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Conference Paper · March 2013

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Research on Innovation and Innovation Policy in Latin America: Perception and Practice of the Nexus

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I. INTRODUCTION

Since the pioneer work of Weiss (1979) on the many meanings of knowledge use, the role of social sciences research in policy-making has been looked at from a broad policy perspective and in some particular sectors, like health and education. With time, the intricacy of the research-policy nexus has given rise to increasingly sophisticated and holistic models to account for the dynamics involved, mainly in the developed world.

Within this frame, in the last two decades there has been a growing interest in, and practice of, evidence-based policy (EBP) in several fields and countries. Putting the best available research evidence at the heart of policy development and implementation stands in contrast to opinion-based policy, which relies on a selective use of evidence or on untested views of individuals or groups (Davies, 2004:3). The EBP trend renewed expectations about the usefulness of social sciences for policy-making.

From an innovation policy perspective, the use of social sciences research (SSR) in policy-making has not been dealt with in the same integral way, even less so in developing countries. This paper is about the links and mismatches between SSR on innovation and science, technology and innovation (STI) policy-making in Latin America. It has a two-fold structure. The first part is centered on the perception of the research-policy nexus by innovation research groups and policymakers (PM) from different Latin American countries. The second part focuses on two policy tools that have been designed in Uruguay to bridge interests from the production sector, the academy, and the policy-making area.

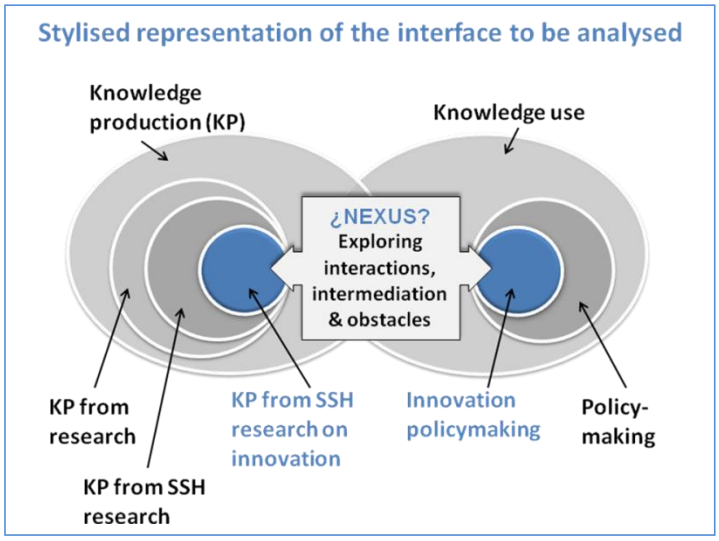
II. SOCIAL SCIENCES RESEARCH ON INNOVATION AND INNOVATION POLICY-MAKING IN LATIN AMERICA

In 2009-2010, a total of 54 in-depth interviews were conducted to social sciences researchers (38) and PM (16) from Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Mexico, Uruguay and Venezuela, as well as to a few selected researchers from developed countries (Denmark, Netherlands, Spain, Sweden, United Kingdom and United States) to contrast opinions.[1] The objective of the survey was to get insights on the nature of the links and mismatches between researchers and PM in the specific field of innovation.

Interviewed researchers were selected for their leading function in an innovation research group; PM were chosen from the main institutional settings for STI policy in the selected countries. Interviews were conducted with a flexible, semi-structured questionnaire,

[1] This survey was conducted by an Uruguayan team in the frame of a regional project (EULAKS: Europe Latin America on Knowledge Systems) funded under the EU Seventh Framework Programme for Research and Technological Development. For the full report of the empirical study by the Uruguayan team, see Snoeck et al. (2010).

addressing mainly the following topics: i) Origin, research interests and agenda fixing of the research group; ii) Perception of the influence and use of the group's research outcomes; iii) Relations with other innovation research groups at the national and international levels; iv) Opinion on the innovation policy-making process in the country, its actors, inputs, etc.; v) Obstacles and suggested actions to bridge research and policy. On the PM side, the interviews focused on: i) Main features of the innovation policy-making process in the PM country; iii) Perception of the relevance of innovation research for innovation policy development; and iv) Obstacles and suggested actions to bridge research and policy. A qualitative data analysis program (Atlas.ti) helped processing the empirical information.



An extensive literature review on the SSR-policy links was previously carried out to provide the conceptual frame of mind for the field work and the data analysis.

1. Researchers' perception of the use of SSR in the policy-making process

When asked if they intended or pretended influencing STI policy, all researchers answered positively and usually considered this as one of the specific objectives of their group. In one way or the other, they expressed that their research' objects are of interest for the policy-making process and therefore wish their findings to be taken into account:

> "Essentially, the idea of the group is to produce information and carry out applied research that is useful for decision-taking by government authorities and also at the international level."

> "[I expect an impact] either through contributing to the construction of development mechanisms or, indirectly, through evaluation work … generating elements that allow the government to improve the functioning of the technological policy instruments. Clearly, one has this pretension."

> "We spend our lives studying the rationality of different STI actors, so we wish to have an influence…"

Researchers reported different means to influence policy design. Publication of research outcomes was not disregarded as influential mechanisms, among others to obtain or consolidate legitimacy as a reference group, or to inform collective actors who can then mark a position on certain topics. But, the following means were reported as more effective: participating in seminars, forums, round tables, and workshops, where PM are included among the guests; participating in advising committees or specific commissions related to policy development; and, to a variable degree, exchanging views on their research findings with STI public authorities they are acquainted with. The following

interviews' excerpts illustrate these views:

> "Obviously, we expect to have an influence through publications but I wouldn't say this is the main way. Though it often takes us more time to organize forums and seminars with decision-takers, this allows the exchange and confrontation of opinions in a more proximate way. It can be more important than handing out reports, though of course we also write documents for these meetings."

> "The other way to have an impact [on policy] is through advising and accompanying institutions and government bodies involved in public policy-making related to the areas, lines and projects of the research group. For example, our national statistics institution was concerned with the measurement issue, so it set up an expert group to help understanding the innovation process. I am advising them on innovation in general and, in particular, on innovation in services. In this type of spaces one has an influence by contributing one's knowledge and experience".

> "From time to time, people from the ministry call us to know our opinion… Some weeks ago, I had a meeting with the undersecretary, who wanted our group to help them thinking on the logics of policies… the mere fact that they would call on research groups to help them thinking is an interesting and valuable demand."

> "[I seek to influence] (i) trough courses, conferences, etc.; (ii) providing advice to government agencies; (iii) constantly following the public debate and seeking to intervene in it; (iv) advising business associations, clusters, etc.

There were almost no references to the role of mediating people or institutions in the knowledge transfer or exchange process (like brokers, 'translators', or more generally knowledge purveyors), except to acknowledge the lack of such figures.

Impact is not expected in the short term. The perceived influence on policy can be clearly associated with the conceptual or *'enlightenment function'* of research. The 'percolation' type of contribution −i.e. the use of new concepts that gradually penetrate in policy networks and alter the language use, thereby shaping the policy discourse− is particularly clear in the following citations:

> "We repeat concepts over and over again in meetings, seminars, etc. I see how they (PM) later incorporate these concepts, I see an evolution, of course not only because of us but I believe we played a role in this. (…); we do this job of raising consciousness."

> "... It is not the fact that one produces a methodology and the government applies it; rather I believe one generates ideas and contributes to the construction of a [framework of] thought. And this thinking ends up spreading… It is not what is written, it is not quantified… Participation and impact, or interference with policy design, often run through informal mechanisms."

> "I would say [studies are] a sort of basket that is available for decision-takers, we dialogue with them, we know each other, they know our work to a certain extent. These studies have given the opportunity for this dialogue, we don't go there talking anything, we have researched this and that. I think PM take us moderately into account, but policy decisions don't depend only on theoretical inputs that a research group generates, it depends on many other things…"

> "Being able to influence and contribute to policy is an objective, but this might well occur in the medium or long term; it is not immediate."

A particular way of influencing policy derives from the training of people within innovation

research groups or centres, as well as from the participation in these groups of researchers educated in renowned STI university departments. Intentionally or not, this establishes a sort of 'reservoir' of specialists that government agencies eventually calls upon and appoint.

> "[At one moment] the research centre, where the national scientific policy was initially conceived, clearly went through a stage of linkage to policy: the first specialists at the national level graduated at the centre and went later to work at the planning ministry. (…) Where I presently work, we also try to have graduates incorporated into the institutions. We try to place them as professionals, to see if they can influence policy."

More generally, research-policy links resulting from *people's movement from academy to the policy-making sphere and vice versa* were mentioned spontaneously in different countries, though it was specially highlighted in Brazil and Mexico. Researchers from both countries asserted:

> "There has been a transit between the academy and the government: two ministers came out from my department and at one moment we had more than then professors working in the government. (…) [The influence] happens through a symbiosis between government people who come back to the academy and academic people who are in the government. It is not strictly due to the academic work but rather to the presence of that the person… People's experience is assumed to be a decisive factor in the policy configuration, but also important is their network of contacts in the academy. When some topics raise doubts, presumably they will activate their networks. I think it is much less probable that a paper published in the Revista Brasileira da Inovação will have a significant impact on policy."

> "I believe social sciences have a fundamental role, inclusive because many academics become policy-makers… So, there is integration between the academy and the government in this debate on innovation and innovation policy. [Would you say this happens because academics take on government positions or rather because there are institutional links between academy and government?] I believe both things happen. There are people going from the academy to the government and from the government to the academy; [while] institutionalization occurs more through agreements and the commissioning of studies."

Researchers also referred to the *instrumental function* of their research, i.e., providing empirical evidence that helps solving a policy problem. Practically all innovation research groups respond, to a higher or lesser extent, to specific demands from government agencies, which somehow relates to the policy-making process. Two collective exercises at the regional level were mentioned for their instrumental impact,[2] but no other cases of influential regional initiatives or networks were reported.

In several countries research groups or individual researchers have been called to participate in some stage of the preparatory works to define the national STI strategy. In these cases there is a mix of conceptual and instrumental influences, with varying impacts depending on the country

In short, researchers' general perception is that their work has some impact on PM but it is not clear-cut, it is mainly intangible and built up through time and through many actors, and

[2] One is the Bogota Manual, a standardisation of technological indicators specifically adapted (from the Oslo Manual) to the Latin American context; and the other is RICYT's periodic recollection and publication of regional and country level STI indicators. Both work are used as a reference tool in most STI diagnoses and other policy related studies in the region.

it is highly dependent on the particular institutional and political context of the moment.

Some diverging views appeared concerning the motivations and effectiveness of policy-making. For several researchers, PM have an *a priori* agenda, relatively immune to research results, in some cases to such an extent that PM insist with policies that research outcomes have explicitly shown to be misplaced. Other researchers have a more positive opinion, indicating that PM implement policies that enhance innovation results and empower innovation actors. An important question is where these divergences come from. Besides reasons derived from differences at the country level, positive opinions are usually related with reporting good personal communications between researchers and PM as well as 'cognitive nearness' between them, for instance for belonging to the same economic school of thought. Negative opinions correspond approximately to institutional and cognitive distance.

There is a wide-ranging diversity in researchers' view on the obstacles to stronger research-policy links. They were classified in five categories: (i) mismatches between research supply and demand, and those related to the so-called 'two communities' problem'; (ii) limitations of research itself; (iii) obstacles derived from the mere nature of the policy-making process; (iv) governability issues; and (v) external factors. A check-list of several issues reported for each category can be found in Annex 1.

2. Role assigned by PM to SSR in policy-making

The role PM assign to social sciences with regard to policy development is huge and seems to go well beyond the content of the studies they presently have access to. In general, this role concerns filling knowledge gaps in a very broad range of STI policy matters, especially those related to the social nature of innovation processes:

> "Presently, many of the actions that are carried out and need to be implemented require, even when the technical proposal is well determined, the work of social sciences for their implementation. Society is a very important element to consider. It is not easy to take certain measures without people's consensus; some decisions entail society as a whole and need the confluence of society. Only social sciences can help us to progress in these fields."

> "…The relevant point is: What is going to motivate the behavioural change that is needed to have society really engaged in innovation, in working together? The study of these dynamics, these resistances, these problems surging from different groups in a social context is very proper of social sciences…"

The following demands to SSR were highlighted by several PM, along the lines of the interviews' excerpts here presented:

- More studies that assess and evaluate innovation policies and instruments:

  "We need more rigorous evaluation studies… in terms of policy impact… We need good mechanisms to evaluate our instruments to progressively improve them. What matters most is to generate knowledge on which public policies work and which not…

  "… Latin American countries are good in formulating and implementing but very bad in evaluating… There are no habits of transparency, accountability and rendering of accounts, and there is a problem of continuity in policy-making."

- A greater emphasis on recommendations in the innovation studies:

"… in this country, we constantly make diagnoses but on the question of how problems are solved I don't see that researchers take a risk… The part that we need most as decision-takers is the identification of the possible pathways to solve a given problem, accompanied with the positive and negative features of each of them.

"… these studies often don't go beyond the characterization of innovation dynamics."

- Social and hard sciences integration to tackle STI related problems:

"SSR is one part of the research that must be taken into account in STI policy definition… For example, if I am going for energy policies, the whole scientific research accounts maybe for 70 to 80 per cent; the rest is a global vision from the social sciences, which goes beyond the technical part."

"A look from the social sciences incorporates the political dimension of science, the capacity to look at another dimension, beyond laboratories and mathematics; somehow it is the access point for society to seize the topic."

"One needs to consider the whole problem, from a technical, scientific, health, etc. point of view, but also the social impact, the economic impact. The question thus becomes how to create these 'integrated spaces' around relevant problems that demand knowledge from all these areas."

- Knowledge, social inclusion and development:

"Ten years ago we were concerned (and still are) with the linkage between research and production; now we are equally worried about the linkage between knowledge creation and social integration. In the same way as scientific research does not generate innovation on its own, innovation by itself does not necessarily improve life conditions. So, if we want innovation getting inserted in society, we need knowledge from social sciences, including maybe anthropology, on the one hand to get S&T development reaching people adequately and on the other hand, to research on the marginalization phenomenon, the question of fragmentation and the best ways to improve society's conditions. Everybody knows that this is not only a problem of resources assignment, but we have incomplete scientific-based knowledge on these processes.

In spite of PM belief that SSR should tackle these and other important innovation related issues, they practically never mentioned the need or convenience to work together with research groups (and eventually other actors) on agenda setting, an issue that some researchers expressed as an essential need.

3. Inputs used in STI policy-making in interviewees' view

Another way of observing the research-policy links is inquiring on the inputs that are usually used in STI policy-making. The following chart shows a frequency ranking of the different options marked by PM and researchers.[3]

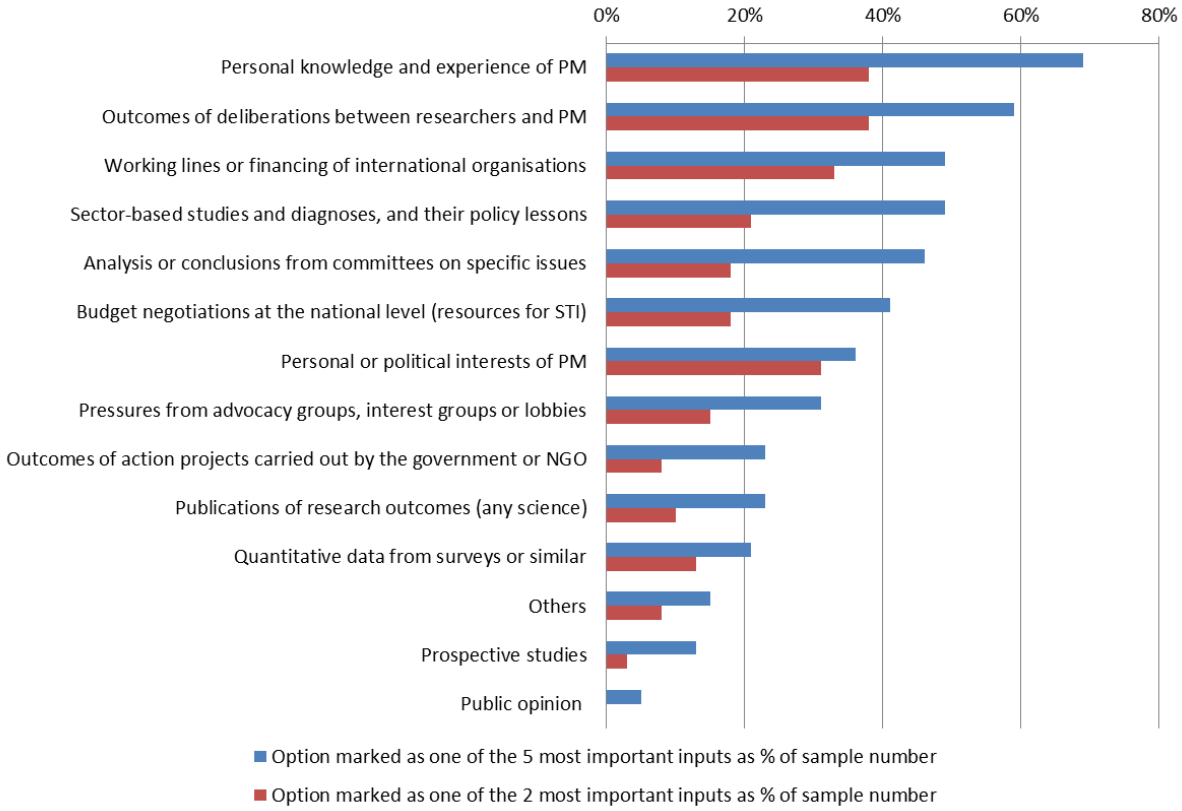
The most often selected item is *Personal knowledge and experience of the PM*. Almost 70% of interviewees marked this item among the five most important and 38% marked it as one of the two most important. *Outcomes of deliberations between researchers and PM* has the second highest ranking. The two main inputs in policy-making thus consist in

[3] We presented a list of 13 possible sources of information to interviewees, including an "other" option, and asked them to identify and rank the main inputs that are actually taken into account in the policy-making process in their country.

knowledge embodied in people.

Working lines or financing of international organisations was highly ranked by researchers and no so much by PM. International funding was often associated with the application of very similar STI policy tools in Latin American countries, according to international agencies own strategies.

Chart 1 – Inputs taken into consideration in STI policy-making in selected LA countries, according to interviewed researchers and policy-makers



Source: Snoeck, Sutz, Cohanoff and Grass (2010).

Among the "written evidence" as inputs, *Sector-based studies and diagnoses, and their policy lessons* is the only highly ranked item, especially by PM. *Quantitative data from surveys or similar, Scientific publications* and *Prospective Studies* have a very moderate ranking. One way of interpreting this difference in ranking is that PM usually want processed, comprehensive and clear-cut information (which is often the case in sector-based studies and diagnoses), which makes their decisions easier and not more complex. As a PM noted in an interview for another study (Baptista et al, 2010):

> "… innovation surveys have a certain value, (…) some data are collected, (…) they give some numbers about the movie but they don't show you the movie, and the movie runs through very complex things, through details, through a network where macroeconomic aspects combine with personal circumstances, technological realities. There is a need to go

into detail and, in this sense, sector-based studies shed other points of view, the same [occurs] with reflections of specific research projects on these topics."

Analysis or conclusions from committees on specific issues appear as a relevant input in policy-making, both in PM and researchers' view. This reinforces the importance of specific, processed knowledge, transmitted through (trusted) people. *Personal or political interests of policy-makers* was confirmed on both sides as an influential factor: it is not one of the most often cited inputs but, when it is, it is almost always ranked in the first or second place.

PM mostly disregard *Pressures from advocacy groups, interest groups or lobbies* as an input, while 40% of researchers marked it as one of the five most important inputs. According to interviewees' comments, this difference in perception can be mainly attributed to the fact that in several of the surveyed countries, PM heading the main STI agencies or ministries stem from the hard science community. Thus, our interviewed researchers, who work in social sciences, view the scientific community as a strong lobby in STI policy-making. Finally, *Public opinion* is practically inexistent as an input.

The countries analysed in this study stand at different stages of STI policy development. Taking extreme cases, Brazil has a long tradition and many specialists with an extended trajectory, both on the research and the policy-making side, while in Costa Rica innovation policy and research are in their infancy. Thus, one could think *a priori* that the type of inputs might differ among countries. Indeed, there is some specificity at the country level[4] but it does not alter significantly the previous analysis. Some general conclusions on the different relationships between SSR and STI policy across countries are presented in the next section.

4. Differences across countries in the innovation research-policy links

The empirical work provides evidence that the relationship between research and policy differ across countries. In this regard, we propose a taxonomy of modes of articulation between research and policy-making in Latin America:

- *Arm's length mode*: this mode implies that researchers work in a kind of 'mode 1' of knowledge production, following the well-known Gibbons et al (1994) concept. The policy-making process does not include a systematic consultation of research outcomes or of researchers themselves. The two spheres of action, research and policy, might have encounters, even planned encounters, but the logic that moves both spheres, including the incentive system, precludes a jointly negotiated research agenda. Maybe PM take into consideration research results but the national research community and PM work at a distance (thereby also avoiding conflicts). Maybe researchers are hired by an innovation related agency to perform commissioned research, but the working agenda of the innovation research community will not be much influenced by PM needs, and research will be understated among the knowledge inputs used in the PMP. Venezuela could presently be an example of this mode of articulation.

- *Connected distance mode*: in this case, even though each community working agenda

[4] For example, *Personal or political interests* was not often mentioned in Chile, Colombia and Uruguay; and *Working lines or financing of international organisations* was not mentioned in Brasil. In contrast, *Personal knowledge and experience of the policy-makers* was pointed at in all countries.

relies on its own logic, bridges exist that connect them but not systematically. Argentina, Colombia, Costa Rica, and Uruguay can be included in this mode.

- *Hands-on mode*: this mode stands for strong connections between innovation research agenda and policy design. Links develop among others through: people moving from academia to policy positions and vice versa, transmitting questions, demands, concepts and proposals; joint calls for policy oriented research projects, further debating results and recommendations; specific think tanks, etc. This mode works as a proxy for Brazil, Chile, Mexico, and Cuba.

This taxonomy is a stylized idealization of the situation at the moment of the survey. Countries eventually shift from one articulation mode to another at different rates and moments, depending among others on the specific institutional context as expressed in the corresponding National Innovation System (NIS). The innovative context of the hands-on mode of articulation probably implies a strong and genuine national agreement on the importance of innovation for the future of the country. This has been the Brazilian case since long ago, while Chile evolved more recently towards a hands-on mode, now showing a strongly institutionalized STI system and local, 'independent' means for STI policy financing through copper production taxes.

The connected distance mode can have different underlying reasons. In a country like Argentina, the relative weakness of the articulation between innovation research and policy-making can be partly explained by the historical high weight of natural scientists in the orientation of STI policies. In contrast, in Uruguay, such weakness might be traced back to the historically low priority given to STI. The presently growing political importance of the issue thus faces a weak tradition of dialoguing.

Where strong conflicts characterize the relationships between the innovation research community and PM, sometimes as part of a more general conflict between academia and government, arm's length relationships would be the expected mode. This seems to be the case of Venezuela in recent times.

Therefore main challenge in Latin America is to devise institutional tools to foster more hands-on modes of articulating STI policy-making and research (hard sciences and social sciences); doing so implies changing the innovative context.

5. Issues to consider to narrow the gap between SSR and STI policy-making

Fostering evidence-informed policies in STI requires building bridges or strengthening existing connections between the research community –including social sciences researchers– and the different layers and stages of the policy-making process. Disconnection between both spheres is unacceptable in today's society. At the same time, each sphere must retain an important degree of autonomy to be effective in its own terms, making certain kinds of tensions and mismatches unavoidable. If connectivity must take place respecting the relative autonomy of each sphere, "connected autonomy" could be an appropriate concept to define or delimit the nature of the nexus that can reasonably be promoted.

Connected autonomy requires, first of all, the will of researchers to be connected to policy-making. Our interviews to social sciences researchers show this will exist, independently of the difficulties to translate research outcomes into 'ready for use' results. Second, it requires

PM to transmit their research needs to the research community. In our interviews, PM generally expressed a strong interest in SSR but no particular action or intention to improve their communication channels with the research community and express policy-related demands. This obstacle to STI research-policy connection is worsen by the fact that PM themselves are in need of more information on demands from different actors of society that could be addressed through innovation policies and instruments, including, though not exclusively, demands from the production sectors. This lack of knowledge not only obstructs the design of effective promotional instruments, it also makes difficult for PM to define and communicate research needs to the academy.

It seems clear that researchers following exclusively the set of incentives that rule in academia will not necessarily provide the answers that PM need to design and implement successful innovation policies. It is equally clear that PM who only trust the results for which they pay through consultancy work will not be able to profit from the accumulated research capacities that otherwise may be at their disposal. Some bridges or system of signals must be built to better connect STI research and policy. We propose that the first step be for STI policy to express a clear demand for information and analysis that can put SSR to work. Examples exist that show that when such demand is expressed the research community responds. This should be then a main focus of future work. Simultaneously, the research community should accept to revise its incentive system and evaluation criteria. Little has changed in this regard since Booth noted in the eighties: "[the] structure of incentives within the academic community has also driven a wedge between social scientists and policymakers. These incentives attach greater weight to knowledge-building as against policy-forming research; to authoritativeness rather than usefulness; to the pursuit of rigor as against relevance; to the values of scientific independence as against the virtues of policy involvement; and to understanding rather than action" (1988: 226).

If we were to classify the types of knowledge needs that PM should be thoroughly informed about to design performing policies in STI, the following six aspects would stand out, based on this empirical study together with our knowledge from other projects:

- *Knowledge about the innovative performance of firms and about their absorptive capacities, which typically stems from innovation surveys*

The innovative performance of firms has been empirically explored, with special care, in many developed and developing countries. The question is if such explorations have been useful for policy purposes, i.e., if they have been used to inform the design of better policies. This does not seem to be the case for innovation surveys, as Arundel (2005) critically remarks:

> "The CIS (Community Innovation Survey) collects data that could be used to fill some of the gaps in our knowledge of innovation, but unfortunately the CIS has not been fully exploited for this purpose. The main cause is a continued focus on a science-push or linear model of innovation. The countless announcements of the death of this model and its presumed replacement with 'systemic' models using Schumpeterian definitions of innovation are definitely premature. The science-push model based on R&D is probably the dominant model in use today by the policy community, although no one refers anymore to it by its name. This has resulted in a lack of demand on the part of policy makers for a wider range of CIS indicators, and a lack of supply from academics and

national statistical offices for them".[5]

In another work, Arundel makes the same type of observation concerning the divorce between the academic community studying innovation and what innovation policy makers PM want to know about how innovation is going on in their countries:

> "A series of interviews conducted by MERIT staff with members of the European policy community in the Spring of 2005 found that econometric results (stemming from CIS surveys) rarely influenced policy making. Instead, the policy community preferred detailed descriptive analysis, particularly when combined with case studies. This conflicts with the perspective of the academic community, which focuses on econometrics. This has also increased over time, with a decrease in academic reports that contain careful descriptive analyses and a trend towards increasingly complex econometrics in academic publications" (Arundel, 2006).

Why it is that innovation indicators are not widely used in policy-making, a fact that our field work confirmed? Arundel suggests that, to be useful, innovation indicators should provide information that meets three requirements: i) directly assist the development and implementation of policy actions; ii) verify innovation theory as part of a continual process of testing and improving theories of innovation; iii) assist private firms and other institutions to develop and adjust their own innovation strategies (Arundel et al, 1998). We present some comments on the difficulty to fulfil these characteristics.

Directly assisting the development and implementation of policy actions requires clarity and specificity in the sphere of policy. If policy goals are vague or merely quantitative (e.g., 'to add knowledge-based value to production', or 'to increase the proportion of innovative firms in the universe of industrial firms'), indicators can be built but at this level of generality they probably will indicate what is already known, for instance that there are relatively few firms introducing successful innovations in the market, as is the case in most Latin American countries. The real challenge comes when good indicators must be designed for a delimited and concrete innovation policy. For example, what do we need to know if we want to help the textile industry to systematically innovate by incorporating high level design? Re-phrasing the question in terms that may be useful for policy design would be: What value do firms attribute to innovating through design? How many textile firms innovate through design? For those who innovate this way, how do they do it, by subcontracting or in-house? The answers to questions that directly address the information needs for concrete policies can lead to good indicators. Finding the right questions is particularly difficult in developing countries, and the main reason has to do with meta-policy: innovation can become important at the discourse level, but this is no guarantee that the concrete concerns that lead to good indicators and tools for innovation policy design will be dealt with. Uncritical copies of successful policy models are common, and usually such models are not good enough to raise the questions and get the answers that could inform sound contextualized policies.

Verifying innovation theory as part of a continual process of testing and improving theories of innovation is an indicator requirement based on the vital role of theory to interpret

[5] As an example of wrong policies built on the lack of good indicators rooted on sound theory, Arundel indicates the Lisbon Agenda for the European Union. Not only is the aim of 3% of R&D/GDP for 2015 unattainable, but the Agenda did not set goals for other parameters of vital importance for innovation (Arundel, ibid.).

empirical data. Indicators should help testing theory, beliefs and assumptions about the innovation process. For example, the set of indicators needed to answer the question about why firms innovate in developing countries must be derived from a theory of innovation that recognizes the specificity of such countries, and it will prove its worth by helping to refine such theory. Ultimately, the reason why theory matters at all is that the alternative of trial and error processes is too costly.

Finally, assisting private firms and other institutions to develop and adjust their own innovation strategies should be another characteristic of a good set of innovation indicators. Managers will be more motivated to complete innovation questionnaires when the results are of value to them, direct or indirectly. In the latter case, the indicators would be used in analyses that provide useful information, among others, to managers of innovative firms. For example, given that innovation is always a collective endeavour involving several actors, being able to signal to a firm possible partners in some of the innovative avenues it wants to pursue or reinforce can be useful. This can be made in matrix form, taking key issues signalled by firms and finding who can provide an answer among the actors of the innovation system at national, regional, local or production-chain level.

Some types of capacities at the firm level are often disregarded in innovation surveys, particularly concerning 'knowledgeable' people in firms. For instance, in Latin America information on the number and type of engineers (chemical, electrical, mechanical, environmental, etc.) who work in industrial firms is neither gathered nor demanded, with few exceptions. This is a curious fact since common sense dictates that the present capacity of a firm largely determines its ability to recognize innovation related paths. Having a biotechnologist or a classical agronomical engineer is quite different for the prospects of an innovative young firm in terms of identifying opportunities and threats for its business. And having no engineers at all, as happens in so many firms in Latin America, is a very telling of their limitations. Because private R&D is so uncommon in small, medium and even large firms in Latin America, the question of who performs engineering, industrial design, quality control, etc. in the firm becomes an essential aspect to understand business dynamics, providing clues to policy design.[6]

In the opposite sense, STI surveys do provide information on some issues that should work as an alert signal to PM in Latin America but are not taken into account to the extent they deserve. For example, survey data show that Latin America has tenths times less researchers by inhabitant than the OECD countries, an issue that is verbalized as a concern and addressed at policy level: the supply of well-trained people is fostered through fellowship and the like. However, the demand side of this issue does not raises similar concerns and policy action: where will these (new) researchers work, considering that the same surveys clearly show that most R&D in Latin America is performed in public institutions. Coming back to Arundel's remark on the “linear model of innovation”, it seems indeed well alive in spite of its repeated funerals. STI policies are still very much focused on the very beginning of the chain, promoting the increase of the number of researchers, and tend to disregard the importance of the demand side issues, which are indeed complex and should be dealt with in the SSR innovation community.

[6] An example of this type of analysis can be found in Bianchi, Gras and Sutz (2009).

- *Knowledge about the overall capacities of the country, which in some countries are provided through institutions like observatories or national councils in the field of STI*

The question of collecting data on the overall capacities of the country should be treated in a way that fosters a better articulation between actors of the NIS, besides indicating the state of S&T indicators. To be used as an articulation tool, indicators must convey a variety of information and satisfy a variety of searching.

For instance, in Brazil and Colombia, a complete directory of research groups is provided online, with information about the cognitive area and research lines the groups are involved in. In the case of Brazil, the connections of the groups with firms are also indicated. In Uruguay a group registry tool was built with the aim of stimulating articulations between actors of the production and academic sectors, though it will take time until its usefulness can be proved. The point is to make available, through dynamic communication tools, systematized information on research capacities that is useful in the production sector perspective and that innovation PM could also put to good use.[7] This kind of articulating or networking indicators is of great importance to inform pro-active innovation policies. Organizing and updating them can be a heavy task, but it surely is one way to bridging innovation researchers and innovation PM.

- *Knowledge about the technological needs of the production sectors and other actors, and on the promotional instruments that these actors would consider useful, so that STI policies can be better tuned with concrete demands*

Main mismatches between the aims of innovation policies and its results are often caused by the unawareness on the part of PM of what industry really needs to become more innovative and competitive. The national innovation surveys (usually based on the Oslo OECD Manual and the Bogota Manual) usually ask about which innovative activities are carried out, what is expected from the actions taken, the reasons why some courses of action are no taken, etc., but a thorough inquiry on what industry *needs* in order to innovate is missing. The questions around actions and obstacles to innovate are in a multiple choice format, limiting the analysis to those factors that were presumed beforehand and therefore included as options. Obstacles are too diverse to be taken into account in closed questions, partly because innovation is a highly contextual socio-economic process. Direct and open questions on industry needs are necessary, and this way of proceeding is uncommon, in part because they make surveys more difficult to conduct and also because comparability seems more important than accuracy and meaningfulness.

- *Impact studies of the existing promotional instruments, to enable monitoring and rectifying them*

It is now widely accepted that policy interventions should be evaluated as part of a 'policy

[7] An example of this was the policy followed by the Basque Country in the early 1990s, in the midst of its effort to reconstruct the damaged national industrial fabric. The government wanted to modernize the Basque industry and give participation in this effort to the Basque high-tech sectors, particularly microelectronics. It was a clear issue of articulating actors, an issue that required information about the microelectronic firms, their production, and their main clients. The policy makers commissioned this information, and provided economic incentives for the effective articulation of firms in need of microelectronics and microelectronics firms able to satisfy firms' demands.

implementation life-cycle': i) impact assessment or ex-ante evaluation before decision and implementation; ii) interim and on-going evaluation during implementation; and iii) final or ex-post evaluation after completion of the intervention. In STI, our field work confirms that the programs and policy tools are often evaluated for their efficiency in achieving their goals and spending the money, but too rarely for their socio-economic impacts. Expertise in this field should be sought in the sphere of SSR or, when national capacities are limited, co-learning also offers a bridging opportunity between PM and researchers.

- *Strategic knowledge or foresight on STI*

Any policy, but innovation policy in particular, addresses a moving target. Trying to understand where the target will be in a near future is therefore important to design today's policy interventions. If a goal is fixed for some years ahead, the road toward it must be designed today. Stating goals for the future implies scrutinizing the present to be able to act. Foresight is, according to Godet (1985), "a reflection for action and against fatality", characterized by seven key-ideas: i) illuminate present action in the light of the future; ii) explore multiple and uncertain times to come; iii) adopt a global and systemic vision; iv) take into account qualitative factors and actors' strategies; v) permanently bear in mind that information and prevision are not neutral; vi) choose pluralism and complementary approaches; vii) revise received ideas.

There are some key aspects to make foresight useful for policy: i) long term thinking; ii) taking into account the past as well as exploring the future; iii) focusing on a project or a problem; iv) defining an audience (the users of the outcomes are a key factor to take into account when defining foresight exercises); v) engaging different people in participatory exercises; vi) ensuring wide legitimacy to increase the probability that the results will be incorporated into policy design; vii) carefully carrying out foresight because the process can be even more important that the results; and, last but least, viii) having good and reliable information.

From all this, it is clear that the SSR community has an important role to play if the goal is to inform innovation policies. Particularly relevant is preparing the key questions to be answered by a wide variety of specialized people. For example, one of the problems Latin America should look at very carefully is the prospects of human capital deficits in the Western highly industrialized countries (nowadays lessened due to the European Union crisis). In a long-term view, such deficit is becoming worrisome for them, under the double pressure of decaying vocation for sciences and engineering and the successful strategies of Easter and Southern Asia to keep on training, retaining and attracting back home their own citizens. If Latin America, being a quite possible source of recruitment for coping with such deficits, wants to avoid the passive witnessing of a new wave of brain drain, what kind of policy should be put forwards? This is a typical policy question that requires the best of foresight to be answered.

- *Knowledge about what citizens think, value and fear about STI*

To be successful, any innovation policy in a democratic context needs that whatever is innovative for society −new drugs, new tools, or new procedures− be largely understood and accepted. Innovation policies need to communicate with people in some occasions, making explicit the policy goals and the rationale of the selected choices. To be efficient in this communication process, information about what people think, know, value and fear is

important. Latin America and Spain have been doing surveys on the vast issue of public understanding of science, and some of the results are quite informative for innovation policies. But as in the case of innovation surveys, a comparability criterion prevails; there should be more room to detect people perceptions on specific policy topics, for instance, in energy, health, transport, or whatever that will provoke changes in existing routines. This could be a fruitful field for collaboration between innovation PM and researchers, particularly because the process of understanding people's thinking about STI leads to reflexive analyses about what innovation policies want to achieve: it goes far beyond supporting the innovative behaviour of firms, particularly in developing contexts.

No single, simple, or linear solution can be put forward to reduce these research gaps and take full advantage of existing research capacities for evidence-based policies in the field of STI. However, there are ways to lower the barriers identified in this study. Among others, researchers could be incentivised to develop policy-relevant projects, where they engage with PM and other stakeholders from an early stage (design) and end up with policy briefings that are understandable and useable in the policy-making sphere to frame, select and/or evaluate policies. In several developed countries, best practices increasingly recognize the importance of knowledge brokerage and other forms of 'boundary work' (think tanks, advisory bodies, etc.) between scientists and PM to overcome the 'two communities problems'. Latin America has a long way to go in this presently underexplored action field. How to strengthen dialogue between social science researchers and PM –especially with a view to agenda fixing in the field of STI– should be a major concern in most Latin American countries.

III. URUGUAY: EXPERIENCING WITH BRIDGING POLICY TOOLS

In what follows we present a couple of policy initiatives in Uruguay that largely rely on research-policy links to improve different types of issues in the production sector.

1. A joint 'Public Enterprise–University' Program

This program reunites ANCAP, the state-owned company mainly devoted to oil refining, and cement and alcohol production, with the Universidad de la Republica (UDELAR), the public university, responsible for over 70% of all the research done in the country.

The program's main aim is to put the research capacities of the university at work to solve problems detected by the enterprise. The reasons for inventing this program are reasonable in a way. The public enterprise faces three types of problems: those for which solutions can be found by its own personnel; those whose solution requires a type of expertise outside the enterprise, mainly related to technological adaptation and leading to consultancy work; and those of a more complex nature, with no known type of solutions, and therefore needing the production of new knowledge. For this third type of problems, the alliance between ANCAP and UDELAR seems a straightforward strategy. This is, however, not so simple: for several reasons, enterprises, including the public ones, have been historically reluctant to enter into cognitive relationships with the university. Too much theoretical work, a too long time to deliver results, difficulties to convey the real nature of the problems leading to frequent misunderstandings: the list can go on. Only hypothetical reasons can be given to explain why the program was built five years ago: perhaps because the president of the enterprise was young and had a scientific background, or because an alliance with the

university was seen as a sign of modernization, or because the national climate regarding innovation is stronger than it used to be or, finally, because it seemed reasonable to put the pull of capacities concentrated in the university at the enterprise advantage. Be as it may, the program was discussed between the president of the enterprise and the university's vice-chancellor for research, and started in 2008, with annual calls since then.

The formal program aims are: "to promote the realization of high-quality research in all areas of knowledge, seeking solutions to issues of interest to the country, in the areas of development of the public enterprise. It is another objective of this program to strengthen the link between the enterprise and the university, through the generation of new knowledge and its application." The program is thus conceived as a bridging policy tool, given that the results obtained through research will influence the enterprise policy in different ways. Indeed, what ANCAP is searching for through the program is evidence to base its policies.

The implementation of this tool implies several stages. The main one is an annual workshop where ANCAP's managers and technical staff and UDELAR's researchers gather and exchange views on problems and ways of solving them. But before that the problems have to be identified, as well as researchers able to tackle them. The first edition of the program was quite difficult because it was far from easy to identify the problems: university researchers specialized in science, technology and society spent a lot of time talking to the managers of the diverse enterprise's sections to detect the type of problems fitted to be included into the program. An interesting example linking social sciences and atmospheric sciences is as follows: the enterprise needed to know approximately the average temperature in the country between May and August to determine, based on that information, the demand for super gas used for heating. The first part of the problem lead to a project presented by the Faculty of Sciences; the second part of the problem was taken by the Faculty of Economics. In the following editions of the program the problem identification was shifted to the enterprise itself: the managers got to know and value the program, and were willing to present issues of their direct interest. This made the annual workshops more alive and interesting: in the last two workshops (2011-2012) the managers themselves made presentations around the main problems they were facing to an audience of other managers, the authorities of the enterprise and plenty of researchers.

After the annual workshop small and specific ones generally follow, related to each of the issues put forwards by ANCAP. In these small workshops face-to face contacts between people in the enterprise and in the university took place, opening opportunities to discuss in more detail the nature of the problems, the kind of solutions needed, the acceptable time-frame to obtain results, etc.

Immediately after each workshop, a call for projects focusing on the problems highlighted by the enterprise was opened at the university, with funds mainly coming from ANCAP. The evaluation process followed two steps. Step one was an academic evaluation, following the rules of any other R&D project: those of sufficient quality passed to step two, a techno-economic evaluation done by the managers of the enterprise, who finally decided which projects would be financed by the enterprise.

Even if the bulk of the financed projects relate to engineering, industrial chemistry, and to a lesser extent biology, SSR played its role. The following table shows the projects with intervention of social sciences and humanities that have been financed up to now:

Project title	UDELAR's faculty in charge
Models predicting the demand for liquid fuels and supergas	Economics
System performance incentives	Economics
Labour risk perception by workers. Psychological and cultural factors	Psychology, Fine Arts
A system for monitoring worker exposure to volatile hydrocarbons in the refinery	Medicine
Development of a multi-criteria evaluation system of the enterprise strategic initiatives	Engineering
Organizational culture as a key factor in knowledge management: an exploratory study	Psychology

The model explained so far is now being replicated in another public organization: the National Administration of Harbours (ANP). The first workshop between ANP and UDELAR took place in 2012 and, afterwards, fifteen projects were presented to the ensuing call. Another quite original follow-up of this model for bridging SSR and policy design is now beginning to develop between the university and the trade-union organization reuniting the vast majority of formal workers and some part of the informal ones, in Uruguay. This is a case where social sciences will have a central role to play in the definition of the policies defined by a vast social movement.

2. Creation of an Industrial Extension Centre

The very origin of the proposal to create an Industrial Extension Centre (IEC) in Uruguay was a shared conviction between the Ministry of Industry (MIEM), the public university (UDELAR) and the Chamber of Industry (CIU) that the design of effective innovation policies and tools required better insights on the range of problems that restrict innovation at the firm level. The perception was that the set of new policy tools put in place in recent years, even if intended to spur demand for knowledge and innovation, was not conceived from the industrial firms' point of view. The red signal came from the lower than expected demand level for these tools.

An agreement was signed among the mentioned institutions to jointly fund a research project aiming at producing and analysing information on technological and innovation needs, capacities and opportunities in three industrial sectors (metallurgy, plastics and food processing). Project outputs would be inputs for the design of industrial and innovation policies, programs or projects for the corresponding sectors. This pilot project was the first one where the classical actors of the Sabato Triangle –government, academia and industry– agreed there was not enough solid evidence to build a sound and comprehensive industrial innovation policy.

About 80 face-to-face, in-depth interviews to managers were carried out in 2010-2011 following a semi-structured questionnaire, to detect: i) production bottlenecks and technological weaknesses; ii) the firms technological projection and the missing resources or conditions to reduce their productivity gap; iii) the use and assessment of existing policy instruments, and the perception of missing ones; iv) the process that leads to product and process innovations, including factors such as motivation and decision, needs and obstacles, achievements and failures; and v) information on the firm capacities, especially

in terms of human resources. An important underlying idea was that by giving visibility to industrial needs it would become possible to transform them into demands that could then be addressed to different actors and policy tools of the STI system.

The field work showed, among many other valuable aspects, that the hypothesis about a supply-demand mismatch in policy instruments was right. In contrast, the hypothesis that firms are aware and eager to transmit their knowledge needs and requirements to engage in innovation processes proved wrong, at least for a large proportion of the interviewed firms.[8] In other words, not only is it difficult to transform needs in demand, needs' detection itself is a complex issue. It was also clear that raising innovation performance at the firm level is a systemic issue: it involves intertwined market, technology and human resources factors, among others.

In short, the main recommendation of this research project –carried out by two economists and one sociologist– was that in many cases SME firms would benefit from "coaching" actions that would help them identifying problems and opportunities, and kick-start innovation and collaboration processes with different actors of the NIS. It was suggested that supply-demand articulation be invigorated through the development and application of industrial extension tools and facilitation resources. Accordingly, the three institutions supporting the initial pilot project decided to join efforts to design a new policy tool, called Industrial Extension Centre (IEC).[9]

The creation of the IEC is intended to provide an industrial policy tool that systematically stimulates the expression of technological and innovation demands by Uruguayan firms and the articulation of these demands with the NIS capacities. Its administration would rely on an interinstitutional –State-Academy-Industry– council.

Industrial extension has to be understood as a proactive public policy seeking to revert the structural tendency of firms to underutilize the knowledge required to increase productivity and competitiveness. It includes three basic functions: i) identify needs; ii) transform the needs into demands; and iii) collaborate to satisfy demands by mobilizing to that end the supporting structure of the NIS.

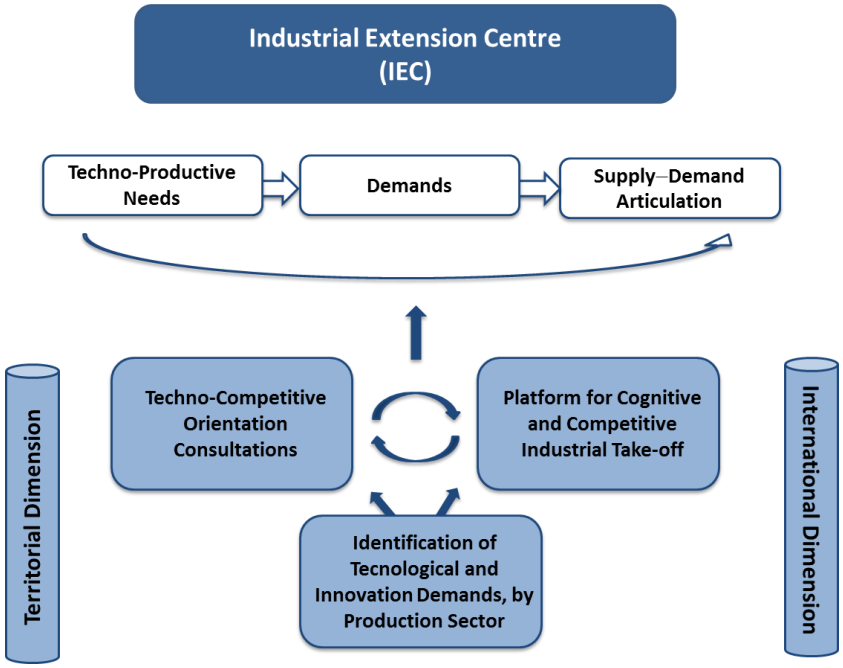
The IEC has been conceived as a set of three interconnected components, as represented in the next diagram. The first one consists of a service of "techno-competitive orientation consultations", provided to a selection of individual firms by teams composed of an engineer, a trade expert, a professional with an outstanding grasp of all existing policy tools, and a facilitator. In the first place, such teams would offer SME a free check-up to identify their needs. After the check-up, the team would discuss and propose specific actions to the firm's manager, work with him on how to best implement the selected actions, and coach him in his first contacts with either institutions, experts, or any other source of knowledge.

[8] Broadly speaking, entrepreneurs tended to assimilate technology to automated machinery and equipment, and they perceived no real difficulty in selecting equipment. Their real concerns was how to get soft loans to acquire or upgrade machinery and how to enlarge their market share or accessing new markets, since automation entails higher production volumes, so as to ensure a return on their investment. See Snoeck, Hernández, Waiter (2012) for the final report of the project.

[9] Presently (april 2013), a two-year program for the creation and initial implementation of the IEC is being evaluated by the national innovation financing agency.

The second component, a "platform for cognitive and competitive industrial takeoff", is about building a user-friendly web platform for the whole selected sector, that actively links technology supply and demand mainly through: i) providing access to existing knowledge and services in attractive formats; ii) stimulating the expression of demands by firms; and iii) diffusing relevant information through different means (podcasts, etc.). It implies a huge work to systematize knowledge by sector, including sources of information, expertise and services available at the university level (public, private, and eventually foreign), as well as existing policy tools and support programs for the selected sectors. Since the challenge of such a platform lies in it being used, a specialist in communication will work full time in feeding and updating the various components of the platform, as well as diffusing it. The project staff would also include a researcher in order to document the whole process, relate it to other experiences of the kind, organize academic-government-industry workshops, and the like.

During the first two years of operation of the IEC, these two components will be applied to the industrial sectors that were explored in the previous pilot project –metallurgy, plastics and food processing–, since some of their needs have already been detected. At the same time, the third component of the IEC will be dedicated to detecting firms' needs in twelve other industrial sectors, so that this information will be ready to apply the first two components after the second year of operation of the IEC.



To a great extent, the challenge of the IEC project consists in developing the right pro-activity capacities (internally) to achieve a higher level of supply-demand matching in the field of technology and innovation. The IEC is expected to energize technological demands and channel problems toward the existing policy instruments, programs and institutional structures, thereby improving the industrial firms' propensity to develop and/or absorb

innovations.

The IEC project is an atypical proposal for evidence-based policy intervention, in the Uruguayan context. It is to be noted that the project design by itself was evidence-based and that the proposal prospered, up to now, thanks to a combination of several factors and circumstances. As was highlighted in a recent study (Belen, 2012), the following factors stand out: a favorable institutional context and moment, the research relevance and its pragmatic approach, the unusual profile of decision-takers involved in this case, and the trust relationships among the persons concerned by the whole initiative. Also to be noted, is the learning process that took place through the several phases of this initiative, not only because the IEC proposal was jointly drafted by researchers, PM and business representatives, but also considering the different activities and actions involved in the process (e.g., two workshops with international consultants in industrial extensionism; negotiations with the probable financing agency; etc.)

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Annex 1 – Checklist of obstacles to a stronger research-policy nexus in the field of innovation

(as reported by SSH researchers for their respective country)

On the research side

- Frequent lack of convincing power of SSH research results.
- Short-sighted researchers' view of the innovation process, limiting their perception of (institutional) restrictions of policy-making and, therefore, their findings validity.
- Divorce between economic, political and public policy view of innovation: an economic-based frame of thought prevails, with limited interactions with research on public policy issues.
- Among economists, the equilibrium model view of the macro economy prevails over the institutional and micro approach (à la Freeman and Lundvall).
- Tough dialogue between social scientists and lawyers to solve coordination problems.
- Innovation researchers are predominantly 'industrialists'. Innovation in more dynamic sectors has been neglected.
- A disciplinary research mode thus still prevails over a problem-based and multidisciplinary approach.
- Lack of human capital specialised and trained in innovation topics.

On the linking

Mismatches between research supply and demand

- Knowledge supply from SSH (indicators, base studies, etc.) is subutilized in the decision-making system.
- Research is auto-referential: researchers are reluctant to take advice on knowledge needs of other actors.

Two communities problems

- Different languages (jargon) entail the need to decodifying on both sides.
- Timing and evidence requirements of PM and researchers are distinct.
- The academic evaluation and incentives system is contrary to researchers' involvement outside the academy.
- Historical and/or political factors exacerbate the gap.

On the nature of the policy-making process

- The many stages following STI policy design to reach decision-taking are outside the reach of researchers.
- Beyond theory, when it comes to define policy we are all actors with our own interests, inertias, tramps, etc.
- Ideological, strategic, tactical, circumstantial and personal factors interplay in policy-making and priority setting.
- PM want fast and simple evidence, and ambitious STI plans to leave their imprint. Little interest in learning from previous strategies and instruments.
- Agenda problems: a change of government or unforeseen events may suddenly affect STI priority in the policy agenda.
- Research findings do not easily permeate when adverse to preconceived ideas, subjacent to some PM actions.

On governability and governance

- The 'principal and agent' relation affect STI policy and the crucial articulation between public policies and instruments.
- Lack of consultation tradition of PM, and of citizens' participation in STI public issues.
- Low empowerment of STI ministry.
- PM demands are discretional; they are often addressed to privileged groups.
- Dialogue and meetings taking place between different actors are inefficient in terms of knowledge exchange.
- Difficulty of collectively building an articulated policy, encompassing other social actors than PM and researchers.
- Lack of articulation of macro, sectorial and STI policies. Ensuing inconsistency of instruments.
- Institutional restrictions.
- Lack of a specialised bureaucracy in STI, trained to taking into account research findings as inputs for policy design.
- Public agencies do not exchange information on the findings of the projects they finance, to improve policy design.
- Public policy decisions are frequently taken without information and knowledge.
- Limited and/or discretional diffusion of primary data obtained by public entities (surveys).
- Lack of development strategies whose long-term objectives require a focus on STI (e.g., structural change).

External influences

- Latin American mimetic: solutions adopted in the North are replicated as if problems were identical in the South.
- International research networks influence the setting of local research agendas.
- Neo-liberal times left behind a remnant of supply based policy.

Source: Based on 39 interviews to members of SSH research groups on innovation in Latin America, 2009-2010.