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INNOVATIVE CAPACITY AND ADVANTAGE: A CASE STUDY OF BRAZILIAN FIRMS

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Abstract

The purpose of this paper is to contribute to the debate on how companies create organizational environments conducive to innovation development, through its culture, resources, competencies, and the use of interorganizational networks. These factors, as a set, are known as innovative capacity. To accomplish this goal, a bibliographic review theme is carried out, as well as an exploratory research, conducted by case study about the innovation management process in two companies, both considered innovative, and each belonging to a different industrial sector. An analysis of the results of the empirical study suggests that the building of innovative capacity can have different meanings in different types of companies that act in market segments featuring different levels of technology. A greater understanding of how the building of innovative capacity occurs across different industry sectors could assist companies in better allocation of their resources to leverage their innovative capacity, and therefore building sustainable competitive advantages.

Keywords: Competitive advantage, innovation networks, innovative capacity.

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1 INTRODUCTION

Innovation is a key element of corporate competitiveness in the 21st century, and has therefore attracted special attention from management researchers and practitioners. Although this theme has been in the spotlight over the past few years, its discussion is in no way recent.

One may observe a division of the research on innovation into two large fields. The first, based on economic theory, focuses on the differences in patterns of innovation between countries and industry sectors, the evolution of technology over time, and differences in propensity to innovate in a given sector; that is, a macro view of innovation. The second area, focusing on the micro level and individual companies, has the study of product development processes as one of its concerns (BROWN; EISENHARDT, 1995).

However, in order to benefit corporate competitiveness, by providing new products or processes to set a company apart from its competitors, innovation cannot be restricted to researching new technologies and developing new products. After development, new technologies may fail upon being transformed into products and services; products and services, in turn, may be commercially unsuccessful despite successful development. A survey carried out by management consultancy firm Booz Allen Hamilton notes that, within a sample of 1000 innovative global companies, the most successful were not necessarily those that invested the most resources in R&D (JARUZELSKI; DEHOFF; BORDIA, 2006*)*. Andreassi and Sbragia (2002) also obtained similar results in their studies. It may therefore be said that innovation goes beyond investment in R&D and technology; it is a more wide-ranging and complex process, the result of complex interactions – on local, national and global levels – between individuals, corporations and other knowledge-producing institutions that warrant further study (ARBIX, 2006).

Innovation can improve companies' competitiveness, but, in order to do so, it requires a different set of management knowledge and skills than that used in running the firm's day-to-day operations (TIDD; BESSANT; PAVITT, 2001). This set of knowledge and management skills may be termed companies' **innovative capacity**, as defined the internal potential to generate new ideas, identify new market opportunities and implement marketable innovations through exploration of the company's existing resources and capacities (HII; NEELY, 2000).

As innovative capacity is a key element of companies' competitiveness in the current global scenario, knowledge of how to make this **innovative capacity** operational – that is, how the company should be organized and managed in order to develop products, services, and processes that actually offer sustainable competitive advantages over time – can be quite interesting. This article seeks to contribute to the discussion of this matter, and, more specifically, to demonstrate how a company could create an organizational environment conducive to the development of product innovation, drawing from its corporate culture, its competencies and, finally, its relationship with other institutions. To this end, a literature search on the theme was performed and an exploratory research on the innovation management process in two companies, both considered innovative, and each belonging to a different industry sector in Brazil, was carried out.

The article is organized as follows: in section 2, the conceptual basis of the study is synthesized; section 3 presents research methodology; section 4 has results of the empirical study carried out at the two subject companies; and finally, under section 5, results are discussed and conclusions presented, noting some study limitations and suggesting further research.

2 CONCEPTUAL BASIS

2.1 INNOVATION: DIFFERENT CONCEPTS AND PERSPECTIVES

Innovation has been studied by many authors in different fields, and has therefore been defined in different ways. In its epistemological sense, innovation could be defined **as doing something new** (TIDD; BESSANT; PAVITT, 2001). Accordingly, the common ground shared by the several definitions of innovation is the idea of **something new,** be it a characteristic of a product or service, of a process, a technique, or a new use for a product or service. Tushman and Nadler (1986) therefore distinguish two types of innovation: product innovation, when there is a change in the product manufactured by the organization or the service it offers; and process innovation, which is a change in the way a product is manufactured or a service is provided. Zawislak (1995) includes management innovation in this type.

The definition adopted by the Organisation for Economic Co-operation and Development (2005) divides innovation into four specific segments: the implementation of a new or significantly improved solution for the company, be it a new product, process, organizational method or marketing method, with the aim of reinforcing the company's competitive positioning, improving its performance or increasing its knowledge. According to the manual, product innovation entails significant changes in the potentials and functionalities of products and services, which may include both completely new goods and services and important improvements to existing products. Process innovations are significant changes in production and distribution methods. Organizational innovation refers to the implementation of new organizational methods, new management practices, such as changes in business practices, human resources management, organization of labor or the firm's external relations. Finally, yet importantly, come marketing innovations, which involve implementation of new marketing methods, including changes in product and packaging design, changes in product promotion and placement, and changes in pricing methods for goods and services.

This paper focuses on product innovation, that is, the development of new products or the significant improvement in product performance, to bring competitive advantages to the developing companies. However, we attempted not to limit our scope to the strictly technological aspects of innovation, but to extend it as far as possible to all processes capable of turning an idea into a product with an edge on the market (ARBIX, 2006). From this broader concept of product innovation, the need is evident for an organizational environment that is conducive to new product development – not simply high-tech aspects, but also the development of concept and ideas for products with market potential. As heavy R&D spending is no guarantee of commercially successful innovation development, the company must develop the capacity to innovate throughout its value chain, by working on different functional areas involved in the process, including marketing, technological, and productive aspects (JARUZELSKI; DEHOFF; BORDIA, 2006).

2.2 INNOVATIVE CAPACITY AND COMPETITIVE ADVANTAGE

According to Tidd, Bessant and Pavitt (2001), the innovation process is key to the company's business; it is associated with renewal and evolution of the business, renewing what the company has to offer and how it creates this. In order to do so, each firm may adapt the innovation process to its own specificities, in order to integrate the process into the firm's way of building knowledge. Large companies, for instance, may have their own R&D labs or may outsource research; small businesses, on the other hand, prioritize speedy, empirical development of solutions, based on practical problem-solving experience.

Barañano (2005) argues that innovation is a complex technological, sociological, and economic process that involves a highly intricate set of interactions, both within the firm and between it and its economic, technical, social, and competitive surroundings. Success is therefore not expected to be satisfactorily justified by one or two factors alone. According to the author, no element can be effective by itself and, thus, no single management tool or technique will be able to create an environment that is conducive to innovation. What is actually found is a set of different (though strictly inter-related) factors that must work in an integrated manner to create and reinforce an environment that fosters the success of technological innovation in the company.

According to Hii and Neely (2000), a company's innovative potential is not derived from a single specific skill, but rather from a set of skills termed **innovative capacity**, which is defined as the internal potential to generate new ideas, identify new market opportunities and implement marketable innovations through exploration of the company's existing resources and capacities. It would be the result of the several interrelationships between its **organizational culture, resources, competencies, and relationships with other organizations**. These four constituent factors of innovative capacity will be discussed below.

2.2.1 ORGANIZATIONAL CULTURE

According to Hii and Neely (2000), a company's culture molds its main abilities and its knowledge base, in tandem with the existing physical structure and managerial environment. It influences the way in which things are done and employee relationships. Organizational culture determines which knowledge is valued and how it is disseminated to employees, setting the company apart from its competitors.

Maximiano (2002) also highlights the corporate culture's capacity to differentiate. To the author, as well as defining the way in which a company's personnel interact with one another and with the environment, organizational culture also distinguishes one firm from another. In fact, organizational culture – comprising the set of knowledge valued and disseminated among employees – is what distinguishes a particular company from others in all aspects, including its innovation process. Seeking to better understand the generation and accumulation of knowledge within the company and how it may contribute to forming organizational culture, Lemon and Sahota (2004) listed the main repositories of knowledge in a company, namely: the environment; its mission, vision, and values; technology; knowledge structures; the management style and organizational structure; individuals; the collective; and organizational memory.

Neely and Hii (1998) associate organizational culture to several factors, including knowledge of the company's mission and objectives, strategy geared towards innovation, the existence of an organizational structure that privileges teamwork, and encouragement to take risks related to innovative activity.

Molina-Palma (2004) defines the organizational culture dimension of innovation by the following values: being innovative and willing to experiment with new ideas, being opportunistic, not constrained by many rules, and willing to take risks. With these characteristics, the author claims, managers who perceive the company's culture to be highly innovative feel comfortable carrying out projects that are new, untested, and risky. High management support for its creation and maintenance is therefore of the utmost importance.

In short, based on the literature review, four indicators that would constitute an innovation-directed organizational culture can be defined: innovation strategy in the company; supportive high management; risk aversion; and systems in place to encourage innovation.

2.2.2 RESOURCES

Penrose (1959) says that a firm firstly comprises a variety of **productive resources** and, secondly, a **managerial environment** that connects and coordinates individual and collective activities in order to attain desired goals. Within this concept, new products and services are created from the management's capacity to respond rapidly to opportunities in the market. According to Barney (1991), a company's resources may be divided into three separate categories: physical resources, human resources and organizational resources. These constitute inputs to the productive process, in this case ideas generated, which can be classified as a fourth resource category.

Based on the studies reviewed, the following indicators were developed in order to measure the different categories of resources: Innovation-directed financial resources – R&D spending and spending on new product launch (Financial Resources); Number of people involved in innovation (Human Resources); Number of engineers, including technicians, masters' and doctorate holders (Human Resources); Existence of a structured R&D function within the company (Organizational resources).

2.2.3 COMPETENCIES

Allied to resources, competencies are for the most part responsible for the number of new products and services developed by the firm (HII; NEELY, 2000). Competencies are defined as a set of skills needed to coordinate and allocate company resources towards the fulfillment of tasks. They could be classified as a group of capacities or processes necessary for the conception and implementation of innovation. Distinguishing personal competencies from organizational ones is of utmost importance. Several authors have discussed the competencies employees of innovative companies should have, but the model proposed by Hii and Neely (2000) focuses on organizational competencies. These competencies provide evidence of how the firm uses its capacities to carry out processes.

Of the countless processes executed by a company, some stand out as more characteristic of innovative organizations, such as: the capacity to generate and pick up on ideas; management of a project portfolio; formulation, communication, and management of corporate strategy, through the use of indicators; and the capacity to manage, develop and make use of all knowledge presented to the company by employees (MOLINA-PALMA, 2004).

It is therefore paramount that companies that wish to be innovative know the market they are part of and the technological trends of its sector, taking notice of opportunities of new products or services that may be developed. The innovative company should also have in place systematic processes for new product development that allow constant development and implementation of innovation in the firm's products, be it radical or incremental.

The following indicators were selected to identify, for the purposes of this study, the innovative capacity of the subject companies with regard to their competencies: Processes of new idea generation; Processes of new product development; New product implementation; Production management and continuous improvement; Project management; Knowledge of the market; Knowledge of technology.

2.2.4 INTERORGANIZATIONAL NETWORKS

Adler and Shenbar (1990) use the term **external assets** to characterize a company's connection to the environment. They outline three types of relationship with external entities that can be a source of innovation:

1- Connections to consumers: relates to the extent of access the company has to consumers' decision-making process. Also includes what the company may learn from consumers, including new product ideas.
2- Connections to suppliers, sales teams, and sources of scientific and technical knowledge: relates to the quality of the company's connections to the best people in the field and to whether these relationships are sufficiently collaborative.
3- Horizontal connections through partnerships and alliances, trade associations and informal relationships: these connections can be a source of substantial knowledge to guide the development of the company's technological assets.

Fleury and Fleury (2000) also highlight the possibility of seeking extra-organizational resources to help in the firm's innovation process, after the company has learned to organize its own resources. Based on the conclusions of the authors studied, the following questions should be able to indicate how the interorganizational relationship would affect the firm's innovative capacity: Which are the main sources of innovation ideas used; and Who develops innovation (the company itself / third parties)

2.3 SUMMARY OF CONCEPTUAL BASIS

Based on the studies analyzed and the dimensions identified, Figure 1 summarizes the constituent variables of innovative capacity, their definition and the indicators selected to measure them through field research.

VARIABLE	DEFINITION **HII & NEELY** (2000)**;** **MOLINA-PALMA** (2004)	INDICATORS IN COMPANY
Culture	Company's support to innovation	- Company's innovation strategy - High management support - Risk aversion - Systems to encourage innovation
Resources	Financial, physical, human, and intellectual resources that support innovation	- Financial resources directed at innovation – R&D/new product launch spending - Number of people involved in innovation - Number of engineers, technicians, masters' and doctorate holders - Established, structured R&D function
Competencies	Competencies developed by the company for innovation development	- Processes of new idea generation - Processes of new product development - New product implementation -Production management and continuous improvement - Project management - Knowledge of market - Knowledge of technology
Interorganizational Networks	Sources of innovation do not exist within the firm alone: they also comprise its clients, suppliers, competitors, and partnerships with research institutes and universities	- Which are the sources of ideas for innovation - Who develops innovation

Figure 1 – Constituent elements of innovative capacity in companies
Source: Developed by the authors

3 METHODOLOGY

The issue of how to make **innovative capacity** – that is, how the company is organized and managed to develop products, services and processes that actually offer sustainable competitive advantages over time – operational in companies has not yet had its variables and theoretical constructs well defined and established in the literature. Therefore, this theme may be considered to still be at the theory building stage.

When there is no certain definition for the constituent constructs and variables of the theory that would explain a given phenomenon, the case study is particularly useful as a research method (VOSS; TSIKRIKTSIS; FROHLICH, 2002). For this reason, the research presented in this paper will be of a qualitative nature and carried out through the case study method. Nonetheless, qualitative research has its disadvantages. The first is greater difficulty in assessing the validity and reliability of results (MILES; HUBERMAN, 1994). Another disadvantage of such studies is the possibility of their becoming excessively complex and overly detailed, which would hamper identification of the relationships most important to the construction of a theory. Finally, qualitative, case study-based research may lead to non-generalizable results, as only part of the phenomenon is being studied (EISENHARDT, 1989). Despite these drawbacks, qualitative case study research is, according to Eisenhardt (1989), the best choice for research in stages where little is known about a given phenomenon.

As study subjects, two Brazilian companies displaying product innovation, acting in different sectors (metal packaging and petrochemicals), which were rated as innovative in the *Índice Brasil de Inovação*[1] were chosen. Following procedures proposed by Yin (2002), three data collection sources were used for the case study, namely, documentation (provided by the companies and obtained at their websites), semi-structured interviews and direct observation.

The interviews conducted could be considered the most important source of information for the study. Using semi-structured questionnaires, executives, engineers, and technicians of each subject company were individually interviewed. At the packaging company (Pack1), two executives from the Human Resources department, one from the Quality department and one from Product Development, were interviewed. Four executives were interviewed at the petrochemicals firm (Petro1): two from the R&D area and one each from the Technology and Production departments. The names of the studied companies were changed, for secrecy reasons.

Another data collection method employed was *in loco* observation. According to Yin (2002), observation is an additional way of collecting evidence for a case study. Informally direct observations were made during field visits to the firms in order to conduct interviews. This observation was useful to provide additional information on the study topics and include an interpretation of the interviewees' perception of the theme.

4 DESCRIPTION OF STUDY CASES

4.1 PACK1

Pack1 is a locally owned company, with three production units in Brazil. Pack1 is recognized by the market as an innovative company, an exception in a sector dominated by

[1] The *Índice Brasil de Inovação* (Brazil Innovation Index) is based on data from the *Pesquisa Industrial de Inovação Tecnológica* (Industry Technological Innovation Survey, PINTEC-2003/IBGE) and the *Pesquisa Industrial Anual* (Annual Industry Survey, PIA-EMPRESA-2003), provided by the companies, and complemented by patent data provided by the *Instituto Nacional de Propriedade Intelectual* (INPI, Brazilian patent office). The Index is an initiative of *Inovação Uniemp* magazine.

manufacturers that depend on suppliers for innovation. It has received several Brazilian and international awards for its products and managerial innovations.

4.1.1 INNOVATIVE CAPACITY AT PACK1

4.1.1.1 CULTURE

To Pack1, innovation is a question of market survival, as metal packaging has been gradually replaced by other materials, such as PET, in the past few years. The company's strategy consists in obtaining competitive advantages over its current and potential competitors through product differentiation and cost reduction. As a result of this strategy, Pack1 has deposited 32 patents both in Brazil and abroad, 12 of which were developed over the past three years.

The company believes this performance is the result of developing a strongly innovation-driven corporate culture. Since the 1980s, when the firm faced a severe financial crisis, constant innovation of management practices has been considered critical to its survival. An example of this mindset is its highly peculiar approach to people management, with a strong commitment on the part of high management to the job stability of their employees (or **inventors,** as staff are referred to within the company).

Another quite common practice in Pack1 is the constant encouragement of employees of all levels to suggest ideas and provide criticism, through what is known as *Projeto Simplificação* (**Simplification Project**). According to one of our interviewees, the firm considers the project to be the foremost promoting factor of their innovation culture and a powerful knowledge management tool. The project started in 1987, as part of a Total Quality Management/Kanban/Just-In-Time implementation program. It began as a program to gather ideas on improving processes, but over time, became the main communication channel between top management and operational staff.

This effort may be credited to the company's remarkably stable management, as its director-superintendent – who largely idealized Pack1's management philosophy – has held the position for nearly 30 years. The company's board of directors and management level are composed for the most part of house employees who have been with the company for their entire careers, many employed initially as interns or even from the firm's operational sector.

As part of the encouragement of an innovative corporate culture, any well-intentioned errors that may be committed during product or process development are written off as **training expenses** by management. To one interviewee, not trying something is worse than trying and getting it wrong. Knowledge development would only be possible through learning, and some errors may be inevitable in the process.

4.1.1.2 RESOURCES

Pack1 is quite a pared-down company, with few hierarchical levels and a simplified organizational structure; around 90% of its staff works on the factory floor. There is no dedicated sector in charge of R&D, but there is a simple Product Development area with four employees, including a coordinator who holds a Master's Degree in Packaging Development. The area is equipped with machinery for prototyping and prototype testing. All employees in Product Development are originally from the operational area. This area is responsible for the technical development of product projects, but is not exclusively in charge of proposing ideas and technical solutions. The department analyses product ideas generated through *Projeto Simplificação*, and also receives suggestions from suppliers and technical assistants, who make regular visits to the company's clients.

4.1.1.3 COMPETENCIES / INTERORGANIZATIONAL NETWORKS

The innovation development process at Pack1, from idea inception to new product (or process) implementation, may be described by the model presented in Figure 2.

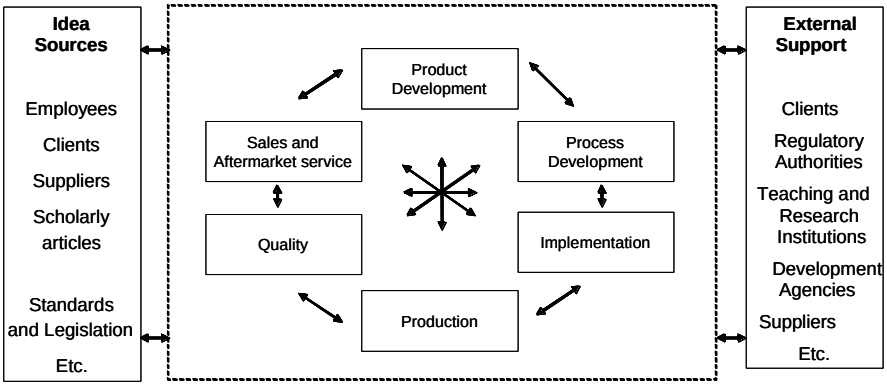

Figure 2 – Pack1 innovation model
Source: Developed by the authors

According to the company, this model reflects the way in which innovation is generated and developed by it, accounting not only for ideas generated by employees and clients, but also for the firm's relationship with external entities, such as research institutes, suppliers and development agencies. At the center of the model, reflecting the company's internal organizational structure, interdependency may be noted between all the areas involved, reflecting the result of organizational changes undertaken by the firm and the simplicity of its structure, which privileges contact between all sectors. Therefore, there is no single structured process for innovation development; it is **ad-hoc**, according to the type of innovation developed, which provides the company with greater agility in product development.

Ideas obtained through *Projeto Simplificação* are not the only sources of innovation. Relationships with clients, suppliers, and research institutions are also paramount to product development. As an example, a partnership between Pack1 and CETEA (Packaging Technology Center of the São Paulo State Institute of Food Technology) may be mentioned for product development and testing. Pack1 also relies on its machinery and raw material suppliers for product development assistance.

4.2 PETRO1

Petro1 is a Brazilian owned company, operating in Brazil, Venezuela and Mexico. It is one of the largest firms in the Brazilian petrochemicals sector, and exports its products to over 40 countries. Petro1 employs around 1000 staff in its five Brazilian production units.

4.2.1 INNOVATIVE CAPACITY AT PETRO1

4.2.1.1 CULTURE

Petro1 has a history of 30 years in the petrochemical sector, manufacturing commodity chemicals, catalysts, and specialty chemicals (mainly surfactants). With growing international competition and high oil prices, the profitability of basic chemicals has been decreasing over the

past few years; the company is therefore attempting to shift its focus to the specialty chemicals market. In this scenario, product innovation has become critical.

Petro1's corporate culture has always been directed at operational excellence, focused on production cost efficiency. Although operational excellence is still strategically important to the company, its management also believes that a stronger innovation-driven culture is necessary.

Although the company has obtained good results on the innovation front over the past years, it can still be considered conservative with regard to its willingness to take the risks inherent to innovation. This may be partly explained by the sector's characteristics. Petro1 operates in a segment in which the investment required to develop a new product is high and amortization periods are long; consequently, innovation proposals require greater maturity.

4.2.1.2 RESOURCES

Petro1 allocates approximately 2% of its net earnings to RD&E (Research, Development and Engineering), above the Brazilian average and that of its sector.[2] Around 12% of its staff (approximately 140 people) is involved in RD&E activities. Of these 140, 28% have technical education, 61% are chemical engineers or chemists, and 11% hold master or doctoral degrees.

The RD&E function is carried out by three different structures within the company. The first is the **New Business Development** area, directly connected to the company Superintendence, and responsible for identifying new market opportunities in already existing technologies in the company or the market, and also for developing new scenarios or technologies, such as alcohol and oleo chemicals. This area is also in charge of developing long-term operation strategies and projects.

The second area is **Development and Applications,** connected to the Commercial department. This area is in charge of the technical development of new products or new applications for products the company already manufactures. It is structured according to the target market segments of the company's products, and divided into departments: Food Additives, Agrochemicals, Personal Care, etc. The company also has laboratories that provide analytical research support and a technical information center, which conducts scientific literature and patent searches. It is focused on market needs, identified by department technicians or by Sales and Marketing personnel.

The third area responsible for R&DE activity – **Process and Technology** –, attached to the Industrial department, is directed at the development of new processes to meet the needs identified by staff at Application or New Business. This department also includes the Catalyst Development area, which follows its own product development process, due to the specificity of its products.

4.2.1.3 COMPETENCIES

The new product development at Petro1, from idea generation to the implementation of the new product (or process), may be briefly described as shown in Figure 3. Depending on the type of project, the outlined steps may be executed simultaneously, and their duration depends on the type of product, its degree of novelty, and the resources required – the development of a new molecule, requiring new process, for instance, may take up to two or three years.

The catalyst development flowchart is similar, but the catalyst area (part of the Industrial department) is solely responsible for the entire development process. The timeline of new catalyst development is longer – it may increase to five years – and its implementation depends on client-side testing.

[2]Average technological intensity (as measured by relative R&D spending over earnings) of the 20 most innovative industrial activities in Brazil is 1,0%. Data source: IBGE, Pintec 2003.

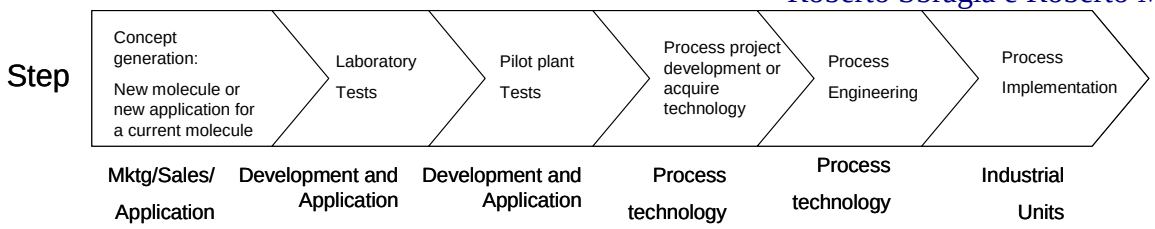

Figure 3 – Simplified new product development flowchart
Source: Developed by the authors

Petro1 has an internal group, known as the Technological-Scientific Committee, to aid in the development of technological strategies. It is composed of academic researchers and specialist consultants of the petrochemical industry, both Brazilian and from other countries. This committee convenes every six months or so to discuss future trends in the sector and to suggest strategic technology directions for the company.

The current product development structure shows a concern for meeting market needs and the needs of specific segments. Consequently, a strong concern for the technical knowledge and expertise of employees can be noticed. Even in commercial areas, the employment of engineers and/or chemists is commonplace, as the company believes technical expertise to be paramount for competency building, and also considers client and supplier information to be an important input for process and product innovation. Due to the technologies and processes used by the company, a certain level of technical knowledge and training is required even of factory floor operators and laborers.

Petro1 preferentially hires personnel through internships and trainee programs, and targets graduates of first-line universities and trade schools.

4.2.1.d Interorganizational Networks:

The main source of innovation ideas for Petro1 is its customer base. As well as product development, the company also offers services to its clients, such as analysis and testing in company laboratories or pilot plants.

Another important source of innovation at Petro1 is its network of relationships with universities and research institutes. Contact with academic research is particularly important to the catalyst area. The theory of catalyst development is still not fully established or understood by the market and academia; it is still at the building stage, and therefore requires fairly heavy basic research work – which would mean high risks and long development timelines for the company. In this segment, agreements between companies and researchers at educational institutions, to arrange the execution of development stages more closely dependent on exploratory research, are quite commonplace.

In areas that are considered strategic for the company's future, but in which the company still has no internal competency, the establishment of partnerships between the firm and research institutions or universities is also common. An example of such a partnership was the joint publication with FAPESP (the State of São Paulo Research Foundation) of a call for proposals for alcohol and sugar chemistry projects to be collaboratively executed. Another initiative is a nanotechnology research program for catalysts, agrochemicals, and thermoplastics segments, in partnership with the State University of Campinas (Unicamp), the Federal University of São Carlos (UFSCAR), the Federal University of Campina Grande (UFCG), and the Federal University of Rio de Janeiro (UFRJ).

A summary of the constituent elements of innovative capacity found at Petro1 is presented in Table 2.

VARIABLE	FOUND AT PETROL	FOUND AT PACKL
Culture	- Current strategy seeks to focus business on specialty chemicals with high added value - Conservative company with regard to risk - Mid-level management took part in course on innovation	- Product differentiation strategy consisting of innovation and cost reduction. - Top management involved in innovation process. Director-superintendent is academic researcher in field and main motivator of innovation in company. - "Errors made with good intentions are training costs". - "Projeto Simplificação" (idea generation project) is main axis of creating an innovation culture in company.
Resources	- 2% of net earnings invested in R&D - 25 patents deposited in Brazil and abroad - Around 140 employees (12% of staff) allocated to R&D - 72% of R&D staff are university graduates or hold post -graduation degrees - R&D function is allocated partly to Industrial Department (Engineering and Catalyst Development) and partly to Commercial Department (Product Development and Applications).	- 32 deposited patents, 12 of which in the past year - No dedicated R&D function; instead, a Technical Development department, which employs four technicians with product and process experience. Coordinator holds a Master's Degree in Packaging Development.
Competencies	- New Business Development area and Technological-Scientific Committee evaluate future trends and propose new business ideas (such as oleo chemicals) - Input may also come from market or internal company needs - Structured New Product Development process, currently undergoing critical analysis - Market knowledge: structure of the Product Development area, segmented into markets serviced by the company - Company privileges technical knowledge – emphasis on hiring engineers, chemists, Master's Degree and PhD holders; in contact with universities	- "Projeto Simplificação", as main Knowledge Management and competency development tool, Production management and continuous improvement - Ad-hoc innovation process, giving preference to the involvement of different departments in product development. - Interaction with suppliers, clients, and research institutions as a way of developing technological competencies.
Interorganizational Networks	- Customers and market are main sources of innovation. Other important sources are universities and research institutes, for segments more closely dependent on basic research (such as catalysts) or still incipient (nanotechnology, alternative fuels, green chemistry) - Innovation is developed in-company, but makes use of partnerships with universities and research institutes and outsourcing of highly routine activities (such as engineering calculations)	- Employees, clients, suppliers, technical literature, standards, and regulations. - Innovation developed by the company itself, giving preference to ideas presented by employees.

Figure 4 – Summary of constituent elements of innovative capacity found at Pack1 and Petro1
Source: Developed by the authors

5 DISCUSSION AND CONCLUSIONS

One may say that innovation is a wide-ranging and complex process, the result of interactions between several factors, including individuals, customers and clients, competitors, suppliers, the market, research centers, and other knowledge producing institutions. Innovation may indeed improve corporate competitiveness; however, so as to come true, it requires a set of different management knowledge, practices and skills. This set may be termed **innovative capacity of a firm,** as defined above.

Its limitations considered, this paper sought to contribute to the debate on how companies may create organizational environments conducive to innovation development, through its culture, resources, competencies, and through the use of interorganizational networks; these factors, as a set, are known as innovative capacity. In the pursuit of this goal, two case studies of companies showing product innovation obtained through different practices were conducted.

Although the results obtained cannot be generalized to the universe of innovative Brazilian companies, they do tend to confirm the basic premise that corporate innovation is largely conditional to the existence of an organizational environment conducive to its development. Innovation in companies is therefore not spontaneous, but rather the result of systematic investment (not necessarily financial) and continuous effort towards it.

In the subject companies – Pack1 and Petro1 – the success of innovation cannot be satisfactorily justified by one or two single factors acting as **innovation promoters.** It may besafely said that, in these companies, no isolated element (culture competencies, resources, and interorganizational interactions) could possibly be effective. However, it became clear during the course of this study that innovative capacity appears with different configurations in different companies, that is, in some corporate environments, it may be more strongly influenced by certain constituent factors and less so by others. In Pack1, for instance, innovative capacity is built mostly upon its **corporate culture and competencies**, while at Petro1 it is built upon **resources and interorganizational networks**.

Innovative capacity at Pack1 is more specifically based on the development of an innovative organizational **culture** and on **competencies** (knowledge), as represented by *Projeto Simplificação*, which involves the participation of operational staff on proposing new ideas, incremental suggestions, and new products. Although it is systematized, the innovation management process appears to be less dependent on a formal organizational structure (product development is not restricted to a single department) and more dependent on (or more stimulated by) innovation-driven management practices, many of them simple, such as **idea boxes.** One such practice is massive employee participation in the idea generation process, allowing innovation to stem from the direct interaction of people from different departments.

A likely explanation, besides management practices adopted, may be a characteristic of the sector Pack1 operates in; a low **technological density** sector, where empirical knowledge of the market and products may be accessible to a greater number of individuals who may then act as **innovators,** contributing competencies without necessarily being employed by a structured, established R&D department or having in-depth technical expertise on the theme. In such a scenario, organizational culture and competency are more important to the promotion of innovation than resources and interorganizational networks.

On the other hand, at Petro1, although organizational culture and competencies are important to innovation, resources and interorganizational networks are more so. Petro1 operated in a medium- to high-tech market segment, and has a structured innovation management process, based on interaction and relationships with clients, suppliers, and research institutions. Unlike Pack1, where innovation may stem from different in-company sources and employees at several departments, the technological complexity and density of Petro1 products and processes would

make spontaneous innovations, not based upon a structured R&D effort, quite unlikely. This would explain the company's tendency of recruiting professionals with a solid background in its target technology areas – specifically, chemical engineers and chemists.

The main sources of ideas for innovation at Petro1 are the company's clients and its R&D process. As there is a structured R&D function, the company's concern with being directly in touch with clients is noticeable. In fact, the company goes beyond product development and also offers services to clients, such as analyses and testing in company laboratories or pilot plants. Another important source of innovation, as well as clients and R&D, is the firm's relationship with universities and research institutions. Contact with academia is paramount for development in the catalyst segment.

An analysis of the results of the empirical study allows one to conclude that the building of innovative capacity can have different meanings in different types of companies that act in market segments featuring different levels of technology. A greater understanding of how the building of innovative capacity occurs across different industry sectors could assist companies in better allocating their resources to leverage their innovative capacity. Future studies are advised ao as to broaden the subject company base to different industry sectors with varied technological densities and different sources of innovation. More precise measurements for evaluating the available indicators of innovative capacity could also be employed for more quantitatively robust studies.

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CAPACIDADE INOVADORA E VANTAGEM COMPETITIVA: UM ESTUDO DE CASO EM EMPRESAS BRASILEIRAS

Resumo

O propósito deste artigo é contribuir para o debate sobre como empresas criam ambientes organizacionais compatíveis com o desenvolvimento de inovações, por meio de sua cultura, recursos, competências e do uso de redes interorganizacionais. Estes fatores, no seu conjunto, são

conhecidos como capacitação inovadora. Para atingir este objetivo, uma revisão bibliográfica é desenvolvida para dar suporte a uma pesquisa exploratória, conduzida na forma de estudos de caso sobre gestão da inovação em duas empresas inovadoras, cada qual em um setor industrial. Uma análise dos resultados dos estudos exploratórios sugere que a construção de uma capacidade inovadora pode ter diferentes significados em diferentes empresas que atuam em mercados com padrões tecnológicos diferenciados. Um melhor entendimento sobre a construção de capacitação inovadora verificada entre diferentes setores industriais ajuda as empresas a melhor alocar seus recursos visando ampliar a capacidade inovadora e, consequentemente, desenvolver uma vantegem competitiva sustentável.

Palavras chave: Capacitação inovadora, redes de inovação, vantagem competitiva.

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