"The innovation Surveys in Latin America: Results and methodological novelties"[1].

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THEME: G: Measuring knowledge and other intangibles

1. INTRODUCTION

This work aims to provide new elements for the debate about the conceptual and methodological lines that guide the execution of innovation surveys. This debate has gained growing importance as a result of the current process for the revision of the Oslo Manual, though its validity is, undoubtedly, permanent.

In the first place, we refer to the measurement of the enterprises' capabilities to face the innovation process, and their efforts to increase them, including their capabilities for linkage. In the second place, we consider the treatment to be given to organizational change and non-technological innovations in the innovation surveys.

Finally, with the basis of these commentaries, we suggest some changes on the usually adopted modality for the approach to the efforts and actions performed by firms (Innovation Activities) and the results obtained by them (Innovations).

The conceptual issues presented in this work have been enriched by empiric verification. Many of the suggestions have been applied in the questionnaires of several of the latest innovation surveys

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performed in Latin America. In this sense, it is worth to stand out the results obtained by RICYT[1] in the cases of Uruguay and Argentina.

This work seeks to continue and look deeper into the conceptual developments expressed in the Bogotá Manual, which has resulted to be a valuable point of reference for the understanding and measurement of the innovation process in Latin America.

Other sources of important comments and contributions have been the interchanges between experts from South America in the framework of the "Methodological Study about the Innovation Survey to Enterprises", executed as a part of the EU/MERCOSUR/Chile Project for Statistical Cooperation, carried out during 2002.

2. RECONSIDERING THE THEORETICAL FRAMEWORK WHAT'S THE AIM OF INNOVATION SURVEYS?

The measurement of innovation is required and justified by various reasons; the most important of them (mainly in countries with a smaller relative development) is that it can provide useful criteria and elements for the decision-making for public policies and enterprises strategies in the field of generation, spreading, appropriation and use of new knowledge for the production and commerce of goods and services.

As long as knowledge increasingly becomes the edge of economic activity, we are moving closer to the notion of "knowledge society", this might allow:

- Making a better use of natural resources, and improve their presentation.
- More qualified human resources.

On these bases, innovation would prevail over other sources of competitiveness, providing genuine, sustainable and accumulative advantages.

> The notion of genuine advantages refers to achieving competitive advantages from knowledge accumulation, skills development and taking advantage of capabilities (natural or acquired), which allows the firms and then, the countries, stand over their competitors, in opposition to those advantages (called "spurious" by Fernando Fajnzlber, 1988) based on low salaries, currency depreciation, subsidies, or other variants. Sustainable advantages are those that even depending on natural resources exploitation, don't imply their deterioration, neither the environment pollution, thanks to the use of "clean technologies" or to an environment management oriented to resources preservation (R, Sutcliffe, 1995). Moreover, the notion of "sustainable" refers to competitive advantages that might no fade easily if sudden changes on institutional or market conditions occur, because they don't depend on immediately relevant circumstances but on attributes that the firms have been able to develop. At last, the notion of "accumulative" advantages refers to the conditioning role played by the "path dependency", that comprises firms technological behavior and the creation of dynamic economies of scale related to learning processes and technological improvement (Ocampo, J. A., 1991).

1 Ibero American Network of Science and Technology Indicators (CYTED Program). Web site: www.ricyt.edu.ar.

A growing number of firms trying to increase their level of competitiveness through a better knowledge management, tends to turn, at national level, into improvements on income and income distribution. As a matter of fact, genuine improvements on competitiveness are favorable to:

- generating positive spillovers to the rest of the economy;
- increase of productivity;
- larger growth rates, thanks to the access to more dynamic markets, related to differentiated goods;
- more employment creation –and better qualified jobs-, which generates higher salaries;

DO INNOVATION SURVEYS PROVIDE USEFUL POLICY MAKING CRITERIA?

Knowledge generation and development are usually measured through inputs, whereas knowledge application is measured through the output (results). Nevertheless, centering the analysis on innovation results (object approach) might have little practical implications, might even lead us to erroneous conclusions. Since long ago, RICYT and Grupo Redes have been underlying the importance of analyzing innovation processes rather than results (Bogotá Manual). This means emphasizing firms efforts in order to produce innovations, and with the aim of increasing and improving their human and material capabilities to generate, develop, adapt and put into practice new knowledge.

The Argentina Second Innovation Survey (Segunda Encuesta Argentina de Innovación -1998/2001) shows different data depending on which of these two aspects the approach is centered. The number of TPP innovative firms provided by the survey is very high (56%) in comparison to international parameters. Nevertheless Argentina production and trade structures, directed towards commodities and low-tech products, proves that that significant proportion of innovative firms has not turned into outstanding capabilities to compete in knowledge intensive activities.

Possibly, the clue of this paradox lies on the quality of the innovations introduced, which might be very difficult to appreciate or determine. Nevertheless, the analysis of Innovation Activities (IA) carried out by argentine manufacturer firms provides important evidence in relation to firms accumulated capabilities and their improvement path.

As a matter of fact, there are to negative aspects that arise up form that analysis: low level and unbalanced expenditure. The expenditure on IA (which includes R&D) expressed as a percentage of turnovers represented 2.05% in 1998, and 1.64% in 2001, while European average for 2001 was 3.7%. Using a calculation methodology similar to the one used in Argentina, Uruguay IA expenditure as a percentage of turnovers represented 2.9% for 1998-2000 period. In Brasil the group of firms related to extractive and manufacturer activities invested IA 3.8% of year 2000 turnovers.

In the same way, Argentina R&D expenditure as a percentage of turnovers was 0.19% in 1998, and 0.26% in 2001. Even though these values exceed the ones showed by Mexico (0.13%), Turkey (0.18%), Greece (0.22%) and Portugal (0.25%), they are far below from the ones showed by the European Union (1.61%) and the OECD average (1.89%) (OECD STI Scoreboard 2001).

In fact, the efforts directed to improve technological and organizational capabilities during 1998-2001 period, have been strongly focused on Acquisition of Embodied Technology (71% of IA expenditure), avoiding other sources of knowledge and capabilities development. This lack of balance in the IA, risks the development of endogenous capabilities, which are indispensable in order to get the maximum advantage out of the efforts made.

Other representative data provided by the survey are those related to the incorporation process of

the tools provided by the new Information and Communication Technologies (ICTs). In this respect we can observe a rapid and intense process of ICTs diffusion among the argentine firms (similar or superior to the one observed in Europe and the United States), but with low quality tools incorporation and showing a scarce use of them.

Another element of the negative picture is related to the very low level of linkage between the firms and the rest of the agents that belong to the National Innovation System (NIS), particularly with universities and other elements of the scientific system.

Argentina's firms poor performance in respect to IA, ICTs and links, might let us infer that argentine industry evolving in the direction that we've pointed as desirable. This underlines the importance of innovations surveys capability to provide criteria to evaluate the quality of innovation processes, and the learning and development path on which the firms are walking.

CAN SURVEYS BE USEFUL TO EVALUATE INNOVATION QUALITY?

Three aspects seem to stand out when we focus on innovative process quality: innovation scope, significance, and direction. The chances provided by the surveys, of making an approach focusing on these three different aspects are uneven. On one side, the introduction of questions distinguishing between novelties for the firm, for the local market and for the international market, gives a quite acceptable treatment to the scope of introduced innovations. On the other side, innovations significance, which refers to the difference between radical changes and incremental changes, is not satisfactorily covered, and the help given by the questions on applied and obtained patents is clearly insufficient.

The innovation process direction or course, which is the most important mentioned aspect, is very hard to detect through innovation surveys, specially if data collection doesn't emphasize the inquiry about the firms learning path, given that answers to questions on matters such as new products participation in total turnovers, let us know very little about the course.

If we are trying to strengthen the transit towards Knowledge Economy, firms learning paths are exactly where innovation support policies should be oriented to.

In other words, if we want the firms to direct public policies and instruments appropriately, and focusing on more participation of Latin American economies in knowledge intensive goods markets, then innovation surveys emphasis should be focused on measuring firms capabilities to innovate and their effort to increase them, including their linking capability.

CAPABILITIES STRATEGIC IMPORTANCE

The innovation capabilities shown by an enterprise are the tacit consequence of a permanent conciliation between two dimensions. In the one hand, there are the opportunities (or the requirements) detected by the enterprise's strategic direction. In the other hand, there are the capabilities available for the enterprise to benefit from them.

Along its activities, the enterprise permanently "reads" markets in which it plays, both domestically and internationally, trying to take a picture of their situation and their possible evolution in the future. That reading includes, specially, an evaluation of the characteristics and preferences of the current and potential customers, and an estimation of the possible development of its competitors. In addition, an analysis of the general context in which the enterprise acts or intends to act

(macroeconomic situation, international commercial relationships, etc.) can't be dodged, neither an analysis of the normative and institutional aspects that condition or affect its action.

The enterprise must interpret all the signs collected and define how to better situate, and to which direction it must move for sustaining its achievements or for advancing to new goals. Then it could appear both detected weaknesses (of whose resolution depends that the current positions could be maintained) and opportunities perceived as promising for the achievement of new and better results.

Both the resolution of the detected weaknesses and the exploitation of perceived opportunities or potentialities require building strategies (or action lines) for the introduction of changes, improvements and/or innovations to redefine products offered by the enterprise or the ways of their production or commercialization.

These guidelines construction will be, however, unavoidably conditioned by the firm's available capabilities (or those that are possible to obtain) in the terms and ways required for its efficient implementation. That is the cause of the strategic value that these capabilities acquire for the definition of the enterprise's innovative possibilities and, consequently, the importance of obtaining data from them when analyzing the innovation processes. Between these capabilities, the knowledge accumulated by the enterprise has a core place, as well as their possibilities for the acquisition and use of new knowledge.

So, we are facing the problem of how to measure not just the stock (knowledge, capabilities, etc.), but the processes and flows. The identification and valuation of those capabilities could be assimilated to the measurement of stocks, whereas the dynamic component could be given by the identification and quantification of some activities related to circulation, interchange and creation of knowledge.

However, how to measure the intellectual capital? How to quantify and valuate knowledge? A great part of knowledge is not codified, but it is stored in the individuals' minds. It isn't easy to find reliable data from the enterprises about the interchange of knowledge with other agents or organizations.

For this purpose there is usually used the measurement of knowledge inputs and codified knowledge flows, such as R&D expenditure, engineers and technicians employment or acquisition of capital embodied and disembodied technology. However, there are at least two dimensions that require special attention. In the one hand, the incorporation to the firm of instruments provided by the new Information and Communication Technologies (ICTs) which show to have a significant capability to innovation and technological change in enterprises and in the whole economy. In the other hand, the knowledge distribution networks, since knowledge spreading is recognized as such important as knowledge creation itself.

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS)

To take advantage from the opportunities provided by ICTs require: (1) new capabilities and skills, as well as (2) performing some activities, and (3) deliberate efforts for overcoming various obstacles. In this sense, it could be stated that the new capabilities involve technical, economical and social (cultural) feasibility for the access to ICTs, as well as the skills and necessary knowledge to correctly use instruments and resources that make possible the exploitation of new technologies.

Since long ago, the analysis of the firm's actions and efforts in the search of the introduction of innovations (Innovation Activities) has assigned an specific chapter to the incorporation of machineries

and equipments (acquisition of embodied technology) that constitute a novelty for the enterprise, considering that the capital goods have the characteristic of being spreaders of technological progress. Moreover, the acquisition of new equipments involves, usually, to perform other associated efforts, such as personnel training and changes in the organization of production.

In the same way, the incorporation of ICTs to a firm could spark off a series of adaptations and processes that could lead to improvements in performance that go beyond those directly related to the fact of having a new equipment or instrument. In the first place, it requires concrete efforts oriented to furnish personnel with skills and knowledge required to correctly operate and benefit from the possibilities provided by ICTs, which promote processes of learning and training into the enterprise. In the second place, the systematic use of these instruments opens new perspectives of learning and improvements in the available capabilities, in a circular and accumulative process.

At the same time, the innovation activities usually named as "organizational change" acquire special importance in this stage of the spreading of ICTs, as the creativity and pertinence with which the organization's structures are redesigned will determine, in a high degree, the firms' capability to assimilate ICTs and to translate their potential to genuine improvements on their performance. Indeed, ICTs promote changes not just in the organization of production, but also in the administrative and commercial organization, and they are generating possibilities for achieving important improvements on processes and products, from a better coordination of the complex group of activities executed by an enterprise.

In an opposite way, ICTs maximize their advantages and potentialities if their incorporation is accompanied by efforts for organizational change and training, such as the adoption of new strategies, new managerial processes, new organizational structures and improvements in workers' capabilities.

ICTs also affect positively the rest of the innovation activities. Since they represent a paradigmatic change in the ways of processing, storing and spreading information, they imply an important series of opportunities for the execution of the internal and external R&D activities; for the exploitation of licenses, patents and marks; for the transference of technology and services of consulting; for the tasks of industrial design, products and processes engineering, and maintaining and working of the plants; besides what was already mentioned with reference to changes in organization, commercialization and training.

The incorporation of ICTs to commercialization and supplying also seems to be a source of important improvements in the firms' performance, as a result of new commercial relationships. The changes in this processes, which have generated the "business to consumer" (b2c) and the "business to business" (b2b), are more evident each day. In a similar way, there are new possibilities for training given by the "e-learning", both by reducing costs of transport for personnel or for professionals in charge of the courses, and by the use of instruments of simulation, essential for the learning and development of capabilities till now reduced by the expensive "learning by doing".

Likewise, and perhaps even more important, ICTs are promoting an incipient circulation of tacit knowledge, thanks to the possibilities of fluid interaction that they are generating. Undoubtedly, by reducing costs of transaction, ICTs have opened a new stage in the definition of the enterprise's limits. Since these technologies have redefined the idea of distance, the same logic applied to the firm's internal systems of interchange and interaction could be also applied to build networks in the scale of the productive net and even in a global scale.

NETWORKING FOR INNOVATION

It is known that innovation is a social and interactive process. It is also known that the products and processes obsolescence is becoming faster and that the complexity of the required technologies is growing up, and this is the reason of the high costs and risks associated to these efforts.

In this sense, both cooperation between organizations and networking reduce uncertainty and allow to share risks and costs. This leads to generate a fluid flow of knowledge between organizations, and cause changes in the relationship between technical progress, innovation and growth. The innovation activities performed in contexts where these networks or interchange and interaction systems have been established are positively influenced, which allows to expect bigger and better results.

For this reasons, it is usual that the innovation surveys include questions to firms referred to cooperation agreements signed with other agents of the Innovation System, seeking to jointly develop new knowledge or new applications for knowledge previously acquired. By this way, it is expected to get data which reflect the firm's disposition to link and not to act separately in the field of innovation, as well as signs of the System's strength or density of its net.

In Latin America, the results of this inquires use to be very poor, both for the short number of answers and for the few linkages reported. This is congruent with the extreme weakness of the nets that characterizes our Innovation Systems. Thus, the implementation of actions oriented to foster a bigger disposition of associability and linkage between agents constitutes one of the priorities to be fulfilled by the science and technology policies in our countries.

With the aim of obtaining evidences for a better design of these policies, it becomes relevant to collect data not limited to formal cooperation agreements, but including the multiple and different possibilities of interaction of the agents. This information would be useful for exploring incipient channels of linkage (seeking to strengthen or reinforce them), as well as for detecting those not usually approached by firms, aiming to revert the situation.

ORGANIZATIONAL CHANGE IMPORTANCE AND SPECIFICITY, AND NON TECHNOLOGICAL INNOVATIONS (NTIS)

Innovation activities container in the "organizational change" term acquire special importance in this stage of TICs difusion, provided that creativity and appropriateness involved in the redesign of organizative structures will be an important determinant of the firms ability to assimilate TICs and translate their potential into genuine performaces improvements. As a matter of fact, TICs generate changes not only on the sphere of production organization, but also on the sphere of administrative and commercial organization, and are opening chances for substantial improvements on products and processes, because of a better coordination in the complex set of activities developed inside each firm.

Oslo Manual (OM), which is an unavoidable reference for innovations processes matters and methodological guidelines for measuring OECD countries exercises, sets two main innovations categories: technological, and non technological innovations.

According to the OM, the first category includes those innovations related to new products or processes, or to significant improvements on these: TPP innovations[2]; so, this kind of innovations

2 TPP innovations: Technological product and process innovations.

appears in the products new features, or in the new way to manufacture existent products.

The adoption of this approach has been very often accompanied by a bias. OM might not be responsible for this deviation. As a matter of fact, most of the international innovation measuring exercises (particularly, those that put into practice the EUROSTAT CIS, or similar forms based on it) center the survey's focus of attention on asking questions about new or improved products and processes introduced. And only when they have those answers they start inquiring about the amounts of investments and expenditures for the different activities related to their developments, the obstacles they faced, the sources of information used, and the impact on the different matters that influence the firm's performance.

Non-Technological innovations (NTIs) on their side are defined by the opposite: those innovations that cannot be considered TPPs, are NTIs. This category is mainly made up of institutional, management, and strategic changes. Even though the OM underlines several times the importance of NTIs for the economical performance of the firm, it warns that measuring NTIs is difficult and imprecise, and so it recommends that as long as we don't have better chances and knowledge to quantify their economic impact, attention should be focused on measuring TPP innovations.

It might be advisable to anticipate a possible confusion between organizational innovation and technological innovation of process. According to the OM, a technological innovation of process occurs when a new or significantly improved production or distribution method is adopted, with the aim of manufacturing new products or improving the efficiency of existent products production and/or distribution. The adoption of new production or distribution methods, or the improvement of the already existent ones, might require equipment or production organization changes, and so, these actions are also part of the process innovations.

Provisionally, this definition might lead us to concluding that organizational innovation is just a part of the technological innovation of the process. This could be considered correct if production were the only relevant process for the firm, understanding production as the physical transformation of raw material and inputs. But otherwise, if we understand the firm as an organization where multiple processes are developed, we will be able to prove that such equivalence is unacceptable. As a matter of fact, many organizational changes are not epicentered in input transformation methods, in stead; they consist in looking for a better articulation among the different areas of the firm. The importance of this factor in terms of impact on performance is increasingly recognized in specialized literature.

This also seems to be the way the Australian Bureau o Statistics (ABS) understands the subject. The ABS suggests three kinds of organizational innovations that are independent from the productive process: a) advanced management techniques implementation, b) introduction of significant changes on the organizational structure, c) implementation of new or significantly improved firm strategy orientation.

As the OM suggests, the most convenient way to include NTIs in innovation surveys matter of study of is to take advantage of the experience that comes up from the exercises, and to practice some pilot runs.

Under RICYT sphere of activities, several information collection exercises focused on innovation process developed by industrial firms have been done. These exercises have taken place in Latin American countries under economic and social contexts that force the firms to being more active in terms of adaptation and incremental innovation, and less active in terms of radical innovations (Bogotá Manual). The absorption (or incorporation or assimilation) process for new technologies, many of them incorporated in equipment and machinery, requires significant organizational changes,

even more or deeper changes that in the case of industrialized countries, provided that in many cases (in Latin America) there are technologies from different generations, origins, and with different levels of performance, coexisting in the same production line. Besides, the business environment is recurrently affected by abrupt and deep changes that force the firms to reconsidering quickly and radically their strategy.

In less developed countries, the sum of these factors probably determines that the firms capability to make significant changes in their organizational structures and in their management routines, play a more significant role than in does in developed countries. This represents a strong incentive for the Latin American information collection exercises related to firms innovation, in order to consider these aspects that in other contexts might be avoided. The peculiarities of the innovation process in Latin America turn the collection of organizational change and innovative capabilities data into a prior matter, reaching the same level of importance as inquiring about technological innovations on products and processes.

Then, it's necessary to resolve the problem of how to deal with organizational change in the innovation surveys, and in particular, to determine when achievements related to this matter can be considered as technological innovations. The decision to be taken in this respect can cause specific practical effects, because the construction of innovative firms indicator and its comparability depend on it. Especially if, as it seems to be appropriate, the definition suggested by the OM is used, because according to it, an innovative firm is the one that has introduced TPP innovations into the market.

On the other hand, and opposite to what the OM suggests, we agree with the opinion that organizational change matters and NTIs should be entirely incorporated into the innovation surveys main interest, including them in the group of questions related to Innovation Activities and in the group related to Results (innovations introduced). However, activities and results of the referred projects or TPP innovations on these matters should be measured separately in order not to affect the possibility of international comparison between the resulting indicators.

THE NECESSARY DISTINCTION BETWEEN CHANGES IN PRODUCTION ORGANIZATION AND NON TECHNOLOGICAL INNOVATIONS

In line with the Australian Bureau of Statistics (ABS) , we can consider can consider there are non technological innovations (NTIs) when some of the following matters can be verified:

- The implementation of new management routines or, more usually, when the existent ones are substancially modified
- Changes in formal structures or changes in the relationships that regulate the different activities envolved by the firms business.
- Significant modifications on the firm's strategy orientation.

a. Management

Unlike the ABS proposal, we've preferred to use the notion of modifications on "management routines" better than the introduction of "new techniques". We believe that the idea of "new techniques"

might lead to understanding that theses changes are the result of the adoption of a new management approach by the firm, based on notions from business schools. With little exemptions, habits or procedures related to the way in which firm resources are used, or how certain obstacles and problems are faced is what is modified. We refer to matters such as tasks planning, equipment preparation and maintenance, waste reduction, possibility to adapt to the local context certain equipments that have been designed for other pace and inputs, aspects related to quality control, capability to mark out processes, and generation and good use of management indicators that allow an efficient supervision of the activities.

It should be noticed that these changes could be caused by the incorporation of new machinery, or by the need of manufacturing a new product. In that case, expenditures related to these modifications in the management routines, and the effects caused by them, will be included in the activities related to introducing product or process technological innovations, as it is recommended by the Oslo Manual. Nevertheless, it's been observed that in several occasions, Latin American firms develop "modernization" on their management routines, motivated by a change in the price of an input, the change in some regulations, the advise of a consultant, or as a result from the incorporation of a new manager or the training of an existent ones. These changes are the product of deliberate efforts that result in activities that can be identified separately, that generate their own expenditures, and can be determinant for the firm survival.

b. Institucional Organization

Another kind of NTIs refers to the changes in institucional organization, understanding these as the modifications on the guidelines that control relationships between the different agents involved in the productive process. Some of these guidelines are represented by formal structures that define responsibilities and concerning areas inside the firm, and they can be modified in order to increase efficiency (merging departments, creating new business units, reducing the hierarchical scale, redistributing functions or responsibilities, etc.).

Aspects related to human resources organization are also included in this category (workgroups or cells, temporary or permanent work, variable salaries, payment through shares and bonus, etc.). Finally, it seems appropriate to consider relationships between clients and suppliers inside this group.

Again, we should warn that this kind of changes can appear as a result from taking advantage or making feasible a product or process innovation, but their implementation can also be independent from technological innovations.

c. Strategic Orientation

In the third place, we shall include the significant changes in the firm's strategic orientation. In this case we are making reference to matters such as strategic alliances, mergers and acquisitions, decisions related to entering a new market, outsourcing certain activities or processes, opening it's own distribution or sales channels, or participating in previous stages of the chain, etc. In the case of this kind of NTIs it's possible to think that we might be able to identify them easily. Nevertheless, this should not lead us to think that links or relations between these NTIs and the rest of the innovations

are inexistent or weak. Quite the opposite, we could argue that as a matter of fact, this kind of innovations is the real trigger of the rest of the innovations and NTIs. It doesn't seem feasible to make a change in the firm strategic orientation without affecting management routines, changing institutional organization, or not needing neither stimulating the development of new products or processes.

3. PROPOSALS FOR MEASUREMENT
PROPOSALS FOR THE TREATMENT OF FIRMS INNOVATION CAPABILITIES

Human resources related capabilities

The human resources of an enterprise could be an important sign of its available capabilities for facing innovative processes. Besides the question usually included in the forms of innovation surveys, referred to the education levels of employees, it could be useful to know the kind of professional education of the firm's employees, such as chemistry, physics, mathematics, natural sciences, etc. this formation could be required only for employees who perform R&D activities, or for the whole of them.

Quality systems

Other source of signs of the firm's capabilities could be the inquire on the systematical implementation of mechanisms or systems for quality control, such as control points and following forms, and the use of statistical instruments such as frequencies distribution, cause-effect diagrams, graphics for the control of variables, statistical control and Pareto diagrams.

Information and Communication Technologies (ICTs)

The latest Argentine innovation survey tried (with quite satisfactory results, in terms of number and quality of the received answers) to collect signs referred to the enterprises' capabilities and their efforts to increase them, inquiring on the performed by the firms for the incorporation and use of ICTs. With this aim, the questions presented in Tables 1 and 2 were added to the survey form.

TABLE 1. INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS)

It is inquired which part of employees (not including those with jobs in the production line) use some of the following ICTs to perform their activities

	Percentage of employees (excluding those who work in the production line) who use some of the following ICTs instruments			
	None	Less than 25%	Between 25% and 75%	More than 75%
a Mobile phones furnished by the enterprise	❒	❒	❒	❒
b E-mail accounts	❒	❒	❒	❒
c Access to Internet	❒	❒	❒	❒

TABLE 2

It is inquired whether the enterprise use some of the following products and systems, and which of them are integrated by specific software with other areas of the enterprise

Products and systems	Do use	Integrated by software
A Logic programmable control (LPC)	❒	❒
b Numeric programmable control (CNC)	❒	❒
C Distributed numeric control (DNC)	❒	❒
d Robots	❒	❒
E Flexible manufacturing cells (FMC)	❒	❒
F Flexible manufacturing systems (FMS)	❒	❒
g Flexible assembly systems (FAS)	❒	❒
h Computer assisted design (CAD)	❒	❒
I Test and measurement (CAT)	❒	❒
J Computer assisted engineering (CAE)	❒	❒
K Computer assisted manufacturing (CAM)	❒	❒
L Material resources planning (MR)	❒	❒
M Manufacturing requirements planning (MRPII)	❒	❒
N Computer integrated manufacturing (CIM)	❒	❒
O Quality guarantee and computer assisted statistical control	❒	❒

Networking for innovation

Some Latin American surveys have followed the guidelines set by the Bogotá Manual, and they have added questions seeking to know the existence (and, in some cases, the frequency) of the firm's relationships or links with the other agents of the System (whatever the degree of formalization of these relationships could be), as well as the purposes or objects of such links and their geographic or territorial expression.

The problem consists in how to measure knowledge flows between agents. It can be tried to grasp interactions (between individual and society; between members of an organization, enterprise

or institution; between an organization and other members of the System) with the potentiality of increasing the levels of individual and collective knowledge. However, to compute interactions between agents is much more easier than to evaluate the quality of those interactions. It is supposed that there is technology transference in these interactions, but in fact it can't be determined how much is transferred, neither how much is assimilated.

TABLE 3. RELATIONSHIPS WITH THE INNOVATION SYSTEM

It is inquired whether, in its performance, the enterprise has had relationships with the following agents or institutions during the surveyed period. If such relationship did existed, it is inquired about the geographical situation of the other institution.

Agent	Have had some relationship?		Situation						
			Local (to 100km)	National	Regional	Latin America	European Union	USA and Canada	Others
University	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Technology center	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Technical education institute	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Laboratories / R&D firms	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Linkage organisms	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Suppliers	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Customers	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Headquarters	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Firms from the same group	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Other firms	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Consultants	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒
Governmental S&T agencies or programs	Yes ❒	No ❒	❒	❒	❒	❒	❒	❒	❒

TABLE 4

If the relationship had existed, it is inquired which of the following OBJECTS of the relationship were important for the firm's activities

Agents:	Objects Information	Training	Organizational change	Tests	Technical assistance	Design	R&D	Cooperation[1]
University	❒	❒	❒	❒	❒	❒	❒	❒
Technology center	❒	❒	❒	❒	❒	❒	❒	❒
Technical education institute	❒	❒	❒	❒	❒	❒	❒	❒
Laboratories / R&D firms	❒	❒	❒	❒	❒	❒	❒	❒
Linkage organisms	❒	❒	❒	❒	❒	❒	❒	❒
Suppliers	❒	❒	❒	❒	❒	❒	❒	❒
Customers	❒	❒	❒	❒	❒	❒	❒	❒
Headquarters	❒	❒	❒	❒	❒	❒	❒	❒
Firms from the same group	❒	❒	❒	❒	❒	❒	❒	❒
Other firms	❒	❒	❒	❒	❒	❒	❒	❒
Consultants	❒	❒	❒	❒	❒	❒	❒	❒
Governmental S&T agencies	❒	❒	❒	❒	❒	❒	❒	❒

1. Meaning the active participation in joint R&D projects and other innovation projects with other organization –enterprise or institution–. This doesn't necessarily imply that the involved parts could obtain immediate commercial benefits. The engagement to other organization, without an active collaboration, is not considered as cooperation, and it will be registered as other object.

Even though, it seems to be clear that it is necessary to continue on this way, seeking to develop ways for a better approach to the analysis of these processes. In the "Methodological Study on Enterprises Innovation Survey" of EU / Mercosur / Chile Project, it was stated the convenience of adopting a formula which, in a question format, could be exemplified as shown in Tables 3 and 4, where the formal cooperation agreements are differentiated from other linkages, aiming not to put an influence on the possibilities of international comparison of the resulting indicator.

PROPOSALS FOR THE TREATEMENT OF THE ORGANIZATIONAL CHANGE OF PRODUCTION AND NON-TECHNOLOGICAL INNOVATIONS (NTIS)

A change of status for NTIs and organizational change

As it was expressed above, we aim here is to plenty incorporate the issue of organizational change (in its four dimensions) to the main interest field of the innovation surveys, including the theme into the group of questions on Innovation Activities, as well as into the Results (introduced innovations). Both activities and results on these subjects can be measured separately of those referred to projects or TPP innovations; therefore, the possibilities of international comparison of the resulting indicators are not affected. The advantage of this option lies on that a more complete and integrated vision of the firms' strategies can be achieved, meaning the processes developed by firms for improving their

technical and organizational capabilities and for benefiting from the opportunities the market presents.

Certainly, to choose this option would imply to adopt a different concept of the survey questionnaire as a whole (though this not necessarily should be seen as inconvenient).

THE CHANGES AT THE ORGANIZATION OF PRODUCTION AS TPP INNOVATIONS

Following the Oslo Manual, when certain conditions are fulfilled, a part of the organizational changes (concretely, changes at the organization of production) should be considered as a part of the process innovations, and therefore they would integrate the TPP innovations. Such conditions are highly restrictive: the Oslo Manual states that the organizational change could be included as PPTI only if it generates "measurable" changes on production or sales. Despite these conditionings (or, perhaps, due to them), this option presents an important ambiguity, as it is very difficult that the surveyed firm (which has to resolve the issue at the moment of answering the question) has the necessary data to make the required distinction. In fact, the independent (or separated) measurement of the impacts on performance due to organizational change will be possible only in some cases, such as, for example, the introduction of the "just in time" method, which could allow to register diminutions of costs specifically related to it.

In other Oslo Manual's reference to this issue it is admitted that organizational change could be considered as innovation when it is a part of a "technological innovation project", criterion also adopted by CISIII (Eurostat). This avoids the measurement of the impact of organizational change, but it turns innocuous the posed issue, since in order to measure innovations (and innovators) it would not have practical consequences.

INNOVATIONS

Here we aim to incorporate the changes at the organization of production to the measurement of the achieved innovations, and separating them from the process innovations, as presented in Table 5. In other words, we propose to exclude from the calculations of process innovations the changes at the "organization of the productive process", considered as TPP innovations by the Oslo Manual and the CIS3 ("just in time" systems, quality circles, etc.) and calculated separately. This doesn't affect the comparability of the indicator of quantity of innovative firms with the indicators obtained until now through, for example, the application of CIS2 or CIS3, for if it is maintained the definition of innovative firms as those which have performed TPP innovations, it should be considered as innovative firms only those which have answered positively to the item 1) and 2) of Table 5.

Likewise, we propose to include (separately) the rest of the organizational changes, jointed under the label "Non-Technological Innovations" (NTIs). Such NTIs include changes at management, institutional organization and strategic orientation.

TABLE 5. INNOVATIONS

It is inquired about whether the firm obtained INNOVATIONS as a result of innovation activities or other activities during the surveyed period and the degree of novelty of the innovation

ACHIEVED INNOVATIONS			NEW TO		
1) Product Innovation	Yes	No	ENTERPRISE	**LOCAL** market	INTERNACIONAL market
2) Process Innovation	Yes	No	ENTERPRISE	**LOCAL** market	INTERNACIONAL market
3) Changes in organization of productive process	Yes	No			
4) Non Technological Innovations	Yes	No			

1) Product innovation is the introduction to the market of a technologically new product (whose technological characteristics or expected uses significantly differ of those related to previous products of the firm) or significantly improved (previously existing whose performance has been perfected or highly improved).

2) Process innovation is the adoption of new or significantly improved manufacturing methods. It could seek to produce or deliver technologically new or improved products, which couldn't be produced nor delivered using conventional manufacturing methods, as well as increasing the efficiency at the production or delivery of existing products.

3) Changes in organization of productive process are the implementation of changes at the ways of organization or management of the manufacturing process.

4) Non-Technological Innovations are the introduction of routines of firm management which are new or substantially modified; changes at the institutional organization or at the relationships that regulate the firm's activities or the implementation of new or substantially modified strategic orientations.

INNOVATION ACTIVITIES

The more important aspect here involved is the possibility of following a similar criterion for Innovation Activities. This means to add specific space for organizational change in the respective question, obtaining the same data than for the other activities, specially those referred to executed expenditures.

Both in the recently performed Uruguayan and Argentinean surveys, it has been applied a formula like that, obtaining promising results that encourage to go on with its development. In Table 6 is shown a model of question which meets the mentioned criteria. As it can be seen, the question also includes an inquiry about the orientation or kind of innovation sought with the undertaken activity. This aims to obtain signs about which are the firms' priorities when facing an innovation process.

TABLA 6. INNOVATION ACTIVITIES

It is inquired whether the firm has developed some of the following activities during the last three years, independently of the results obtained with them. It is also questioned which was the orientation of those activities.

	Oriented to changes, improvements and/or innovations in						
	Technological Innovations		Non Technological Innovations				
	Product	Process	Organization of productive process	Management routines	Institutional organization	Strategic orientation	Total in each expenditure section in the period
1) Internal R&D	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
2) External R&D	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
3) Machinery and equipment	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
4) Hardware	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
5) Software	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
6) Technology Contracts	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
7) Engineering and industrial design and systems implementation	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
9) Training	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
10) Consultancies	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	Y❐N❐	
						TOTAL	

4. CONCLUSIONS

We have formulated here a set of proposals referred to the aspects to be inquired by the innovation surveys, aiming they provide more and better criteria or evidence for the decision-making process of pubic policies and entrepreneurial strategies in the field of the generation, spreading, appropriation and use of new knowledge for the production and commerce of goods and services.

The efforts made by enterprises and organizations to this direction (the Innovation Activities) and the capabilities shown (stocks and flows) make, for this reason, equal or even more important to know and analyze the results obtained (innovation).

As a consequence of this, the measurement must try to display the innovation processes: their determinants, the obstacles or ties afforded and the characteristics presented in each case. This involves a clear preference for the "subject focus" over the "object focus", such as stated in the Oslo Manual and the Bogotá Manual (with a bigger emphasis in the last one).

The procedures and instrumental aspects must take into account practical criteria and adequate in a realistic way to the available possibilities and resources of both surveyers and surveyed. However, it is of a great importance that this condition doesn't distort or make lost consideration to the previously expressed criteria.

These proposals seek, in the first place, to identify signs related to the firms' capabilities for facing innovation processes. With such goal, it is suggested:

- To extend the inquiries about formation or educational level of employees, asking about the specific formation of the firm's professionals (chemistry, physics, mathematics, natural sciences, etc.)

- To inquire about the systematic implementation of quality control mechanisms or systems (control points and follow-up forms), and the use of statistical instruments (frequencies distribution, cause-effect diagrams, graphics of variables control, statistical control of attributes, and Pareto diagrams)
- To investigate about things done by the firms for the incorporation and use of new Technologies of Information and Communication (ICTs)
- To extend the inquires about the existence of relationships or linkages established by the firms with other agents of the Innovation System, and not limited to formal agreements for cooperation, but including several and various possibilities of interaction between actors, as well as the aims and objects of the linkage and its geographical and territorial expression.

We have also expressed different proposals for approaching to organizational change and non-technological innovations (NTIs) at the innovation surveys. This is helpful to suggest some changes on the ways usually employed when approaching to the efforts and actions of the firms (Innovation Activities) and the results obtained by them (Innovations). The proposals are:

- To differentiate tour kinds of organizational changes: organization of production, management, institutional organization, and strategic orientation. The last three are jointed as the so called "Non-Technological Innovations" (NTIs).
- To ask the firms, both TPP innovative or not, about the performance of NTIs in their three kinds.
- To differentiate or separate the process innovations from the changes at the organization of production.
- To give the changes at the organization of production and NTIs a similar level of importance of the TPP innovations, including these issues to the main field of interest of the innovation surveys (Innovation Activities and achieved Innovations), assigning them specific spaces or places with such aim, and surveying the same data that for the other activities, specially those referred to performed expenditure.
- To inquire about the orientation or kind of innovation pursued, with the initiated innovation activities, no matter the achieved results.

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