn.

THE INSERTION OF SUBSIDIARIES IN THE GLOBAL FIRMS' STRATEGY AND OPPORTUNITIES OF CAPABILITY

The Brazilian subsidiary – V&M do Brasil S.A. (Mannesmanaa S.A.), located in Belo Horizonte (Minas Gerais) was founded in August 1954 to provide steel pipes for the nascent Brazilian oil industry and joined the Vallourec group in May 2000. The Brazilian company manufactures hot-rolled seamless steel pipes for the oil and gas industry, drawn tubes for several applications in the automotive industry, pipes for the petrochemical industry, power generation, and mechanical industry. V&M do Brasil has two subsidiaries; V&M Florestal, with 215,000 ha of farms in the north of Minas Gerais state; and V&M Mineração Ltda, to supply the blast furnaces with the necessary charcoal and iron ore.

V&M do Brasil has contributed greatly to Brazilian development and the main national and international corporations that act in the petroleum, petrochemical, automobile and basic infrastructure construction (sewage) sectors are clients. This integration allows V&M a great space for dissemination of its technologies and its internationally recognized quality standard. But it is fundamental that these ties are also extended to the local universities and research centers. In short, use the same approach of CEV management strategy to the Brazilian reality.

In 2001 V&M do Brasil attained a production of 500 thousand tons of brute steel and 445 thousand tons of seamless tubes, and 27% of the production was sold on the foreign market and the remaining 73% on the domestic market. This performance represented a net income of approximately US$ 223 million (US$ 1.00 - R$ 3.3) (January 2003). The corporation finished 2001 with a total of 5,001 employees.

It should be emphasized that in spite of the restrictions that Brazil has suffered lately, V&M do Brazil presented a significant evolution in productivity, which rose from 283 m^3/ man/year in 1994 to 359, 465 and 572 m^3/ man/year in 1996, 1998 and 2001, respectively (V&M do Brasil Information).

To Conclude: Some reflections on the opportunities of developing countries in the context of global firm rearrangements

We stated at the beginning of this article that the potential of local competence construction was associated to the Group strategy, technological nature and trajectory, and to the institutional conditions (market, industrial policy, etc) of each country. What we can state with the analysis of the corporative and technological strategy of the Vallourec Group is that there is a strong stimulus and support to local development to incorporation for existing competencies (tacit knowledge). The market perspectives are extremely favorable,

not only in Latin America, but especially in Brazil, bearing in mind the priority of the government to overcome basic structural problems in the country while keeping a strong presence in the international scenario. In this sense, the constitution of an industrial and technological policy in Brazil that stimulates the innovation process may favor the systematic integration of these existing tacit competencies. These policies should stimulate the subsidiaries to exploit more effectively the contribution of multinational corporations that dominate state-of-the-art technology in creating and strengthening the national innovation system that is fundamental for construction of entrepreneurial competitiveness.

International competitiveness and the links it can have with the R&D capacity in a country and the ability to innovate itself became central topics of the debate, which considered the elaboration, and implementation of industrial and technological policies. A structural competitiveness does not mean the sum of the companies' competitiveness because, besides the organizational capacity of the companies, the efficiency of the productive structure of the national economy, its infrastructure and other externalities that determine the potential of the companies should be considered (CHESNAIS, 1991).

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NOTES

[1] In September 2002, after to give an interview for the Research on the Dynamics of Innovation Process, the Manager of Non Destructive Testing and Statistic *Department of Vallourec Research Center (CEV) witch is a part of the R&D Organization of this group. Mr. Bernard Bisiaux*, accepted the invitation to collaborate in the construction of this article. The idea of the article was born after a interesting discussion about the role that the multinational companies have had to the development of the country and could be more important in the strength of the local enterprise capability and of the national system of innovation, basic for the country' competitiveness. We would like to thank the contribution of the Dr. Leonardo Daher of the VM do Brasil, in the attainment of data of the Brazilian subsidiary.

[2] Pavitt (1991) showed that the ability of a company to internalize the basic research results from different countries depends partially on its own capacity to carry out basic research. According to the author, the internationalization of R&D, which is a consequence of the production internationalization brought about by the large multinational groups, does not necessarily mean the internationalization of the links between research and technology. Still according to Pavitt, there is no clearly defined tendency towards internationalization of the basic research, and what is presently observed is a concentration of innovation activities in the home countries of the multinational companies. Niosi e Bellon (1994) reported that in spite of the existence of specific strategies for each industry, it is clear that the international R&D laboratories are being induced to intensify the output of technology which are for international and not only national use.

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