The Role of Informal R&D Activities in the Evaluation of the SMEs
Technological Capability - the Mechanics Industry in Brazil

Thaise Graziadio
NITEC/PPGA/UFRGS - Brasil
thagrazi@vortex.ufrgs.br

Dr. Paulo Antônio Zawislak
NITEC/PPGA/UFRGS - Brasil
paz@vortex.ufrgs.br

Abstract
Technological information management is an efficient tool in the competitive context. It helps firms to find better solutions for productive problems and new business possibilities. Usually, information about product and process innovation is generated and managed by R&D staff. But what about firms that do not have R&D structures? Do they also collect, choose and apply technological information? This paper investigates informal R&D activities in three SMEs of Mechanics Industry in Brazil. Discussing topics as innovation, learning, accumulation of knowledge and skills, technological changes and strategic positioning, we found that informal R&D activities are not continuous, but moved by need of solving problems. Most of new ideas are generated by blue-collar employees, using creativity, experience and knowledge. Research demonstrated the importance of informal R&D activities in technological capability analyses.

1. Introduction
The present competitive context exposes worldwide industrial firms to a very turbulent market, where information about products, processes, suppliers and customers is very worthy. In this sense, technological information helps firms to find better solutions for productive problems and also provides new business opportunities. However, many firms are realizing that besides getting information, they must know how to manage it appropriately. In order to get a high level of adequacy, firms should coordinate their strategic choices and available resources (human, financial and technical). Since technological information must be adequate to firms strategy, the way a firm deals with different types and sources of information reveals its ability in managing technology itself. Because of this, we could say that innovative firms should be more open-minded, fast and aggressive while managing information. On the contrary, this is not essential in adaptive firms, where information flow is slower.

Although different, both strategies are supported by structures that search, test and apply information about products and processes. More innovative firms tend to use organized, scientifically based and continuous structures, usually Research and Development (R&D). However, firms oriented to adaptation does not seem to need formal R&D structures. Besides, one must consider that R&D activities are not available to all firms, mainly the small and medium ones [1,2].

Analyzing industries from point of view of product and history, Pavitt [3] found that sectors using emerging technology need to emphasize innovative efforts, in an active and prolonged searching system. On the contrary, sectors using mature technologies (no radical changes and innovations) would not need to emphasize product innovation, but process improving. In these sectors, again, formal R&D seldom exists. Above aspects may help us to understand why smaller firms of sectors like mechanics do not have R&D labs or specific fund allocation.

However, it should be referred that although their in-use technology is widely known, many of these firms do spend some money in process and product improvements. According to Lefebvre & Lefebvre [1] "even without formal policies on technological innovation, SMEs implicitly emphasize efforts oriented towards the improvements or modification of the technical characteristics of a product (product innovation) or towards the adoption of a new manufacturing process or the introduction of new computer-based technologies (process innovation) (p. 297)".

For Brazilian industry, strongly represented by mature technology sectors, studies about informal R&D activities are very relevant. In order to understand the real technological capability of such firms, one should firstly get closer to their technical needs and choices.

Because of this assumption, the present paper suggests that technological capability could be understood as a cumulative process, based on the
Evolutionary Theory [5]. In this sense, firms’ ability to use, modify and generate technology would be a result of their technological experiences, learning processes and choices. From this point of view, technological information would be generated throughout the firm, including manufacturing, from workers to directors. Taking this into consideration, we try to identify some informal R&D activities, as well as to understand how they are performed in SMEs of the mechanics industry in Brazil. Specifically, we will analyze situations in which firms have to perform any type of research activity. As a way to focus the research activity, we use this context to identify kinds of technological information firms mostly search. Second, we will try to characterize some sources of information, since there is no internal R&D labs or departments. Finally, we will describe how firms manage and apply technological information in order to solve problems or improve their competitive performance.

This paper continues with a review on the literature that will help us to elaborate questions and raise conclusions. We discuss innovation in SMEs, technological changes, learning accumulation and strategic positioning (2). Also, we describe briefly mechanics industry context in Brazil (3). Afterwards, we present the research method (4) and the results (5). Finally we raise some comments on the research (6).

2. Conceptual review

2.1. Innovation and informal R&D in SMEs

Nowadays, a lot of studies have mentioned SMEs context, describing their advantages and problems. This emphasis can be explained by their large representativity in economy or their employing capability. However, when considering R&D fund allocation, SMEs rarely appear in statistical databases and analyses. Such absence may be related to SMEs financial weakness to support scientists, laboratories or people exclusively dedicated to research. Or maybe, some smaller firms do not have the necessity of keeping internal R&D activities, due to the kind of sector they belong.

Trying to understand this situation, some recent studies have paid special attention to the importance of analyzing informal R&D activities. Kleiknecht [2] suggests that formal R&D inquiring is quite restrictive in case of SMEs. According to him, questions should not be limited to number of men dedicated to R&D per year. In his research on OECD countries, Kleiknecht found that if questions were more open, answers would change. Doing so, SMEs would have a more representative participation in statistical analyses.

Let’s assume that when we ask to a small firm if it allocates funds to R&D activities, the answer is no. In our point of view, this negative answer does not mean that firm spend no efforts to try to solve their productive problems. Frequently, solutions imply on the search for information that have to be applied. Even though such efforts are not oriented to radical innovation, they bring positive results to firms.

As a way to study the competitive positioning of SMEs, Lefebvre and Lefebvre [1] suggest alternative analyses for innovative efforts, such as product and process improving. Then, besides taking usual indicators, R&D as a percentage of annual sales, or percentage of firms holding at least one patent., authors included others, like informal R&D activities, patent data bases consulting and computer-based production technologies.

In France, Lhuillery and Templé [6] considered that research activities in SMEs are informally organized, like discontinuous activities happening throughout the whole firm and sometimes even out of the it. Authors attribute these particularities to the technical needs of SMEs, which do not justify the maintenance of R&D labs.

As we see, informal R&D seems to be a reality in most of SMEs, but it is not the same in high tech firms. They have completely different needs, and because of that, should not be inserted in the informal R&D context.

As one can observe, evaluations on SMEs technological capability require an open-minded and creative performance from researchers. At this point, it would be interesting to understand reasons that possibly justify presence of informal R&D in today’s technological context.

2.2. Technological changes and different sectors

A possible explanation for the existence of informal R&D appraisal, is the fact that there is not only one technology, but lots of them. Some of the existing technologies are a result of very recent innovations, while others come from a long time ago. While new technologies still present lots of problems to be solved, the older ones had already enough time to solve all problems. From the point of view of history and economy [4], mechanics industry started in 1840 while recent information and communication technologies date from 1980.

After being developed, technologies start being used by firms. Every single firm that adopts a technology...
will incorporate at least one change to its original version, what may cause either incremental or radical changes. Therefore, technological opportunities differs among industrial groups. According to Dosi, sectors, as well as technologies, “differ in the easiness and scope of technological advances” [7]. As we see, innovative efforts in firms and sectors are much related to demand and adequacy of resources.

This could explains why informal processes of information search are so used among some sectors. Analyzing production and use of innovation, Pavitt [3] identifies four main groups of sectors. From this typology, mechanics is classified as scale-intensive or even specialized suppliers. According to Nelson & Rosenberg [8], “many small firms engage in significant design and development work, yet they do not have a formal designated R&D department or facility; their design and development work may or may not be accounted and reported as R&D” (p.10).

Focusing on the evolutionary though, it is possible to understand reasons why small and medium firms of traditional sectors, as mechanics, count mainly on informal processes of learning and accumulation of technological capability.

### 2.3. Learning accumulation and technological capability

This paper will assume that a firm’s technological capability means the ability to use and modify its own technology and also generate new technologies. In this context, accumulation of knowing and experiences contribute to the increase of such capability. Again, Dosi [7] mentions that “learning is also local and cumulative at the level of individual firms”, and due to this, “one is likely to observe also firm-specific trajectories, involving the cumulative development and exploitation of internalized (and thus private) technological competences” (p.226). This assumption was also mentioned by King [9] who described the indigenous technological capability (ITC) in these terms: “a firm or agency that has ITC is able to carry out preinvestment work, make technology choices, negotiate, purchase, install, maintain, modify, and even diffuse the technology acquired. To carry out these activities, particular individuals in the enterprise will need to have gained certain levels of expertise, through education, training and experience” (p.39 - our bold).

According to this idea of informal learning process, it is important to refer to the different kinds of learning processes proposed by Bell [10], in his study about developing countries. Starting from the conception that learning can be understood as “the acquisition of additional technical skill and knowledge by individuals and, through them, by organizations” (p. 188), the author raised two possible learning processes. Differences are in terms of formality, costs, and orientation.

Firstly, the most “formal” process involves mechanisms such as: system performance feedback, learning by training, hiring and searching. They relate to “any way in which a firm increases its capacity to manage technology and to implement technical change” (p. 189). Formality is more associated to active positioning of the firm, in terms of allocating specific efforts to acquire information and knowledge. They also require expertise consulting and systematic contacts with other firms or institutes that generate technology.

After, but not less important, informal learning processes are presented as learning by doing. This group is the one that deserves most of our attention, since it may bring more effective contribution to our work. According to the author, learning by doing requires less resources allocation, arises passively and is virtually automatic [10]. It is “a process of acquiring skill and knowledge that depends largely or entirely on experience” (p. 188). Basic idea is that production tasks “generates a flow of information and understanding which allows execution to be improved in a subsequent way” (p. 188). Information flow can be driven by searching for solutions or opportunities of improvement. Considering this, we suppose that informal R&D activities involve not only the search for information but also its processing, comprehension and use. While searching is related to research, processing, comprehension and use are related to development. This idea will help us to raise research design.

Concerning to the informal learning, by-doing, Bell [10] suggests two possible processes, which are: operating and changing. Operating consists of a “combination of change-stimuli and increased understanding which enables individuals to improve their own execution of given production tasks” (p. 190); these changes improve firms performance. Changing is associated to capability of understanding and solving technical problems. The accumulation of knowledge and experience improves firms performance and technological capability, since this “extra” knowledge will provide an additional ability to use and modify the existing technology.

Focusing on Brazilian experience, we could suggest another kind of learning, which would be even more “informal” than by-doing. Something like learning “by watching”. In few words, this learning works as a “presentation” of the task to an employee who is not
qualified for such task. Basically, a new employee stays besides another one and observes his performance, until he (the newest employee) shows ability to start doing the work. At this moment, he passes to the process of learning by doing. Although it is difficult to see any advantage in such informality, we should notice that this procedure represents a transference of knowing and experience\(^1\).

This also raises some opportunities of changing opinions about tasks, and because of this, some good ideas may be generated. The relevance of such approach is that particularly in small Brazilian firms, learning is dominantly informal. Very often Brazilian SMEs deals with the problem of non-qualified human resources. Due to the poor quality of ground education and the few number of technical schools, added to financial difficulties in supporting formal and adequate training, this is a very common practice in firms.

The importance of learning in innovative activities performed by Brazilian firms, specially the ones from traditional sectors, was focused by Zawislak in an alternative approach, called Problem Solving Activity [11, 13]. Based on the evolutionary view of technical progress, main idea of ARP is that while firms try to solve productive problems, they accumulate knowledge and experience and improve their technological capability. Moreover, they will be able to change their technical orientation in order to accomplish effective and efficient evolution. As a matter of fact, this is the very objective of formal R&D. The ARP approach allows the deployment of any solving problem function (including formal R&D) into more tangible variables: know-how level (employees knowledge), record level (routine organization), workers participation level (autonomy in routine and no-routine decisions) and learning level (formal and informal processes). The Problem Solving Activity is based on employees participation; every single solution that brings economically positive results to the firm is considered as an incremental innovation.

Another important discussion in innovative activities is centered in the strategic positioning. Due to their goals, firms may be totally turned either to innovation or to adaptation. This is the decision point that will guide firms positioning in relation to a formal or informal R&D choice.

### 2.4. Strategic positioning

This discussion is relevant, since it may explains why and when an informal R&D activity is suitable, or feasible. Moreover, strategic positioning may allow the understanding of how R&D activities leave informality and turn to a more formal context.

Nowadays, many studies have related strategy to technology, mainly concerned with the market segment where firm is situated or other markets that firm wants to access. Since technological information must be adequate to firms strategy, the way a firm deals with different types and sources of information reveals its ability in managing technology itself. At the firm level, main task of the strategic planning seems to be the management of present and future technological sources; it means, the ones a firm has today and others that must be searched to face new technological needs. Therefore, coordinating strategic choices implies in R&D activities (formal and informal), cooperative research and project developing, technology acquisition and learning.

As one could observe, strategy is very closely related to technological choices. Considering this, Freeman [12] suggests six possibilities of the strategic positioning of the firm, taking into consideration market and technology. They are: offensive, defensive, imitative, dependent, traditional and opportunist. These strategies are separated in two main groups:

1. **Innovation and market response** (offensive, defensive and imitative). This group may be identified by some key characteristics, such as: first in the market, follow (closely) the lidar, innovation capability, product innovation, ability to copy and innovate with lower cost. Firms with such strategies should emphasize efforts to increase their technological capability, basically through R&D, formal training and specialization. R&D activities involve specific fund allocation, often use of laboratories, scientists, high specialized equipment, patent consulting and licensing, etc.

2. **Adaptability** (dependent, traditional and opportunist): Very often among Brazilian firms, this group can be defined by: technological dependency, easiness to adapt and improve process technology, incremental changes in products, flexibility, capability to keep on market. Due to their technological needs, these firms dedicate efforts on processes and material adaptability. Here, training may be formal or informal. R&D activities seem to be eventual, more related to particular situation (as one problem solving) and tend to informalism.

Having seen the differences between two groups, one can observe that depending on the firms objective, it may become more or less innovative or adaptive. Not so often, however, and much more hard, it would be to move from an adaptive positioning to a very innovative one.

---

\(^1\) Authors have focused this category of learning in studies with small and medium firms in Rio Grande do Sul.
Different strategies are supported by structures that search, test and apply information about products and processes. More innovative firms tend to use organized, scientifically based and continuous structures, usually Research and Development (R&D). However, firms oriented to adaptation do not seem to need formal R&D structures. Besides, one must consider that R&D activities are not available to all firms, mainly the small and medium ones [1,2]. Based on this discussion, we consider that informal R&D activities are oriented to smaller firms in traditional sectors that have chosen adaptive strategies. In these cases, main functions of informal R&D activities consists of collecting, processing and applying information, as a way to solve any kind of productive problem.

At this point, the paper will specially refer to the mechanics industry, where research was conducted.

3. Mechanics industry in Brazil

In this paper, mechanics sector will be referred as a group of tools, machines and equipment. In order to understand the actual situation of mechanics industry in Brazil, we will mention some considerations proposed by Coutinho and Ferraz [13] in their large analysis about the competitiveness of Brazilian industry.

First of all, it is important to assume that since 1950, general Brazilian industry was mostly dedicated to import activities and adaptation of technologies (strategic positioning turned to adaptability). Because of this, reverse engineering was a common practice among firms, which demonstrated capability of incremental innovation. As electronic technologies became diffused in international market, firms had to turn to patents and licensing of products.

However, small and medium firms were not able to follow this tendency. As a result, they still find difficulties on establishing good licensing contracts, basically because they seldom have access to foreign firms developing new technologies. The authors also believe that while micro-electronic technology becomes diffused among most of machines, such firms could take back their technological trajectory.

According to this sectors study, mechanics was considered as *diffuser of technical progress*, in the sense that machines may transfer technological knowing to other industries. However, authors assume that mechanics’ actual situation is not of competitive positioning. In fact, since an economic crisis initiated 1980 in Brazil, mechanics is facing serious problems. As investment rates have decreased, domestic market also reduced, and a large idleness in productive capability has emerged. Then, firms tended to diversify their products, what cannot be considered an advantage, since it just tries to solve the problem of declining sales in large productive capability. Besides, the whole sector presents heterogeneous aspects:

- Products are manufactured both in a standard way and by-order. Production in scope requires more capability on projects developing and closer contacts to clients, while scale emphasizes process improving to be price competitive.
- Some products use mainly electric-mechanics based technologies. Others integrate electronics to mechanics, which configures the manufacturing equipment of electronic automation - a new technological paradigm.
- Firms are not homogeneous in size and dominant capital. Due to this, they differ very much in production, technical and management capability.

4. Method

According to the research proposal, that is to identify informal R&D activities in SMEs, and as we do not know exactly which they are, the nature of this research is exploratory. The method can be configured as an empirical study, since the results were field-based.

Research was conducted with three SMEs of the mechanics sector; all of them are situated in Rio Grande do Sul, Brazil. Firms have from 20 to 200 employees; and produce equipment, tools and machines to automotive industry. Firms sales are exclusively by order, mainly oriented to internal market. No firm is associated to international firms. Directors, who are also the owners, participate very closely from production, sales and marketing. Although they make most of the decisions, employees have informal ways of participating, in different levels of participation.

Firms use both universal and numerical control machines in the production; computers are predominantly used in administrative tasks. Only of the firms have specialized equipment to test and measure pieces in detail, which is used in quality control. Another firm produces equipment that aggregate electronic components.

Due to their technical abilities, firms tend to developed some tools for their own use. They try to employ qualified people, with technician certificates, but they also use internal training such as by watching, doing and operating.

• Data was collected during interviews, with directors. Based on the literature review, the research instrument considered that informal R&D activities are oriented to process changes, basically by the evidence
of problematic situations. Therefore, in order to contextualize firms answers, we have defined three possible situations which could lead firms to introduce any changes in their routine procedures:

- **Situation A: Improving Products**
- **Situation B: Improving Processes**
- **Situation C: Solving Problems in Processes**

After, we concentrated to the assumption that informal R&D activities involve not only the search for information, but also its processing, comprehension and use. Then, we raised three specific questions that would guide our interviews.

1. **What kind of information would you search?**
2. **Where would you look for the information?**
3. **What would you do after having the information?**

Each one of the question above was applied to situations A, B and C. Directors were supposed to tell how their firms would react in a determinate situation (A,B,C). With this research design we try to identify the types, sources and appliances of technological information that characterizes informal R&D activities in these firms.

### 5. Results

Due to the nature and method of the research, its results are not expected to be conclusive; no statistical analyses will be performed. On the contrary, we intend to study firms context and detect activities which could be related to informal R&D activities. As research objectives did not involve any kind of measurement, results are not organized in levels of informality. All answers were transcript, no matter they have been given by one or more respondents.

#### 5.1 Products improvement

A1) In case you have to improve any of your products, **what kind of information you would search?**

Firms gave three possible answers for this question. First, they study the possibility of changing any detail in product, as a design or technical feature. Second, they investigate other materials that could provide better results. Third, they try to know if solution may be raised by changing any step of the process. This last answer drive us to the situation dedicated to process improvements which is described bellow in letter B.

A2) In case you have to improve any of your products, **where would you search?**

The sources of information that are mostly used are: material suppliers, clients, tools and equipment suppliers. Firms also consult technical guides, magazines and books that are kept among their records. This material is collected in courses, fairs, meetings, specialized libraries, or directly to other firms. In some cases, external advice is searched, in institutes that tests material specifications and also with new suppliers. In many times firms make use of their internal knowledge and creativity.

A3) In case you have to improve any of your products, **what would you do after having the information?**

With some information that may provide a change in the product, firms have to decide if they will apply it (or not).

Decision may be made in group meetings; with the help of external institutes; by the use of a descriptive planning or informally, like simply talking. Having made the decision, next step is to communicate clients about the content of the changes, which is done in formal and informal meetings, depending on the situation.

In firms that produce by-order, changes in products are usually caused by clients needs. Firms tell that sometimes a project have to be modified during its development (they considered as a product change).

From the point of view of technological sources, clients use to be more formally structured, in terms of engineering activities and data base consulting. Therefore, firms use their cumulative knowledge and also collect information with clients.

#### 5.2. Process improving

B1) In case you have to improve any process, **what kind of information you would search?**

Firstly firms search for process information, such as the need of an incremental or radical change and the internal feasibility to promote the improvement. Second they investigate the adequacy of the existing equipment and try to discover new and better equipment. Some of the most “urgent” information were *prices* and *payment forms*.

The decision: buy or develop? Finally firms investigate their personal capability to promote changes. Here it is important to evaluate the need of knowledge and experience and estimates if firm have this internal capability. If not, it will have to provide external training.

B2) In case you have to improve any process, **where would you search?**
Again, mostly mentioned sources of information were suppliers, external advice (engineering consulting), technical services, besides internal people. Firms use to collect technological information in national fairs and eventually in international fairs (specially Hannover and Tokyo). Other forms are the meetings, courses and events organized by sector associations. These are opportunities of changing experience and knowledge, as well as getting in contact to other suppliers. Concerning to the acquisition of machines, firms referred to the national financing organizations or private banks.

B3) In case you have to improve any process, what would you do after having the information?

When changes are incremental, they use to apply information informally, in group meetings. When it is radical, like a machine acquisition, it involves more formal planning. In order to made the decision, firms may do internally or with external help (technicians and engineers).

In SMEs many of the process improvements are results from ideas generated by blue-collar employees in plan floor, and may be developed together with technicians. In this sense, one of them illustrate a particular example of the Problem Solving Activity as proposed by Zawislak [11]. According to a client order, firm X produced a very detailed machine component. The industrial director had to participate to the project development and it took three days for an employee to produce the component. Product was delivered, and after a week, client ordered more five components. Here firms faced a problem, because although they wanted to accept the order, it would not be profitable. Main reason for that was the long time of the production process. Then, director, operator and supervisor studied the whole process, in order to try to optimize and reduce manufacturing time. The best idea was raised by the operator, and represented a reduce of one day in process time. In order to apply the idea, firm also searched for information in its tool supplier. The idea raised by the operator allowed firm to accept that and next orders, with their usual profit margin. Operator was financially rewarded and this idea was incorporated in other processes.

It is not an eventual case in SMEs context. In fact, these firms try hard to satisfy their clients needs. Although they try to plan budget, problems do happen (as seen before). Maybe this is related to a reactive strategic positioning, that involves all firm proceedings. However, when firm X realized that it had no conditions to confirm that order, it could count on internal knowledge and mechanisms to find a solution. This uses to be a very often situation in SMEs, and could illustrate an example of informal R&D activity.

5.3. Solving problems in processes

Problematic situations occur in all firms, and the way a firm deals with its problems may show how it manage technology itself. Usual problems are related to inadequate material, human labor, error or break in equipment. In these cases, firms try to find solutions in their storage of knowing and experience. In order to share ideas, group meetings are very often. Most organized firms tend to have internal mechanisms to avoid and prevent problems/errors. They may be described in forms, manuals or in tacit proceedings. These last ones involve mechanisms of suggestion, employees participation on profits, better wages and financial rewarding.

C1) In case you have to solve a problem in a process, what kind of information you would search?

Firstly firms try to understand the situation, which means that they will investigate possible causes for the problem.

Also, they look for information about the solution applying, such as the existing resources and the necessary ones.

C2) In case you have to solve a problem in a process, where would you search?

Firstly firms mentioned their internal experience and knowledge, records like manuals, forms, manufacturing cards, project designs and also the use of literary material collected in fairs, trips, visits to other firms. External advice from engineering firms is usually maintained; but help from research institutes is rare. Considering external advice, in Brazil there are some organizations that can provide technical information to SMEs, in terms of fast solutions. One of the problems of SMEs, is their financial weakness to hire professional services from engineering firms. Another, is that when they have a problem, they need the solution with extreme urgency (it is a general characteristic of private firms). Because of all this, some SMEs prefer to use resources that are closer to them. However, one should mention that searching for specialized information is an increasing tendency in Brazil.

Some Brazilian Universities have worried about the urgency that characterizes private firms need. Concerning to that, there are several studies been developed about the relationship between Universities and firms. One of this actions is the Disque-Tecnologia (call for technology), a service from Universidade do Estado de São Paulo (USP) that allows a first contact by telephone, when firms’ problems are exposed. Some cases involve fast information, others are more
complex. Depending on the firm’s need, other services, as laboratories, are provided.

A second example is a initiative created in some colleges, such as FEA/USP, IE/UNICAMP, POLI/USP, FGV and Mauá. These institutions created the UNIEMP project, that is an effort to keep closer communication to private firms. Besides this, UNIEMP proposes to incorporate more technological knowledge in private firms and identify technological demands and necessities. Some of the observed demands are human sources capability, suppliers qualifying and food engineering. From the point of view of private firms, these demands seem to be eventual, directed to specific objectives (mainly problems in products and processes), and closely related to engineering, what might could explain the nature of informal R&D activities.

All over the country one can observe this “new” tendency or preoccupation. Through these initiatives, Brazilian Universities are trying to drive their research efforts in the direction of main priorities of the national industry. Moreover, these projects allow that researchers play one more role in Brazilian society, that is: to participate from the transference of technical and technological knowledge among firms and Universities. In this relationship, technicians, businessmen and researchers seem to learn a lot.

C3) In case you have to solve a problem in a process, what would you do after having the information?

After problem is understood, firms evaluate their internal capability of solving it. For this, it is necessary to actually know each strong and weak point of the organization. A mistake in evaluation may be very expensive. They decide if will develop or buy the “solution” and plan its appliance in formal projects or even informally. In some cases, solutions are registered in files or projects; in others, solution stays with “personal data basis”.

6. Final comments

After having analyzed firms answers, we may raise some final comments. It is important to assume, however, that such comments are applicable only to these cases. As it was conducted with a small number of firms, research results may not be generalized. In this sense, other studies could analyze these findings in a larger number of firms.

As one could observe, informal R&D activities are neither continuous nor generalist, and varies in time and intensity. They seem to involve the solution of a specific problem or improvement of situation. In a sense, it may be related to what Dosi [7] considers an evolutionary assumption of the innovative process: “innovative activities are strongly selective, finalized in rather precise directions, often cumulative activities” (p. 225).

Because of this, informal R&D activities are directly related to the amount of knowledge a firm already owns. Moreover, it is based on the ability demonstrated by firms while exploring their knowledge and experiences. As Dosi [7] assumed, “technological and organizational changes in each firm are cumulative processes, too. What the firm can hope to do technologically in the future is heavily constrained by what it has been capable of doing in the past” (p. 225).

In an informal level, R&D activities do not occur in specific places and departments. In fact, there is no room or department whose door signalizes: Informal R&D Area. Commonly, such activity is performed in manufacturing, engineering, marketing and sales. Any person who can contribute to the situation takes part of the process, which can be more or less structured.

Mechanisms of information searching and decision making are quite abstract, not systematically organized and difficult to evaluate. In general, one may have the impression that, when necessary, firms have “invisible” manuals which provide instructions and adequate proceedings. This must be related to the cumulative learning, that is not easy to visualize, but certainly exists. However, some mechanisms are partially formalized, through the use of manuals for project developing, planning and problems preventing.

Occurrence of informal R&D activities seem to depend on the necessity of firms, which may be associated to the orientation of the firms strategic positioning. Mechanics industry, specially SMEs are more turned to adaptability than to innovation. In a way, informal activities take place after a problem or need of change is detected. Due to this, it may be considered a reactive mechanism. A firm that decides to increase its efforts in a radically innovative positioning, would probably have to “formalize” its R&D activities. This would involve more fund allocation to organize informal R&D, through continuous contact with researching institutes, data bases consulting, contracting technicians and engineers, etc.

When internal, informal R&D activities are predominantly (but not exclusively) related to blue-collar employees. As research process is developed according to specific situations, it seems that to each time, a group of different people participates of the activity, although directors use to be always present. Just as the Problem Solving Activity suggests,
usually, news ideas are raised internally, and firms use their own resources to develop them. In fact, it is a result of a coordinated activity in which any person who may contributes is likely to participate.

Trying to summarize all these considerations, and based on the research findings, we could say that informal research and development activities involve a coordination of several proceedings and mechanisms, such as:

- consulting, keeping informal contacts and visiting clients, tool suppliers, equipment suppliers, material suppliers and other plants;
- collecting information from sector guides, folders, specialized magazines, books;
- using ideas from internal people, group meetings, experience of own employees;
- using internal paper such as manuals, manufacturing cards, forms, designs, etc.;
- participating of meeting, associations, sector events, fairs (national and international);
- consulting engineering firms, data bases, experts and institutes; and
- hiring external advice and training support, such as the new services offered by Universities.

From this point of view, one could say that informal R&D activities help SMEs in the search of adequate solutions. However, it does not mean that informal R&D can solve all problems that happens to SMEs. What is apparently evident, is that informal R&D activities, considering whole process of searching for information and managing it, plays a relevant role in SMEs technological capability, since it functions as an “invisible consulting guide” that provides adequate orientation.

We believe that this results should be useful in other studies, specially those dealing with the strategic planning in traditional sectors. As they rarely allocate spending to R&D, common indicators are not feasible to them. In this sense, our results would guide firms in the analyze of their adequacy level between strategic goals and spending with R&D activities.

7. References